**Right choice for ultimate yield**

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

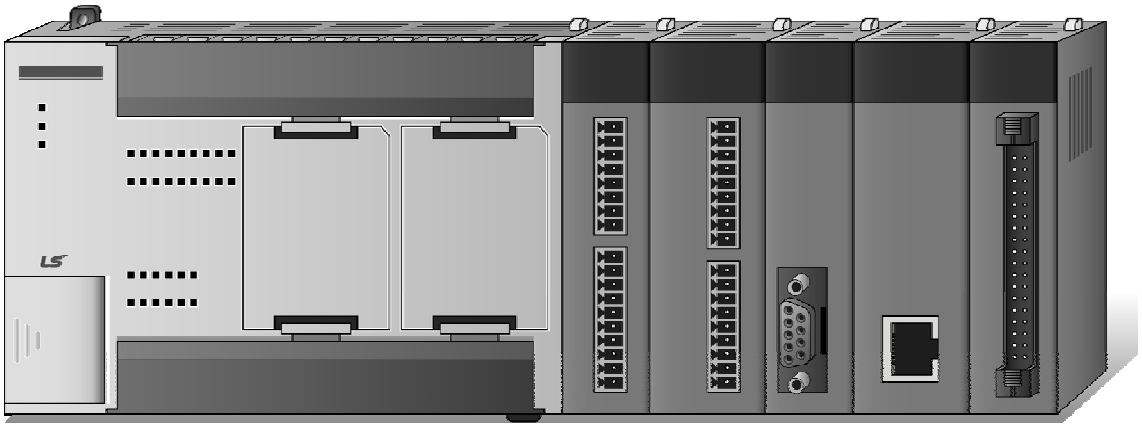
Programmable Logic Controller

# XBC Standard/Economic Type Main Unit

XGT Series

**User's Manual**

**XBC-DR10E**
**XBC-DR14E**
**XBC-DR20E**
**XBC-DR30E**
**XBC-DN20S**
**XBC-DN30S**



## Safety Instructions

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

LS Industrial Systems

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# Safety Instruction

## Before using the product …

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

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

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

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

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

  ⚠ Be careful! Danger may be expected.

  ⚠ Be careful! Electric shock may occur.

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

# Safety Instruction

## Safety Instructions when designing

### ⚠Warning

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

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

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

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

# Safety Instruction

## Safety Instructions when designing

### ⚠ Caution

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

## Safety Instructions when designing

### ⚠ Caution

- **Use PLC only in the environment specified in PLC manual or general standard of data sheet.** If not, electric shock, fire, abnormal operation of the product or flames may be caused.
- **Before installing the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.
- **Be sure that each module of PLC is correctly secured.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused.
- **Be sure that I/O or extension connecter is correctly secured.** If not, electric shock, fire or abnormal operation may be caused.
- **If lots of vibration is expected in the installation environment, don't let PLC directly vibrated.** Electric shock, fire or abnormal operation may be caused.
- **Don't let any metallic foreign materials inside the product**, which may cause electric shock, fire or abnormal operation..

# Safety Instruction

## Safety Instructions when wiring

### ⚠ Warning

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

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

### ⚠ Caution

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

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

*

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

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

# Safety Instruction

## Safety Instructions for test-operation or repair

### ⚠ Warning

- **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.
- **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Don't let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

### ⚠ Caution

- **Don't remove PCB from the module case nor remodel the module.** Fire, electric shock or abnormal operation may occur.
- **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Keep any wireless installations or cell phone at least 30cm away from PLC**. If not, abnormal operation may be caused.

## Safety Instructions for waste disposal

### ⚠ Caution

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

# Revision History

| Version | Date | Remark | Page |
|---|---|---|---|
| V 1.0 | 2010.3 | 1. First Edition | - |

※ The number of User's manual is indicated the right side of the back cover.

# About User's Manual

Congratulations on purchasing PLC of LS Industrial System Co.,Ltd.

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

The Use's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website(http://eng.lsis.biz/) 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 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 main unit. | 10310000920 |
| XGB Cnet I/F User's Manual | It describes how to use built-in communication function for XGB main 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 |

# ◎ Contents ◎

# Chapter 1 Introduction

## 1.1 Guide to Use This Manual

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

| No. | Title | Contents |
|---|---|---|
| Chapter 1 | Introduction | Describes configuration of this manual, unit's features and terminology. |
| Chapter 2 | System Configurations | Describes available units and system configuration in the XGB series. |
| Chapter 3 | General Specifications | Describes general specifications of units used in the XGB series. |
| Chapter 4 | CPU Specifications | Describes performances, specifications and operations. |
| Chapter 5 | Program Configuration and Operation Method | |
| Chapter 6 | CPU Module Functions | |
| Chapter 7 | Input/Output Specifications | Describes operation of basic and input/output. |
| Chapter 8 | Built-in High-speed Counter Function | Describes built-in high-speed counter functions. |
| Chapter 9 | 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. 284 I/O control supporting small & mid-sized system implementation

| Item | Type | | Reference |
|---|---|---|---|
| | XBC-DRxxE | XBC-DxxxS | |
| Operation processing speed | 0.24 μs / Step | 94ns / Step | - |
| Max IO contact point | 38 points | 284 points | In case of using option module 4 points (Coming soon) |
| Program capacity | 4kstep | 15kstep | - |
| Max. no. of expanded stage | Option module 2 stages | 7 stages (including option module 2 stages) | - |

(c) Enough program capacity

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

(e) XBC-DRxxE is expressed as “E” type and XBC-DxxxS is expressed as “S” type.

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

(a) Compact panel realized through the smallest size.

(Unit: mm)

| Item | Type | Size (W * H * D) | Reference |
|---|---|---|---|
| Basic unit | XBC-Dx20S | 135*90*64 | “S” type |
| | XBC-Dx30S | | |
| | XBC-DR10E | 100*90*64 | “E” type |
| | XBC-DR14E | | |
| | XBC-DR20E | 135*90*64 | |
| | XBC-DR30E | | |
| Extension module | XBE-,XBF-,XBL- | 20 * 90 * 60 | Basis of minimum size |

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

(a) By adopting a removable terminal block connector (M3 X 6 screw), convenience of wiring may be increased. (“S” type main unit)

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

(4) Improved maintenance ability with kinds of register, RTC option, 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 (1 channel for “E” type (except load port)), 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). (“S” type main unit)

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

(e) Convenient networking to upper systems through Enet or Cnet. (“S” type main unit)

(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. (“S” type: up to 7 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) Integrated programming environment

(a) XG 5000: intensified program convenience, diverse monitoring, diagnosis and editing function

(b) XG - PD: COM/network parameters setting, frame monitoring, protocol analysis function

(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 (“S” type TR output main unit)

(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 (“S” type main unit)

(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, ΔMV, ΔPV and SV Ramp, improving the control preciseness.

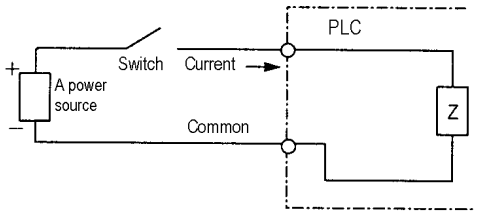
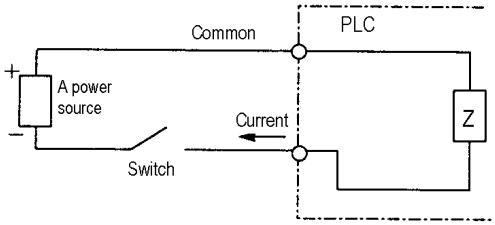
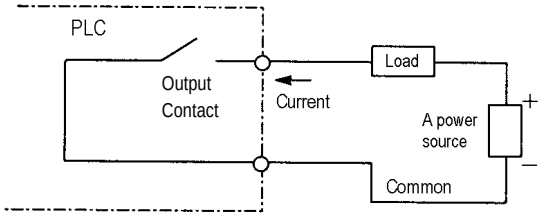
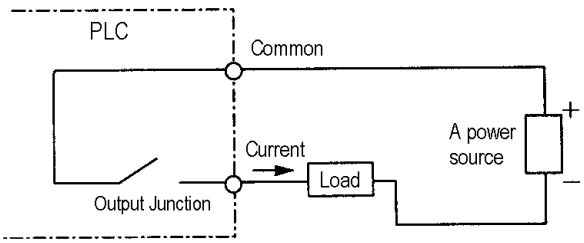
(e) Supporting types of control modes such as forward/backward mixed operation, 2-stage SV PID control, cascade control and etc.

(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) | - |
| XG - PD | Software to execute description, edition of basic parameter, high speed link, P2P parameter, and function of communication diagnosis | - |
| I/O image area | Internal memory area of the CPU module which used to hold I/O status. | |
| Cnet | Computer Network | - |
| FEnet | Fast Ethernet Network | - |
| Pnet | Profibus-DP Network | - |
| Dnet | DeviceNet Network | - |
| RTC | Abbreviation of ‘Real Time Clock’. It is used to call general IC that contains clock function. | - |
| Watchdog Timer | Supervisors the pre-set execution times of programs and warns if a program is not competed within the pre-set time. | - |

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

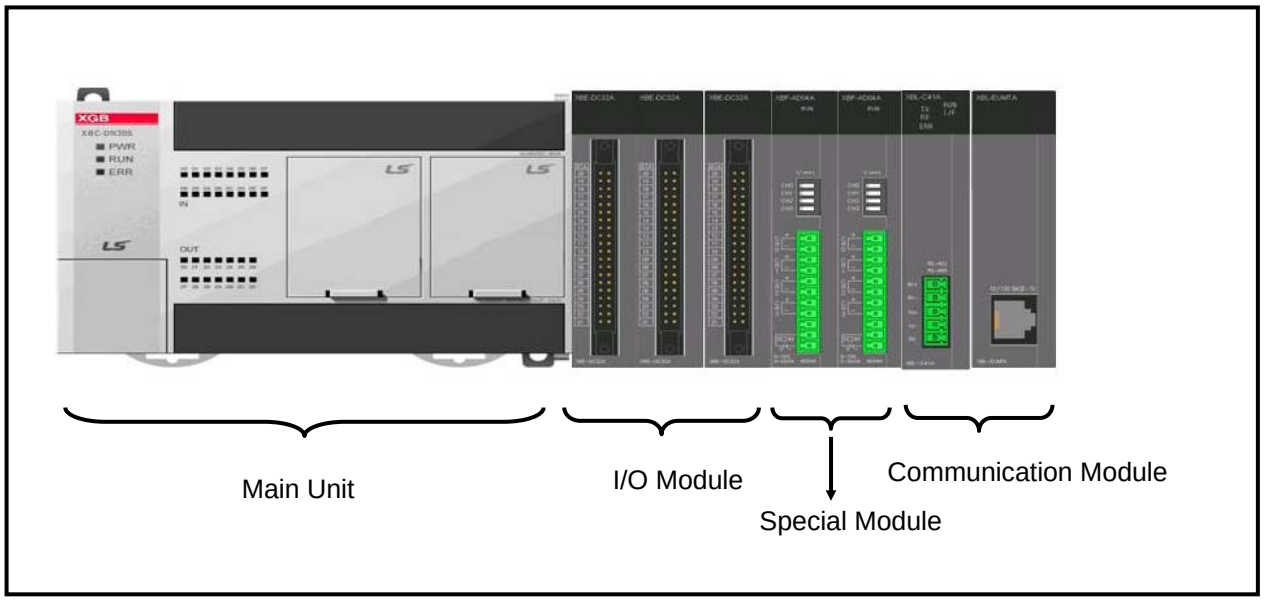
# Chapter 2 System Configuration

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

This chapter describes the configuration and features of each system.

## 2.1 XGB System Configuration

XGB series System Configuration is as follows.
For “E” type, only option module can be attached
For “S” type, up to 7 stages connection is available. But in case of attaching 2 option modules, up to 5 stages connection is available. (For communication module, up to 2 connection is available.)




| Item | | | Description |
|---|---|---|---|
| Total I/O points | | | • XBC-DxxxS (“S” type): 20~284 points |
| | | | • XBC-DRxxE (“E” type): 10~38 points |
| Maximum number of expansion modules | | Digital I/O module | • “S” type: Max. 7 |
| | | Special module | • “S” type: Max. 7 |
| | | Communication I/F module | • “S” type: Max. 2 |
| | | Option module | • “S” type: Max. 2 |
| | | | • “E” type: Max. 2<br>(In case of 10/14 points, only one is available) |
| Items | Main unit | “S” type | • XBC-DR20/30/40/60S • XBC-DN20/30/40/60S |
| | | “E” type | • XBC-DR10/14/20/30E |

| Item | | | Description | | |
|---|---|---|---|---|---|
| | Expansion module | Digital I/O module | • XBE-DC08/16/32A<br>• XBE-RY08/16A | • XBE-TN08/16/32A<br>• XBE-DR16A | • XBE-TP08/16/32A |
| | | A/D·D/A module | • XBF-AD04A<br>• XBF-AH04A<br>• XBF-RD04A | • XBF-DV04A<br>• XBF-TC04S<br>• XBF-AD08A | • XBF-DC04A<br>• XBF-PD02A |
| | | Communication I/F module | • XBL-C41A<br>• XBL-EMTA | • XBL-C21A<br>• XBL-EIMT | • XBL-EIPT |
| | Option module | Digital I/O module | • XBO-DC04A<br>• XBO-TN04A | | |
| | | Special module | • XBO-AD02A<br>• XBO-RD01A | • XBO-DA02A<br>• XBO-TC02A | • XBO-AH02A |
| | | RTC module | • XBO-RTCA | | |
| | | Memory module | • XBO-M1KB | | |

## 2.2 Product List

XGB series' product list is as follows.

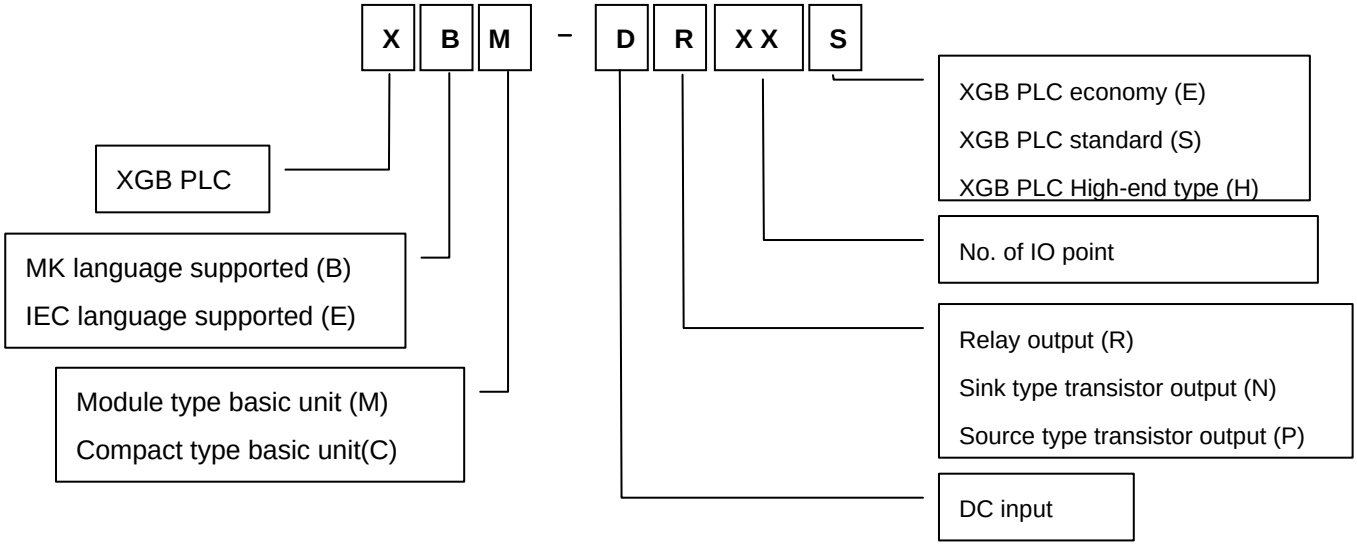
| Types | Model | Description | Remark |
|---|---|---|---|
| Main Unit | XBC-DR32H | AC100~220V power supply, DC24V input 16 point, Relay output 16 point | - |
| | XBC-DN32H | AC100~220V power supply, DC24V input 16 point, Transistor output 16 point | - |
| | XBC-DR64H | AC100~220V power supply, DC24V input 32 point, Relay output 32 point | - |
| | XBC-DN64H | AC100~220V power supply, DC24V input 32 point, Transistor output 32 point | - |
| | XBC-DR20S | AC100~220V power supply, DC 24V input 12 point, relay output 8 point | Coming soon |
| | XBC-DN20S | AC100~220V power supply, DC24V input 12 point, transistor 8 point | |
| | XBC-DR30S | AC100~220V power supply, DC 24V input 18 point, relay output 12 point | Coming soon |
| | XBC-DN30S | AC100~220V power supply, DC 24V input 18 point, transistor output 12 point | |
| | XBC-DR40S | AC100~220V power supply, DC 24V input 24 point, relay output 16 point | Coming soon |
| | XBC-DN40S | AC100~220V power supply, DC 24V input 24 point, transistor output 16 point | |
| | XBC-DR60S | AC100~220V power supply, DC 24V input 36 point, relay output 24 point | |
| | XBC-DN60S | AC100~220V power supply, DC 24V input 36 point, transistor output 24 point | |
| | XBC-DR10E | AC100~220V power supply, DC 24V input 6 point, relay output 4 point | |
| | XBC-DR14E | AC100~220V power supply, DC 24V input 8 point, relay output 6 point | |
| | XBC-DR20E | AC100~220V power supply, DC 24V input 12 point, relay output 8 point | |
| | XBC-DR30E | AC100~220V power supply, DC 24V input 18 point, relay output 12 point | |
| | XBM-DN16S | DC24V Power supply, DC24V Input 8 point, Transistor output 8 point | - |
| | XBM-DN32S | DC24V Power supply, DC24V Input 16 point, Transistor output 16 point | - |
| | XBM-DR16S | DC24V Power supply, DC24V Input 8 point, Relay output 8 point | - |
| Expansion Module | XBE-DC08A | DC24V Input 8 point | - |
| | XBE-DC16A | DC24V Input 16 point | - |
| | XBE-DC32A | DC24V Input 32 point | - |
| | XBE-RY08A | Relay output 8 point | - |
| | XBE-RY16A | Relay output 16 point | - |
| | XBE-TN08A | Transistor output 8 point | - |
| | XBE-TN16A | Transistor output 16 point | - |
| | XBE-TN32A | Transistor output 32 point | - |
| | XBE-TN64A | Transistor output 64 point (sink 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 | - |

| Types | Model | Description | Remark |
|---|---|---|---|
| Special Module | XBF-AD04A | Current/Voltage input 4 channel | - |
| | XBF-DC04A | Current output 4 channel | - |
| | XBF-DV04A | Voltage output 4 channel | - |
| | XBF-AH04A | Current/voltage input 2 channel, output 2 channel | |
| | XBF-RD04A | RTD (Resistance Temperature Detector) input 4 channel | - |
| | XBF-AD08A | Current/voltage input 8 channel | - |
| | XBF-TC04S | TC (Thermocouple) input 4 channel | - |
| | XBF-PD02A | 2 axes, line driver type | |
| 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 | - |
| | XBL-EIPT | EtherNet/IP module | |
| Option Module | XBO-M1024 | Memory module | |
| | XBO-AD02A | Current/voltage input 2channel | Coming soon |
| | XBO-DA02A | Current/voltage output 2 channel | |
| | XBO-AH02A | Current/Voltage input 1 channel, output 1 channel | |
| | XBO-RD01A | RTD input 1 channel | |
| | XBO-TC02A | Thermocouple input 2 channel | |
| | XBO-DC04A | DC 24V input 4 point (“S” type HSC 4 channel) | |
| | XBO-TN04A | Sink type transistor output 4 channel<br>(“S” type Positioning 2 axes (low speed)) | |
| | XBO-RTCA | RTC module | |
| | XBO-M1KB | Memory module | |

## 2.3 Classification and Type of Product Name

### 2.3.1 Classification and type of basic unit

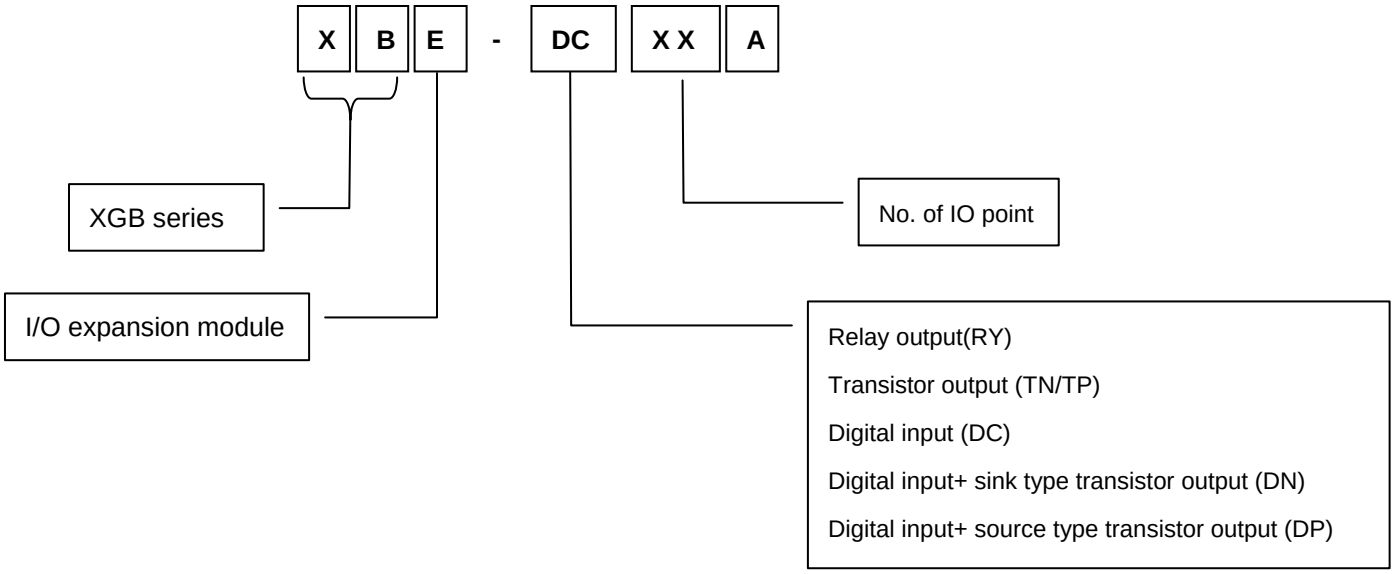
Name of basic unit is classified as follows.




| Classification | Name | DC input | Relay output | Transistor output | Power |
|---|---|---|---|---|---|
| Modular type main 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 main nit | 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-DN20S | 12 point | None | 8 point | |
| | XBC-DN30S | 18 point | None | 12 point | |
| | XBC-DR10E | 6 point | 4 point | None | |
| | XBC-DR14E | 8 point | 6 point | None | |
| | XBC-DR20E | 12 point | 8 point | None | |
| | XBC-DR30E | 18 point | 12 point | None | |

### 2.3.2 Classification and type of expansion module

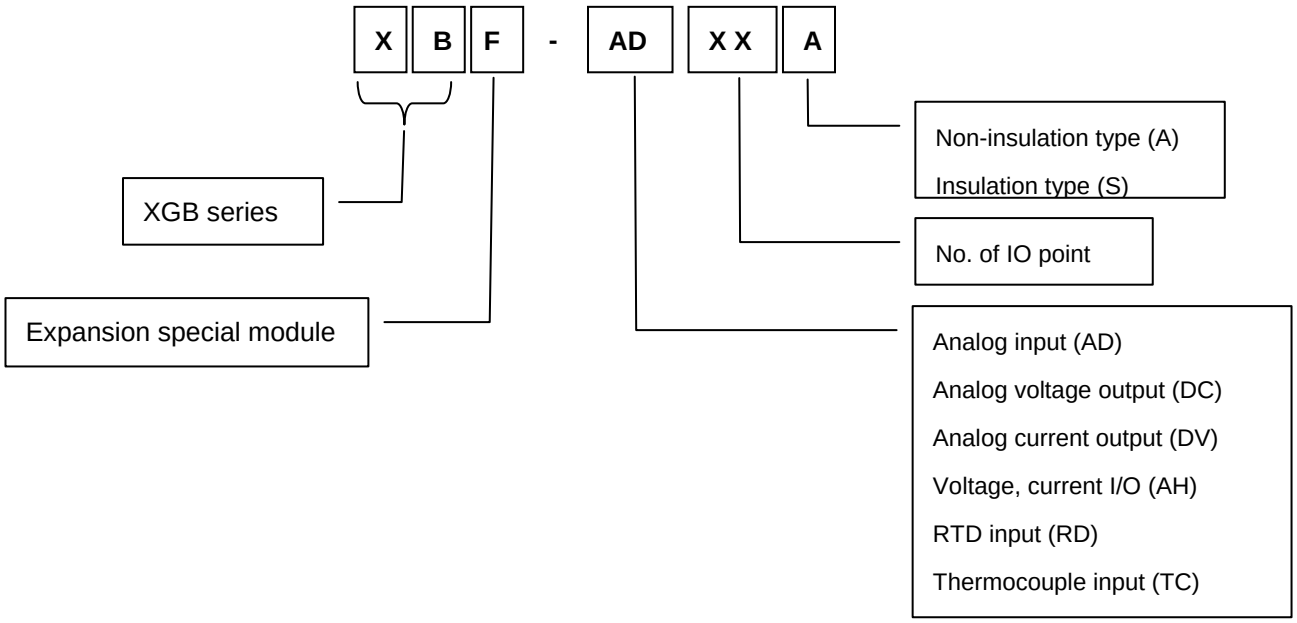
Name of expansion module is classified as follows.




| Name | DC input | Relay output | Transistor output | Reference |
|---|---|---|---|---|
| XBE-DC08A | 8 point | None | None | |
| XBE-DC16A | 16 point | None | None | |
| XBE-DC32A | 32 point | None | None | |
| XBE-RY08A | None | 8 point | None | |
| XBE-RY16A | None | 16 point | None | |
| XBE-TN08A | None | None | 8 point | |
| XBE-TN16A | None | None | 16 point | Sink type |
| XBE-TN32A | None | None | 32 point | |
| XBE-TP08A | None | None | 8 point | |
| XBE-TP16A | None | None | 16 point | Source type |
| XBE-TP32A | None | None | 32 point | |
| XBE-DR16A | 8 point | 8 point | None | |

### 2.3.3 Classification and type of special module

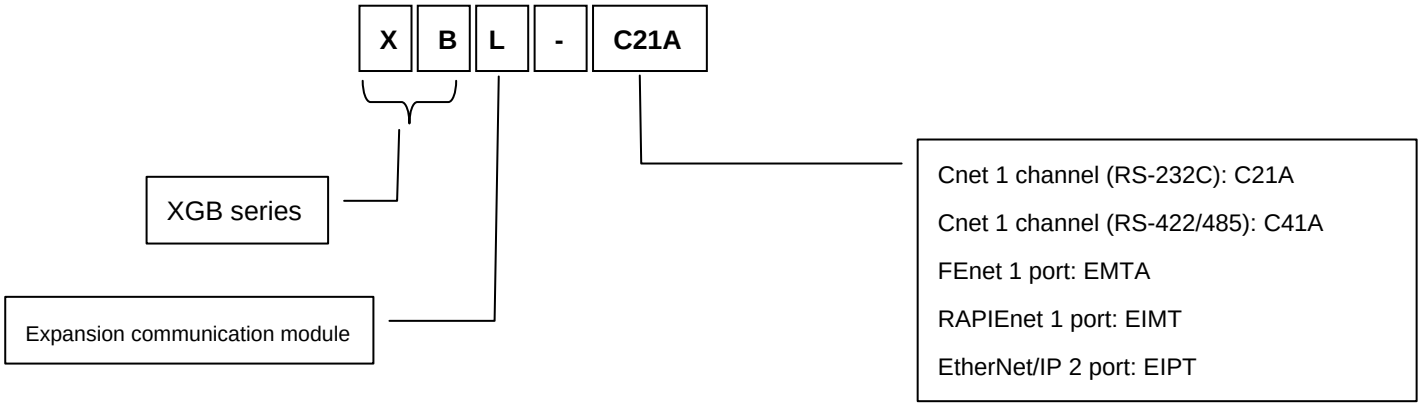
Special module is classified as follows.




| Classification | Name | No. of input ch. | Input type | No. of output ch. | Output type |
|---|---|---|---|---|---|
| Analog input | XBF-AD04A | 4 | Voltage/Current | None | - |
| | XBF-AD08A | 8 | Voltage/Current | None | |
| Analog output | XBF-DC04A | None | - | 4 | Current |
| | XBF-DV04A | None | - | 4 | Voltage |
| Analog I/O | XBF-AH04A | 2 | Voltage/Current | 2 | Voltage/Current |
| RTD input | XBF-RD04A | 4 | PT100/JPT100 | None | - |
| TC input | XBF-TC04S | 4 | K, J, T, R | None | - |

### 2.3.4 Classification and type of communication module

Name of communication module is classified as follows.




| 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 | Comm. Module between PLCs, electric media, 100 Mbps industrial Ethernet supported |
| EtherNet/IP Comm. Module | XBL-EIPT | Electricity, open type Ethernet |

# 2.4 System Configuration

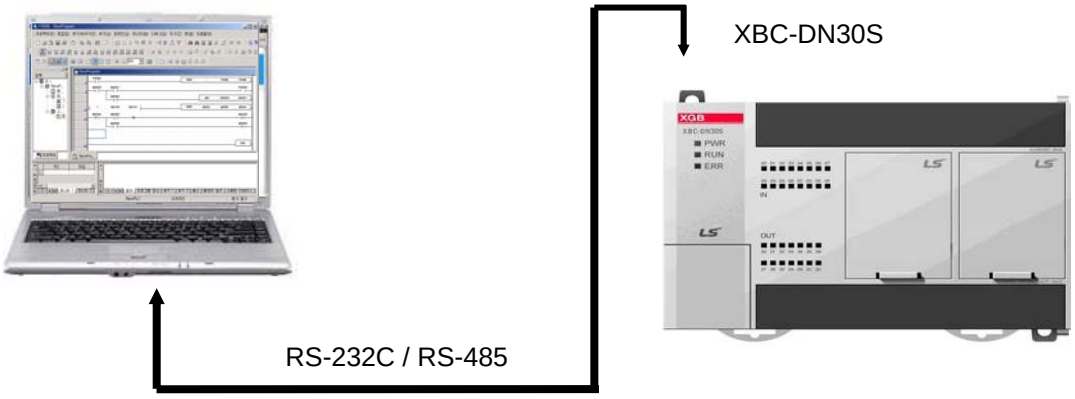
## 2.4.1 Cnet I/F system

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

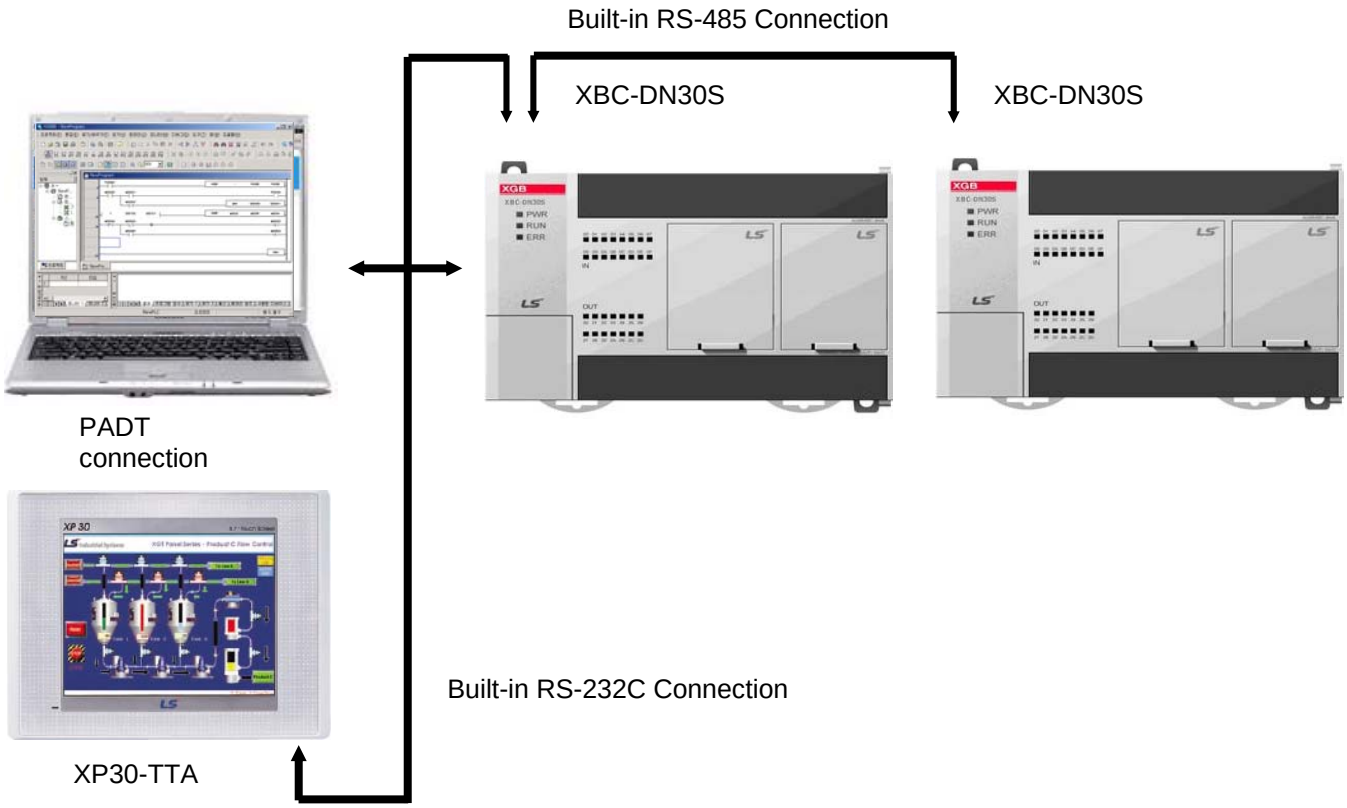
For “E” type, only one communication port between RS-232C and RS-485 can be used and you can specify at parameter setting window. For “S” type, RS-232C and RS-485 can be used independently and add RS-232C dedicated Cnet I/F module (XBL-C21A) and RS-422/485 dedicated Cnet I/F module (XBL-C41A). It is possible to configure the following communication system on demand

(1) 1:1 communication system

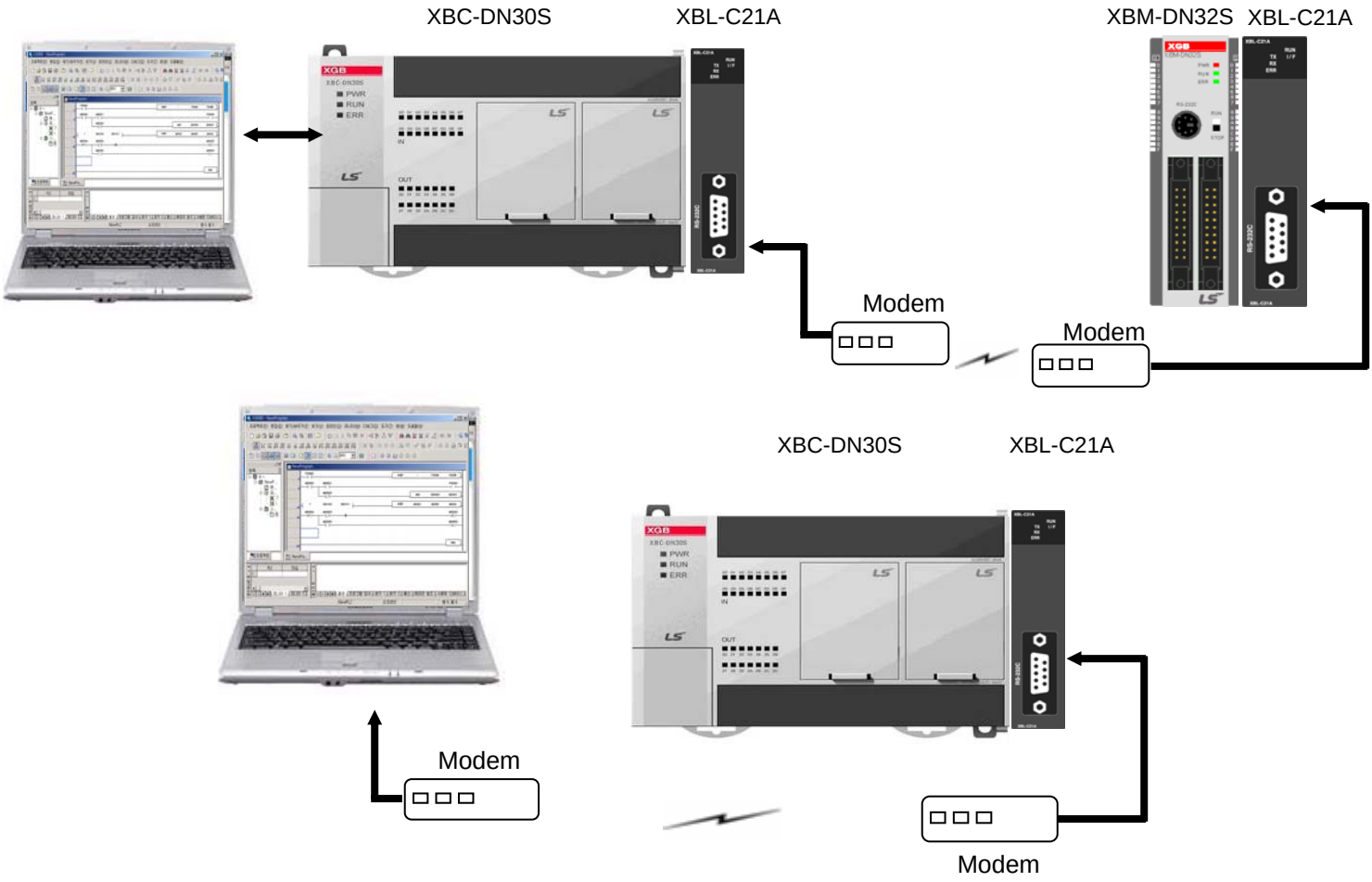
(a) 1:1 communication of an external device (computer) with main unit using a built-in port (RS-232C/RS-485)



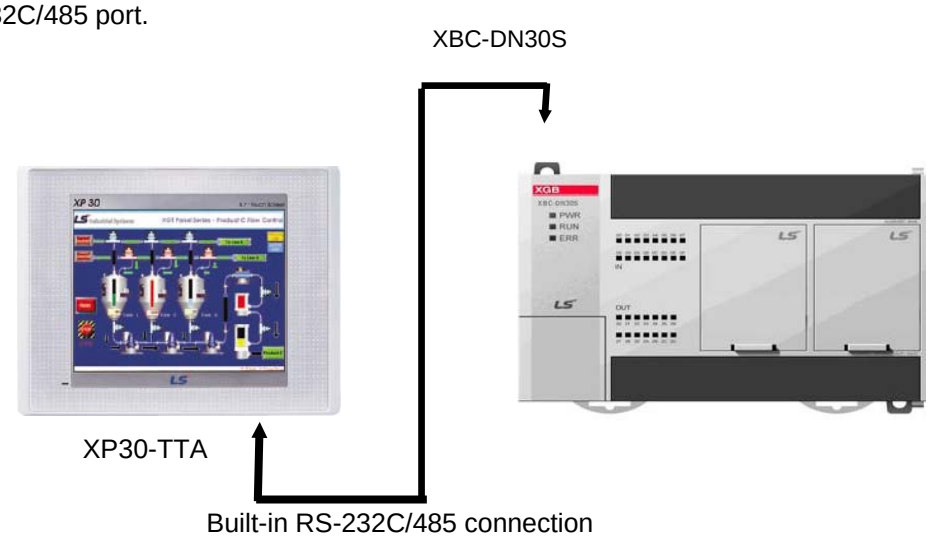

(b) 1:1 communication with main unit using a built-in RS-485 port
(In case of built-in RS-232C,it is for connecting to HMI device.)



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

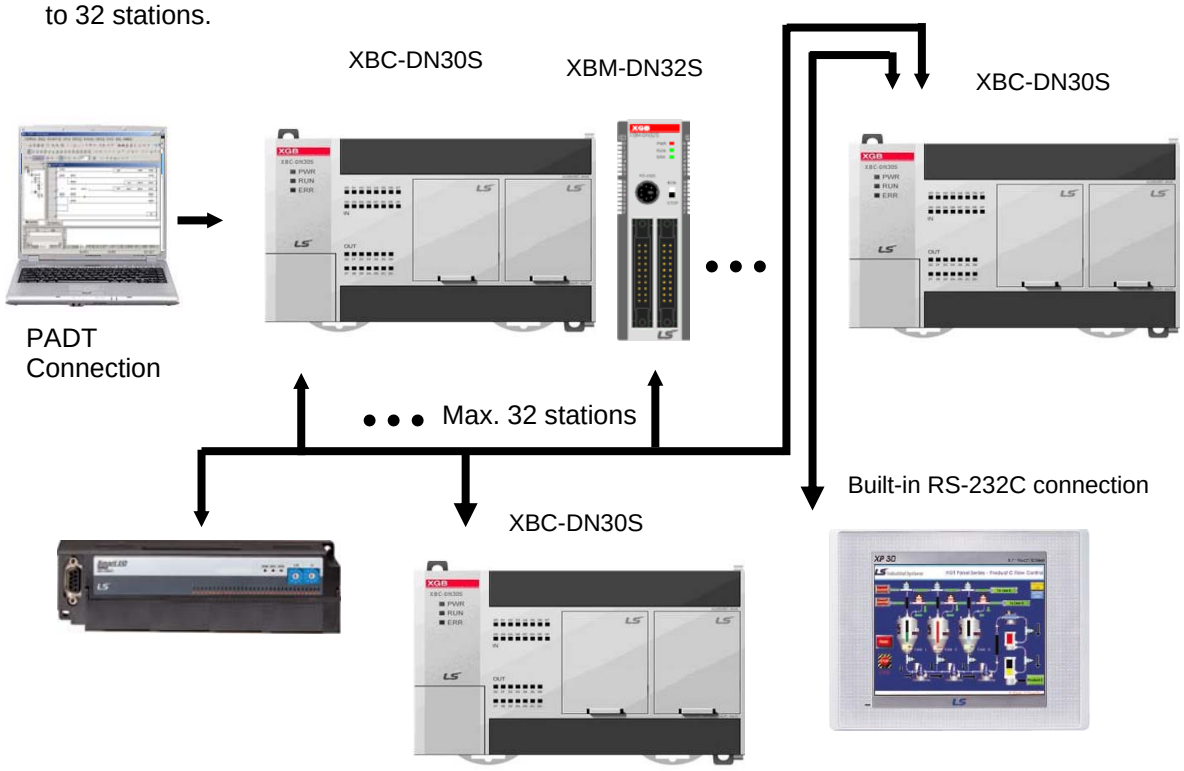



(d) 1:1 communication of an external device (monitoring unit) with main unit using a built-in RS-232C/485 port.

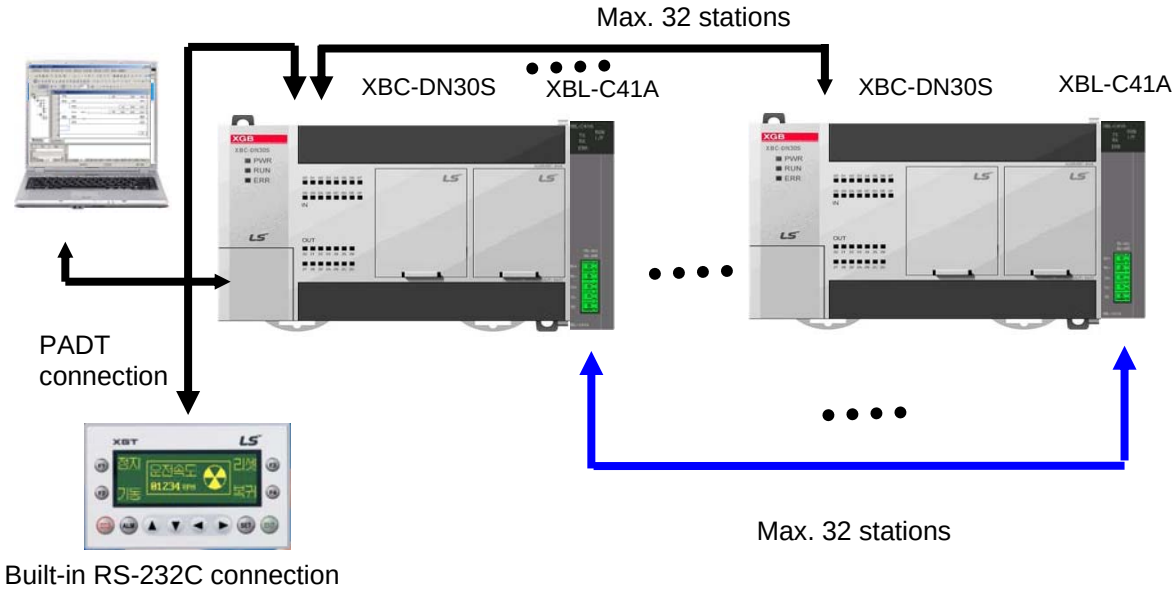


(2) 1:n Communication system

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




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

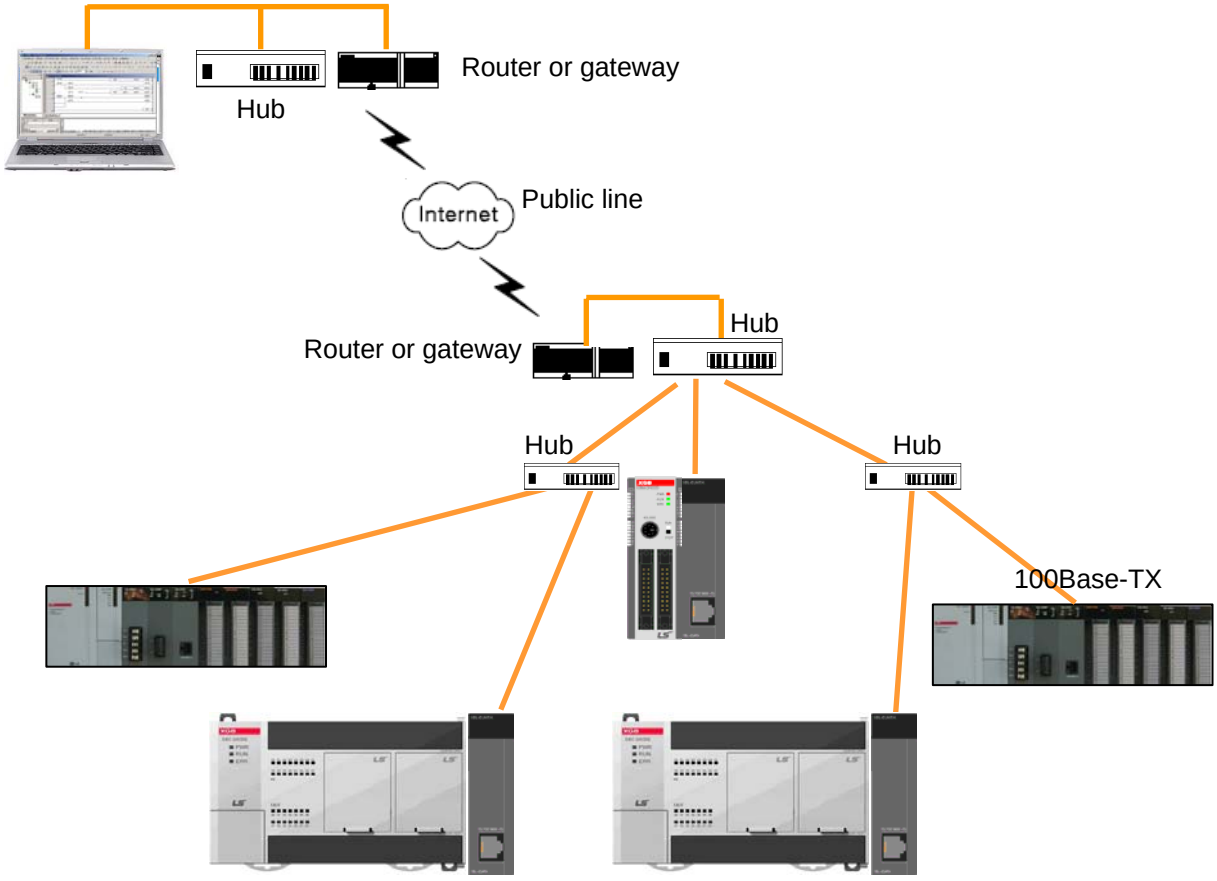



**Note**

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.

<table>
<tr><th>No.</th><th>Items</th><th colspan="6">Specification</th><th>Reference</th></tr>
<tr><td>1</td><td>Ambient Temp.</td><td colspan="6">0 ~ 55 °C</td><td rowspan="4">-</td></tr>
<tr><td>2</td><td>Storage Temp.</td><td colspan="6">–25 ~ +70 °C</td></tr>
<tr><td>3</td><td>Ambient humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration resistance</td><td colspan="5">Occasional vibration</td><td>-</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td colspan="2">Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td colspan="2">10 ≤ f < 57Hz</td><td>–</td><td>0.075mm</td><td rowspan="5">10 times each direction (X,Y and Z)</td></tr>
<tr><td colspan="2">57 ≤ f ≤ 150Hz</td><td>9.8m/s$^2$ (1G)</td><td>–</td></tr>
<tr><td colspan="5">Continuous vibration</td></tr>
<tr><td colspan="2">Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td colspan="2">10 ≤ f < 57Hz</td><td>–</td><td>0.035mm</td></tr>
<tr><td colspan="2">57 ≤ f ≤ 150Hz</td><td>4.9m/s$^2$ (0.5G)</td><td>–</td></tr>
<tr><td>6</td><td>Shock resistance</td><td colspan="6">• Peak acceleration : 147 m/s$^2$ (15G)<br>• Duration : 11ms<br>• Half-sine, 3 times each direction per each axis</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Noise resistance</td><td>Square wave impulse noise</td><td colspan="4">±1,500 V</td><td>LSIS standard</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage: 4kV (Contact discharge)</td><td>IEC61131-2<br>IEC61000-4-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="4">80 ~ 1,000 MHz, 10V/m</td><td>IEC61131-2,<br>IEC61000-4-3</td></tr>
<tr><td rowspan="2">Fast transient /Burst noise</td><td>Segment</td><td>Power supply module</td><td colspan="2">Digital/Analog Input/Output, Communication Interface</td><td rowspan="2">IEC61131-2<br>IEC61000-4-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="2">1kV</td></tr>
<tr><td>8</td><td>Environment</td><td colspan="6">Free from corrosive gases and excessive dust</td><td rowspan="4">-</td></tr>
<tr><td>9</td><td>Altitude</td><td colspan="6">Up to 2,000 ms</td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="6">2 or less</td></tr>
<tr><td>11</td><td>Cooling</td><td colspan="6">Air-cooling</td></tr>
</table>

**Notes**

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

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

# Chapter 4 CPU Specifications

## 4.1 Performance Specifications

The following table shows the general specifications of the XGB module type CPU (XBC-DR10/14/20/30E).

| Items | | Specifications ("E" type) | | | | Remark |
|---|---|---|---|---|---|---|
| | | XBC-DR10E | XBC-DR14E | XBC-DR20E | XBC-DR30E | |
| Program control method | | Reiterative operation, fixed cycle operation, constant scan | | | | - |
| I/O control method | | Scan synchronous batch processing method (Refresh method), Directed by program instruction | | | | |
| Program language | | Ladder Diagram, Instruction List | | | | |
| Number of instructions | Basic | 28 | | | | |
| | Application | 677 | | | | |
| Processing speed (Basic instruction) | | 0.24 ㎲/Step | | | | |
| Program capacity | | 4 k steps | | | | |
| Max. I/O points | | 14 point Main + 1 option | 18 point Main + 1 option | 28 point Main + 2 options | 38 point Main + 2 options | |
| 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 (256 point) (Adjustable by parameter setting) | | | | |
| | C | C000 ~ C255 (256 point) | | | | |
| | S | S00.00 ~ S127.99 | | | | |
| | D | D0000 ~ D5119 (5120 word) | | | | Word |
| | U | U00.00 ~ U07.31 (Analog data refresh area: 256 word, analog data refresh area) | | | | |
| | Z | Z000~Z127 (128 Word) | | | | |
| Total program | | 128 | | | | - |
| Initial task | | 1 | | | | |
| Cyclic task | | Max. 8 | | | | |
| I/O task | | Max. 4 | | | | |
| Internal device task | | Max. 8 | | | | |
| Operation mode | | RUN, STOP, DEBUG | | | | |
| Self-diagnosis function | | Detects errors of scan time, memory, I/O | | | | |
| Program port | | RS-232C (Loader) | | | | |
| Back-up method | | Latch area setting in basic parameter | | | | |
| Internal consumption current | | 250mA | 315mA | 355mA | 485mA | |
| Weight | | 330g | 340g | 450g | 465 g | |

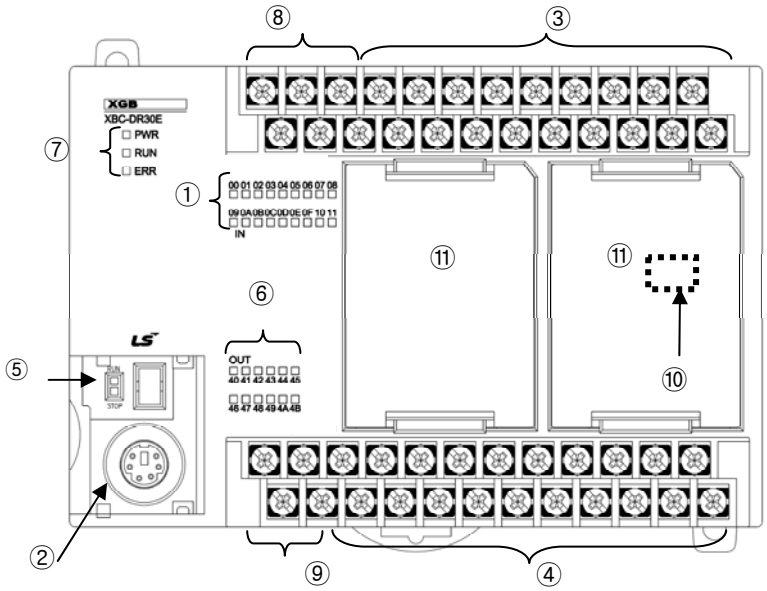
The following table shows the general specifications of the XGB compact type CPU (XBC-DN20/30S).

| Items | | Specifications ("S" type) | | | | Remark |
|---|---|---|---|---|---|---|
| | | XBC-DN20S | XBC-DR20S | XBC-DN30S | XBC-DR30S | |
| Program control method | | Reiterative operation, fixed cycle operation, constant scan | | | | - |
| I/O control method | | Scan synchronous batch processing method (Refresh method), Directed by program instruction | | | | |
| Program language | | Ladder Diagram, Instruction List | | | | |
| Number of instructions | Basic | 28 | | | | |
| | Application | 687 | | | | |
| Processing speed (Basic instruction) | | 94 ns/Step | | | | |
| Program capacity | | 15 k steps | | | | |
| Max. I/O points | | 244 point (Main + Expansion 7 stages) | | 254 point (Main + Expansion 7 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) | | | | |
| | R | R0000~R10239 (10,240 word) | | | | |
| Total program | | 128 | | | | - |
| Initial task | | 1 | | | | |
| 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 | | | | |
| Program port | | RS-232C 1 channel | | | | |
| Back-up method | | Latch area setting in basic parameter | | | | |
| Internal consumption current | | 240 mA | | 255 mA | | |
| Weight | | 470g | | 475g | | |

| Items | | | Specifications | | Remark |
|---|---|---|---|---|---|
| | | | "E" type | "S" type | |
| Built-in function | PID control function | | Controlled by instructions, Auto-tuning, PWM output, Forced output, Adjustable operation scan time, Anti Windup, Delta MV function, SV-Ramp function | | Supported in "S" type |
| | Cnet I/F function | | Dedicated protocol support<br>MODBUS protocol support<br>User defined protocol support | | |
| | | | Select one port between RS-232C 1 port, RS-485 1 port by parameter | RS-232C 1 port, RS-485 1 port respectively | |
| | High-speed counter | Capacity | 1 phase: 4 kHz 4 channel<br>2 phase: 2 kHz 2 channel | 1 phase: 100 kHz 2 channel, 20kHz 6 channel<br>2 phase: 50 kHz 1 channel, 8kHz 3 channel | |
| | | Counter mode | 4 different counter modes according to input pulse and addition/subtraction method<br>• 1 phase pulse input: addition/subtraction counter<br>• 1 phase pulse input: addition/subtraction counter by B phase<br>• 2 phase pulse input: addition/subtraction counter | | |
| | | | • 2 phase pulse input: addition/subtraction by rising pulse phase differences | • 2 phase pulse input: addition/subtraction by rising/falling pulse phase differences | |
| | | Additional function | • Internal/External preset function<br>• Latch counter function<br>• Comparison output function<br>• Revolution number per unit time function | | |
| | Positioning function | Basic function | No. of control axis: 2 axes<br>Control method: position/speed control<br>Control unit: pulse<br>Positioning data: 80 data/axis (operation step No. 1~80)<br>Operation mode: End/Keep/Continuous<br>Operation method: Single, Repeated operation | | Supported in "S" type transistor output |
| | | Positioning function | Positioning method: Absolute / Incremental<br>Address range: -2,147,483,648 ~ 2,147,483,647<br>Speed: Max. 100kpps(setting range 1 ~ 100,000pps)<br>Acceleration / Deceleration method : trapezoidal method | | |
| | | Return to Origin | By Home and DOG (Off)<br>By Home and DOG (On)<br>By DOG | | |
| | | JOG operation | Setting range: 1~100,000 ( High / Low speed) | | |
| | | Additional function | Inching operation, Speed synchronizing operation, Position synchronizing operation, linear interpolation operation etc. | | |
| | Pulse catch | | 50 ㎲<br>4 point (P0000 ~ P0003) | 10 ㎲ 2 point<br>(P0000 ~ P0001)<br>50 ㎲ 6 point<br>(P0002 ~ P0007) | - |
| | External interrupt | | 4 point: 50 ㎲<br>(P0000 ~ P0003) | 10 ㎲ 2 point<br>(P0000 ~ P0001)<br>50 ㎲ 6 point<br>(P0002 ~ P0007) | |
| | Input filter | | Select among 1,3,5,10,20,70,100 ㎳ (Adjustable) | | |

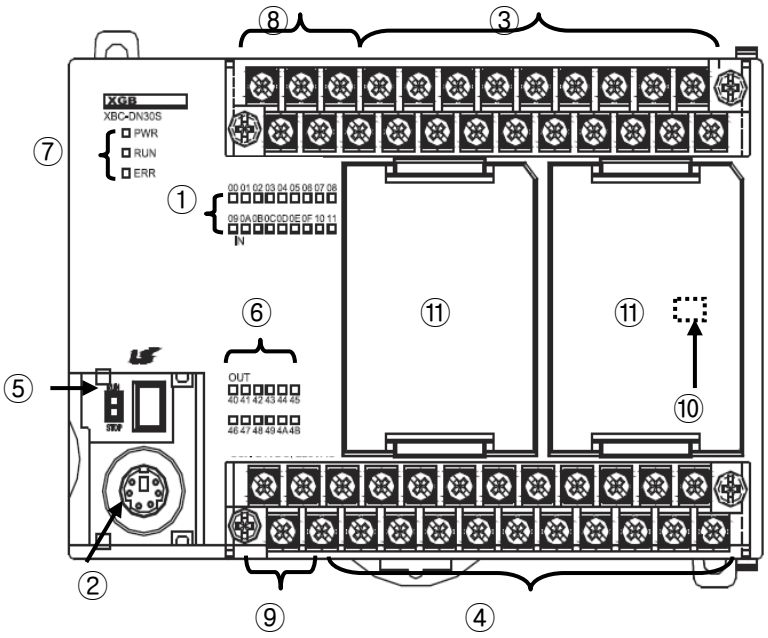
## 4.2 Names of Part and Function

### "E" Type




| No. | Name | Description |
|---|---|---|
| ① | Input indicator LED | ▪ Input indicator LED |
| ② | PADT connecting connector | ▪ PADT connector<br>RS-232C 1 channel |
| ③ | Input terminal block | ▪ Input terminal block |
| ④ | Output terminal block | ▪ Output terminal block |
| ⑤ | RUN/STOP mode switch | ▪ Sets the operation mode of main unit<br>STOP → RUN: execute operation of program<br>RUN → STOP: stop operation of program<br>(In case of STOP, remote mode is available) |
| ⑥ | Output indicator LED | ▪ Output indicator LED |
| ⑦ | Status indicator LED | It indicates CPU module's status.<br>▪ PWR(Red on): Power status<br>▪ RUN(Green on): RUN status<br>▪ Error(Red flickering): In case of error, it is flickering. |
| ⑧ | Built-in communication Connecting connector | • Built-in RS-232C/485 connecting connector |
| ⑨ | Power supply connector | ▪ AC100~240V power supply connector |
| ⑩ | OS mode dip switch | ▪ Dip switch for setting O/S download/Operation mode<br>On: Boot mode, available to download O/S<br>Off: User mode, available to download program using PADT |
| ⑪ | Option board holder | ▪For connection option board |

## "S" Type




| No. | Name | Description |
|---|---|---|
| ① | Input indicator LED | ▪ Input indicator LED |
| ② | PADT connecting connector | ▪ PADT connector<br>RS-232C 1 channel |
| ③ | Input terminal block | ▪ Input terminal block |
| ④ | Output terminal block | ▪ Output terminal block |
| ⑤ | RUN/STOP mode switch | ▪ Sets the operation mode of main unit<br>STOP → RUN: execute operation of program<br>RUN → STOP: stop operation of program<br>(In case of STOP, remote mode is available) |
| ⑥ | Output indicator LED | ▪ Output indicator LED |
| ⑦ | Status indicator LED | It indicates CPU module's status.<br>▪ PWR(Red on): Power status<br>▪ RUN(Green on): RUN status<br>▪ Error(Red flickering): In case of error, it is flickering. |
| ⑧ | Built-in communication Connecting connector | • Built-in RS-232C/485 connecting connector |
| ⑨ | Power supply connector | ▪ AC100~240V power supply connector |
| ⑩ | OS mode dip switch | ▪ Dip switch for setting O/S download/Operation mode<br>On: Boot mode, available to download O/S<br>Off: User mode, available to download program using PADT |
| ⑪ | Option board holder | ▪For connection option board |

## 4.3 Power Supply Specifications

It describes the power supply specification of main unit.

| Items | | | Specification | | |
|---|---|---|---|---|---|
| | | | XBC-DR10/14E | XBC-DR20/30E | XBC-DN20/30S |
| Input | Rated voltage (UL warranty voltage) | | AC 100 ~ 240 V | | |
| | Input voltage range | | AC85~264V(-15%, +10%) | | |
| | Inrush current | | 50A$_{Peak}$ or less | | |
| | Input current | | 0.5A or less (220V), 1A or less (110V) | | |
| | Efficiency | | 65% or more | | |
| | Permitted momentary power failure | | Less than 10 ㎳ | | |
| Output | Rated output | DC5V | 500mA | 800mA | 1.5A |
| | | DC24V | 0.2A | 0.2A | 0.3A |
| | Output voltage ripple | | DC5V (±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)

| Type | Model | Consumption current (Unit : mA) |
|---|---|---|
| Main unit | XBM-DR16S | 400 |
| | XBM-DN16S | 250 |
| | XBM-DN32S | 280 |
| | XBC-DR32H | 660 |
| | XBC-DR64H | 1,040 |
| | XBC-DN32H | 260 |
| | XBC-DN64H | 330 |
| | XBC-DN30S | 255 |
| | XBC-DN20S | 240 |
| | XBC-DR30E | 485 |
| | XBC-DR20E | 355 |
| | XBC-DR14E | 315 |
| | XBC-DR10E | 250 |
| Expansion I/O module | XBE-DC32A | 50 |
| | XBE-DC16A | 30 |
| | XBE-DC08A | 20 |
| | XBE-RY16A | 440 |
| | XBE-RY08A | 240 |
| | XBE-TN32A | 80 |
| | XBE-TN16A | 50 |
| | XBE-TN08A | 40 |
| | XBE-DR16A | 250 |
| Expansion special module | XBF-AD04A | 120 |
| | XBF-AD08A | 105 |
| | XBF-AH04A | 120 |
| | XBF-DV04A | 110 |
| | XBF-DC04A | 110 |
| | XBF-RD04A | 100 |
| | XBF-TC04S | 100 |
| | XBF-PD02A | 500 |
| Expansion communication module | XBL-C21A | 110 |
| | XBL-C41A | 110 |
| | XBL-EMTA | 190 |

## 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 | XBC-DN20S | 1 | 240 | In case contact points are On. (Maximum consumption current) |
| Expansion module | XBE-DC32A | 2 | 50 | |
| | XBE-TN32A | 2 | 80 | |
| | XBF-AD04A | 1 | 120 | All channel is used. (Maximum consumption current) |
| | XBF-DC04A | 1 | 110 | |
| | XBL-C21A | 1 | 110 | |
| Consumption current | 850 mA | | | - |
| Consumption voltage | 4.25 W | | | 0.85 * 5V = 4.25W |

In case system is configured as above, since 5V consumption current is total 850mA 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 | XBC-DN30S | 1 | 255 | In case all contact points are On. (Maximum consumption current) |
| Expansion module | XBE-DR16A | 2 | 250 | |
| | XBE-RY16A | 2 | 440 | |
| | XBF-AD04A | 2 | 120 | All channel is used. (Maximum consumption current) |
| | XBL-C21A | 1 | 110 | |
| Consumption current | 1,985 mA | | | - |
| Consumption voltage | 9.925 W | | | 1.985 × 5V = 9.925W |

If system is configured as above, total 5V current consumption is exceeded 1,985 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 : mA) | Remark |
|---|---|---|---|---|
| Main unit | XBC-DN32H | 1 | 260 | In case of all contact points are On. (Maximum consumption current) |
| Expansion module | XBE-DR16A | 2 | 250 | |
| | XBE-RY16A | 2 | 440 | |
| | XBF-AD04A | 2 | 120 | All channel is used. (Maximum consumption current) |
| | XBL-C21A | 1 | 110 | |
| Consumption current | 1,990 mA | | | - |
| Consumption voltage | 9.95 W | | | 1.99A × 5V = 9.95W |

The above system is an example using XBC-DN32H about system example (2). Unlike (2) example, 5V output capacity of XBC-DN32H is maximum 2A, normal configuration is available.

## 4.5 Data Backup Time

When RTC module is not installed with main unit, data is kept by super capacitor. Data backup time is 1,000 hours or above at normal temperature. But charge super capacitor enough while power is on over 30 minute.

In case super capacitor is not charged enough or power is off more than data backup time, latch data is not kept and warning occurs. At this time, phenomenon and measure are as follows.

(1) Phenomenon
  (a) RUN mode
    1) In case of Remote Run mode, operation mode changes to Stop mode. In case of Local Run mode, it operates normally with abnormal data backup warning
    2) In case of Stop mode, abnormal data backup warning occurs.
  (b) Latch data
    1) Latch area 1,2 : all data are cleared into “0”.
    2) K area, F area : all data are cleared into “0”.

(2) Measure
  (a) In case abnormal data backup warning occurs when turning off and turning on within short time (about 1,000 hours at normal temperature), A/S of main unit is necessary. Be careful data backup time is getting shorter at high temperature. (About 150 hours at 55℃)

**Notice**

Above data backup time can be different according to temperature condition.

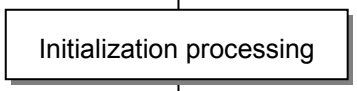
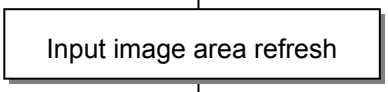
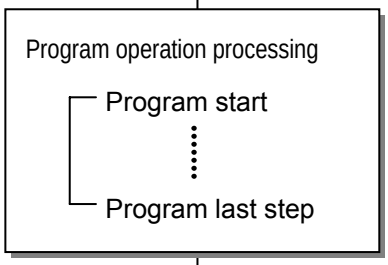
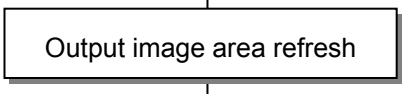
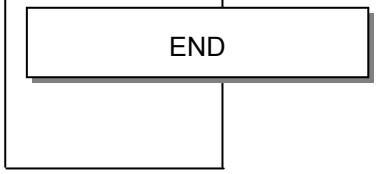
# Chapter 5 Program Configuration and Operation Method

## 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 |
|---|---|
|  | - |
|  | • A stage to start the scan processing which is executed once when power is applied or Reset is executed, as below.<br>▸ I/O module reset<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. |
|  | • Reads the state of input module and saves it in input image area before starting the operation of program. |
|  | • Performs the operation in order from the program start to last step. |
|  | • Performs the operation in order from the program start to last step. |
|  | • 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 ("S" type: P000~P007, "E" type: P000~P003). Besides, there is an internal device start program that starts according to the state change of device assigned inside.

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

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

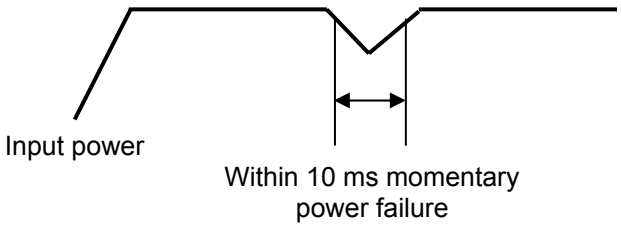
At constant operation, the scan time indicates the net program processing time where the standby time is deducted. In case that scan time is bigger than 'constant', [F0005C] '_CONSTANT_ER' flag shall be 'ON'.

## 5.1.2 Operation processing during momentary power failure

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

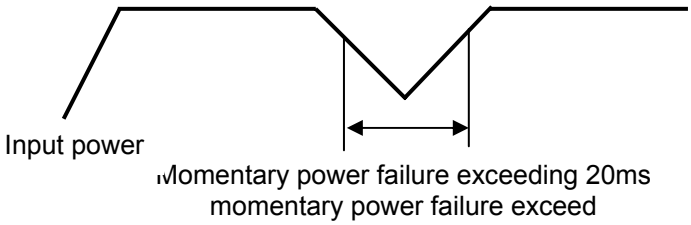
If momentary power failure within 10 ms is occurred, main unit (CPU) keeps the operation. But, if momentary power failure above 10 ㎳, the operation is stop and the output is Off. Restart processing like at power input shall be performed.

(1) Momentary power failure within 10 ms




• CPU keeps the operation.

(2) Momentary power failure exceeding 10 ms




• Restart processing like at power input shall be performed.

**Remark**

1) Momentary power failure?

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

### 5.1.3 Scan time

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

(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.

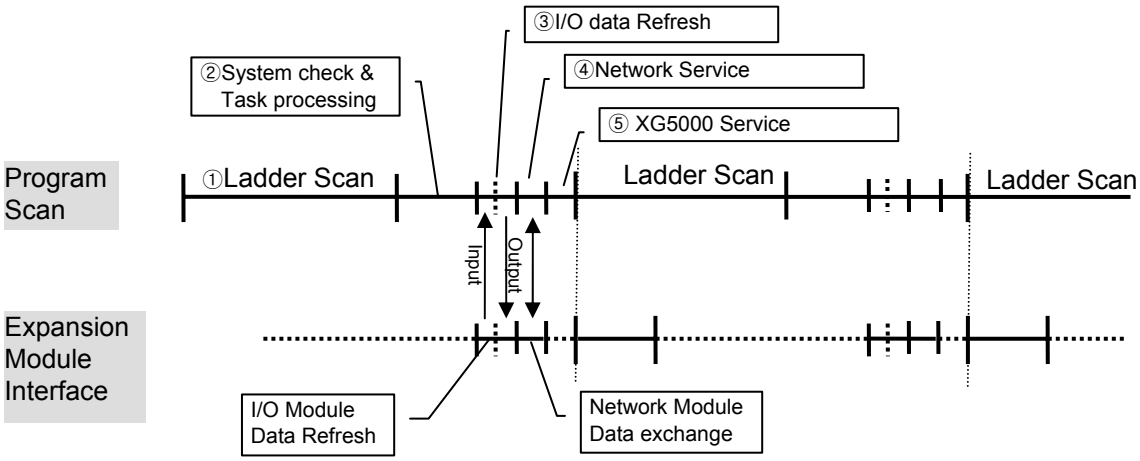
(a) Scan time = Scan program processing time ＋ Interrupt program processing time ＋ PLC internal processing time

- Scan program processing time = processing time of user program except 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

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

| Type | MPU processing time | | Expansion interface processing time | | |
|---|---|---|---|---|---|
| | Executing ladder (4Kstep) | PLC internal processing time | Digital I/O module (32 point, 1 unit) | Analog module (8 channel, 1 unit) | Comm. module (main/expansion) (200 byte, 1 block) |
| "E" type | 5.4 ㎳ | 1.0 ㎳ | - | - | 0.5 ㎳ |
| "S" type | 3.0 ㎳ | 0.5 ㎳ | 0.3 ㎳ | 3.0 ㎳ | 0.8 ㎳ |

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




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

① Scan program process = no. of instruction x process speed per each instruction (refer to XGK/XGB instruction user manual)
② System check & Task process: 600 ㎲ ~ 1.0 ms [varies depending on the usage of auxiliary functions]
③XG5000 Service process time: 100 ㎲ at the max data monitor
④ Task Program process time: sum of task processing time that occurs within a scan; the time calculation by task programs are as same as that of scan program.

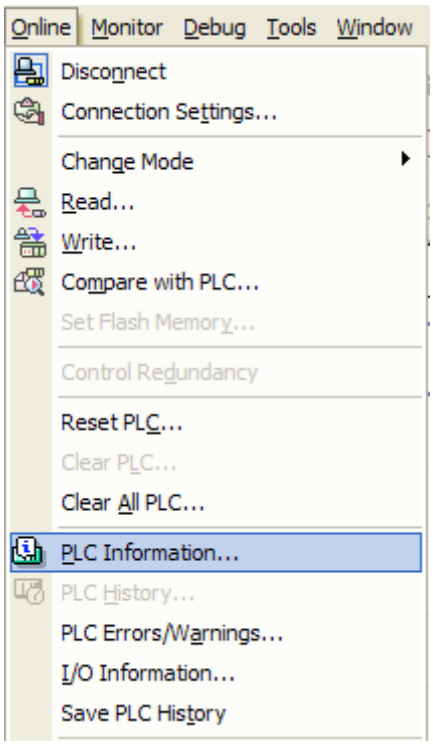
(2) Example

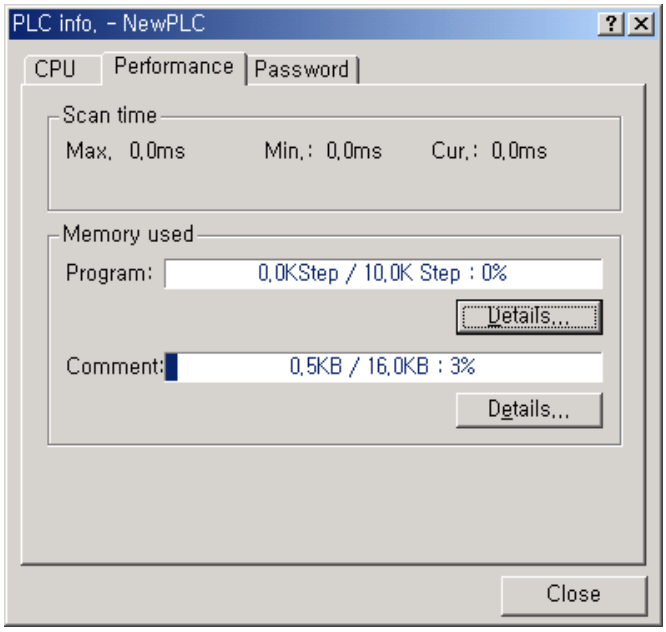
The scan time of a system consisting of main unit (program 4kstep) + five 32-point I/O modules + one analog module + one communication modules (200 byte 1 block)

Scan time(㎲) = ladder execution time + system processing time + digital module I/O processing time + analog I/O processing time + communication module processing time + XG5000 Service processing time
= (2047 x (0.67(LOAD)+ 0.80(OUT)) + (500) + (300 x 5) + (3000 x 1) + (800 x 1) + (100) ㎲
= 3009 + 500 + 1500 + 3000 + 800 + 100 ㎲ = 8909 ㎲
= 8.9 ㎳
(But, in case of online editing or writing XG-PD parameter, scan time increases temporary up to 100ms)

(3) Scan time monitor

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




(b) 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

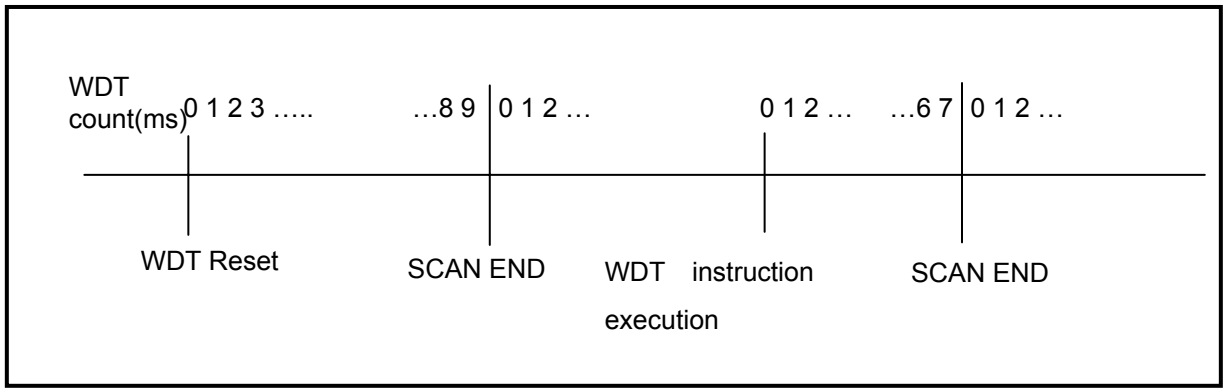
WDT (Watchdog Timer) is the function to detect the program congestion by the error of hardware and software of PLC CPU module.

(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.



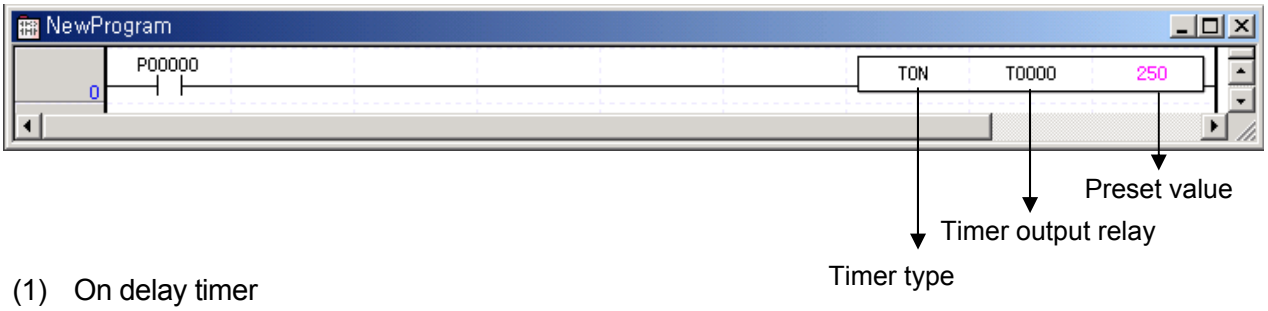

**Remark**

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

### 5.1.5 Timer processing

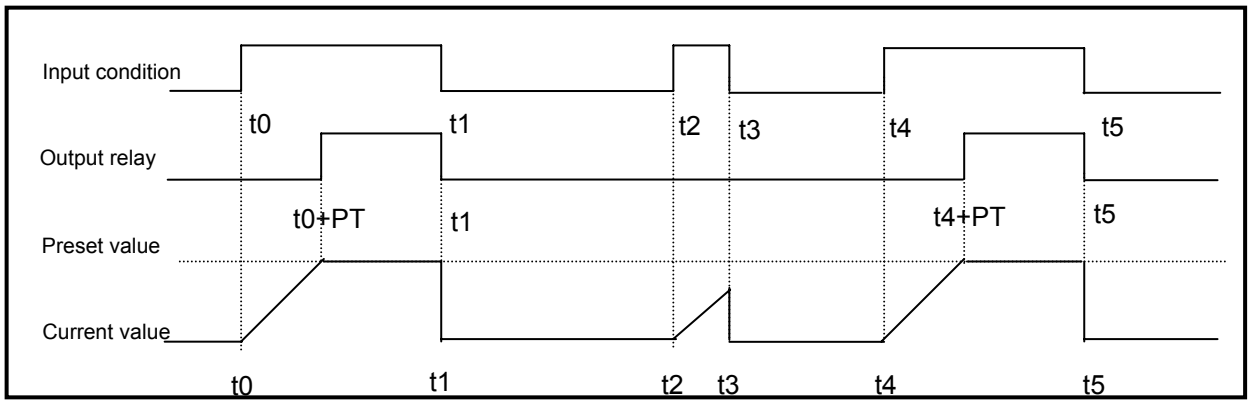
The XGB series use up count timer. There are 5 timer instructions such as on-delay (TON), off-delay (TOFF), integral (TMR), monostable (TMON), and re-triggerable (TRTG) timer.

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.



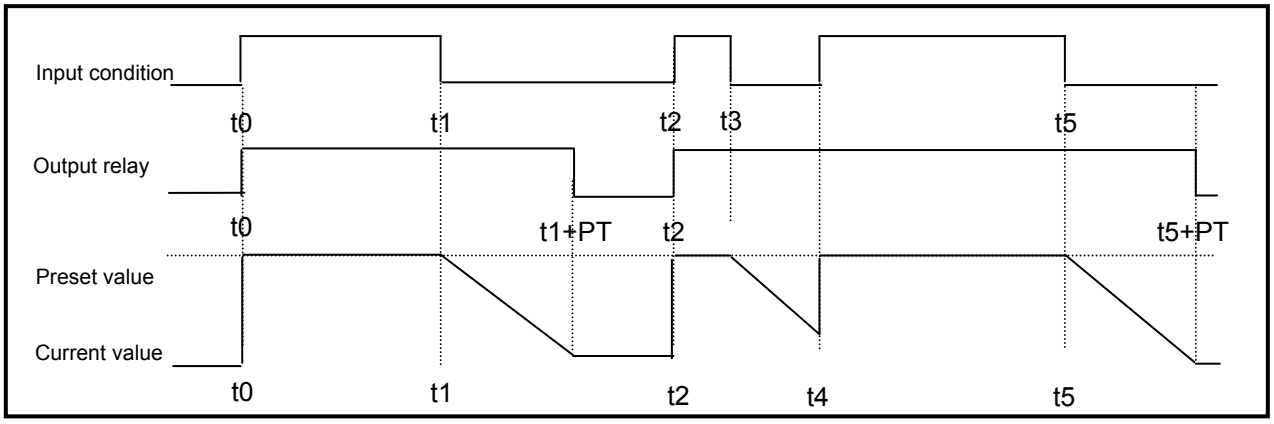

(1) On delay timer

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

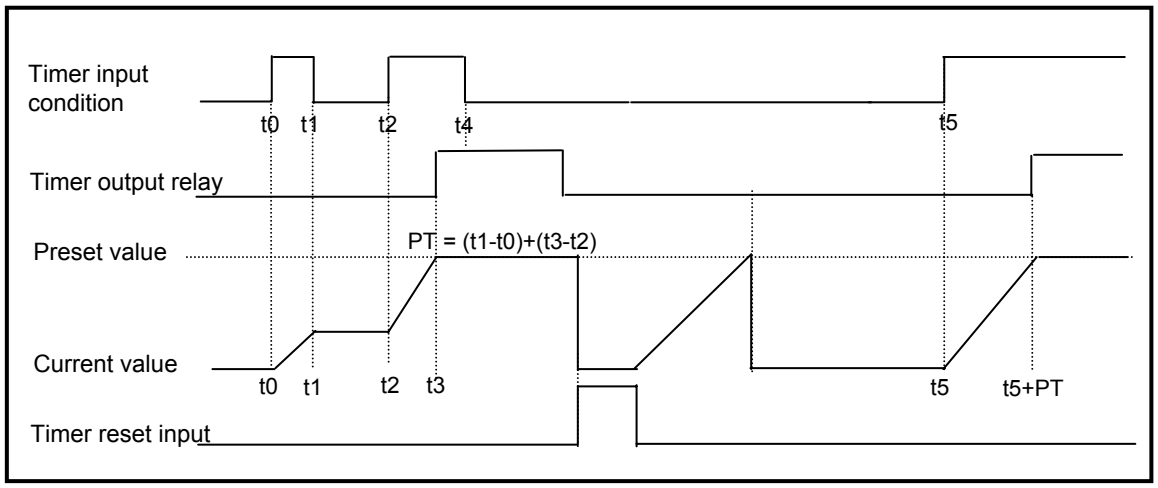
The current value of timer set as preset value and the timer output relay is turned on when the input condition of TOFF instruction turns on. When the input condition is turned off, the current value starts to decrease. The timer output relay is turned off when the current value reaches 0.



(3) Integral timer

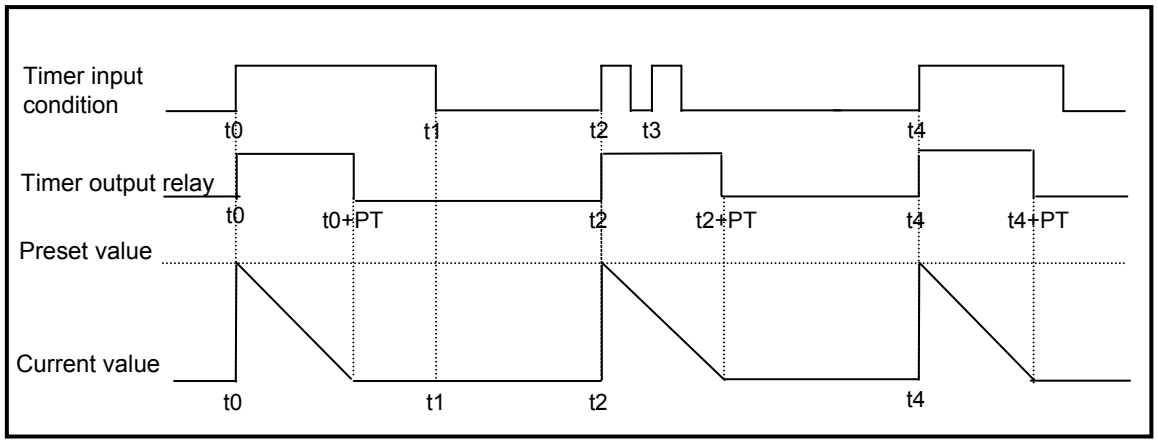
In general, its operation is same as on-delay timer. Only the difference is the current value will not be clear when the input condition of TMR instruction is turned off. It keeps the elapsed value and restart to increase when the input condition is turned on again. When the current value reaches preset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

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



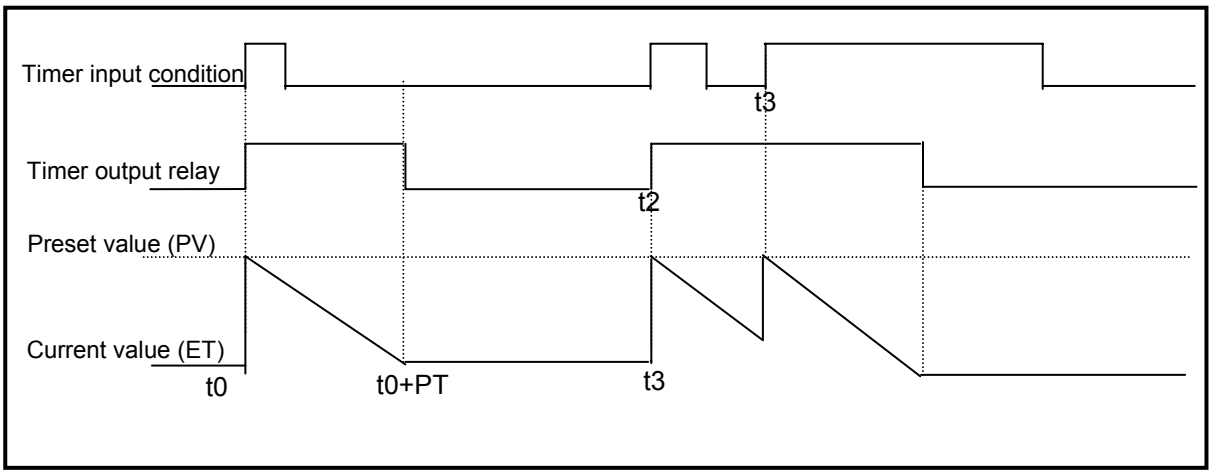

(4) Monostable timer

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

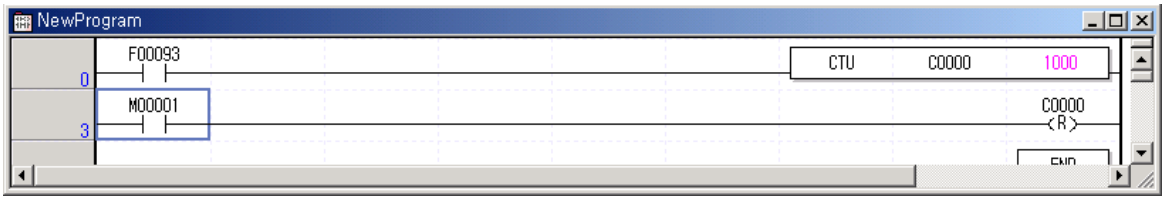
### 5.1.6 Counter processing

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.

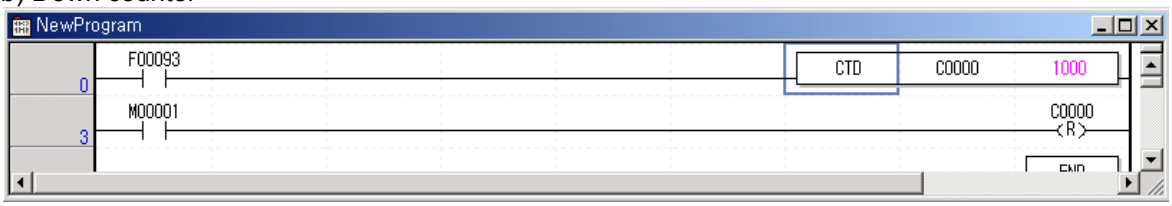
(1)Renewal of counter's current value and contact On/Off

(a) Up counter



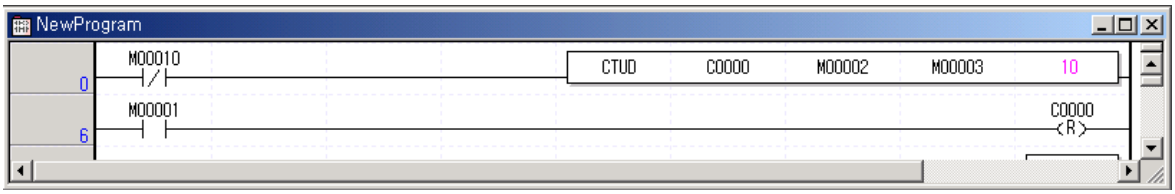

- Up counter increases the current value at the rising edges of input.
- The counter output contact (Cxxx) is turned On when the current value reaches the preset value. When the reset input is turned On, the counter output contact (Cxxx) is turned Off.

(b) Down counter



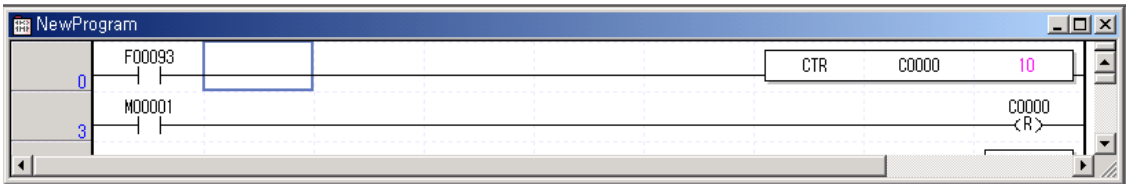

- Down counter decreases the current value at the rising edges of input.
- The counter output contact (Cxxx) is turned On when the current value reaches the preset value. When the reset input is turned On, the counter output contact (Cxxx) is turned Off.

(c) 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.

(d) Ring counter




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

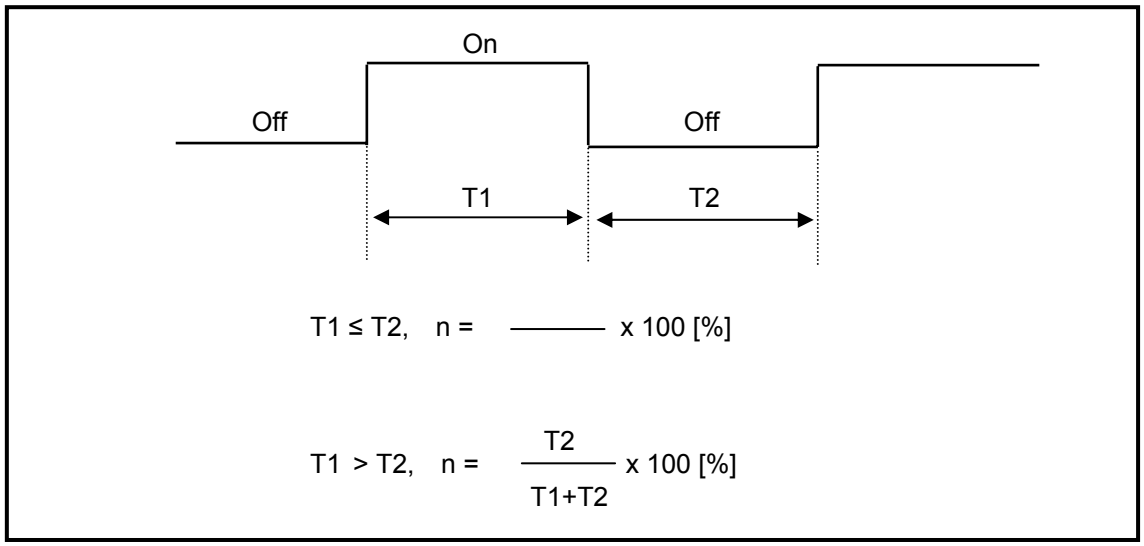
(2) Maximum counting speed

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

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

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

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




**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

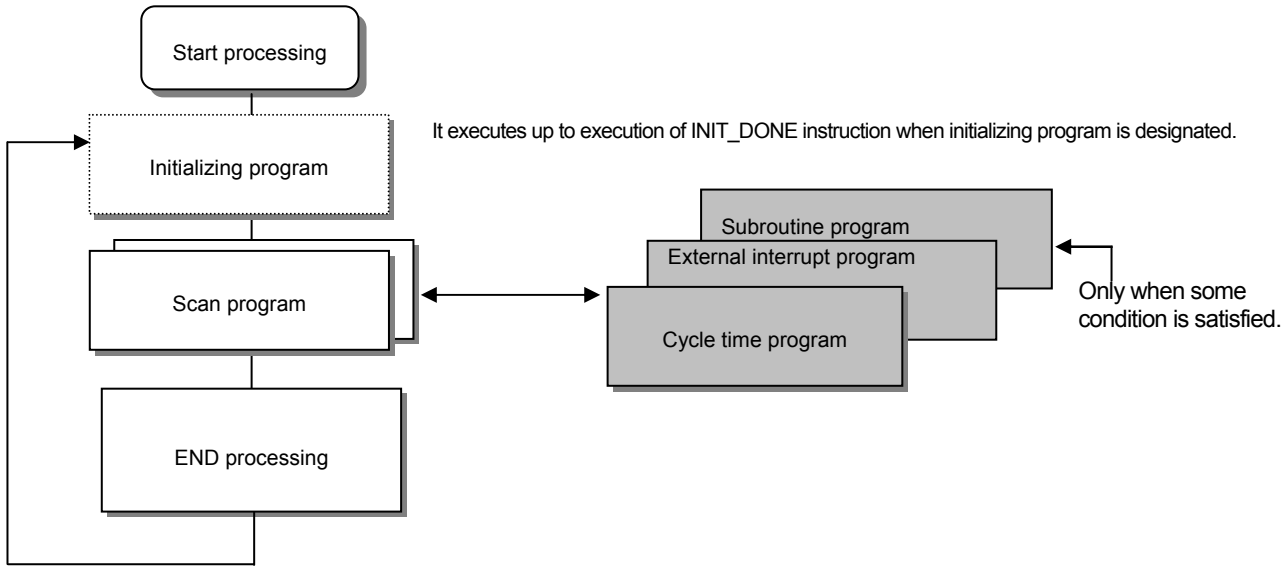
## 5.2.1 Configuration of program

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, cycle task, external interrupt task and internal device task are not executed. I/O refresh, high speed counter and communication are 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

(a) 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

(a) 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.

(b) 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): "S" type available to use up to 8. (P000 ~ P007)
    "E" type available to use up to 4. (P000~P003)

• 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 ("S" type: P000~P007, "E" type: P000~P003).

**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.

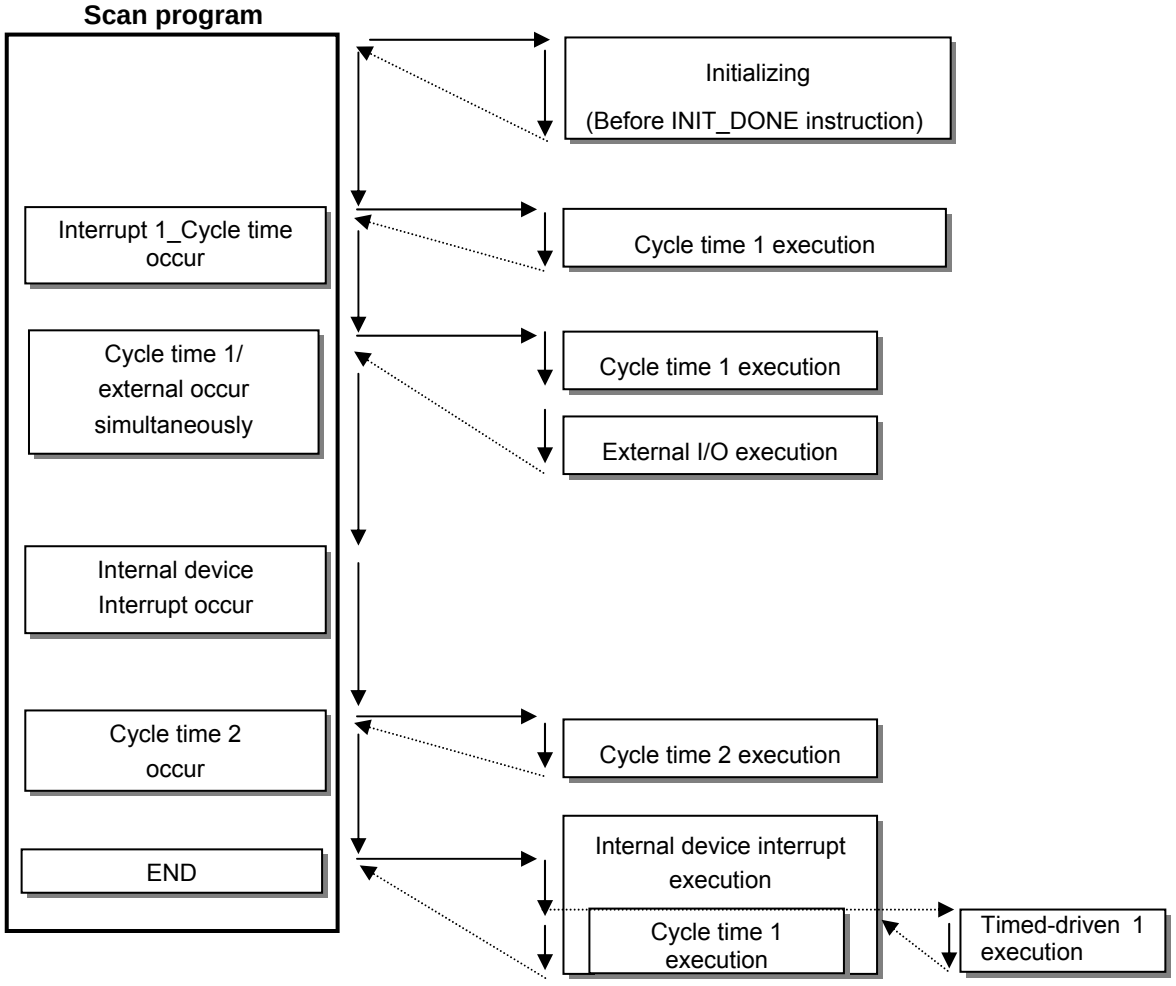
(2) Though interrupt which has lower priority occurs many times during execution of interrupt which has higher priority, interrupt which has lower priority occurs only one time.

### 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 |



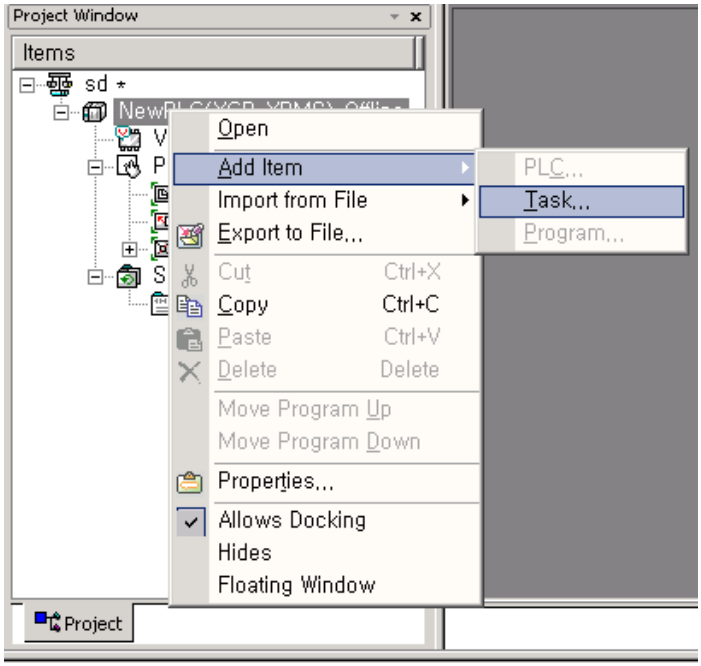

**Remark**

- 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 'Enable'. In case you don't use it, disable the interrupts by using DI instruction. If you want to use it again, enable by using EI instruction.
- Internal device interrupt is executed after END instruction.

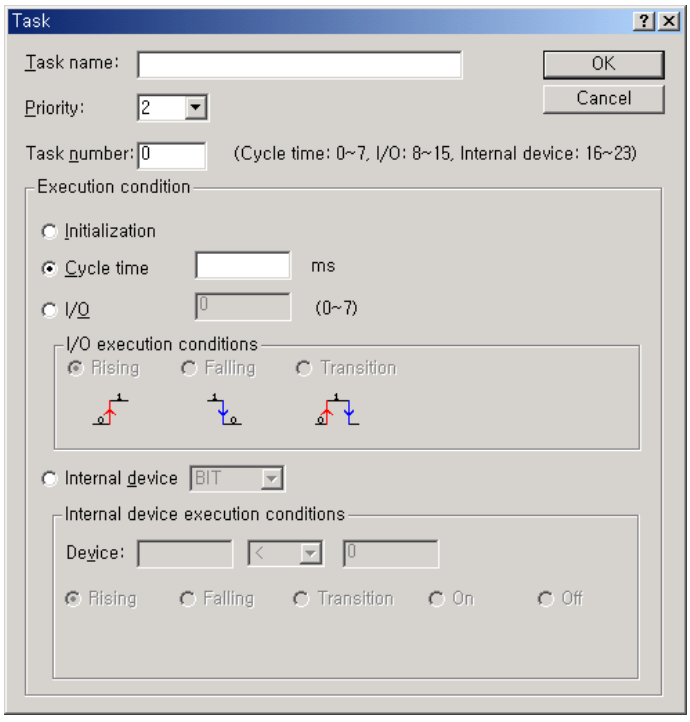
(1)How to prepare interrupt program

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.)

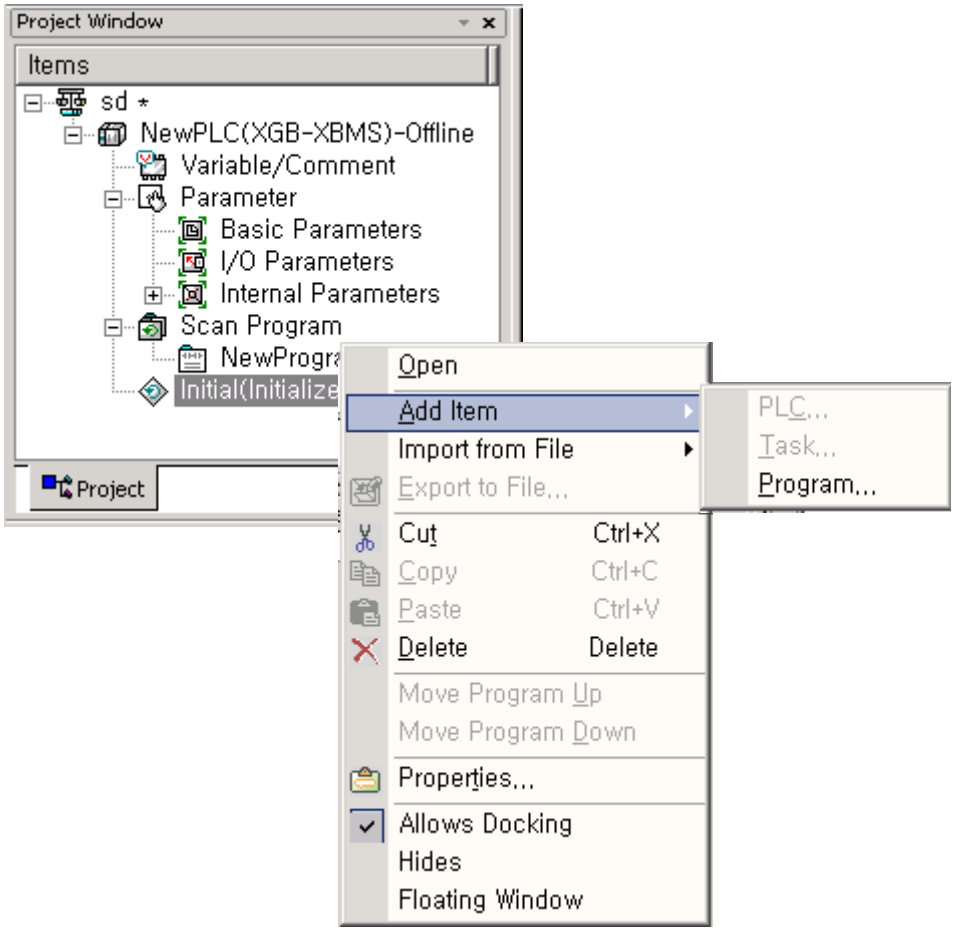
(a) Click right button of mouse on project name and click 『Add item』 - 『Task』 .



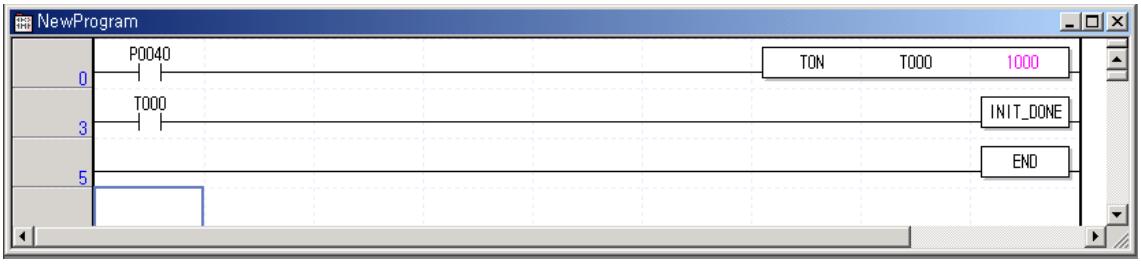

(b) The screen of Task setting is shown. Click 『Initialization』 in Execution condition and make a Task name.



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



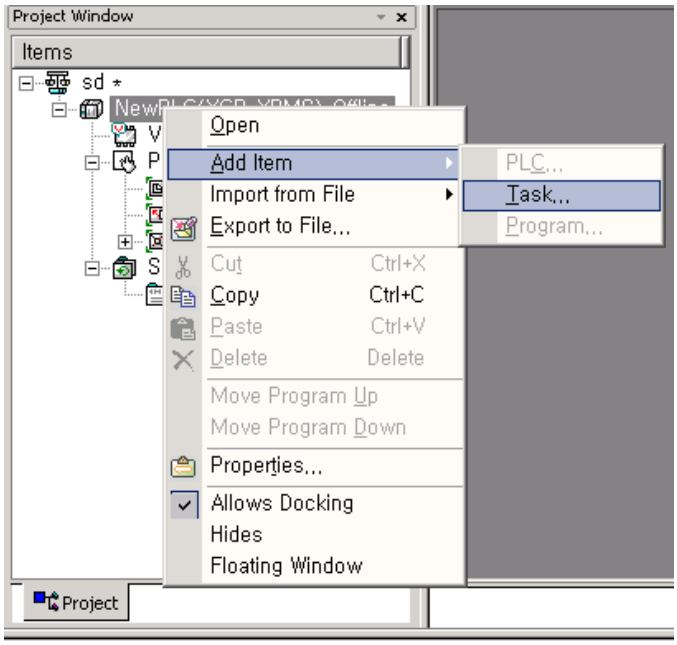

(d) Make initializing program. In initializing program, INIT_DONE instruction must be made. If not, Scan program is not executed.



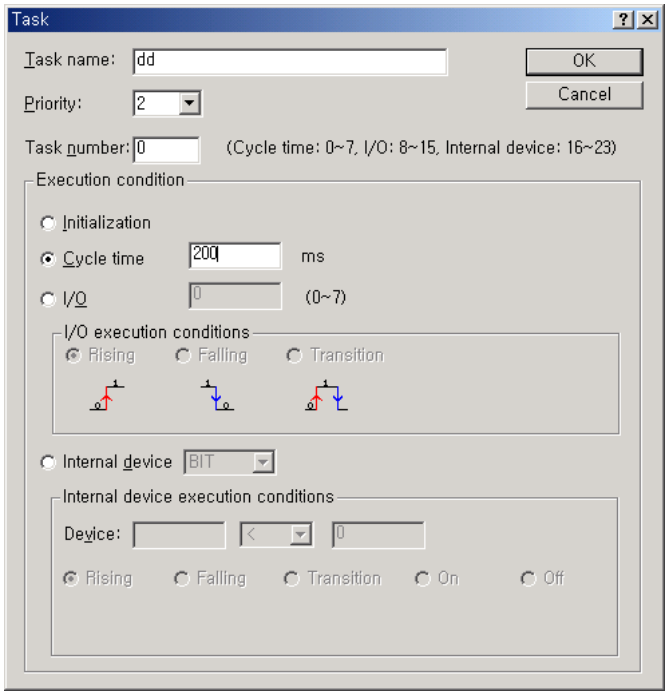
(2) How to prepare Cycle interrupt program

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)

(a) Click right button of mouse at registered task and select『Add Item』-『Task』.



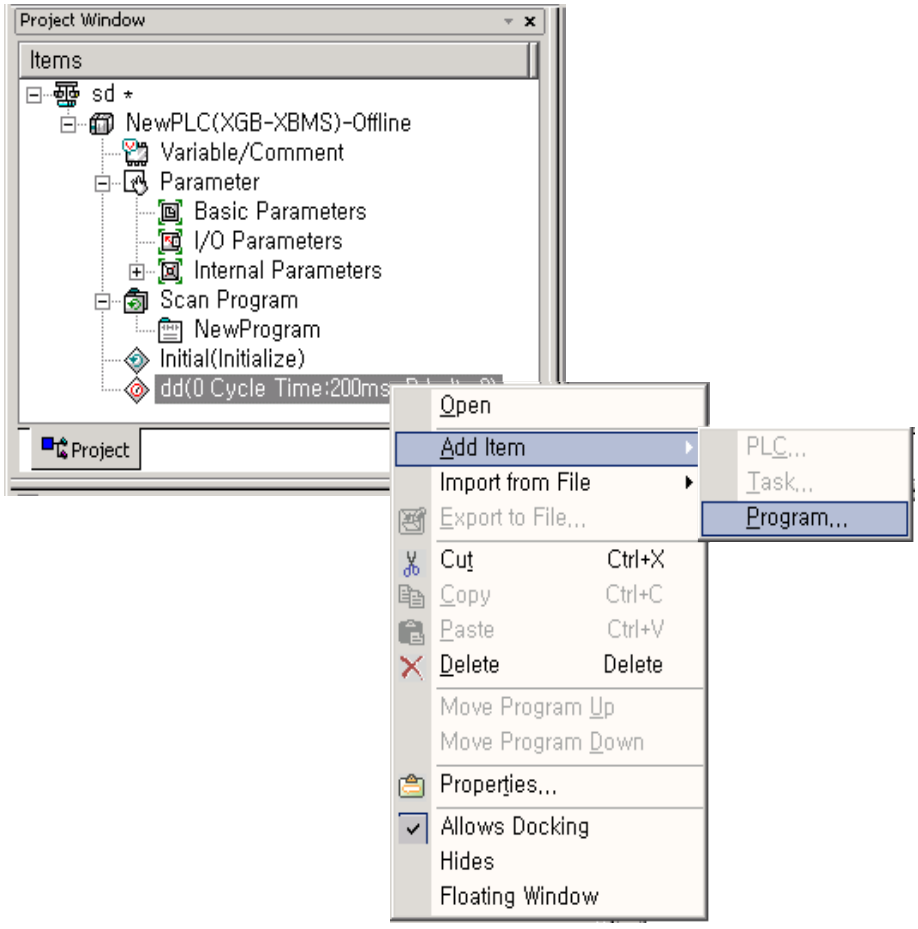

- It shows setting screen of Task.



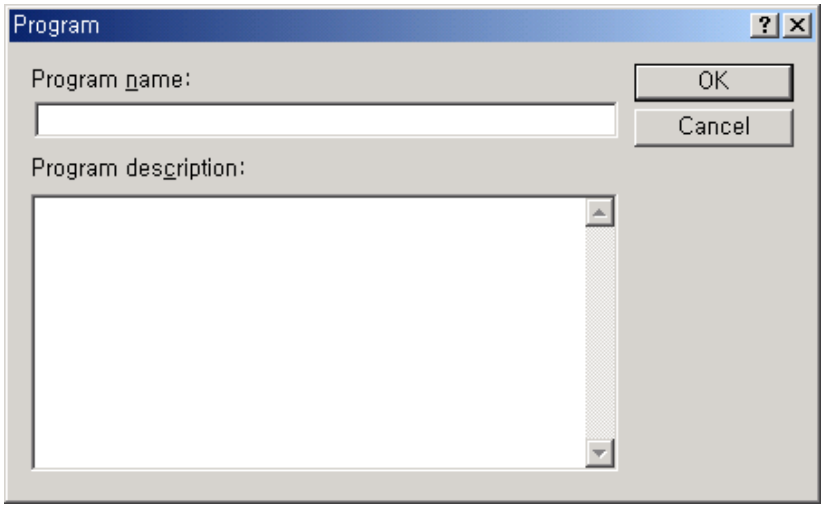
(b) Task type

| 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): "S" type: 8, "E" type: 4<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 >,>=,<,<= | - |

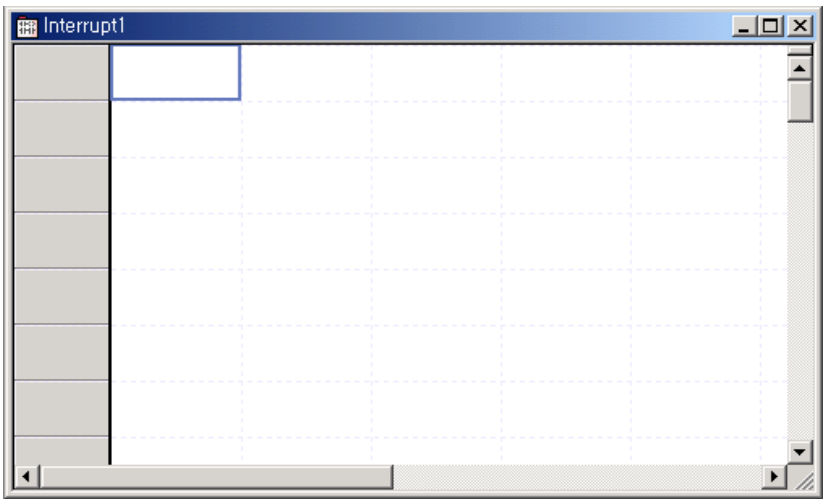
(c) Click right button of mouse at registered task and select 『Add Item』- 『Program』.



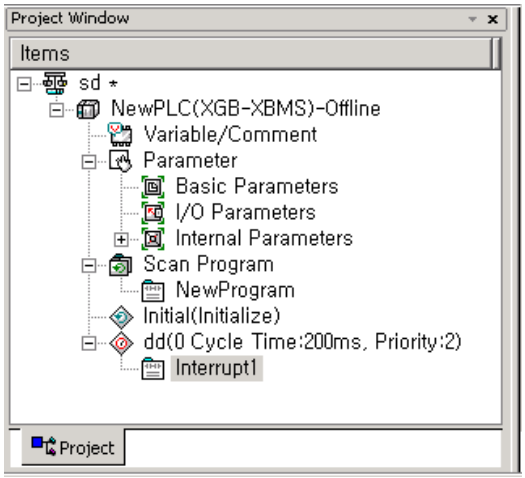
(d) Register the Program name and Program description.




(e) It is displayed the program window to write task program.




(f) It is displayed the setting in project window.



(3) Task type

Task type and function is as follows.

| Spec. \ Type | Cycle time task (Interval task) | I/O task (Interrupt task) | | Internal device task (Single task) |
|---|---|---|---|---|
| | | "S" type | "E" type | |
| Max. Task number | 8 | 8 | 4 | 8 |
| Start condition | Cyclic (setting up to max. 4,294,967.295 sec. by 1ms unit) | Rising or falling edge of main unit's contact P000 ~P007 | Rising or falling edge of main unit's contact P000 ~P003 | Internal device execution condition |
| Detection and execution | Cyclic execution per setting time | Immediate execution at the edge of main unit's contact | | Retrieve the condition and execute after completing Scan Program |
| Detection delay time | Max. 1 ms delay | Max. 0.05 ms delay | | Delay as much as max. scan time |
| Execution priority | 2~7 level setting (2 level is highest in priority) | 2~7 level setting (2 level is highest in priority) | | 2~7 level setting (2 level is highest in priority) |
| Task no. | Within 0~7 range without user duplication | With 8~15 range without user duplication | | Within 16~23 range without user duplication |

(4) Processing methods of task program

Here describes common processing method and notices for Task program.

(a) Feature of task program

1) Task Program is executed only when execution condition occurs without every scan repeat processing. When preparing Task Program, please consider this point.
2) 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.

(b) Execution priority

1) 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.
2) In case Cycle time task and external I/O task is occurred concurrently, execute from the highest task program. (In sequence of XG5000 setting)
3) The task program priority should be set considering the program features, importance and the emergency when the execution requested.

(c) Processing delay time

There are some causes for Task Program processing delay as below. Please consider this when task setting or program preparation.

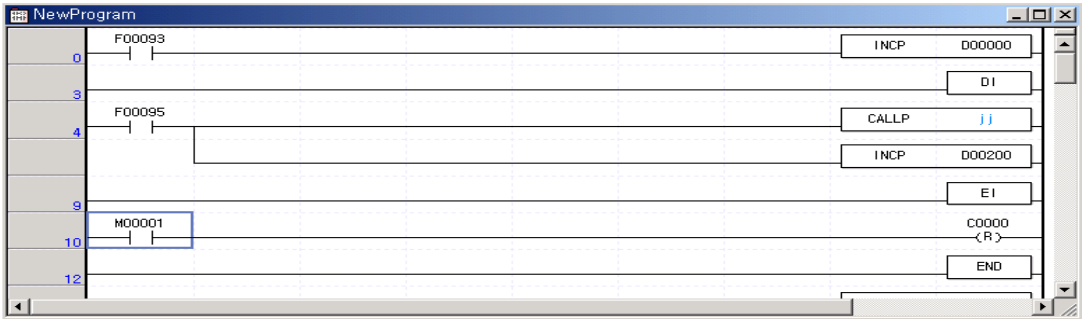
1) Task detection delay (Refer to detailed description of each task.)
2) Program proceeding delay caused by Priority Task Program proceeding

(d) Relationship of initialize, Scan Program and Task Program

1) ser identification task does not start while performing Initialization Task Program.
2) 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.

(e) Protection of Program in execution from Task Program

1) 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.
2) 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.
3) 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.

(a) Items to be set in Task

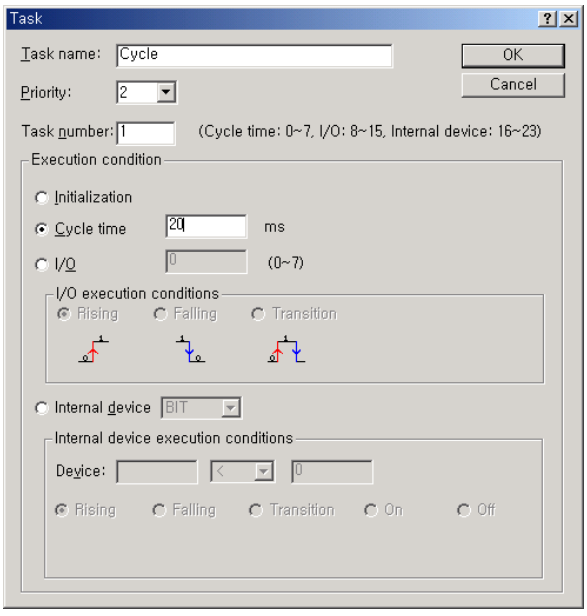
Set the execution cycle and priority which are the start condition o f Task program to execution. Check the task no. to manage the task.

(b) Cyclic task processing

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

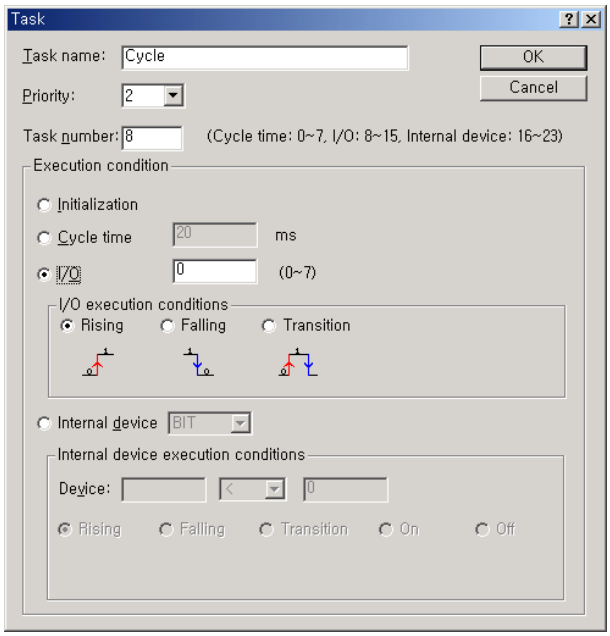
(c) Notice in using cyclic task program

1) 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.
2) 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.
3) 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. (“S” type: P000~P007, “E” type: P000~P003)




(a) 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.

(b) I/O task processing

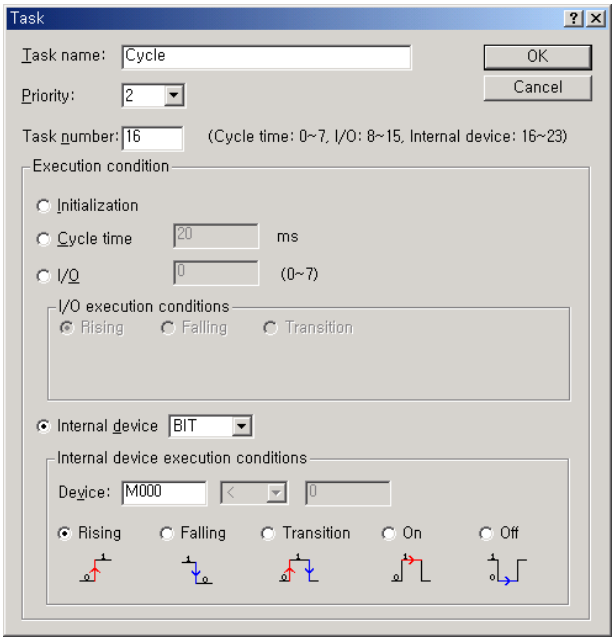
If interrupt signal from external signal (I/O) is occurred on main unit (“S” type: P000 ~ P007. “E” type: P000~P003), task program is executed by external (I/O) signal.

(c) Precaution in using I/O task program

1) 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.
2) 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.




(a) Items to be set in Task

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

(b) 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.

(c) Precautions in using internal device task program

1) 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.
2) 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

(a) 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.

(b) 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.

(c) 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.)

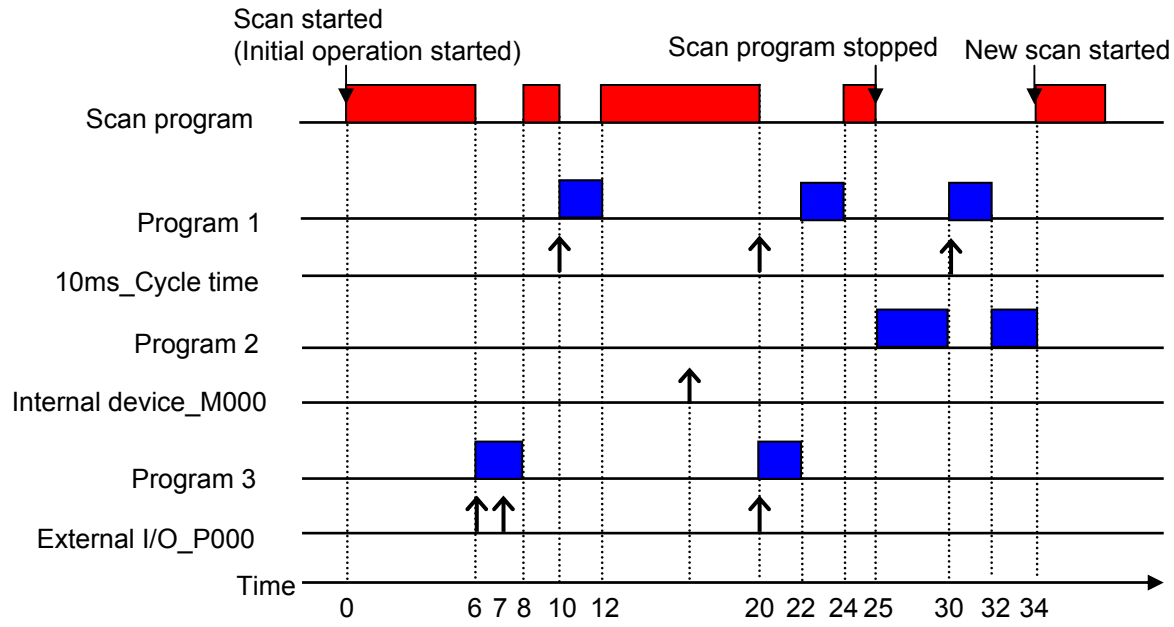
(d) Is program protection for the high priority task needed during program execution?
If other task is inserted during task program execution, complete the task in execution and operate the standby tasks in the order of high priority. In case that it is not allowed to insert other task in Scan Program, 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 |

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



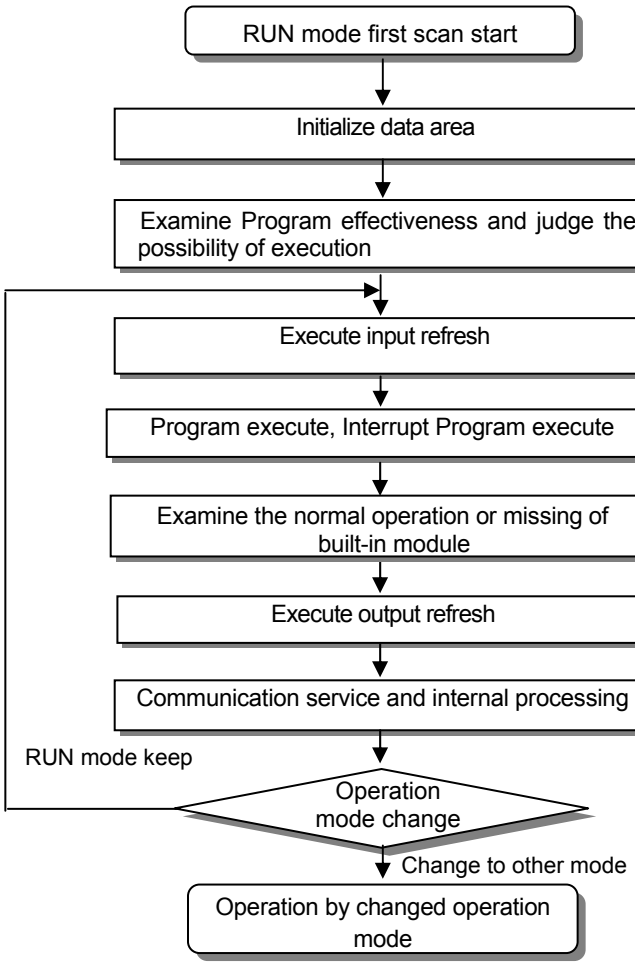

| Process per time | |
|---|---|
| Time (㎳) | Process |
| 0 | Scan started and scan program started to execute. |
| 0~6 | Scan program is executed. |
| 6~8 | Scan program is stop because execution external I/O (P000) is requested. And program 3 is executed. Request of execution at 7[ms] is ignored because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

## 5.3 Operation Mode

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

### 5.3.1 RUN mode

This is the mode to executed program operation normally.




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

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

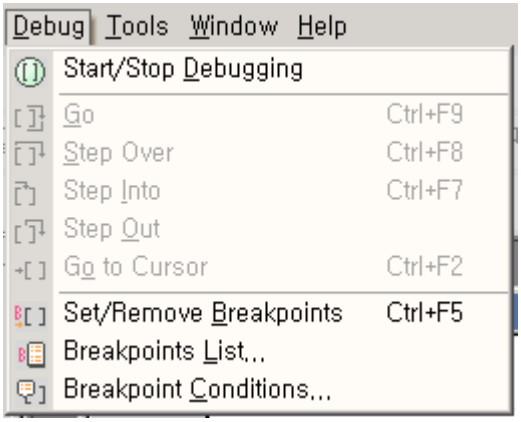
### 5.3.3 DEBUG mode (Supported at “S” type)

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
(a) Initializes the data area at the beginning of mode change.
(b) Clears the output image area and execute input refresh.

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

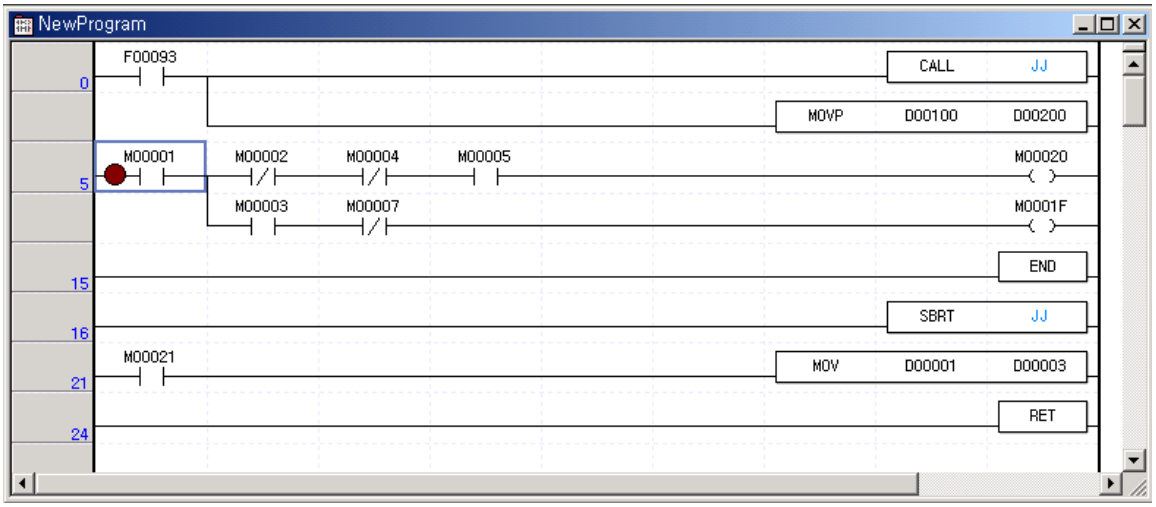
(3) Debug operation
❑ It describes debug mode.



| 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. | |

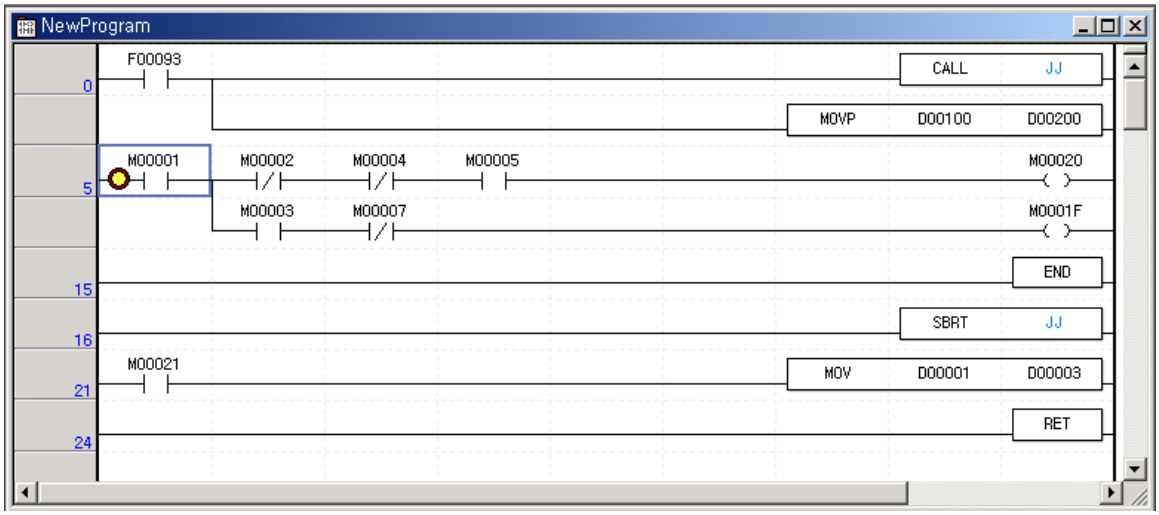
(a) Set/Remove Breakpoints

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



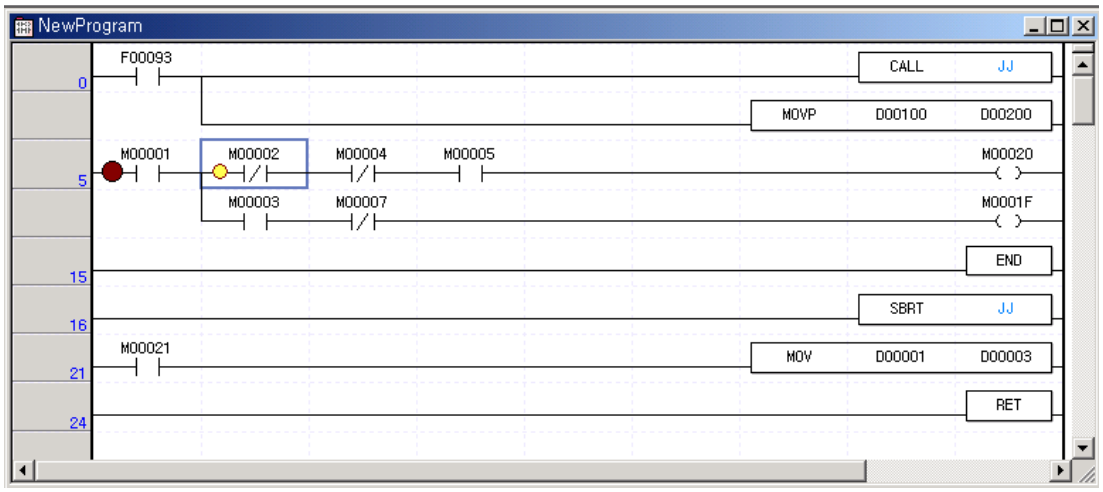

(b) Go

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



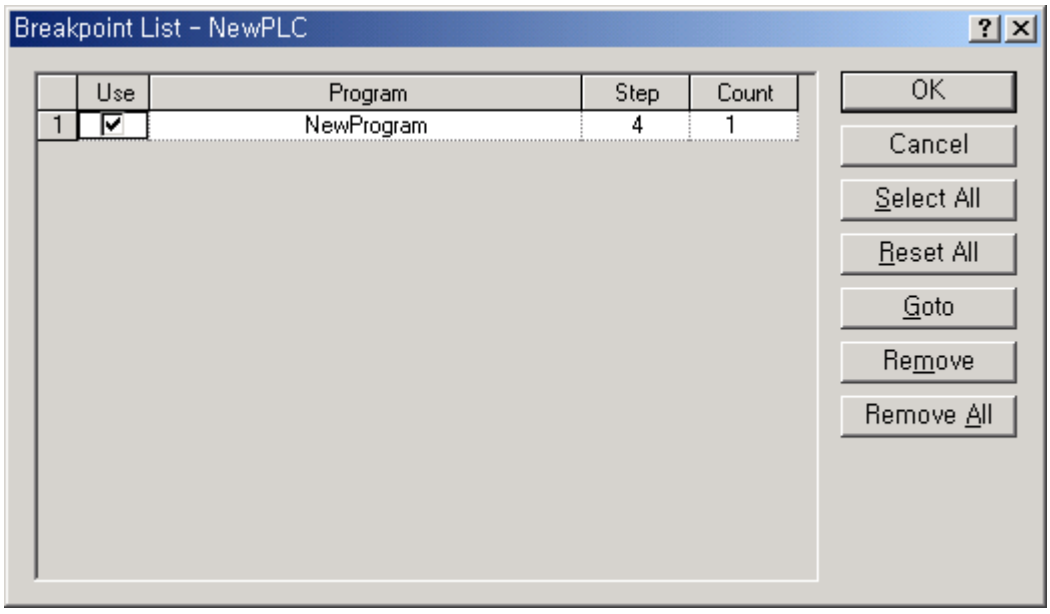
(c) Step Over

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



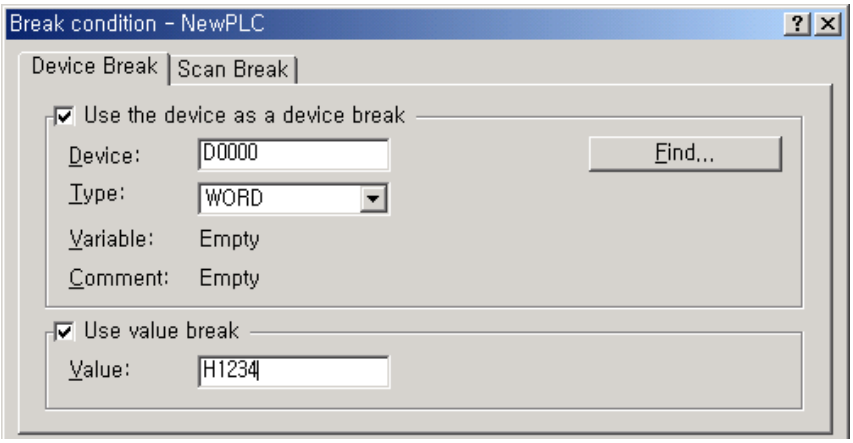

(d) Breakpoint List

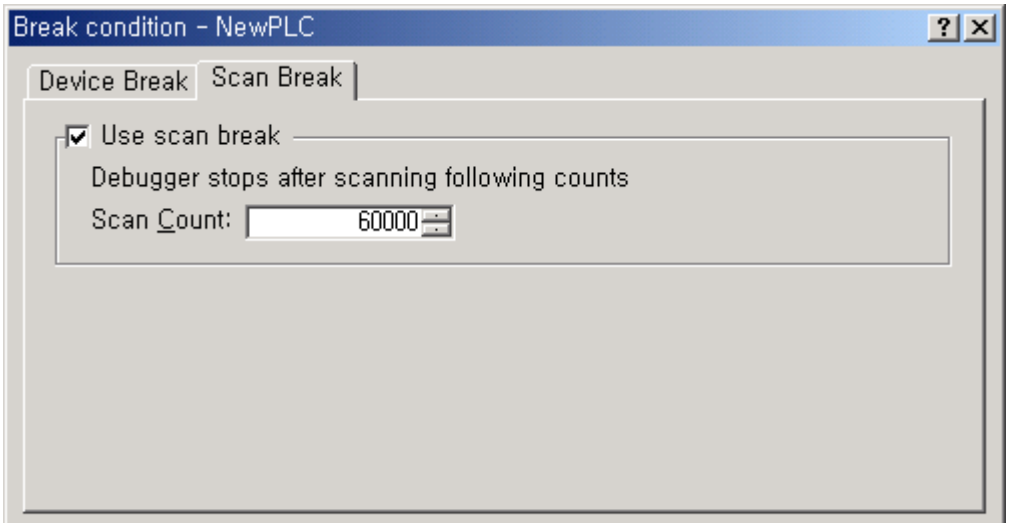
▪ It displays current Breakpoint List. It supports Select All, Reset All, Goto, Remove, Remove All.




(e) Break condition

▪ It sets Device Break and Scan Break.






**Remark**

1) 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.

(a) By mode key of CPU module
(b) By connecting the programming tool (XG5000) to communication port of CPU
(c) By changing the operation mode of other CPU module connected to network by XG5000 connected to communication port of CPU.
(d) By using XG5000, HMI, computer link module connected to network
(e) 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 | unchangeable | Local Run |
| STOP | RUN | Remote Run |
| | STOP | Remote Stop |
| | Debug | Debug Run |
| | Mode change | Previous operation mode |
| RUN -> STOP | - | Stop |

(a) Remote mode conversion is available only in the state of **'Remote Enabled: On'**, **'Mode switch: Stop'**. 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.

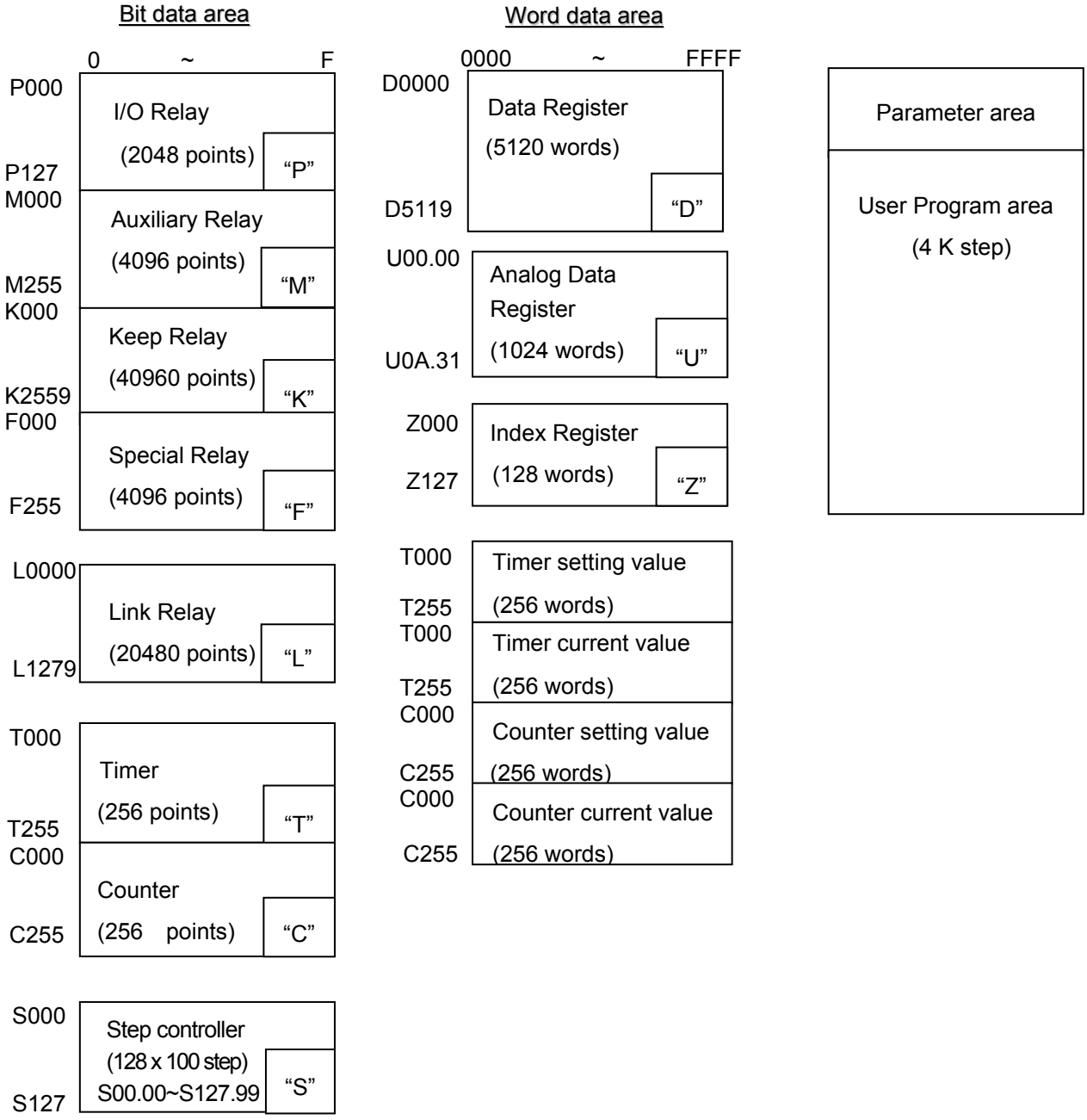
| Area per device | | Device features | Description |
|---|---|---|---|
| "E" type | "S" type | | |
| P0000 ~ P127f | P0000~ P1023f | I/O device "P" | Image area to save the state of I/O device. After reading the input module state, saves it in the corresponding P area and sends P area Data saving the 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

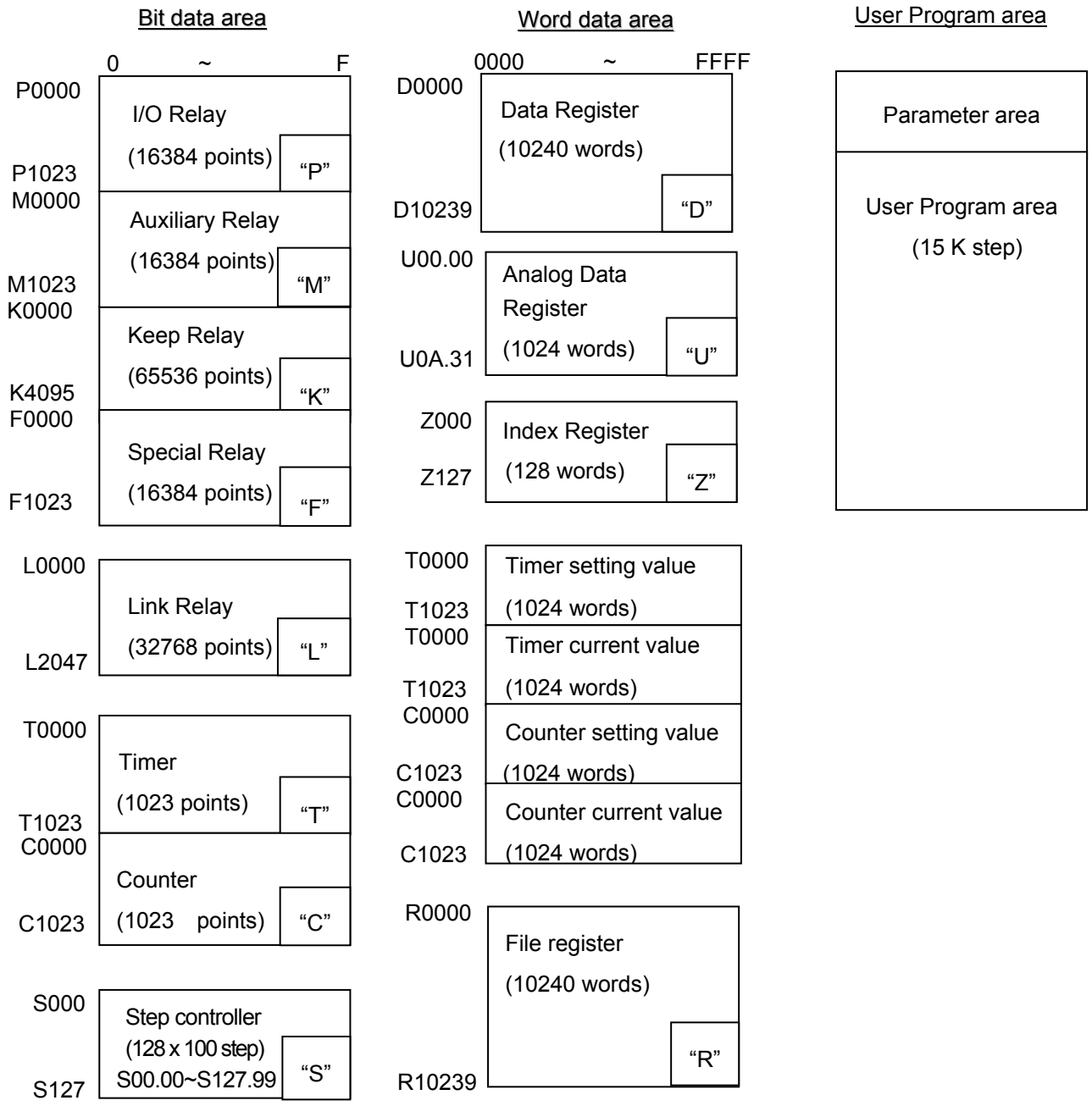
| Area per device | | Device features | Description |
|---|---|---|---|
| "E" type | "S" type | | |
| D00000 ~ D5119 | D0000~ D10239 | Data register "D" | Area to preserve the internal data.<br>Bit expression possible. (D0000.0) |
| U00.00 ~ U0A.31 | U00.00~ U0A.31 | Analog data register "U" | Register used to read data from special module installed in the slot. Bit expression possible |
| 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 file<br>Bit expression available (F0000.0) |

## 5.5 Configuration Diagram of Data Memory

### 5.5.1 “E” type



### 5.5.2 “S” type


Bit data area
0 ~ F
P0000
I/O Relay
(16384 points)
“P”
P1023
M0000
Auxiliary Relay
(16384 points)
“M”
M1023
K0000
Keep Relay
(65536 points)
“K”
K4095
F0000
Special Relay
(16384 points)
“F”
F1023
L0000
Link Relay
(32768 points)
“L”
L2047
T0000
Timer
(1023 points)
“T”
T1023
C0000
Counter
(1023 points)
“C”
C1023
S000
Step controller
(128 x 100 step)
S00.00~S127.99
“S”
S127
Word data area
0000 ~ FFFF
D0000
Data Register
(10240 words)
“D”
D10239
U00.00
Analog Data Register
(1024 words)
“U”
U0A.31
Z000
Index Register
(128 words)
“Z”
Z127
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
R0000
File register
(10240 words)
“R”
R10239
User Program area
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.

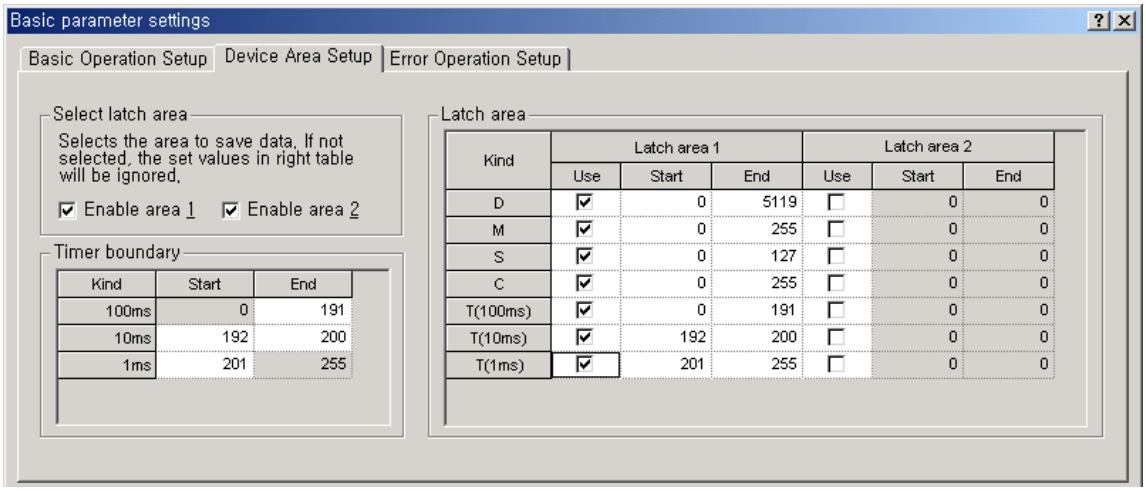
| Device | 1st latch | 2nd latch | Features |
|---|---|---|---|
| P | X | X | Image area to save the state of I/O device |
| M | O | O | Internal device area |
| K | X | X | Device keeping the device state during power shutdown |
| F | X | X | System flag area |
| T | O | O | Timer related area (Bit/words 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) |
| Z | X | X | Index dedicated Register (latch disabled) |
| R | O | O | File register (latch enabled) |

**Remark**

▪ K, L, R devices are basically latched.

(1) Latch area setting

(a) Click Device Area Setup of Basic parameter settings.



(2) Data latch area operation

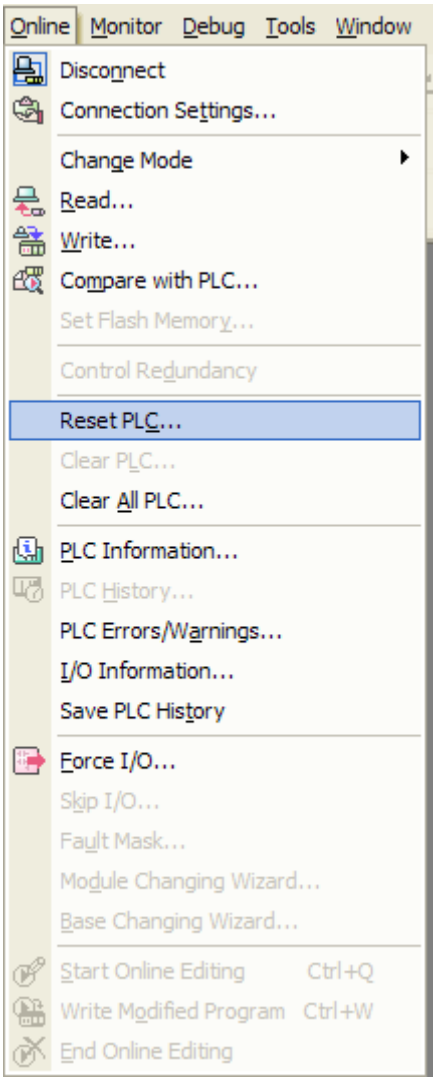
(a) The method to delete the latched data is as below.

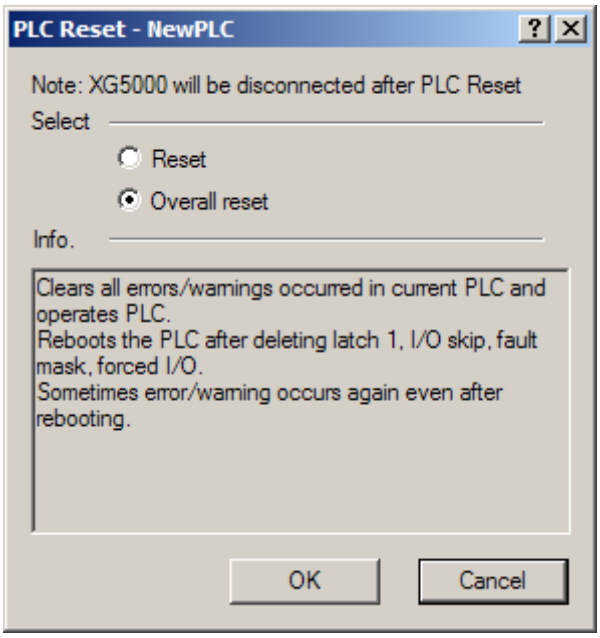
- latch 1, latch 2 clear operation by XG5000
- write by Program (initialization program recommended)
- write '0' FILL from XG5000 monitor mode.

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

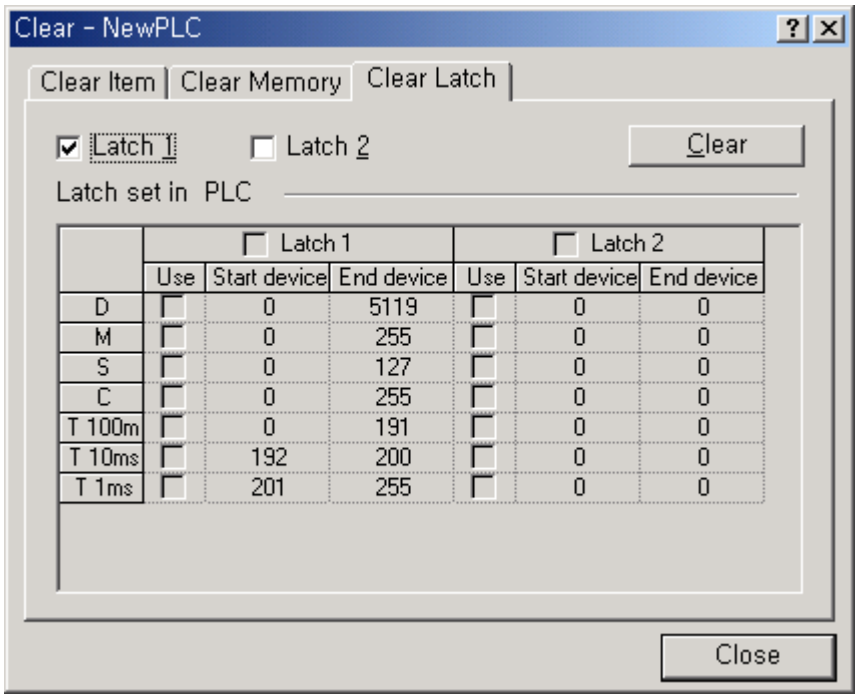
| No. | Classification | Detailed operation | Latch 1 | Latch 2 |
|---|---|---|---|---|
| 1 | Power change | Off/On | Keep | Keep |
| 2 | Reset by XG5000 | Overall reset | Reset | Keep |
| 3 | Program write (online) | - | Keep | Keep |
| 4 | Data broken | SRAM broken by battery error | Reset | Reset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

(b) Latch 1 area is cleared by 『Online』 - 『Reset PLC』 - "Overall reset".



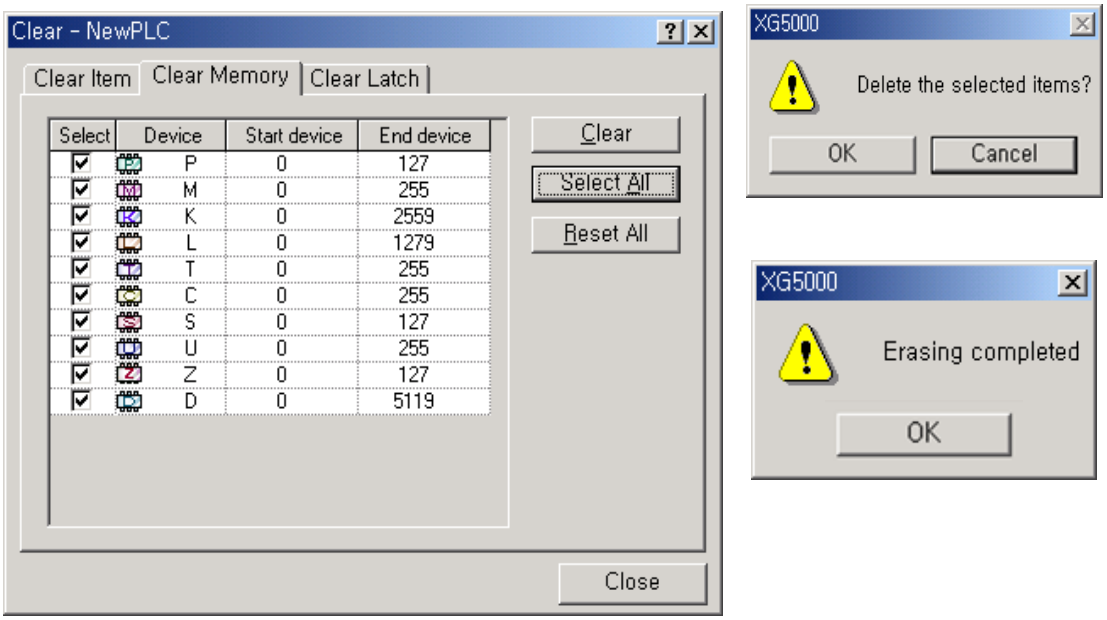
**(c)** Latch 1, 2 area is cleared by 『Online』- 『Clear PLC』.




(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.

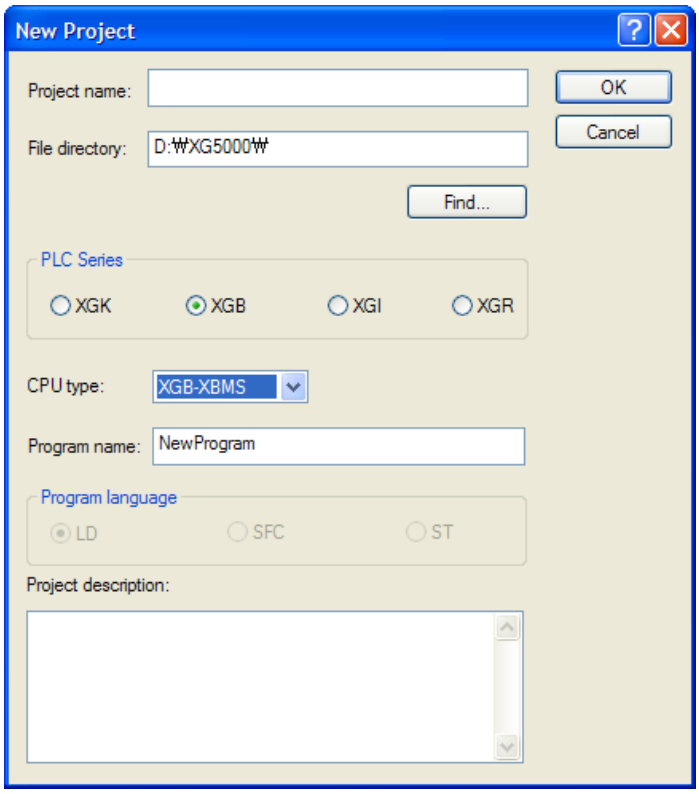
(a) Device area is cleared by click 'Clear' in 『Online』- 『Clear PLC』- 『Clear Memory』.



# Chapter 6 CPU Functions

## 6.1 Type Setting

It describes setting of XGB PLC type.




| PLC Series | CPU type | Description | Reference |
|---|---|---|---|
| XGB | XGB-DR16C3 | Dedicated product | Modular type |
| | XGB-DR32HL | Dedicated product | Modular type |
| | XGB-XBCE | “E” type : XBC-DR10/14/20/30E | Compact type |
| | XGB-XBCH | “H” type : XBC-DR32/64H , XBC-DN32/64H | Compact type |
| | XGB-XBCS | “S” type : XBC-DR20/30S, XBC-DN20/30S | Compact type |
| | XGB-XBMS | “S” type : XBM-DN16/32S , XBM-DR16S | Modular type |
| | XGB-XECH | “H” type : XEC-DR32/64H, XEC-DN32/64H | Compact type IEC language |

**Remark**

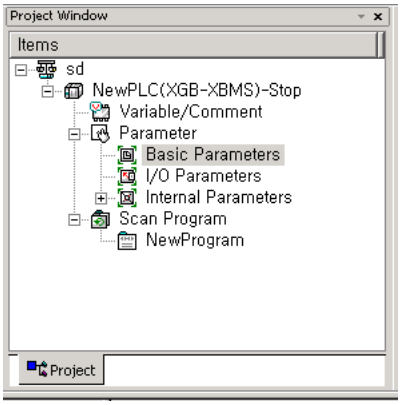
▪ In case type is different, connection is not available.

# 6.2 Parameter Setting

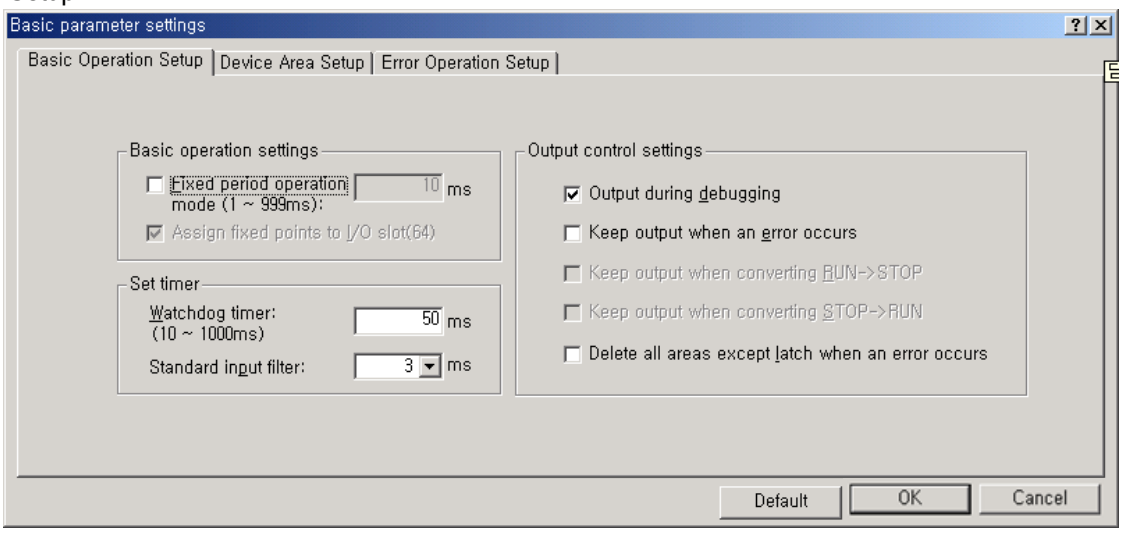
This paragraph describes how to set parameters.

## 6.2.1 Basic parameter setting

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



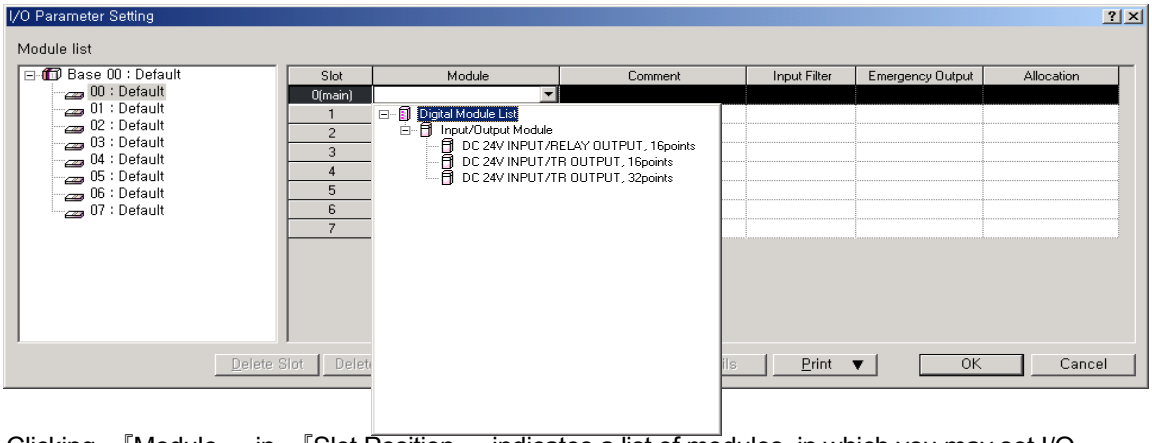

There are three main options ; “Basic Operation Setup” , “Device Area Setup” and “Error Operation Setup”.



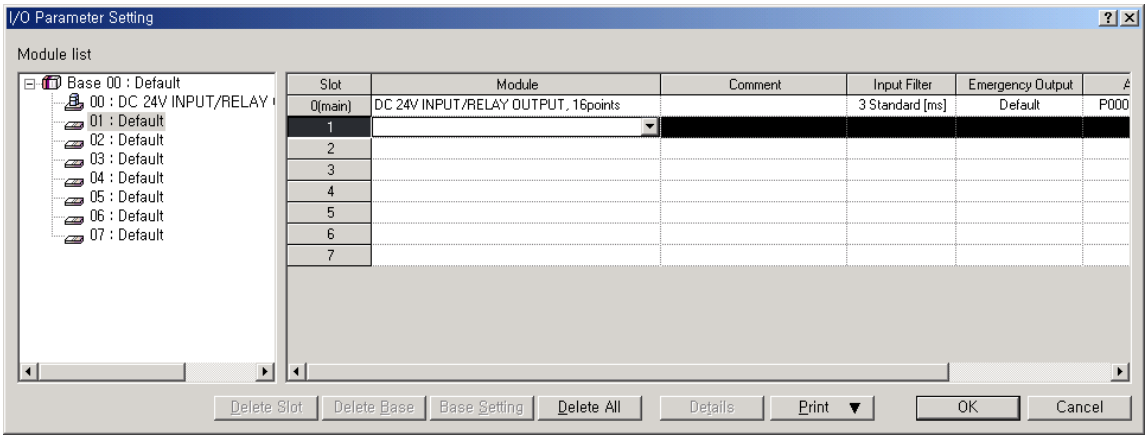

| Category | Item | Description | Note |
|---|---|---|---|
| Basic operations | Fixed period operation | Set the time of fixed period operation. | 1~999 ㎳ |
| | Watchdog timer | Set the time of scan watchdog. | 10~1000 ㎳ |
| | Standard input filter | Set the time of standard input filter. | 1,3,5,10,20,70,100 ㎳ |
| | 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

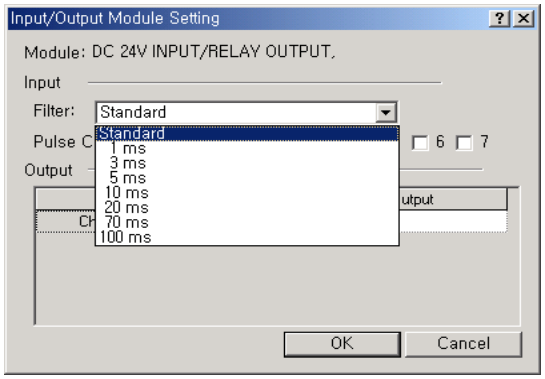
This setting is to set and reserve each I/O information. Clicking 『I/O Parameter』 in the project window shows the following setting window.

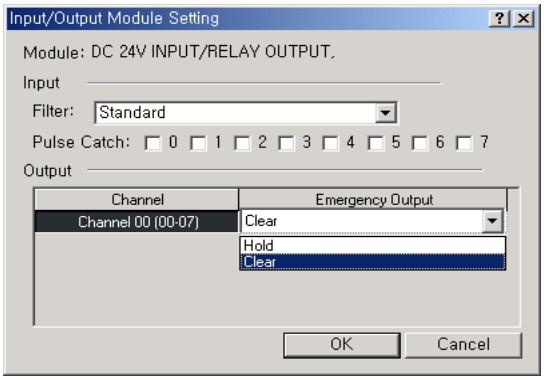



Clicking 『Module』 in 『Slot Position』 indicates a list of modules, in which you may set I/O corresponding to the actual system. Then, the following window is displayed.




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



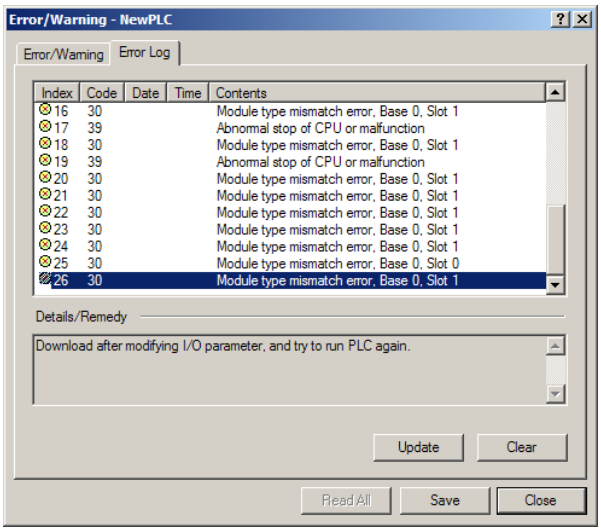

**Remark**

(1) If settings are different with I/O module actually accessed, “Inconsistent module type error” occurs, displaying error.
(2) 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.




| 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”.

## 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 trouble number is saved in a special relay F002,003.
(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.
  (a) Operable by accessing to XG5000 through RS-232C port mounted on CPU module.
  (b) Can operate other PLC connected to PLC network with CPU module connected to XG5000.

(2) Remote RUN/STOP
  (a) Remote RUN/STOP is the externally controlled RUN/STOP function.
  (b) 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
  (a) It manages debugging remotely when remote mode is STOP. Namely, DEBUG operation is to execute program operation depending on designated operation conditions.
  (b) Remote DEBUG is a convenient function when confirming program operation status or data during system debugging.

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

**Remark**

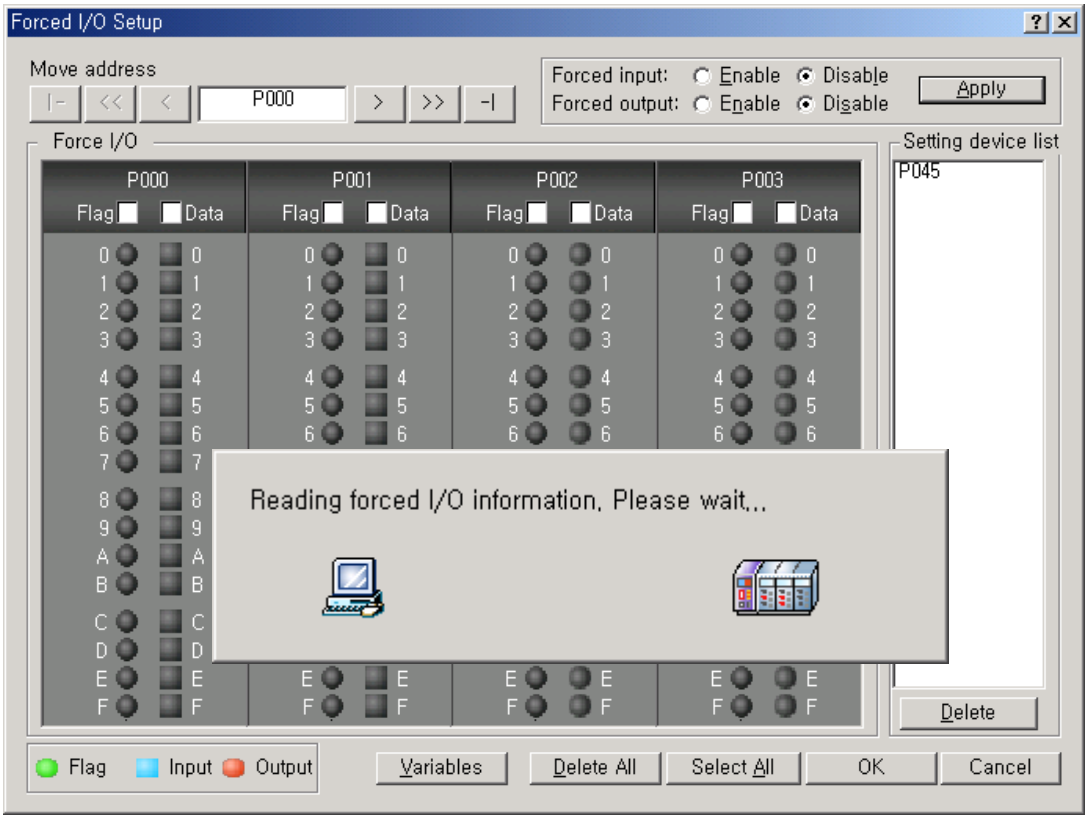
(1) For details regarding remote functions, refer to 'Ch10 Online' of XG5000 Users Manual.

## 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 | |- -| | 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

(a) It operates from the time when I/O is individually set as 'Allow' after setting Force data.
(b) It is possible to set Force input although I/O module is not actually mounted.
(c) 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.
(d) Even in STOP mode, Force I/O data is not removed.
(e) To set new data from the beginning, it is necessary to deselect all settings of I/O by using 'Delete All' option.

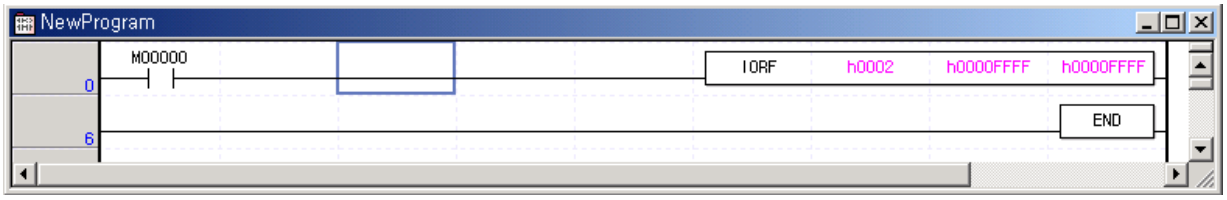
(4) Operation in case of error

(a) If error occurs after setting forced output, PLC operates based on "Keep output when an error occurs" in Basic parameter and "Emergency output" in I/O parameter.
If you set "Emergency output" as "Clear" after setting "Keep output when an error occurs", output is cleared when an error occurs. If you set "Emergency output" as "Hold" after setting "Keep output when an error occurs", output is held when an error occurs.
(b) If you don't set "Keep output when an error occurs", output is off when an error occurs.

## 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**

- When using IORF instruction to read/write data at expansion module, scan time increases by 2ms. So when executing interrupt task program by external input less than 10ms or cycle time task less than 10ms, task collision may occurs.
-For details regarding IORF instruction, refer to XGK/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

(a) 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.

(b) 'Error' uses 'F202 (_ANC_ERR)' and 'Warning' uses 'F203 (_ANC_WB) flag'.

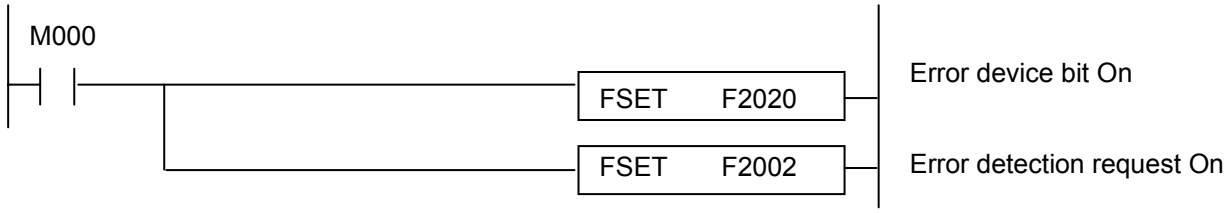
(c) As the detection request flag, 'Error' uses 'F2002 (_CHK_ANC_ERR) flag' while 'Warning' uses 'F2003 (_CHK_ANC_WB) flag'.

(2) Troubleshooting external device

(a) 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 outputs based on the "Emergency Output" setting in I/O parameter, making it as the same error status as detected by PLC itself.

(b) If any trouble occurs, a user may identify the cause by using XG5000 and alternatively by monitoring 'F202 (_ANC_ERR) flag'.

❑ Example




(c) 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.)

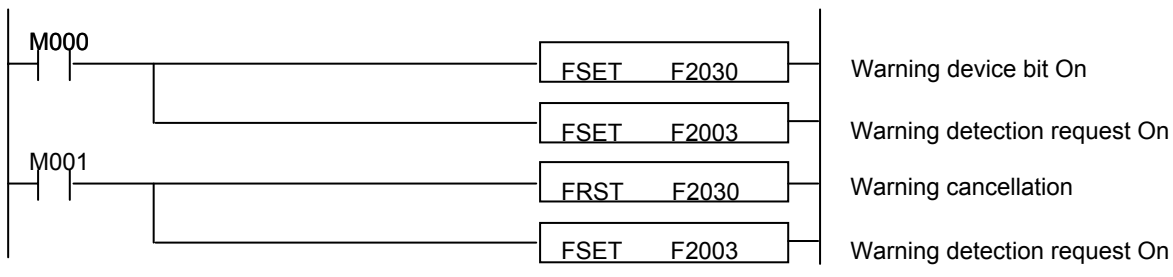
(3) Processing warning of external device

(a) 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).

(b) If a warning occurs, the LED switches on and off every other second.

(c) 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.

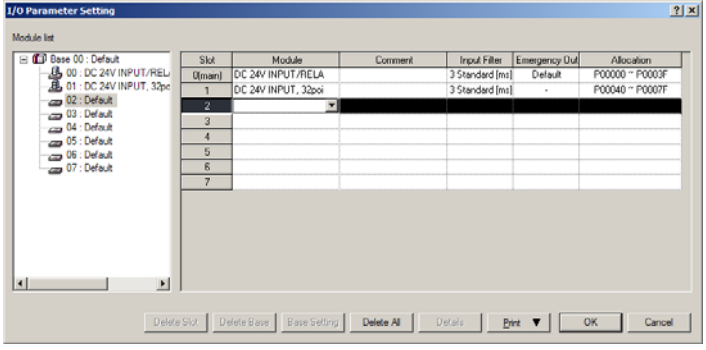
(1) Allocation of I/O number
124 points are allocated to main unit and 64 points are allocated to every module except main unit (incl. special, communication).

**System Configuration**

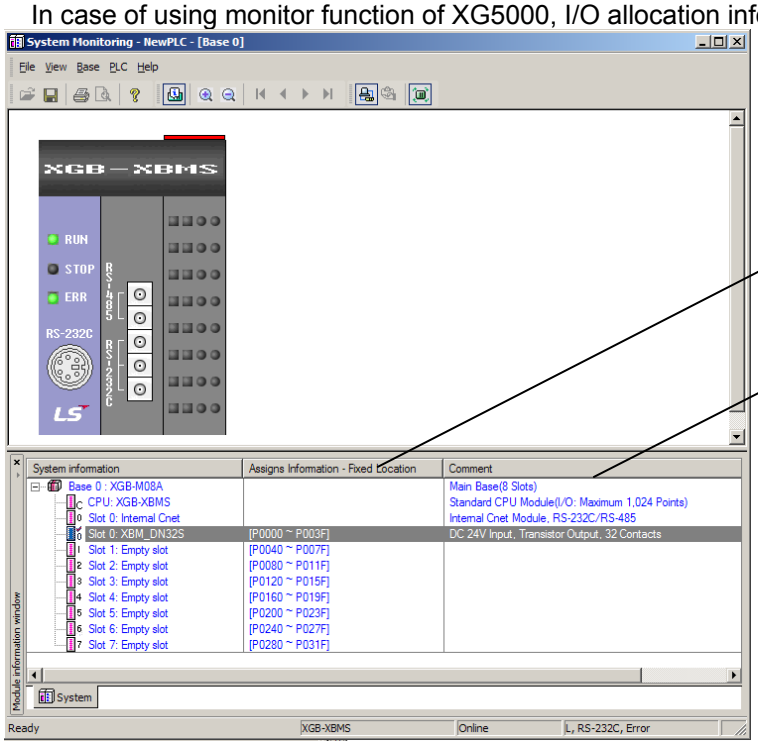
| Number of Connection stage | Type | I/O allocation | Remarks |
|---|---|---|---|
| 0 | XBC-DN30S | Input : P0000 ~ P003F<br>Output : P0040 ~ P007F | Main unit fixed |
| 1 | XBE-DC32A | Input : P0080~P011F | Actual input: P0080 ~ P009F |
| 2 | XBE-TN32A | Output : P0120 ~ P015F | Actual output : P0120 ~ P013F |
| 3 | XBL-C21A | P0160 ~ P019F | - |
| 4 | XBF-AD04A | P0200 ~ P023F | - |
| 5 | XBF-DV04A | P0240 ~ P027F | - |
| 6 | XBE-DC32A | Input : P0280 ~ P031F | Actual input : P0280 ~ P029F |
| 7 | XBE-TN32A | Output : P0320 ~ P035F | Actual output : P0320 ~ P033F |

Empty I/O point is available for internal relay.

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



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




I/O module allocation information

Description of each module

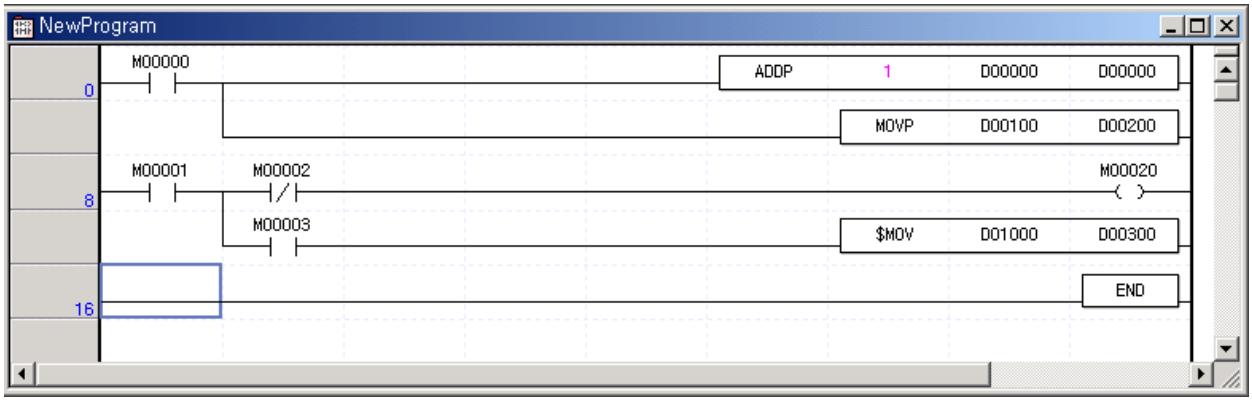
## 6.9 Online Editing

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.

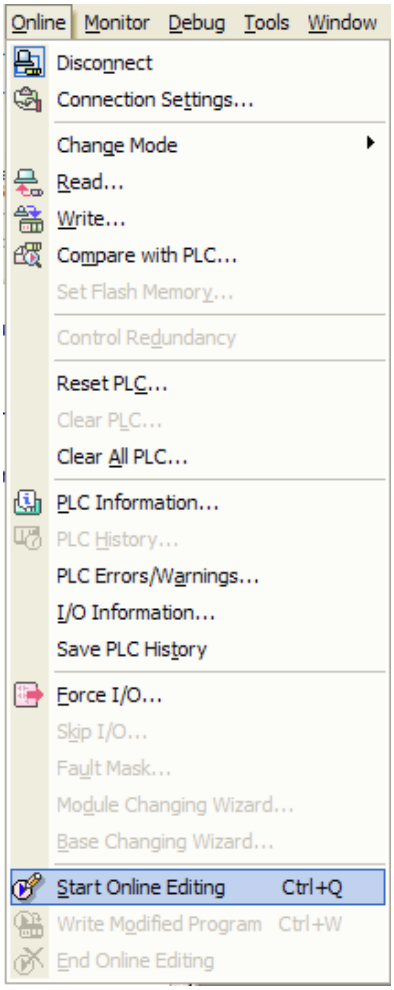
Items to be modified during operation are as follows.

- Program
- Communication parameter

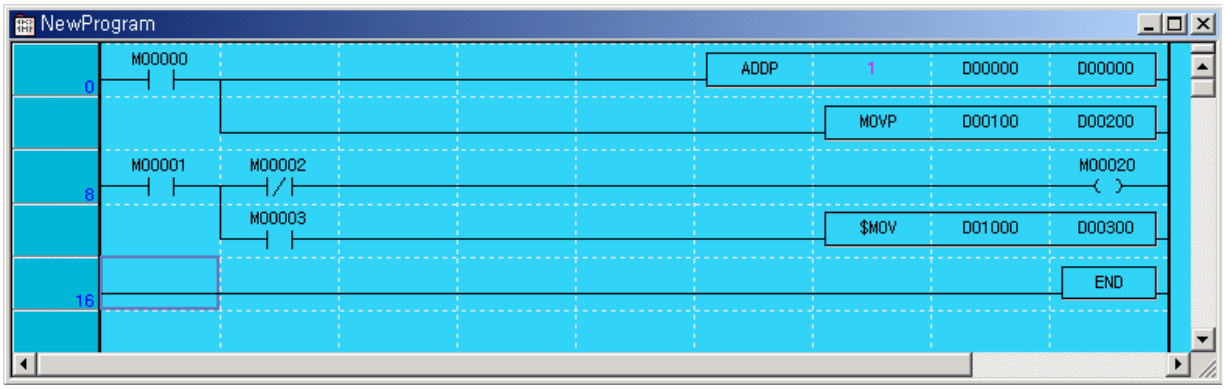
(1) It displays programs that are currently running.



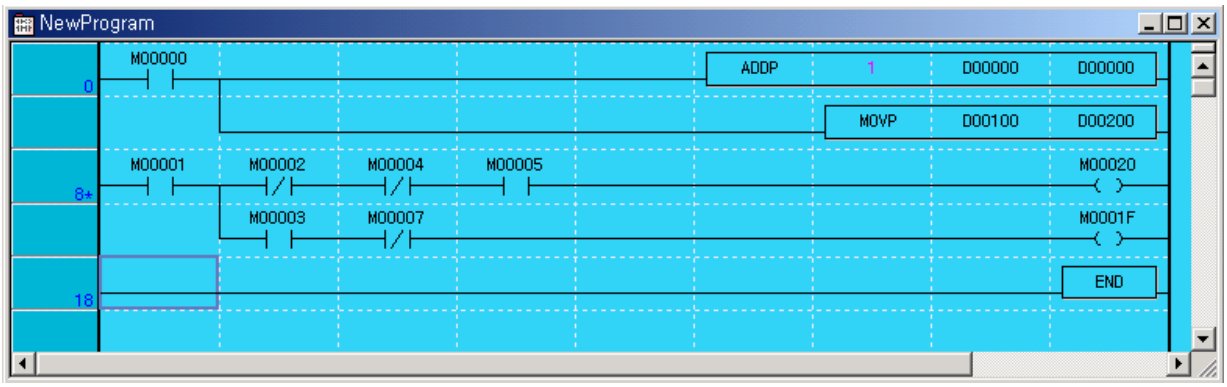

(2) Click 『Online』 - 『Start Online Editing』 .



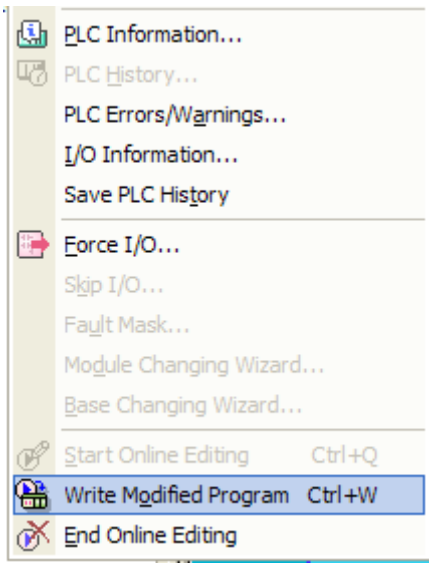
(3) It turns to program modification mode during run when the program background is changed.

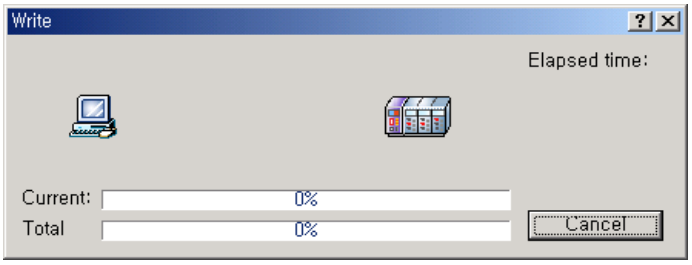


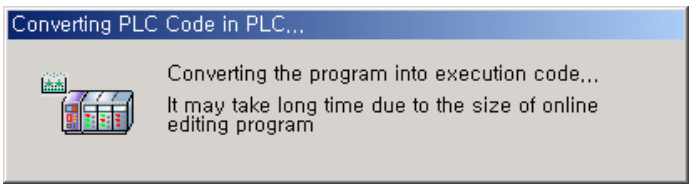

(4) Modifying a program.

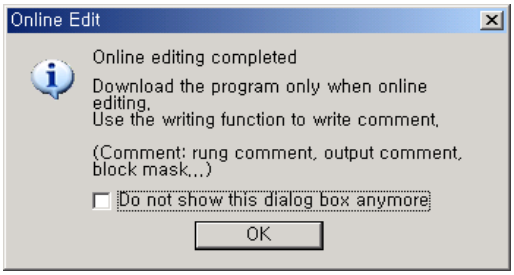



(5) Upon the modification of program, click 『Online』- 『Write Modified Program』.

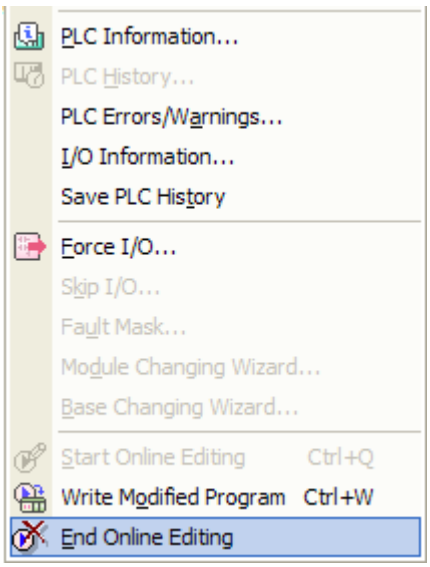


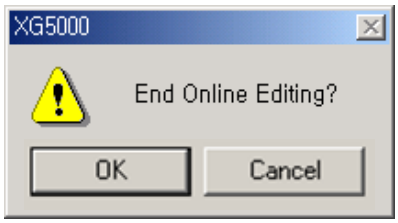



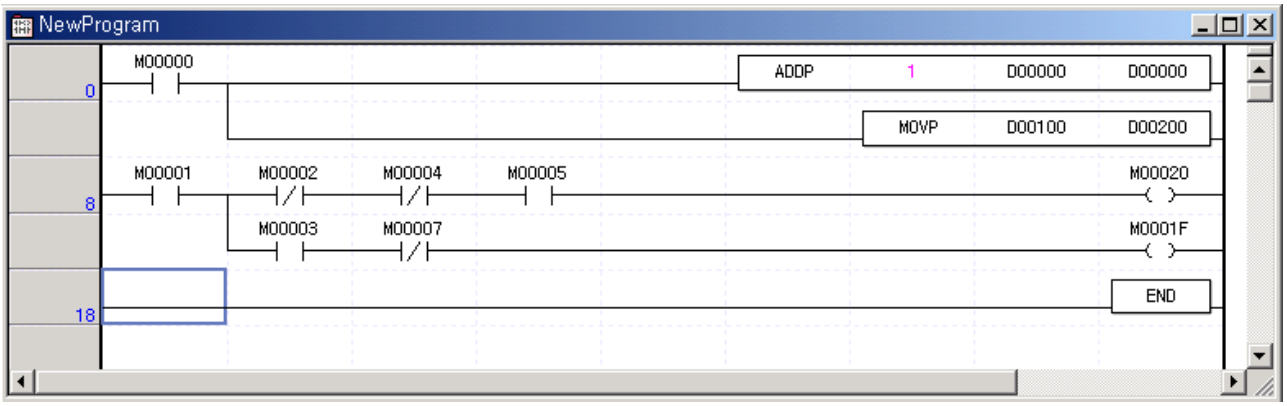



(6) Upon the writing of program, click 『Online』-『End Online Editing』.




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



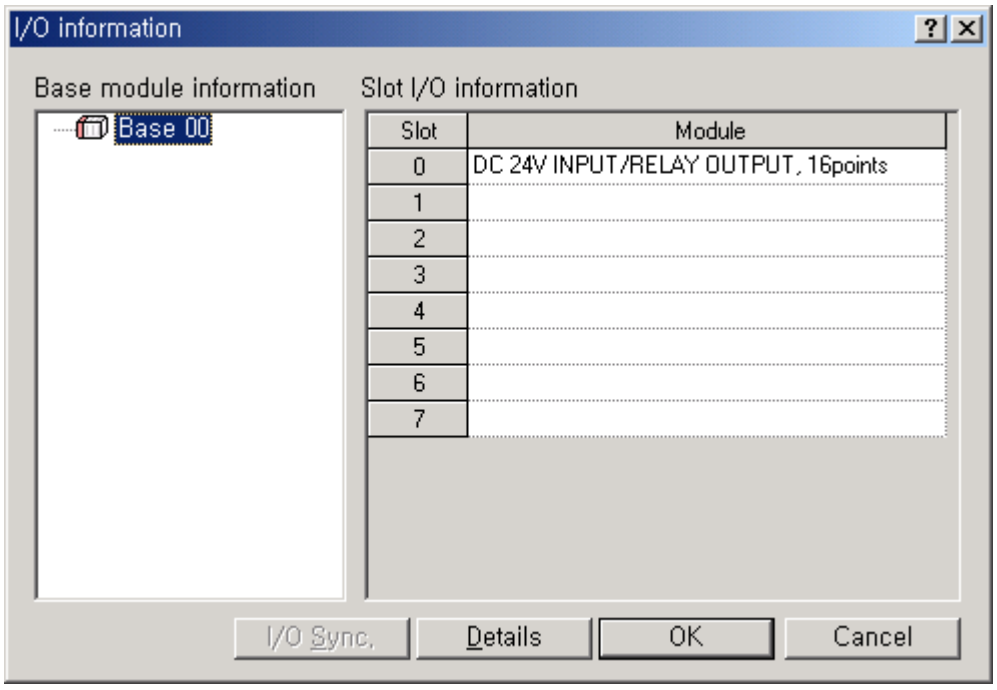

**Remark**

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

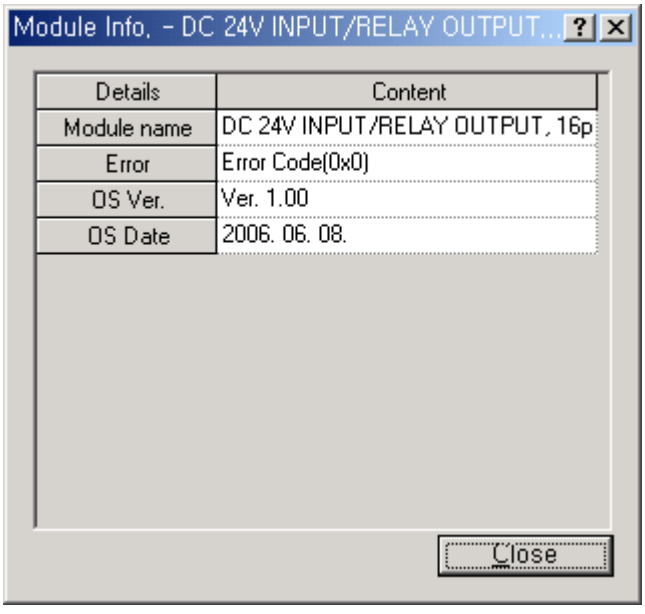
## 6.10 Reading Input/Output Information

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.



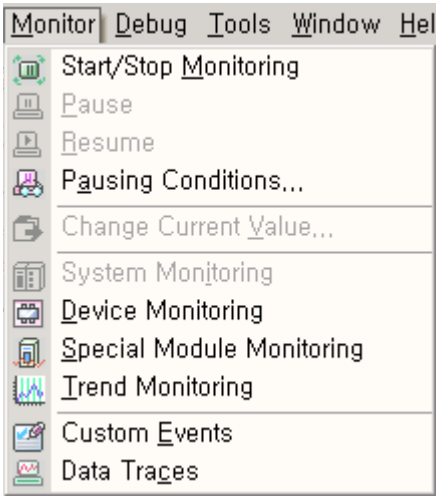

(2) If clicking Details after selecting a module, it displays detail information of a selected module.



## 6.11 Monitoring

It monitors system information of XGB series system.

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

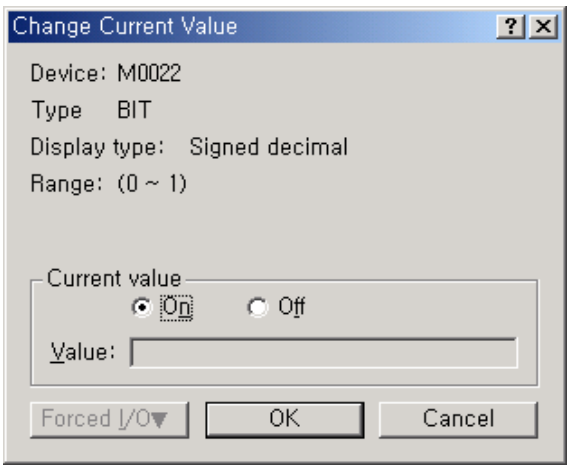


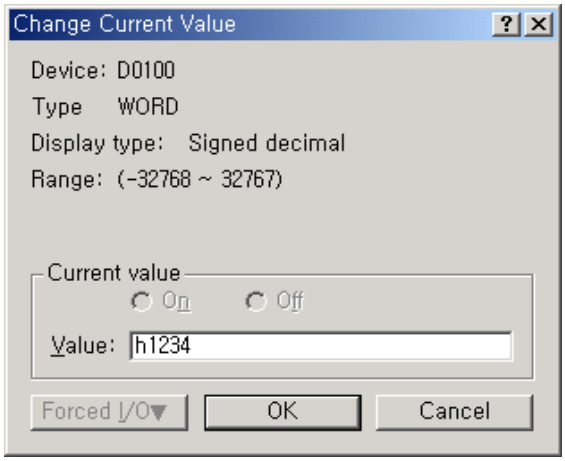

(2) Items and descriptions

| 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

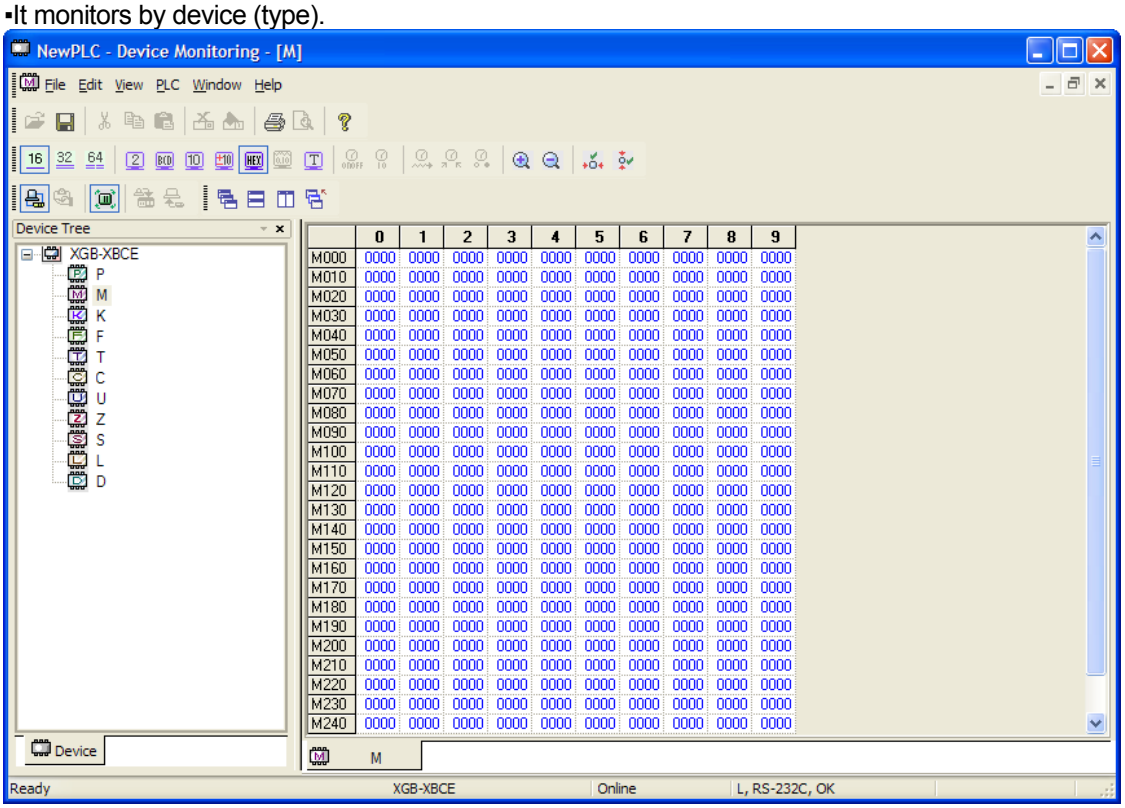
▪It changes the current value of each device selected in the current program window.



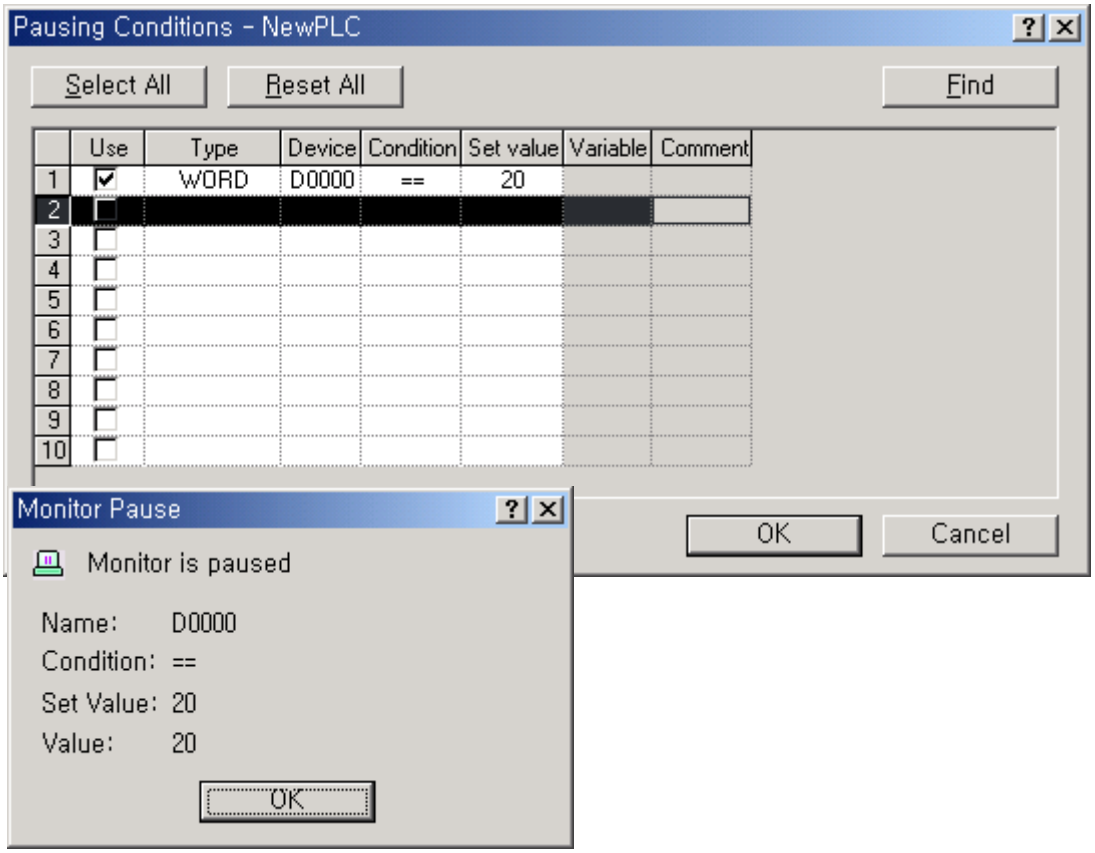

(b) Device monitoring

▪It monitors by device (type).



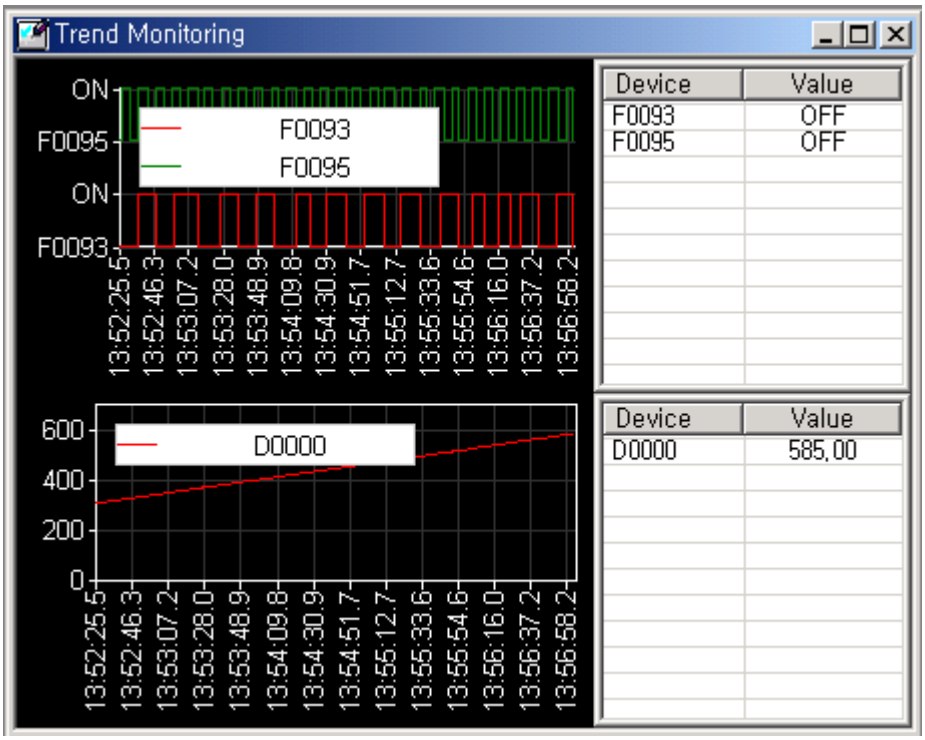
(c) Pausing conditions

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



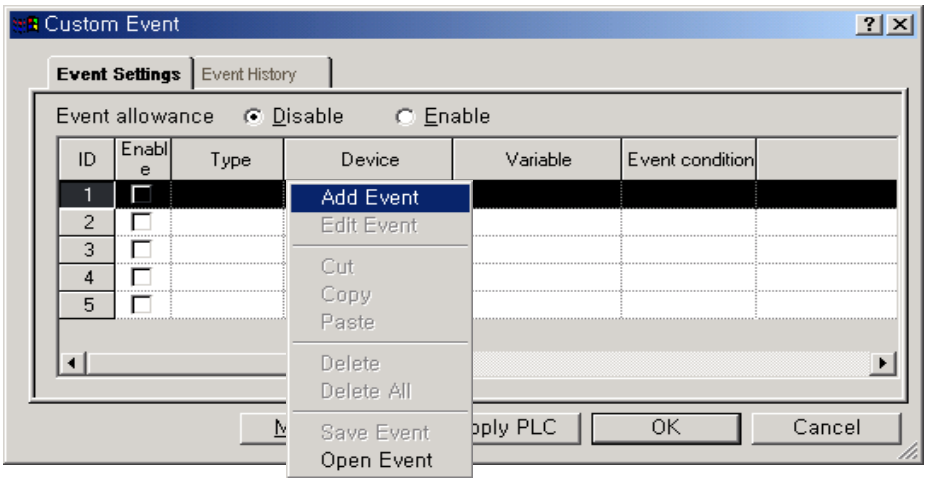

(d) Trend monitoring

▪It displays device values graphically.

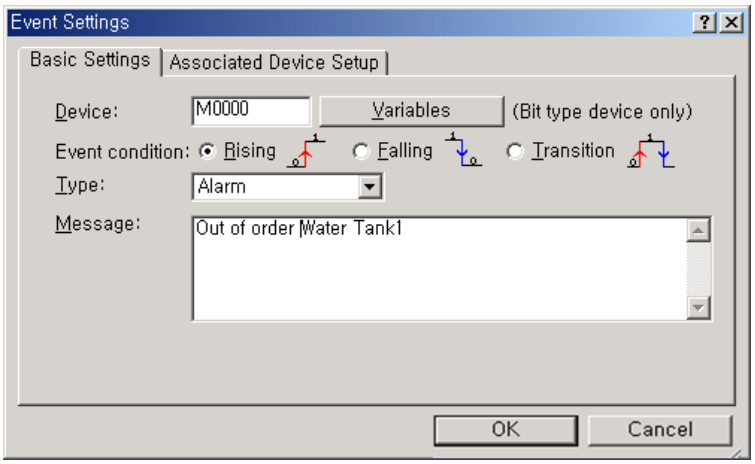


(e) Custom events

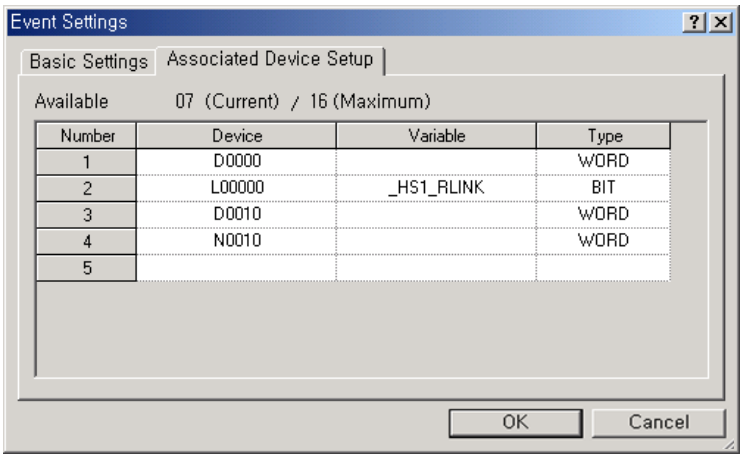
1) It monitors detail information when an event set by a user occurs. Additional user event may be registered.



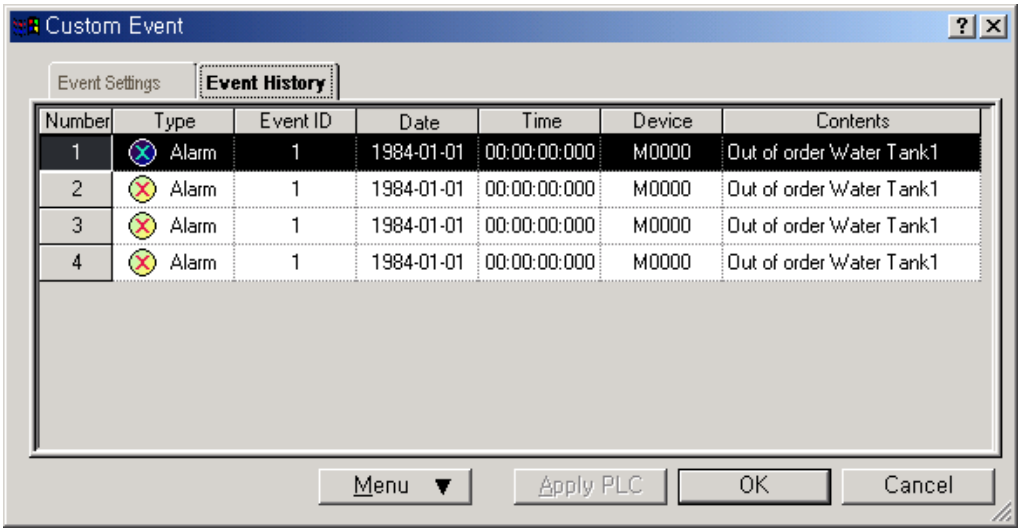

2) It sets basic setting and relative device.
If rising edge of M0000 device occurs, it records the message of an alarm, “Out of order Water Tank 1” and the device values of D0000,L0000,D0100,N1000 are recorded.



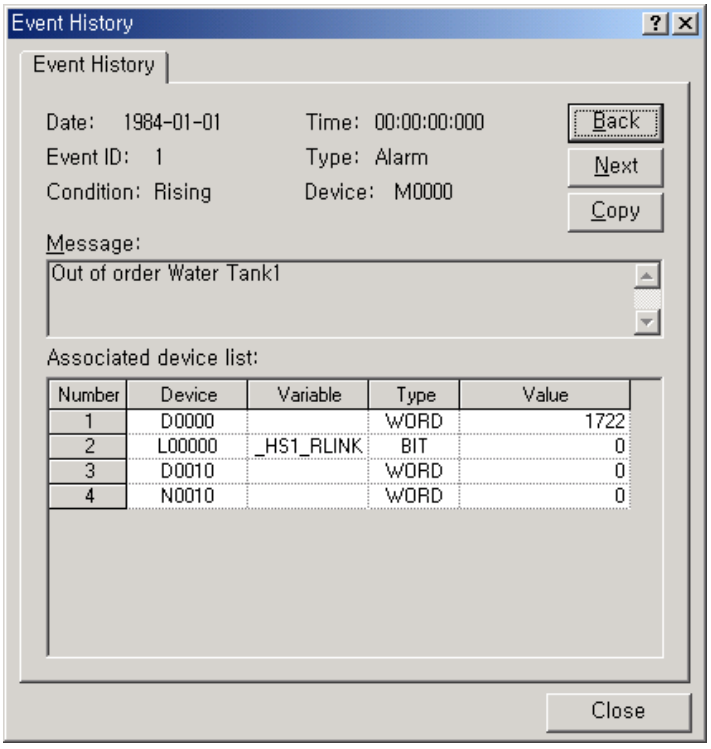

3) Set the relative device(s).



4) Monitor event history of custom event.




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



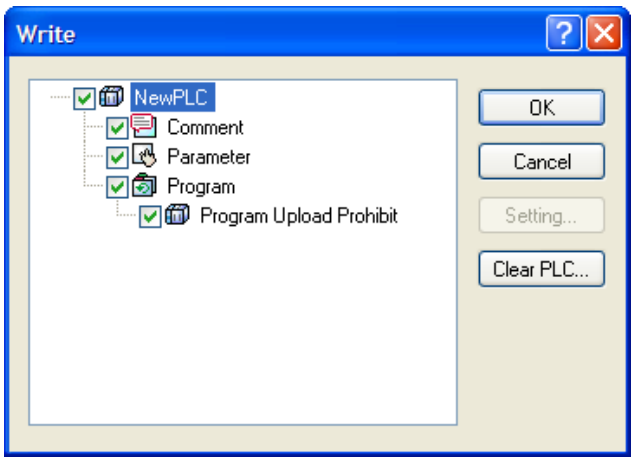

**Remark**

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

## 6.12 Program Upload Prohibit

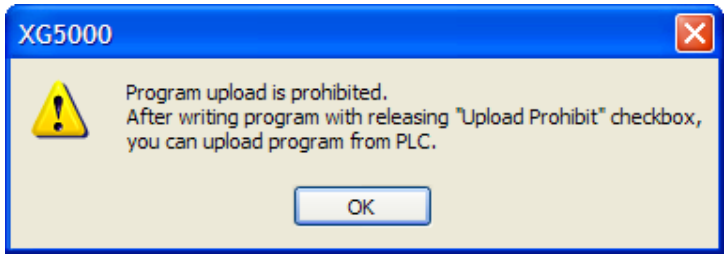
Program Upload Prohibit function prohibits from uploading comment, parameter, program saved on PLC. If Program Upload Prohibit function is set, you can't open from PLC, read PLC and compare PLC.

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

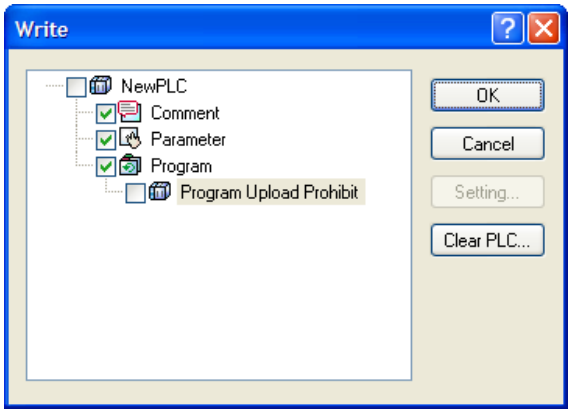



(b) Select "Program Upload Prohibit" and click OK.

(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』.



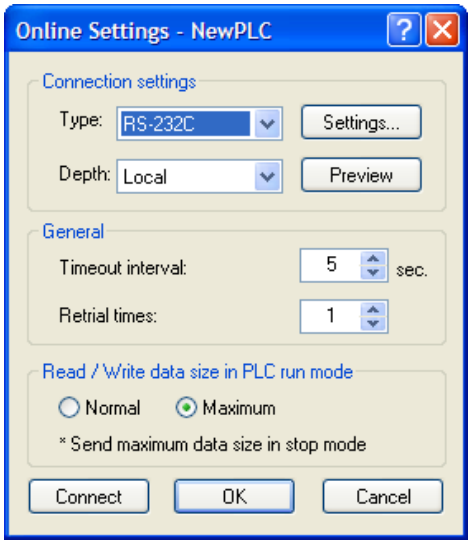

(b) Release Program Upload Prohibit and click OK.

## 6.13 Clear All PLC

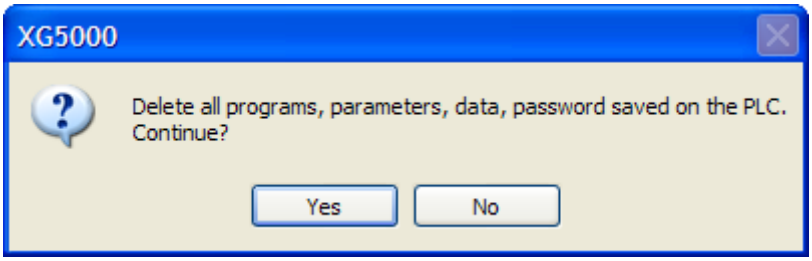
Clear All PLC function clears parameter, program, data, password saved on PLC

(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.

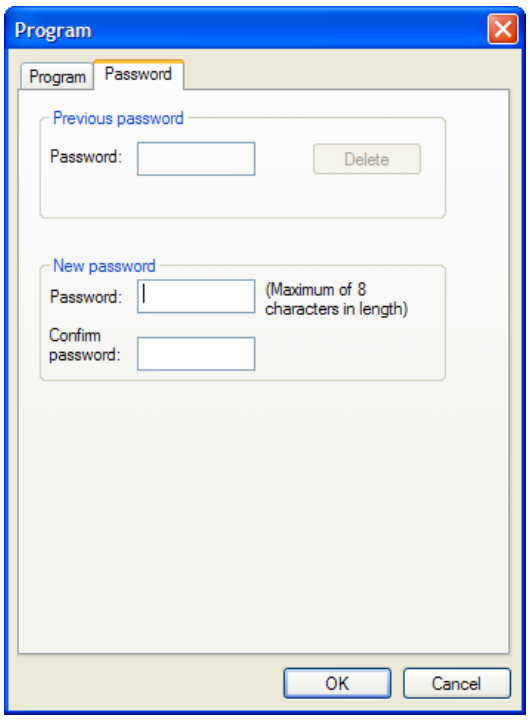
**Note**

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

## 6.14 Password Setting per Program Block

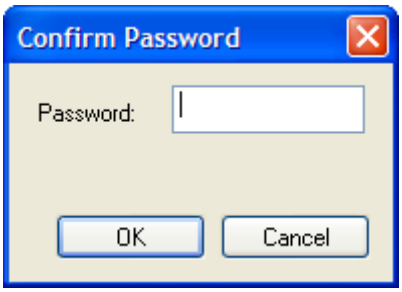
Password Setting per Program Block function sets password for each program block. You should input password to open program.

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



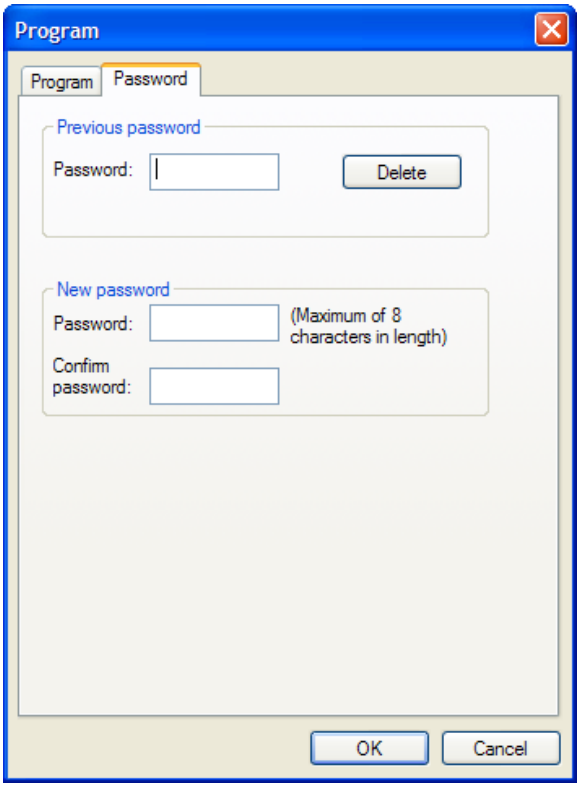

(c) Click 『OK』 after inputting new password.

(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.




(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.

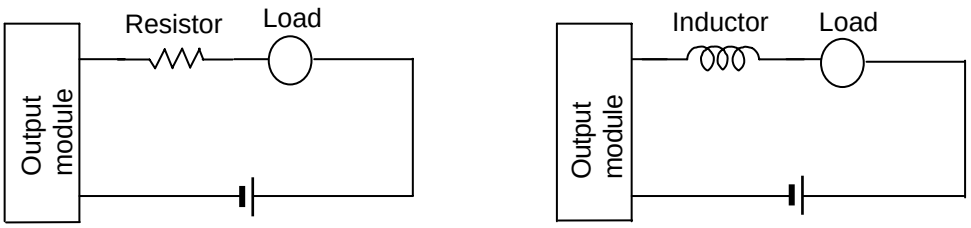
(2) The number of max. Simultaneous input contact point is different according to module type. It depends on the input voltage, ambient temperature. Use input module after checking the specification.

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

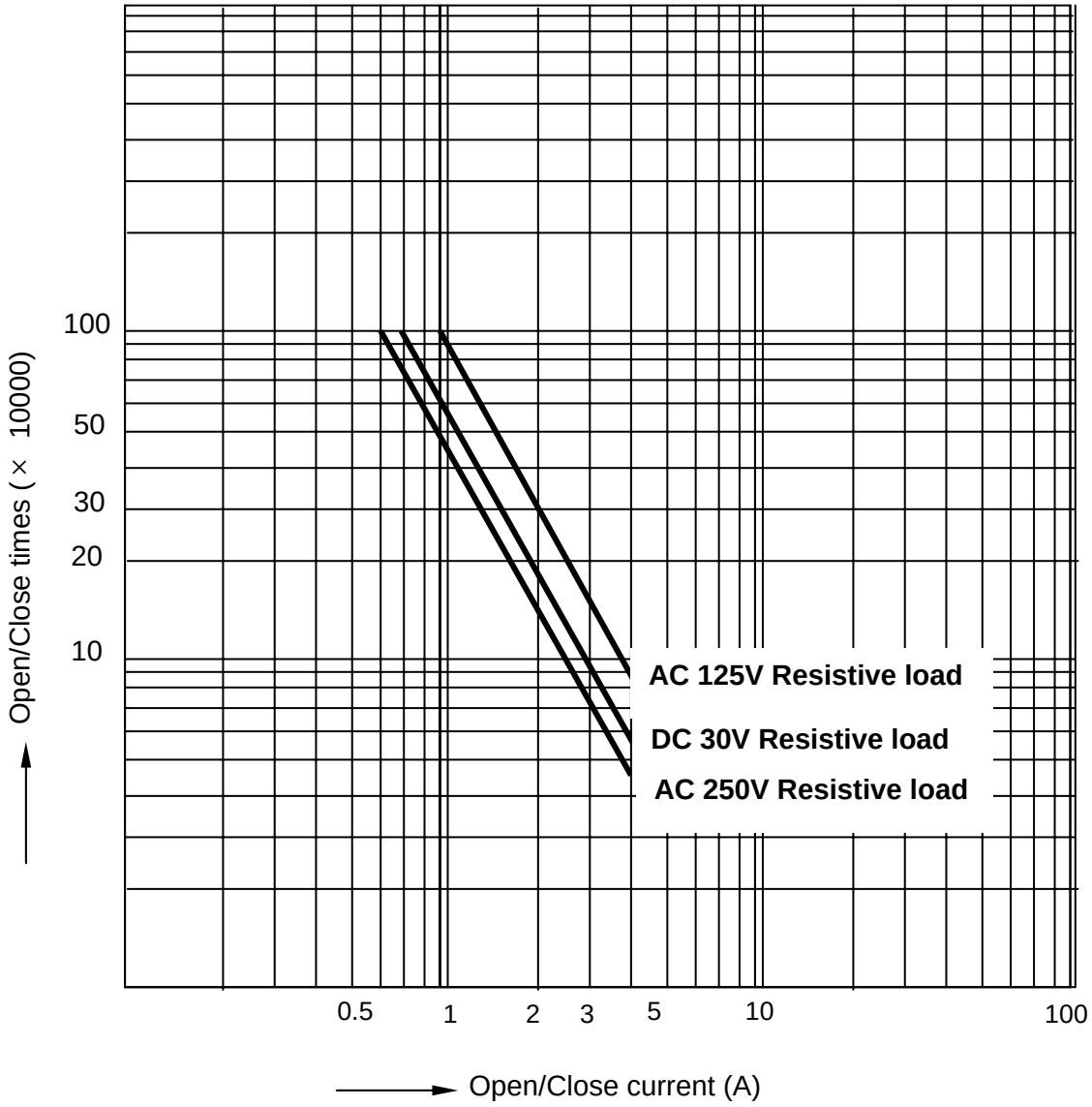
(4) In case that open/close frequency is high or it is used for conductive load open/close, use Transistor output module or triac output module as the durability of Relay Output Module shall be reduced.

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

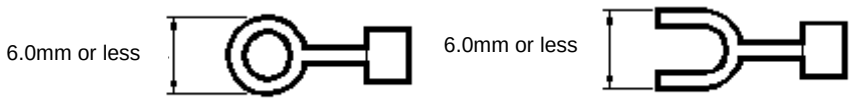
(6) For output module, in case that counter timer using DC/DC Converter as a load was used, Inrush current may flow in a certain cycle when it is ON or during operation. In this case, if average current is selected, it may cause the failure. Accordingly, if the previous load was used, it is recommended 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) A clamped terminal with sleeve can not be used for the XGB terminal strip. The clamped terminals suitable for terminal strip are as follows (JOR 1.25-3:Daedong Electricity in Korea).




(9) The cable size connected to a terminal strip should be 0.3~0.75 ㎟ stranded cable and 2.8 ㎜ thick. The cable may have different current allowance depending on the insulation thickness.

(10) The coupling torque available for fixation screw and terminal strip screw should follow the table below.

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

(11) 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.

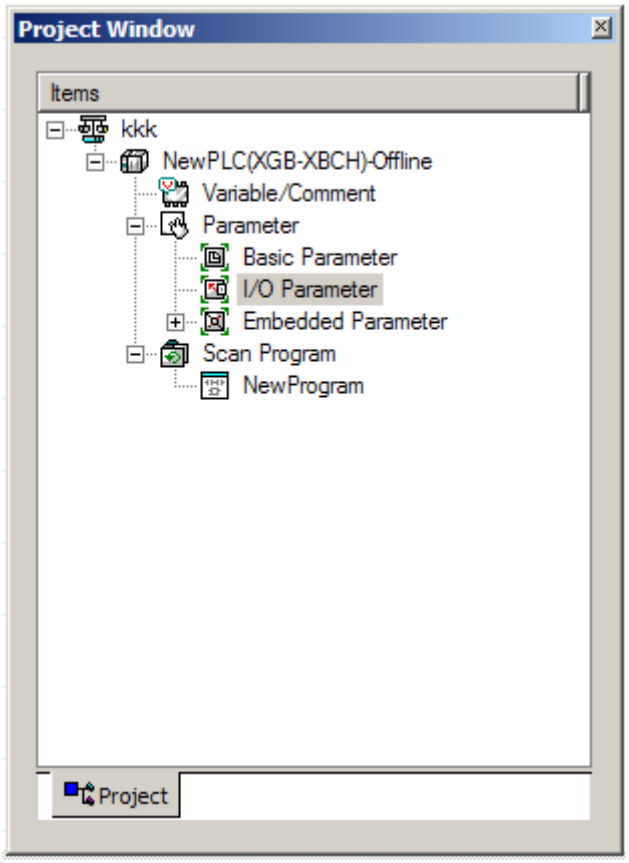
(a) Rated voltage, load: 3 million times: 100 million times
(b) 200V AC 1.5A, 240V AC 1A (COS¢ =0.7): 1 million times
(c) 200V AC 0.4A, 240V AC 0.3A (COS¢ =0.7): 3 million times
(d) 200V AC 1A, 240V AC 0.5A (COS¢ =0.35): 1 million times
(e) 200V AC 0.3A, 240V AC 0.15A (COS¢ =0.35): 3 million times
(f) 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

(12) 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.

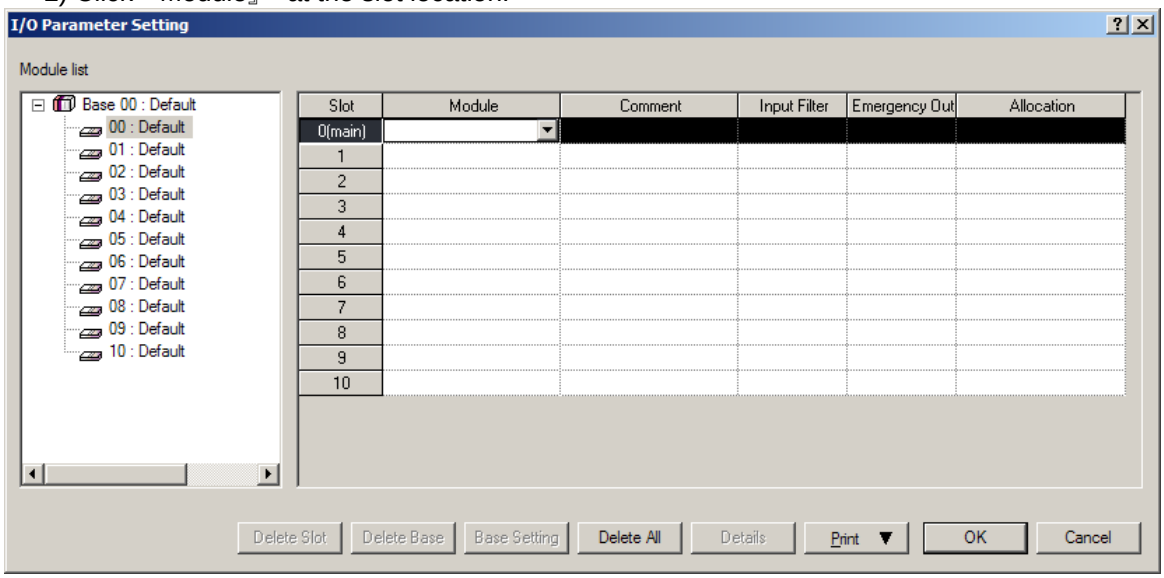
| Input filter time (ms) | Noise signal pulse size (ms) | Reference |
|---|---|---|
| 1 | 0.3 | |
| 3 | 1.8 | Initial value |
| 5 | 3 | |
| 10 | 6 | |
| 20 | 12 | |
| 70 | 45 | |
| 100 | 60 | |

(a) Setting input filter

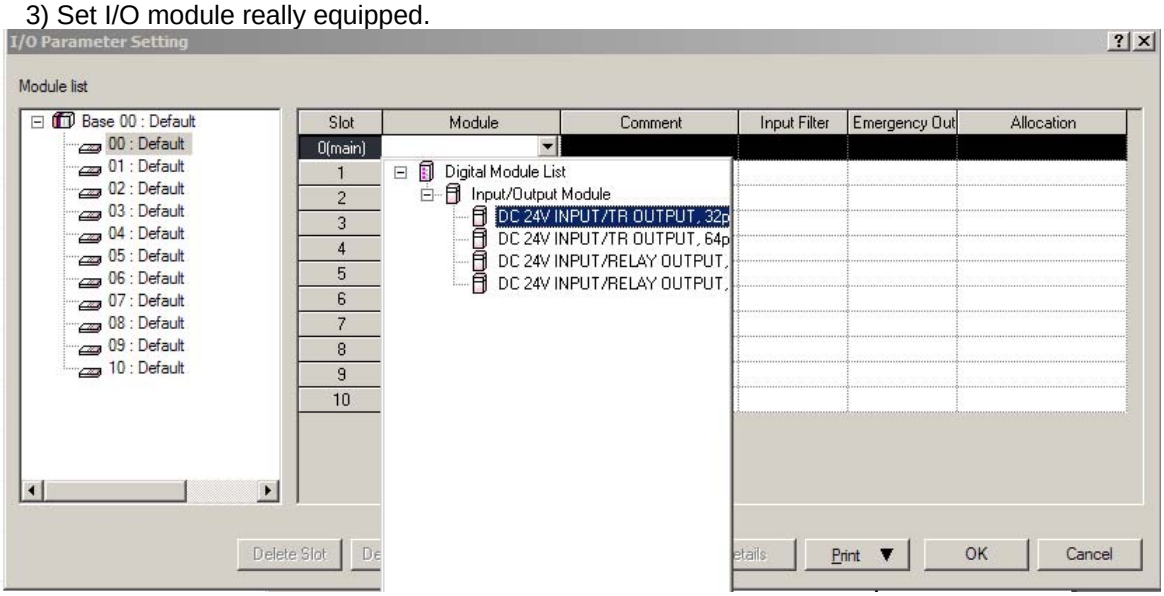
1) Click I/O Parameter』 in the project window of XG5000



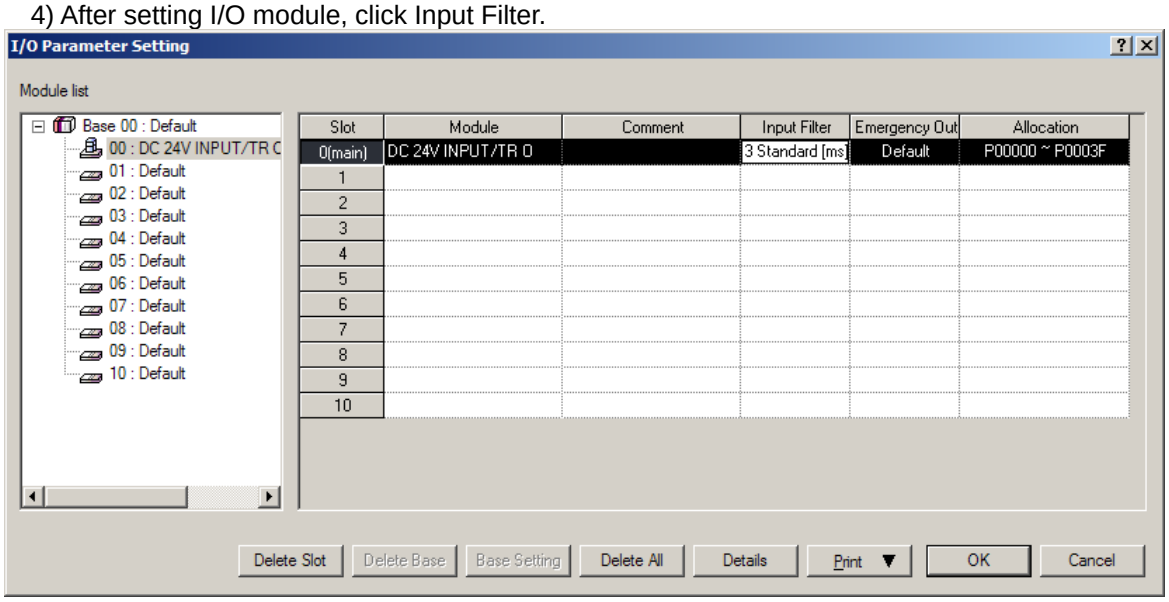

2) Click『Module』 at the slot location.



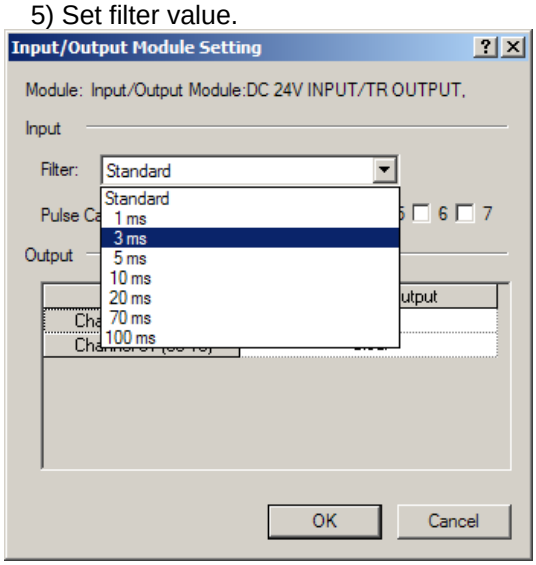
3) Set I/O module really equipped.




4) After setting I/O module, click Input Filter.

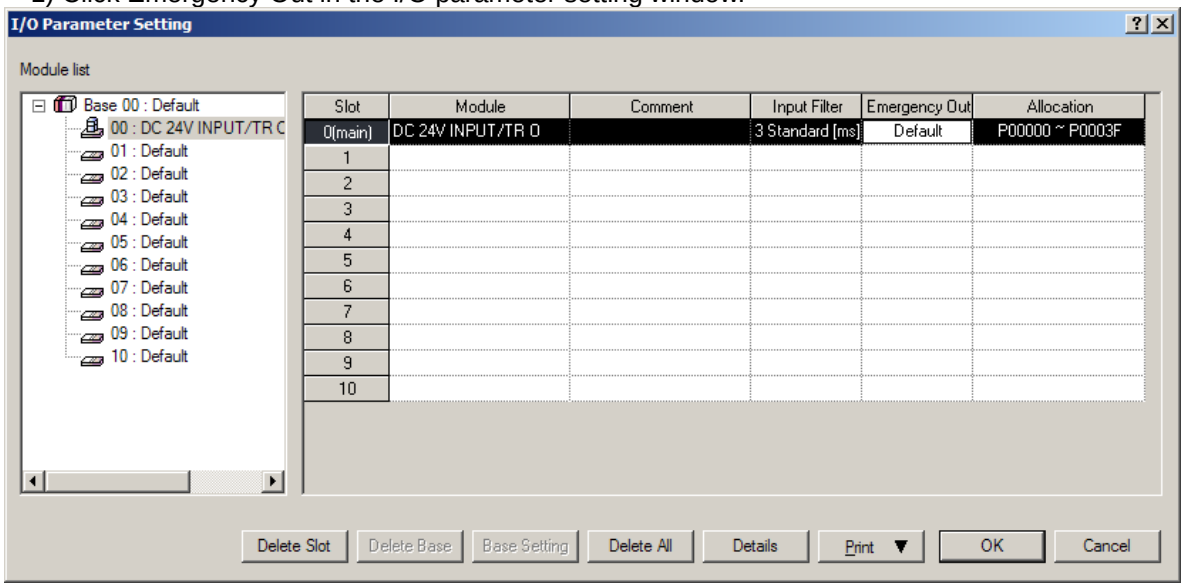



5) Set filter value.

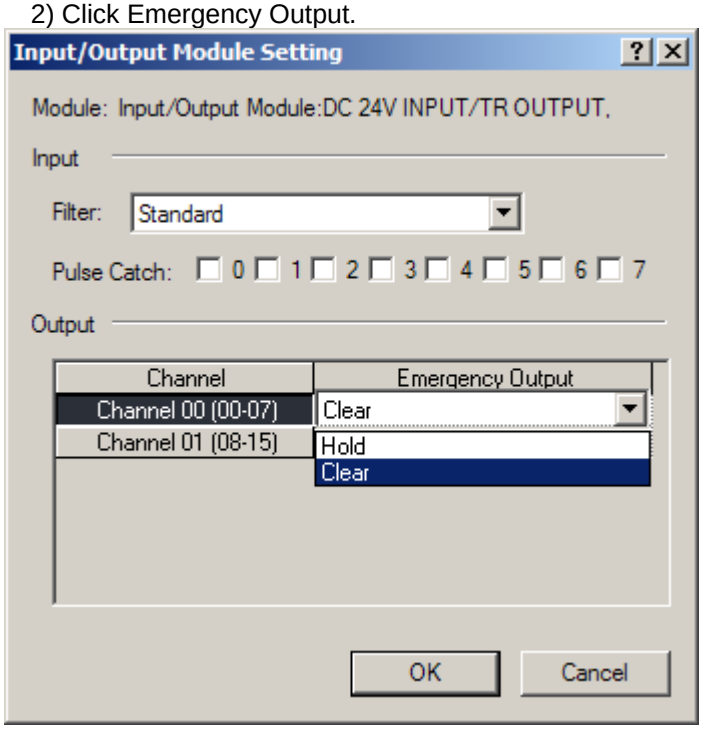


(b) Setting output status in case of error

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




2) Click Emergency Output.



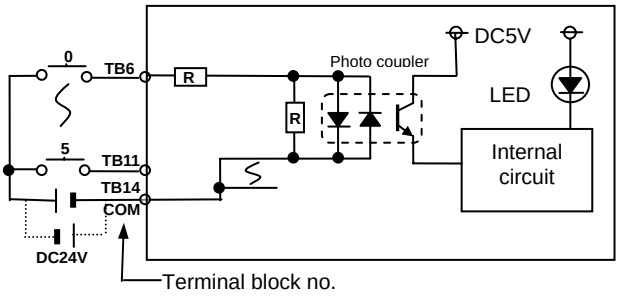

If it is selected as Clear, the output will be Off and if Hold is selected, the output will be kept.

## 7.2 Main Unit Digital Input Specifications

### 7.2.1 XBC-DR10E 6 point DC24V input (Source/Sink type)

| Model / Specification | | Main unit |
|---|---|---|
| | | XBC-DR10E |
| Input point | | 6 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 (within ripple rate 5%) |
| On voltage / On current | | DC19V or higher / 3 ㎃ or higher |
| Off voltage / Off current | | DC6V or lower / 1 ㎃ or lower |
| Input resistance | | About 5.6 ㏀ (P00~P03: about 2.7 ㏀) |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (Set by I/O parameter) Default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3 cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by MegOhmMeter |
| Common method | | 6 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Internal current consumption | | 200 ㎃ (When all inputs are on) |
| Operation indicator | | LED On when Input On |
| External connection method | | 14 point terminal block connector (M3 X 6 screw) |
| Weight | | 330g |

Circuit configuration

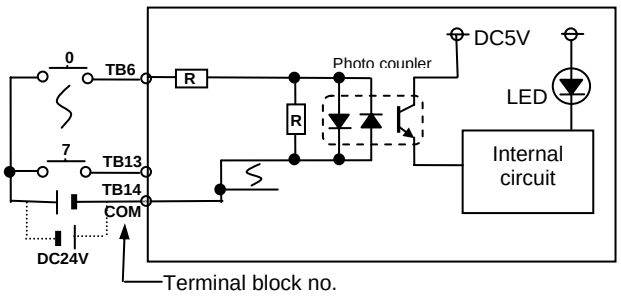



| No. | Contact | No. | Contact | Type | | |
|---|---|---|---|---|---|---|
| TB2 | 485+ | TB1 | RX | TB2 | RX | TB1 |
| TB4 | 485- | TB3 | TX | TB4 | 485+ | TB3 |
| TB6 | 00 | TB5 | SG | TB6 | 485- | TB5 |
| TB8 | 02 | TB7 | 01 | TB8 | P00 | TB7 |
| TB10 | 04 | TB9 | 03 | TB10 | P02 | TB9 |
| TB12 | NC | TB11 | 05 | TB12 | P04 | TB11 |
| TB14 | COM | TB13 | NC | TB14 | NC | TB13 |
| | | | | | COM | |

### 7.2.2 XBC-DR14E 8 point DC24V input (Source/Sink type)

| Model / Specification | | Main unit |
|---|---|---|
| | | XBC-DR14E |
| Input point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ (Contact point 0~3: about 7 ㎃) |
| Operation voltage range | | DC20.4~28.8V (Within ripple rate 5%) |
| On voltage / On current | | DC19V or higher / 3 ㎃ or higher |
| Off voltage / Off current | | DC6V or lower / 1 ㎃ or lower |
| Input resistance | | About 5.6 ㏀ (P00~P03: about 2.7 ㏀) |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by I/O parameter) default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3 cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by MegOhmMeter |
| Common method | | 8 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Internal current consumption | | 200 ㎃ (When all inputs are on) |
| Operation indicator | | LED On when Input On |
| External connection method | | 14 point terminal block connector (M3 X 6 screw) |
| Weight | | 340g |

Circuit configuration

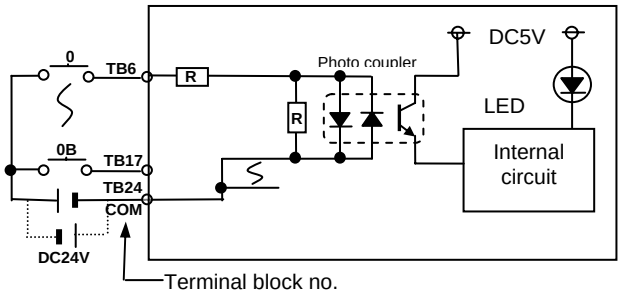



| No. | Contact | No. | Contact | Type | | |
|---|---|---|---|---|---|---|
| | | TB1 | RX | | | TB1 |
| TB2 | 485+ | TB3 | TX | TB2 | 485+ | TB3 |
| TB4 | 485- | TB5 | SG | TB4 | 485- | TB5 |
| TB6 | 00 | TB7 | 01 | TB6 | P00 | TB7 |
| TB8 | 02 | TB9 | 03 | TB8 | P02 | TB9 |
| TB10 | 04 | TB11 | 05 | TB10 | P04 | TB11 |
| TB12 | 06 | TB13 | 07 | TB12 | P06 | TB13 |
| TB14 | 08 | | | TB14 | COM | |

### 7.2.3 XBC-DR20E 12 point DC24V input (Source/Sink type)

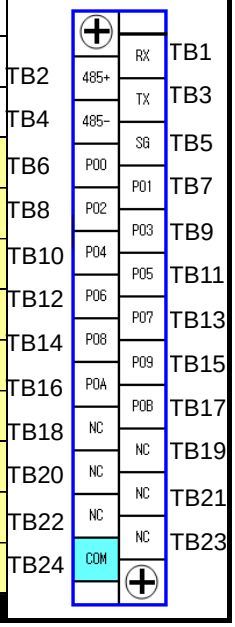
| Model / Specification | | Main unit |
|---|---|---|
| | | XBC-DR20E |
| Input point | | 12 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ (Contact point 0~3: about 7 ㎃) |
| Operation voltage range | | DC20.4~28.8V (within ripple rate 5%) |
| On voltage / On current | | DC19V or higher / 3 ㎃ or higher |
| Off voltage / Off current | | DC6V or lower / 1 ㎃ or lower |
| Input resistance | | About 5.6 ㏀ (P00~P07: about 2.7 ㏀) |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by I/O parameter) default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3 cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by MegOhmMeter |
| Common method | | 12 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 200 ㎃ (When all inputs are on) |
| Operation indicator | | LED On When Input On |
| External connection method | | 24 point terminal block connector (M3 X 6 screw) |
| Weight | | 450g |

Circuit configuration




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

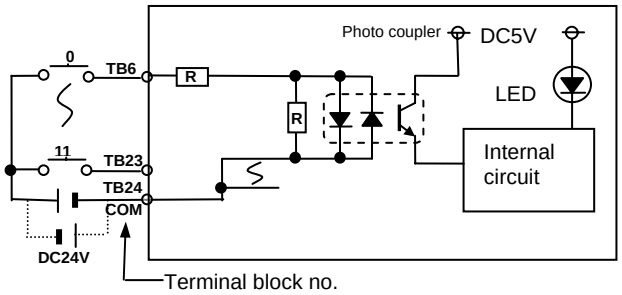
Type



### 7.2.4 XBC-DR30E 18 point DC24V input (Source/Sink type)

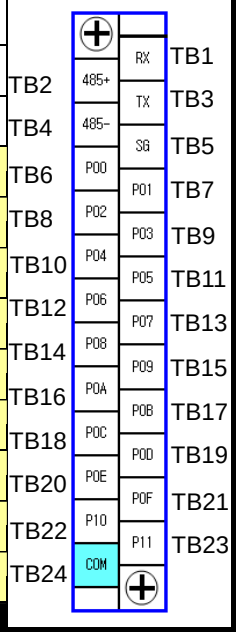
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DR30E |
| Input point | | 18 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ (Contact point 0~3: about 7 ㎃) |
| Operation voltage range | | DC20.4~28.8V (within ripple rate 5%) |
| On voltage / On current | | DC19V or higher / 3 ㎃ or higher |
| Off voltage / Off current | | DC6V or lower / 1 ㎃ or lower |
| Input resistance | | About 5.6 ㏀ (P00~P07: about 2.7 ㏀) |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by I/O parameter) default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3 cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or higher by MegOhmMeter |
| Common method | | 18 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 200 ㎃ (When all inputs are on) |
| Operation indicator | | LED on when Input On |
| External connection method | | 24 point terminal block connector (M3 X 6 screw) |
| Weight | | 465g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| TB2 | 485+ | TB1 | RX |
| TB4 | 485- | TB3 | TX |
| TB6 | 00 | TB5 | SG |
| TB8 | 02 | TB7 | 01 |
| TB10 | 04 | TB9 | 03 |
| TB12 | 06 | TB11 | 05 |
| TB14 | 08 | TB13 | 07 |
| TB16 | 0A | TB15 | 09 |
| TB18 | 0C | TB17 | 0B |
| TB20 | 0E | TB19 | 0D |
| TB22 | 10 | TB21 | 0F |
| TB24 | COM | TB23 | 11 |

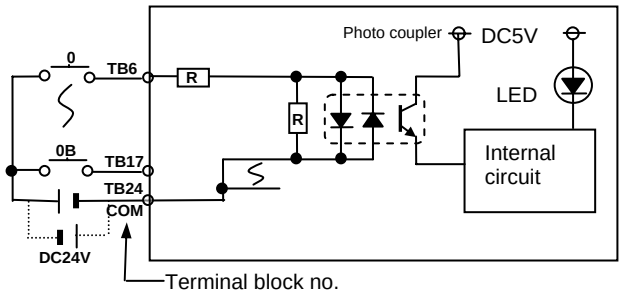
Type



### 7.2.5 XBC-DN20S 12 point DC24V input (Source/Sink type)

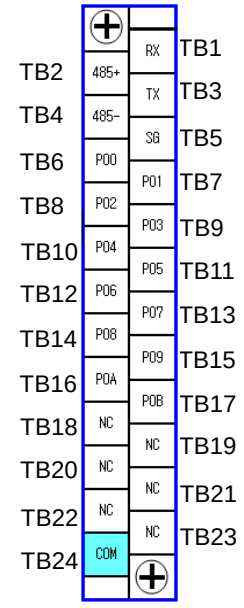
| Model / Specification | | Main unit |
|---|---|---|
| | | XBC-DN20S |
| Input point | | 12 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ (Contact point 0~3: about 7 ㎃) |
| Operation voltage range | | DC20.4~28.8V (within ripple rate 5%) |
| On voltage / On current | | DC19V or higher / 3 ㎃ or higher |
| Off voltage / Off current | | DC6V or lower / 1 ㎃ or lower |
| Input resistance | | About 5.6 ㏀ (P00~P07: about 2.7 ㏀) |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by I/O parameter) default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3 cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or higher by MegOhmMeter |
| Common method | | 12 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 200 ㎃ (When all inputs are on) |
| Operation indicator | | LED on when Input On |
| External connection method | | 24 point terminal block connector (M3 X 6 screw) |
| Weight | | 470g |

Circuit configuration




| 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 | NC |
| TB19 | NC | TB20 | NC |
| TB21 | NC | TB22 | NC |
| TB23 | NC | TB24 | COM |

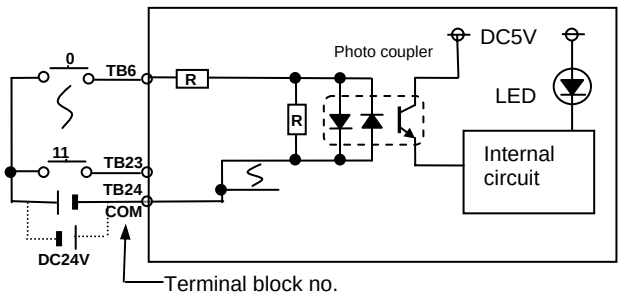
Type



### 7.2.6 XBC-DN30S 18 point DC24V input (Source/Sink type)

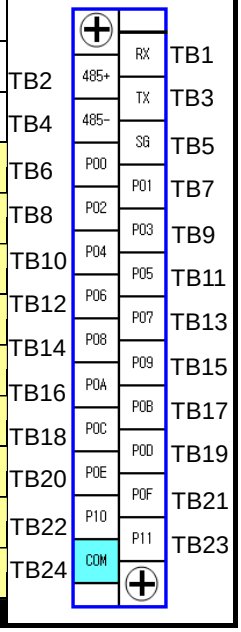
| Model / Specification | | Main unit |
|---|---|---|
| | | XBC-DN30S |
| Input point | | 18 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ (Contact point 0~3: about 7 ㎃) |
| Operation voltage range | | DC20.4~28.8V (within ripple rate 5%) |
| On voltage / On current | | DC19V or higher / 3 ㎃ or higher |
| Off voltage / Off current | | DC6V or lower / 1 ㎃ or lower |
| Input resistance | | About 5.6 ㏀ (P00~P07: about 2.7 ㏀) |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by I/O parameter) default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3 cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or higher by MegOhmMeter |
| Common method | | 18 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 200 ㎃ (When all inputs are on) |
| Operation indicator | | LED on when Input On |
| External connection method | | 24 point terminal block connector (M3 X 6 screw) |
| Weight | | 475g |

Circuit configuration




| 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 | 10 | TB23 | 11 |
| TB24 | COM | | |

Type

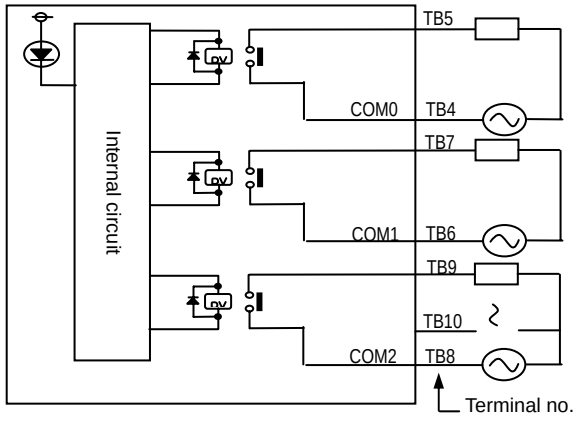


## 7.3 Main Unit Digital Output Specification

### 7.3.1 XBC-DR10E 4 point relay output

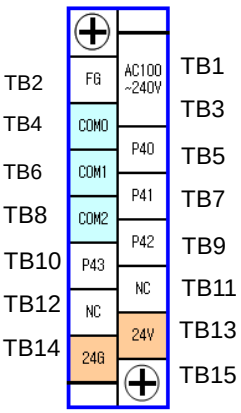
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DR10E |
| Output point | | 4 point |
| Insulation method | | Relay insulation |
| Rated load voltage/current | | DC24V 2A (resistive load) / AC220V 2A (COSΦ = 1), 5A/COM |
| Min. load voltage/current | | DC5V / 1 ㎃ |
| Max. load voltage | | AC250V, DC125V |
| Off leakage current | | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. On/Off frequency | | 3,600 times / hour |
| Surge absorber | | None |
| Service life | Mechanical | 20 million times or more |
| | Electrical | Rated load voltage / Current 100,000 times or more |
| | | AC200V / 1.5A, AC240V / 1A (COSΦ = 0.7) 100,000 times or more |
| | | AC200V / 1A, AC240V / 0.5A (COSΦ = 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 | | 2 point / COM |
| Proper cable size | | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | | 360 ㎃ (When all outputs are on) |
| Operation indicator | | LED On when Output On |
| External connection method | | 14 point terminal block connector (M3 X 6 screw) |
| Weight | | 330g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| TB2 | FG | TB1 | AC100 ~240V |
| TB4 | COM0 | TB3 | |
| TB6 | COM1 | TB5 | 40 |
| TB8 | COM2 | TB7 | 41 |
| TB10 | 43 | TB9 | 42 |
| TB12 | NC | TB11 | NC |
| TB14 | 24G | TB13 | 24V |

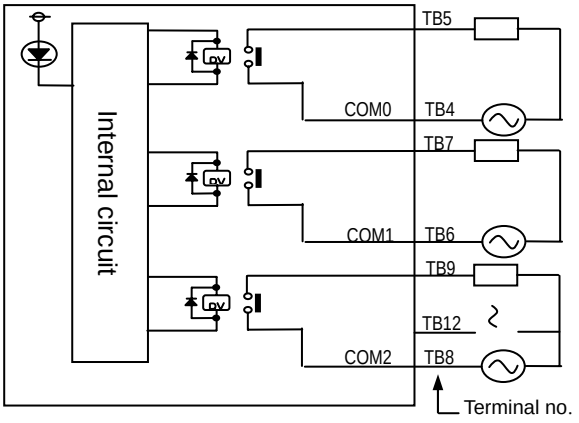
Type



### 7.3.2 XBC-DR14E 6 point relay output

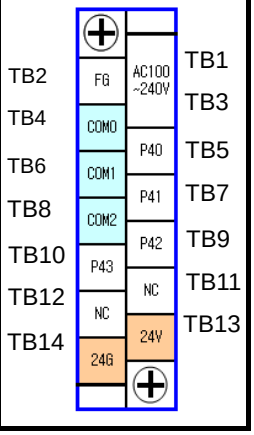
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DR14E |
| Output point | | 6 point |
| Insulation method | | Relay insulation |
| Rated load voltage/current | | DC24V 2A (resistive load) / AC220V 2A (COSΦ = 1), 5A/COM |
| Min. load voltage/current | | DC5V / 1 ㎃ |
| Max. load voltage | | AC250V, DC125V |
| Off leakage current | | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. On/Off frequency | | 3,600 times / hour |
| Surge absorber | | None |
| Service life | Mechanical | 20 million times or more |
| | Electrical | Rated load voltage / Current 100,000 times or more |
| | | AC200V / 1.5A, AC240V / 1A (COSΦ = 0.7) 100,000 times or more |
| | | AC200V / 1A, AC240V / 0.5A (COSΦ = 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 | | 4 point / COM |
| Proper cable size | | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | | 360 ㎃ (When all outputs are on) |
| Operation indicator | | LED On when Output On |
| External connection method | | 14 point terminal block connector (M3 X 6 screw) |
| Weight | | 340g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| TB2 | FG | TB1 | AC100 ~240V |
| TB4 | COM0 | TB3 | |
| TB6 | COM1 | TB5 | 40 |
| TB8 | COM2 | TB7 | 41 |
| TB10 | 43 | TB9 | 42 |
| TB12 | NC | TB11 | NC |
| TB14 | 24G | TB13 | 24V |

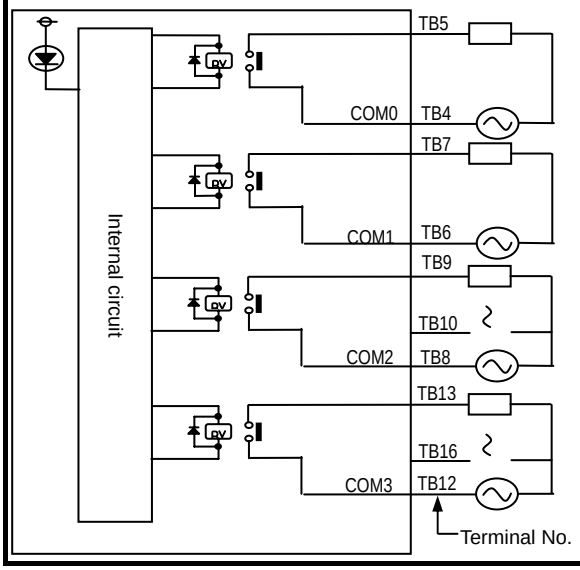
Type



### 7.3.3 XBC-DR20E 8 point relay output

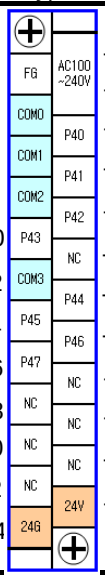
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DR20E |
| Output point | | 8 point |
| Insulation method | | Relay insulation |
| Rated load voltage/current | | DC24V 2A (resistive load) / AC220V 2A (COSΦ = 1), 5A/COM |
| Min. load voltage/current | | DC5V / 1 ㎃ |
| Max. load voltage | | AC250V, DC125V |
| Off leakage current | | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. On/Off frequency | | 3,600 times / hour |
| Surge absorber | | None |
| Service life | Mechanical | Service life |
| | Electrical | |
| Response time | Off → On | Response time |
| | On → Off | |
| Common method | | 4 point / COM (COM0~COM8), 8 point / COM (COM4~COM5) |
| Proper cable size | | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | | 720 ㎃ (When all outputs are on) |
| Operation indicator | | LED On when Output On |
| External connection method | | 42 point terminal block connector (M3 X 6 screw) |
| Weight | | 450g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| | | TB1 | AC100 ~240V |
| TB2 | FG | TB3 | |
| TB4 | COM0 | TB5 | 40 |
| TB6 | COM1 | TB7 | 41 |
| TB8 | COM2 | TB9 | 42 |
| TB10 | 43 | TB11 | NC |
| TB12 | COM3 | TB13 | 44 |
| TB14 | 45 | TB15 | 46 |
| TB16 | 47 | TB17 | NC |
| TB18 | NC | TB19 | NC |
| TB20 | NC | TB21 | NC |
| TB22 | NC | TB23 | 24V |
| TB24 | 24G | | |

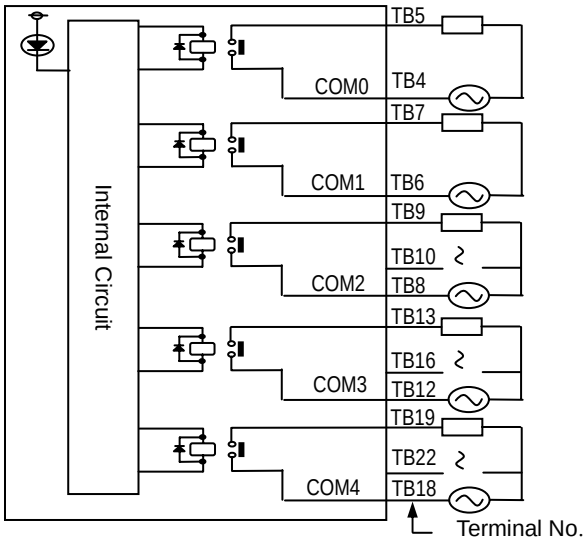
Type



### 7.3.4 XBC-DR30E 12 point relay output

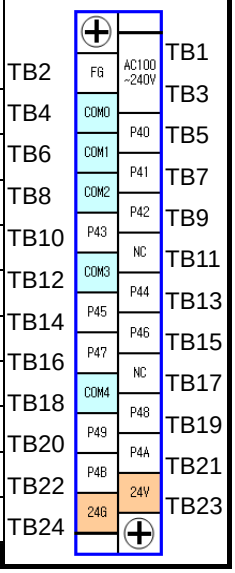
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DR30E |
| Output point | | 12 point |
| Insulation method | | Relay insulation |
| Rated load voltage/current | | DC24V 2A (resistive load) / AC220V 2A (COSΦ = 1), 5A/COM |
| Min. load voltage/current | | DC5V / 1 ㎃ |
| Max. load voltage | | AC250V, DC125V |
| Off leakage current | | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. On/Off frequency | | 3,600 times / hour |
| Surge absorber | | None |
| Service life | Mechanical | 20 million times or more |
| | Electrical | Rated load voltage / Current 100,000 times or more |
| | | AC200V / 1.5A, AC240V / 1A (COSΦ = 0.7) 100,000 times or more |
| | | AC200V / 1A, AC240V / 0.5A (COSΦ = 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 | | 4 point / COM (COM0~COM8), 8 point / COM (COM4~COM5) |
| Proper cable size | | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | | 720 ㎃ (When all outputs are on) |
| Operation indicator | | LED On when Output On |
| External connection method | | 42 point terminal block connector (M3 X 6 screw) |
| Weight | | 465g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| | | TB1 | AC100 ~240V |
| TB2 | FG | TB3 | |
| TB4 | COM0 | TB5 | 40 |
| TB6 | COM1 | TB7 | 41 |
| TB8 | COM2 | TB9 | 42 |
| TB10 | 43 | TB11 | NC |
| TB12 | COM3 | TB13 | 44 |
| TB14 | 45 | TB15 | 46 |
| TB16 | 47 | TB17 | NC |
| TB18 | COM4 | TB19 | 48 |
| TB20 | 49 | TB21 | 4A |
| TB22 | 4B | TB23 | 24V |
| TB24 | 24G | | |

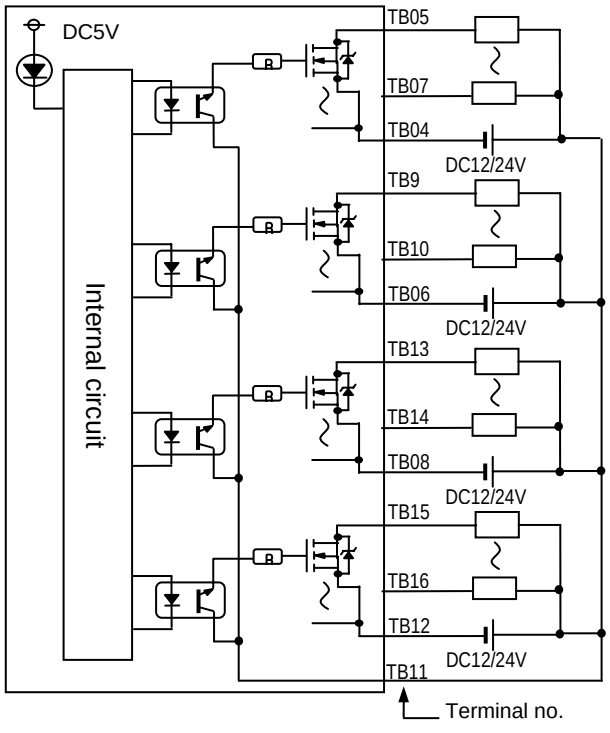
Type



### 7.3.5 XBC-DN20S 8 point transistor output (Sink type)

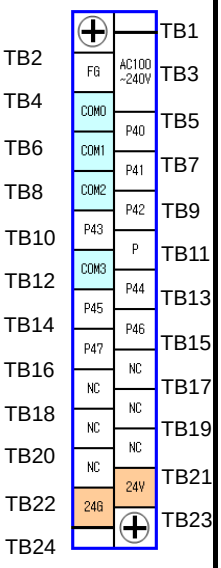
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DN20S |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Operation load voltage range | | DC 10.2 ~ 26.4V |
| Max. load current | | 0.5A / 1 point, 2A / 1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop when 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 | | 4 point / COM |
| Proper wire size | | Stranded wire 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less) |
| Current consumption | | 400 ㎃ (when all outputs are on) |
| External power | Voltage | DC12/24V ± 10% (Ripple voltage 4 Vp-p or less) |
| | Current | 25 ㎃ or less (When connecting DC24V) |
| Operation indicator | | LED On when Output On |
| External connection method | | 24 point terminal block connector(M3 X 6 screw) |
| Weight | | 470g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| | | TB1 | AC100 ~240V |
| TB2 | FG | TB3 | |
| TB4 | COM0 | TB5 | 40 |
| TB6 | COM1 | TB7 | 41 |
| TB8 | COM2 | TB9 | 42 |
| TB10 | 43 | TB11 | P |
| TB12 | COM3 | TB13 | 44 |
| TB14 | 45 | TB15 | 46 |
| TB16 | 47 | TB17 | NC |
| TB18 | NC | TB19 | NC |
| TB20 | NC | TB21 | NC |
| TB22 | NC | TB23 | 24V |
| TB24 | 24G | | |

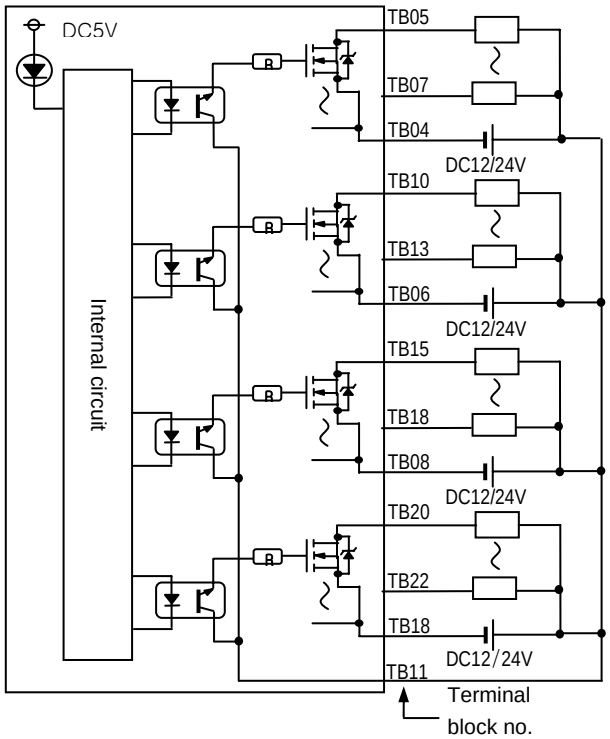
Type



### 7.3.6 XBC-DN30S 12 point transistor output (Sink type)

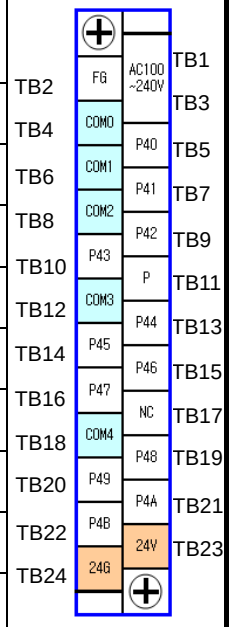
| Specification \ Model | | Main unit |
|---|---|---|
| | | XBC-DN30S |
| Output point | | 12 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Operation load voltage range | | DC 10.2 ~ 26.4V |
| Max. load current | | 0.5A / 1 point, 2A / 1COM |
| Off leakage current | | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop when 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 | | 4 point / COM |
| Proper wire size | | Stranded wire 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less) |
| Current consumption | | 400 ㎃ (When all outputs are on) |
| External power | Voltage | DC12/24V ± 10% (Ripple voltage 4 Vp-p or less) |
| | Current | 25 ㎃ or less (When connecting DC24V) |
| Operation indicator | | LED On when Output On |
| External connection method | | 24 point terminal block connector(M3 X 6 screw) |
| Weight | | 475g |

Circuit configuration




| No. | Contact | No. | Contact |
|---|---|---|---|
| | | TB1 | AC100 ~240V |
| TB2 | FG | TB3 | |
| TB4 | COM0 | TB5 | 40 |
| TB6 | COM1 | TB7 | 41 |
| TB8 | COM2 | TB9 | 42 |
| TB10 | 43 | TB11 | P |
| TB12 | COM3 | TB13 | 44 |
| TB14 | 45 | TB15 | 46 |
| TB16 | 47 | TB17 | NC |
| TB18 | COM4 | TB19 | 48 |
| TB20 | 49 | TB21 | 4A |
| TB22 | 4B | TB23 | 24V |
| TB24 | 24G | | |

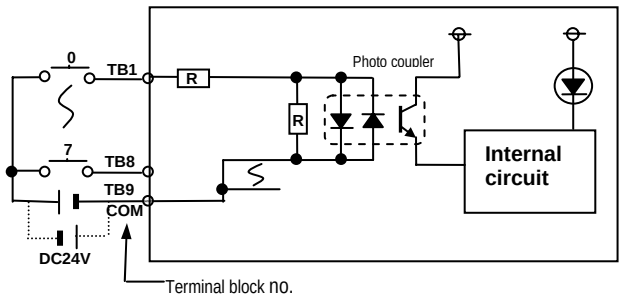
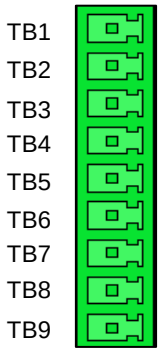
Type



# 7.4 Digital Input Module Specification

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

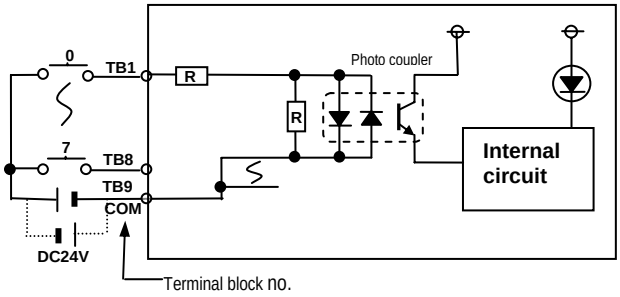
| Model / Specification | | DC input module |
|---|---|---|
| | | XBE-DC08A |
| Input point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ |
| Operation voltage range | | DC20.4~28.8V (ripple rate < 5%) |
| On Voltage/Current | | DC19V or higher / 3 ㎃ or higher |
| Off Voltage/Current | | DC6V or less / 1 ㎃ or less |
| Input resistance | | About 5.6 ㏀ |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳(set by CPU parameter) Default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3Cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by 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 | | 9 point terminal block connector |
| Weight | | 52 g |

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

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

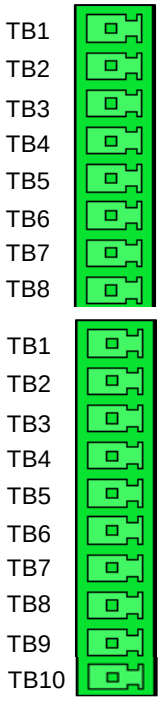
| Model / Specification | | DC input module |
|---|---|---|
| | | XBE-DC16A |
| Input point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ |
| Operation voltage range | | DC20.4~28.8V (ripple rate < 5%) |
| On Voltage/Current | | DC19V or higher / 3 ㎃ or higher |
| Off Voltage/Current | | DC6V or less / 1 ㎃ or less |
| Input resistance | | About 5.6 ㏀ |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3Cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by 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 |
|---|---|
| TB1 | 0 |
| TB2 | 1 |
| TB3 | 2 |
| TB4 | 3 |
| TB5 | 4 |
| TB6 | 5 |
| TB7 | 6 |
| TB8 | 7 |
| TB1 | 8 |
| TB2 | 9 |
| TB3 | A |
| TB4 | B |
| TB5 | C |
| TB6 | D |
| TB7 | E |
| TB8 | F |
| TB9 | COM |
| TB10 | COM |

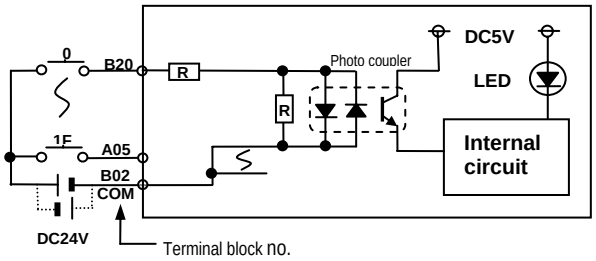
Type



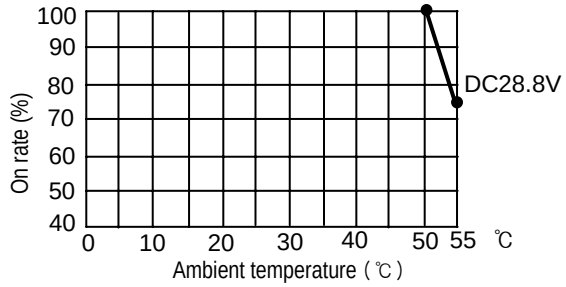
### 7.4.3 32 point DC24V input module (Source/Sink type)

| Specification \ Model | | DC input module |
|---|---|---|
| | | XBE-DC32A |
| Input point | | 32 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ |
| Operation voltage range | | DC20.4~28.8V (ripple rate < 5%) |
| Input Derating | | Refer to Derating diagram |
| On Voltage/Current | | DC 19V or higher / 3 ㎃ or higher |
| Off Voltage/Current | | DC 6V or less / 1 ㎃ or less |
| Input resistance | | About 5.6 ㏀ |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default:3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC 560Vrms / 3 Cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by 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

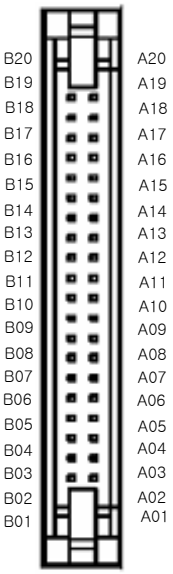



Input Derating diagram




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

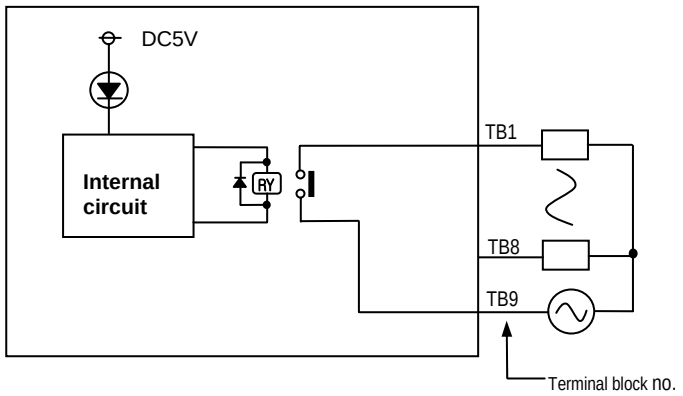
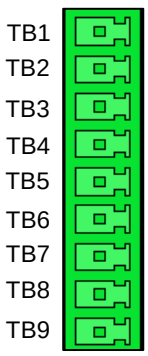
Type



## 7.5 Digital Output Module Specification

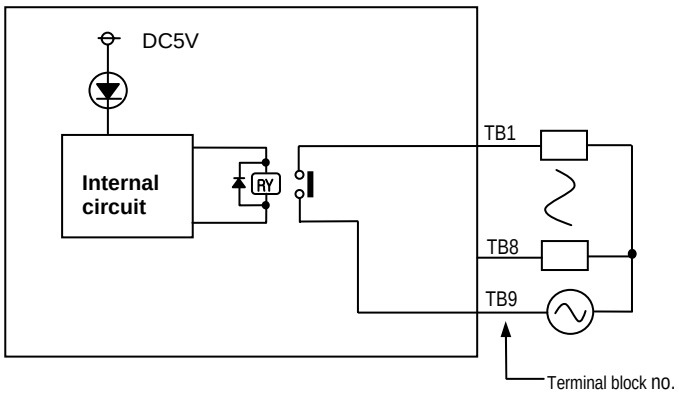
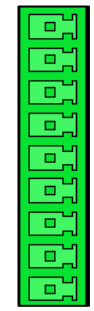
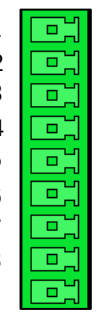
### 7.5.1 8 point relay output module

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

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

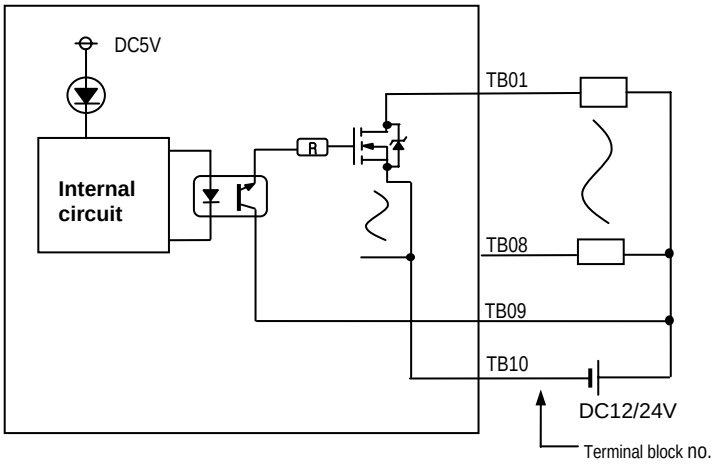
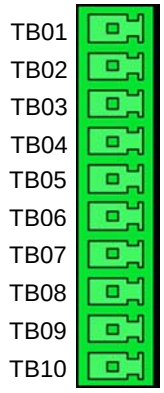
### 7.5.2 16 point relay output module

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

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

### 7.5.3 8 point transistor output module (Sink type)

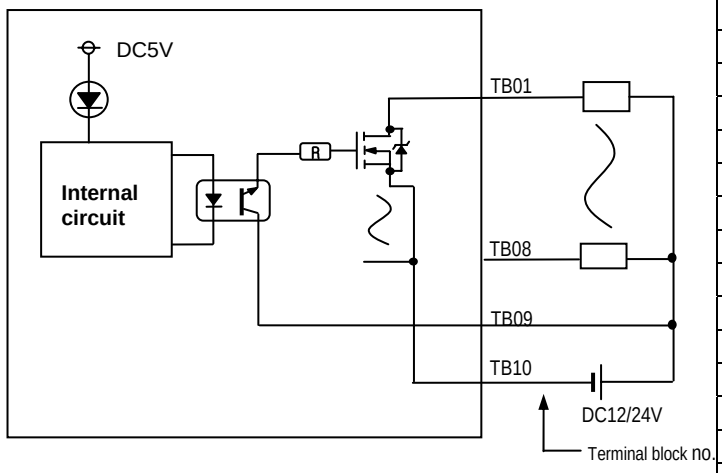
| Model / Specification | | Transistor output module |
|---|---|---|
| | | XBE-TN08A |
| Output point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.5A / 1 point |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 8 point / COM |
| Proper cable size | | Stranded 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 point terminal block connector |
| Weight | | 53 |

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

### 7.5.4 16 point transistor output module (Sink type)

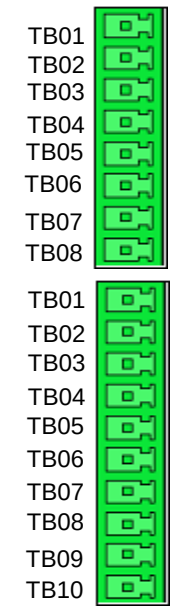
| Specification \ Model | | Transistor output module |
|---|---|---|
| | | XBE-TN16A |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.2A / 1 point, 2A / 1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 16 point / COM |
| Proper cable size | | Stranded 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) |
| | 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 |
|---|---|
| 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 |

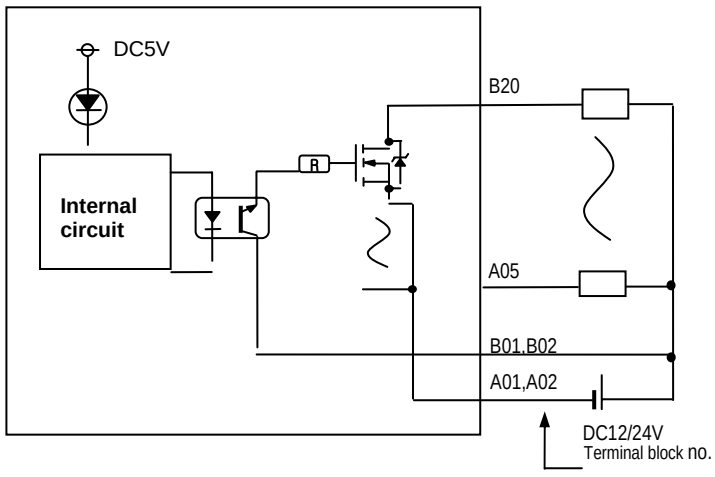
Type

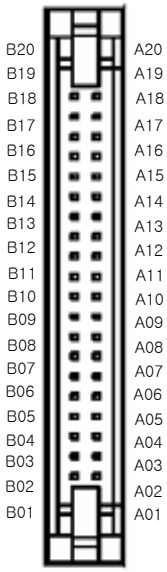


### 7.5.5 32 point transistor output module (Sink type)

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

Circuit configuration

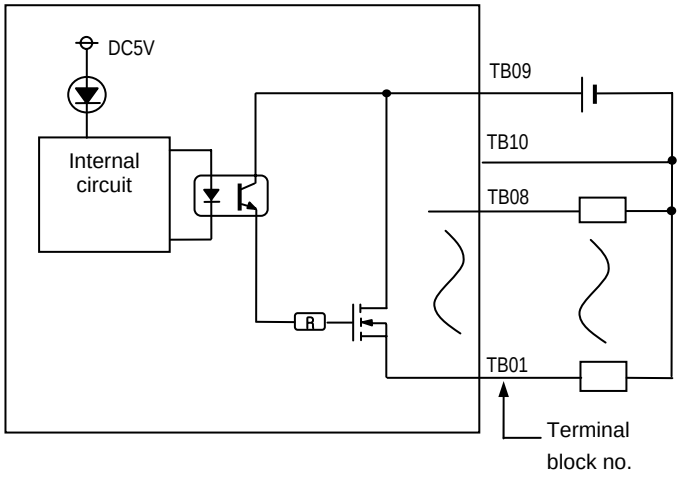



| No. | Contact | No. | Contact | Type |
|---|---|---|---|---|
| B20 | 00 | A20 | 10 |  |
| B19 | 01 | A19 | 11 | |
| B18 | 02 | A18 | 12 | |
| B17 | 03 | A17 | 13 | |
| B16 | 04 | A16 | 14 | |
| B15 | 05 | A15 | 15 | |
| B14 | 06 | A14 | 16 | |
| B13 | 07 | A13 | 17 | |
| B12 | 08 | A12 | 18 | |
| B11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

### 7.5.6 8 point transistor output module (Source type)

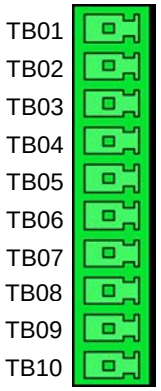
| Model / Specification | | Transistor output module |
|---|---|---|
| | | XBE-TP08A |
| Output point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.5A / 1 point |
| Off leakage 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 |
|---|---|
| TB01 | 0 |
| TB02 | 1 |
| TB03 | 2 |
| TB04 | 3 |
| TB05 | 4 |
| TB06 | 5 |
| TB07 | 6 |
| TB08 | 7 |
| TB09 | COM |
| TB10 | 0V |

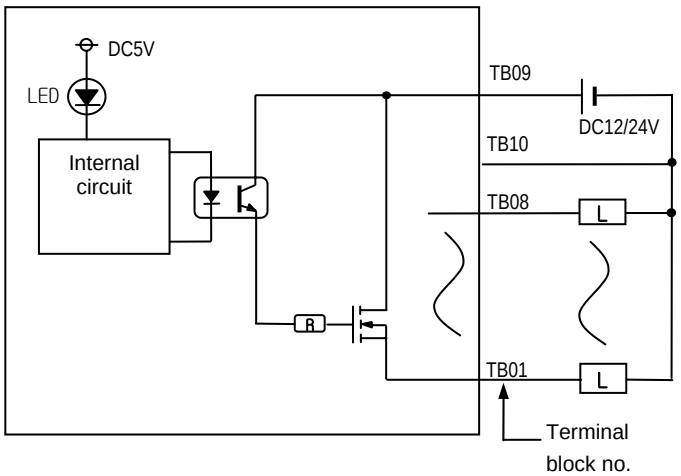
Type



### 7.5.7 16 point transistor output module (Source type)

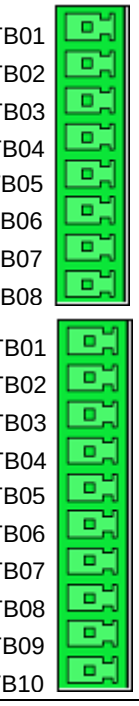
| Specification \ Model | | Transistor output module |
|---|---|---|
| | | XBE-TP16A |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.5A / 1 point, 2A / 1COM |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

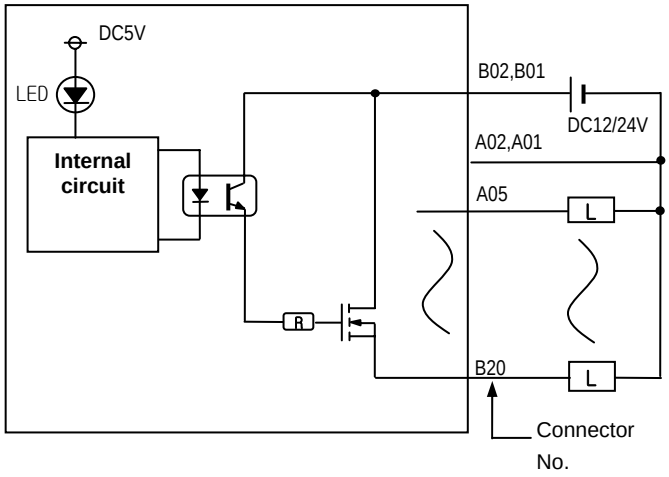
Type



### 7.5.8 32 point transistor output module (Source type)

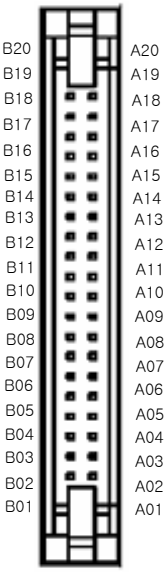
| Specification \ Model | | Transistor output module |
|---|---|---|
| | | XBE-TP32A |
| Output point | | 32 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.2A / 1 point, 2A / 1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 32 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 120 ㎃ (When all outputs are on) |
| External power | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | 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 |
|---|---|---|---|
| B20 | 00 | A20 | 10 |
| B19 | 01 | A19 | 11 |
| B18 | 02 | A18 | 12 |
| B17 | 03 | A17 | 13 |
| B16 | 04 | A16 | 14 |
| B15 | 05 | A15 | 15 |
| B14 | 06 | A14 | 16 |
| B13 | 07 | A13 | 17 |
| B12 | 08 | A12 | 18 |
| B11 | 09 | A11 | 19 |
| B10 | 0A | A10 | 1A |
| B09 | 0B | A09 | 1B |
| B08 | 0C | A08 | 1C |
| B07 | 0D | A07 | 1D |
| B06 | 0E | A06 | 1E |
| B05 | 0F | A05 | 1F |
| B04 | NC | A04 | NC |
| B03 | NC | A03 | NC |
| B02 | COM | A02 | 0V |
| B01 | | A01 | |

Type

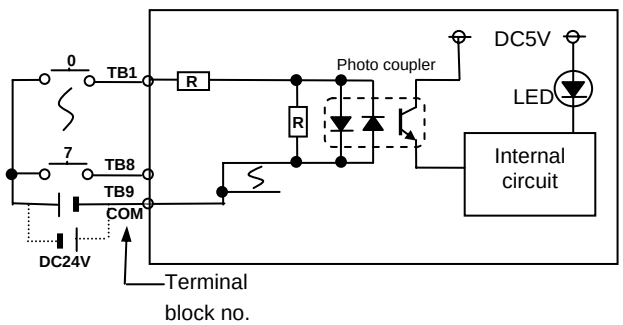


## 7.6 Combined Digital I/O module Input Specification

### 7.6.1 8 point DC24V input (Source/Sink type)

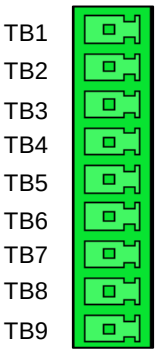
| Model / Specification | | DC input module |
|---|---|---|
| | | XBE-DR16A |
| Input point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 ㎃ |
| Operation voltage range | | DC20.4~28.8V (within ripple rate 5%) |
| On Voltage/Current | | DC19V or higher / 3 ㎃ or higher |
| Off Voltage/Current | | DC6V or less / 1 ㎃ or less |
| Input resistance | | About 5.6 ㏀ |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳(set by CPU parameter) Default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC560Vrms / 3Cycle (altitude 2000m) |
| Insulation resistance | | 10 ㏁ or more by Megohmmeter |
| 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 input on |
| External connection method | | 9 pin terminal block connector |
| Weight | | 81g |

Circuit configuration




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

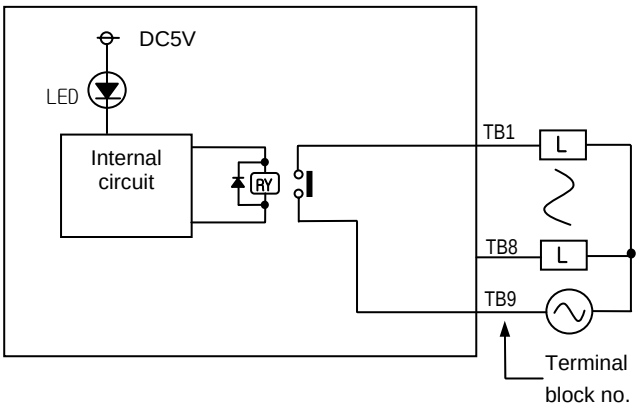
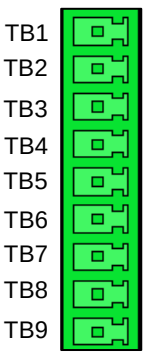
Type



## 7.7 Combined Digital I/O module Output Specification

### 7.7.1 8 point relay output

| Specification \ Model | | 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 | |
| | TB4 | 3 | |
| | TB5 | 4 | |
| | TB6 | 5 | |
| | TB7 | 6 | |
| | TB8 | 7 | |
| | TB9 | COM | |

# 7.8 IO Wiring by Using Smart Link Board

## 7.8.1 Smart link board

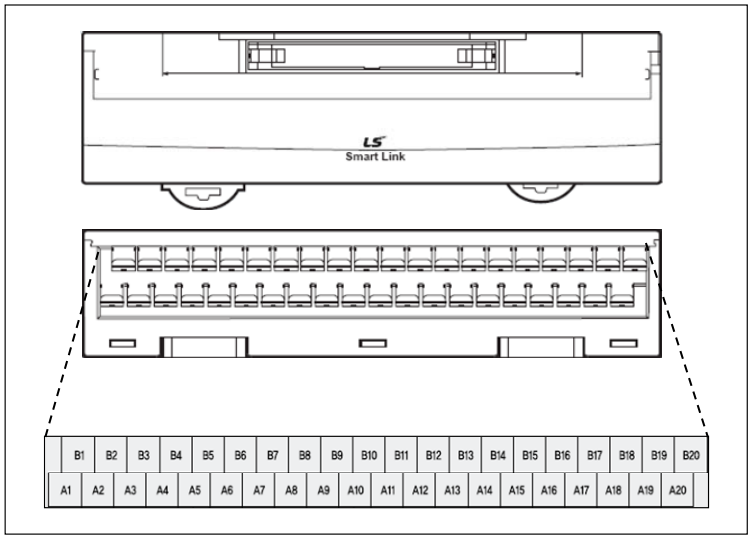
Easy wiring is available by connecting the IO connector with smart link board.
The available smart link and IO cable are as follows.

| XGB | | Smart link | | Connection cable | | |
|---|---|---|---|---|---|---|
| Item | Model | Model | No. of Pin | Model | Length | Contents |
| Main unit | XBM-DN32S | SLP-T40P | 40 | SLT-CT101-XBM | 1m | For main unit connection (20Pin + 20Pin) |
| | XBM-DN16S | | | | | |
| Expansion module | XBE-DC32A | SLP-T40P | 40 | SLT-CT101-XBE | 1m | For expansion module connection (40Pin) |
| | XBE-TN32A | SLP-T40P | 40 | SLT-CT101-XBE | 1m | |
| | | SLP-RY4A | 40 | SLP-CT101-XBE | 1m | For expansion module connection (40Pin) Exclusive for relay built-in SLP type |

It describes wring of XGB, SLP-T40P and SLT-CT101-XBM.
For wring of other smart link boards or XGB extension module, refer to XGB user manual for hardware.

1) SLT-T40P terminal array

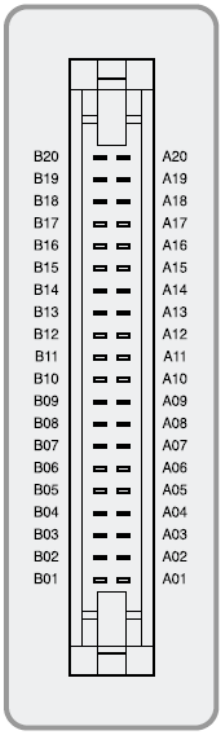
Terminal array of SLP-T40P is as follows.




| Item | Specification |
|---|---|
| Rated voltage | AC/DC 125[V] |
| Rated current | Max. 1[A] |
| Withstanding voltage | 600V 1min |
| Insulation resistor | 100 ㏁ (DC500V) |
| Cable specification | 1.25[㎟] or below |
| Terminal/screw | M3 X 8L |
| Torque | 6.2 ㎏f.㎝ or above |
| Terminal material | PBT, UL94V-0 |
| Weight | 186g |

2) Wiring of SLT-T40P and XGB extension modulet
Wiring of XGB extension module through SLP-T40P and SLT-CT101-XBE is as follows.

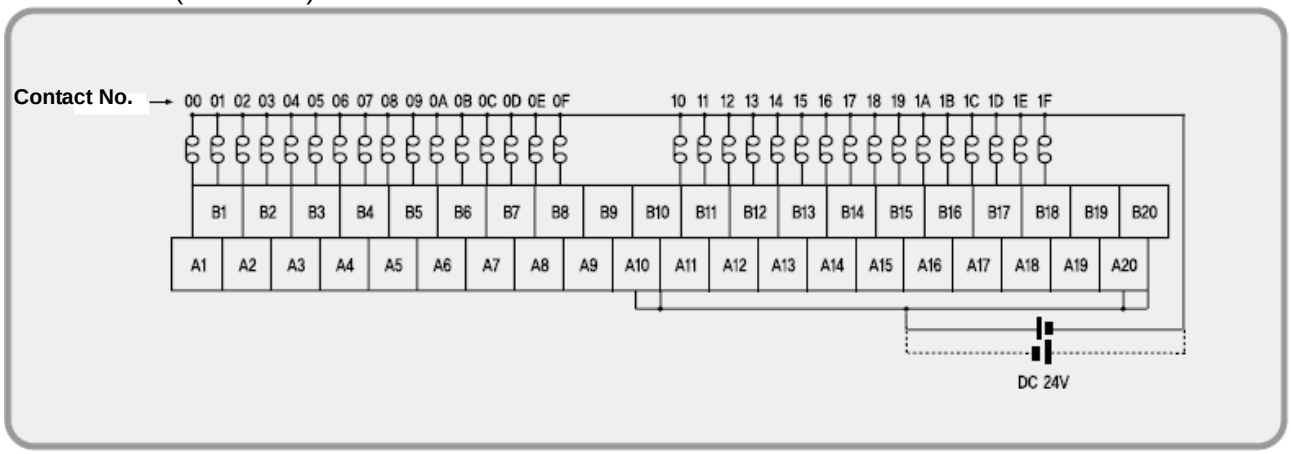

At this time, relationship of XGB IO signal and Smart link board terminal number is as follows.
The following figure describes signal allocation when SLT-CT101-XBE is used as connection cable.
When the user makes the cable, make sure that wring is done as figure below.



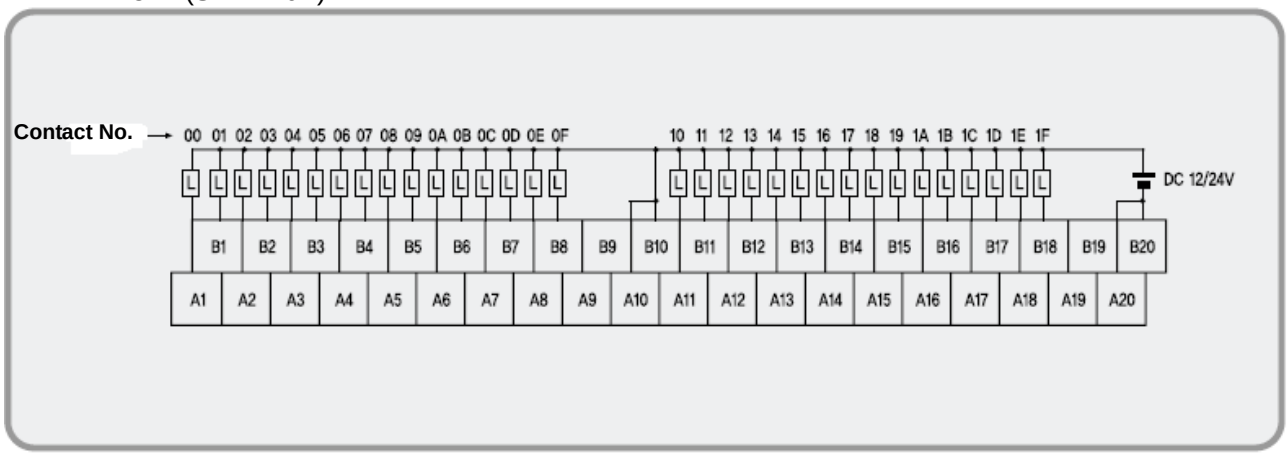

| PLC | | | | | | | | Terminal block Name | |
|---|---|---|---|---|---|---|---|---|---|
| Pin No. | | XBE-DC32A | | XBE-TN32A | | XBE-TP32A | | Terminal block board (SLP-T40P) | |
| B20 | A20 | 00 | 10 | 00 | 10 | 00 | 10 | A1 | A11 |
| B19 | A19 | 01 | 11 | 01 | 11 | 01 | 11 | B1 | B11 |
| B18 | A18 | 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 |

3) I/O wiring

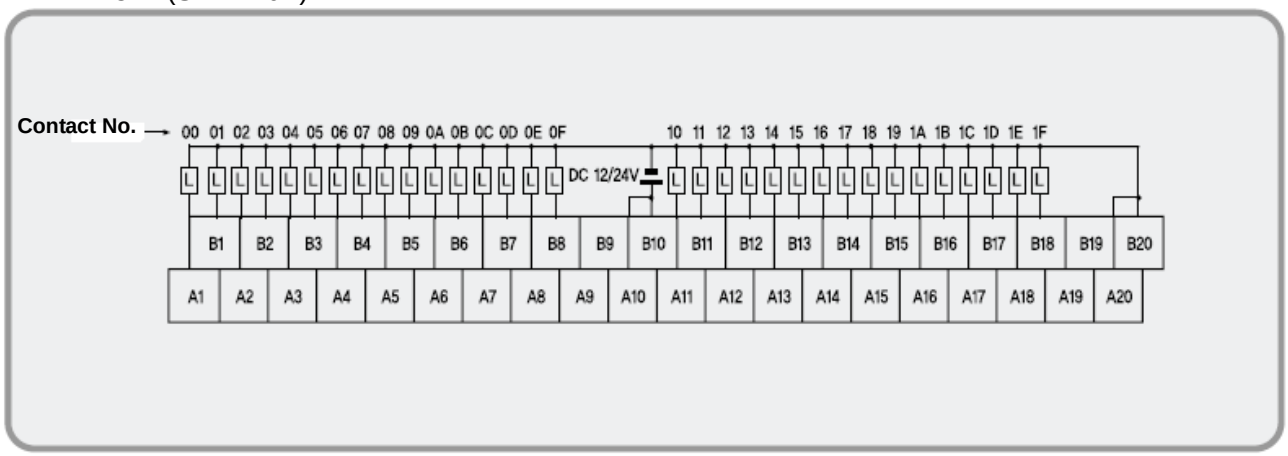
- XBE-DC32A (SLP-T40P)



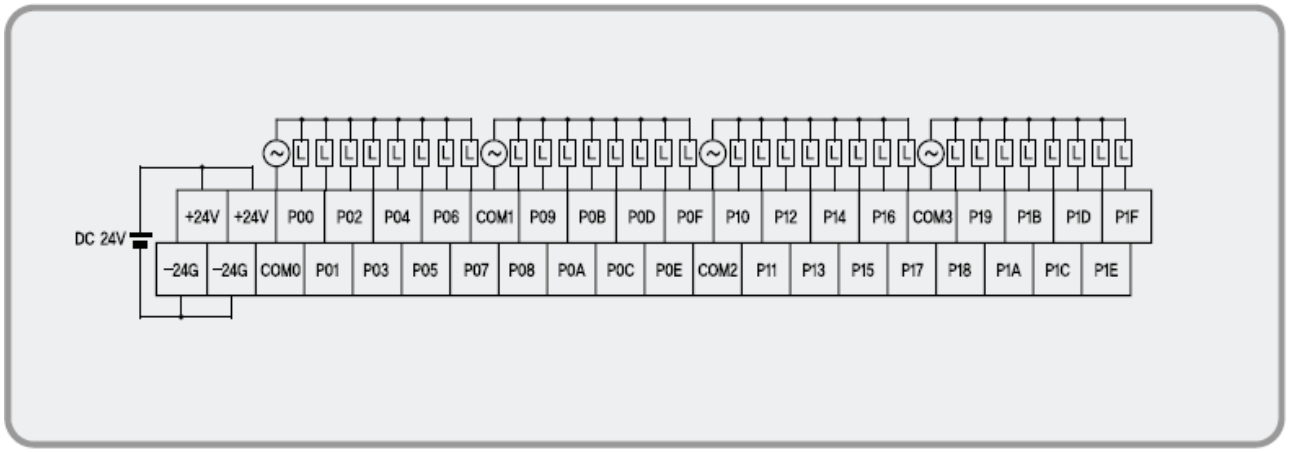

- XBE-TN32A (SLP-T40P)




- XBE-TP32A (SLP-T40P)



- XBE-TN32A (SLP-RY4A)



# Chapter 8 Built-in High-speed Counter Function

XGB series have built-in function of High-speed counter in main 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 main unit.

### 8.1.1 Performance specifications

(1) Performance specification

| Classification | | Description | |
|---|---|---|---|
| | | "E" type | "S" type |
| Count input signal | Signal | A-phase, B-phase | |
| | Input type | Voltage input (Open collector) | |
| | Signal level | DC 24V | |
| Max. count speed | | 4kpps | 100kpps |
| Number of channels | 1 phase | 4kpps 4 channels | 100kpps 2 channels/ 20kpps 6 channels |
| | 2 phase | 2kpps 2 channels | 50kpps 1 channel / 8kpps 3 channels |
| Count 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 | Operating setting by rising edge phase difference | Operating setting by rising/falling edge phase difference |
| | CW/CCW | A-phase input: increasing operation | |
| | | B-phase input: decreasing operation | |
| Multiplication function | 1 phase input | 1 multiplication | |
| | 2 phase input | 2 multiplication | 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) :uses output contact point of main unit | 2 point/channel (for each channel) :use output contact point of main unit |
| | Type | Selects single-compared (>, >=, =, =<, <) or section-compared output (included or excluded) (program setting) | |
| | Output type | Relay, Open-collector output (Sink) | |

| Classification | Description | |
|---|---|---|
| | "E" type | "S" type |
| 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<br>(Program setting) | Count Latch<br>Count per unit time (time setting value: 1~60,000ms) | |

(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 |

**Notice**

If higher pulse than high speed counter input limit is inputted, 「abnormal operation stop」 error may occur because MPU processing time increases to count fast and memory becomes full. When using high speed counter, consider this.

## 8.1.2 Designation of parts

(1) Designation of parts

(a) “E” 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 | Ch4 preset 24V | - | Preset input terminal | No use |
| COM0 | Input common | Input common | Common terminal | Common terminal |

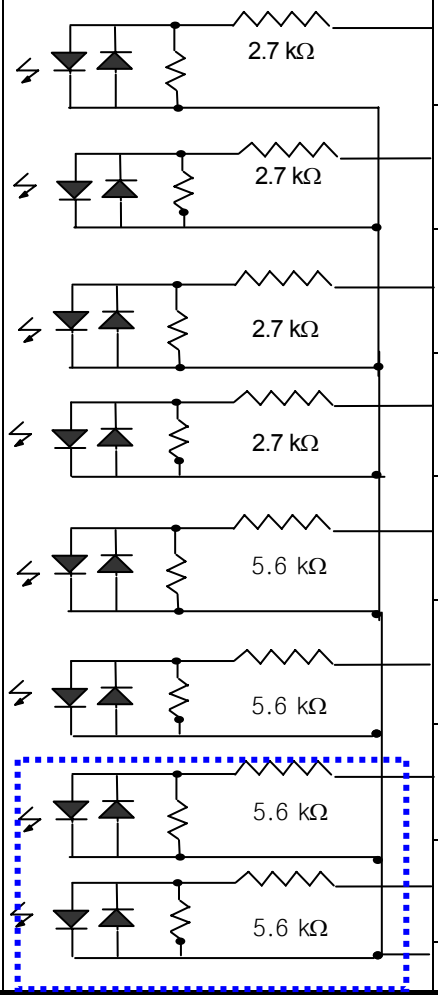
(b) “S” type

| 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 | 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 |

(2) Interface with external devices

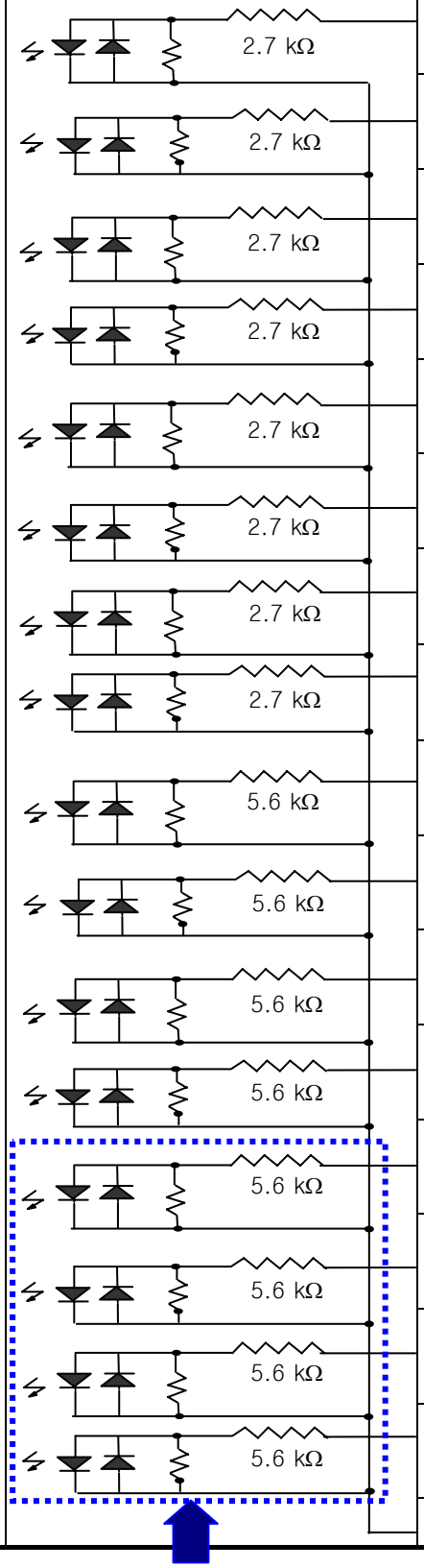
The internal circuit of High-speed counter is as shown below.

(a) “E” type

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

For XBC-DR10E, there is no physical circuit for P0006 ~ P0007. Turn on this contact point by program.

(b) “E” type

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



For XBC-DR/DN20S, there is no physical circuit for P000C ~ P000F. Turn on this contact point by program.

### 8.1.3 “E” 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) Periodic Pulse Count

(e) Pulse input mode

1) 1-phase count mode

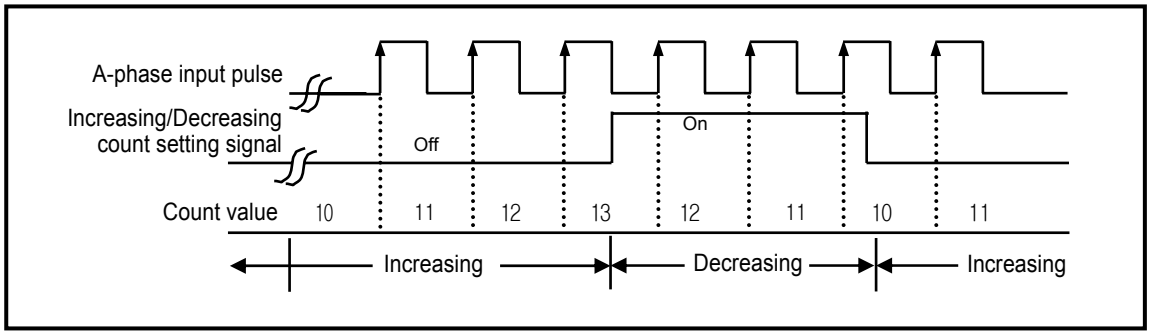
a) Increasing/decreasing count operation by program setting

● 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



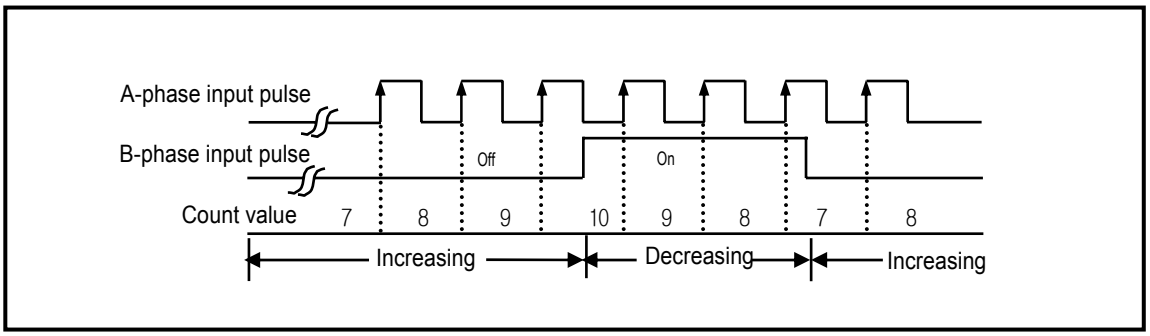
b) Increasing/decreasing count operation by B-phase input signal

● 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

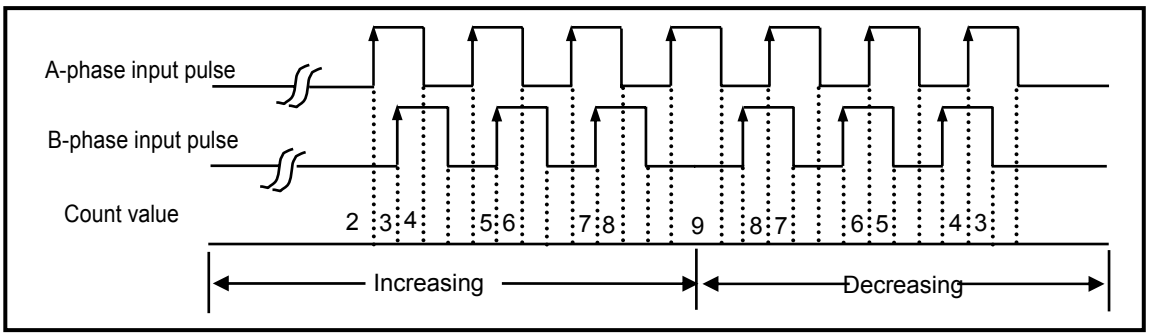



2) 2-phase count mode

a) 2-phase 2-multiplication operation mode

A-phase input pulse and B-phase input pulse count at rising. 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



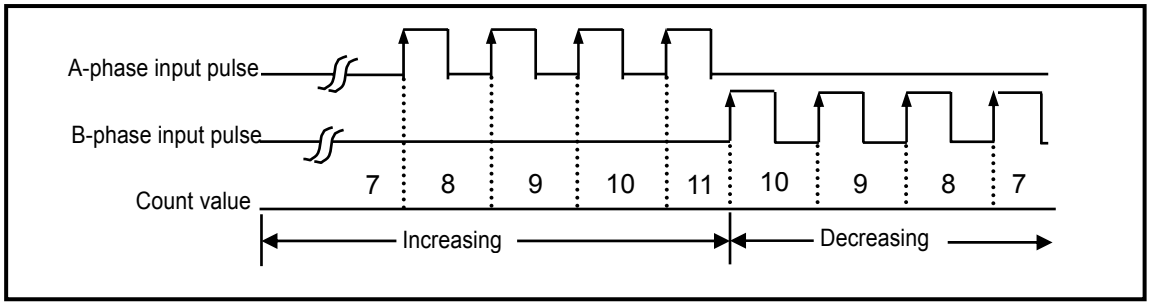
3) CW(Clockwise)/CCW(Counter Clockwise) operation mode

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.

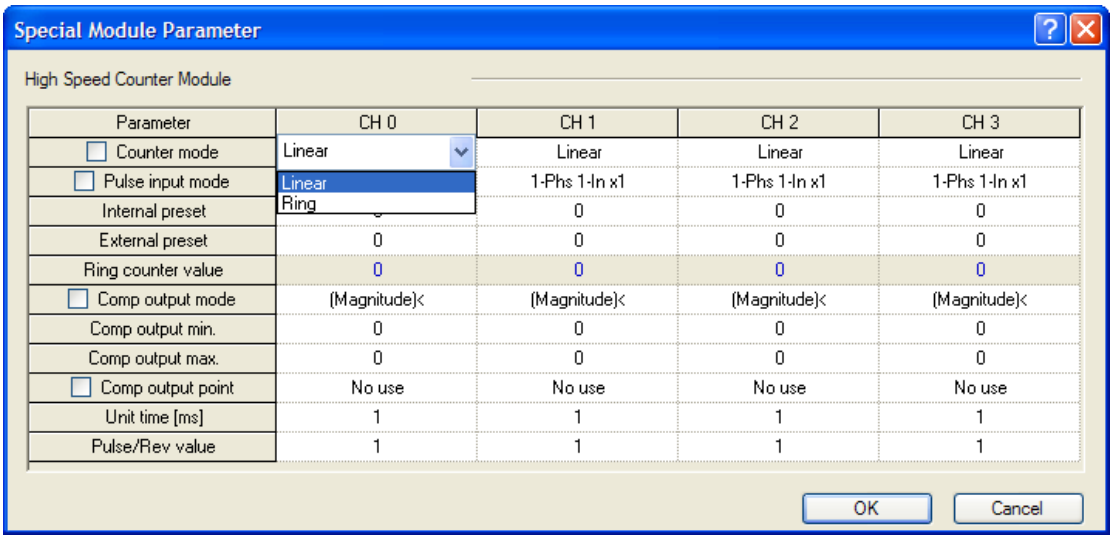
| Increasing/Decreasing classification | A-phase input pulse High | A-phase input pulse Low |
|---|---|---|
| B-phase input pulse High | - | decreasing count |
| B-phase input pulse Low | Increasing count | - |

▪ 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) | | | | Reference*1) |
|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | |
| Counter mode | K300 | K330 | K360 | K390 | 0 : linear<br>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.

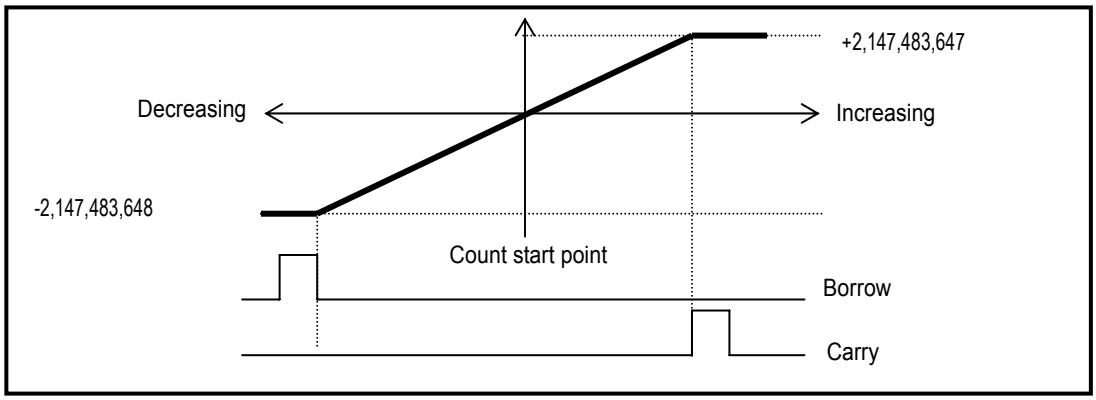
(a) Linear counter

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

2) 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.

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

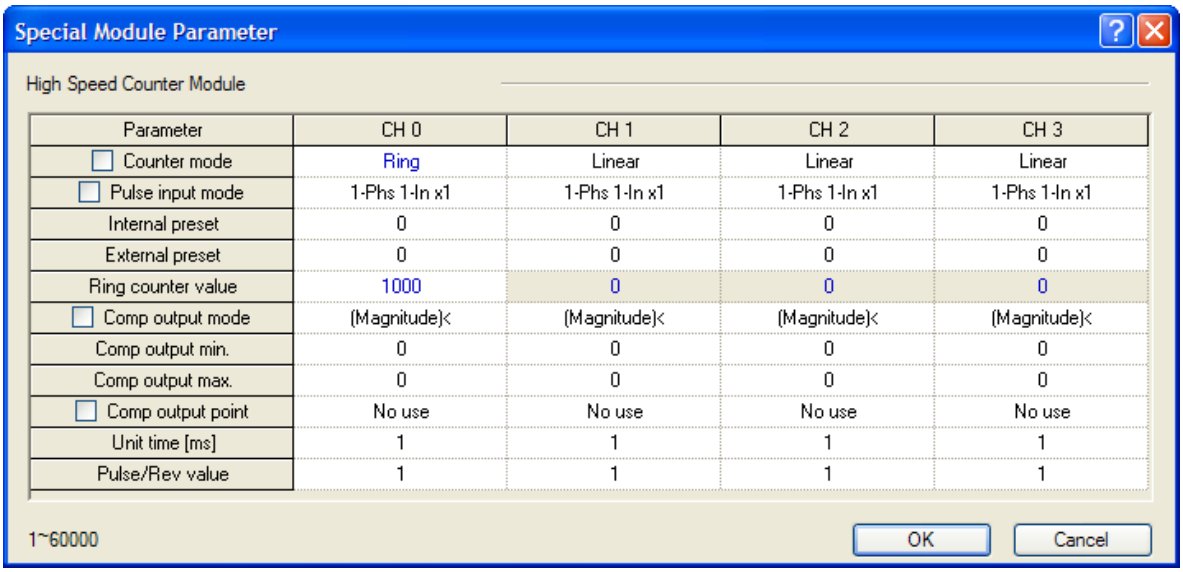
4) If Borrow occurs, count stops and decreasing is not available but increasing is available.




(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.

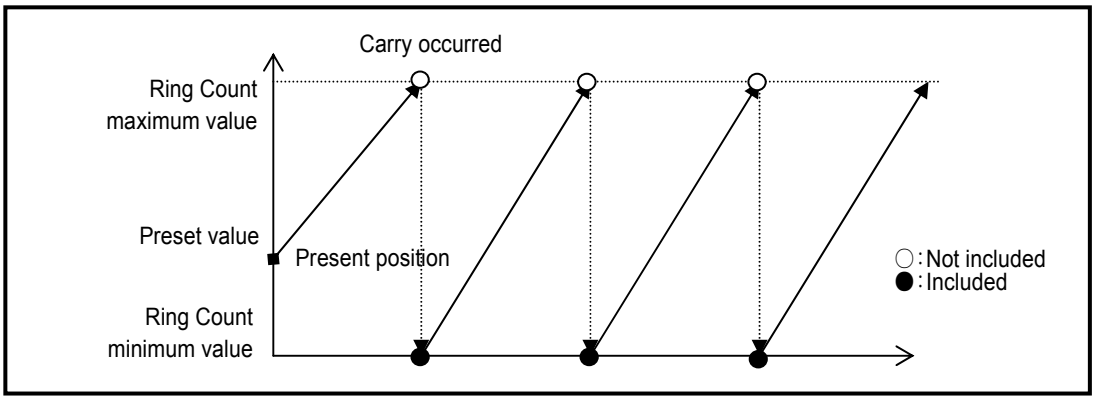



• Ring counter value is saved at the following special K area.

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

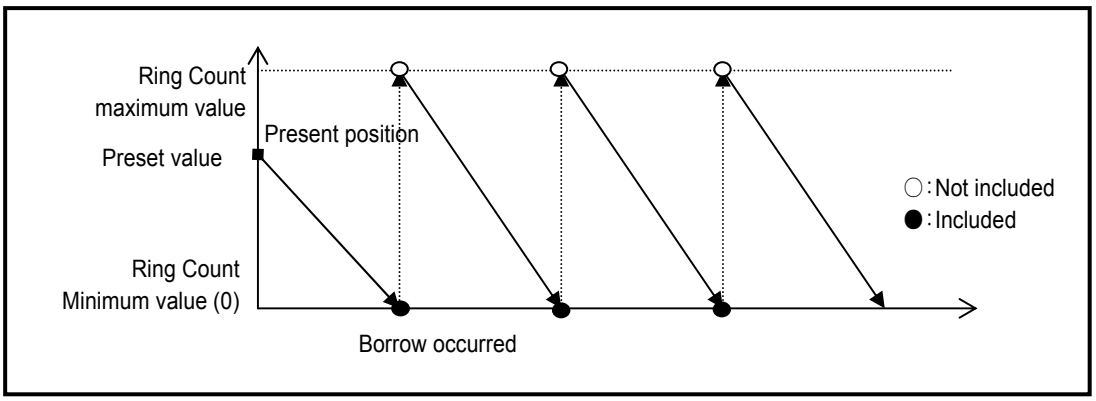
1) During increasing count

■ 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.



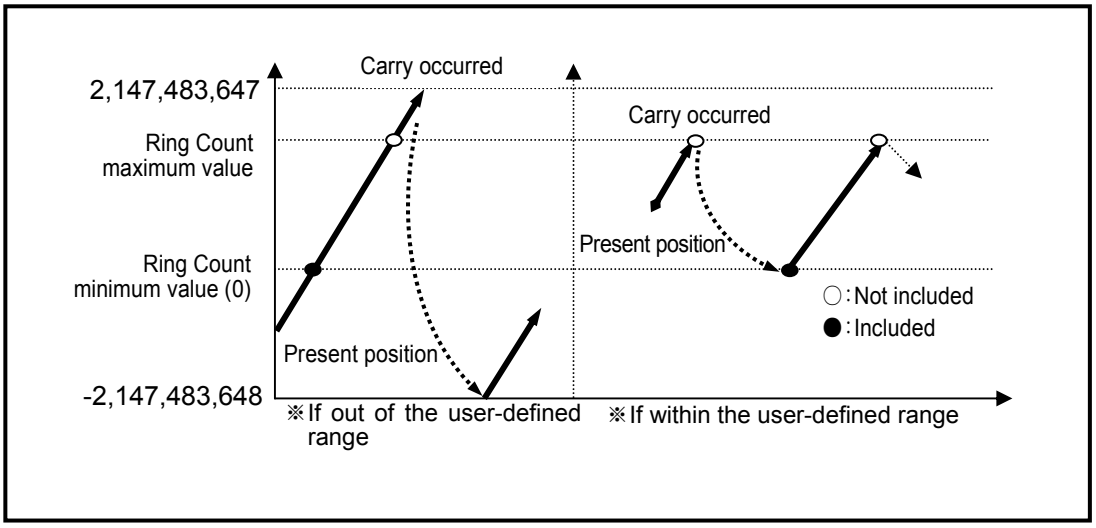

3) Operation when setting Ring Count based on present count value (during increasing count)

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

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

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

- Present count value starts to increase up to the user-defined maximum value and down to the user-defined minimum value and keeps counting after Carry occurs.
- Not the maximum but the minimum value only is displayed with count kept on as shown below.



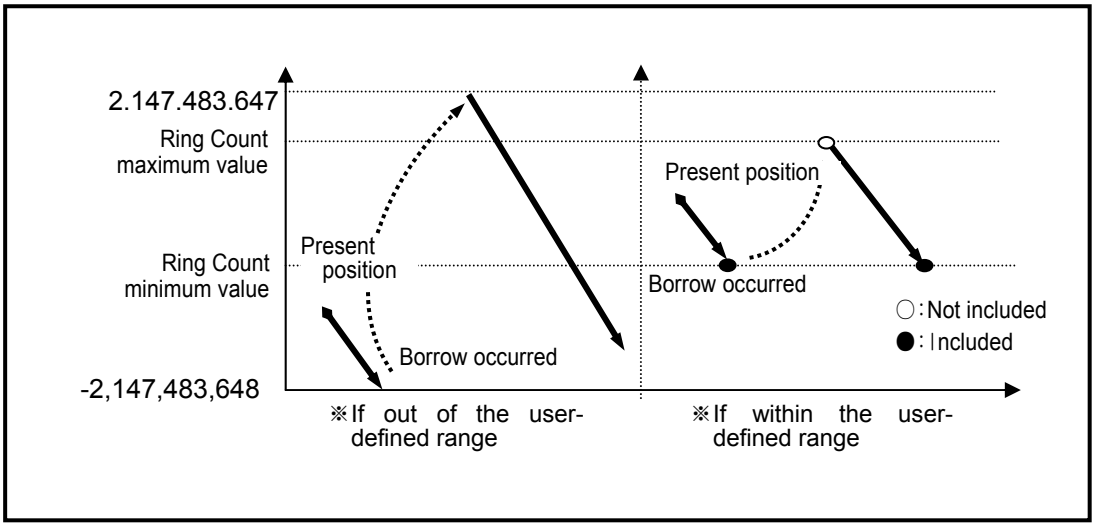

4) Operation when setting Ring Count based on present count value (during decreasing count)

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

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

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

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




**Remark**

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

(2) Ring Count setting when count value is out of the range is regarded as user's mistake. The count is not available within the Ring Count range.

(3) Use preset function or the like when using Ring Count so to surely position the count value within the range.

(3) Compared output

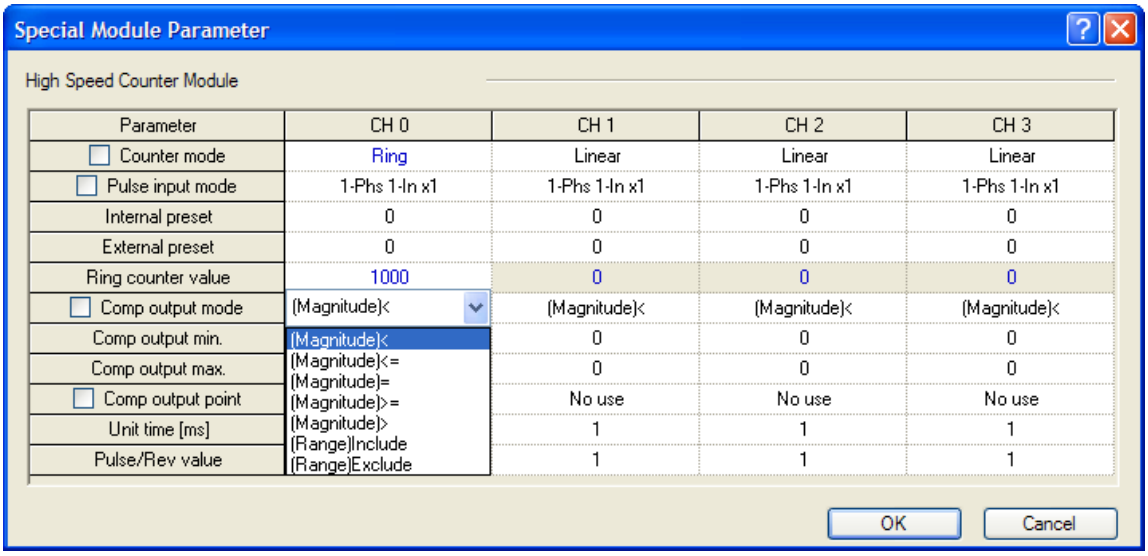
(a) High Speed counter module has a compared output function used to compare present count value with compared value in size to output as compared.

(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.

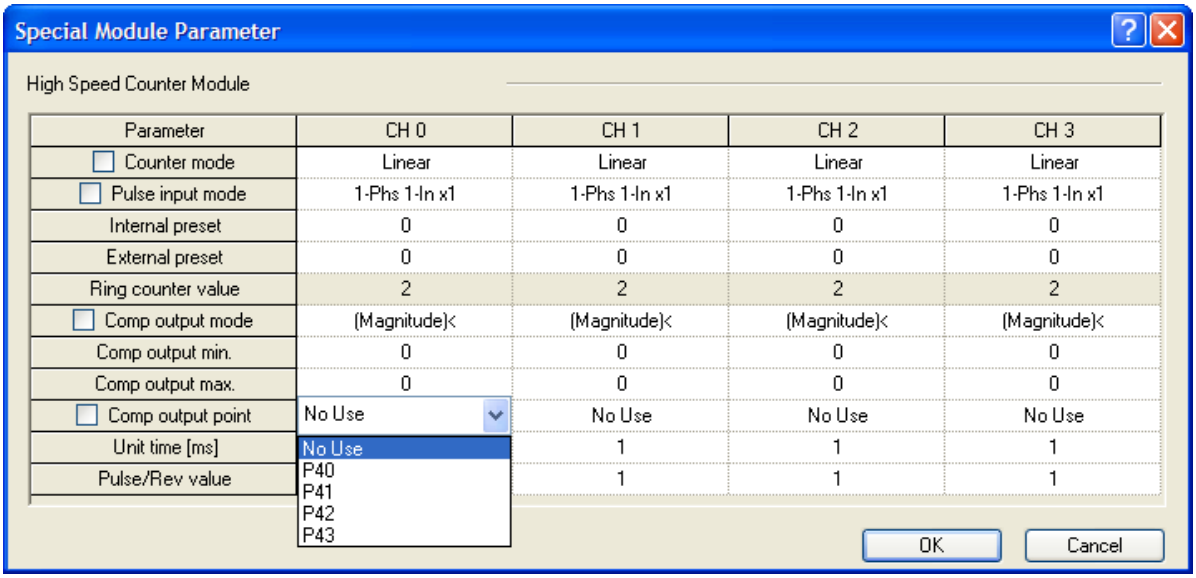
■ In order to make actual comparison enabled after compared output condition set, the compared enable signal is to be On.

| 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 |

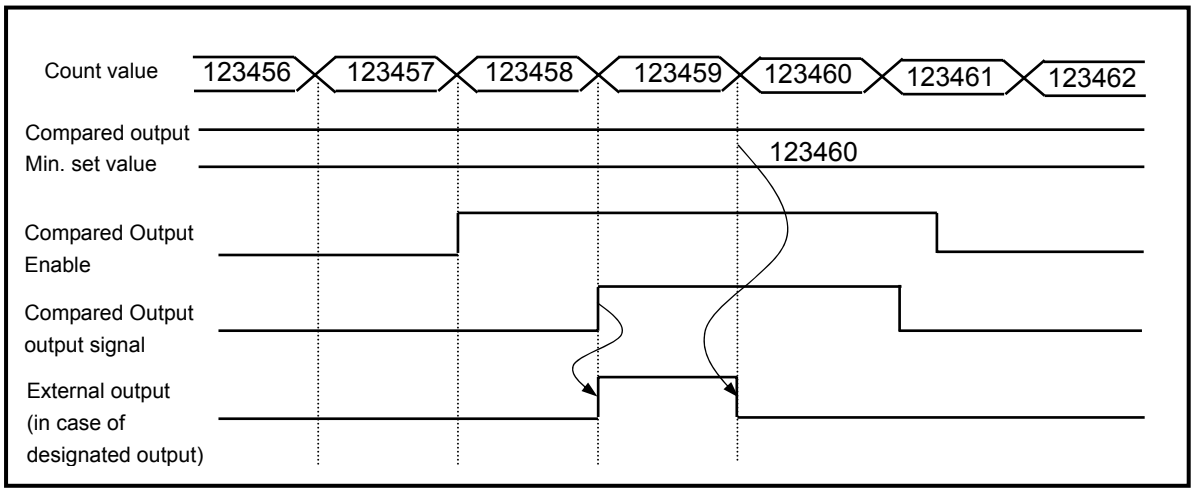
• Comp output point (P40 ~ P43) setting



(e) Detailed description for compared output

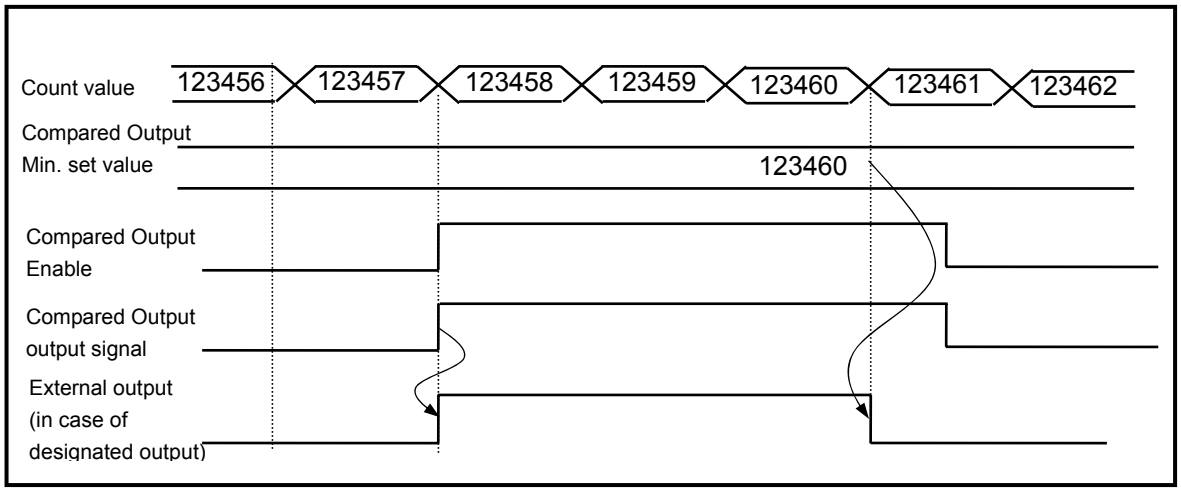
1) Mode 0 (Present value < Compared value)

■ 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.



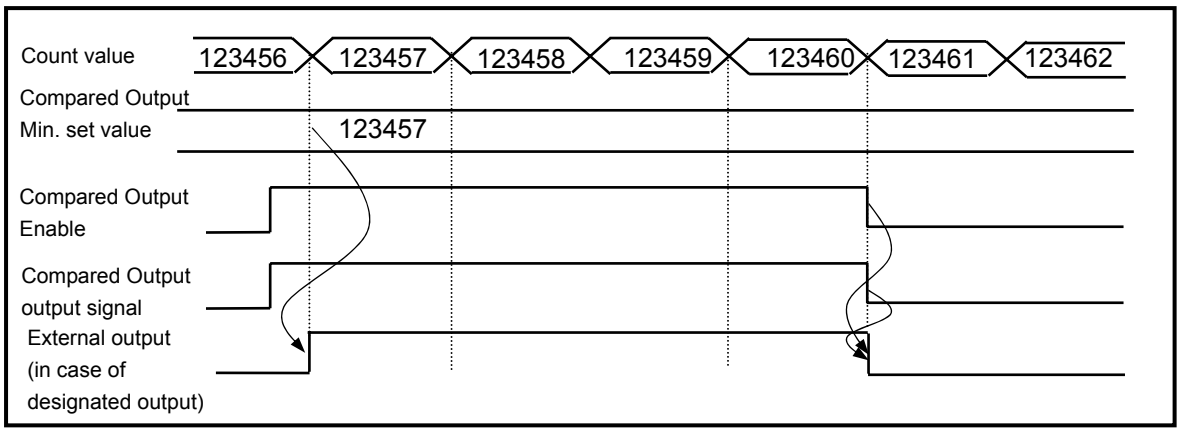

2) Mode1 (Count value ≤ Compared value)

■ 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.



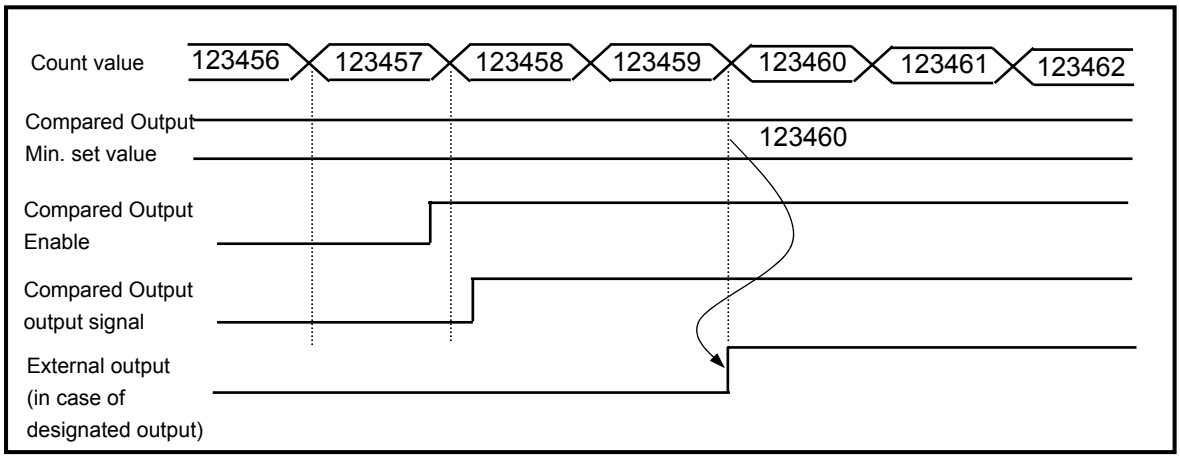
3) Mode 2 (Count value = Compared value)

■ 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.



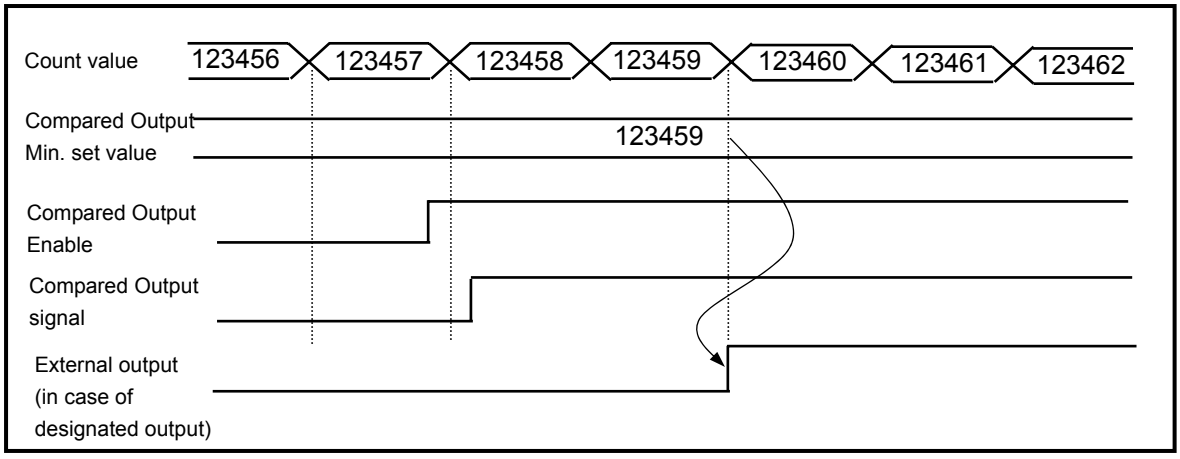

4) Mode 3 (Count value ≥ Compared value)

■ 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.



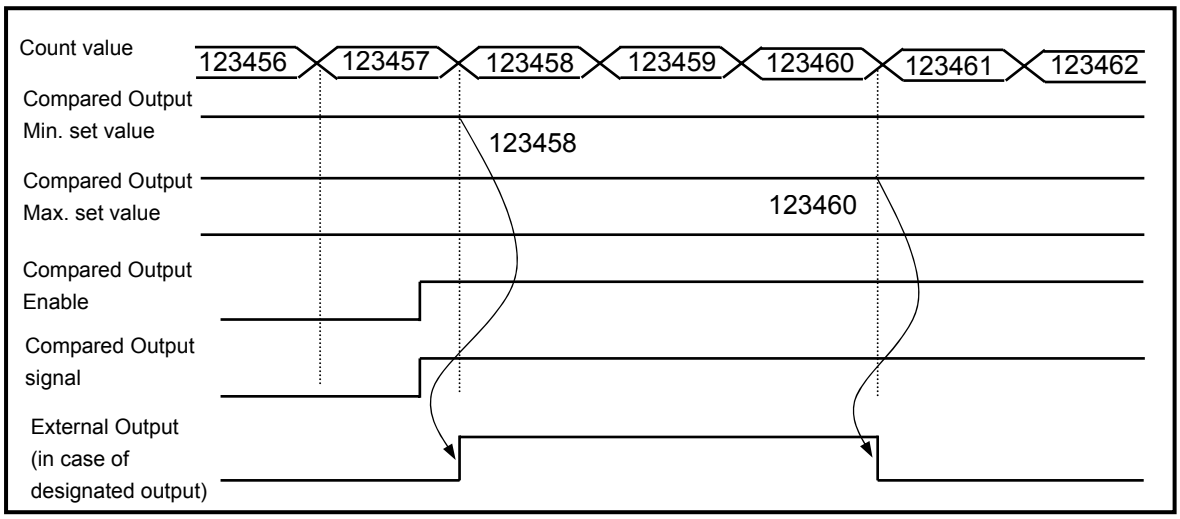
5) Mode 4 (Count value > Compared value)

■ 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.



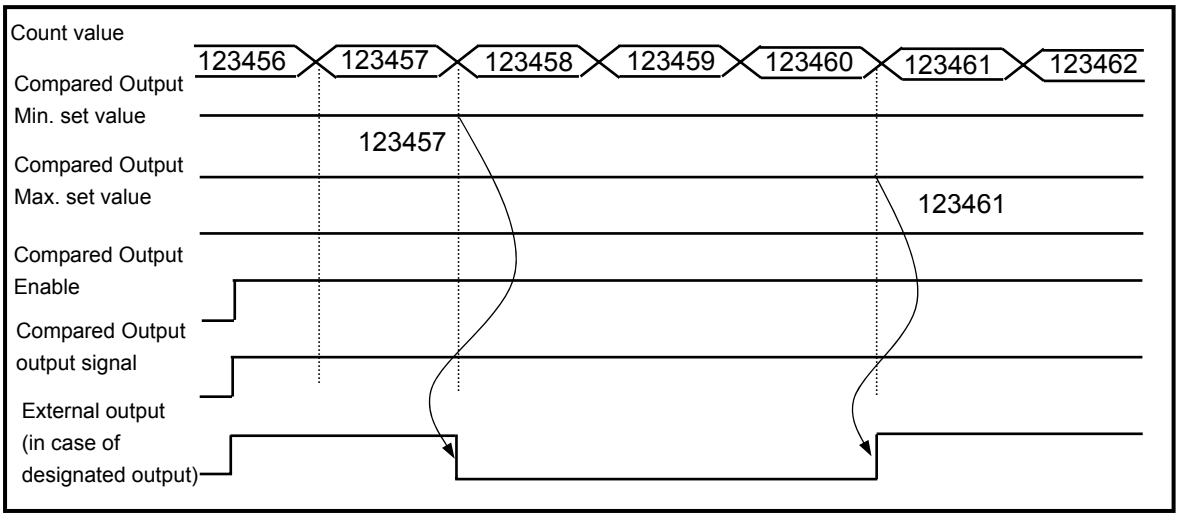

6) Mode 5 (Compared output Min. set value ≤ Count value ≤ Compared output Max. set value)

■ 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.



7) 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.



(4) Carry signal

(a) Carry signal occurs

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

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

(b) Count when Carry Signal occurs

1) Count stops if Carry occurs during Linear Count.

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

(c) Carry reset

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

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

(5) Borrow signal

(a) Borrow signal occurs

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

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

(b) Count when Borrow signal occurs

1) Count stops if Borrow occurs during Linear Count.

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

(c) Borrow reset

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

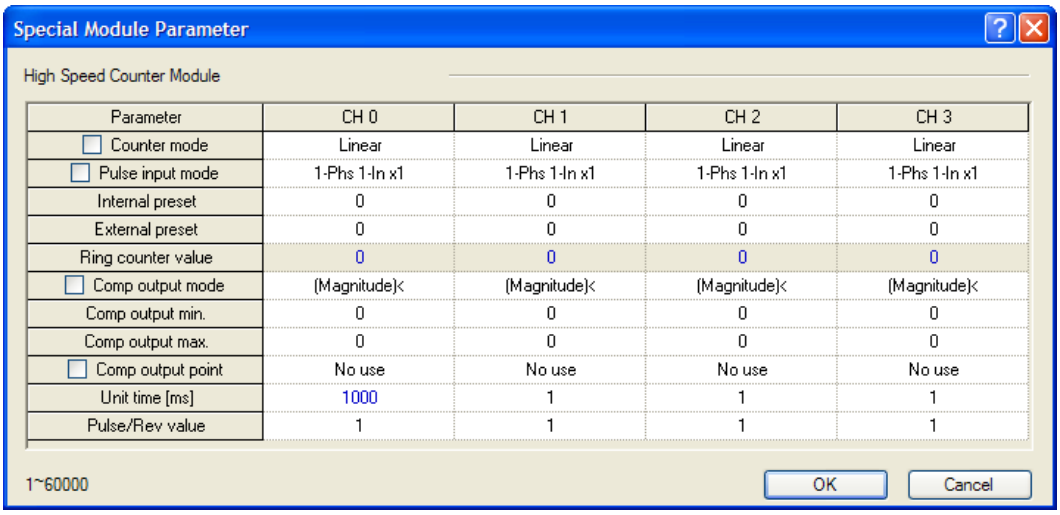
| Classification | Device area per channel | | | |
|---|---|---|---|---|
| | Channel 0 | Channel 1 | Channel 2 | Channel 3 |
| Borrow signal | K2611 | K2711 | K2811 | K2911 |

6) Revolution/Unit time

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

(a) Setting

1) 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 (1~60000㎳)*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.

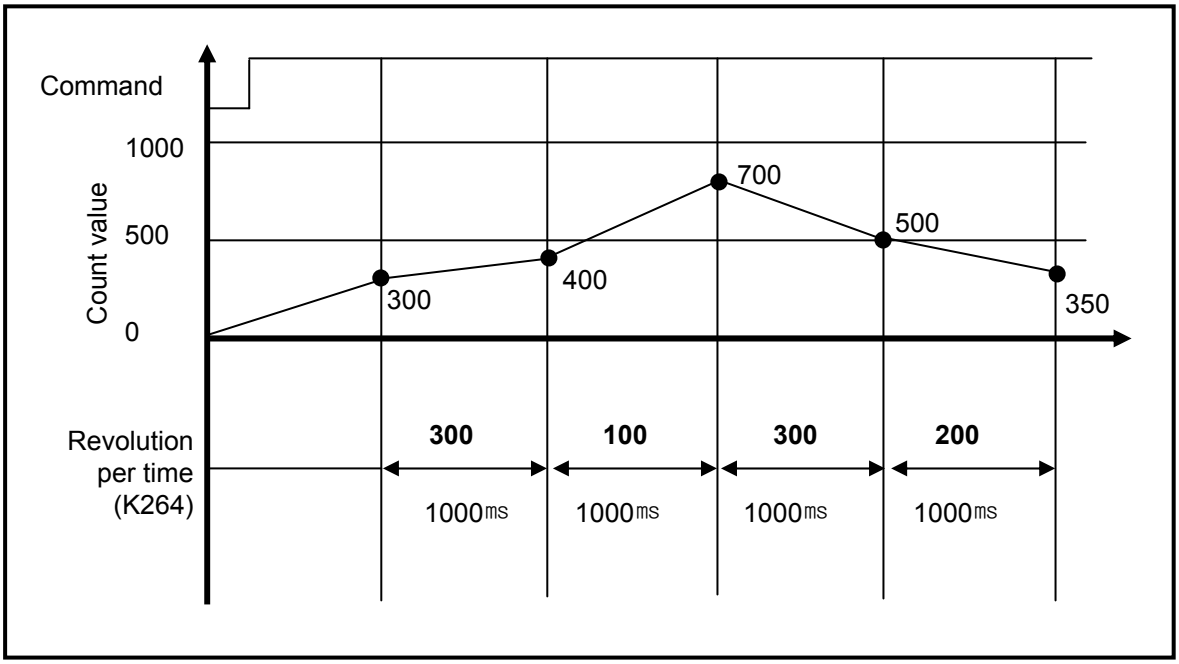
| Classification | Device area per channel | | | |
|---|---|---|---|---|
| | Channel 0 | Channel 1 | Channel 2 | Channel 3 |
| Revolution/unit time command | K2605 | K2705 | K2805 | K2905 |

(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.

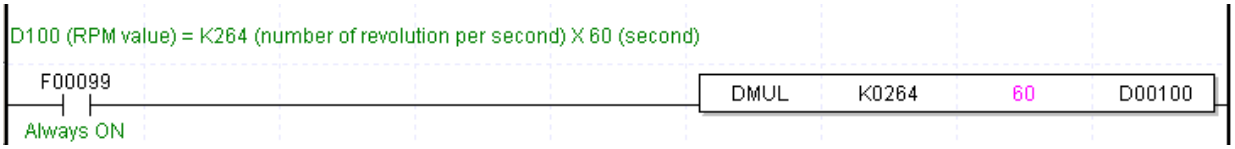
(c) With the displayed number of pulses updated for a specified time and the number of pulses per revolution input, Revolution/Unit time can be counted.

(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.

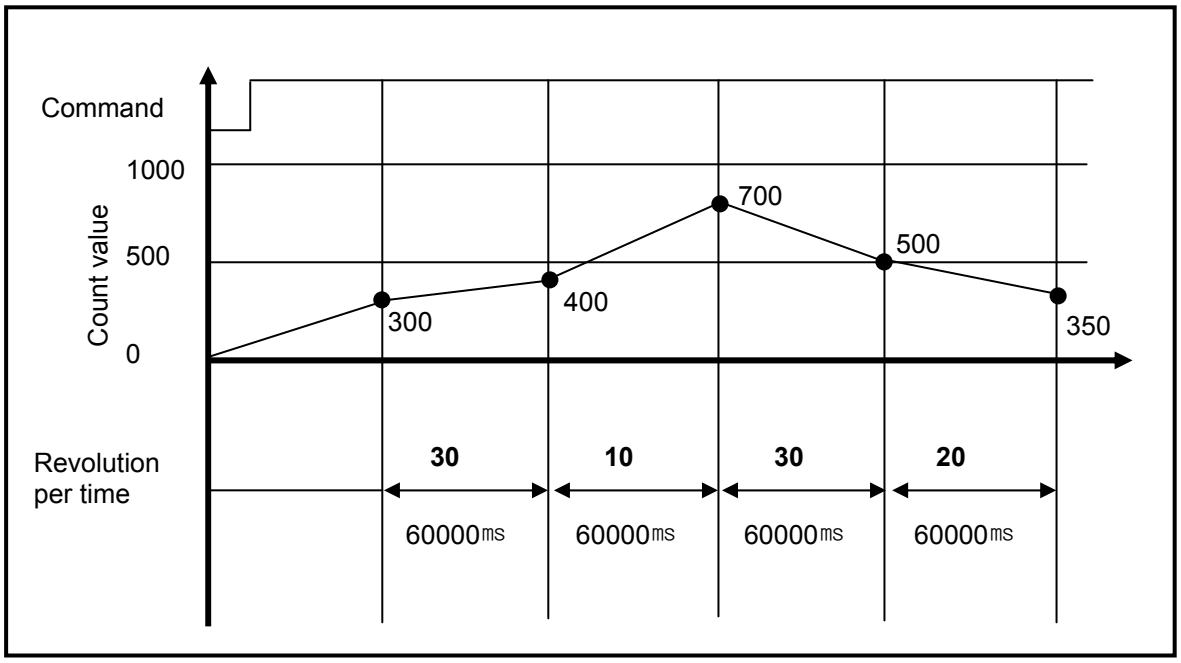
(e) The example that number of pulse per 1 revolution set to '1' and time is set to 1000 ms is as shown below. (Ch0)




(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.




(7) 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 |

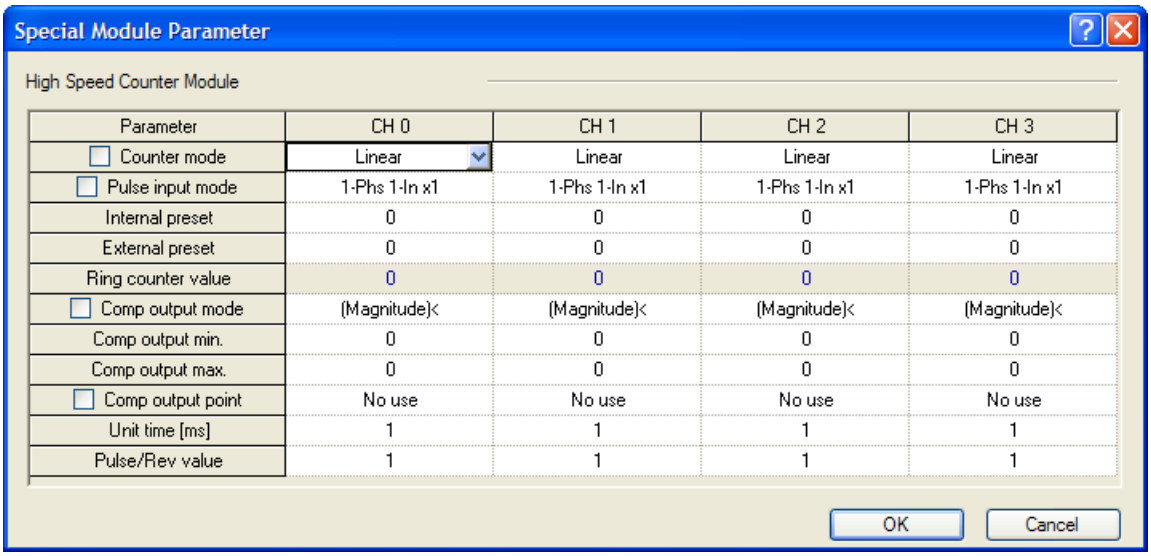
(c) Count latch function is operated when Count latch signal is On. Namely, counter value is not cleared when power supply Off =>On and mode change, it is counted from previous value.

(d) 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 | |
| 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 “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: a) Increasing/decreasing count operation by program setting
b) 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

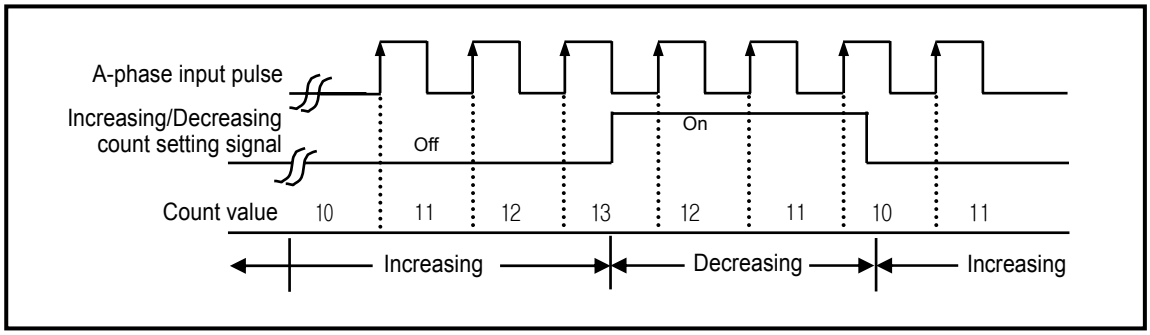
a) Increasing/decreasing count operation by program setting

● 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



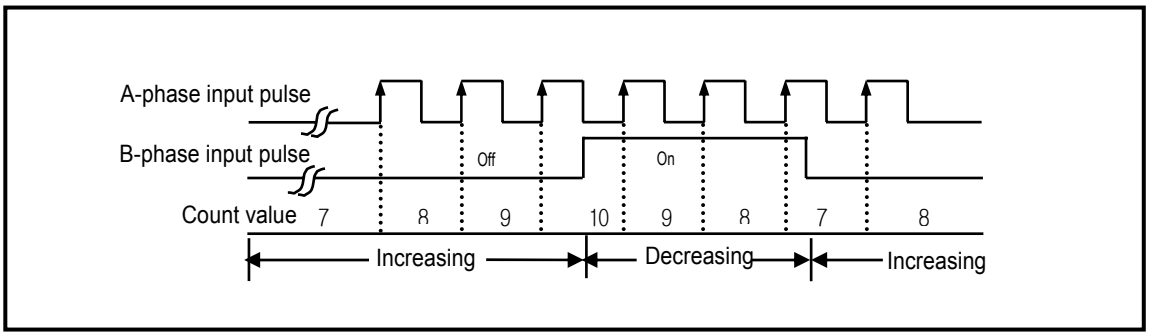
b) Increasing/decreasing count operation by B-phase input signal

● 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

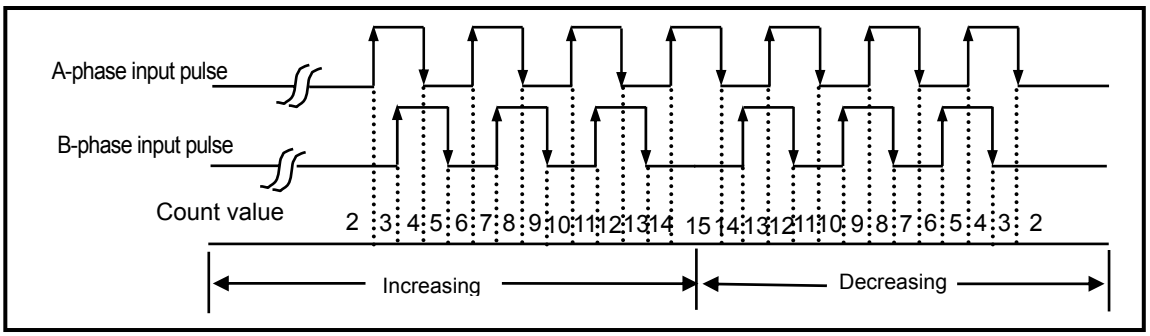



2) 2-phase count mode

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



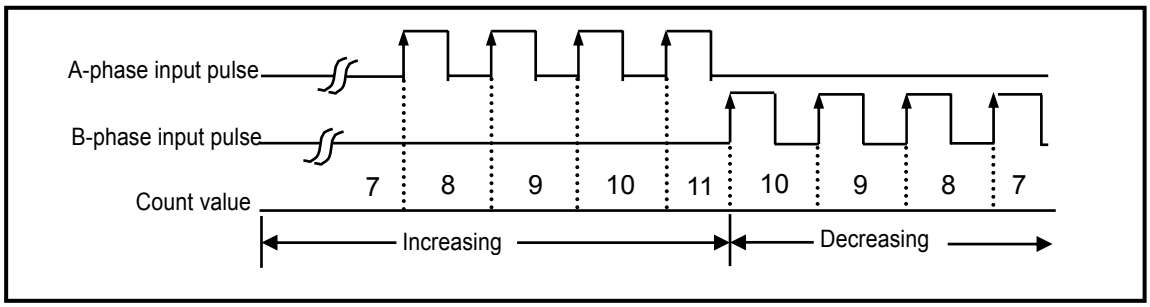
3) CW(Clockwise)/CCW(Counter Clockwise) operation mode

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.

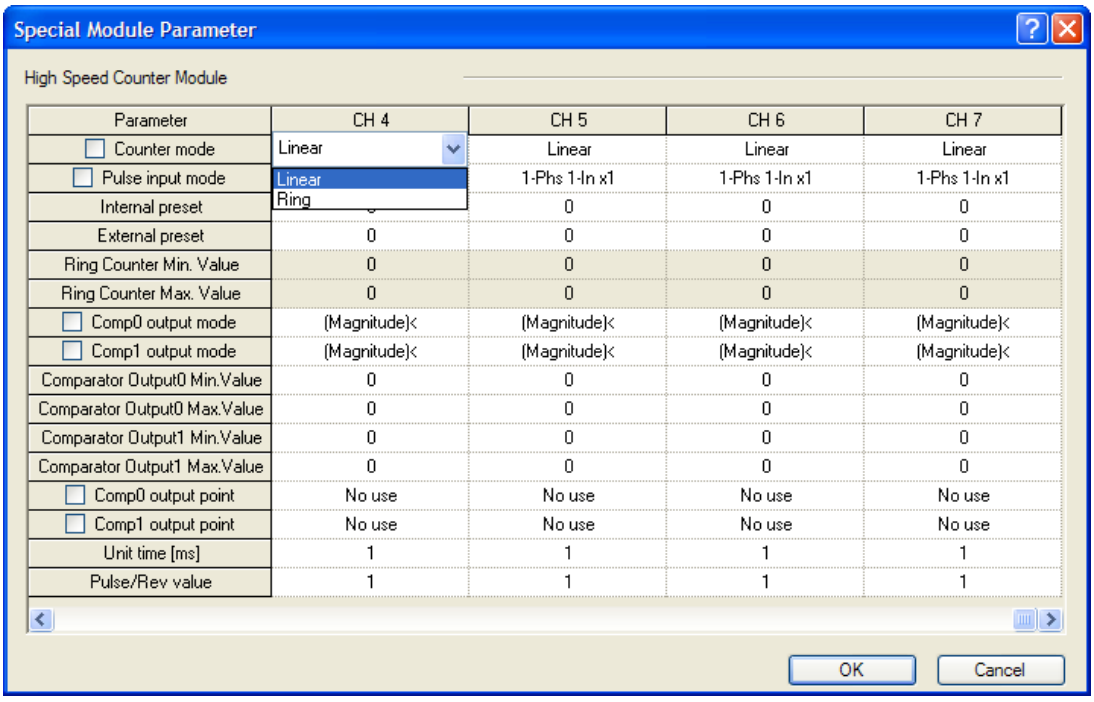
| Increasing/Decreasing classification | A-phase input pulse High | A-phase input pulse Low |
|---|---|---|
| B-phase input pulse High | - | decreasing count |
| B-phase input pulse Low | Increasing count | - |

▪ Operation example




(2) Counter mode

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<br>1 : ring |

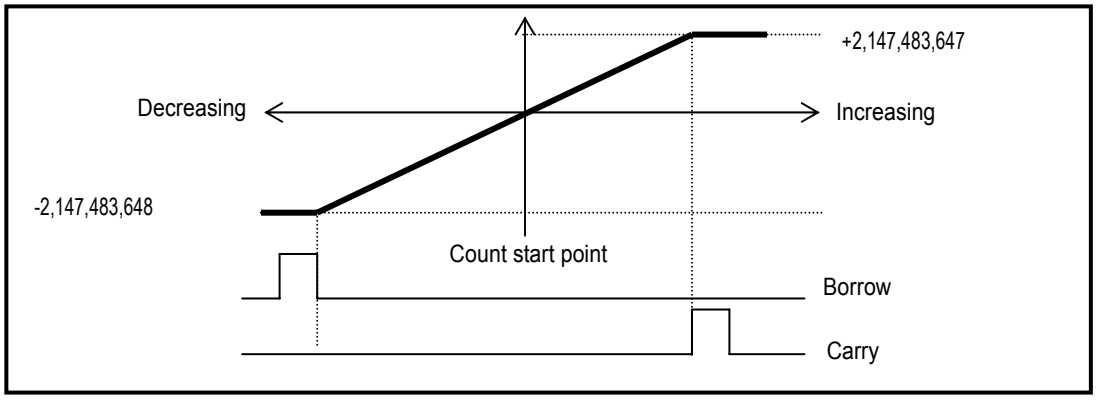
(a) Linear counter

■ 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.

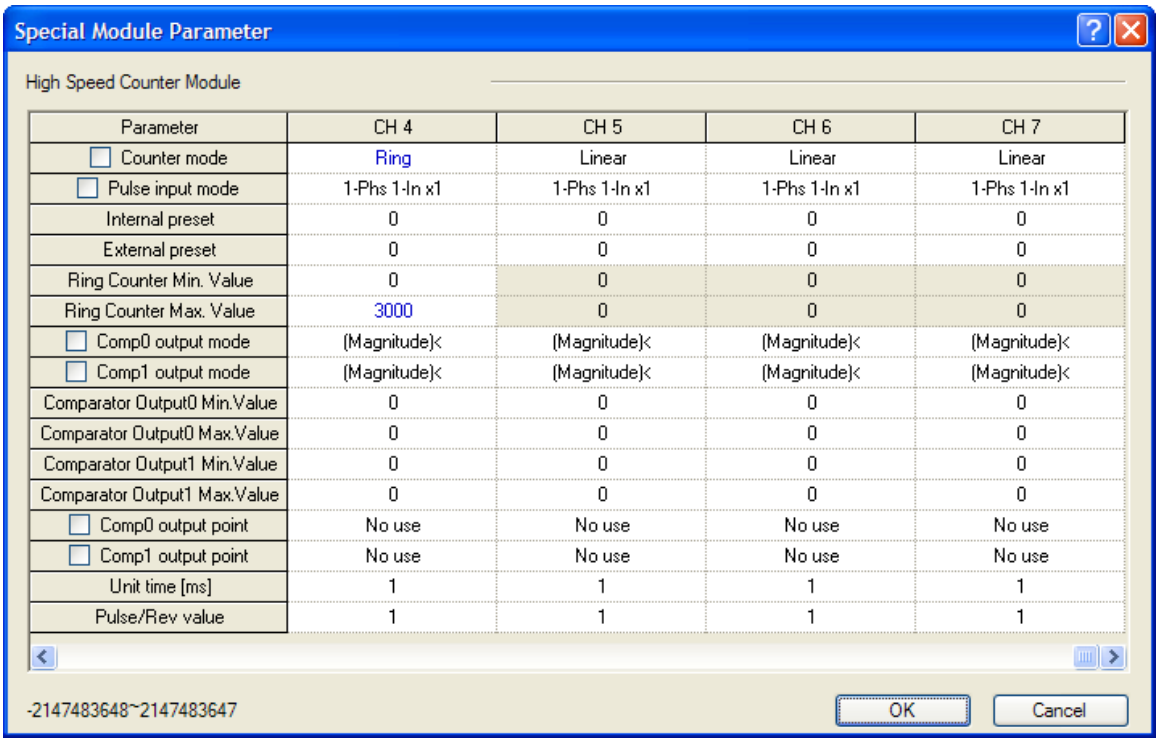
■ If Carry occurs, count stops and increasing is not available but decreasing is available.

■ 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.




| Parameter | CH 4 | CH 5 | CH 6 | CH 7 |
|---|---|---|---|---|
| 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. Value | 0 | 0 | 0 | 0 |
| Ring Counter Max. Value | 3000 | 0 | 0 | 0 |
| Comp0 output mode | (Magnitude)< | (Magnitude)< | (Magnitude)< | (Magnitude)< |
| Comp1 output mode | (Magnitude)< | (Magnitude)< | (Magnitude)< | (Magnitude)< |
| Comparator Output0 Min.Value | 0 | 0 | 0 | 0 |
| Comparator Output0 Max.Value | 0 | 0 | 0 | 0 |
| Comparator Output1 Min.Value | 0 | 0 | 0 | 0 |
| Comparator Output1 Max.Value | 0 | 0 | 0 | 0 |
| Comp0 output point | No use | No use | No use | No use |
| Comp1 output point | No use | No use | No use | No use |
| Unit time [ms] | 1 | 1 | 1 | 1 |
| Pulse/Rev value | 1 | 1 | 1 | 1 |

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

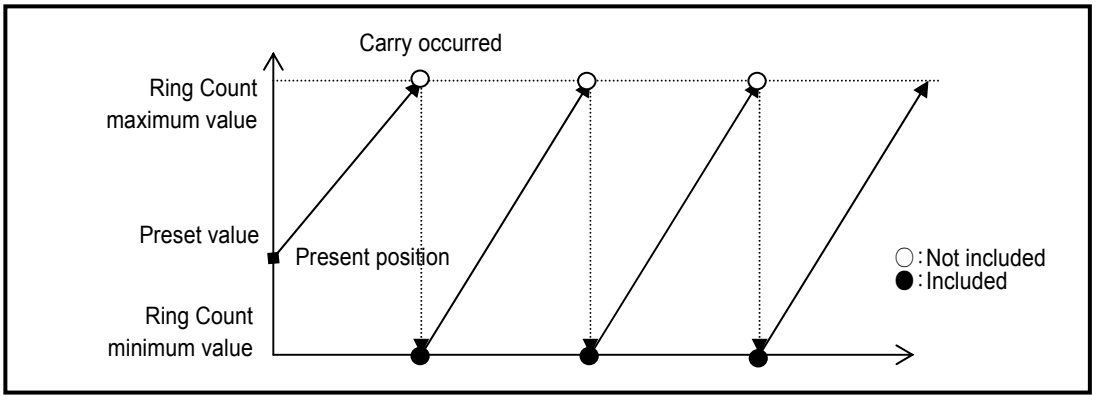
| type | Area per each channel (Double word) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Ring counter min. value | K308 | K338 | K368 | K398 | K2228 | K2258 | K2288 | K2318 | - |
| Ring counter max. value | K310 | K340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

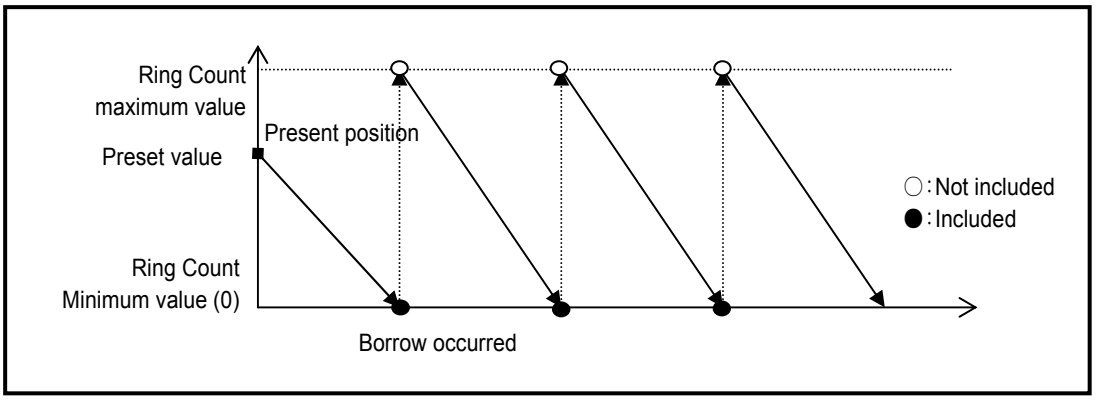
1) During increasing count

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




2) During decreasing count

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



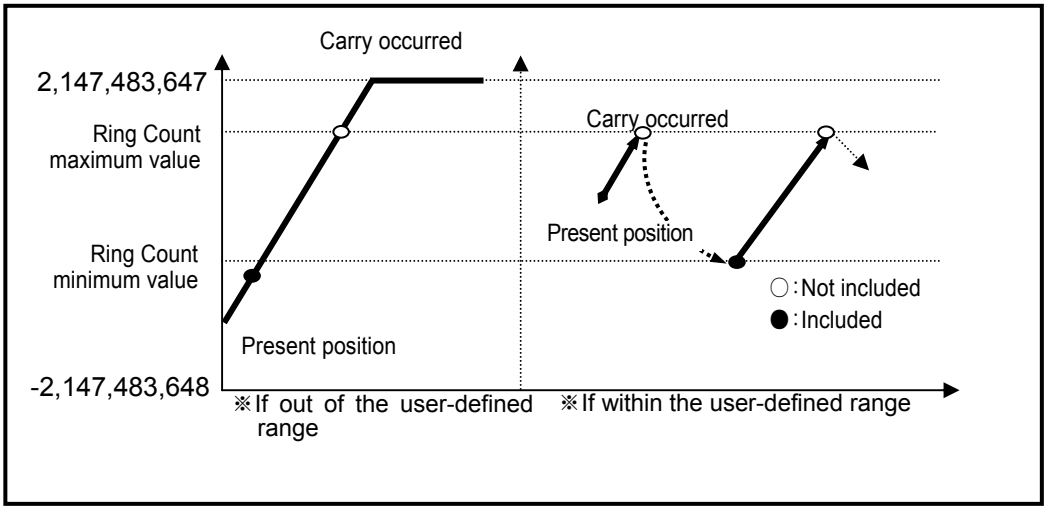

3) Operation when setting Ring Count based on present count value (during increasing count)

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

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

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

- Present count value starts to increase up to the user-defined maximum value and down to the user-defined minimum value and keeps counting after Carry occurs.
- Not the maximum but the minimum value only is displayed with count kept on as shown below.



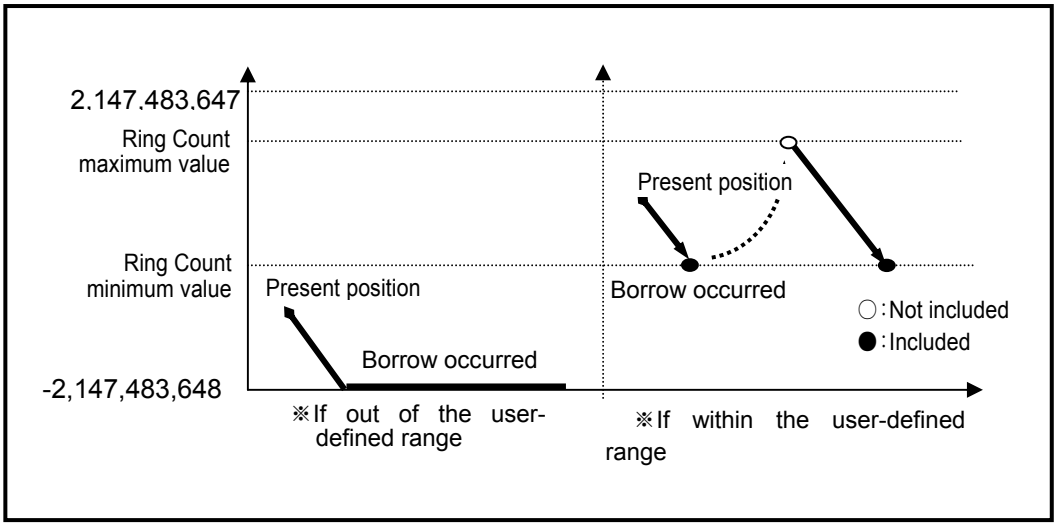

4) Operation when setting Ring Count based on present count value (during decreasing count)

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

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

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

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




**Remark**

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

(2) Ring Count setting when count value is out of the range is regarded as user's mistake. The count is not available within the Ring Count range.

(3) Use preset function or the like when using Ring Count so to surely position the count value within the range.

(3) Compared output

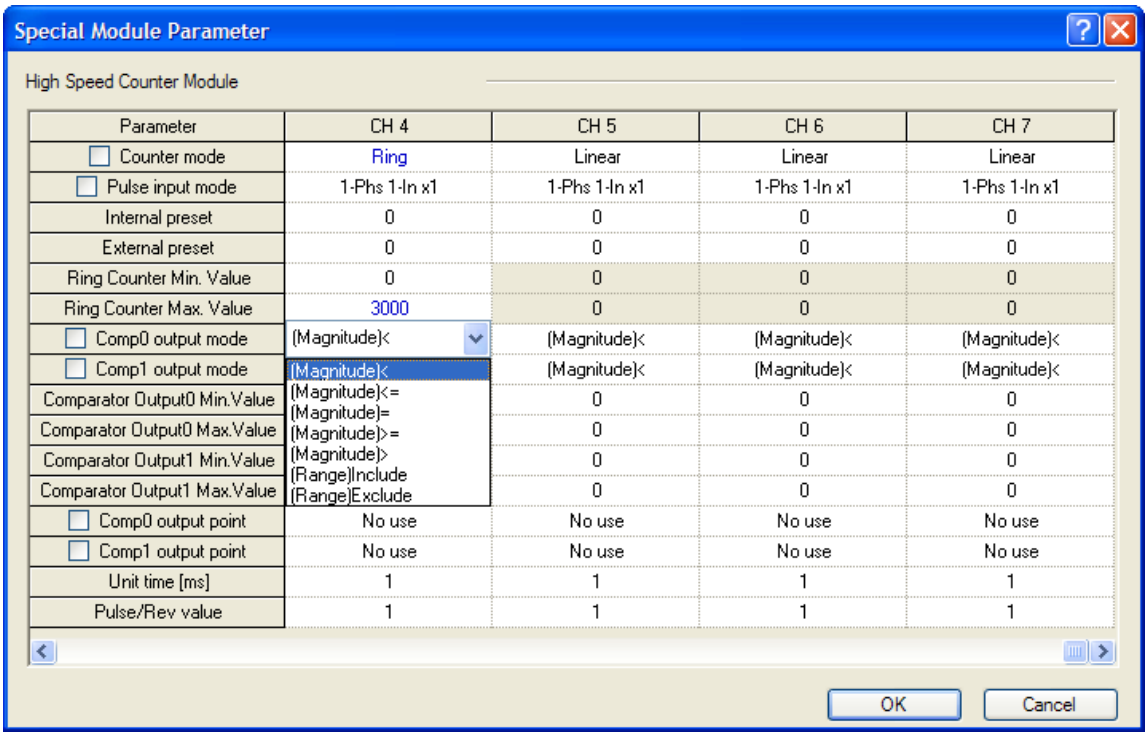
(a) High Speed counter module has a compared output function used to compare present count value with compared value in size to output as compared.

(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.

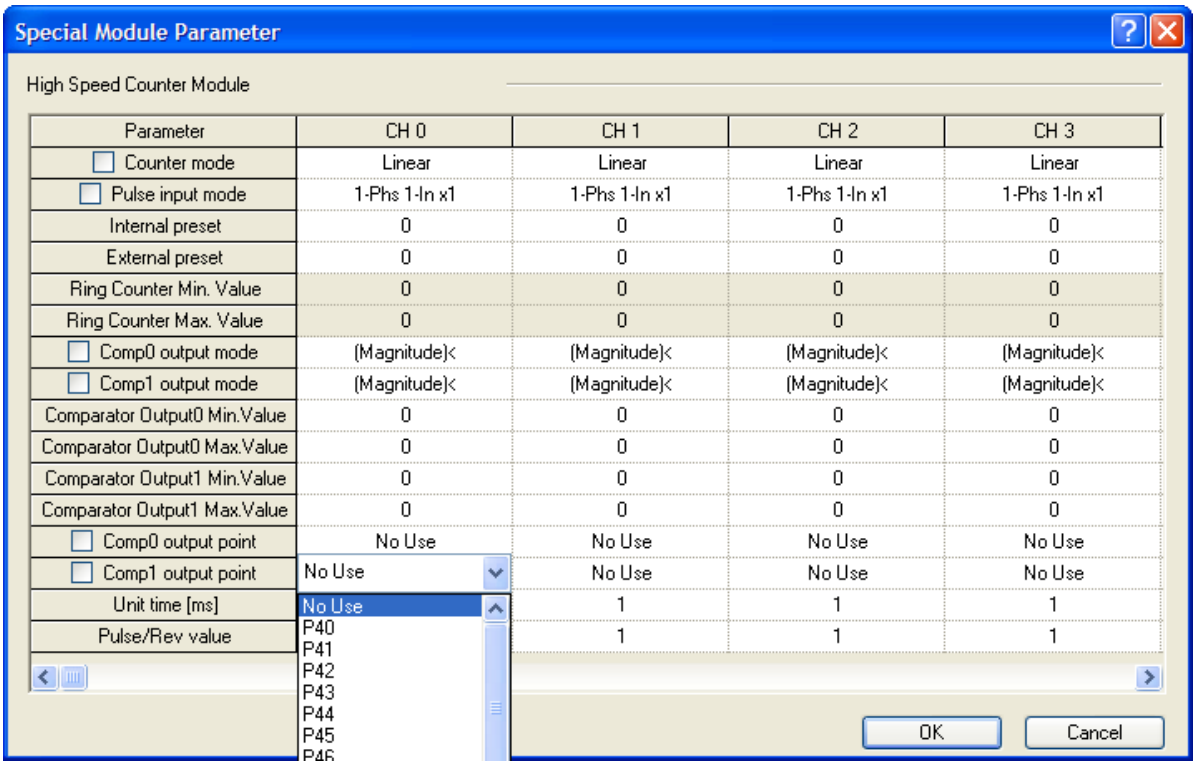
■ In order to output the compared output signal, compared output enable flag set to '1' after compared output condition set.

| 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 (P40 ~ P4F) setting

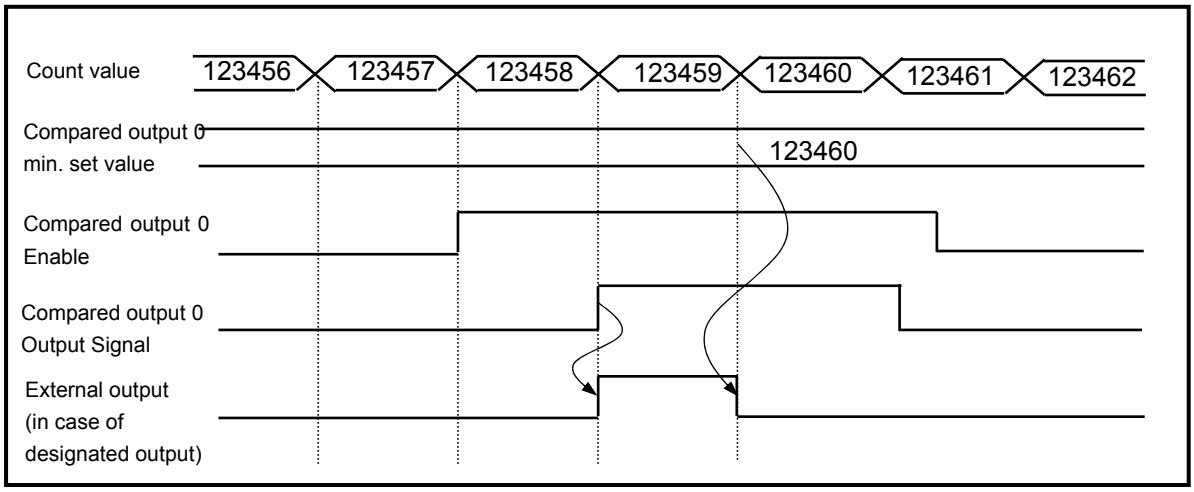


(e) Detail of comparator output

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

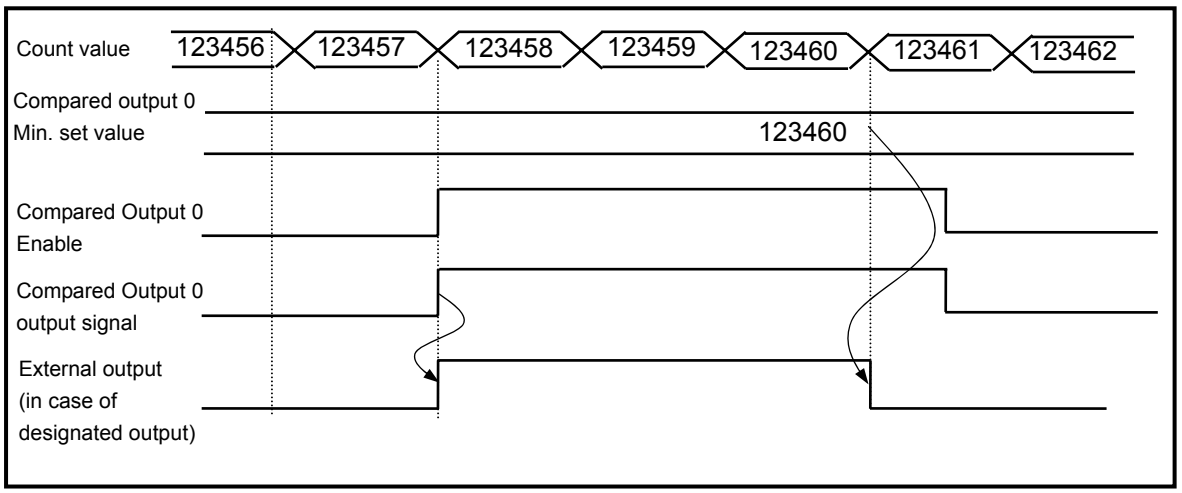
1) Mode 0 (Present value < Compared value)

■ 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.



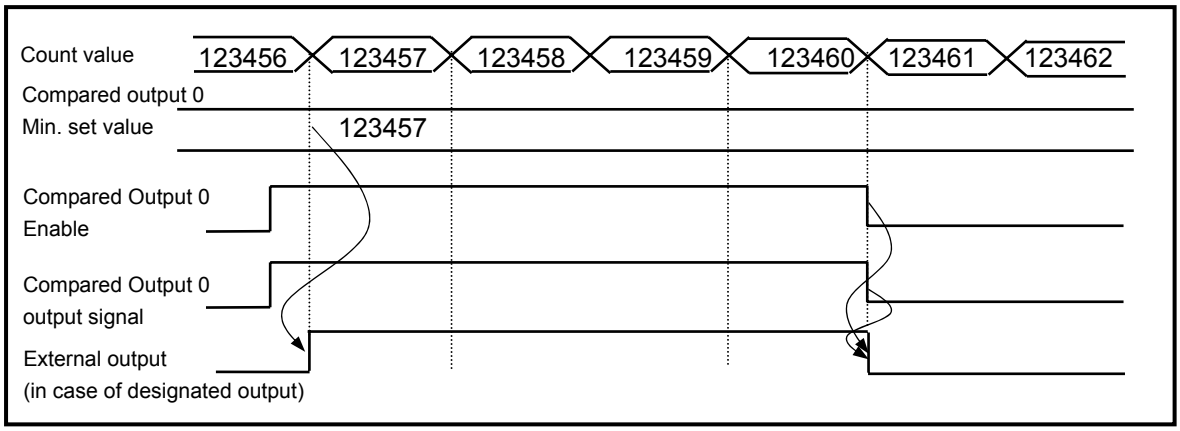

2) Mode1 (Count value ≤ Compared value)

■ 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.



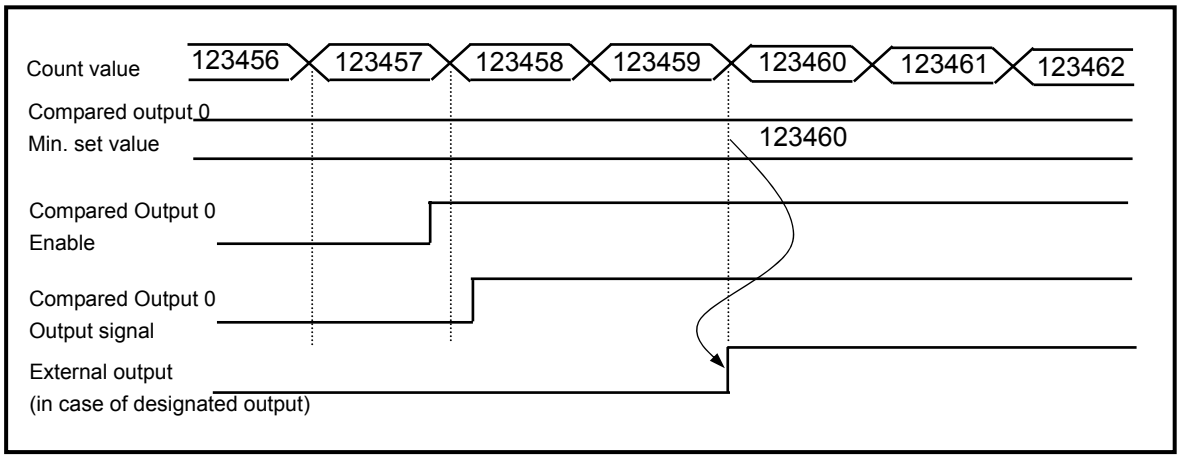
3) Mode 2 (Count value = Compared value)

■ 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.



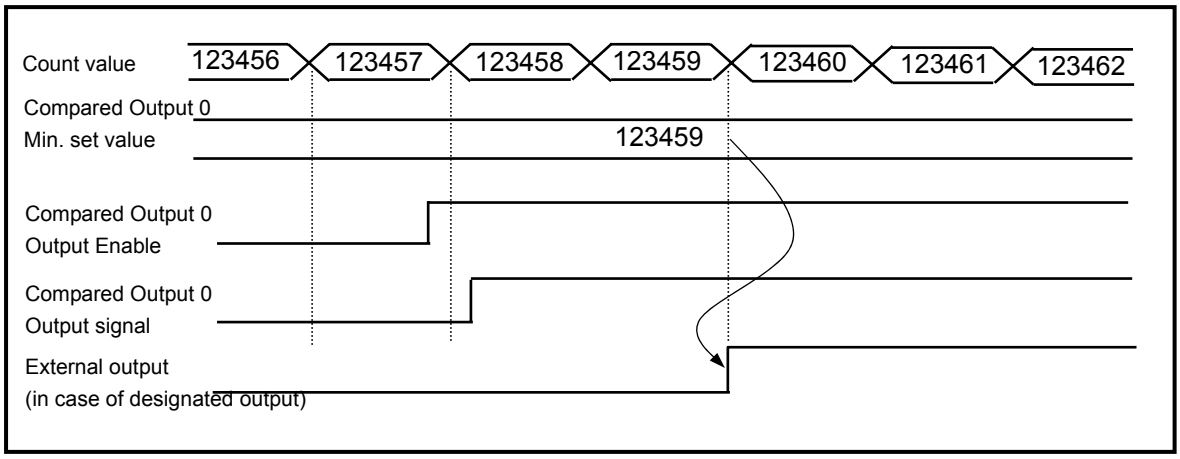

4) Mode 3 (Count value ≥ Compared value)

■ 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.



5) Mode 4 (Count value > Compared Output value)

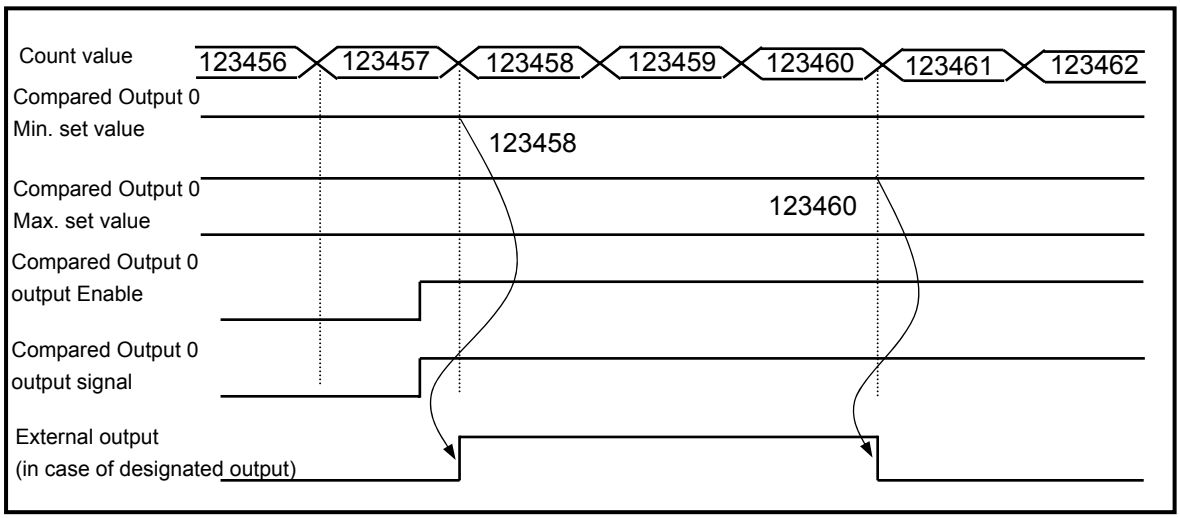
■ If present count value is greater than the minimum set value of compared output 0, output is sent out, and if count value decreases to be less than or equal to the minimum set value of compared output 0, output is not sent out.




6) Mode 5

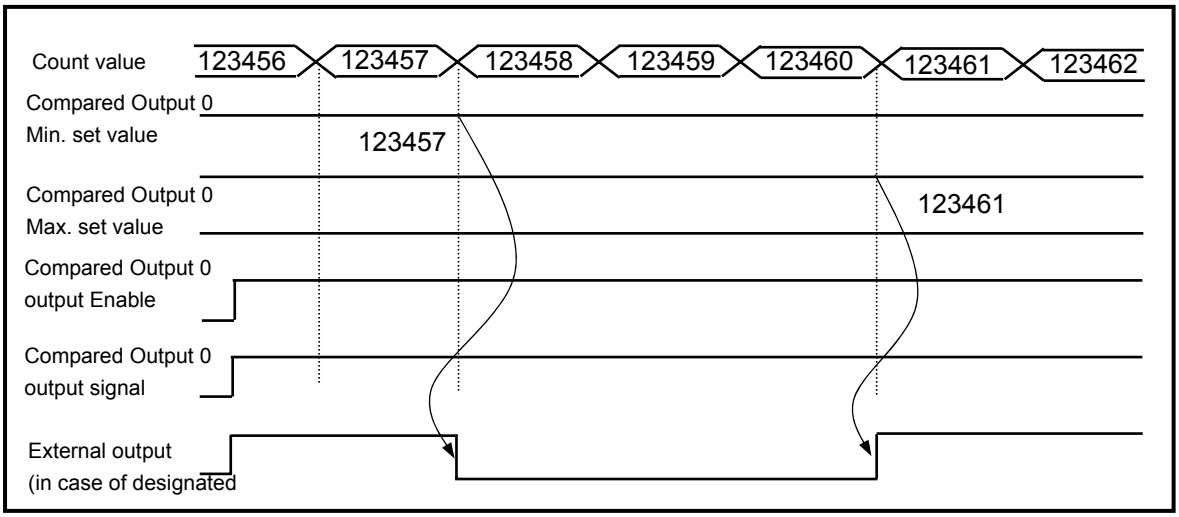
(Section comparison: Min. set value of Compared Output 0 ≤ Count value ≤ Max. set value of Compared Output 0)

■ 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.



7) 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.

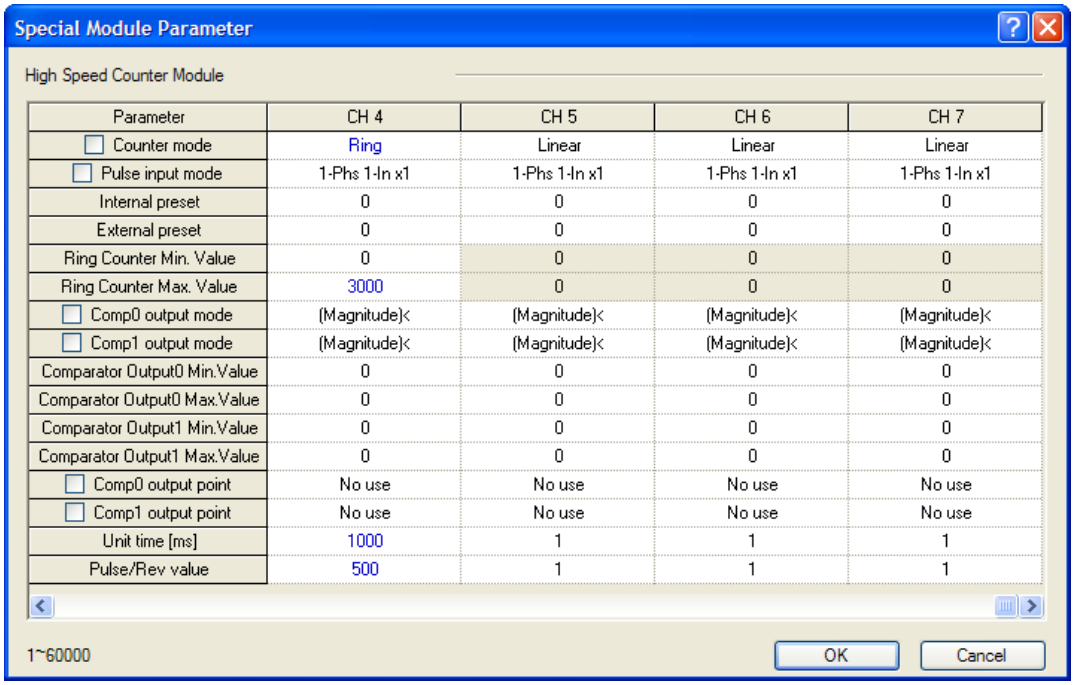
| Classification | Device area per channel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 |
| Borrow signal | K2611 | K2711 | K2811 | K2911 | K21811 | K21911 | K22011 | K22111 |

(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) 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 | 1~60000㎳ |
| 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<br>1: enable |

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

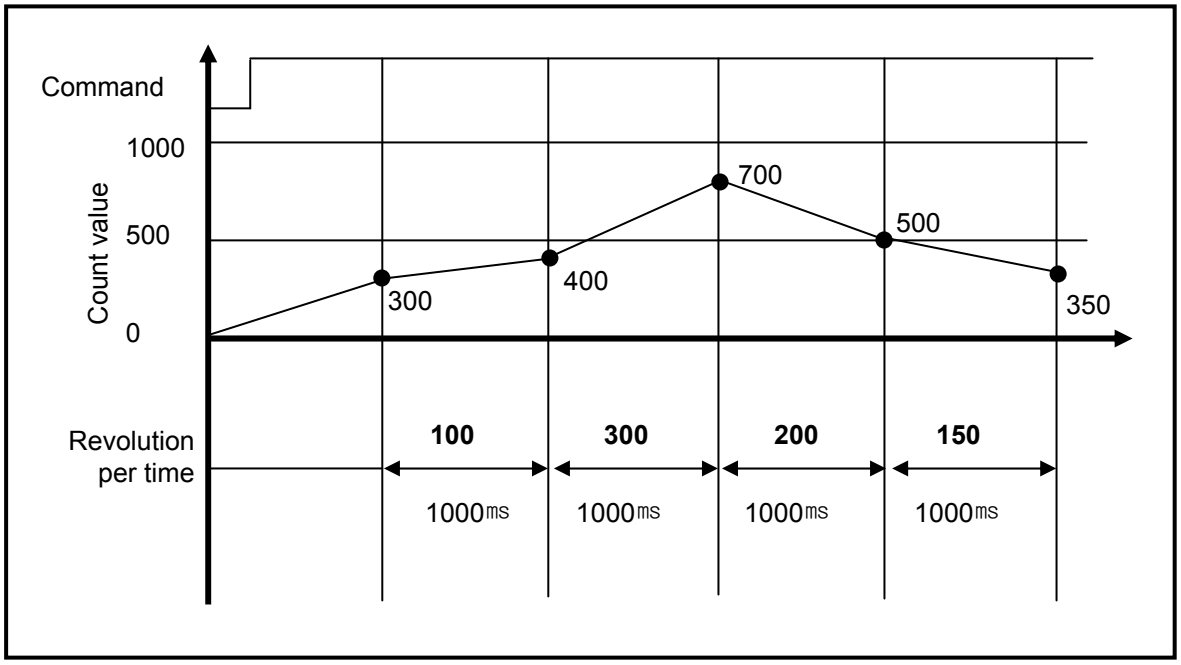
| Class | Device per each channel (Word) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Rev/unit time | K264 | K274 | K284 | K294 | K2184 | K2194 | K2204 | K2214 | - |

(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.

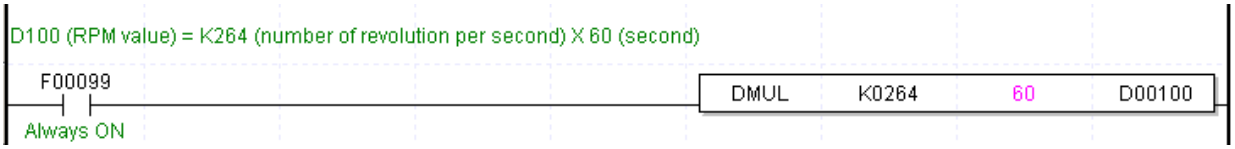
(c) With the displayed number of pulses updated for a specified time and the number of pulses per revolution input, Revolution/Unit time can be counted.

(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.

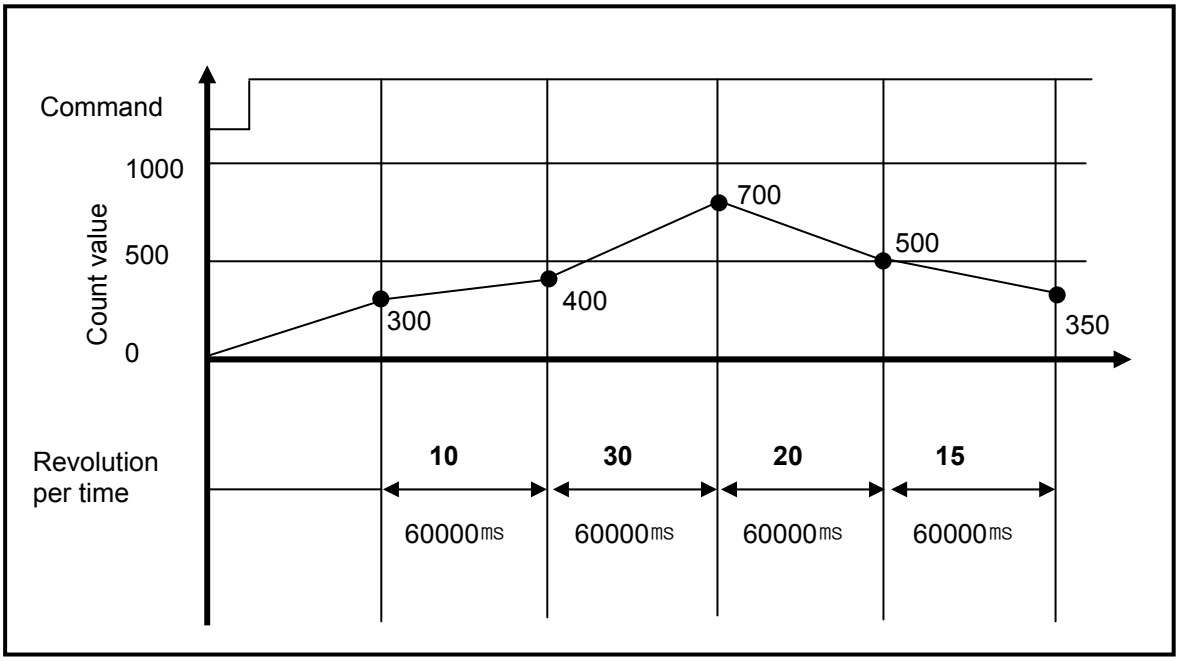
(e) The example that number of pulse per 1 revolution set to '1' and time is set to 1000 ms is as shown below. (Ch0)




(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<br>1: enable |

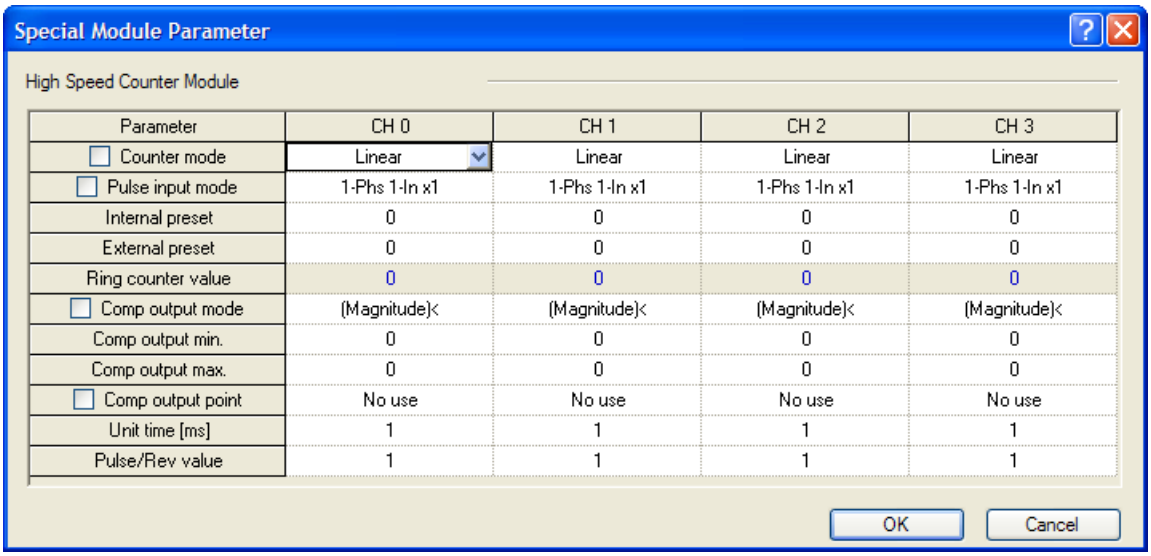
▪ Count latch function is operated when Count latch signal is On. Namely, counter value is not cleared when power supply Off =>On and mode change, it is counted from previous value.

▪ 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.

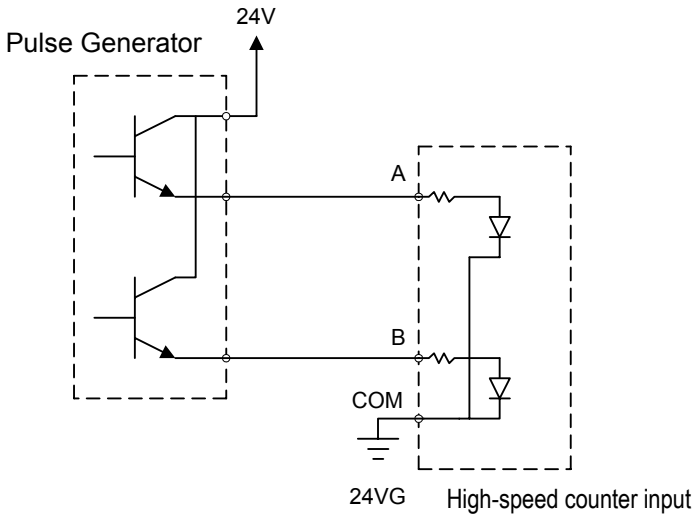
(2) Keep away from power cable or I/O line which may cause noise.

(3) Stabilized power should be used for filter.

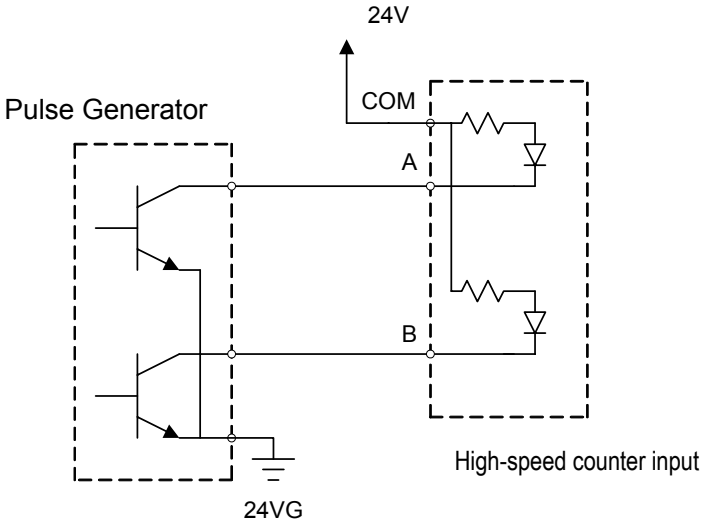
- ▶ Connect A-phase only for 1-phase input.
- ▶ Connect A-phase and B-phase for 2-phase input.

### 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

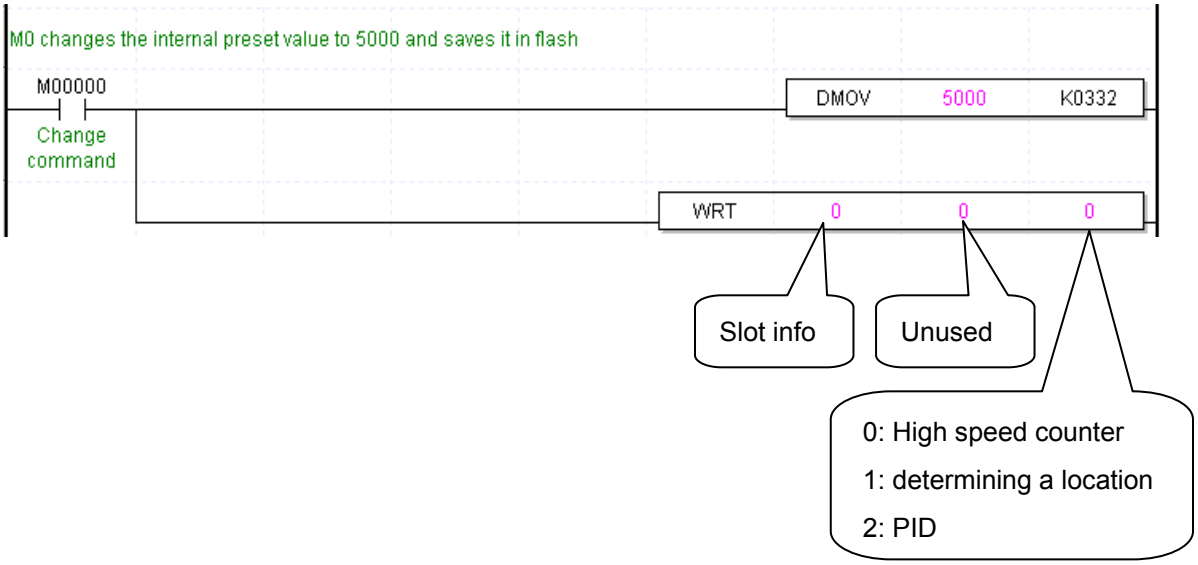
### 8.3.1 Special area for High-speed counter

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.



(1) “E” 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 2 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) “S” 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 | |
| | | | 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 |
|---|---|
| 20 | Counter type is set out of range |
| 21 | Pulse input type is set out of range |
| 22 | Requesting #1(3,)channel Run during the operation of #0(2) channel 2 phase(<br>* During #0(2) channel 2 phase inputting, using #1(3)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 | Compared output is set out of the default output value |
| 34 | Set value of Unit time is out of the range |
| 35 | Pulse value per 1 revolution is set out of range |

**Remark**

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

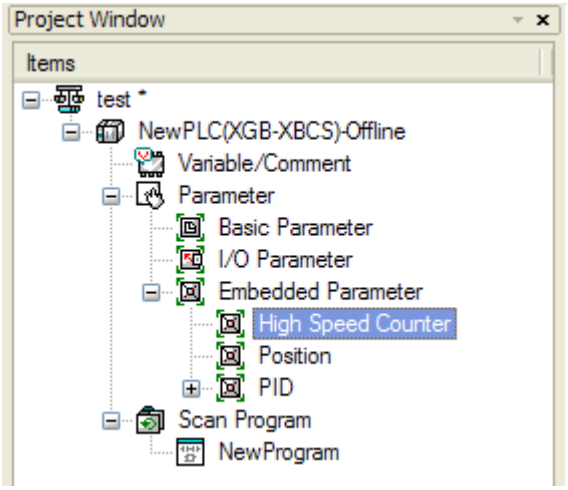
## 8.4 Examples: Using High-speed Counter

It describes examples of using high-speed counter.

(1)Setting high-speed counter parameter

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

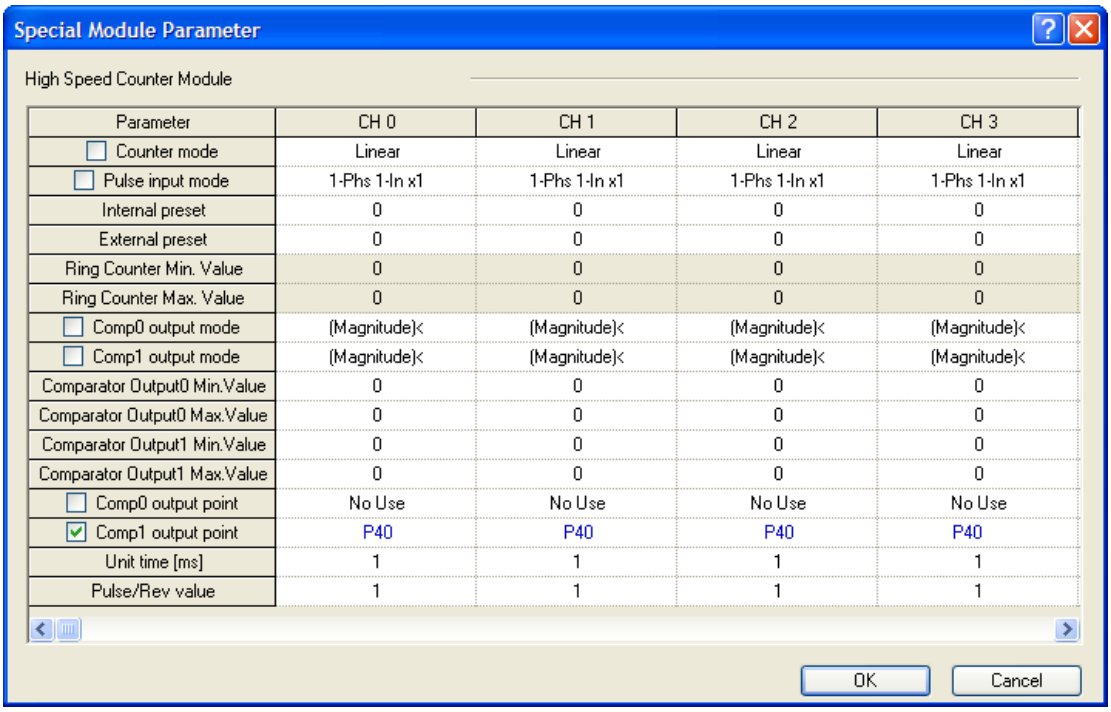
(a) Set 『Internal Parameters』 in the basic project window.




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

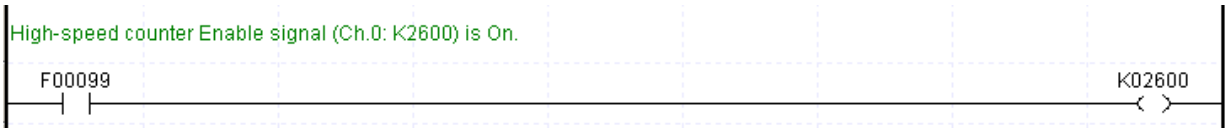
For details regarding each parameter setting, refer to 8.1~8.3.

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




| Parameter | CH 0 | CH 1 | CH 2 | CH 3 |
|---|---|---|---|---|
| Counter mode | Linear | Linear | Linear | Linear |
| Pulse input mode | 1-Phs 1-In x1 | 1-Phs 1-In x1 | 1-Phs 1-In x1 | 1-Phs 1-In x1 |
| Internal preset | 0 | 0 | 0 | 0 |
| External preset | 0 | 0 | 0 | 0 |
| Ring Counter Min. Value | 0 | 0 | 0 | 0 |
| Ring Counter Max. Value | 0 | 0 | 0 | 0 |
| Comp0 output mode | (Magnitude)< | (Magnitude)< | (Magnitude)< | (Magnitude)< |
| Comp1 output mode | (Magnitude)< | (Magnitude)< | (Magnitude)< | (Magnitude)< |
| Comparator Output0 Min.Value | 0 | 0 | 0 | 0 |
| Comparator Output0 Max.Value | 0 | 0 | 0 | 0 |
| Comparator Output1 Min.Value | 0 | 0 | 0 | 0 |
| Comparator Output1 Max.Value | 0 | 0 | 0 | 0 |
| Comp0 output point | No Use | No Use | No Use | No Use |
| Comp1 output point | P40 | P40 | P40 | P40 |
| Unit time [ms] | 1 | 1 | 1 | 1 |
| Pulse/Rev value | 1 | 1 | 1 | 1 |

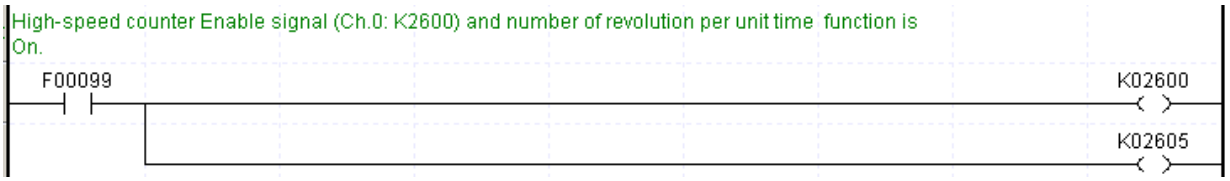
(c) Turn 'ON' the high-speed counter Enable signal (CH0:K2600) in the program.



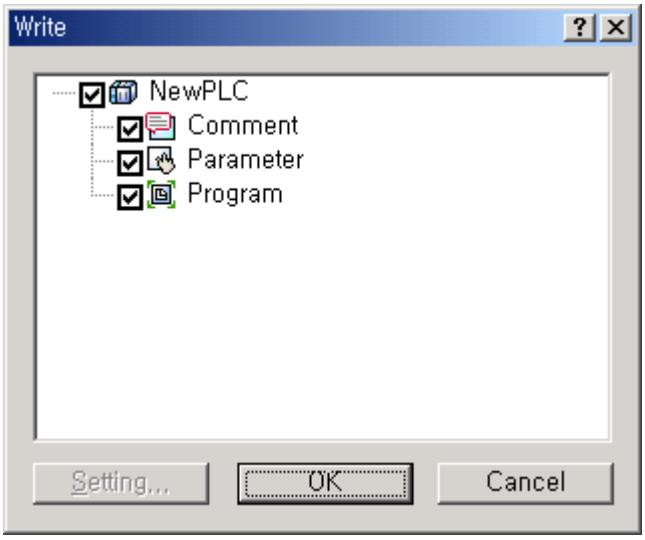

(d) To use additional functions of the high-speed counter, you needs to turn on the flag allowing an operation command.

* 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.



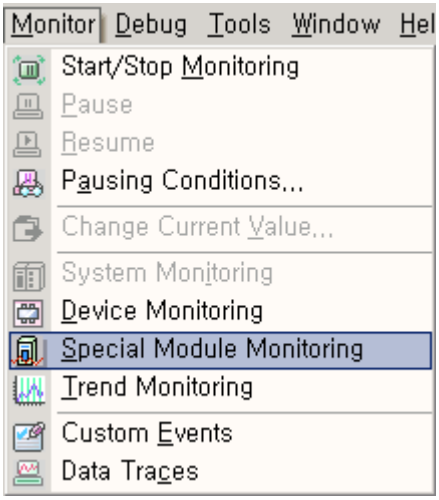

(e) Upon the setting, download program and parameter to PLC.

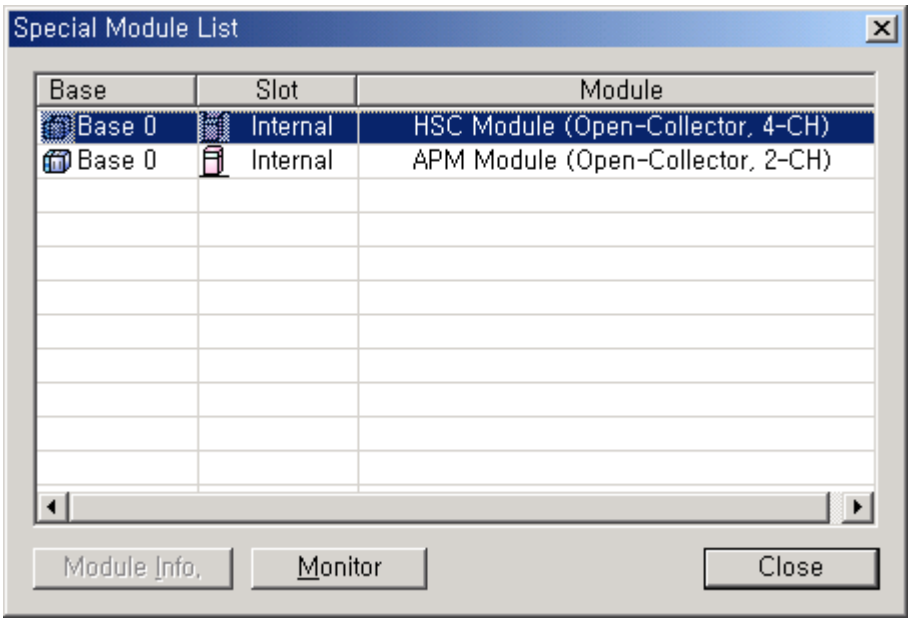


(2)Monitoring and setting command

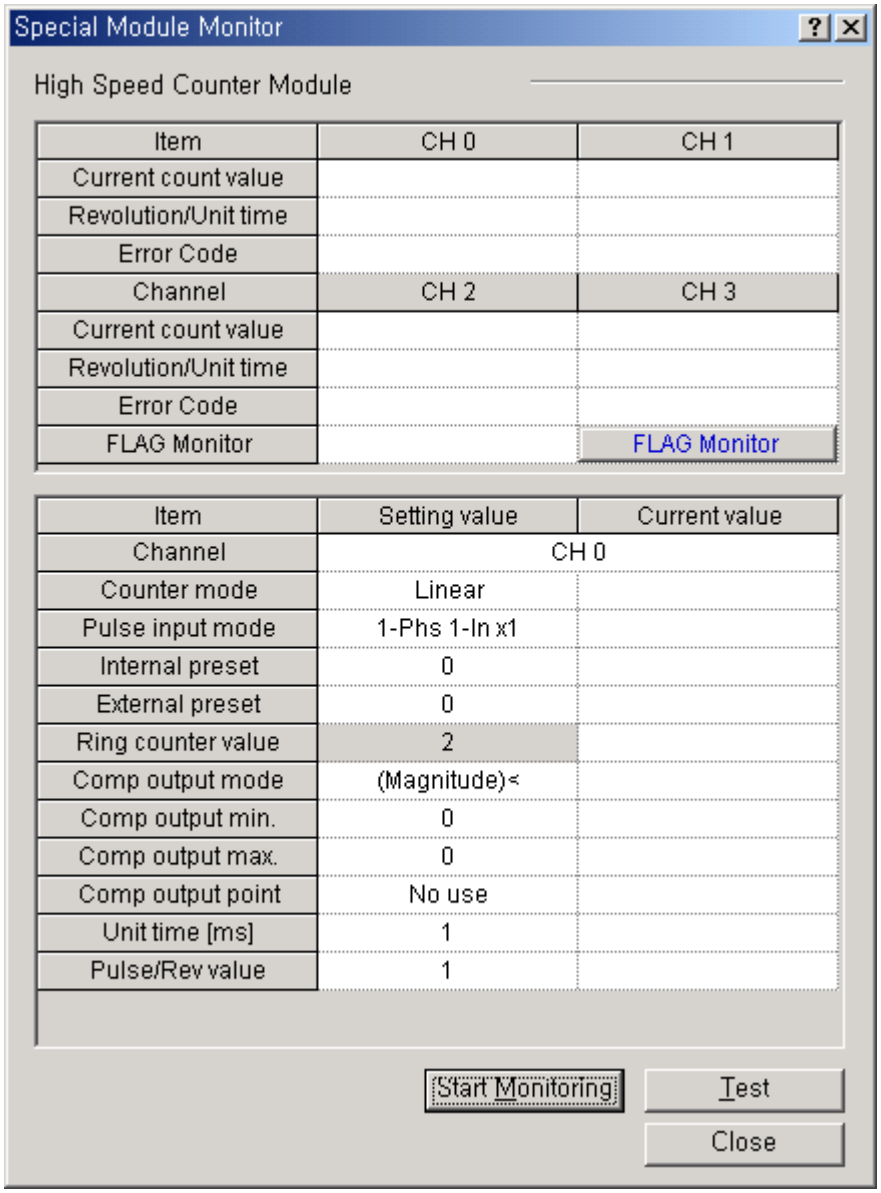
Monitoring and command setting of high-speed counter are described as follows.

(a) If starting a monitor and clicking a Special Module Monitor, the following window is opened.



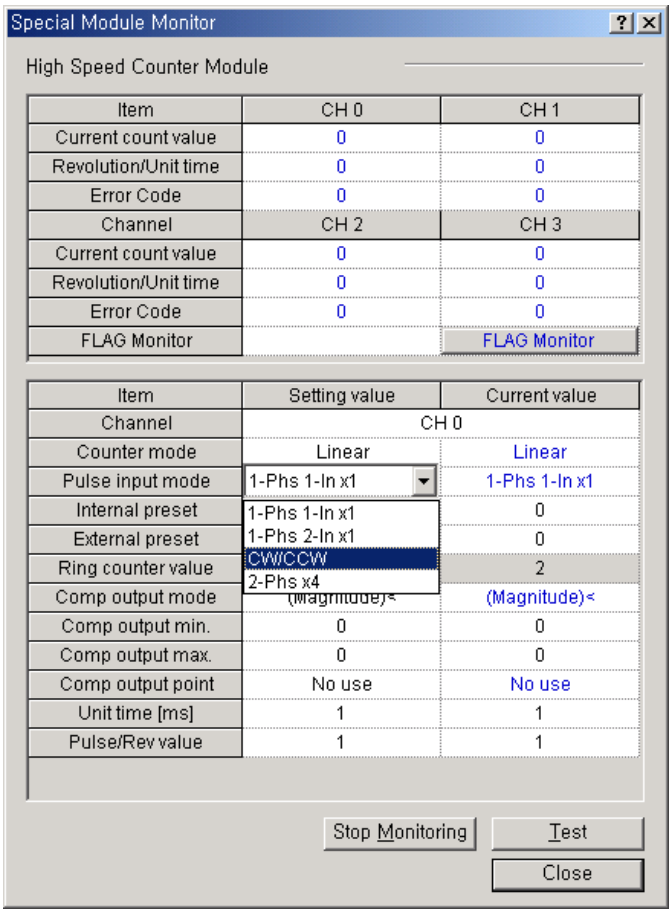



(b) Clicking 『Monitor』 shows monitor and test window of high-speed counter.

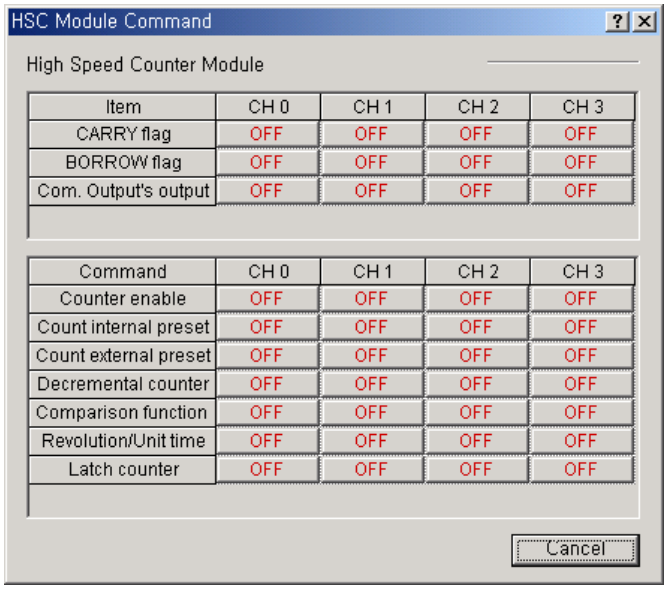



| Item | Description |
|---|---|
| FLAG Monitor | Show flag monitoring and command window of high-speed counter |
| Start Monitoring | Start monitoring each item (special K device area monitor). |
| Test | Write each item setting to PLC.<br>(Write the setting to special K device) |
| Close | Close monitor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

(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.




(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).



# 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 10.2 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.

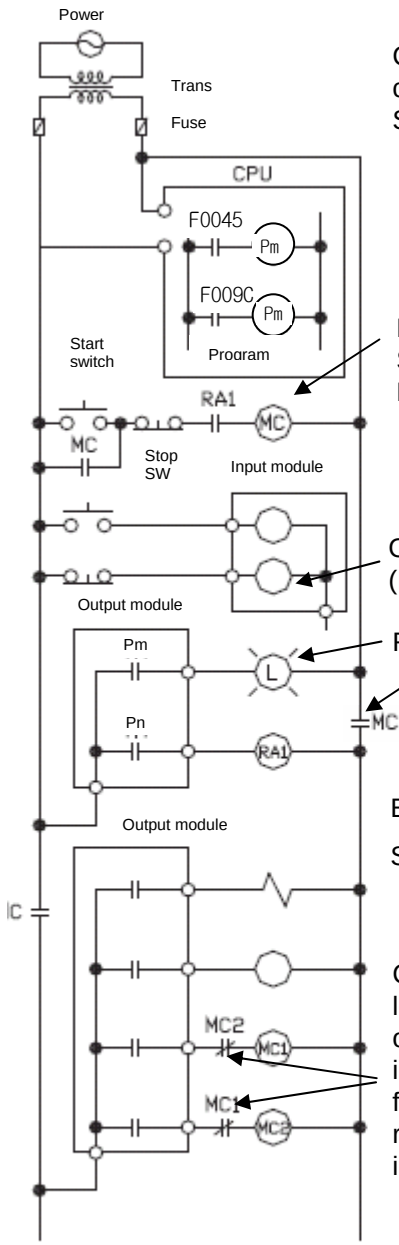
- Process output may not work properly according to difference of delay of PLC main power and external power for process (especially DC in case of PLC power On-Off and of start time.
  For example, in case of turning on PLC main power after supplying external power for process, DC output module may malfunction 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




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

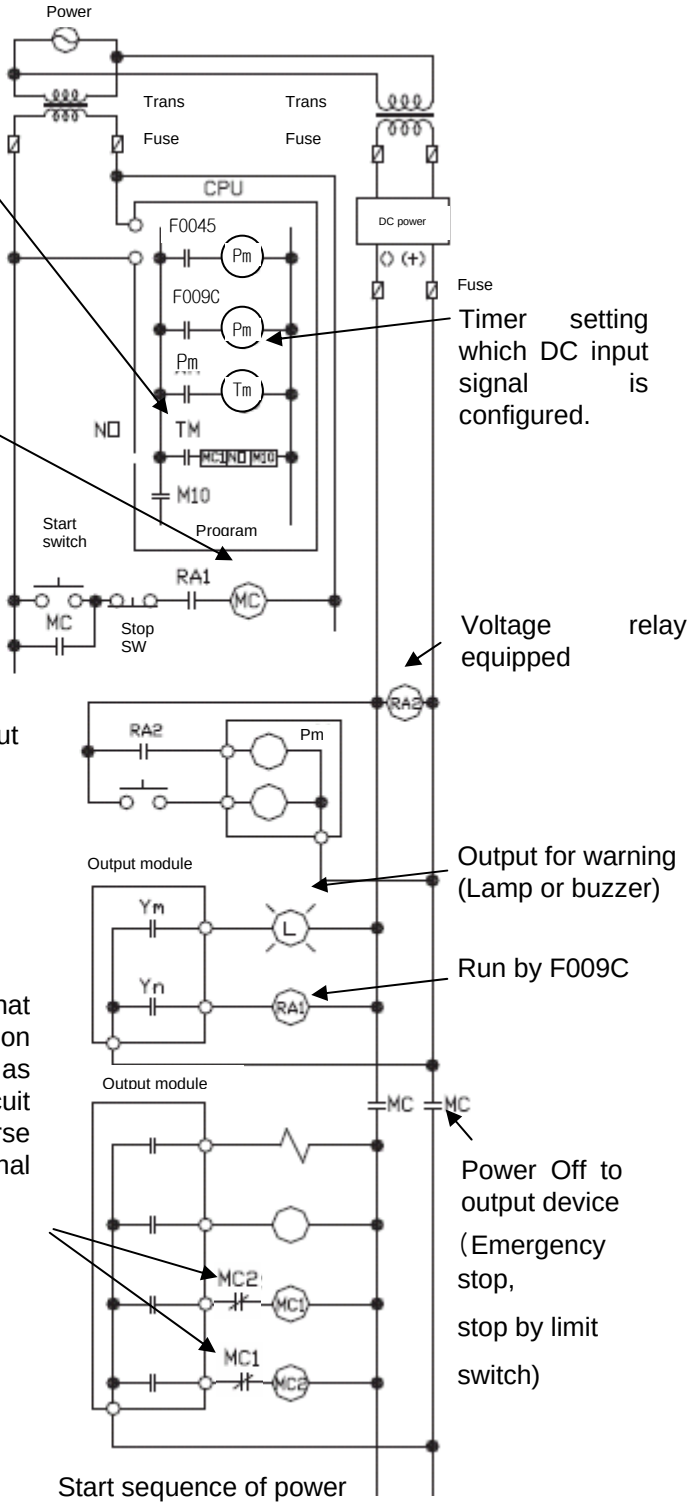
Emergency stop,

Stop by limit

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

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]

In case of AC . DC




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

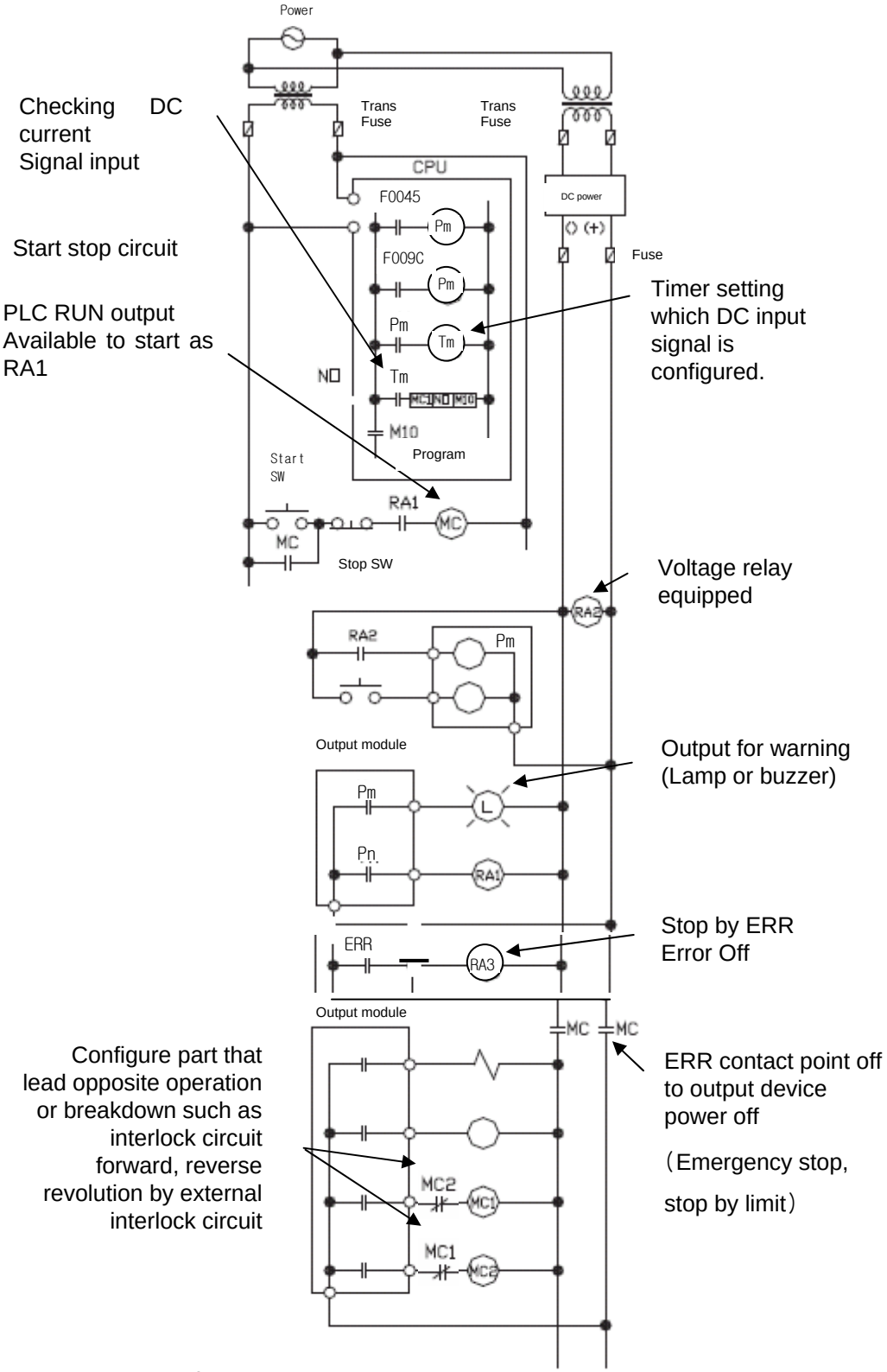
(Emergency stop,

stop by limit

switch)

Start sequence of power
In case of AC DC
(1) Run CPU after power is on
(2) Turn on RA2 as DC power on
(3) Turn on timer after DC power is stable.
(4) Turn on start switch
(5) 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)



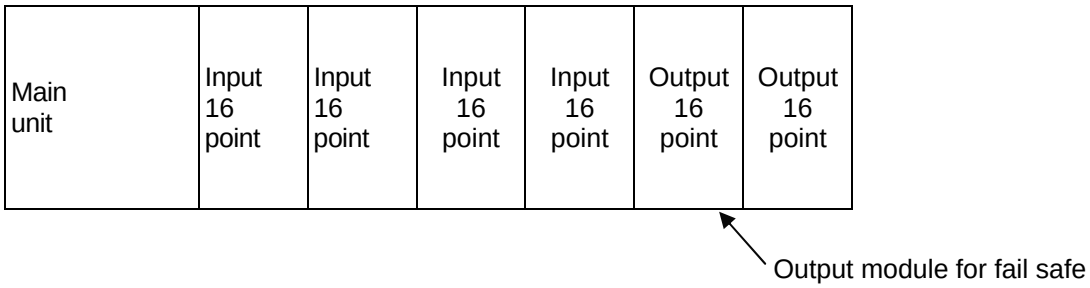

Start sequence of power
In case of AC DC

(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 s/w
(5) Turn on start switch Output device runs by program through magnetic contactor (MC) [On]

(3) Fail safe countermeasure in case of PLC error

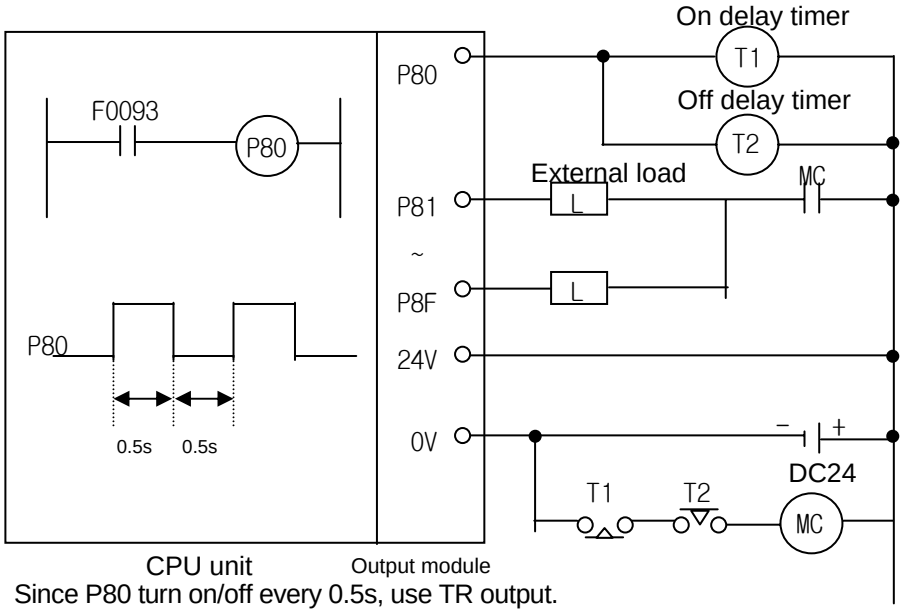
Error of PLC CPU and memory is detected by self diagnosis but in case error occurs in IO control part, etc., CPU can detect the error. At this case, though it is different according to status of error, all contact point is on or off, so safety may not be guaranteed. Though we do out best to our quality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

System example




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.

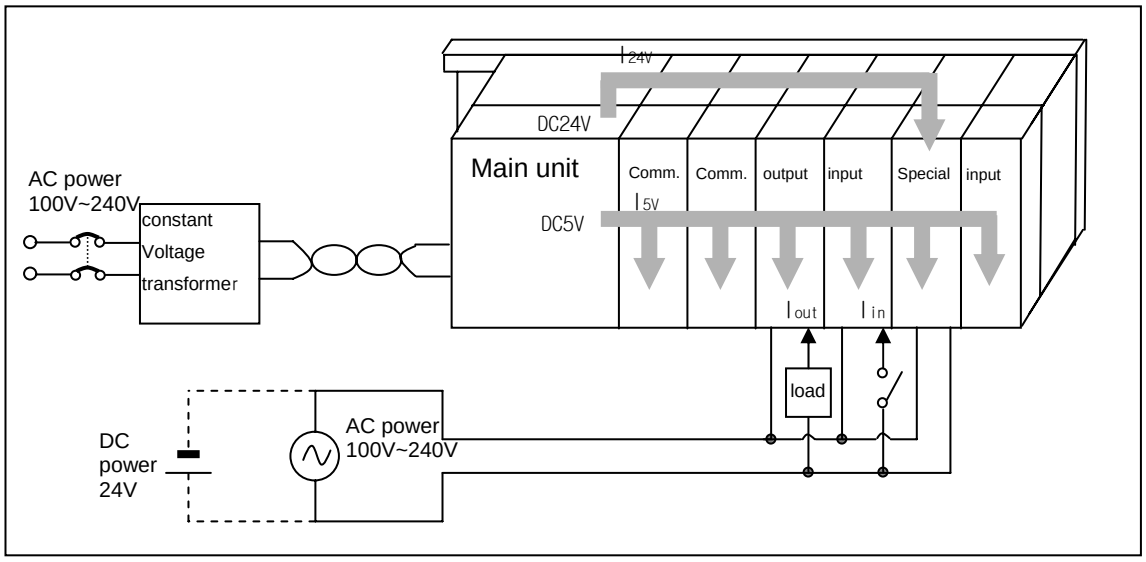
- $W_{24V} = I_{24V} \times 24$ (W)

(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 X 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 X 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 [$m^2$]
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

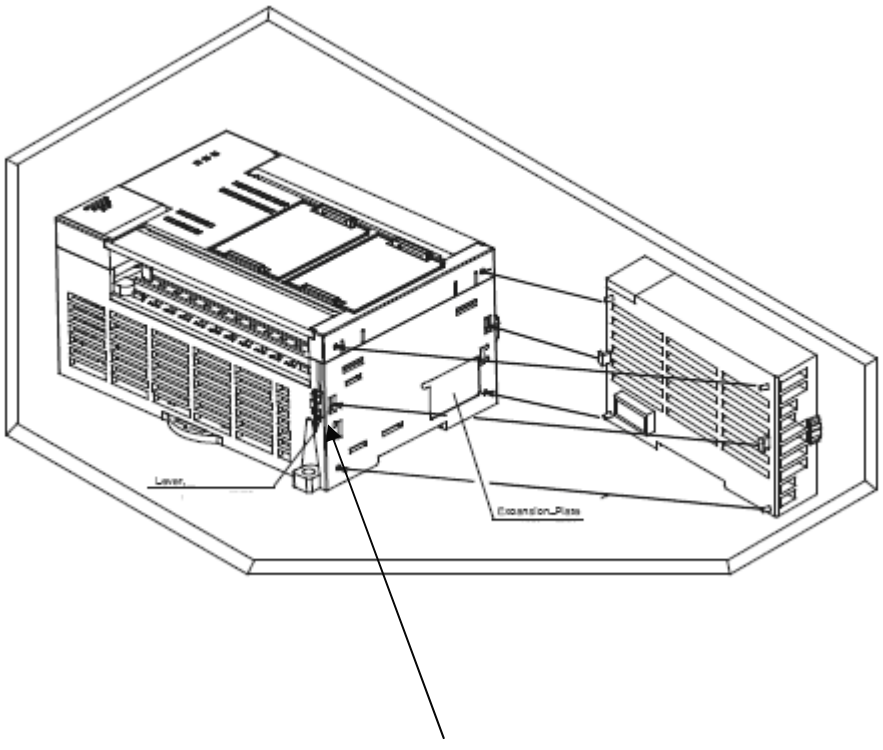
Caution in handling
Use PLC in the range of general specification specified by manual.
In case of using out of range, it may cause electric shock, fire, malfunction, damage of product.

**⚠ 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

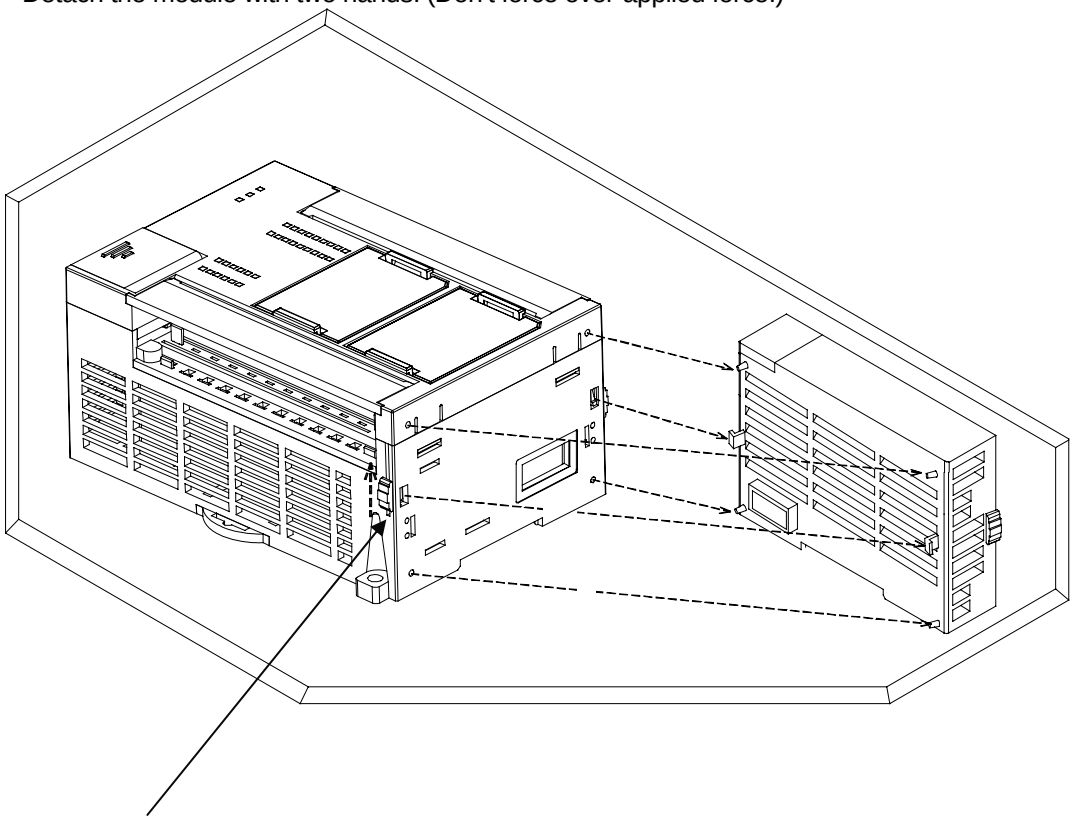
- Eliminate the extension cover at the upper of module.
- Push the module and connect it in agreement with hook for fixation of four edges and hook for connection at the bottom.
- After connection, get down the hook for fixation at the upper part and lower part and fix it completely.




Module fixation (Hook)

(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.)



Hook for module fixation

**⚠ Caution**

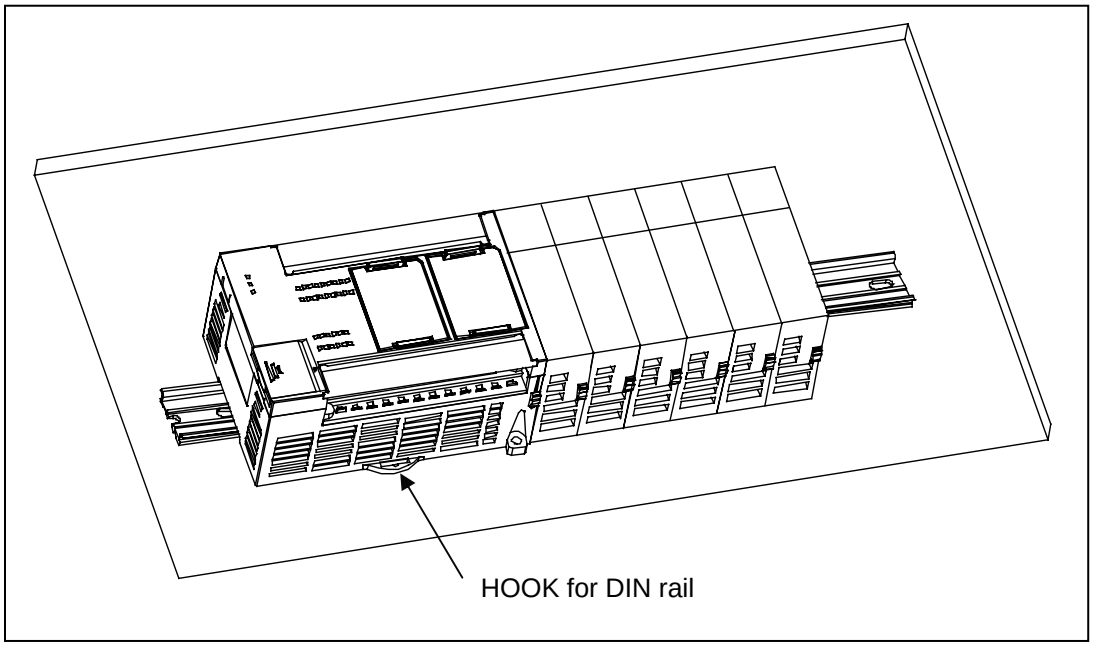
- When separating module, don't force over-applied power. If so, hook may be damaged.

(3) Installation of module

XGB PLC is having hook for DIN rail (rail width: 35mm) so that cab be installed at DIN rail.

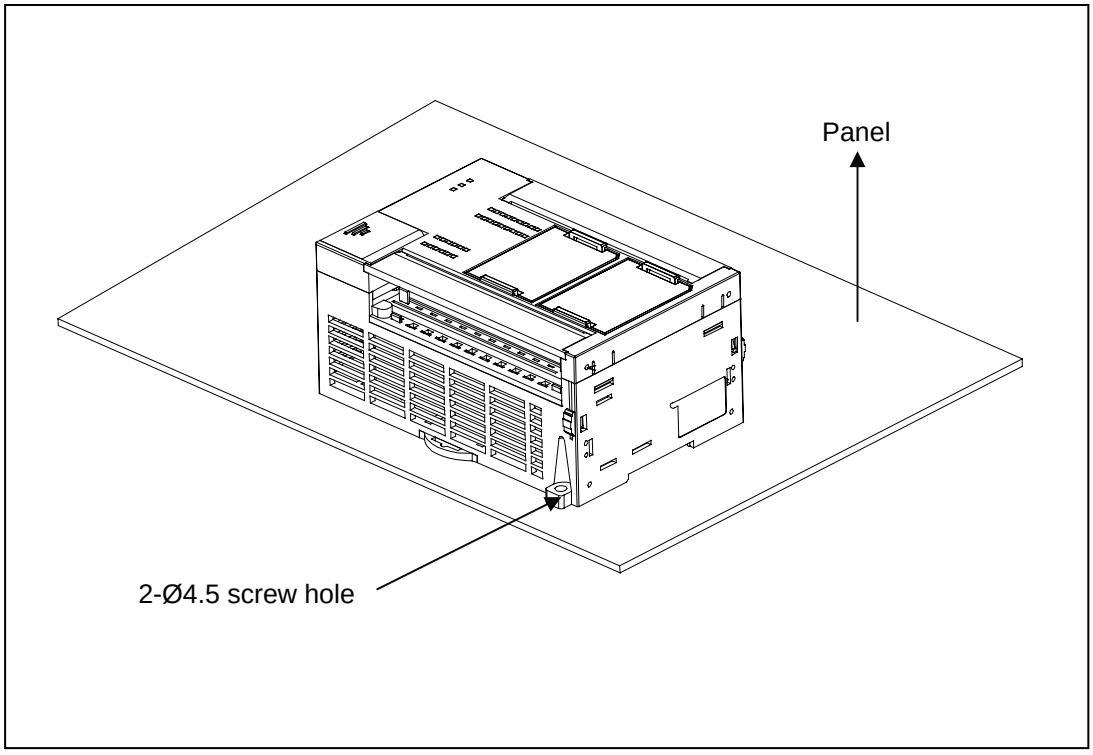
(a) In case of installing at DIN rail

- Pull hook for DIN rail at the bottom of module and install it at DIN rail
- Push hook to fix the module at DIN rail after installing module at DIN rail



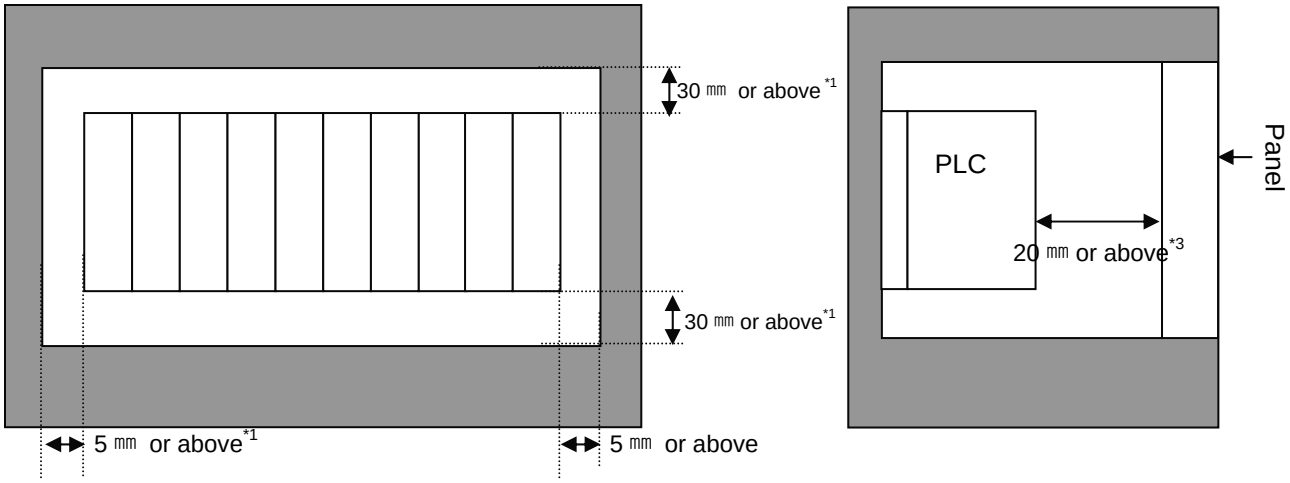

(b) In case of installing at panel

- You can install XGB compact type main unit at panel directly using screw hole
- Use M4 type screw to install the product at panel.



(4) Module equipment location

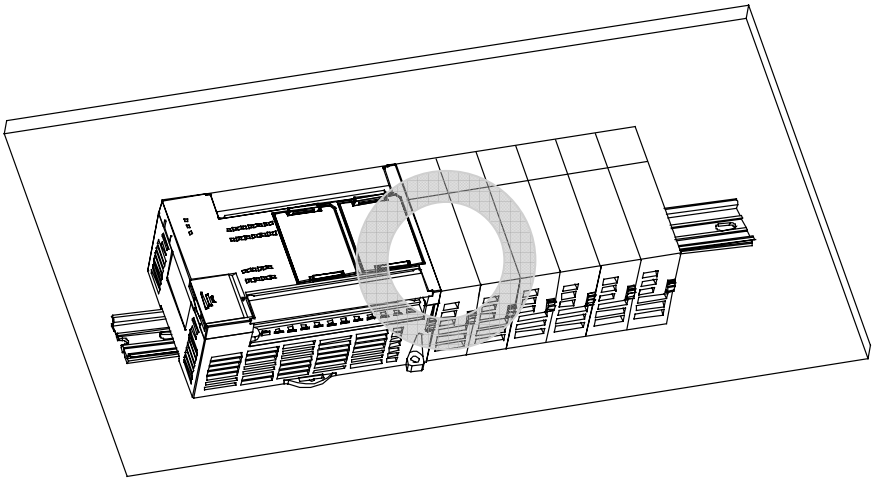
Keep the following distance between module and structure or part for well ventilation and easy detachment and attachment.



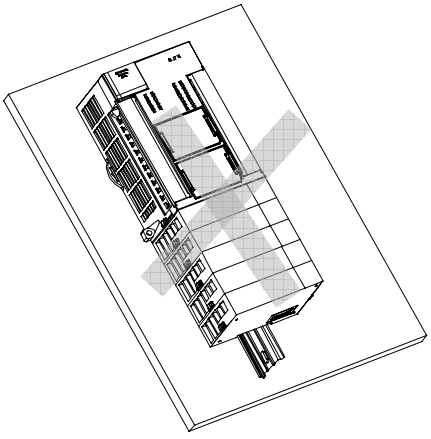

*1 : In case height of wiring duct is less than 50 mm (except this 40mm or above)
*2 : In case of equipping cable without removing near module, 20mm or above
*3 : In case of connector type, 80mm or above

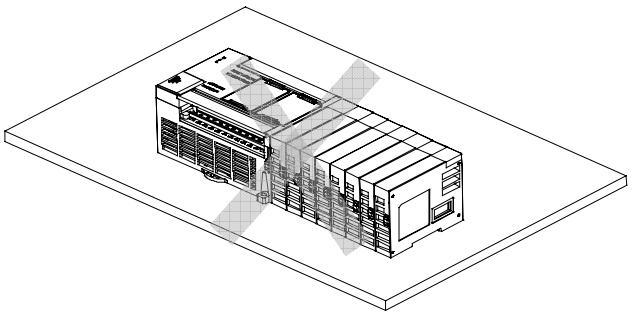
(5) Module equipment direction

(a) For easy ventilation, install like the following figure.



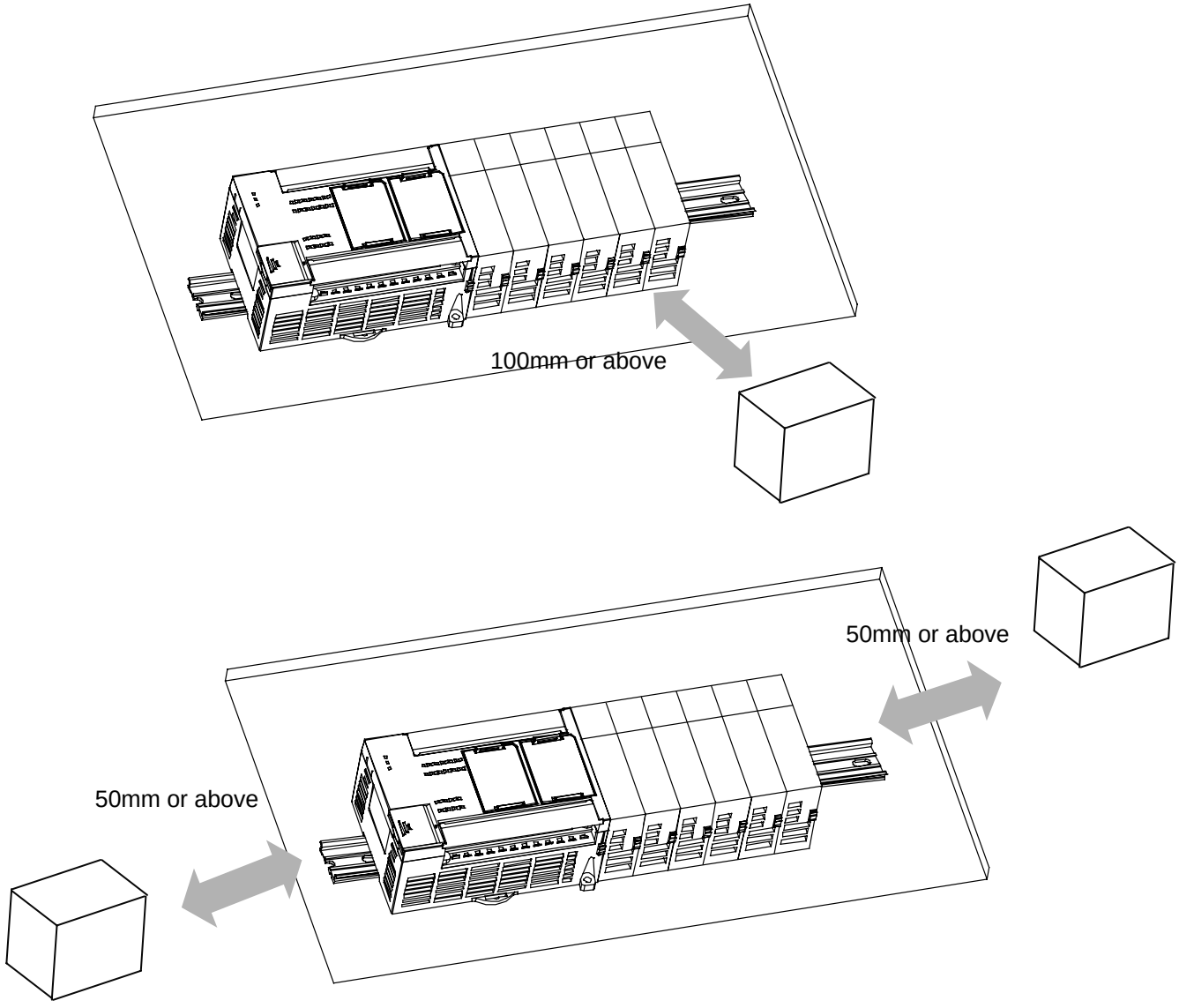
(b) Don't install like the following figure





(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.

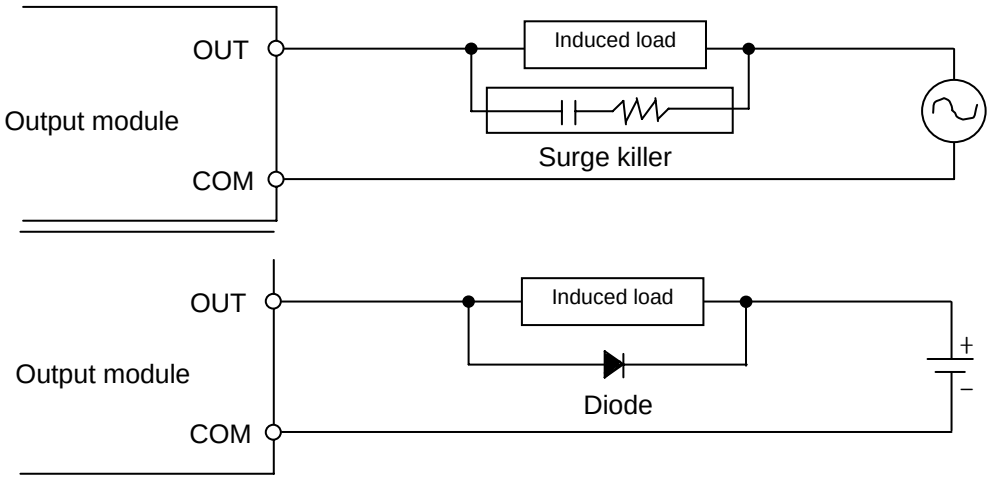
(b) Used wire
When selecting wire, consider ambient temp, allowed current and minimum size of wire is AWG22(0.3mm$^2$) or above.

(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

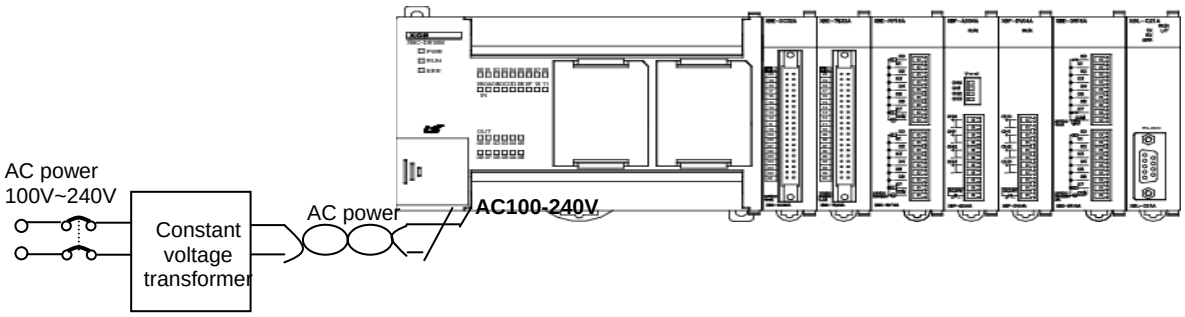
- When wiring, cut off the external power.
- If all power is cut, it may cause electric shock or damage of product.
- In case of flowing electric or testing after wiring, equip terminal cover included in product. It not, it may cause electric shock.

### ⚠ 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.

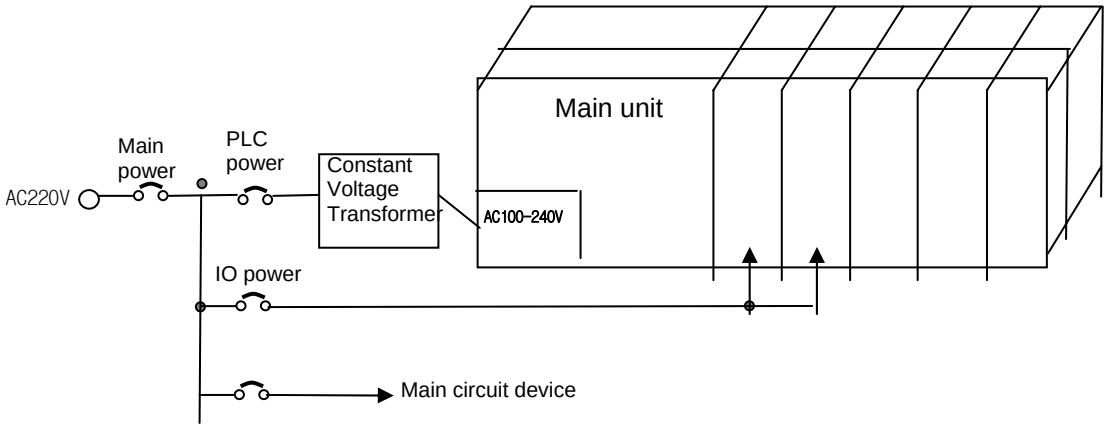
### 9.3.1Power wiring

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



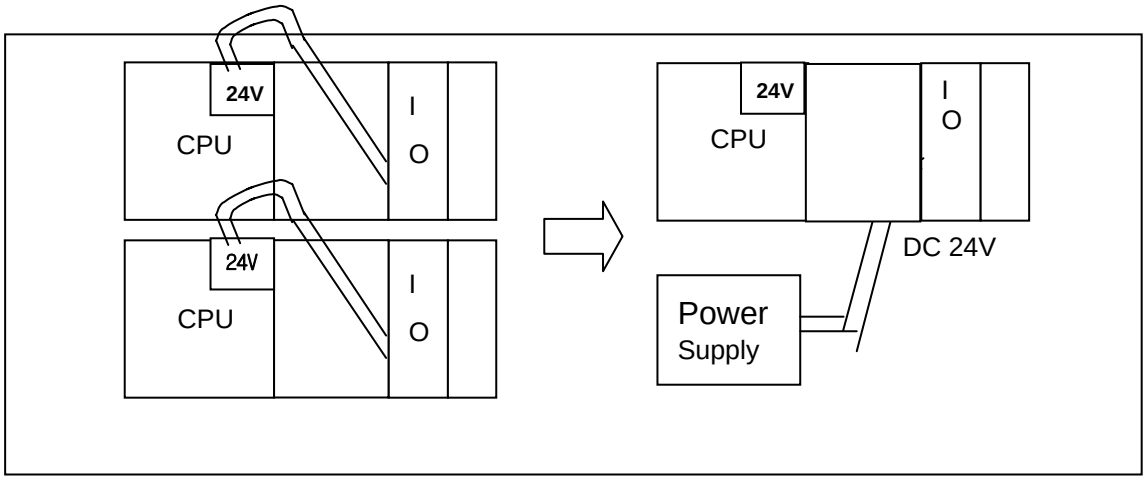

(2) Connect noise that include small noise between line and earth.
(When there are many noise, connect insulated transformer.)

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




(4) If using DC24V of the main unit

(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.

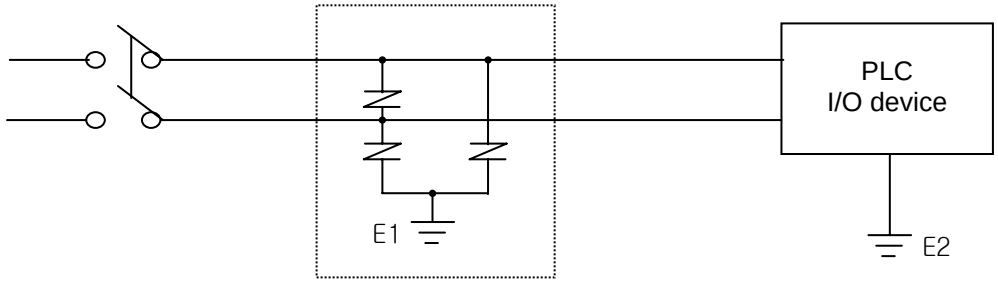



(5) AC110V/AC220V/DC24V cables should be compactly twisted and connected in the shortest distance.

(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.

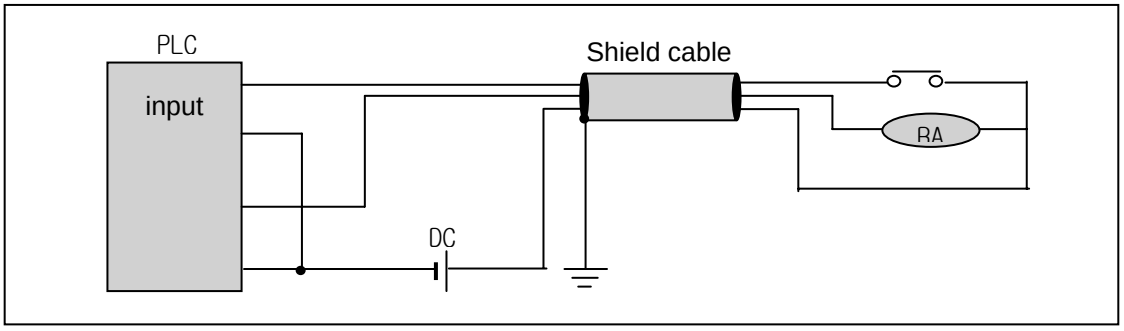
### 9.3.2 I/O Device wiring

(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.



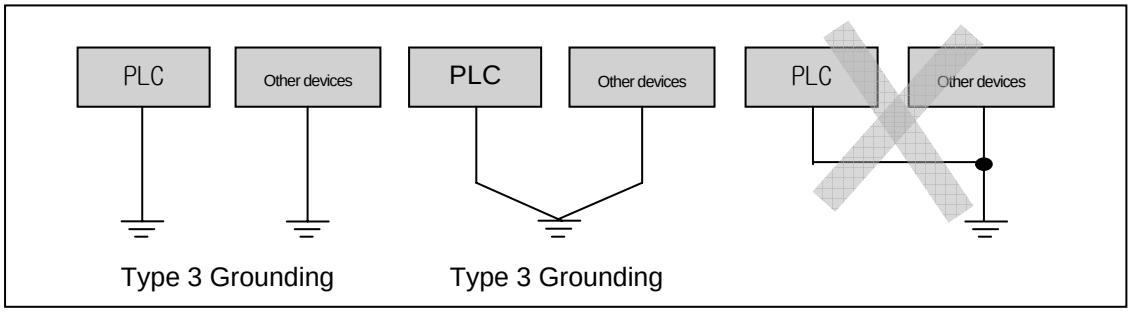

(5) When applying pipe-wiring, make sure to firmly ground the piping.

### 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 Ω)

(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 ($mm^2$) | |
|---|---|---|
| | Lower limit | Upper limit |
| Digital input | 0.18 (AWG24) | 1.5 (AWG16) |
| 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 4. |
| | Run LED | Check that the LED is On during Run. | On (flickering or On indicates an error) | See chapter 4. |
| | ERR LED | Check that the LED is Off during Run. | Flickering indicates an error | See chapter 4. |
| | Input LED | Check that the LED turns On and Off. | On when input is On, Off when input is off. | See chapter 4. |
| | Output LED | Check that the LED turns On and Off | On when output is On, Off when output is off | See chapter 4. |

## 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<br>(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.

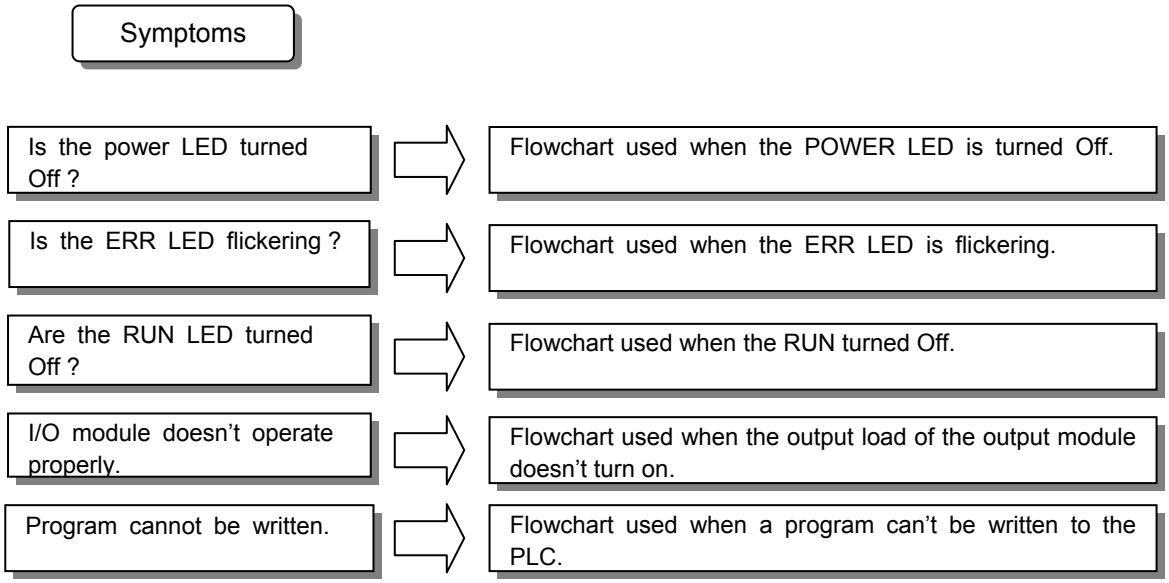
- Switch to the STOP position, and then turn the power on and off.

(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?

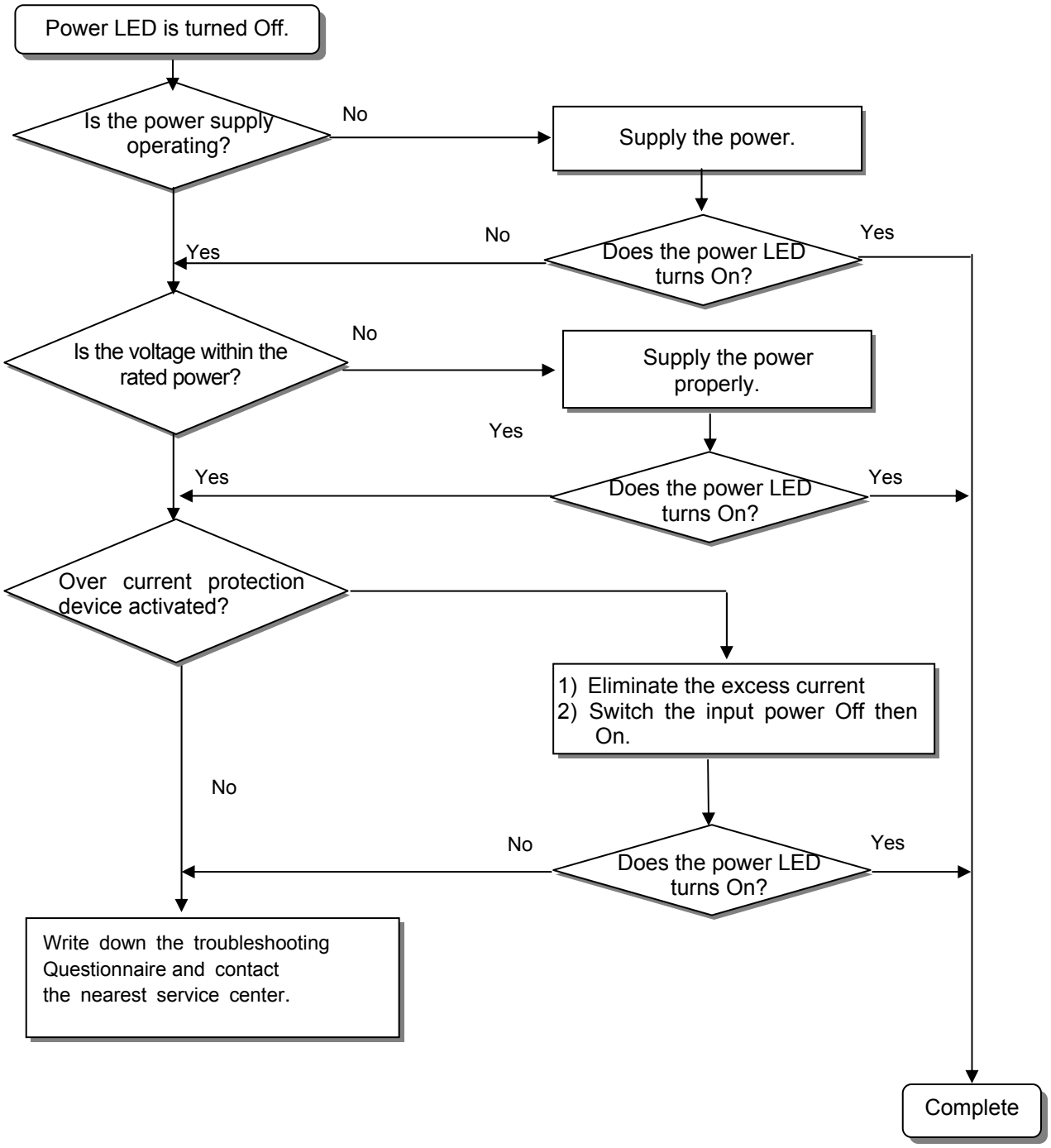
## 11.2 Troubleshooting

This section explains the procedure for determining the cause of troubles as well as the errors and corrective actions.



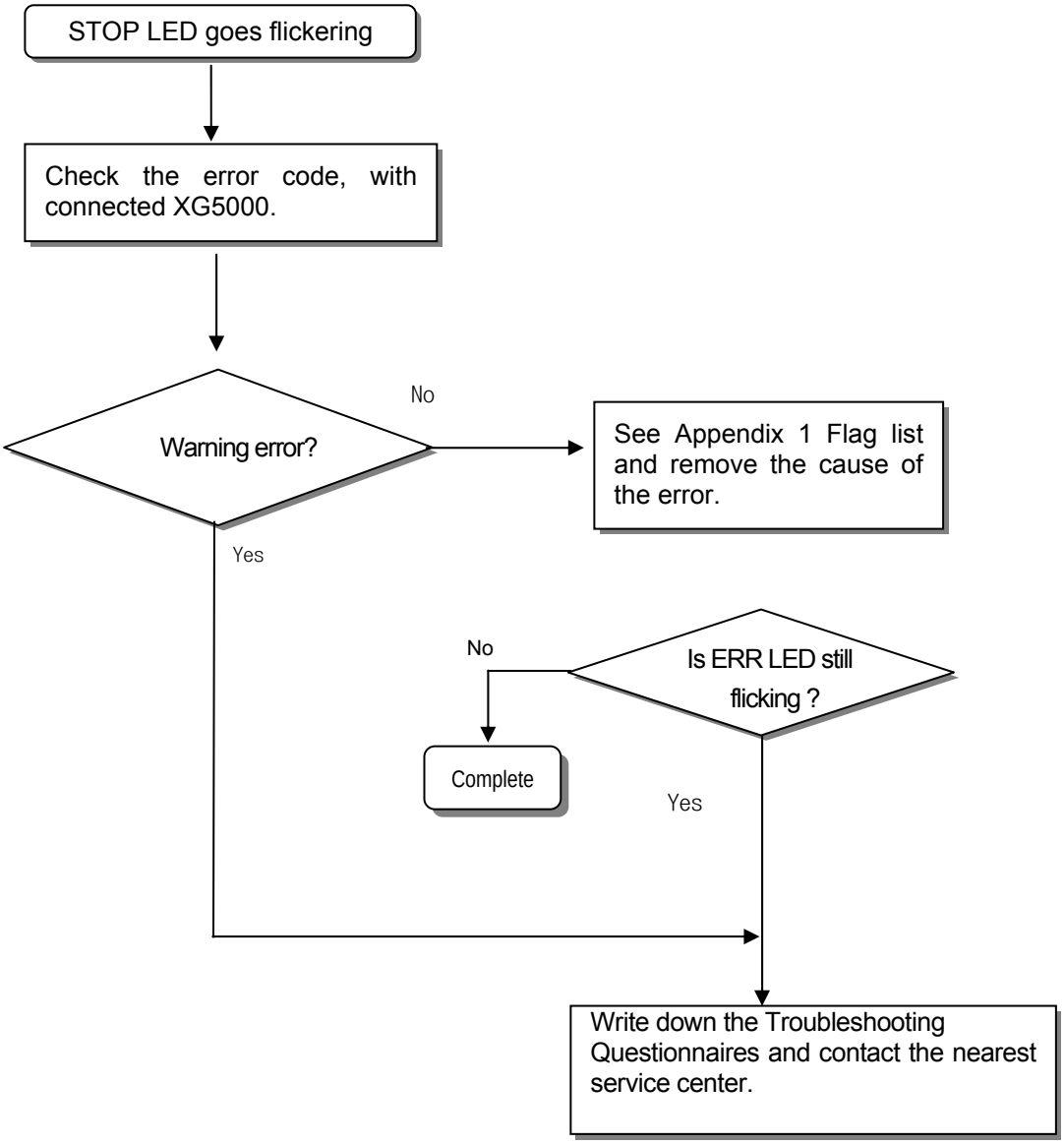
### 11.2.1 Troubleshooting flowchart used when the PWR (Power) LED turns Off.

The following flowchart explains corrective action procedure used when the power is supplied or the power LED turns Off during operation.



### 11.2.2 Troubleshooting flowchart used with when the ERR (Error) LED is flickering

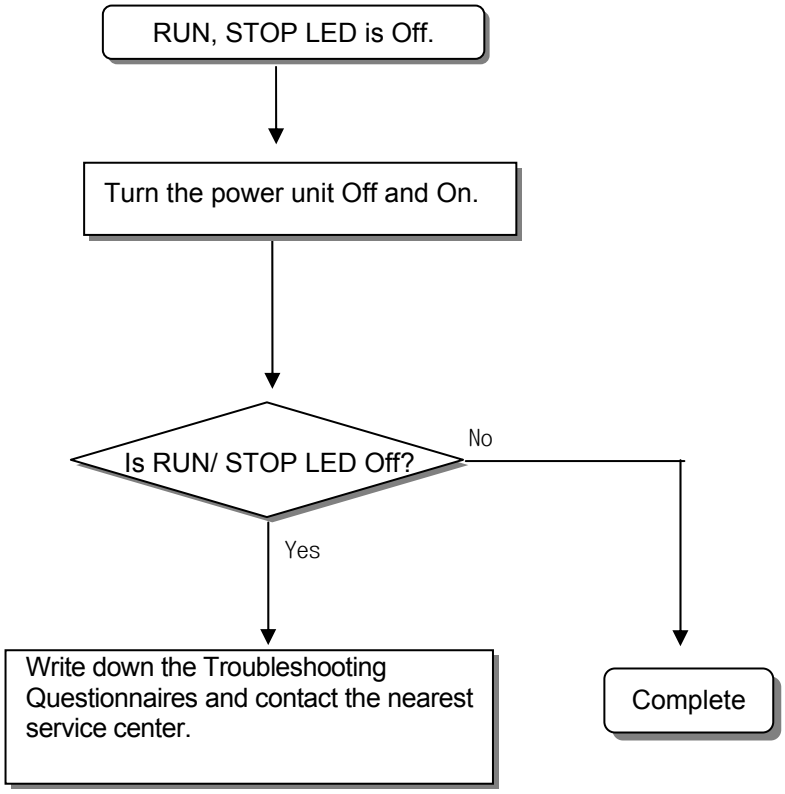
The following flowchart explains corrective action procedure use when the power is supplied star ts or the ERR LED is flickering during operation.




| ⚠ Warning |
| --- |
| Though warning error appears, PLC system doesn't stop but corrective action is needed promptly. If not, it may cause the system failure. |

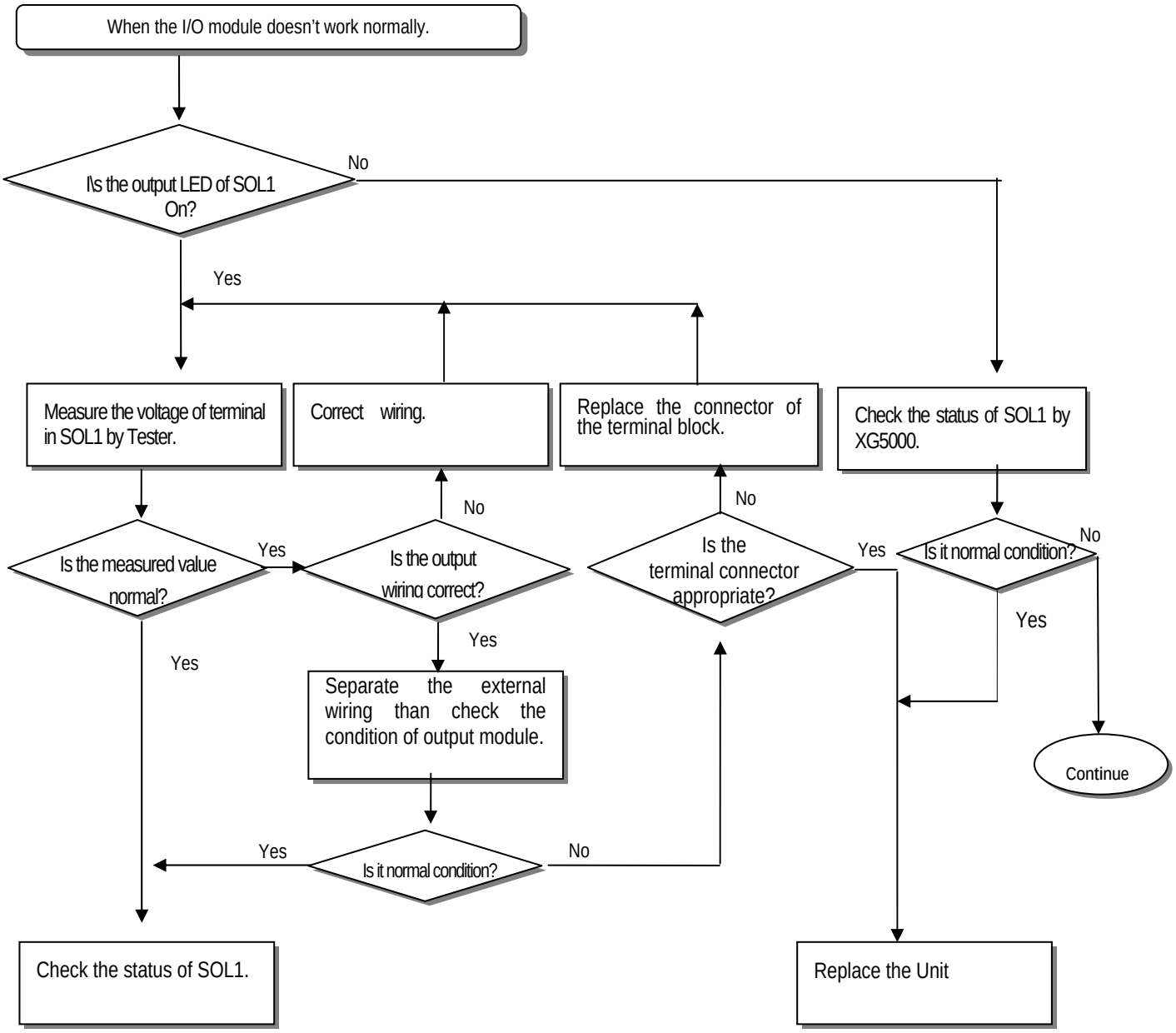
### 11.2.3 Troubleshooting flowchart used with when the RUN , STOP LED turns Off.

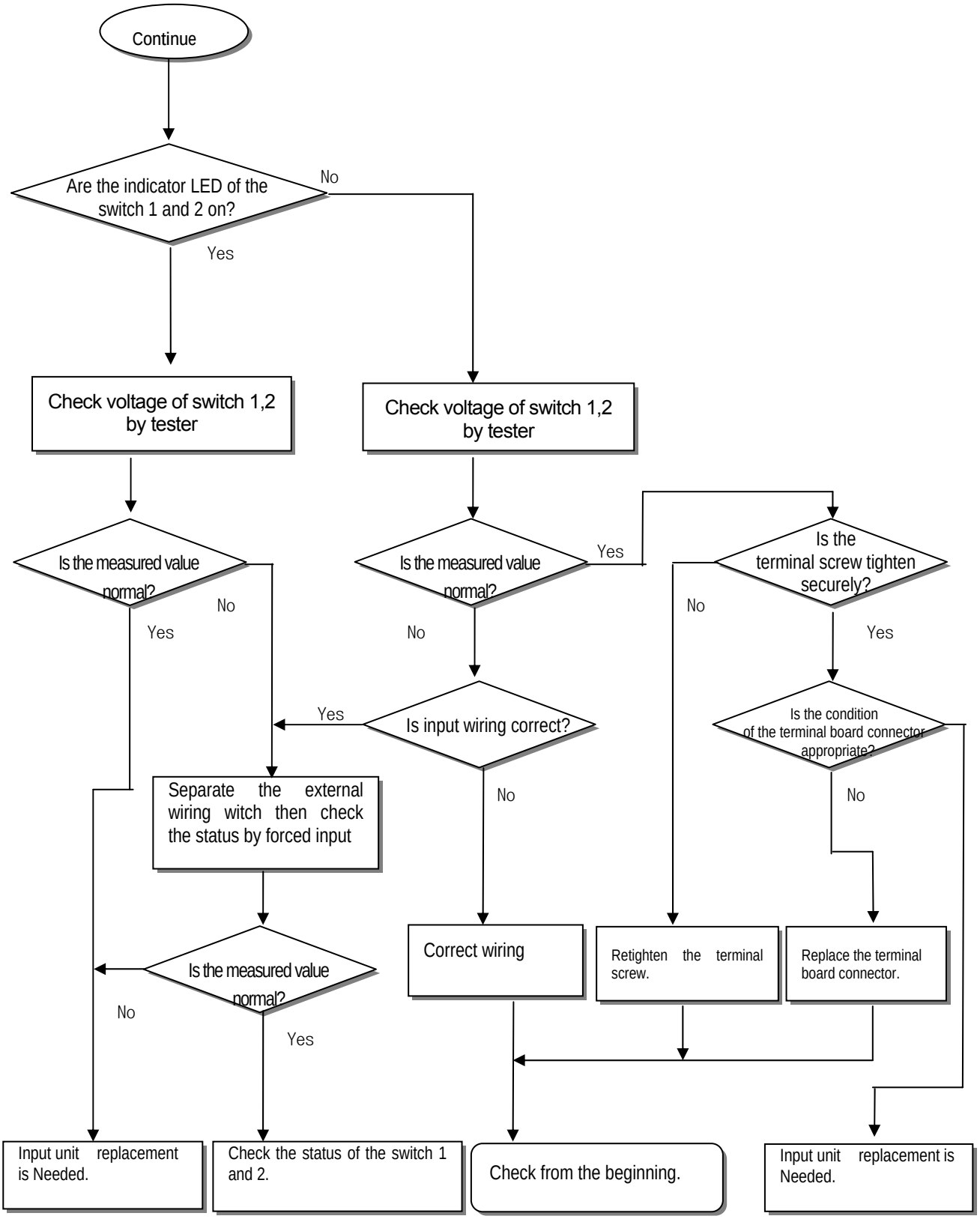
The following flowchart explains corrective action procedure to treat the lights-out of RUN LED when the power is supplied, operation starts or operation is in the process.



### 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 switch 1 and 2 on?
No
Yes
Check voltage of switch 1,2 by tester
Check voltage of switch 1,2 by tester
Is the measured value normal?
No
Yes
Is the measured value normal?
Yes
No
Is the terminal screw tighten securely?
No
Yes
Is input wiring correct?
Yes
No
Is the condition of the terminal board connector appropriate?
No
Separate the external wiring witch then check the status by forced input
Is the measured value normal?
No
Yes
Correct wiring
Retighten the terminal screw.
Replace the terminal board connector.
Input unit replacement is Needed.
Check the status of the switch 1 and 2.
Check from the beginning.
Input unit replacement is Needed.

## 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:

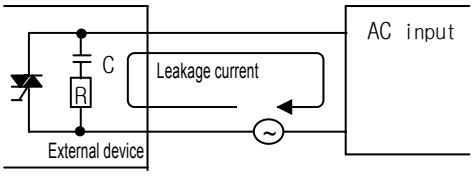
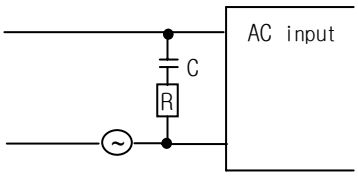
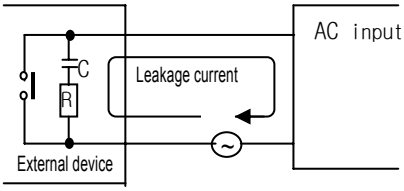
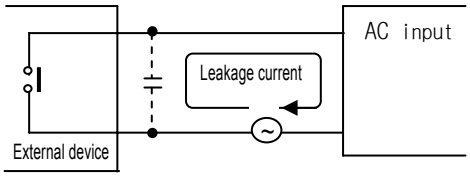
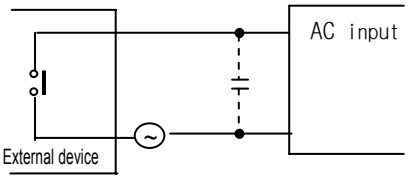
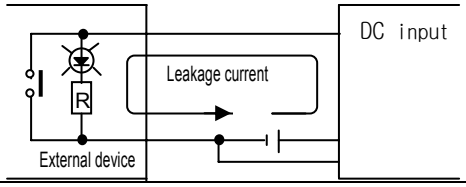
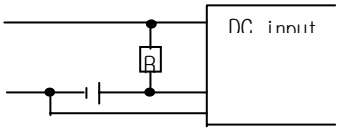
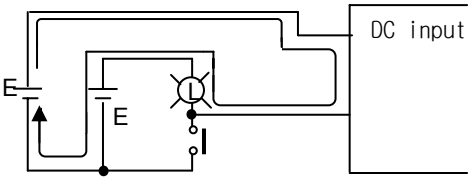
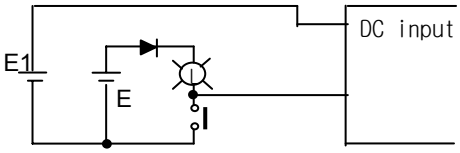
12. Configuration diagram for the applied system:

## 11.4 Troubleshooting Examples

Possible troubles with various circuits and their corrective actions are explained.

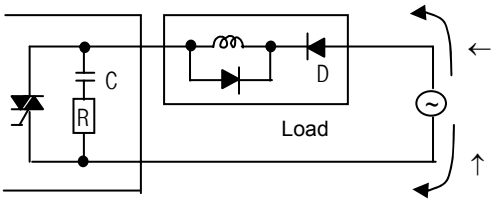
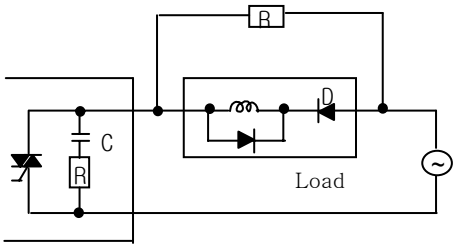
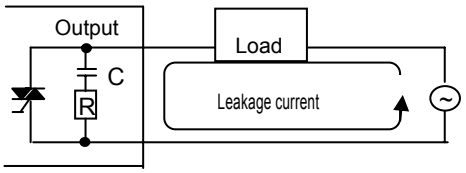
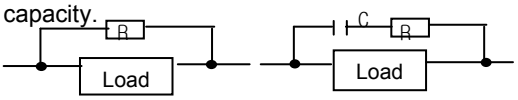
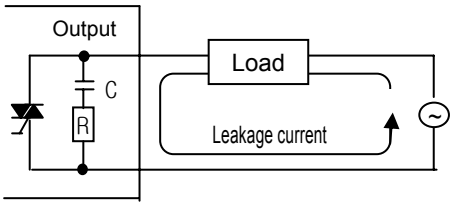
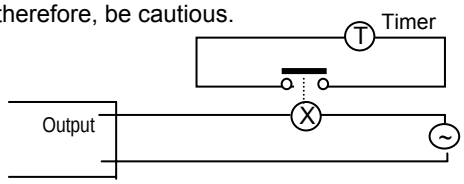
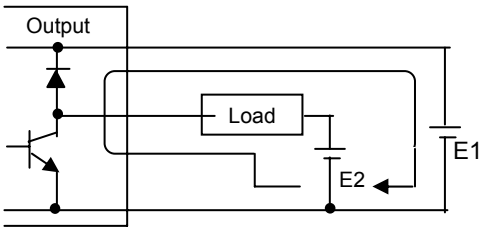
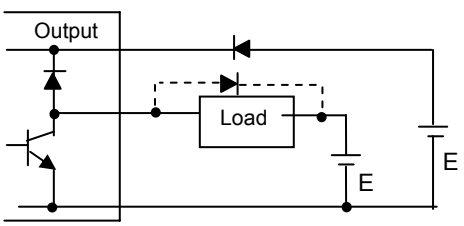
### 11.4.1 Input circuit troubles and corrective actions

The followings describe possible troubles with input circuits, as well as corrective actions.

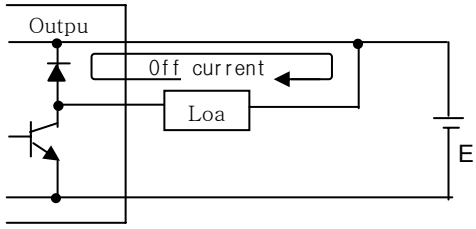
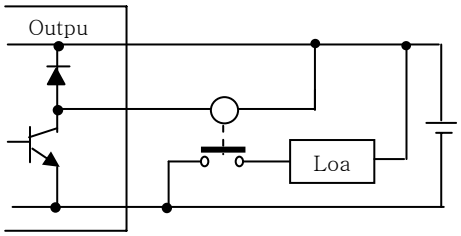
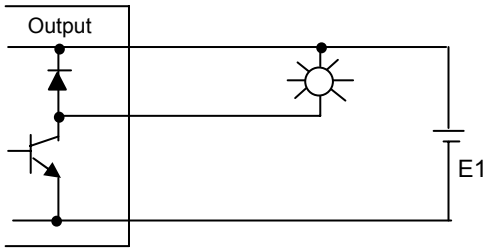
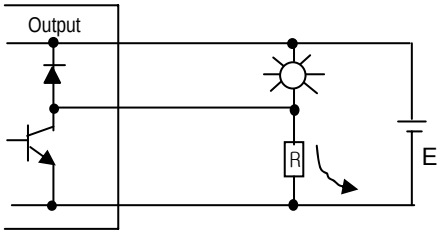
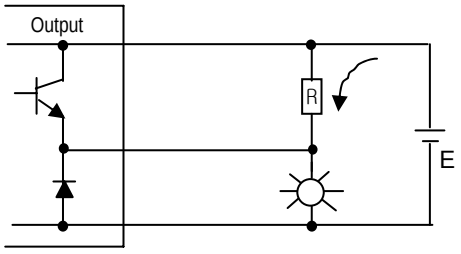
| Condition | Cause | Corrective Actions |
|---|---|---|
| Input signal doesn't turn off. | Leakage current of external device (Such as a drive by non-contact switch)<br>  | • Connect an appropriate register and capacity, which will make the voltage lower across the terminals of the input module.<br>  |
| Input signal doesn't turn off.<br>(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>• 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>  |
| Output transistor is destroyed. | Surge current of the white lamp<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>Sink type transistor output<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.<br>1) If it occurs repeatedly when power reinput, request service center<br>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<br>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

(1) “S” type

| 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. |

## Appendix 1 Flag List

| 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. |

## Appendix 1 Flag List

| 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)<br>Supported when using RTC option module |
| F0054 | - | _TIME_DAY | Hour/date | Clock data (hour/date)<br>Supported when using RTC option module |
| F0055 | - | _SEC_MIN | Second/minute | Clock data (Second/minute)<br>Supported when using RTC option module |

## Appendix 1 Flag List

| Word | Bit | Variable | Function | Description |
|---|---|---|---|---|
| F0056 | - | _HUND_WK | Hundred year/week | Clock data (Hundred year/week)<br>Supported when using RTC option module |
| 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. |

## Appendix 1 Flag List

| 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 | N/A | |
| 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)<br>Supported when using RTC option module |
| F211 | - | _TIME_DAY_DT | Hour/date | Clock data (hour/date)<br>Supported when using RTC option module |
| F212 | - | _SEC_MIN_DT | Second/minute | Clock data (Second/minute)<br>Supported when using RTC option module |
| F213 | - | _HUND_WK_DT | Hundred year/week | Clock data (Hundred year/week)<br>Supported when using RTC option module |

(2) “E” type

| 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 | N/A | |
| | 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. |

## Appendix 1 Flag List

| 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 | N/A | |
| | F0049 | _HS_WAR2 | N/A | |
| | F0054 | _P2P_WAR1 | P2P parameter 1 | P2P – parameter 1 error. |
| | F0055 | _P2P_WAR2 | N/A | |
| | F0056 | _P2P_WAR3 | N/A | |
| | 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. |

## Appendix 1 Flag List

| 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)<br>Supported when using RTC option module |
| F0054 | - | _TIME_DAY | Hour/date | Clock data (hour/date)<br>Supported when using RTC option module |
| F0055 | - | _SEC_MIN | Second/minute | Clock data (Second/minute)<br>Supported when using RTC option module |

## Appendix 1 Flag List

| Word | Bit | Variable | Function | Description |
|---|---|---|---|---|
| F0056 | - | _HUND_WK | Hundred year/week | Clock data (Hundred year/week)<br>Supported when using RTC option module |
| 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. |

## Appendix 1 Flag List

| 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 | N/A | |
| F142 | - | _ERR_HIS_CNT | N/A | |
| F144 | - | _MOD_HIS_CNT | N/A | |
| F146 | - | _SYS_HIS_CNT | History occur times | Saves the times of system history. |
| F148 | - | _LOG_ROTATE | N/A | |
| 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)<br>Supported when using RTC option module |
| F211 | - | _TIME_DAY_DT | Hour/date | Clock data (hour/date)<br>Supported when using RTC option module |
| F212 | - | _SEC_MIN_DT | Second/minute | Clock data (Second/minute)<br>Supported when using RTC option module |
| F213 | - | _HUND_WK_DT | Hundred year/week | Clock data (Hundred year/week)<br>Supported when using RTC option module |

## Appendix 1.2 Communication Relay (L) List

Here describes data link communication relay(L). (Supported in “S” type)

(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

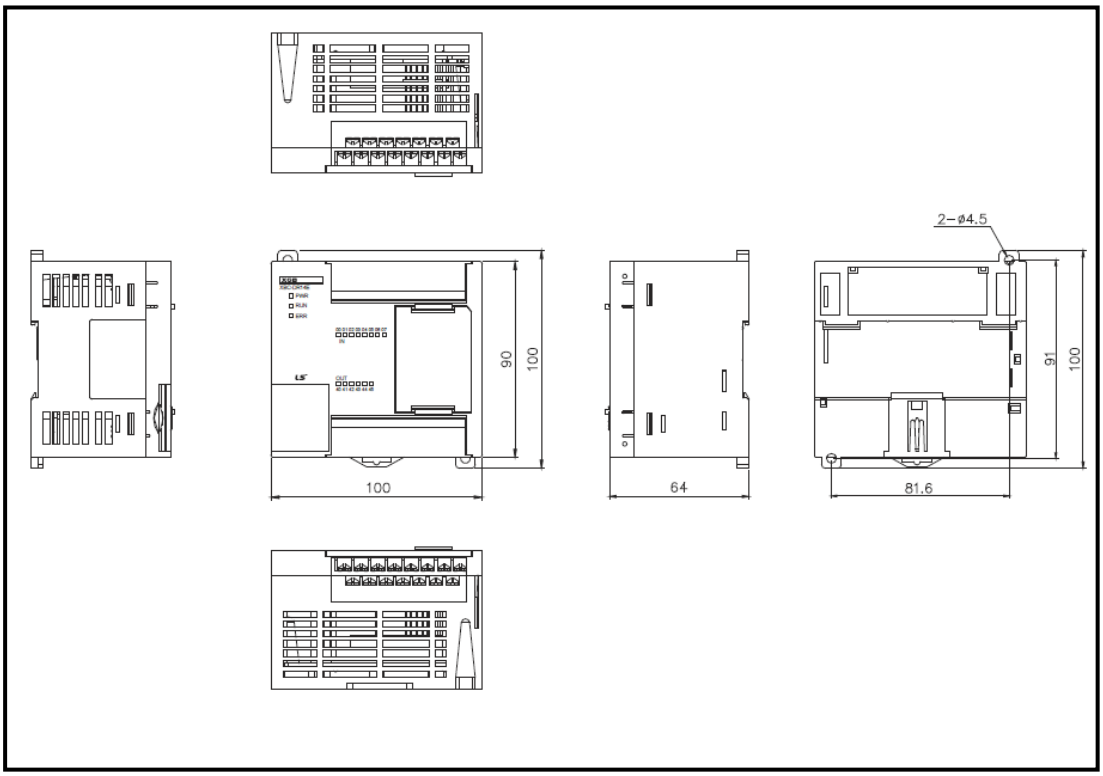
Communication flag list according to P2P service setting.
P2P parameter: “S” type 1~3, “E” type 1
P2P block: “S” type and “E” type 0~31

| 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. |

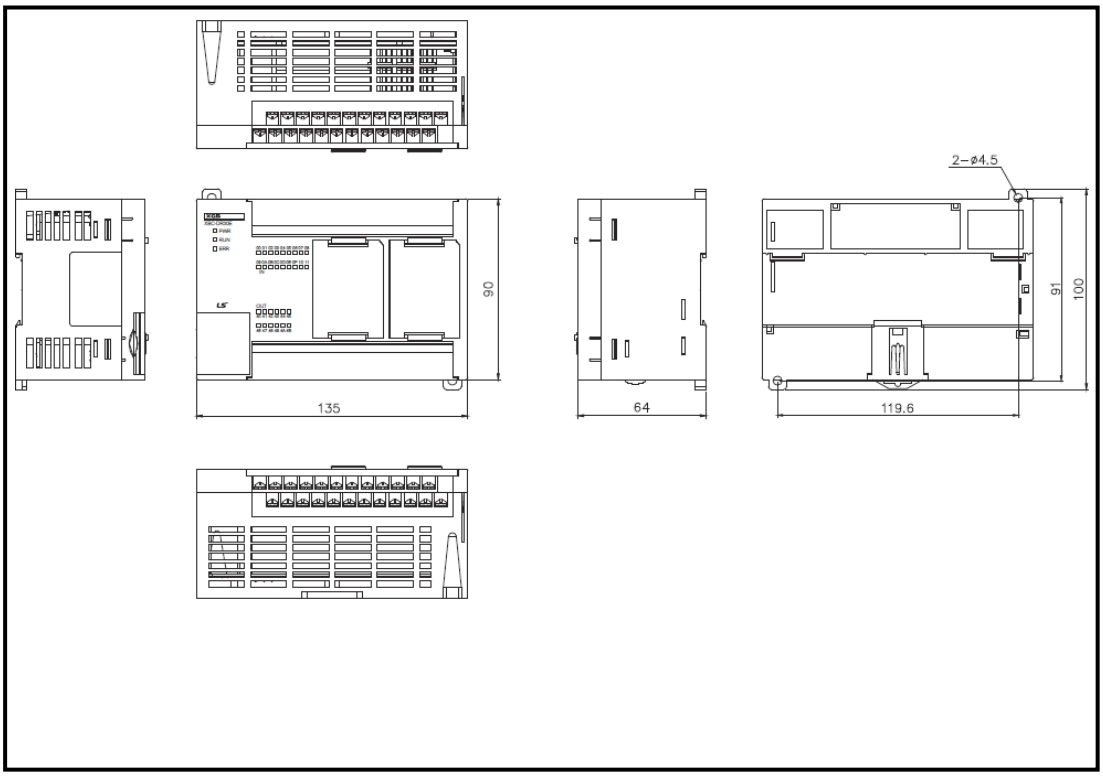
# Appendix 2 Dimension (Unit: mm)

(1) Economy type main unit (“E” type)

-. XBC-DR10/14E



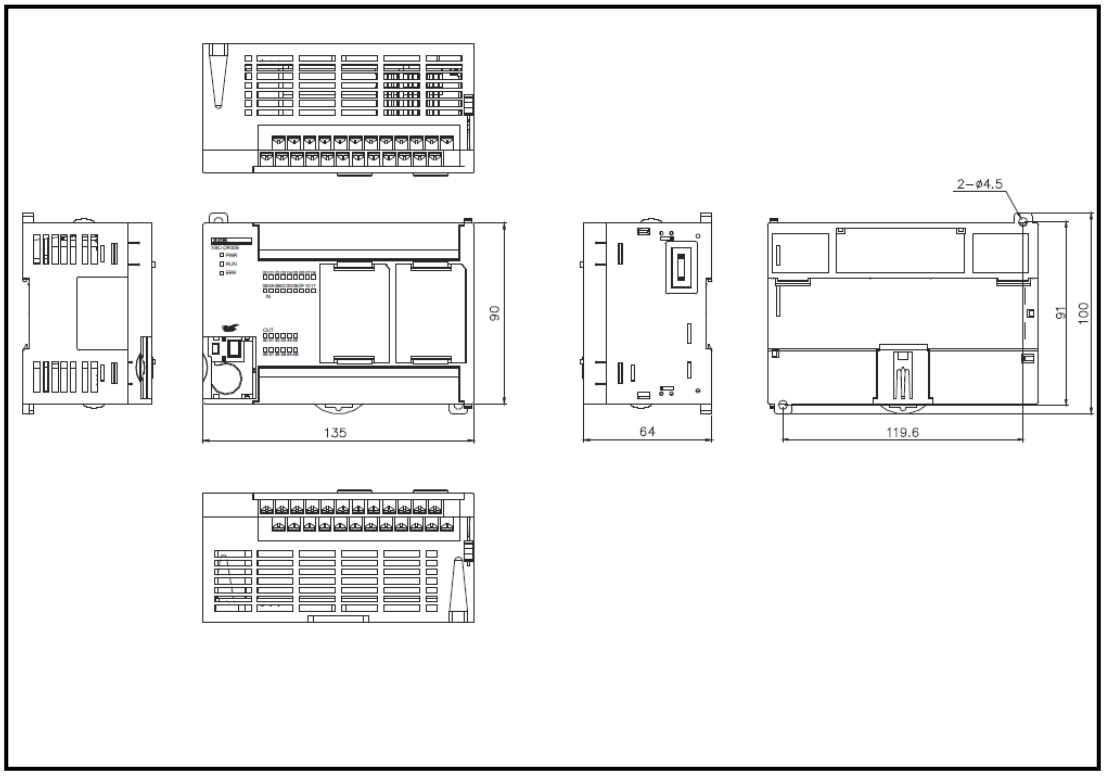

-. XBC-DR20/30E



## Appendix 2 Dimension

(2) Standard type main unit (“S” type)

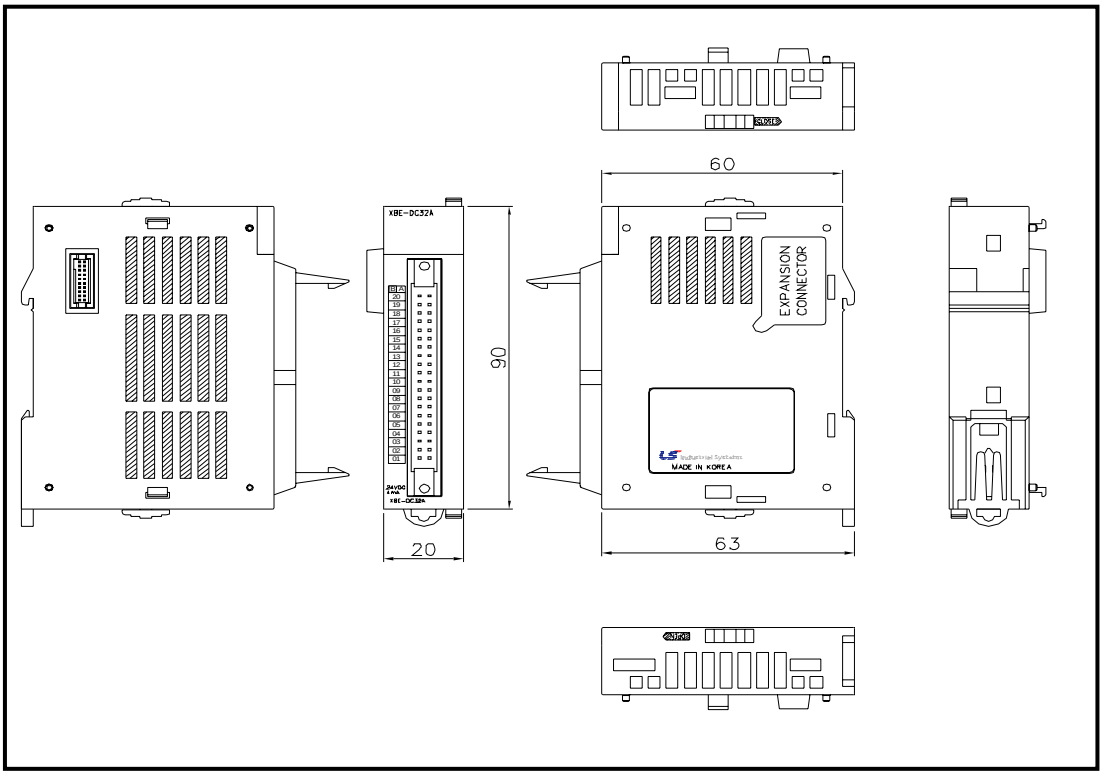
-. XBC-DN20/30H



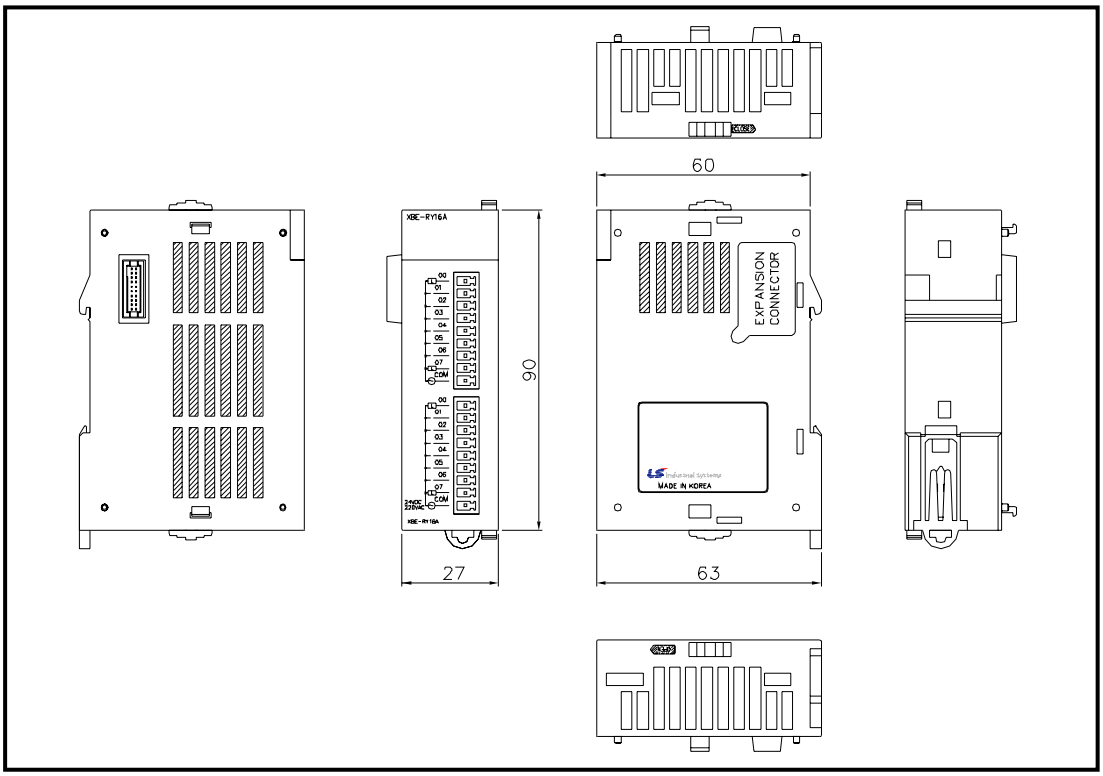
## Appendix 2 Dimension

(3) Extension I/O module

-. XBE-DC32A, XBE-TR32A

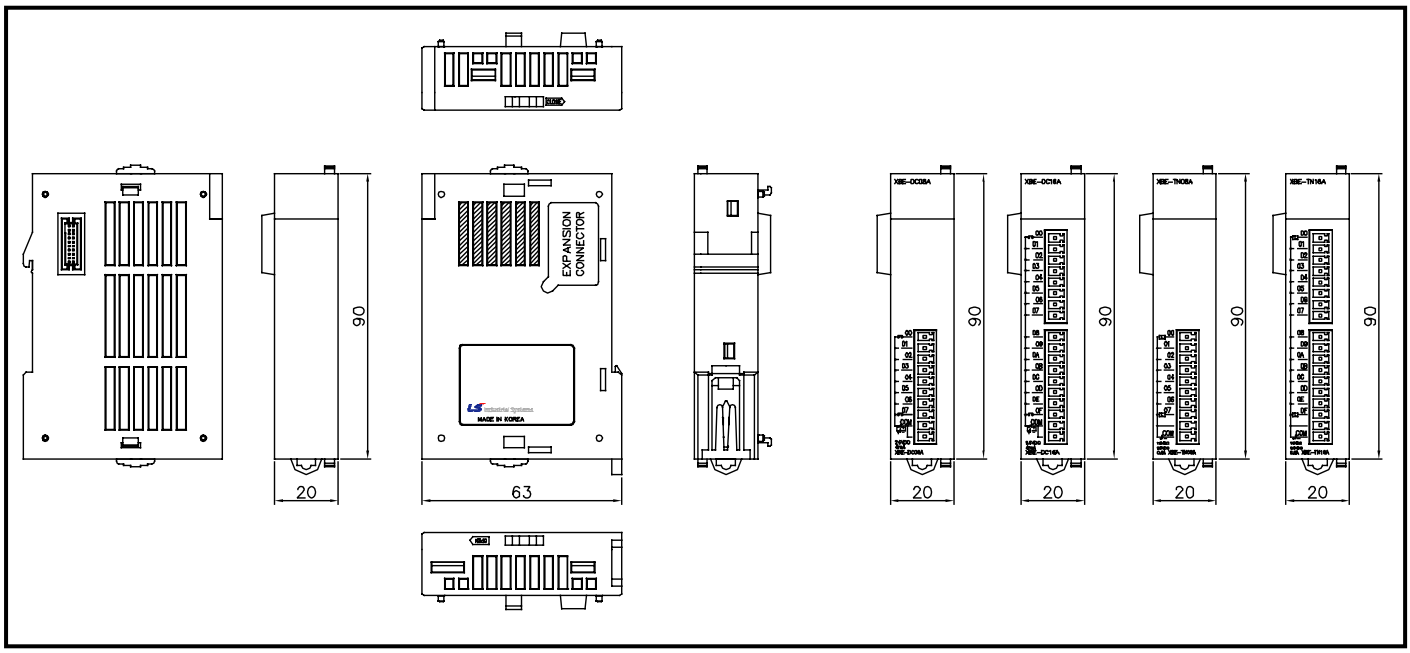



-. XBE-RY16A

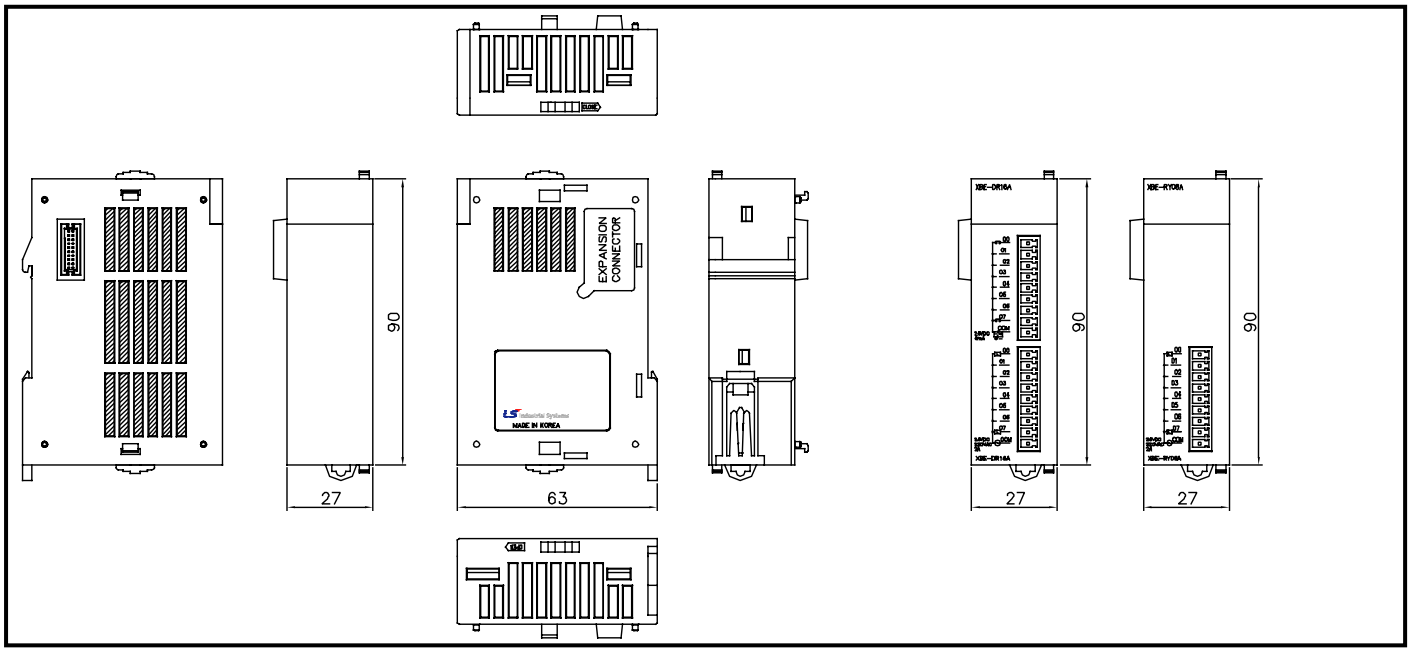


## Appendix 2 Dimension

-. XBE-DC08A, XBE-DC16A, XBE-TN08A, XBE-TN16A




-. XBE-DR16A, XBE-RY08A



# Appendix 3 Compatibility with MASTER-K (Special Relay)

| MASTER-K | | Symbol | XGB | |
|---|---|---|---|---|
| Device | Function | | 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 |

## Appendix 3 Compatibility with MASTER-K (Special Relay)

| MASTER-K | | Symbol | XGB | |
|---|---|---|---|---|
| Device | Function | | Device | Function |
| F0020 | 1 Step RUN | _CPU_ER | F0020 | CPU configuration error |
| F0021 | Break Point RUN | _IO_TYER | F0021 | Module type mismatch error |
| F0022 | Scan RUN | _IO_DEER | F0022 | Module detach error |
| F0023 | Contact value match RUN | _FUSE_ER | F0023 | Fuse cutoff error |
| F0024 | Word value match RUN | _IO_RWER | F0024 | I/O module read/write error |
| F0025 ~ F002F | N/A | _IP_IFER | F0025 | Special/communication module interface error |
| | | _ANNUM_ER | F0026 | Heavy error detection of external equipment error |
| | | - | F0027 | N/A |
| | | _BPRM_ER | F0028 | Basic parameter error |
| | | _IOPRM_ER | F0029 | I/O configuration parameter error |
| | | _SPPRM_ER | F002A | Special module parameter error |
| | | _CPPRM_ER | F002B | Communication module parameter error |
| | | _PGM_ER | F002C | Program error |
| | | _CODE_ER | F002D | Program Code error |
| | | _SWDT_ER | F002E | System watchdog error |
| | | _BASE_POWER_ER | F002F | Base power error |
| F0030 | Heavy error | _WDT_ER | F0030 | Scan watchdog |
| F0031 | Light error | - | F0031 | - |
| F0032 | WDT error | - | F0032 | - |
| F0033 | I/O combination error | - | F0033 | - |
| F0034 | Battery voltage error | - | F0034 | - |
| F0035 | Fuse error | - | F0035 | - |
| F0036 ~ F0038 | N/A | - | F0036 ~ F0038 | - |
| F0039 | Backup normal | - | F0039 | - |
| F003A | Clock data error | - | F003A | - |
| F003B | Program change | - | F003B | - |
| F003C | Program change error | - | F003C | - |
| F003D ~ F003F | N/A | - | F003D ~ F003F | N/A |
| F0040~ F005F | N/A | _RTC_ER | F0040 | RTC data error |
| | | _DBCK_ER | F0041 | Data backup error |
| | | _HBCK_ER | F0042 | Hot restart disabled error |
| | | _ABSD_ER | F0043 | Abnormal operation stop |
| | | _TASK_ER | F0044 | Task collision |
| | | _BAT_ER | F0045 | Battery error |
| | | _ANNUM_ER | F0046 | Light error detection of external equipment |

## Appendix 3 Compatibility with MASTER-K (Special Relay)

| MASTER-K | | Symbol | XGB | |
|---|---|---|---|---|
| Device | Function | | Device | Function |
| F0040 ~ F005F | N/A | _LOG_FULL | F0047 | Log memory full warning |
| | | _HS_WAR1 | F0048 | High speed link parameter 1 error |
| | | _HS_WAR2 | F0049 | High speed link parameter 2 error |
| | | - | 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 |
| 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 |

## Appendix 3 Compatibility with MASTER-K (Special Relay)

| MASTER-K | | Symbol | XGB | |
|---|---|---|---|---|
| Device | Function | | Device | Function |
| 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 |

## Appendix 3 Compatibility with MASTER-K (Special Relay)

| MASTER-K | | Symbol | XGB | |
|---|---|---|---|---|
| Device | Function | | 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 3 Compatibility with MASTER-K (Special Relay)

**Note**

1. When you convert the project written by KGLWIN in MASTER-K series (K80S, K200S, K300S, and K1000S) into XG5000 project, some instructions used in only MASTER-K is not converted. And the previous parameter used in MASTER-K is converted into default value.
2. XGB economy type project can be converted into XGB standard type project but parameter is converted into default value.
3. When you convert the XGB standard type project into XGB economy type project, some instructions used in only XGB standard type is not converted. And the parameter is converted into default value.

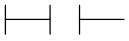
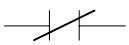
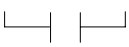
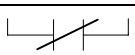
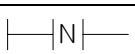
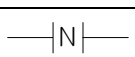
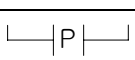
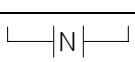
# Appendix 4 Instruction List

## Appendix 4.1 Classification of Instructions

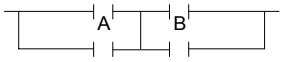
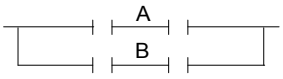
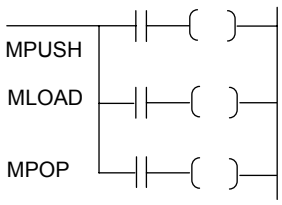
| Classification | Instructions | Details | Remarks |
|---|---|---|---|
| Basic Instructions | Contact Point Instruction | LOAD, AND, OR related Instructions | |
| | Unite Instruction | AND LOAD, OR LOAD, MPUSH, MLOAD, MPOP | |
| | Reverse Instruction | NOT | |
| | Master Control Instruction | MCS, MCSCLR | |
| | 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 | |
| | File related Instruction | Blcok Read/Write/Compare/Convert, Flash data Transmission | |

# Appendix 4.2 Basic Instructions

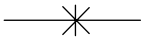
## (1) Contact point instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Contact Point | LOAD |  | A Contact Point Operation Start | ○ | ○ |
| | LOAD NOT |  | B Contact Point Operation Start | ○ | ○ |
| | AND |  | A Contact Point Series-Connected | ○ | ○ |
| | AND NOT |  | B Contact Point Series-Connected | ○ | ○ |
| | OR |  | A Contact Point Parallel-Connected | ○ | ○ |
| | OR NOT |  | B Contact Point Parallel-Connected | ○ | ○ |
| | LOADP |  | Positive Convert Detected Contact Point | ○ | ○ |
| | LOADN |  | Negative Convert Detected Contact Point | ○ | ○ |
| | ANDP |  | Positive Convert Detected Contact Point Series-Connected | ○ | ○ |
| | ANDN |  | Negative Convert Detected Contact Point Series-Connected | ○ | ○ |
| | ORP |  | Positive Convert Detected Contact Point Parallel- | ○ | ○ |
| | ORN |  | Negative Convert Detected Contact Point Parallel- | ○ | ○ |

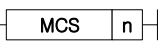
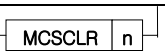
## (2) Union instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Unite | AND LOAD |  | A,B Block Series-Connected | ○ | ○ |
| | OR LOAD |  | A,B Block Parallel-Connected | ○ | ○ |
| | MPUSH |  | Operation Result Push up to present | ○ | ○ |
| | MLOAD | | Operation Result Load Previous to Diverge Point | ○ | ○ |
| | MPOP | | Operation Result Pop Previous to Diverge Point | ○ | ○ |

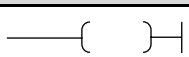
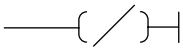
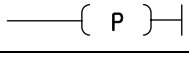
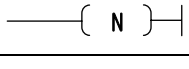
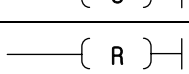
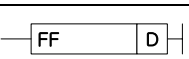
### (3) Reverse instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Reverse | NOT |  | Previous Operation results Reverse | ○ | ○ |

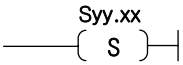
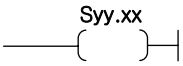
### (4) Master Control instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Master Control | MCS |  | Master Control Setting (n:0~7) | ○ | ○ |
| | MCSCLR |  | Master Control Cancel (n:0~7) | ○ | ○ |

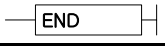
### (5) Output instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Output | OUT |  | Operation Results Output | ○ | ○ |
| | OUT NOT |  | Operation Results Reverse Output | ○ | ○ |
| | OUTP |  | 1 Scan Output if Input Condition rises | ○ | ○ |
| | OUTN |  | 1 Scan Output if Input Condition falls | ○ | ○ |
| | SET |  | Contact Point Output ON kept | ○ | ○ |
| | RST |  | Contact Point Output OFF kept | ○ | ○ |
| | FF |  | Output Reverse if Input Condition rises | ○ | ○ |

### (6) Sequence/Last-input preferred instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Step Control | SET S |  | Sequence Control | ○ | ○ |
| | OUT S |  | Last-input Preferred | ○ | ○ |

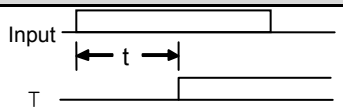
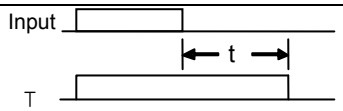
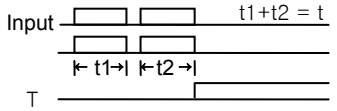
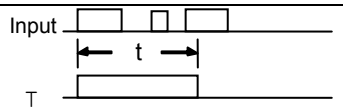
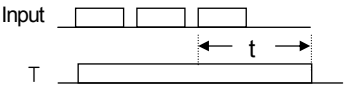
### (7) End instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| End | END |  | Program End | ○ | ○ |

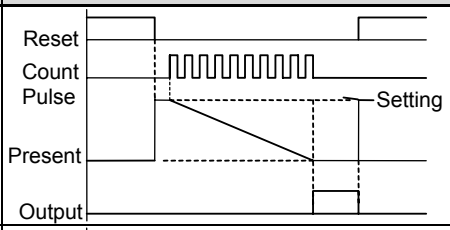
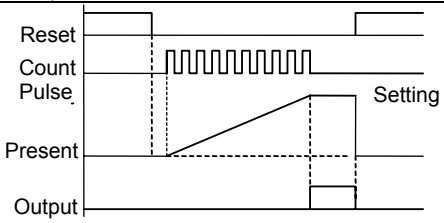
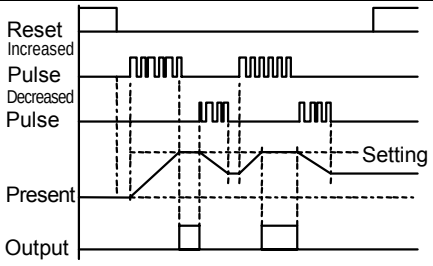
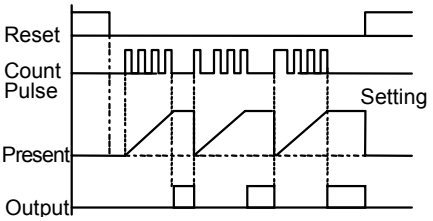
### (8) Non-process instruction

| 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 | (Sb): Bit Position, b15, b0, 4bit trans, (Db): Bit Position | ○ | ○ |
| | MOV4P | MOV4P Sb Db | | | |
| 8 bits Transfer | MOV8 | MOV8 Sb Db | (Sb): Bit Position, b15, b0, 8bit trans, (Db): Bit Position | ○ | ○ |
| | 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 | (S), (D), N | ○ | ○ |
| | GMOVP | GMOVP S D N | | | |
| Multiple Transfer | FMOV | FMOV S D N | (S), (D), N | ○ | ○ |
| | FMOVP | FMOVP S D N | | | |
| Specified Bits Transfer | BMOV | BMOV S D N | b15, b0, (S), (D), * Z: Control Word | ○ | ○ |
| | BMOVP | BMOVP S D N | | | |
| Specified Bits Group Transfer | GBMOV | GBMOV S D Z N | (S) : (S+N), (D) : (D+N), b15, b0, N, * Z: Control Word | ○ | ○ |
| | GBMOVP | GBMOVP S D Z N | | ○ | ○ |

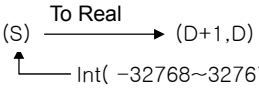
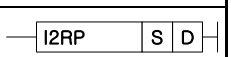
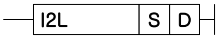
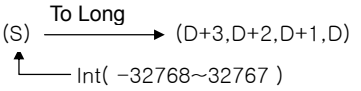
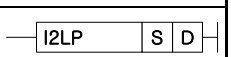
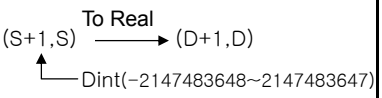
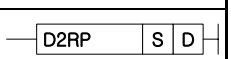
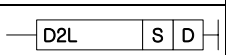
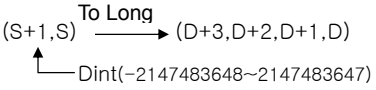
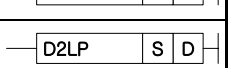
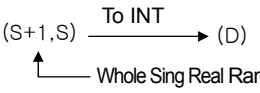
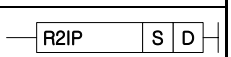
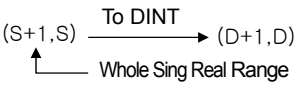
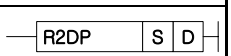
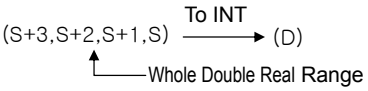
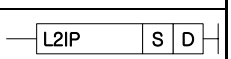
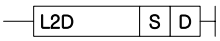
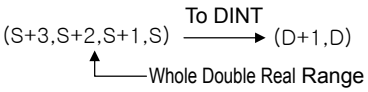
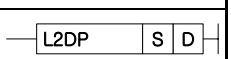
## (1) Data Transfer Instruction (continued)

| 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); b15 b0; To 4bit BCD; (Db): Bit | ○ | ○ |
| | BCD4P | BCD4P Sb Db | | | |
| | BCD8 | BCD8 Sb Db | (Sb):Bit, BIN(0~99); b15 b0; 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); b15 b0; To 4bit BIN; (Db):Bit | ○ | ○ |
| | BIN4P | BIN4P Sb Db | | | |
| | BIN8 | BIN8 Sb Db | (Sb):Bit, BCD(0~99); b15 b0; 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 |  |  | ○ | ○ |
| | I2RP |  | | | |
| | I2L |  |  | ○ | ○ |
| | I2LP |  | | | |
| 32 Bits Integer/Real Conversion | D2R |  |  | ○ | ○ |
| | D2RP |  | | | |
| | D2L |  |  | ○ | ○ |
| | D2LP |  | | | |
| Short Real/Integer Conversion | R2I |  |  | ○ | ○ |
| | R2IP |  | | | |
| | R2D |  |  | ○ | ○ |
| | R2DP |  | | | |
| Long Real/Integer Conversion | L2I |  |  | ○ | ○ |
| | L2IP |  | | | |
| | L2D |  |  | ○ | ○ |
| | L2DP |  | | | |

**Remark**

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))<br>⋮<br>CMP(S1+15,S2+15)<br>Result:(D) ~ (D+15), 1 if identical | ○ | ○ |
| | TCMPP | TCMPP S1 S2 D | | | |
| | DTCMP | DTCMP S1 S2 D | CMP((S1+1,S1),(S2+1,S2))<br>⋮<br>CMP((S1+31,S1+30),(S2+31,S2+30))<br>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<br>( 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 | | | |

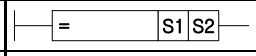
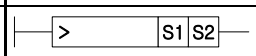
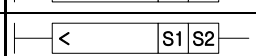
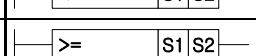
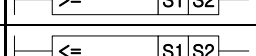
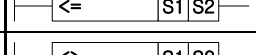
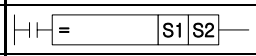
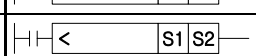
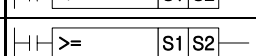
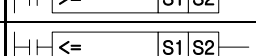
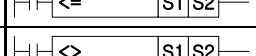
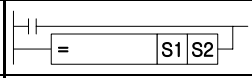
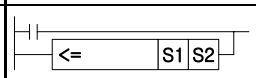
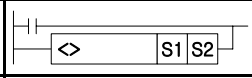
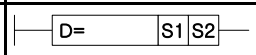
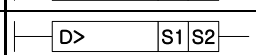
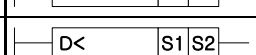
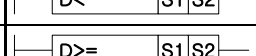
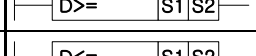
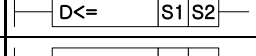
**Remark**

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= |  | Compares (S1) to (S2), and saves its result in Bit Result(BR) (Signed Operation) | ○ | ○ |
| | LOAD> |  | | | |
| | LOAD< |  | | | |
| | LOAD>= |  | | | |
| | LOAD<= |  | | | |
| | LOAD<> |  | | | |
| 16 Bits Data Compare (AND) | AND= |  | Performs AND operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | AND> |  | | | |
| | AND< |  | | | |
| | AND>= |  | | | |
| | AND<= |  | | | |
| | AND<> |  | | | |
| 16 Bits Data Compare (OR) | OR= |  | Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | OR<= |  | | ○ | ○ |
| | OR<> |  | | | |
| 32 Bits Data Compare (LOAD) | LOADD= |  | Compares (S1) to (S2), and saves its result in Bit Result(BR) (Signed Operation) | | |
| | LOADD> |  | | | |
| | LOADD< |  | | | |
| | LOADD>= |  | | | |
| | LOADD<= |  | | | |
| | LOADD<> |  | | | |

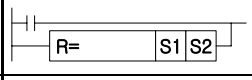
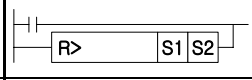
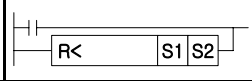
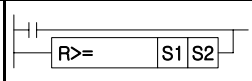
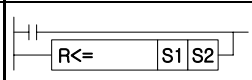
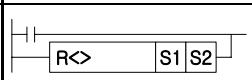
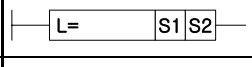
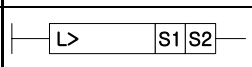
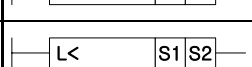
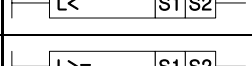
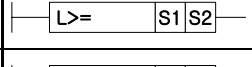
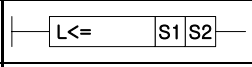
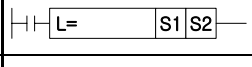
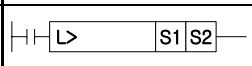
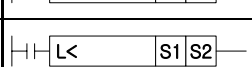
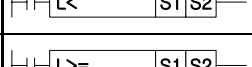
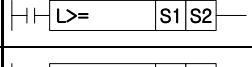
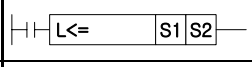
**Remark**

Comparison instruction for input process the result of Signed comparison instruction generally. To process Unsigned comparison, Use comparison instruction for input.

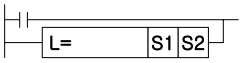
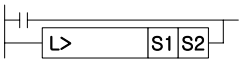
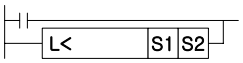
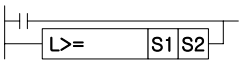
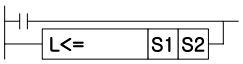
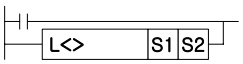
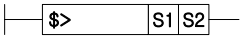
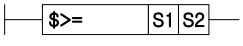
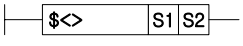
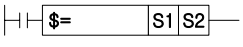
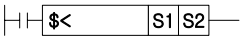
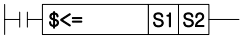
## (4) Comparison instruction (continued)

| 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 | | | |

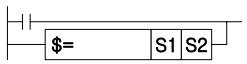
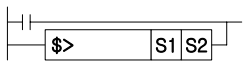
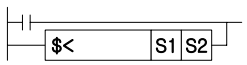
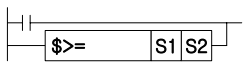
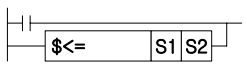
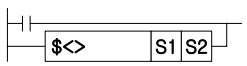
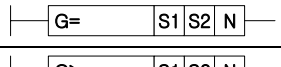
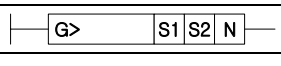
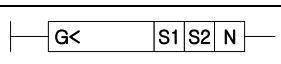
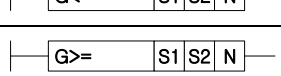
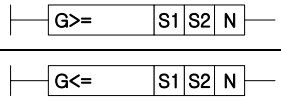
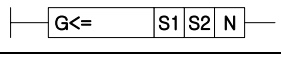
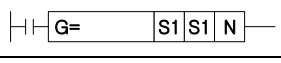
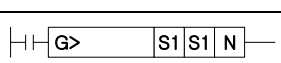
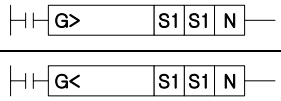
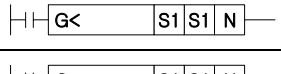
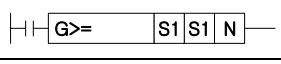
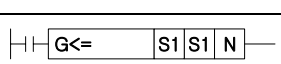
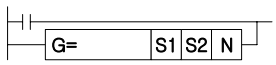
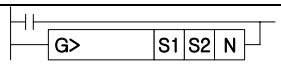
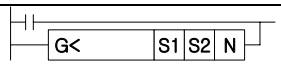
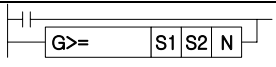
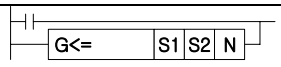
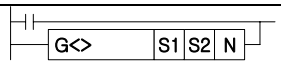
## (4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Real Number Compare (OR) | ORR= |  | Compares (S1+1,S1) to (S2+1,S2) and saves its result in Bit Result (BR) (Signed Operation) | ○ | ○ |
| | ORR> |  | | | |
| | ORR< |  | | | |
| | ORR>= |  | | | |
| | ORR<= |  | | | |
| | ORR<> |  | | | |
| Long Real Number Compare (LOAD) | LOADL= |  | Compares (S1+3,S1+2,S1+1,S) to (S2+3,S2+2, S2+1,S2) and saves its result in Bit Result(BR) (Signed Operation) | ○ | ○ |
| | LOADL> |  | | | |
| | LOADL< |  | | | |
| | LOADL>= |  | | | |
| | LOADL<= |  | | | |
| | LOADL<> |  | | | |
| Long Real Number Compare (AND) | ANDL= |  | Performs AND operation of (S1+ 1,S1) & (S2+1,S2) Compare Result and Bit Result(BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | ANDL> |  | | | |
| | ANDL< |  | | | |
| | ANDL>= |  | | | |
| | ANDL<= |  | | | |
| | ANDL<> |  | | | |

## (4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Double Real Number Compare (OR) | ORL= |  | Performs OR operation of (S1 +1,S1) & (S2+1,S2) Compare Result and Bit Result(BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | ORL> |  | | | |
| | ORL< |  | | | |
| | ORL>= |  | | | |
| | ORL<= |  | | | |
| | ORL<> |  | | | |
| String Compare (LOAD) | LOAD$= |  | Compares (S1) to (S2) Starting String and saves its result in Bit Result(BR) | ○ | ○ |
| | LOAD$> |  | | | |
| | LOAD$< |  | | | |
| | LOAD$>= |  | | | |
| | LOAD$<= |  | | | |
| | LOAD$<> |  | | | |
| String Compare (AND) | AND$= |  | Performs AND operation of (S 1) & (S2) Starting String Compare Result and Bit Result(BR), and then saves its result in BR | ○ | ○ |
| | AND$> |  | | | |
| | AND$< |  | | | |
| | AND$>= |  | | | |
| | AND$<= |  | | | |
| | AND$<> |  | | | |

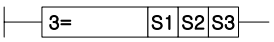
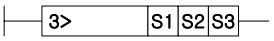
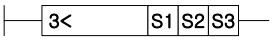
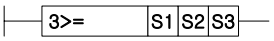
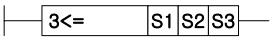
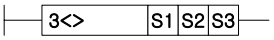
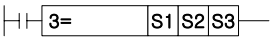
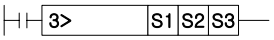
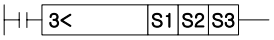
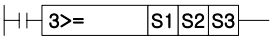
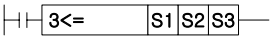
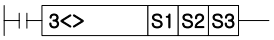
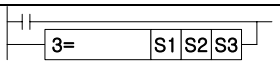
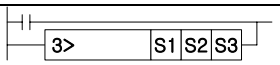
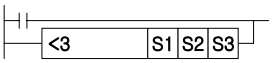
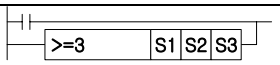
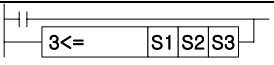
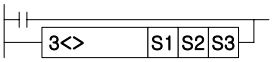
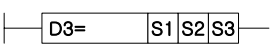
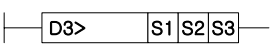
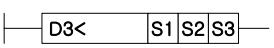
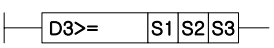
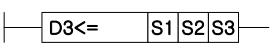
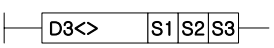
## (4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| String Compare (OR) | OR$= |  | Performs OR operation of (S1) & (S2) Starting String Compare Result and Bit Result(BR), and then saves its result in BR | ○ | ○ |
| | OR$> |  | | | |
| | OR$< |  | | | |
| | OR$>= |  | | | |
| | OR$<= |  | | | |
| | OR$<> |  | | | |
| 16 Bits Data Group Compare (LOAD) | LOADG= |  | 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> |  | | | |
| | LOADG< |  | | | |
| | LOADG>= |  | | | |
| | LOADG<= |  | | | |
| | LOADG<> |  | | | |
| 16 Bits Data Group Compare (AND) | ANDG= |  | 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> |  | | | |
| | ANDG< |  | | | |
| | ANDG>= |  | | | |
| | ANDG<= |  | | | |
| | ANDG<> |  | | | |
| 16 Bits Data Group Compare (OR) | ORG= |  | 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> |  | | | |
| | ORG< |  | | | |
| | ORG>= |  | | | |
| | ORG<= |  | | | |
| | ORG<> |  | | | |

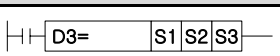
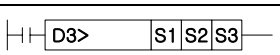
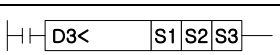
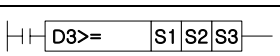
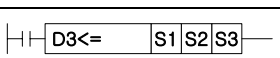
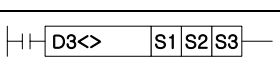
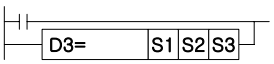
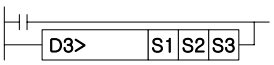
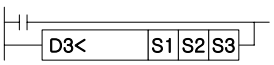
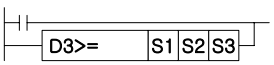
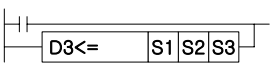
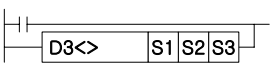
## (4) Comparison instruction (continued)

| 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= |  | Saves 1 in Bit Result(BR) if each value of (S1), (S2), (S3) meets given condition | ○ | ○ |
| | LOAD3> |  | | | |
| | LOAD3< |  | | | |
| | LOAD3>= |  | | | |
| | LOAD3<= |  | | | |
| | LOAD3<> |  | | | |
| Three 16-Bit Data Compare (AND) | AND3= |  | Performs AND operation of (S1), (S2), (S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | AND3> |  | | | |
| | AND3< |  | | | |
| | AND3>= |  | | | |
| | AND3<= |  | | | |
| | AND3<> |  | | | |
| Three 32-Bit Data Compare (OR) | OR3= |  | Performs OR operation of (S1), (S2), (S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | OR3> |  | | | |
| | OR3< |  | | | |
| | OR3>= |  | | | |
| | OR3<= |  | | | |
| | OR3<> |  | | | |
| Three 16-Bit Data Compare (LOAD) | LOADD3= |  | Saves 1 in Bit Result(BR) if each value of (S1+1,S1), (S2+ 1,S2), (S3+1,S3) meets given condition | ○ | ○ |
| | LOADD3> |  | | | |
| | LOADD3< |  | | | |
| | LOADD3>= |  | | | |
| | LOADD3<= |  | | | |
| | LOADD3<> |  | | | |

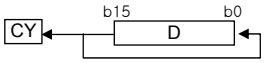
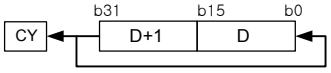
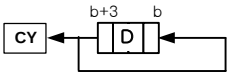
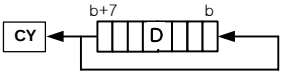
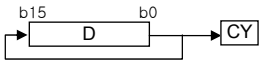
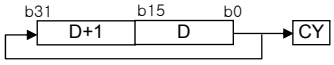
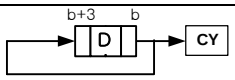
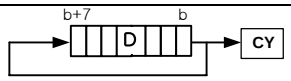
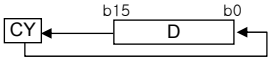
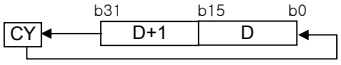
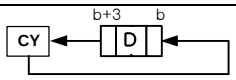
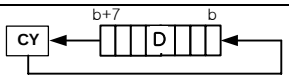
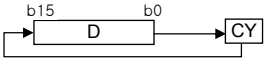
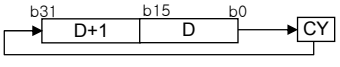
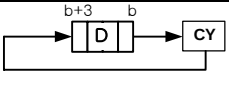
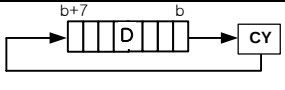
## (4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Three 32-Bit Data Compare (AND) | ANDD3= |  | Performs AND operation of (S1+1,S1), (S2+1,S2), (S3+1,S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | ANDD3> |  | | | |
| | ANDD3< |  | | | |
| | ANDD3>= |  | | | |
| | ANDD3<= |  | | | |
| | ANDD<> |  | | | |
| Three 32-Bit Data Compare (OR) | ORD3= |  | Performs OR operation of (S1+1, S1), (S2+1,S2), (S3+1,S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | ORD3> |  | | | |
| | ORD3< |  | | | |
| | ORD3>= |  | | | |
| | ORD3<= |  | | | |
| | ORD3<> |  | | | |

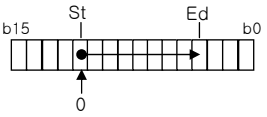
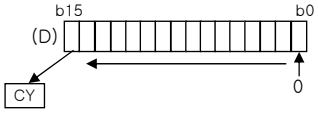
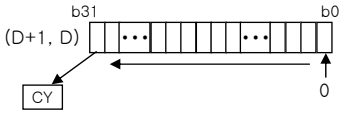
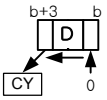
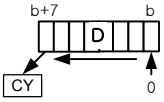
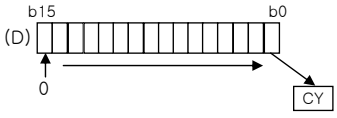
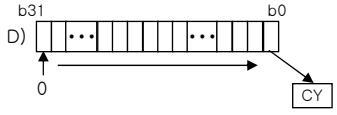
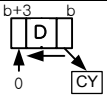
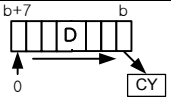
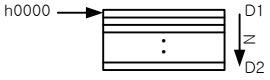
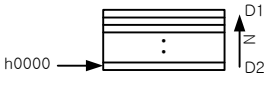
## (5) Increase/Decrease instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| BIN Data Increase / Decrease (Signed) | INC | INC D | (D)+1 → (D) | 2 | 4-94 |
| | INCP | INCP D | | | |
| | DINC | DINC D | (D+1,D)+1 → (D+1,D) | 2 | |
| | DINCP | DINCP D | | | |
| | DEC | DEC D | (D)−1 → (D) | 2 | 4-96 |
| | DECP | DECP D | | | |
| | DDEC | DDEC D | (D+1,D)−1 → (D+1,D) | 2 | |
| | DDECP | DDECP D | | | |
| 4/8 Bits Data Increase / Decrease (Signed) | INC4 | INC4 Db | (D:x bit ~ D:x bit+4) + 1 → (D:x bit ~ D:x bit+4) | 2 | 4-95 |
| | INC4P | INC4P Db | | 3 | |
| | INC8 | INC8 Db | (D:x bit ~ D:x bit+8) + 1 → (D:x bit ~ D:x bit+8) | 2 | |
| | INC8P | INC8P Db | | 3 | |
| | DEC4 | DEC4 Db | (D:x bit ~ D:x bit+4) − 1 → (D:x bit ~ D:x bit+4) | 2 | 4-97 |
| | DEC4P | DEC4P Db | | 3 | |
| | DEC8 | DEC8 Db | (D:x bit ~ D:x bit+8) − 1 → (D:x bit ~ D:x bit+8) | 2 | |
| | DEC8P | DEC8P Db | | 3 | |
| BIN Data Increase / Decrease (Unsigned) | INCU | INCU D | (D)+1 → (D) | 2 | 4-98 |
| | INCUP | INCUP D | | | |
| | DINCU | DINCU D | (D+1,D)+1 → (D+1,D) | 2 | |
| | DINCUP | DINCUP D | | | |
| | DECU | DECU D | (D)−1 → (D) | 2 | 4-99 |
| | DECUP | DECUP D | | | |
| | DDECU | DDECU D | (D+1,D)−1 → (D+1,D) | 2 | |
| | DDECUP | DDECUP D | | | |

## (6) Rotation instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Rotate to Left | ROL | ROL D n |  | ○ | ○ |
| | ROLP | ROLP D n | | | |
| | DROL | DROL D n |  | | |
| | DROLP | DROLP D n | | | |
| 4/8 Bits Rotate to Left | ROL4 | ROL4 Db n |  | ○ | ○ |
| | ROL4P | ROL4P Db n | | | |
| | ROL8 | ROL8 Db n |  | | |
| | ROL8P | ROL8P Db n | | | |
| Rotate to Right | ROR | ROR D n |  | ○ | ○ |
| | RORP | RORP D n | | | |
| | DROR | DROR D n |  | | |
| | DRORP | DRORP D n | | | |
| 4/8 Bits Rotate to Right | ROR4 | ROR4 Db n |  | ○ | ○ |
| | ROR4P | ROR4P Db n | | | |
| | ROR8 | ROR8 Db n |  | | |
| | ROR8P | ROR8P Db n | | | |
| Rotate to Left (including Carry) | RCL | RCL D n |  | ○ | ○ |
| | RCLP | RCLP D n | | | |
| | DRCL | DRCL D n |  | | |
| | DRCLP | DRCLP D n | | | |
| 4/8 Bits Rotate to Left (including Carry) | RCL4 | RCL4 Db n |  | ○ | ○ |
| | RCL4P | RCL4P Db n | | | |
| | RCL8 | RCL8 Db n |  | | |
| | RCL8P | RCL8P Db n | | | |
| Rotate to Right (including Carry) | RCR | RCR D n |  | ○ | ○ |
| | RCRP | RCRP D n | | | |
| | DRCR | DRCR D n |  | | |
| | DRCRP | DRCRP D n | | | |
| 4/8 Bits Rotate to Right (including Carry) | RCR4 | RCR4 Db n |  | ○ | ○ |
| | RCR4P | RCR4P Db n | | | |
| | RCR8 | RCR8 Db n |  | | |
| | RCR8P | RCR8P Db n | | | |

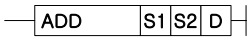
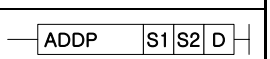
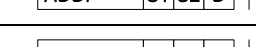
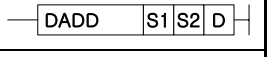
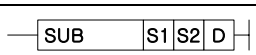
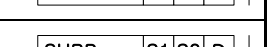
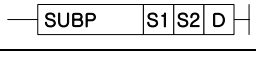
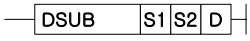
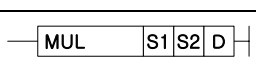
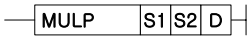
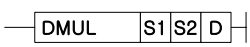
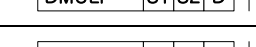
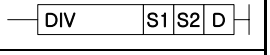
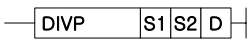
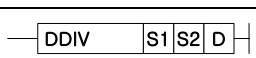
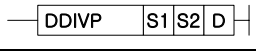
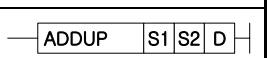
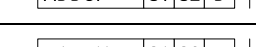
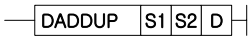
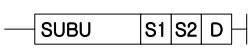
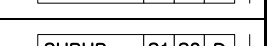
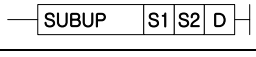
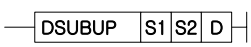
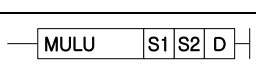
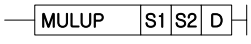
## (7) Move instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Bits Move | BSFT | BSFT St Ed |  | ○ | ○ |
| | BSFTP | BSFTP St Ed | | | |
| Move to Higher Bit | BSFL | BSFL D n |  | ○ | ○ |
| | BSFLP | BSFLP D n | | | |
| | DBSFL | DBSFL D n |  | | |
| | DBSFLP | DBSFLP D n | | | |
| Move to Higher Bit within 4/8 Bits range | BSFL4 | BSFL4 Db n |  | ○ | ○ |
| | BSFL4P | BSFL4P Db n | | | |
| | BSFL8 | BSFL8 Db n |  | | |
| | BSFL8P | BSFL8P Db n | | | |
| Move to Lower Bit | BSFR | BSFR D n |  | ○ | ○ |
| | BSFRP | BSFRP D n | | | |
| | DBSFR | DBSFR D n |  | | |
| | DBSFRP | DBSFRP D n | | | |
| Move to Lower Bit within 4/8 Bits range | BSFR4 | BSFR4 Db n |  | ○ | ○ |
| | BSFR4P | BSFR4P Db n | | | |
| | BSFR8 | BSFR8 Db n |  | | |
| | BSFR8P | BSFR8P Db n | | | |
| Word Move | WSFT | WSFT Et Ed |  | ○ | ○ |
| | WSFTP | WSFTP Et Ed | | | |
| Word Data Move to Left/Right | WSFL | WSFL D1 D2 N |  | ○ | ○ |
| | WSFLP | WSFLP D1 D2 N | | | |
| | WSFR | WSFR D1 D2 N |  | | |
| | WSFRP | WSFRP D1 D2 N | | | |
| Bit Move | SR | SR Db I D N | Moves N bits starting from Db bit along Input direction (I) and Move direction (D) | ○ | ○ |

## (8) Exchange instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Data Exchange | XCHG | XCHG D1 D2 | (D1) ⟷ (D2) | ○ | ○ |
| | XCHGP | XCHGP D1 D2 | | | |
| | DXCHG | DXCHG D1 D2 | (D1+1, D1) ⟷ (D2+1, D2) | | |
| | DXCHGP | DXCHGP D1 D2 | | | |
| Group Data Exchange | GXCHG | GXCHG D1 D2 N | (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 |  | (S1)+(S2) ⟶ (D) | ○ | ○ |
| | ADDP |  | | | |
| | DADD |  | (S1+1,S1)+(S2+1,S2) ⟶ (D+1,D) | | |
| | DADDP |  | | | |
| Integer Subtraction (Signed) | SUB |  | (S1)−(S2) ⟶ (D) | ○ | ○ |
| | SUBP |  | | | |
| | DSUB |  | (S1+1,S1)−(S2+1,S2) ⟶ (D+1,D) | | |
| | DSUBP |  | | | |
| Integer Multiplication (Signed) | MUL |  | (S1)×(S2) ⟶ (D+1,D) | ○ | ○ |
| | MULP |  | | | |
| | DMUL |  | (S1+1,S1)×(S2+1,S2) ⟶ (D+3,D+2,D+1,D) | | |
| | DMULP |  | | | |
| Integer Division (Signed) | DIV |  | (S1)÷(S2) ⟶ (D) Quotient, (D+1) Remainder | ○ | ○ |
| | DIVP |  | | | |
| | DDIV |  | (S1+1,S1)÷(S2+1,S2) ⟶ (D+1,D) Quotient, (D+3,D+2) Remainder | | |
| | DDIVP |  | | | |
| Integer Addition (Unsigned) | ADDU |  | (S1)+(S2) ⟶ (D) | ○ | ○ |
| | ADDUP |  | | | |
| | DADDU |  | (S1+1,S1)+(S2+1,S2) ⟶ (D+1,D) | | |
| | DADDUP |  | | | |
| Integer Subtraction (Unsigned) | SUBU |  | (S1)−(S2) ⟶ (D) | ○ | ○ |
| | SUBUP |  | | | |
| | DSUBU |  | (S1+1,S1)−(S2+1,S2) ⟶ (D+1,D) | | |
| | DSUBUP |  | | | |
| Integer Multiplication (Unsigned) | MULU |  | (S1)×(S2) ⟶ (D+1,D) | ○ | ○ |
| | MULUP |  | | | |
| | DMULU |  | (S1+1,S1)×(S2+1,S2) ⟶ (D+3,D+2,D+1,D) | | |
| | DMULUP |  | | | |

## (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 | | | |

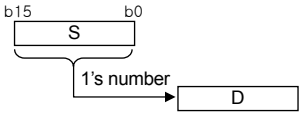
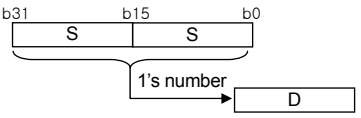
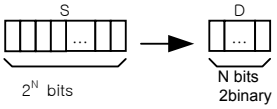
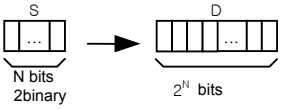
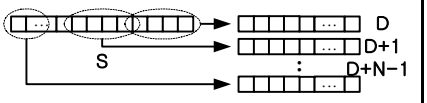
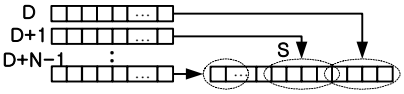
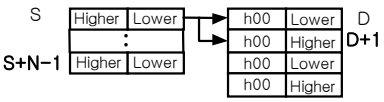
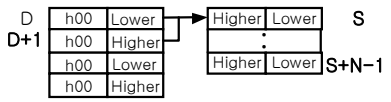
## (10) BCD operation instruction

| 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 | | | |

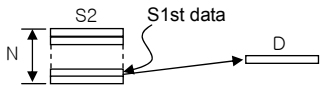
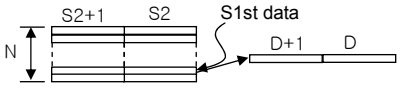
## (11) Logic operation instruction

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| Logic Multiplication | WAND | WAND S1 S2 D | Word AND<br>(S1) ∧ (S2) ⟶ (D) | ○ | ○ |
| | WANDP | WANDP S1 S2 D | | | |
| | DWAND | DWAND S1 S2 D | DWord AND<br>(S1+1,S1) ∧ (S2+1,S2) ⟶ (D+1,D) | | |
| | DWANDP | DWANDP S1 S2 D | | | |
| Logic Addition | WOR | WOR S1 S2 D | Word OR<br>(S1) ∨ (S2) ⟶ (D) | ○ | ○ |
| | WORP | WORP S1 S2 D | | | |
| | DWOR | DWOR S1 S2 D | DWord OR<br>(S1+1,S1) ∨ (S2+1,S2) ⟶ (D+1,D) | | |
| | DWORP | DWORP S1 S2 D | | | |
| Exclusive OR | WXOR | WXOR S1 S2 D | Word Exclusive OR<br>(S1) ⊻ (S2) ⟶ (D) | ○ | ○ |
| | WXORP | WXORP S1 S2 D | | | |
| | DWXOR | DWXOR S1 S2 D | DWord Exclusive OR<br>(S1+1,S1) ⊻ (S2+1,S2) ⟶ (D+1,D) | | |
| | DWXORP | DWXORP S1 S2 D | | | |
| Exclusive NOR | WXNR | WXNR S1 S2 D | Word Exclusive NOR<br>$(S1) \overline{\vee} (S2) \longrightarrow (D)$ | ○ | ○ |
| | WXNRP | WXNRP S1 S2 D | | | |
| | DWXNR | DWXNR S1 S2 D | DWord Exclusive NOR<br>$(S1+1,S1) \overline{\vee} (S2+1,S2) \longrightarrow (D+1,D)$ | | |
| | 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 | $\overline{(S1)} \vee (S2) = (D)$ N | ○ | ○ |
| | GWXNRP | GWXNRP S1 S2 D N | | | |

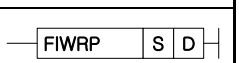
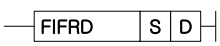
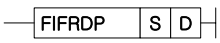
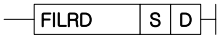
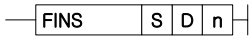
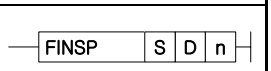
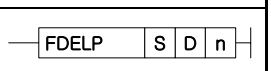
## (12) Data process instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Bit Check | BSUM | BSUM S D |   | ○ | ○ |
| | BSUMP | BSUMP S D | | | |
| | DBSUM | DBSUM S D |   | | |
| | DBSUMP | DBSUMP S D | | | |
| Bit Reset | BRST | BRST D N | Resets N Bits (starting from D) to 0 | ○ | ○ |
| | BRSTP | BRSTP D N | | | |
| Encode | ENCO | ENCO S D n |   | ○ | ○ |
| | ENCOP | ENCOP S D n | | | |
| Decode | DECO | DECO S D n |   | ○ | ○ |
| | DECOP | DECOP S D n | | | |
| Data Disconnect & Connect | DIS | DIS S D n |   | ○ | ○ |
| | DISP | DISP S D n | | | |
| | UNI | UNI S D n |   | | |
| | UNIP | UNIP S D n | | | |
| Word/ Byte Conversion | WTOB | WTOB S D n |   | ○ | ○ |
| | WTOBP | WTOBP S D n | | | |
| | BTOW | BTOW S D n |   | | |
| | BTOWP | BTOWP S D n | | | |
| I/O Refresh | IORF | IORF S1 S2 S3 | Right after masking I/O data (located on S1) with S2 and S3 data, perform process | ○ | ○ |
| | IORFP | IORFP S1 S2 S3 | | | |
| Data Search | SCH | SCH S1 S2 D N | Finds S1 value within S2 ~ N range and saves the first identical valued position in D and S1's identical valued total number in D+1 | ○ | ○ |
| | SCHP | SCHP S1 S2 D N | | | |
| | DSCH | DSCH S1 S2 D N | | | |
| | DSCHP | DSCHP S1 S2 D N | | | |
| Max. Value Search | MAX | MAX S D n | Saves the max value in D among N words starting from S | ○ | ○ |
| | MAXP | MAXP S D n | | | |
| | DMAX | DMAX S D n | Saves the max value in D among N double words starting from S | | |
| | DMAXP | DMAXP S D n | | | |

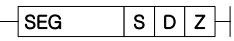
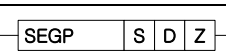
## (12) Data process instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Min. Value Search | MIN | MIN S D n | Saves the min value in D among N words starting from S | ○ | ○ |
| | MINP | MINP S D n | | | |
| | DMIN | DMIN S D n | Saves the min value in D among N double words starting from S | | |
| | DMINP | DMINP S D n | | | |
| Sum | SUM | SUM S D n | Adds up N words starting from S to save in D | ○ | ○ |
| | SUMP | SUMP S D n | | | |
| | DSUM | DSUM S D n | Adds up N double words starting from S to save in D | | |
| | DSUMP | DSUMP S D n | | | |
| Average | AVE | AVE S D n | Averages N words starting from S to save in D | ○ | ○ |
| | AVEP | AVEP S D n | | | |
| | DAVE | DAVE S D n | Averages N double words starting from S to save in D | | |
| | DAVEP | DAVEP S D n | | | |
| MUX | MUX | MUX S1 S2 D N |   | ○ | ○ |
| | MUXP | MUXP S1 S2 D N | | | |
| | DMUX | DMUX S1 S2 D N |   | | |
| | DMUXP | DMUXP S1 S2 D N | | | |
| Data Detect | DETECT | DETECT S1 S2 D N | Detects N data from S1, to save the first value larger than S2 in D, and the extra number in D+1 | ○ | ○ |
| | DETECTP | DETECTP S1 S2 D N | | | |
| Ramp Signal Output | RAMP | RAMP n1 n2 D1 n3 D2 | Saves linear-changed value in D1 during n3 scanning of initial value n1 to final n2 and present scanning number in D1+1, and changes D2 value to ON after completed | ○ | ○ |
| Data Align | SORT | SORT S n1 n2 D1 D2 | S : Head Address of Sort Data<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 |  | Adds S to the last of Data Table D ~ D+N, and increases Data Table Length(N) saved in D by 1 | ○ | ○ |
| | FIWRP |  | | | |
| First-input Data Read | FIFRD |  | 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 |  | | | |
| Last-Input Data Read | FILRD |  | 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 |  | | | |
| Data Insert | FIINS |  | 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 |  | | | |
| Data Pull | FIDEL |  | 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 |  | | | |

## (14) Display instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 7 Segment Display | SEG |  | Converts S Data to 7-Segment as adjusted in Z Format so to save in D | ○ | ○ |
| | SEGP |  | | | |

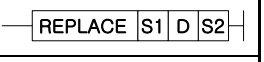
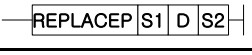
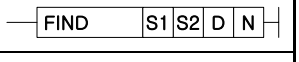
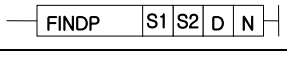
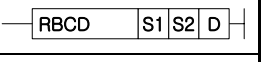
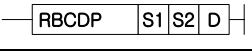
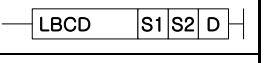
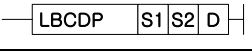
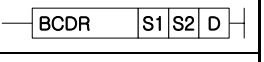
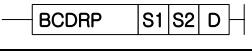
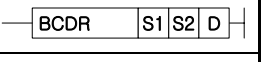
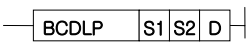
## (15) String Process instruction

| 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 | | | |

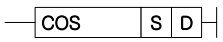
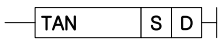
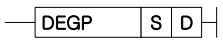
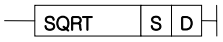
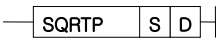
## (15) String process instruction (continued)

| 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 | | | |

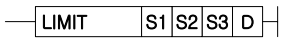
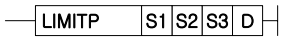
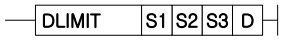
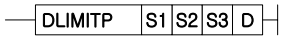
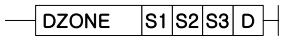
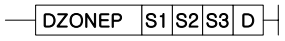
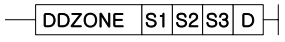
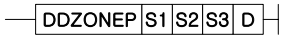
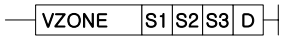
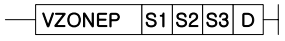
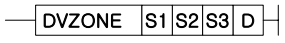
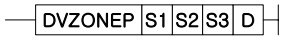
## (15) String process instruction (continued)

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| String Random Replace | REPLACE |  | Processes S1 String as applicable to S2 Condition to save in D String | ○ | ○ |
| | REPLACEP |  | | | |
| String Find | FIND |  | Finds identical String to S2 in S1 ~ N data to save the absolute position in D | ○ | ○ |
| | FINDP |  | | | |
| Parse Real Number to BCD | RBCD |  | Adjusts Floating decimal point point Real Number Data S1 to S2 place to convert to BCD, and then to save in D | ○ | X |
| | RBCDP |  | | | |
| | LBCD |  | Adjusts Floating decimal point point Double Real Number Data S1 to S2 place to convert to BCD, and then to save in D | | |
| | LBCDP |  | | | |
| Convert BCD Data to Real Number | BCDR |  | Adjusts BCD Data S1 to S2 place to convert to Floating decimal point point Real Number, and then to save in D | ○ | X |
| | BCDRP |  | | | |
| | BCDL |  | Adjusts BCD Data S1 to S2 place to convert to Floating decimal point point Double Real Number, and then to save in D | | |
| | BCDLP |  | | | |

## (16) Special function instruction

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| SIN Operation | SIN |  | SIN(S+1,S) ⟶ (D+1,D) | ○ | ○ |
| | SINP |  | | | |
| COS Operation | COS |  | COS(S+1,S) ⟶ (D+1,D) | ○ | ○ |
| | COSP |  | | | |
| TAN Operation | TAN |  | TAN(S+1,S) ⟶ (D+1,D) | ○ | ○ |
| | TANP |  | | | |
| RAD Conversion | RAD |  | (S+1,S) ⟶ (D+1,D)<br>Converts angle to radian | ○ | ○ |
| | RADP |  | | | |
| Angle Conversion | DEG |  | (S+1,S) ⟶ (D+1,D)<br>Converts radian to angle | ○ | ○ |
| | DEGP |  | | | |
| Square Root Operation | SQRT |  | $\sqrt{(S+1,S)}$ ⟶ (D+1,D) | ○ | ○ |
| | SQRTP |  | | | |

## (17) Data control instruction

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| Limit Control | LIMIT |  | If S1 < S2, then D = S2<br>If S2 < S1 < S3, then D = S1<br>If S3 < S1, then D = S3 | ○ | ○ |
| | LIMITP |  | | | |
| | DLIMIT |  | | | |
| | DLIMITP |  | | | |
| Dead-zone Control | DZONE |  | If S1 < -S2, then D = S1+S2-S2(S3/100)<br>If –S2 < S1 < S2, then D = (S3/100)S1<br>If S1 < S2, then D = S1-S2+S2(S3/100) | ○ | ○ |
| | DZONEP |  | | | |
| | DDZONE |  | | | |
| | DDZONEP |  | | | |
| Vertical-zone Control | VZONE |  | If S1 < -S2(S3/100), then D = S1-S2+S2(S3/100)<br>If –S2(S3/100) <S1< S2(S3/100), then D = (100/S3)S1<br>If S1 < S2(S3/100), then D = S1+S2-S2(S3/100) | ○ | ○ |
| | VZONEP |  | | | |
| | DVZONE |  | | | |
| | DVZONEP |  | | | |
| Built-in PID Control Instruction | PIDRUN |  | Operates PID Loop N | ○ | ○ |
| | PIDPAUSE |  | Stops PID Loop N momentarily | ○ | X |
| | PIDPRMT |  | Changes PID Loop N's Parameter. ( SV(word) / Ts(word) / Kp(real) / Ti(real) / Td(real) ) | ○ | X |
| | PIDAT |  | Start of PID loop Auto-tuning | X | ○ |
| | PIDCAS |  | Start of PID loop cascade operation | X | ○ |
| | PIDHBD |  | Start of PID loop combination operation | X | ○ |

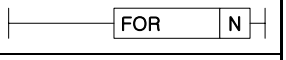
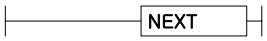
## (18) Time related instruction

| 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 | | | |

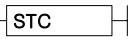
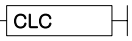
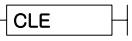
## (19) Divergence instruction

| 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 | | |

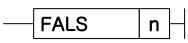
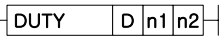
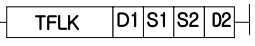
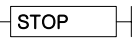
## (20) Loop instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Loop Instruction | FOR |  | Operates FOR~NEXT section n times | ○ | ○ |
| | NEXT |  | | | |
| | BREAK |  | Escapes from FOR~NEXT section | ○ | ○ |

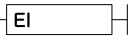
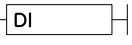
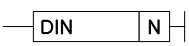
## (21) Flag instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Carry Flag Set, Reset | STC |  | Carry Flag ( F0112 ) SET | ○ | ○ |
| | CLC |  | Carry Flag ( F0112 ) RESET | | |
| Error Flag Clear | CLE |  | Error Latch Flag (F0115) RESET | ○ | ○ |

## (22) System instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Error Display | FALS |  | Self Diagnosis (Error Display ) | ○ | ○ |
| Scan Cluck | DUTY |  | On during n1 Scan, Off during n2 Scan | ○ | ○ |
| Time Cluck | TFLK |  | On during S1 set time, Off during S2 set time | ○ | ○ |
| WDT Initialize | WDT |  | Watch Dog Timer Clear | ○ | ○ |
| | WDTP |  | | | |
| Output Control | OUTOFF |  | All Output Off | ○ | ○ |
| Operation Stop | STOP |  | Finishes applicable scan to end PLC Operation | ○ | ○ |
| Emergent Operation Stop | ESTOP |  | Ends PLC operation right after Instruction executed | ○ | ○ |

## (23) Interrupt related instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| All Channels Interrupt Setting | EI |  | All Channels Interrupt allowed | ○ | ○ |
| | DI |  | All Channel Interrupt prohibited | | |
| Individual Channel Interrupt Setting | EIN |  | Individual Channel Interrupt allowed | ○ | ○ |
| | DIN |  | Individual Channel Interrupt prohibited | | |

## (24) Sign reversion instruction

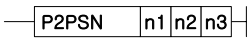
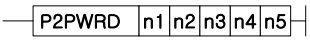
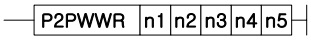
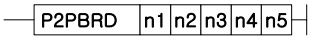
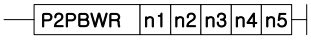
| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 2's complement | NEG | NEG D | Saves D value again in D with 2's complement taken | ○ | ○ |
| | NEGP | NEGP D | | | |
| | DNEG | DNEG D | Saves (D+1,D) value again in (D+1,D) with 2's complement taken | | |
| | DNEGP | DNEGP D | | | |
| Real Number Data Sign Reverse | RNEG | RNEG D | Reverses D Real Number Sign then to save again | ○ | ○ |
| | RNEGP | RNEGP D | | | |
| | LNEGR | LNEG D | Reverses D Double Real Number Sign then to save again | | |
| | LNEGP | LNEGP D | | | |
| Absolute Value Operation | ABS | ABS D | Converts D highest Bit to 0 | ○ | ○ |
| | ABSP | ABSP D | | | |
| | DABS | DABS D | Converts (D+1,D) highest Bit to 0 | | |
| | DABSP | DABSP D | | | |

## (25) File related instruction

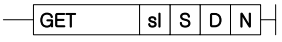
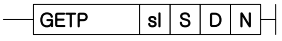
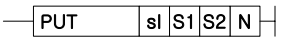
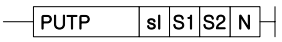
| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Block Conversion | RSET | RSET S | Changes Block Number of file register to S Number | ○ | X |
| | RSETP | RSETP S | | | |
| Flash Word Data Transfer | EMOV | EMOV S1 S2 D | Transfers S2 word data in S1 Block to D | o | X |
| | EMOVP | EMOVP S1 S2 D | | | |
| Flash Double Word Data Transfer | EDMOV | EDMOV S1 S2 D | Transfers S2+1, S2 double word data in S1 Block to D+1, D | | |
| | EDMOVP | EDMOVP S1 S2 D | | | |
| Block Read | EBREAD | EBREAD S1 S2 | Reads Flash Memory Block | ○ | X |
| Block Write | EBWRITE | EBWRITE S1 S2 | Writes Flash Memory Block | ○ | X |
| Block Compare | EBCMP | EBCMP S1 S2 D1 D2 | Compares R Area's Bank with Flash Area's Block | ○ | X |

# Appendix 4.4 Special/Communication Instruction

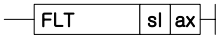
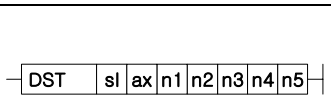
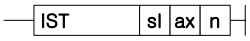
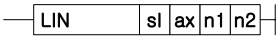
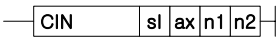
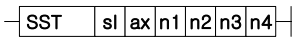
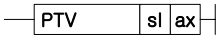
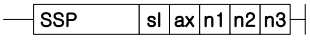
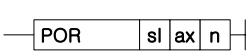
## (1) Communication module related instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Station No. Set | P2PSN |  | Sets opposite station No. for P2P Communication. n1:P2P No., n2:Block, n3:Station No. | ○ | X |
| Read Area Set (WORD) | P2PWRD |  | Sets word data Read Area n1:P2P No., n2:Block, n3:Variable sequence, n4:Variable Size, n5:Device | ○ | X |
| Write Area Set (WORD) | P2PWWR |  | Sets word data Write Area n1:P2P No., n2:Block, n3:Variable sequence, n4:Variable Size, n5:Device | ○ | X |
| Read Area Set (BIT) | P2PBRD |  | Sets bit data Read Area n1:P2P No., n2:Block, n3:Variable sequence, n4: Variable Size, n5:Device | ○ | X |
| Write Area Set (BIT) | P2PBWR |  | Sets bit data Write Area n1:P2P No., n2:Block, n3:Variable sequence,n4:Variable Size, n5:Device | ○ | X |

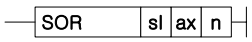
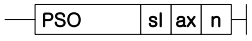
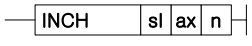
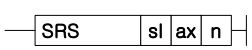
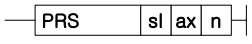
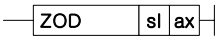
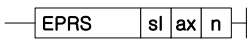
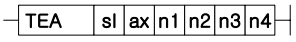
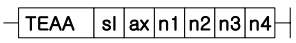
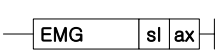
## (2) Special module common instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Special Module Read/Write | GET |  | Reads data of special module memory is installed on | ○ | ○ |
| | GETP |  | | | |
| | PUT |  | Writes data on special module memory is installed on | ○ | ○ |
| | PUTP |  | | | |

## (3) Exclusive positioning instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Return to Origin Point | ORG |  | Instructions Positioning Module's ax axis installed on sl slot to return to Origin Point | ○ | ○ |
| Floating Origin Point | FLT |  | Instructions Positioning Module's ax axis installed on sl slot to set Floating Origin Point | ○ | ○ |
| Direct Start | DST |  | 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 |  | Instructions Positioning Module's ax axis installed on sl slot to start n step indirectly | ○ | ○ |
| Linear Interpolation | LIN |  | Instructions Positioning Module's ax axis installed on sl slot to let n2 axes operate n1 step by Linear Interpolation | ○ | ○ |
| Circular Interpolation | CIN |  | Instructions Positioning Module's ax axis installed on sl slot to let n2 axes operate n1 step by Circular Interpolation | ○ | X |
| Simultaneous Start | SST |  | 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 |  | Instructions Positioning Module's ax axis installed on sl slot to switch Speed to Position Control | ○ | ○ |
| Position/Speed Control Switch | PTV |  | Instructions Positioning Module's ax axis installed on sl slot to switch Position to Speed Control | ○ | ○ |
| Decelerated Stop | STP |  | Instructions Positioning Module's ax axis installed on sl slot to stop as decelerated. | ○ | ○ |
| Skip | SKP |  | Instructions Positioning Module's ax axis installed on sl slot to skip | ○ | X |
| Position Synchronization | SSP |  | 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 |  | 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 |  | 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 |  | 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 |  | 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 |  | Instructions Positioning Module's ax axis installed on sl slot to operate continuously to n step | ○ | X |
| Inching | INCH |  | Instructions Positioning Module's ax axis installed on sl slot to inch to n position | ○ | ○ |
| Return to Position Previous to Manual Operation | RTP |  | Instructions Positioning Module's ax axis installed on sl slot to return to position previous to manual operation | ○ | X |
| Operation Step Change | SNS |  | Instructions Positioning Module's ax axis installed on sl slot to change operation step to n | ○ | ○ |
| Repeated Operation Step Change | SRS |  | Instructions Positioning Module's ax axis installed on sl slot to change repeated operation step to n | ○ | X |
| M Code Off | MOF |  | Instructions Positioning Module's ax axis installed on sl slot to make M code off | ○ | ○ |
| Present Position Change | PRS |  | Instructions Positioning Module's ax axis to change present position to n | ○ | ○ |
| Zone Allowed | ZOE |  | Allows zone output of Positioning Module installed on sl slot | ○ | X |
| Zone Prohibited | ZOD |  | Prohibits zone output of Positioning Module installed on sl slot | ○ | X |
| Encoder Value change | EPRS |  | Changes Encoder Value of Positioning Module installed on sl slot to n | ○ | X |
| Teaching | TEA |  | Changes n1 step's target position or speed of Positioning Module's ax axis installed on sl slot | ○ | X |
| Teaching Array | TEAA |  | Changes multiple target positions or speed of Positioning Module's ax axis installed on sl slot | ○ | X |
| Emergent Stop | EMG |  | Instructions Positioning Module installed on sl slot to perform Emergent Stop | ○ | ○ |

## (5) Exclusive position control instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Error Reset | CLR | CLR sl ax n | Resets Error originated from Positioning Module's ax axis installed on sl slot | ○ | ○ |
| Error History Reset | ECLR | ECLR sl ax | Deletes Error History originated from Positioning Module's ax axis installed on sl slot | ○ | X |
| Point Operation | PST | PST sl ax n | Performs Point Operation of Positioning Module's ax axis installed on sl slot | ○ | X |
| Basic Parameter Teaching | TBP | TBP sl ax n1 n2 | Changes n2 to n1 among basic parameters of Positioning Module's ax axis installed on sl slot | ○ | X |
| Extended Parameter Teaching | TEP | TEP sl ax n1 n2 | Changes n2 to n1 among extended parameters of Positioning Module's ax axis installed on sl slot | ○ | X |
| Return to Origin Point Parameter Teaching | THP | THP sl ax n1 n2 | Changes n2 to n1 among returned parameters to origin point of Positioning Module's ax axis installed on sl slot | ○ | X |
| Manual Operation Parameter Teaching | TMP | TMP sl ax n1 n2 | Changes n2 to n1 among manual operation parameters of Positioning Module's ax axis installed on sl slot | ○ | X |
| Input Signal Parameter Teaching | TSP | TSP sl ax n | Changes input signal parameter of Positioning Module's ax axis installed on sl slot to the value set in n1 | ○ | X |
| Common Parameter Teaching | TCP | TCP sl ax n1 n2 | Changes n2 to n1 among common parameters of Positioning Module installed on sl slot | ○ | X |
| Parameter Save | WRT | WRT sl ax n | Instructions Positioning Module's ax axis installed on sl slot to save present parameter of n axis in flash ROM. | ○ | ○ |
| Present State Read | SRD | SRD sl ax D | Reads and saves present state of Positioning Module's ax axis installed on sl slot in D area of CPU | ○ | X |
| Point Operation Step Write | PWR | PWR sl ax S n1 | Writes value of S area of CPU on point operation step area of Positioning Module's ax axis installed on sl slot in | ○ | X |
| Plural Teaching Data Write | TWR | TWR sl ax S n1 | Writes n value of S area of CPU on plural teaching dada area of Positioning Module's ax axis installed on sl slot in | ○ | X |

## Warranty

1. Warranty Period
   The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty
   Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

   (1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
   (2) Any trouble attributable to others' products,
   (3) If the product is modified or repaired in any other place not designated by the company,
   (4) Due to unintended purposes
   (5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
   (6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

## Environmental Policy

LS Industrial Systems Co.,Ltd supports and observes the environmental policy as below.

### Environmental Management

LS Industrial Systems considers the environmental preservation as the preferential management subject and every staff of LS Industrial Systems use the reasonable endeavors for the pleasurably environmental preservation of the earth.

### About Disposal

LS Industrial Systems' PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product as they are reusable.


**LS values every single customers.**

**Quality and service come first at LSIS.**

**Always at your service, standing for our customers.**

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※ LS Industrial Systems constantly endeavors to improve its product so that information in this manual is subject to change without notice.



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