

User Manual

GLOFA GM4 Series

Programmable Logic Controller



Safety Instructions

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

SAFETY INSTRUCTIONS

To Prevent injury and property damage, follow these instructions. Incorrect operation due to ignoring instructions will cause harm or damage, the seriousness of which is indicated by the following symbols.



DANGER

This symbol indicates the instant death or serious injury if you don't follow instructions



WARNING

This symbol indicates the possibility of death or serious injury



CAUTION

This symbol indicates the possibility of injury or damage to property.

The meaning of each symbol on equipment is as followed



This is the safety alert symbol.

Read and follow instructions carefully to avoid dangerous situation.



This Symbol alerts the user to the presence of "dangerous voltage"

Inside the product that might cause harm or electric shock.

SAFETY INSTRUCTIONS

Design Precautions



Warning

Install a safety circuit external to the PLC that keeps the entire system safe even when there are problems with the external power supply or the PLC module. Otherwise, serious trouble could result from erroneous output or erroneous operation.

Outside the PLC, construct mechanical damage preventing interlock circuits such as emergency stop, protective circuits, positioning upper and lower limits switches and interlocking forward/reverse operation.

When the PLC detects the following problems, it will stop calculation and turn off all output in the case of watchdog timer error, module interface error, or other hardware errors.

However, one or more outputs could be turned on when there are problems that the PLC CPU cannot detect, such as malfunction of output device (relay, transistor, etc.) itself or I/O controller. Build a fail safe circuit exterior to the PLC that will make sure the equipment operates safely at such times. Also, build an external monitoring circuit that will monitor any single outputs that could cause serious trouble.

Make sure all external load connected to output does NOT exceed the rating of output module.

Overcurrent exceeding the rating of output module could cause fire, damage or erroneous operation.

Build a circuit that turns on the external power supply when the PLC main module power is turned on.

If the external power supply is turned on first, it could result in erroneous output or erroneous operation.

SAFETY INSTRUCTIONS

Design Precautions



Caution

Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other. They should be installed 100mm (3.94inch) or more from each other.

Not doing so could result in noise that would cause erroneous operation.

Installation Precautions



Caution

Use the PLC in an environment that meets the general specification contained in this manual or datasheet.

Using the PLC in an environment outside the range of the general specifications could result in electric shock, fire, erroneous operation, and damage to or deterioration of the product.

Completely turn off the power supply before loading or unloading the module.

Not doing so could result in electric shock or damage to the product.

Make sure all modules are loaded correctly and securely.

Not doing so could cause a malfunction, failure or drop.

Make sure I/O and extension connector are installed correctly.

Poor connection could cause an input or output failure.

When install the PLC in environment of much vibration, be sure to insulate the PLC from direct vibration.

Not doing so could cause electric shock, fire, and erroneous operation.

Be sure to there are no foreign substances such as conductive debris inside the module.

Conductive debris could cause fires, damage, or erroneous operation.

SAFETY INSTRUCTIONS

Wiring Precautions

Warning

Completely turn off the external power supply when installing or placing wiring.

Not doing so could cause electric shock or damage to the product.

Make sure that all terminal covers are correctly attached.

Not attaching the terminal cover could result in electric shock.

Caution

Be sure that wiring is done correctly by checking the product's rated voltage and the terminal layout.

Incorrect wiring could result in fire, damage, or erroneous operation.

Tighten the terminal screws with the specified torque.

If the terminal screws are loose, it could result in short circuits, fire, or erroneous operation.

Be sure to ground the FG or LG terminal to the protective ground conductor.

Not doing so could result in erroneous operation.

Be sure there are no foreign substances such as sawdust or wiring debris inside the module.

Such debris could cause fire, damage, or erroneous operation.

SAFETY INSTRUCTIONS

Startup and Maintenance Precautions

Warning

Do not touch the terminals while power is on.

Doing so could cause electric shock or erroneous operation.

Switch all phases of the external power supply off when cleaning the module or retightening the terminal or module mounting screws.

Not doing so could result in electric shock or erroneous operation.

Do not charge, disassemble, heat, place in fire, short circuit, or solder the battery.

Mishandling of battery can cause overheating or cracks which could result in injury and fires.

Caution

Do not disassemble or modify the modules.

Doing so could cause trouble, erroneous operation, injury, or fire.

Switch all phases of the external power supply off before mounting or removing the module.

Not doing so could cause failure or malfunction of the module.

Use a cellular phone or walky-talky more than 30cm (11.81 inch) away from the PLC

Not doing so can cause a malfunction.

Disposal Precaution

Caution

When disposing of this product, treat it as industrial waste.

Not doing so could cause poisonous pollution or explosion.

CONTENTS

Chapter 1. INTRODUCTION

1.1 Guide to User's Manual	1 - 1
1.2 Features	1 - 2
1.3 Terminology	1 - 4

Chapter 2. SYSTEM CONFIGURATION

2.1 Overall Configuration	2 - 1
2.2 System Configuration Component Units List	2 - 2
2.2.1 GM4 series Configuration	2 - 2
2.3 System Configuration Types	2 - 6
2.3.1 Basic System	2 - 6
2.3.2 Computer Link System	2 - 10
2.3.3 Network System	2 - 11

Chapter 3. GENERAL SPECIFICATION

3.1 General Specifications	3 - 1
----------------------------------	-------

Chapter 4. CPU MODULE

4.1 Performance Specifications	4 - 1
4.2 Parts Name and Descriptions	4 - 2
4.3 Operation processing	4 - 4
4.3.1 Operation processing Methods	4 - 4
4.3.2 Operation processing at momentary power failure occurrence	4 - 5
4.3.3 Scan Time	4 - 6
4.3.4 Scan Watchdog Timer	4 - 7
4.3.5 Timer processing	4 - 8
4.3.6 Counter processing	4 - 10

4.4 Program	4 - 12
4.4.1 Program Configuration	4 - 12
4.4.2 Program Execution Procedures	4 - 13
4.4.3 Task	4 - 16
4.4.4 Error Handling	4 - 22
4.4.5 Precautions when using special modules	4 - 23
4.5 Operation Modes	4 - 29
4.5.1 RUN mode	4 - 29
4.5.2 STOP mode	4 - 30
4.5.3 PAUSE mode	4 - 30
4.5.4 DEBUG mode	4 - 30
4.5.5 Operation Mode Change	4 - 31
4.5.6 System Starting Method	4 - 32
4.6 Functions	4 - 34
4.6.1 Restart mode	4 - 34
4.6.2 Selfdiagnosis	4 - 36
4.6.3 Clock function	4 - 36
4.6.4 Remote function	4 - 37
4.6.5 I/O Force On/Off function	4 - 38
4.6.6 Direct I/O Operation function	4 - 39
4.6.7 History Log-In	4 - 39
4.6.8 External Device Error Diagnosis function	4 - 40
4.7 GM4-CPUC Dedicated Functions	4 - 42
4.7.1 Error Mask function	4 - 42
4.7.2 I/O Module Skip function	4 - 43
4.7.3 Online Module Changing Function	4 - 44
4.7.4 I/O Reservation Function	4 - 46
4.7.3 FEnet Reset Function	4 - 47
4.7 Memory Configuration	4 - 48
4.8 I/O No. Allocation Method	4 - 50

Chapter 5. BATTERY

5.1 Specifications	5 - 1
5.2 Precautions for Use	5 - 1
5.3 Battery Replacement	5 - 1

Chapter. 6 MEMORY MODULE AND BUILT-IN FLASH MEMORY

6.1 GM4-CPUA (Using Memory Module)	6 -1
6.1.1 Memory Module.....	6 -1
6.1.2 Method of Writing A User Program to the Memory Module	6 -2
6.1.3 Operation Method	6 -3
6.2 GM4-CPUB (Using Built-in Flash Memory)	6 -4
6.2.1 Operation Mode Setting	6 -4
6.2.2 Starting Program in the Built-in Flash Memory And Operation Method	6 -4
6.3 GM4-CPUC (Using Built-in Flash Memory).....	6 -6
6.3.1 Program Storing Method by Using Built-in Flash Memory.....	6 -6
6.3.2 Setting Operation Mode	6 -9
6.3.3 Upload Program Storing Method by Using Built-in Flash Memory	6 -9

Chapter. 7 INPUT AND OUTPUT MODULES

7.1 Notes on Selecting Input and Output Modules	7 - 1
7.2 Digital Input Module Specifications.....	7 - 2
7.2.1 16-point 12/24VDC input module (source/sink type)	7 - 2
7.2.2 16-point 12/24VDC input module (source type).....	7 - 3
7.2.3 32-point 12/24VDC input module (source/sink type)	7 - 4
7.2.4 32-point 12/24VDC input module (source type).....	7 - 5
7.2.5 16-point 24VDC input module (source/sink type).....	7 - 6
7.2.6 32-point 24VDC input module (source/sink type).....	7 - 7
7.2.7 64-point 12/24VDC input module (source/sink type)	7 - 8
7.2.8 16-point 110VAC input module	7 - 9
7.2.9 16-point 220VAC input module	7 -10
7.2.10 Interrupt input module	7 -11
7.3 Digital Output Module Specifications	7 -12
7.3.1 16-point relay output module.....	7 -12
7.3.2 16-point transistor output module (sink type)	7 -13
7.3.3 16-point transistor output module (source type).....	7 -14
7.3.4 32-point transistor output module (sink type).....	7 -15
7.3.5 32-point transistor output module (source type).....	7 -16
7.3.6 64-point transistor output module (sink type).....	7 -17
7.3.7 16-point triac output module	7 -18
7.4 Digital Input / Output Hybrid Module Specifications	7 -19
7.4.1 8-point 12/24VDC input and 8-point relay output module.....	7 -19
7.4.2 8-point 12/24VDC input and 8-point transistor output module	7 -20

Chapter 8. POWER SUPPLY MODULE

8.1 Selection of power supply module	8 - 1
8.2 Specifications	8 - 3
8.3 Names of Parts	8 – 5

Chapter 9. BASE BOARD AND EXPANSION CABLE

9.1 Specifications	9 - 1
9.1.1 Main Base Board	9 - 1
9.1.2 Expansion Base Board	9 - 2
9.1.3 Expansion Cable	9 - 2
9.2 Names of Parts	9 - 3
9.2.1 Main Base Board	9 - 3
9.2.2 Expansion Base Board	9 – 3

Chapter 10. INSTALLATION AND WIRING

10.1 Installation	10- 1
10.1.1 Installation Environment	10- 1
10.1.2 Handling Instructions	10- 4
10.1.3 Mounting And Dismounting of Module	10- 7
10.2 Wiring	10-9
10.2.1 Power Supply Wiring	10-9
10.2.2 Input and Output Devices Wiring	10-11
10.2.3 Grounding	10-11
10.2.4 Cable Specification for wiring	10-12

Chapter 11. MAINTENANCE

11.1 Maintenance and Inspection	11- 1
11.2 Daily Inspection	11- 1
11.3 Periodic Inspection	11- 2

Chapter 12. TROUBLESHOOTING

12.1 Basic Procedures of Troubleshooting	12- 1
12.2 Troubleshooting	12- 1
12.2.1 Troubleshooting flowchart used when the POWER LED turns OFF	12- 2
12.2.2 Troubleshooting flowchart used when the STOP LED is flickering.....	12- 3
12.2.3 Troubleshooting flowchart used when the RUN and STOP LEDs turn off	12- 4
12.2.4 Troubleshooting flowchart used when the output load of the output module does not turn on	12- 5
12.2.5 Troubleshooting flowchart used when a program cannot be written to the CPU module	12- 6
12.3 Troubleshooting Questionnaire.....	12- 7
12.4 Troubleshooting Examples.....	12- 8
12.4.1 Input circuit troubles and corrective actions.....	12- 8
12.4.2 Output circuit troubles and corrective actions.....	12- 9
12.5 Error Code List.....	12-11

APPENDICES

Appendix 1. System Definitions	APP 1 - 1
Appendix 2. Flag List	APP 2 - 1
Appendix 3. Function/Function Block List.....	APP 3 - 1
Appendix 4. Dimensions	APP 4 - 1

Chapter 1. INTRODUCTION

1.1 Guide to User's Manual

This User's Manual gives the specifications, performance and handling instructions for each of the necessary units of the GLOFA-GM4 series PLC system.

The configuration of the User's Manual is given below.

No	Title	Content
Chapter 1	Introduction	Describes configuration of this manual, units' features and terminology.
Chapter 2	System Configuration	Describes available units and system configurations in the GLOFA-GM4 series.
Chapter 3	General Specifications	Describes general specifications of various units used in the GLOFA-GM4 series.
Chapter 4	CPU Module	Describes the performance, specifications and functions of the CPU module.
Chapter 5	Battery	Describes the specifications and handling instructions for other modules except for the CPU module.
Chapter 6	Memory Module	
Chapter 7	Digital I/O Module	
Chapter 8	Power Supply Module	
Chapter 9	Base Unit and Extension Cable	
Chapter 10	Installation and Wiring	Describes installation, wiring and handling instructions for reliability of the PLC system.
Chapter 11	Maintenance	Describes the check items and method for long term normal operation of the PLC system.
Chapter 12	Troubleshooting	Describes various operation errors and corrective actions.
Appendix 1	System Definitions	Describes parameter setting for basic I/O module and communications module.
Appendix 2	Function/ Function Block List	Describes the types and processing time of function/function block.
Appendix 3	Flag List	Describes the types and content of various flags,
Appendix 4	Outer Dimensions	Shows outer dimensions of the CPU, I/O module and base unit.

REMARK

- 1) This manual does not describes the special/communications module and programming for them.
For their own functions, refer to the related User's Manual.

1.2 Features

1) GLOFA-GM series features:

(1) Design on the basis of international standard specifications(IEC 1131-3)

- Easy programming device support.
- Languages in compliance with IEC1131-3 are given. (IL/ LD / SFC)

(2) Open network by use of communications protocol in compliance with international standard specifications.

(3) High speed processing with an operation-dedicated processor included.

(4) Various special modules that enlarge the range of application of the PLC.

2) GM4-CPUA features :

(1) High speed operation processing

High speed processing of 0.2 μ s/step with an operation-dedicated processor included.

(2) Heightened Self-diagnosis

Cause of errors is easily found as error codes has been more divided in accordance with their contents.

(3) Restart mode setting

The User can set Cold/Warm/Hot restart mode in accordance with the environment. Especially, the User can set a allowed time in the Hot restart mode for exact control of the process.

Allowed Time of Power failure (Maximum : 23h 59m 59s)

(4) Debug operation

On-line debugging is available if the PLC operation mode is set to debug operation mode.

Debugging functions :

- Executed by one instruction.
- Executed by the break-point settings
- Executed by the device status
- Executed by the specified scan times

(5) Various Program Executions

Time driven task, external and internal contact task programs as well as scan program can be executed by setting the execution condition. The user can set variously the program execution mode.

(6) On-line Program Editing

On-line Program Editing is available, therefore the user can test systems easily after it is set up.

(7) Various instruction support

GLOFA PLC can support additional instructions steadily without changing CPU module.

- Various Functions and Function Blocks are supported for various applications.
- User can make great instruction groups through making out user's own functions and function blocks.

3) GM4-CPUB features

GM4-CPUB has the same features with GM4-CPUA, and also it has its own features as follow.

(1) Built-in flash memory

GM4-CPUB has a 512kb built-in flash memory for upload program.

(2) Communication module

Up to 4 communication modules (GM4-CPUA : 2 modules) can be mounted.

(3) Communication modules on expansion base board

Communication module can be mounted on an expansion base board.

4) GM4-CPUC features

GM4-CPUC has the same features with GM4-CPUA, and also it has its own features as follow.

(1) High speed processing

Operation processing of GM4-CPUC is faster than GM4-CPUA/B

- GM4-CPUA/B : 0.2 μ s/step.
- GM4-CPUC : 0.12 μ s/step.

(2) Expanded User Program Capacity

GM4-CPUC has 1M byte program capacity which is bigger than GM4-CPUA/B (128k byte).

(3) Communication module

Up to 4 communication modules (8 modules of Cnet) can be mounted.

(Refer to 2.3.3 Network System for details.)

(4) Flexible Application of Cnet Module

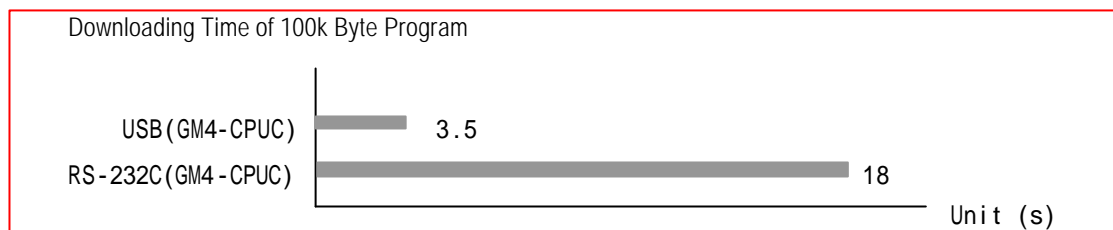
GM4-CPUA/B do not support Cnet Module in expanded base module, however Cnet Module can be mounted on expanded base module in GM4-CPUC. (Refer to 2.3.2 Cnet I/F System for details.)

(5) Flash Memory Writing is available in On-line Editing.

(6) High Speed Communication with GMWIN using USB.

GM4-CPUC can support Maximum 115.2kbps using RS-232C, and also it can support 12Mbps using USB.

User can decrease Program Writing/Reading and Monitoring Time using USB



(7) Maximum 6 expanded base modules are available.

GM4-CPUC supports Maximum 6 expanded base modules using high-performance base modules.

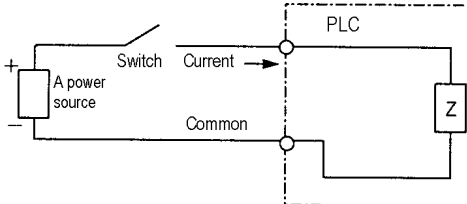
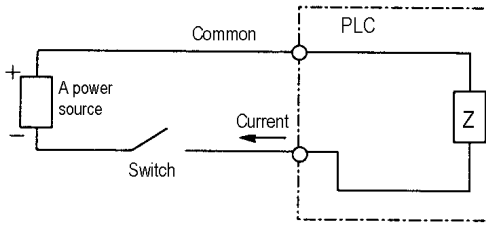
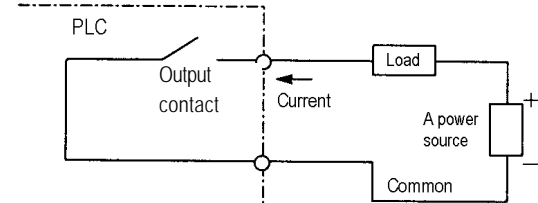
Therefore, Maximum 56 I/O modules can be mounted. Expanding distance is maximum 15 m.

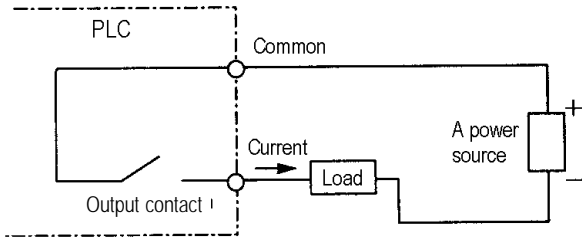
(8) GM4-CPUC can be supported in GMWIN Ver 4.0 or over.

1.3 Terminology

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

Terms	Definition	Remarks
Module	A standard element that has a specified function which configures the system. Devices such as I/O board, which inserted onto the mother board or base unit.	Example) CPU module Power Supply module I/O module
Unit	A module or a module group which is a minimum element to operate and organizes PLC system, and is connected with other modules or other module groups	Example) Main Unit Expansion Unit
PLC system	A system which consists of the PLC and peripheral devices. A user program can control the system.	
Cold Restart	To restart the PLC system and user programs after all of the data(Variables and programs of I/O image area, of internal register, of timer or counter) were set to the specified conditions automatically or manually.	
Warm Restart	In the warm restart mode, The power supply Off occurrence will be informed to the user program and the PLC system restarts with the previous user-defined data and user program after the power supply Off.	
Hot Restart	After a power supply Off, the PLC system return all of the data to the previous status within maximum allowed time and restarts.	
I/O Image Area	Internal memory area of the CPU module which used to hold I/O statuses.	
Watch Dog Timer	Supervisors the pre-set execution times of programs and warns if a program is not completed within the pre-set time.	
Function	Operation Unit which outputs immediately its operation result of an input, while four arithmetic operations comparison operation store their results in the inside of instructions.	
Function Block	Operation Units which store operation result in the inside of instruction such as timer and counter and use the operation results which have been stored through many scans.	
Direct Variable	Variables used without separate declaration of names and type. I.Q.M area correspond to this variable	Example) %IX0.0.2 %QW1.2.1 %MD1234

Terms	Definition	Remarks
Symbolic Variable	Variables used after the user's definition of their names and types. Declarations as 'INPUT_0' = %IX0.0.2, 'RESULT' = %MD1234' makes INPUT_0 and RESULT be able to used instead of %IX0.0.2 and %MD123 in programming.	
GMWIN	A peripheral device for the GLOFA-GM series. It executes program creation, edit, compile and debugging.	
FAM	Abbreviation of the word 'Factory Automation Monitoring S/W'. It is used to call S/W packages for process supervision.	
Task	It means startup conditions for a program. There are three types of plus cycle task, internal junction task and external junction task. External junction task starts by the input signals of external input modules.	
RTC	Abbreviation of the word 'Real Time Clock'. Used to call a general IC which includes clock function.	
Sink Input	Current flows in from the switch to the PLC input terminal if a input signal turns on. 	
Source Input	Current flows in from the PLC input terminal to the switch if a input signal turns on. 	
Sink Output	Current flows in from the load to the output terminal if the PLC output junction turn on. 	

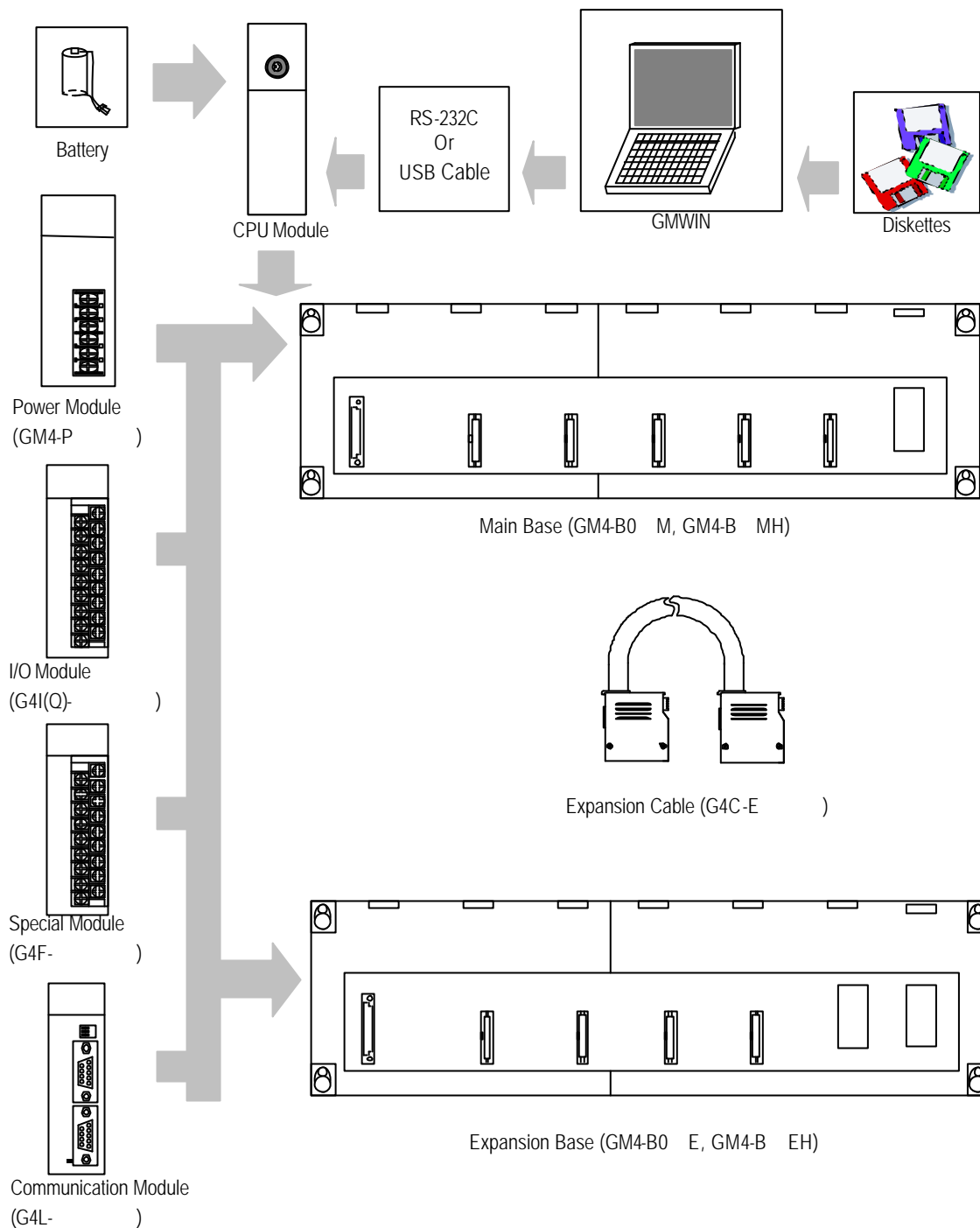
Terms	Definition	Remarks
Source Output	<p>Current flows in from the output terminal to the load if the PLC output junction turn on.</p> 	
Fnet	Fieldbus Network	
Cnet	Computer Network	
Enet	Ethernet Network	
Mnet	Mini-MAP Network	
Dnet	DeviceNet Network	
Pnet	Profibus Network	
ISA	Instrument Society of America	
GM4C System	System which is combined by GM4-CPUC and high performance bases (GM4-B4MH, GM4-B6MH, GM4-B8MH, GM4-B4EH, GM4-B6EH, GM4-B8EH) (Refer to Chapter 2 for details)	

Chapter 2. SYSTEM CONFIGURATION

The GLOFA-GM4 series have various units suitable to configuration of the basic, computer link and network systems. This chapter describes the configuration and features of each system.

2.1 Overall Configuration

The following shows the overall configuration of the GLOFA-GM4 series.



2.2 System Configuration Component Units List

The following table shows components units configuration of GLOFA-GM4 series.

2.2.1 GM4 series Configuration

Items	Models	Description		Remarks
CPU module	GM4-CPUA	Maximum I/O points: 2,048		
	GM4-CPUB	Maximum I/O points: 2,048		
	GM4-CPUC	Maximum I/O points: 3,584		
Digital input module	G4I-D22A	16-point 12/24 VDC input module(current source/sink input)		
	G4I-D22B	16-point 12/24 VDC input module(current source input)		
	G4I-D22C	16-point 24 VDC input module(current source/sink input)		
	G4I-D24A	32-point 12/24 VDC input module(current source/sink input)		
	G4I-D24B	32-point 12/24 VDC input module(current source input)		
	G4I-D24C	32-point 24 VDC input module(current source/sink input)		
	G4I-D28A	64-point 12/24 VDC input module(current source/sink input)		
	G4I-A12A	16-point 110 VAC input module		
	G4I-A22A	16-point 220 VAC input module		
Digital output module	G4Q-RY2A	16-point relay contact output module(2 A)		
	G4Q-TR2A	16-point transistor output module(0.5 A, sink output)		
	G4Q-TR2B	16-point transistor output module(0.5 A, source output)		
	G4Q-TR4A	32-point transistor output module(0.1 A, sink output)		
	G4Q-TR4B	32-point transistor output module(0.1 A, source output)		
	G4Q-TR8A	64-point transistor output module(0.1 A, sink output)		
	G4Q-SS2A	16-point triac output module(1 A)		
	G4Q-SS4A	16-point triac output module(0.6 A)		
Input output hybrid module	G4H-DR2A	8-point 12/24 VDC input module(current source/sink input) 8-point relay contact output module(2 A)		
	G4H-DT2A	8-point 12/24 VDC input module(current source/sink input) 8-point transistor output module(0.5 A, sink output)		
Power supply module	GM4-PA1A	Input 110 VAC	5VDC(1) : 4 A, 5VDC(2) : 1 A 24VDC : 0.7 A	5 VDC(1) for I/O modules 5 VDC(2) for peripheral devices
	GM4-PA2A	Input 220 VAC		
	GM4-PA1B	Input 110 VAC	5VDC : 3 A, 24VDC : 0.5 A	
	GM4-PA2B	Input 220 VAC		
	GM4-PA2C	Input 220VAC	5VDC : 8 A	
	GM4-PD3A	Input 24VDC	5VDC : 4 A	

Items	Models	Description	Remarks
Main base unit	GM4-B04M	Up to four modules can be mounted.	
	GM4-B4MH	Up to four modules can be mounted.(high performance module)	
	GM4-B06M	Up to six modules can be mounted.	
	GM4-B6MH	Up to six modules can be mounted.(high performance module)	
	GM4-B08M	Up to eight modules can be mounted.	
	GM4-B8MH	Up to eight modules can be mounted.(high performance module)	
	GM4-B12M	Up to twelve modules can be mounted.	expansion impossible
Expansion base unit	GM4-B04E	Up to four modules can be mounted.	
	GM4-B4EH	Up to four modules can be mounted.(high performance module)	
	GM4-B06E	Up to six modules can be mounted.	
	GM4-B6EH	Up to six modules can be mounted.(high performance module)	
	GM4-B08E	Up to eight modules can be mounted.	
	GM4-B8EH	Up to eight modules can be mounted.(high performance module)	
Expansion cable	G4C-E041	0.4 m long	
	G4C-E061	0.6 m long	
	G4C-E121	1.2 m long	
	G4C-E301	3.0 m long	
	G4C-E601	6.0 m long	
	G4C-E102	10.0 m long	
	G4C-E152	15.0 m long	
Memory module	G4M-M032	Flash memory (32Kstep)	For GM4-CPUA only

Items		Models	Description	Remarks
Special modules	A/D conversion module	G4F-AD2A	Voltage/current input : 4 channels DC -5 to +5V / -10 to +10V / DC -20 to 20 mA	
		G4F-AD3A	Voltage/current input : 8 channels DC 1 to 5V / 0 to 10V / DC 4 ~ 20 mA	
	D/A conversion module	G4F-DA1A	Voltage/current output : 2 channels DC -10 to 10V / DC -4 to 20 mA	
		G4F-DA2V	Voltage/current output : 4 channels DC -10 to 10V	
		G4F-DA2I	Current output : 4 channels DC 4 to 20 mA	
		G4F-DA3V	Voltage output : 8 channels DC -10 to 10V	
		G4F-DA3I	Current output : 8 channels DC 4 to 20 mA	
	High speed counter module	G4F-HSCA	Counting range: 0 to 16,777,215(24 bit binary) 50 KHz, 1 channel	24 bit binary
		G4F-HO1A	Counting range: -2,147,483,648 to 2,147,483,647 200 KHz, 2 channels	32 bit binary
		G4F-HD1A	Counting range: -2,147,483,648 to 2,147,483,647 500 KHz, 2 channels	32 bit binary
	Positioning module	G4F-POPA	Pulse output, 1 axis control	
		G4F-POPB	Pulse output, 2 axis control	
		G4F-PP1O	Pulse output(Open Collector), 1 axis control	
		G4F-PP2O	Pulse output(Open Collector), 2 axis control	
		G4F-PP3O	Pulse output(Open Collector), 3 axis control	
		G4F-PP1D	Pulse output(Line Driver), 1 axis control	
		G4F-PP2D	Pulse output(Line Driver), 2 axis control	
		G4F-PP3D	Pulse output(Line Driver), 3 axis control	
	Thermocouple input module	G4F-TC2A	Temperature sensor: seven types(K, J, E, T, B,R or S) Input point: 4 channels	
	Temperature-measuring resistor input module	G4F-RD2A	Temperature sensor: Pt 100, Jpt 100 Input point: 4 channels	
	PID control module	G4F-PIDA	Controls maximum 8 loops	
		G4F-PIDB	Controls maximum 8 loops, Transistor output	
	Process control module	G4F-TMCA	2 channels of analog input 2 channels of analog/transistor output PID function	
	Analog timer module	G4F-AT3A	Timer point: 8 points Setting value range: 0.1 to 1.0 sec, 1 to 10 sec, 10 to 60 sec, 60 to 600 sec	Setting 1 point each
	Interrupt input module	G4F-INTA	Input point : 8 points	

Items		Models	Description	Remarks
Commu- nications modules	Fast Enet I/F module	G4L-EUTB	10/100BASE-TX,UTP	For GM4A/B O/S Ver 2.7 or over
		G4L-EUFB	100BASE-Fx, Fiber Optic	
		G4L-EU5B	10BASE-5, AUI	
	Fast Dedicated-Enet I/F module (Master)	G4L-EUTC	10/100BASE-TX,UTP	For GM4C O/S Ver 2.0 or over
		G4L-EUFC	100BASE-Fx, Fiber Optic	
		G4L-EU5C	10BASE-5, AUI	
	Fast Dedicated-Enet I/F module (Slave)	G4L-ERTC	10/100BASE-TX,UTP	
		G4L-ERFC	100BASE-Fx, Fiber Optic	
		G4L-ER5C	10BASE-5, AUI	
	Fnet I/F module	G4L-FUEA	For Fnet I/F	For mounting inside computer
		G0L-FUEA	1 Mbps base band For twisted cable	
	Rnet I/F module	G4L-RUEA	For Rnet I/F For twisted cable	
	Fnet remote I/F module	G4L-RBEA	For Fnet remote I/F For twisted cable	
	Standalone remote I/F module	G0L-SMIA	16-point 12/24 VDC input	
		G0L-SMQA	16-point relay output (1 A)	
		G0L-SMHA	8-point 12/24 VDC input 8-point relay output (1 A)	
		G0L-AD3A	Voltage/current input : 8 channels DC 1 to 5V / DC 0 to 10V / DC 4 to 20 mA	
		G0L-DA3I	Current output : 8 channels DC 4 to 20 mA	
	Repeater	G0L-FREA	For Fnet	
	Optic converter	G0L-FOEA	Optic/Electric converter	
	Active coupler	G0L-FAPA	Power supply board for active coupler	
		G0L-FABA	Base unit for active coupler	
		G0L-FACA	Card for active coupler	
		G0L-FADA	Dummy card for active coupler	
	Computer link module	G4L-CUEA	RD-232C / RS-422 : 1 channel for each	
	Enet I/F module	G4L-EUEA	Comply with IEEE 802.3 10 Base 5 / 10 Base T	
	DeviceNet I/F module	G4L-DUEA	DeviceNet I/F module	
		G0L-DSIA	Dnet slave module 16-point DC12/24V input Comply with ODVA 2.0	
		G0L-DSQA	Dnet slave module 16-point relay input Comply with ODVA 2.0	
	Profibus-DP I/F module	G4L-PUEA	Profibus-DP master module (I/O : 1K)	
		G4L-PUEB	Profibus-DP master module (I/O : 7K)	
Others	Pseudo input switch	G4S-SW16	16-point pseduo switch for GM4 input	
	Dust protection module	GM4-DMMA	Keeps unused slots from dust	

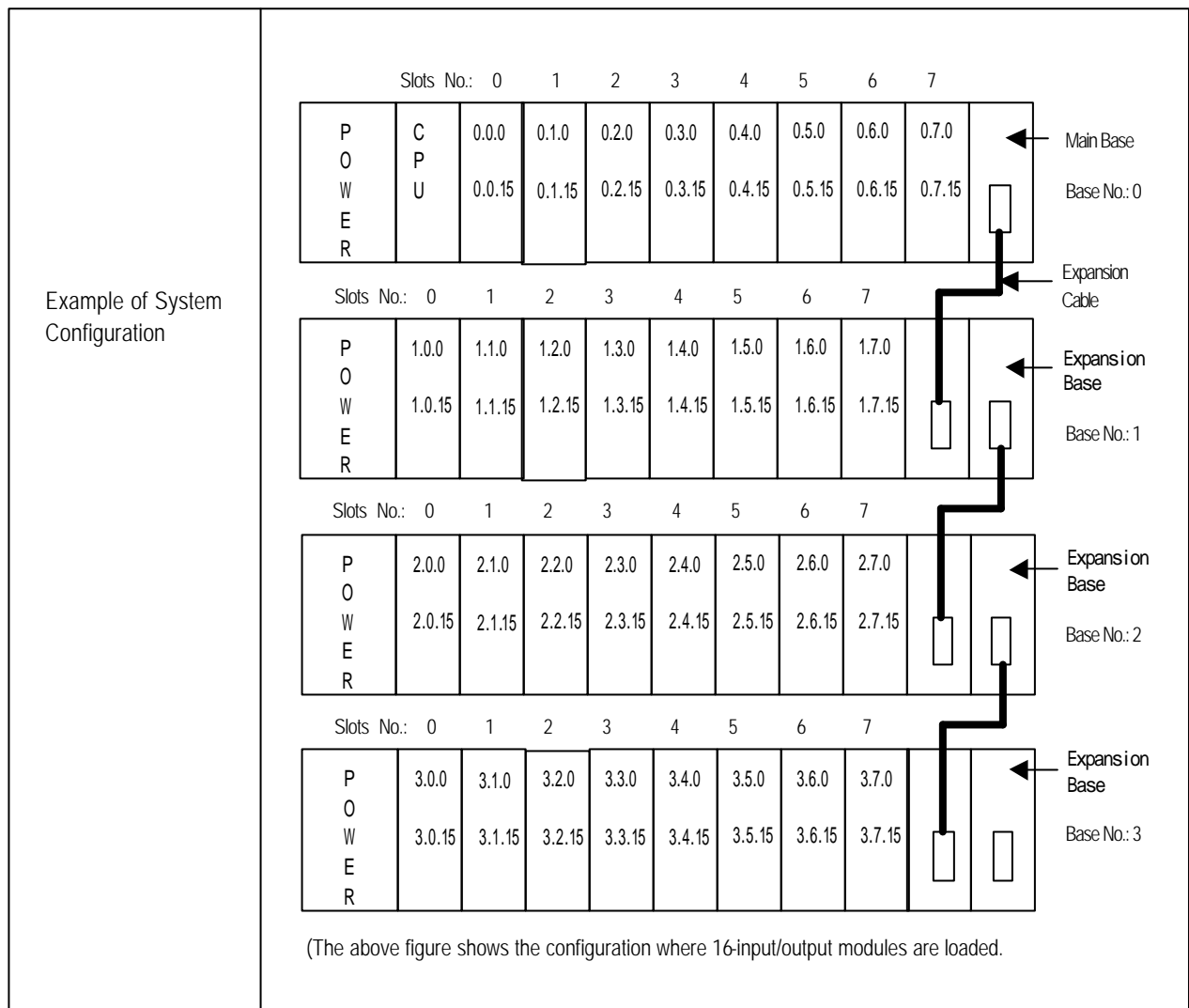
2.3 System Configuration Types

System configuration is classified into 3 types. First, Basic system that is configured with only basic and expansion base units. Second, Computer link system that executes data communications between the CPU module and a computer by use of a computer link module(G4L-CUEA). Third, Network system, which is used to control the PLC and remote I/O modules.

2.3.1 Basic System

1) Existing Systems

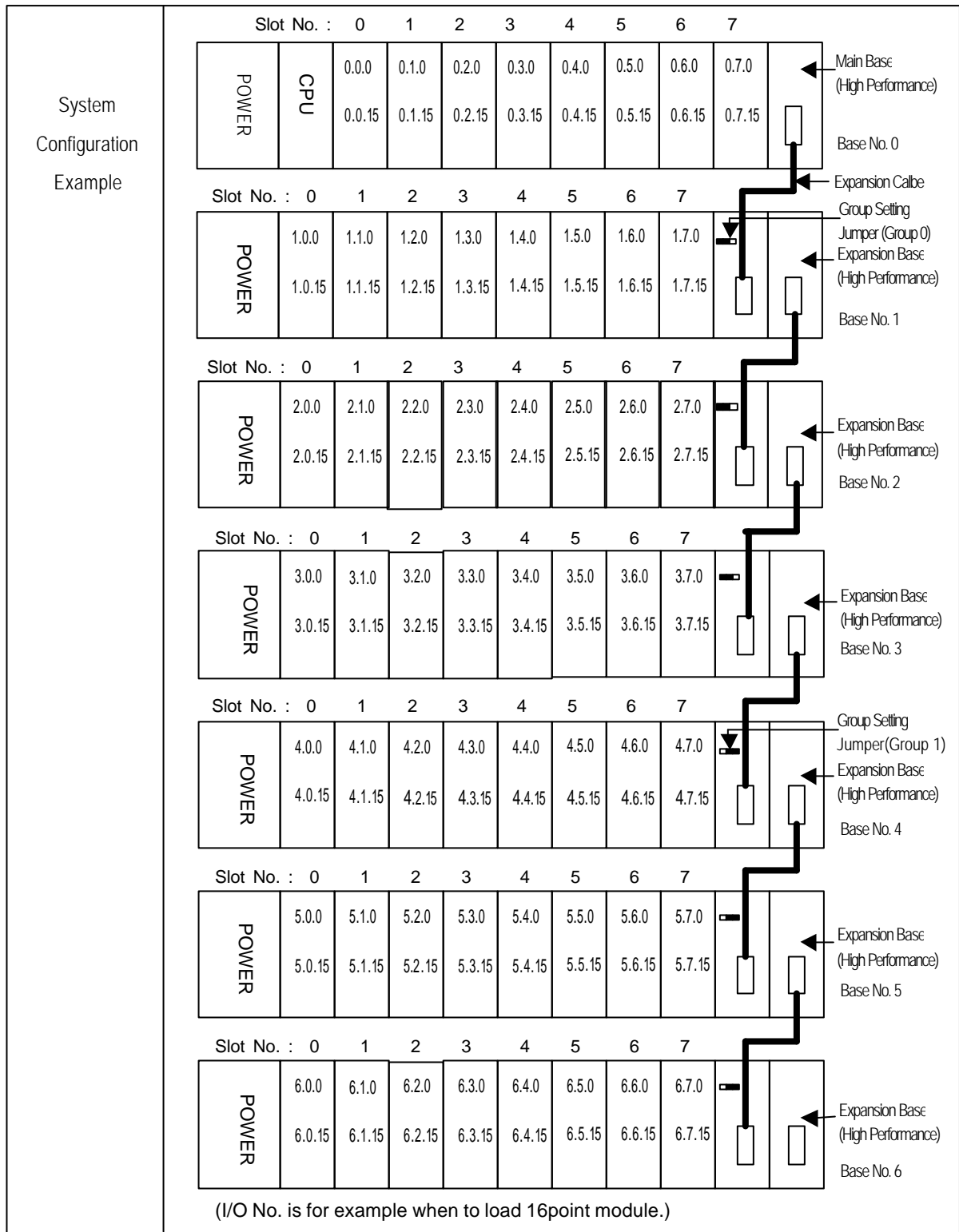
The following describes basic system which is configured with a cable connection of only basic base units and expansion base units. GM4 Series can be used CPU(GM4-CPUA,GM4-CPUB,GM4-CPUC) and Base together.





Maximum Number of Expansion Stages		Three Stages
Maximum Expansion Distance		3 m
Maximum number of Input/Output modules		32 modules
Maximum number of Input/Output points		? 16-point module loaded : 512 points ? 32-point module loaded : 1,024 points ? 64-point module loaded : 2,048 points
Configuration units	CPU module	GM4-CPUA/GM4-CPUB/GM4-CPUC
	Power Supply module	GM4-PA1/2A, GM4-PA1/2B,GM4-PD3A,GM4PA2C
	Basic Base Unit	GM4-B04/06/08/12M , GM4-B4MH,/B6MH/B8MH
	Expansion Base Unit	GM4-B04/06/08E, GM4-B4EH/B6EH/B8EH
	Expansion Cable	G4C-E041/E121/E301
	I/O module	G4I-□□□□ G4Q-□□□□ G4F-□□□□
I/O number allocation		? 64 I/O points have been fixedly allocated for every slot in the base unit. ? 64 points are allocated to each slot in a base unit whatever it is empty or not. ? There's no limitation in the loading location and loading number of special modules, ? Special modules do not have fixed I/O numbers while a fixed I/O number is allocated to a digital I/O module. ? A dedicated function block controls a special module and memory is allocated automatically. ? The follow figure shows the example of I/O Address assignment.
		<div><div>SbtNo. : 0 1 2 3 4 5 6 7 0 1 2 3</div><div><div><div>POWER</div><div>CPU</div><div>16 point Input</div><div>16 point Input</div><div>32 point Input</div><div>64 point Input</div><div>16 point Output</div><div>32 point Output</div><div>32 point Output</div><div>64 point Output</div></div><div><div>32 point Input</div><div>16 point Output</div><div>32 point Output</div><div>32 point Output</div></div></div><div><div>%QX 1.3.0 ~ 31</div><div>%QX 1.2.0 ~ 31</div><div>%QX 1.1.0 ~ 15</div><div>%IX 1.0.0 ~ 31</div></div><div>Base No. 1</div></div>

2) GM4C System

GM4C System is the system which is organized with GM4-CPUC for CPU module, and high performance main base(GM4-B4MH/B6MH/B8MH) and expansion base (GM4-B4EH/B6EH/B8EH).



Maximum Number of Expansion Stages		6 Stages
Maximum Expansion Distance		15 m
Maximum number of Input/Output modules		56 Modules
Maximum number of Input/Output points		? 16-point module loaded : 896 points ? 32-point module loaded : 1,792 points ? 64-point module loaded : 3,584 points
Configuration units	CPU Module	GM4-CPUC
	Power Module	GM4-PA1/2A,GM4-PD3A,GM4-PA2C
	Main Base	GM4-B4MH/B6MH/B8MH
	Expansion Base	GM4-B4EH/B6EH/B8EH
	Expansion Cable	G4C-E041/E061/E121/E301/E601/E102/E152
	I/O Module	G4I- G4Q- G4F-
I/O number allocation		<p>? 64 I/O points have been fixedly allocated for every slot in the base unit. ? 64 points are allocated to each slot in a base unit whatever it is empty or not. ? There's no limitation in the loading location and loading number of special modules, ? Special modules do not have fixed I/O numbers while a fixed I/O number is allocated to a digital I/O module. ? A dedicated function block controls a special module and memory is allocated automatically. ? IO Parameter must be same with actual mounted I/O Module. If not, the PLC does not start running. ? High performance expansion bases (GM4-B4EH/GM4-B6EH/GM4-B8EH) are separated by Group '0' and '1'. Groups are set up by jumps on expansion bases. Initial group setting is Group '0'.</p> <p>★ Setting Group Jumper Pins</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Group '0' Setting</p> </div> <div style="text-align: center;">  <p>Group '1' Setting</p> </div> </div>

REMARK :

- 1) Main base No. is fixed to No. 0, and expansion base No. is assigned to 1, 2, 3 as sequence.
(In case of high performance base, jumpers must be set to group '0'.)
- 2) In case of installing expansion base 4 stages or over of GM4C System, install expansion base additionally, and then jumps of additional expansion base must be set to group '1'. In this case, those expansion bases are assigned to 4, 5, 6 as sequence.

2.3.2 Computer Link System

Computer Link System communicates data between the CPU module and peripheral devices like a computer or a printer by use of RS-232C and RS-422(or RS-485)interface of the computer link module. The G4L-CUEA is the computer link module for GM4 series. For details of computer link module, refer to related User's Manual.

REMARK :

- 1) The follow shows the possible mounting number of computer link module and possibility of mounting on expansion base as CPU models.

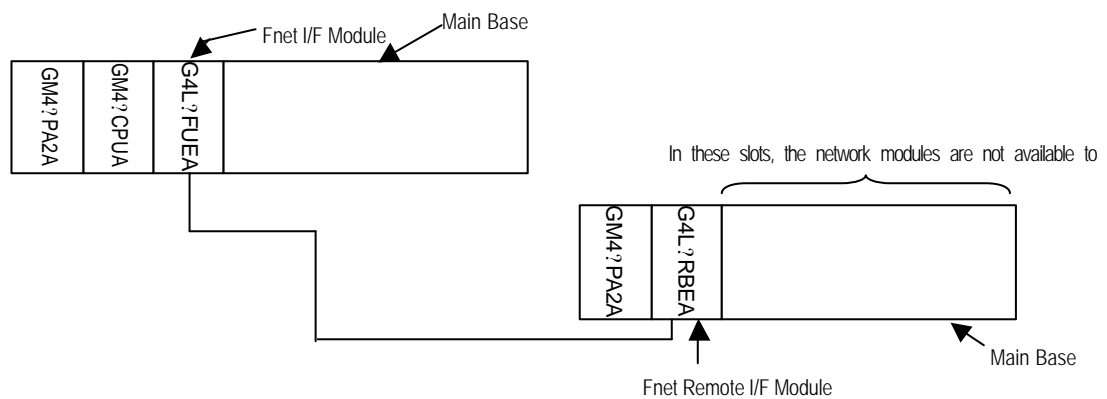
Items	The Possible mounting number of Computer Link Module	Possibility of mounting on expansion base.
GM4-CPUA	4	X
GM4-C PUB	4	O
GM4-CPUC	8	O

2.3.3 Network System

The Network system adapted in the GLOFA series is a Fnet system that satisfies the IEC/ISA field bus specifications. Fnet system as a network system is used for data communications between CPU modules and control of remote I/O modules so that distribution of control and concentration of supervision could be easy. And also, as user's needs, Ethernet I/F system, DeviceNet I/F system or Profibus I/F system could be built. For details, refer to Fnet system user's manual.

1) System Configuration

? Maximum 3 stages of expansion bases could be used in each of remote systems.



2) In case of installing remote system by Fnet remote I/F module, the installing method is same with existing system, however the follow modules are not available.

Section	Name	Items
Special Module	PID Control Module	G4F-PIDA/ PIDB
	Process Control Module	G4F-TMCA
	Position Module	G4F-POPA/POPB G4F-PP1O/2O/3O G4F-PP1D/2D/3D
	Analog Timer Module	G4F-AT3A
Communication Module	Fnet I/F Module	G4L-FUEA
	Computer Link I/F Module	G4L-CUEA
	DeviceNet I/F Module	G4L-DUEA
	Profibus I/F Module	G4L-PUEA G4L-PUEB
	Ethernet I/F Module	G4L-EUEA
	Rnet I/F Module	G4L-RUEA
	Fast Enet I/F Module	G4L-EUTB/EUFB/EU5B
	Fast Dedicated-Enet I/F Module (Master)	G4L-EUTC/EUFC/EU5C
	Fast Dedicated-Enet I/F Module (Slave)	G4L-ERTC/ERFC/ER5C

- 3) The follow shows the possible mounting number of Fnet I/F module and possibility of mounting on expansion base as CPU models

Items	The Possible mounting number of Fnet Module	Possibility of mounting on expansion base.
GM4-CPUA	2	X
GM4-C PUB	4	O
GM4-CPUC	8	O

4) Assignment of Input / Output

- (1) Variables of remote input/output could be assigned by high speed link parameter.
- (2) Input/output variable or internal variable could be assigned for input/output
- (3) Maximum points of input/output variables are as follow

? GM4C : 32,000 points (when to use 64 point module)

%IX0.0.0 to %IX63.7.63, %QX0.0.0 to %QX63.7.63

5) Assignment of Input / Output in the Remote System Configuration

? Assignment of input/output in the remote system configuration is same with basic input/output system.

For example, if it is assigned to starting address %IX12.0.0 and 32 word size for receiving data of remote 12 stage in the high speed parameter, and starting address %QX12.0.0 and 32 word size for sending data, 12 stage remote base is assigned input/output number in the same way to assign base No.12 of basic system configuration.

6) Base Expansion of Remote Stage

? If the size of Rx/Tx data is assigned to '64 words', it is assigned to %IX0.0.0 to %IX0.7.63, %QX0.0.0 to %Qx0.7.63 in the 12 stage base, and also it is assigned to %IX3.0.0 to %IX3.7.63, %QX3.0.0 to %QX3.7.63 in the 12 stage expansion base.

REMARK :

- 1) Pay attention not to overlap sections when to assign remote stage number and area
- 2) Only in case of assigning the Input/output by input/output variable(%IW,%QW), it can support input/output service such as I/O Forcing.

Pay attention to assign input/output using internal variable (%MW).

Chapter 3. General Specifications

3.1 General specifications

The following shows the general specifications of the GLOFA-GM series.

No	Item	Specifications					References
1	Operating ambient temperature	0 ~ 55 ℃					
2	Storage ambient temperature	-25 ~ +75 ℃					
3	Operating ambient humidity	5 ~ 95%RH, non-condensing.					
4	Storage ambient humidity	5 ~ 95%RH, non-condensing.					
5	Vibration	Occasional vibration					IEC 61131-2
		Frequency	Acceleration	Amplitude	Sweep count		
		10? f?57 Hz	-	0.075 mm	10 times per axis, on X,Y, Z axis		
		57? f?150 Hz	9.8 m/s ² {1 G}	-			
		Continuous vibration					
		Frequency	Acceleration	Amplitude			
		10? f <57 Hz	-	0.035 mm			
		57? f?150 Hz	4.9 m/s ² {0.5G}	-			
6	Shocks	Maximum shock acceleration: 147 m/s ² {15G} Duration time: 11 ms Pulse wave: half sine pulse (3 shocks per axis, on X,Y,Z axis)					IEC 61131-2
7	Noise Immunity	Square wave Impulse Noise	? 1,500 V				
		Electronic discharge	Voltage : 4 kV (contact discharge)				IEC 61131-2, IEC 801-3
		Radiated electromagnetic field noise	27 ~ 500 MHz, 10 V/m				IEC 61131-2, IEC 801-3
		Fast transient/burst noise	Item	Power supply	Digital I/O (>24V)	Digital I/O (<24V) Analog I/O interface	IEC 61131-2, IEC 801-4
			Voltage	2 kV	1 kV	0.25 kV	
8	Operating ambience	Free of corrosive gases and excessive dust.					IEC 61131-2
9	Altitude	2,000 m or less					
10	Pollution	2					
11	Cooling method	Air-cooling					

Hint :

- 1) IEC(International Electromechanical Commission) : An international civilian institute who establishes international standards in area of electric's and electronics.
- 2)Pollution : An indicator which indicates pollution degree which determine insulation performance of equipment. Pollution 2 means that nonconductive pollution usually occurs but temporal conduction occurs with condensing

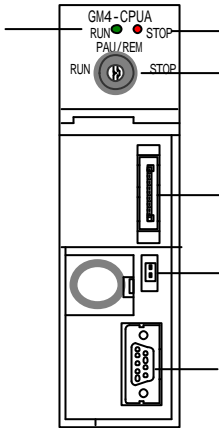
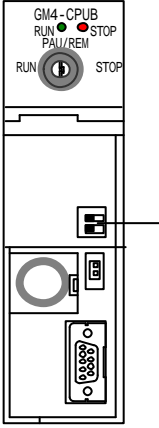
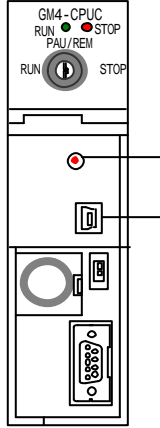
Chapter 4. CPU Module

4.1 Performance Specifications

The following shows the general specifications of the GM4 CPU module.

Items		Specifications		Remarks
		GM4-CPUA(B)	GM4-CPUC	
Operation method		Cyclic operation of stored program, Interrupt task operation		
I/O control method		Scan synchronous batch processing method (Refresh method)		
Programming language		Ladder Diagram Instruction List Sequential Function Chart		
Number of instructions	Operator	21		
	Basic function	194	194 + Floating Point Arithmetic Function	
	Basic function block	11		
	Special function block	82	62	
Processing speed	Operator	0.2 ?s / instruction	0.12 ?s / instruction	
	Basic function	0.2 ?s / Step	0.12 ?s / Step	
	Basic function block			
Programming memory capacity		128K byte	1M byte	
Max. I/O points		2048 points	3,584 points	
Max. I/O points memory mapping area		4,096(8,192) points	32,768 points	
Data memory	Direct variable area	4 to 32K byte	8 to 64K byte	
	Symbolic variable area	54(50)K byte - Direct variable area	428K byte - Direct variable area	
Timer		No limitations in points. Time range : 0.001 to 4,294,967.295 sec(1,193 hours)		1 point occupies 20 bytes of symbolic variable area.
Counter		No limitations in points Counting range : -32,768 to +32,767		1 point occupies 8 bytes of symbolic variable area.
Program types	Numbers of program blocks		180	
	Initialization programs		2 (_INT, _H_INIT)	
	Task Programs	Time driven tasks	8	32
		External interrupt tasks	8	
		Internal task	16	
	Error task		-	1 (_ERR_SYS)
Operation modes		RUN, STOP, PAUSE and DEBUG		
Restart modes		Cold, Warm, Hot Restart		
Self-diagnostic functions		Watch dog timer, Memory error detection, I/O error detection, Battery error detection, Power supply error detection, etc.		
Data protection method at power failure		Set to 'Retain' variables at data declaration.		
Maximum extension stages		3	6	
Internal current consumption		130mA	700mA	
Weight		0.25 Kg	0.23 Kg	

4.2 Parts Name and Descriptions

<div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p>< GM4-CPUA ></p> </div> <div style="text-align: center;">  <p>< GM4-CPUB ></p> </div> <div style="text-align: center;">  <p>< GM4-CPUC ></p> </div> </div>		
No.	Name	Details
1	RUN LED	<p>Indicator of CPU Operation Mode.</p> <p>On : In case of Key Switch is Local or Remote RUN Mode.</p> <p>Off : In below case, RUN LED is OFF.</p> <ul style="list-style-type: none"> ☒ In case of Power is supplied abnormally. ☒ In case of Key Switch is STOP or PAU / REM Mode. ☒ In case of occurrence of Error which stops operation.
2	STOP LED	<p>On : In case of Key Switch is Local or Remote STOP Mode.</p> <p>Off : In below case, STOP LED is OFF.</p> <ul style="list-style-type: none"> ☒ In case of Key Switch is Local RUN or Local Pause Mode. ☒ In case of operation mode is Remote RUN / PAUSE / DEBUG. <p>Flickering : In case of detection of Error by Self-Testing Function.</p>
3	Key Switch	<p>To set CPU operating mode.</p> <p>RUN : Execution of Program.</p> <p>STOP : Stop of Program</p> <p>PAU / REM : Mode is as follow.</p> <ul style="list-style-type: none"> ☒ PAUSE : Temporary Stop of program operation. ☒ REMOTE : Set when to operate Remote Mode
4	Manual Reset Switch	PLC System Reset and Initialization when to occur Error on operation. : GM4-CPUC only
5	RS-232C Connector	Connector for communication with GMWIN or other equipments.
6	Memory Module Connector	Connector to mount Memory Module in the CPU Module : GM4-CPUA only
7	Backup Battery Connector	Connector for Backup Battery.
8	Flash Memory Run Mode Setup Switch	Flash Memory Run Mode Setup Switch : GM4-CPUB only (Refer to 6.4 for details)
9	USB Connector	Connector for communication with GMWIN : GM4-CPUC only

Handling Reset Switch of GM4-CPUC

Handling Manual Reset Switch	Operations
Pushing within 5 seconds	Restart in cold or warm mode according to parameters setting
Pushing over 5 seconds	Restart in cold mode unconditionally after turned on STOP LED

REMARK :

The follows show LED features and operation modes according to handling Key Switch.

1) LED features according to operation modes

Operation mode	LED features	
	Run	Stop
Local Run	On	Off
Local Stop	Off	On
Local Pause	Off	Off
Remote Run	On	Off
Remote Stop	Off	On
Remote Pause, Remote Debug	Off	Off

2) Operation mode according to handling Key Switch

Handling Key Switch		Operation Mode
STOP	PAU/REM	Remote Stop
PAU/REM	RUN	Local Run
RUN	PAU/REM	Local Pause
PAU/REM	STOP	Local Stop

*Possible to use remote mode operations after operation mode is remote stop mode.

4.3 Operation Processing

4.3.1 Operation Processing Methods

1) Cyclic operation

A PLC program is sequentially executed from the first step to the last step, which is called scan.

This sequential processing is called cyclic operation. Cyclic operation of the PLC continues as long as conditions do not change for interrupt processing during program execution.

This processing is classified into the following stages.

Stages	Processing
<pre> graph TD Start([Operation Start]) --> Init[Initialization] Init --> Refresh1[Input image area refresh] Refresh1 --> Prog[Program operation processing] subgraph ProgBox [Program operation processing] direction TB StartP[Program start] DashP[~] EndP[Program end] end ProgBox --> Refresh2[Output image area refresh] Refresh2 --> EndProc[END processing] EndProc --> Refresh1 </pre>	<p>-</p> <p>? Stage for the start of a scan processing. It is executed only one time when the power is applied or reset is executed. It executes the following processing.</p> <ul style="list-style-type: none"> □ I/O modules reset □ Execution of self-diagnosis □ Data clear □ I/O module address allocation or type registration <p>? Input module conditions are read and stored into the input image area before operation processing of a program.</p> <p>? Program is sequentially executed from the first step to the last step</p> <p>? The contents stored in the output image area is output to output modules when operation processing of a program is finished.</p> <p>? Stage for return processing after the CPU module has finished 1 scan. The following processing are executed.</p> <ul style="list-style-type: none"> □ Self-diagnosis □ Change of the present values of timer and counter, etc. □ Processing data communications between computer link module and communications module. □ Checking the switch for mode setting.

2) Time driven interrupt operation method

In time driven interrupt operation method, operations are processed not repeatedly but at every pre-set interval. Interval, in the GM4 CPU module, can be set to between 0.01 and 4294967.29 sec. This operation is used to process operation with a constant cycle.

3) Event driven interrupt operation method

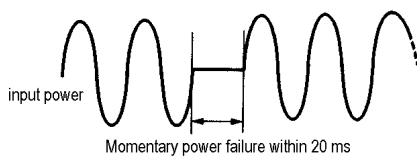
If a situation occurs which is requested to be urgently processed during execution of a PLC program, this operation method processes immediately the operation which corresponds to interrupt program. The signal which informs the CPU module of those urgent conditions is called interrupt signal. The GM4 CPU module has two kind of interrupt operation methods, which are internal and external interrupt signal methods.

4.3.2 Operation processing at momentary power failure occurrence

The CPU module detects any momentary power failure when the input line voltage to the power supply module falls down below the defined value.

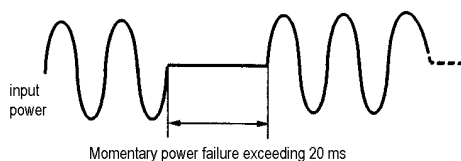
when the CPU module detects any momentary power failure, the following operations will be executed.

1) Momentary power failure within 20 ms



- (1) The operation processing is stopped with the output retained.
- (2) The operation processing is resumed when normal status is restored.
- (3) The output voltage of the power supply module retains the defined value.
- (4) The watch dog timer(WDT) keeps timing and interrupt timing normally while the operations is at a stop.

2) Momentary power failure exceeding 20 ms



- ? The re-start processing is executed as the power is applied.

HINT

1) Momentary power failure

The PLC defining power failure is a state that the voltage of power has been lowered outside the allowable variation range of it. The momentary power failure is a power failure of short interval(several to tens ms).

4.3.3 Scan Time

The processing time from a 0 step to the next 0 step is called scan time.

1) Expression for scan time

Scan time is the addition value of the processing time of scan program that the user has written, of the task program processing time and the PLC internal processing time.

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

? Scan program processing time = The processing time used to process a user program that is not specified to a task program.

? Task program processing time = Total of the processing times of task programs executed during one scan.

? PLC internal processing time = Self-diagnosis time + I/O refresh time + Internal data processing time + Communications service processing time

(2) Scan time differs in accordance with the execution or non-execution of task programs and communications processing, etc.

2) Flag

(1) Scan time is stored in the following system flag area.

? _SCAN_MAX : Maximum scan time (unit : 1 ms)

? _SCAN_MIN : Minimum scan time (unit : 1 ms)

? _SCAN_CUR : Current scan time (unit : 1 ms)

(2) Measuring Processing Time of Task Program (GM4CPUC only)

To measure the processing time of the task program for calculation of the scan time, write the number of the task that will be measured to the system run status information flag '_STSK_NUM' in the GMWIN variables monitor mode and then monitor '_STSK_MAX', '_STSK_MIN' and '_STSK_CUR'. (For details of system run status information flags, refer to the APP 2.

3) Example of calculation of scan time (GM4-CPUC)

The following shows an example of calculation of maximum scan time when the user program has the same structure as shown below and the system executes data communications through communications modules.

? Task : T_SLOW (interval : =T#10 ms.) (priority : = 0.) (task No. := 0)

PROC_1 (single : = %MX0.) (priority := 3.) (task No. := 48)

E_INT1 (Interrupt : = 0.) (priority : = 2.) (task No. : = 32)

? Program : program ? P0

program ? P1 with task T_SLOW

program ? P2 with task PROC_1

Program ? P3 with task E_INT1

(1) Maximum scan time (_SCAN_MAX) will be measured while communications service through the communications module and monitoring through the GMWIN are being executed under the condition that only the scan program except for task programs has been executed.

(2) In order to measure the execution time of a time driven interrupt program, start the program including time driven interrupt task programs, and then register the flags '_STSK_NUM', '_STSK_MAX', '_STSK_MIN' and '_STSK_CUR' and enter '0' to '_STSK_NUM'

as the task No. '0', and then measure the value of '_STSK_MAX'.

(3) After stop other task program and start the program including single task program, designate task number 48 to '_STSK_NUM' and start task with GMWIN. Measure the value of '_STSK_MAX'.

(4) After stop other task program and start the program including interrupt task program, designate task number 32 to '_STSK_NUM' and make input of interrupt input module turn on. Measure the value of '_STSK_MAX'.

(5) It is available to measure this by set the priority of measuring task as most significant to prevent from any delay by another task after executing the main program in task of (2) to (4).

(6) If the measured max. operation times are $Tp0=17ms$, $Tp1=2ms$, $Tp2=7ms$, $Tp3=2ms$, the basic scan time will be $24ms(Tp0 + Tp2)$ when single task is started during program operation.

Time driven interrupt occurs 2 times in the above case, so scan time is $28ms(Tp0 + Tp2 + Tp1 \times 2)$.

If external interrupt occurs in here, scan time will be $30ms(Tp0 + Tp2 + Tp1 \times 2 + Tp3)$ and max. scan time will be $32ms$

$(Tp0 + Tp2 + Tp1 \times 3 + Tp3)$ because time driven interrupt can be occur 1 time.

If the external interrupt can be occur in $32ms$, consider the number of occurrence of time driven interrupt after adding the operation time. (See the timing chart in chap. 4.4.3)

4.3.4 Scan Watchdog Timer

1) Watchdog timer is used to detect a delay of abnormal operation of sequence program.

(Watchdog time is set in menu of basic parameter of GMWIN.)

2) When watchdog timer detects an exceeding of preset watchdog time, the operation of PLC is stopped Immediately and all output is off.

3) If an exceeding of preset watchdog time is expected in sequence program, use 'WDT_RST' function.

'WDT_RST' function make elapsed watchdog time as zero.

4) In order to clear watchdog error, using manual reset switch, restarting the PLC and mode change to STOP mode are available.

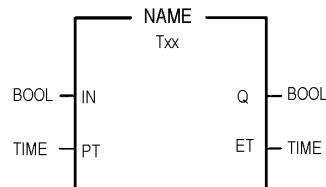
HINT

Setting range of watchdog : 1 to 65,335ms (1ms base)

4.3.5 Timer Processing

The CPU module timer is an incremental timer which increases its present value according to the measuring time. Three types of On Delay Timer (TON), Off Delay Timer (TOF) and Pulse Timer (TP) are available.

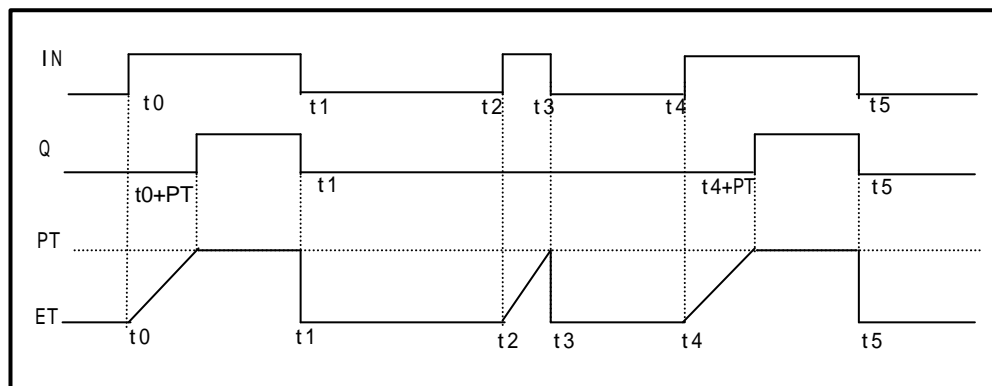
Its measuring range is 0.001 to 4,294,967,295 sec (1,193 hours) by 1 ms. For details, refer to 'GLOFA-GM Programming'.



1) On Delay Timer Process Time Change and Contact On/Off

Timer Process time is newly changed when the timer function block is executed. When the process time reaches the setting time (process time = setting time), the Timer output contact turns on.

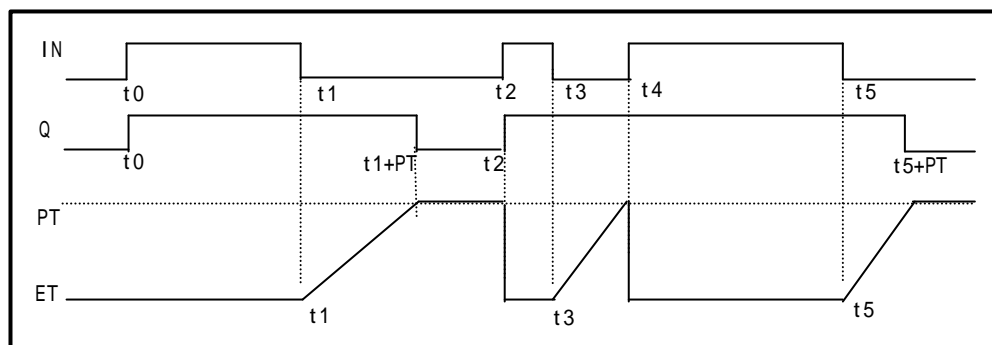
On Delay Timer Timing Diagram is shown as below.



2) Off Delay Timer Process Time Change and Contact On/Off

? If input condition turns on, timer output contact (Q) turns on. If input condition turns off, timer process time change starts.

? The process time is newly changed when the timer function block is executed. When the process time reaches the setting time (process time = setting time), the contact (Q) turns off. The following diagram shows Off Delay Timer Timing.



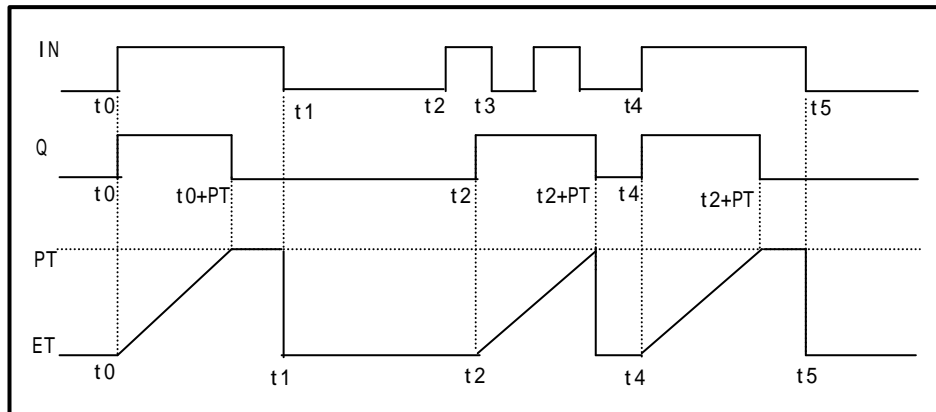
3) Pulse Timer Process Time Change and Contact On/Off

If input condition turns on, output contact (Q) turns on.

The process time is newly changed when the timer function block is executed. When the process time reaches the setting time (process time = setting time), the contact (Q) turns off.

The contact turns off after the setting time regardless of input condition off status.

The following diagram shows pulse timer timing.



4) Timer error

The maximum timer error is

"1 scan time + time from the start of scan to execution of the timer function block".

4.3.6 Counter Processing

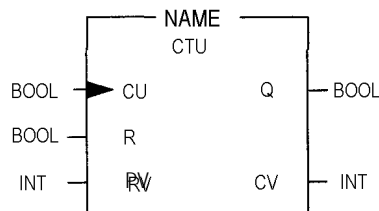
The CPU module counter increment/decrement the present counting value by the detection of rising edge(off~~to~~on) of input signal. Three types of counter are increment counter, Decrement counter and Increment-Decrement Counter. For details, refer to 'GLOFA – GM Programming'.

- ? The Increment counter is a counter which increment the present counting value
- ? The Decrement counter is a counter which decrement the present counting value
- ? The Increment-Decrement counter is a counter which compares the counting values of two input conditions.

1) Counter Present Value Change and Contact On/Off

(1) Increment Counter

- ? It should have Input condition (CU), reset condition (R) and setting value (PV).

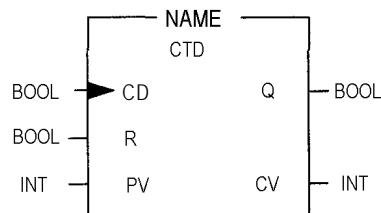


- ? If the counting value (CV) increments and reaches the setting value(PV) the output contact (Q) turns on.

When the reset signal is turned on, the counting value is set to '0' and the output contact (Q) turns off.

(2) Decrement Counter

- ? It should have input condition (CU), load (LD) and setting value (PV).

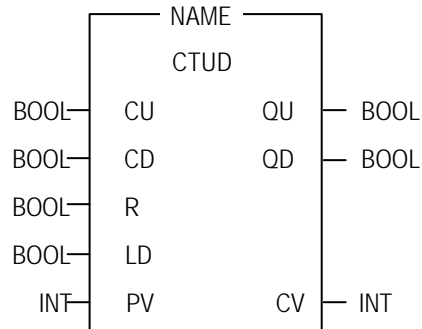


- ? If the counting value (CV) decrements and reaches '0', the output contact (Q) turns on.

If the reset signal is turned on, the counting value is set to the setting value and the output contact (Q) turns off.

(3) Increment/Decrement Counter

? It should have Increment input condition (CU), Decrement input condition (CD), load (LD) and setting value (PV).



? If reset signal(R) turns on, counting value (CV) is set to '0'.

? If load signal(LD) turns on, counting value is set to setting value(PV).

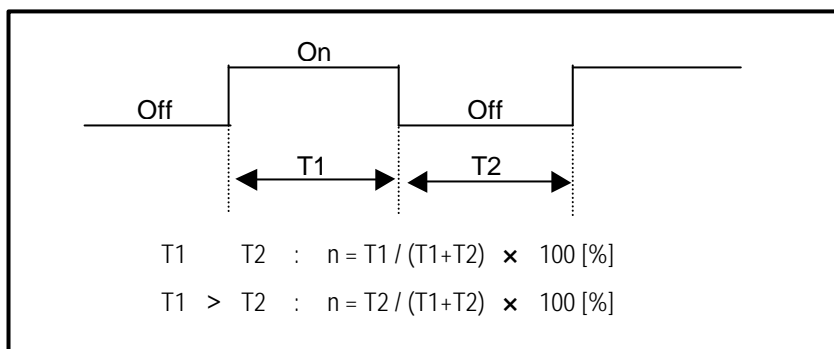
? It is increased by 1 at the rising edge of increment input(CU) and decreased by 1 at the edge of decrement input(CD). If counting value(CV) is equal or larger than setting value(PV), QU will be on, and if counting value(CV) is equal or less than setting value(PV), QD will be on.

2) Counting speed

? The counting speed is decided by scan time and it will be counted when on time or off time of input condition is larger than each scan time.

$$\text{Max. Counting speed (Cmax.)} = n / 100 \times 1 / t_s \quad [\text{pps}] \quad [n : \text{Duty}(\%), \quad t_s : \text{scan time(s)}]$$

? Duty is percent of on time / off time.



4.4 Program

4.4.1 Program Configuration

A program consists of all of the function elements that is needed to execute a particular control. It is to be stored in the internal RAM of the CPU module or the flash memory of the memory module.

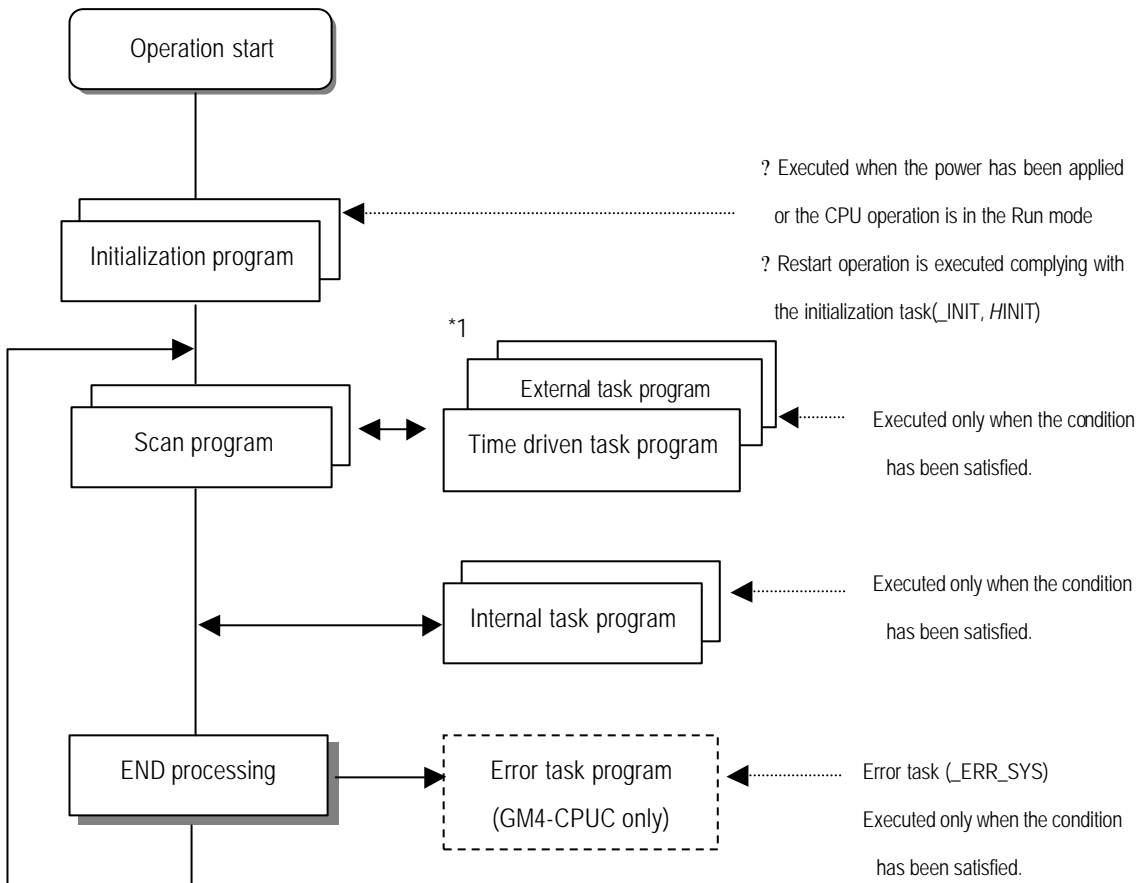
The function elements are classified as below.

Function Elements	Processing Operation
Initialization program	<ul style="list-style-type: none"> ? Executed when the power is applied or the CPU operation is transited to the RUN mode. ? Executes the initial/fixed data setting for execution of scan program and the initialization of peripheral devices on special modules. ? The execution method of initialization differs according to the setting of Restart Mode, etc.
Scan program	? Processes the constantly repeated signals which are executed every scan.
Time driven task program	<ul style="list-style-type: none"> ? When the following time conditional processings are required the program is executed complying with the time interval setting. <ul style="list-style-type: none"> <input type="checkbox"/> In case that the processing need a shorter interval than that of average one scan processing time. <input type="checkbox"/> In case that the processing need a longer interval than that of average one scan processing time. <input type="checkbox"/> In case that the processing should be executed by the specified time interval.
Event driven task program	? A shorter processing is executed for internal or external interrupt.
Error task program	? Error task program is executed, when error is occurred, if the user has made error task program.(GM4-CPUC only)

4.4.2 Program Execution Procedure

The followings explain the program execution procedure when the power is applied or the CPU module key switch is in the RUN status.

Program operation processing is executed as the procedure given below



HINT

- 1) *1 : In the GLOFA PLC, the time driven task programs and event driven task programs are called task program.
Event driven programs are classified into single task(internal interrupt) or interrupt task (external interrupt) according to the S/W and H/W interrupt signaling method.

1) Initialization program

(1) Function

- ? The Initialization program initializes the program to execute scan and task programs.
- ? The initialization can be executed with the restart mode which has been specified for program.

(2) Restart mode execution conditions

- ? The initialization tasks can be specified as below complying with the purpose of the initialization task.
 - Program for Cold/ Warm restart started by the _INIT task
 - Program for Hot Restart : started by the _H_INIT task

(3) Cold/ Warm Restart program

- ? The initialization program specified to _INIT task is executed with cold or warm restart mode when the operation starts.
- ? This initialization program executes the operations repeatedly until the setting conditions are satisfied(that is, until the Flag_INIT_DONE in the initialization program turns on). However, the I/O refresh is still executed.

(4) Hot restart mode program

- ? Task programs specified to the _H_INIT task executes initialization with the hot restart mode when momentary power failure has been occurred.
- ? This initialization program executes the operations repeatedly until the setting conditions are satisfied(that is, until the flag _INIT_DONE in the initialization program turns on). In this case, I/O refresh will not be executed. Therefore, the operation is executed with the data that has been stored into the input image area before a momentary power failure had occurred.

2) Scan program

(1) Function

- ? In order to process signals which repeats constantly, the program executes its sequential operation repeatedly from the first step to the end step.
- ? If the interrupt task execution condition has been satisfied by a time driven task or event driven task module during scan program execution, the program that is under execution will be temporary stopped and the corresponding task program will be executed.
- ? If the scan program has been completely executed, the single task(internal interrupt) execution condition will be checked and the corresponding task program will be executed.

(2) configuration

? Up to 180 scan programs can be used.

(If task programs are used, the usable number is reduced as many as that of the used task programs)

? Program has been not specified to initialization or task program when writing that program, it will be automatically specified to scan program.

? Scan program has lowest execution priority and the priorities of scan program are determined their registration sequence in the GMWIN screen when writing those programs.

3) Task program

(1) Function

? In order to process internal/ external signal which occurs periodically or non-periodically, the task program temporarily stop the operation of scan program and processes first the corresponding function

(2) Types

? Task programs are classified into the three types as below

- ☐ Time driven task program : Up to 32 programs are applicable
- ☐ Single (internal) task program : Up to 16 programs are applicable
- ☐ Interrupt (external) task program : Up to 8 programs are applicable

? Time driven task program

- ☐ The program is executed by the time interval set before

? Single (internal) task program

- ☐ The corresponding program will be executed if the rising edge of the internal contact occurs.
- ☐ The detection of the rising edge will be executed after the scan program has been processed.

? Interrupt (external) task program

- ☐ The program is executed according to the external signal a input to the interrupt module

HINT
1) Refer to section 4.4.3 task for details of task program

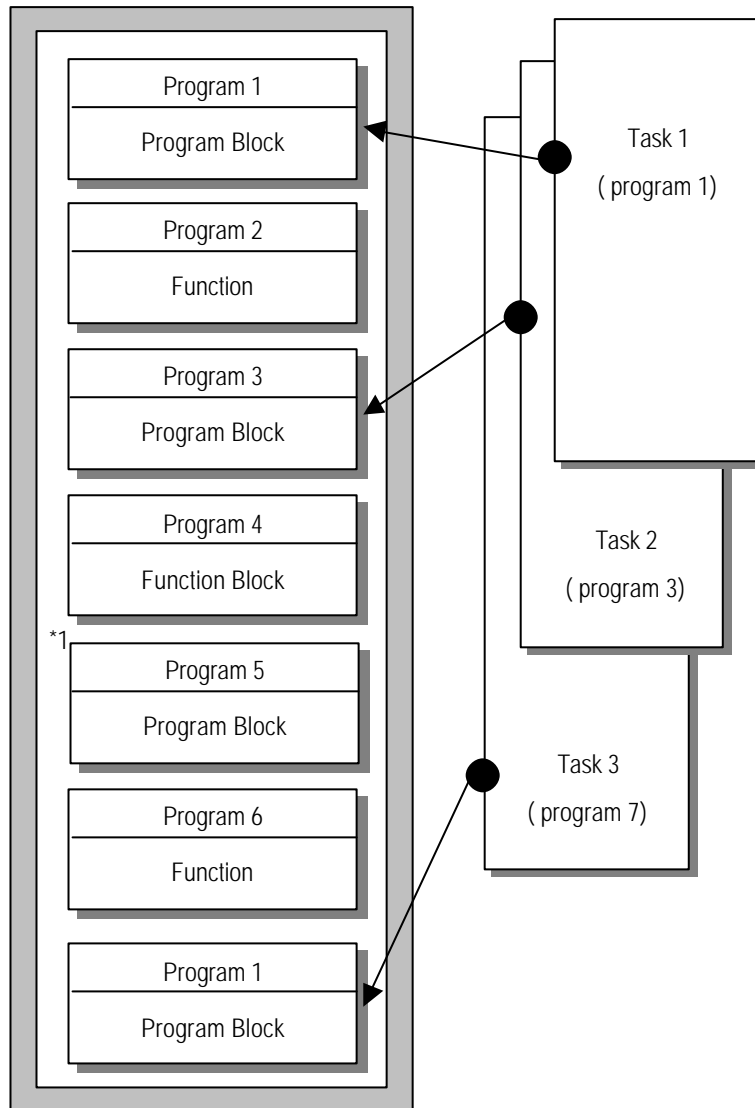
4) Error Task program

? The program which is executed when system error is occurred during the operation of user's program.

? User make error task program, and then program is executed on condition of '_ERR_SYS' task. User can protect system operation failure according as the user controls system error mask flag in the error task program. (For details, refer to section 4.4.4 Error Handling)

4.4.3 Task

The followings explain the program structure and tasks of the GMWIN, that is, the GLOFA-GM programming S/W, in order to give an understanding of the task function



HINT

1) A task executes the some function as the control panel which are used to execute programs. Each task consists of one or more program blocks in the three types of program. Those programs are called task programs A program to which a task has not been specified as marked with '*1' will be automatically specified to scan program

1) Task types and functions

The following table show the types and functions of tasks

Type Specifications	Time driven task	External interrupt task	Internal interrupt task
Number	8 (GM4-CPUA/B) 32 (GM4-CPUC)	8	16
Start up condition	Time driven interrupt (up to 4,294,967.29s by the 10ms)	Rising or falling edge of interrupt module input contact	The rising edge of the BOOL variable data which has been specified of buffer data
Detection and execution	Executed periodically as setting time	Immediately executed when an edge occurs in the interrupt module	Executed with edge detection after scan program has been finished
Detection delay time	Up to 5ms delay	Maximum 5ms delay + Interrupt module delay (within 0.5ms)	Delayed for the same time as maximum scan time
Execution priority	Level 0 to 7 (Level 0 has highest priority)	Level 0 to 7	Level 0 to 7
Task Number	0 to 31 (User set it up not to overlap)	32 to 39 (User set it up not to overlap)	48 to 63 (User set it up not to overlap)

2) Task program processing Method

The following explains the common processing method and instructions for task programs

(1) Task program characteristics

- ? The task program will be executed when a execution condition is satisfied while the scan program is repeatedly processed at every scan. Be sure to consider that point when writing a task program
- ? For example, if a timer and a counter have been used in a 10 sec cycle time driven task program, the timer can occur up to 10 sec error and an input which has been changed within 10 sec will not be counted because the counter checks its input status every 10 sec

(2) Execution priority

- ? The higher priority task program will be first executed if several tasks are ready for their execution If same priority tasks are ready, the FIFO will be applied.
- ? If a newly invoked task has higher priority than that of existing tasks which are under execution, they are temporary stopped and task has higher priority will be executed.
- ? When determining the priority of a task program, consider the characteristics, importance and urgency of the program

(3) Processing delay time

The following factors influence on the processing delay of task program, consider the characteristics, importance and urgency of the program

- ? Task detection delay (Refer to the detailed description of each task)
- ? Execution delay due to the execution of prior task programs
- ? Delay due to the execution of higher priority task programs while executing task programs

(4) Relationship of task program to initialization or scan program

- ? User defined tasks will not start while the initialization task program is being executed. In case of hot restart, the ready tasks before the power failure will be executed after the power has been restored.
- ? As scan program has the lowest priority, if a task is invoked the scan program will be stopped and the task programs will be processed prior to them. Therefore, if tasks are invoked many times or concentrated sometimes the scan time may be extended abnormally. Be cautious when setting task conditions.

(5) Protection of the programs under execution from task programs

- ? If problems can occur in case that program lose its execution continuousness by the task programs which have higher priorities, the execution of task programs can be partly perverted. For program protection, use the DI function(Task program start-up disable) or EI function(task program start-up enable)

3) Time driven task program processing method

The followings explain the processing method of a task program when its task condition(start-up condition) has been set to be driven by time.

(1) Settings that have to be set for the task

- ? Set the task execution cycle and its priority which are used as start-up conditions for the task programs to be executed. Check the task NO. for task control

(2) Time driven task processing

- ? The corresponding time driven interrupt task program will be executed every setting time interval (execution cycle).

(3) Precautions for using the time driven task program

- ? While a time driven task program is being executed or ready for its execution, if a same priority task program has been invoked to be executed the newly invoked task will be ignored, the representative task collision warning flag (_TASK_ERR) will be set to ON, the detailed system error flag(_TC_BMAP[n]) will be set to ON at its corresponding location and occurrence time of the time driven tasks whose execution requests have been ignored will be written at its corresponding location of the flag _TC_CNT[n].
- ? The timer that invokes the execution request for time driven task programs will be incremented only when the operation mode is in the RUN mode

If the RUN mode has been changed into the PAUSE mode while operating with the RUN mode, and then the operation mode has been changed again into the RUN mode, the operation time spent with the PAUSE mode and the power failure time of Hot restart will all be ignored.
- ? When setting the execution cycle for a time driven task program, be cautious that execution requests for many time driven task programs can occur. If four time driven task programs of cycle 2, 4, 10 and 20sec are used, four execution requests will occur every 20 sec and scan time can be momentarily extended.

4) External contact program processing method

The following explains in the case that the task(start-up condition) of a task program has been set to an external interrupt contact signal.

(1) Settings that have to be set for the interrupt module

? Set the dip switch to rising edge or falling edge at each contact of the interrupt module complying with the requested conditions.

(2) Settings that have to be set in the task

? Set the contact No. of interrupt module and priority module in the task that will be used as start-up conditions of the task programs to be executed. Check the task No. for task control.

(3) External contact task processing

? If an interrupt occurs in the interrupt module by a signal which is applied from the external, the CPU module recognize this signal and executes the task program which are invoked by the contact at which the signal has been occurred.

(4) Precautions for using an external contact task.

? While a task program which are invoked by an interrupt module contact is being executed or ready for its execution, if an execution request of a task program has been occurred to the same input contact then the newly invoked task will be ignored, the representative task collision warning flag(_TASK_ERR) will be set to ON, the detailed system error flag(_TC_BAMP[n]) will be set to ON at its corresponding location and the occurrence time of the external task whose execution request has been congested.

? Execution request for a task program can be accepted only when the operation mode is in the RUN mode. That is, if the RUN mode has been changed into the PAUSE mode while operating with the RUN mode and the operation mode has been changed into the RUN mode again, all execution requests occurred during the operation with the PAUSE mode will be ignored.

5) Internal task program processing method

The following explains the processing method when the task (start-up condition) of a task program has been set to the contact of direct variable area(I, Q or M) or automatic variable area.

(1) Settings that have to be set for the task.

? Set the contact and priority that will be the startup conditions of the task program that will be executed. Check the task No. for task control .

(2) Internal contact task processing

? After the execution of scan program has been completed in the CPU module, the contacts that are the start-up conditions of the task program will be checked and the internal task programs where rising edge has been occurred will be executed with its priority. Task program will be executed only once when rising edge is detected.

(3) Precautions when using an internal task program.

? The internal task program is executed when scan program has finished its execution. Therefore, though the execution condition for the internal task program has been invoked in the scan program or task program(time driven, external) the task (start-up condition) will not be immediately executed but will be executed when scan program has finished its execution.

? If execution of an internal task program is requested, the execution conditions will be checked when scan program has finished its execution. Therefore, if an internal task execution conditions, during 'one' scan, has been occurred and disappeared (if the specified contact has been turned from OFF to ON, and then from ON to OFF) by scan program or (time driven or external) task program the task will not be executed as the execution condition can not be detected at the time that execution conditions are being checked.

6) Task processing at momentary power failure

? If the momentary power failure time has been longer than the allowable hot restart setting time and the system restarts with cold restart or warm restart mode, the ready tasks and the tasks invoked during the power failure will all be ignored and only the tasks from the start time will be processed.

? In case of the power failure of 20 ms or less, the ready tasks before the power failure will be executed, a time driven task will be invoked with calculation of the power failure time, and time driven tasks invoked repeatedly before the power failure will be ignored.

7) Examination on task program

After writing down a task program, be sure to examine the following items.

(1) Task setting has been correctly done?

If tasks are invoked more frequently than necessary or several tasks are invoked simultaneously within one scan, the scan time become longer and irregular. In case that the task setting cannot be changed, check the maximum scan time.

(2) Task priorities are properly arranged?

The lower priority tasks still may not be processed after its time due to delay by higher priority tasks. In some cases, if the prior tasks have been delayed and next task occurs task collision can occur. Set the priority with due consideration of items such as urgency and execution time of a task.

(3) Task programs are written as shortly as possible?

If execution time of a task program is long, the scan time may become longer and irregular and also collision of task programs may occur. Therefore, write task programs as shortly as possible.

(4) Protection of lower priority programs against higher priority program isn't needed during execution of those programs.

If the priority of a task program (or a scan program) has been set to lower priority and other tasks must not interrupt during its execution, use the function 'DI' and 'EI' to protect the program partly. When processing global variables used commonly in other programs, special modules or communications modules, problems can occur.

HINT

- 1) For examination on processing speed of scan program and task program, refer to the 'Scan time Calculation Example in the Section 4.2.3 'Scan Time'.

8) Example of program configuration and processing

When the task and program have been registered as below,

? Task registration : T_SLOW (interval : T#10ms, priority : = 0)

PROC_1 (single : %MX0, priority : = 3)

E_INT1 (interrupt : 0, priority : = 0)

? program registration : program ? P0

program ? P1 with the task T_SLOW

program ? P2 with the task PROC_1

program ? P3 with the task E_INT1

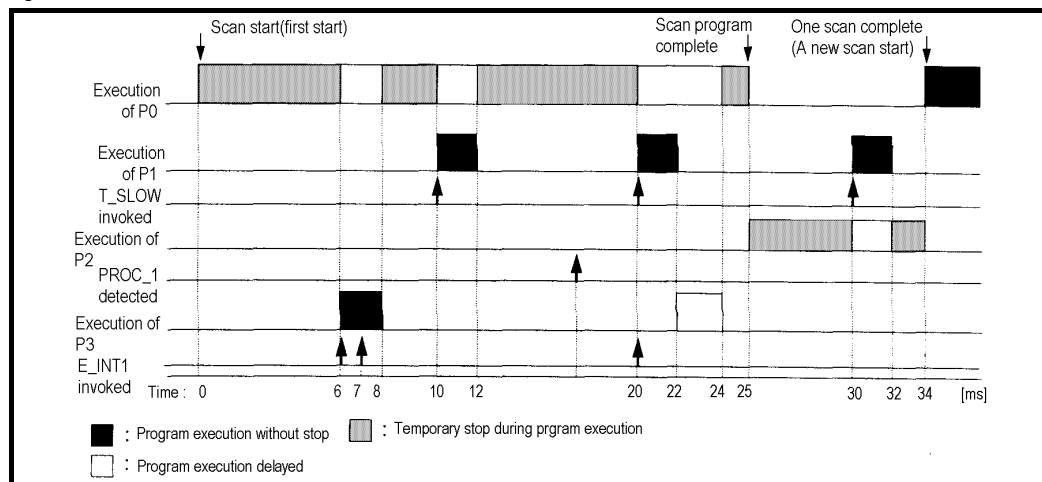
If program execution time is equal to external interrupt occurrence time :

? Execution time for each program : P0 = 17 ms, P1 = 2 ms, P2 = 7 ms, P3 = 2 ms

? Interrupt E_INT occurrence time : Occurred at the 6, 7, 20 ms after the operation started.

? PROC_1 : Invoked during execution of scan program

Program execution is shown as below.



? Processing with time [ms]

0 [ms] : Scan starts and the scan program P0 starts its execution.

0 to 6 [ms] : The program P0 is being executed.

6 to 8 [ms] : Execution request for P3 is input, and P0 is stopped and P3 is executed. Execution request for P1 by E_INT1 at the 7 [msec] is ignored as the P2 is being executed.

8 to 10 [ms] : P3 finishes its execution and the P0 stopped continues its execution.

10 to 12 [ms] : P0 is stopped and P1 is executed due to execution request for P1.

12 to 20 [ms] : P2 finishes its execution and the P0 stopped continues its execution.

20 [ms] : Execution requests for P1 and P3 are simultaneously exist, but the higher priority P1 is executed and P3 is ready for its execution.

20 to 22 [ms] : P0 is stopped and P1 is executed.

22 to 24 [ms] : P1 finishes its execution and the higher priority P3 is executed before P0.

24 to 25 [ms] : P3 finishes its execution and the P0 stopped completes its execution.

25 [ms] : Execution request for P2 is checked at the finish time of the scan program (P0) and P2 is executed.

25 to 30 [ms] : The program P2 is executed.

30 to 32 [ms] : Execution request for P1 is input and P2 is stopped and P1 finishes its execution.

32 to 34 [ms] : P1 finishes its execution and the P2 stopped finishes its execution.

34 [ms] : A new scan starts. (P0 starts its execution.)

4.4.4 Error Handling

1) Error Classification

Errors occur due to various causes such as PLC system defect, system configuration fault or abnormal operation result. Errors are classified into fatal error mode, which stops system operation for system stability, and ordinary error mode, which continues system operation with informing the user of its error warning.

The main factors that occurs the PLC system error are given as followings.

- ? PLC hardware defect
- ? System configuration error
- ? Operation error during execution of the user programs
- ? External device malfunction

2) Operation mode at error occurrence

In case of error occurrence, the PLC system write the error contents the corresponding flags and stops or continues its operation complying with its operation mode.

(1) PLC hardware defect

The system enters into the STOP state if a fatal error such as the CPU module defect has occurred, and continues its operation if an ordinary error such as battery error has occurred.

(2) System configuration error

This error occurs when the PLC hardware configuration differs from the configuration defined in the software. The system enter into the STOP state.

(3) Operation error during execution of the user programs

If the numeric operation error of these errors occurs during execution of the user programs, its contents are marked on the error flags and the system continues its operation. If operation time overruns the watch dog time or I/O modules loaded are not normally controlled, the system enters into the STOP state.

(4) External device malfunction

The PLC user program detects malfunctions of external devices. If a fatal error is detected the system enters into the STOP state, and if an ordinary error is detected the system continues its operation.

HINT

- 1) In occurrence of a fatal error the state is to be stored in the representative system error flags, and an ordinary error in the representative system warning flags.
- 2) For details of flags, refer to Appendix 2. Flag List.

4.4.5 Precautions when using special modules

This system offers convenience and high performance in using special modules compared with the existing methods. Therefore, take some precautions when composing the system. Check the system after the following items have been thoroughly understood.

1) Special module programming

- (1) Special function block is offered for each special module to make programs concise and to prevent errors in writing down the user program.
- (2) Function blocks are largely of two types. 'Initialization' function block for initializing special modules and 'control' function block for control of the operations of special modules. Function block functions as an interface between the user program data and the special modules. As it includes the function that watches the operation status of special modules and indicates the error status, other separate error diagnosis program does not have to be written.

(For detailed description of function block, refer to the User's Manuals of special modules and GLOFA-GM instructions.)

2) Special Module Initialization

This means to define the operations of a special module. It is done with 'initialization' function block. Generally, it specifies the data range to used channel, resolution or filtering method, etc. It defines the hardware characteristics and only one time execution at system start is sufficient.

HINT

- 1) As the initialization should be finished before the scan program starts its execution, its program should be written in the restart program (initialization task program). If the hot restart is used, the same initialization program should also be written in the hot restart initialization program.

3) Control of special modules

In control the operations of special modules, write the program using function blocks which correspond to the operations that have to be controlled. These function blocks can locate at any place within the program.

HINT

- 1) If a power failure occurs in the base unit where special units are loaded, special modules data are removed. Therefore, data should be newly written down in the program.
- 2) If hot restart is used the data in the other parts of the system continues. However, output modules such as the 'D/A conversion module' output standard output of the STOP mode before new data are to be written in the program. If data are written to the special modules every scan normal output is immediately output, but standard output maintains if the output data are changed or written periodically. In this case, in order to maintain continuity of output, it is recommended that an output data restore program be written in the hot restart program.

4) Control of special module on the remote base unit

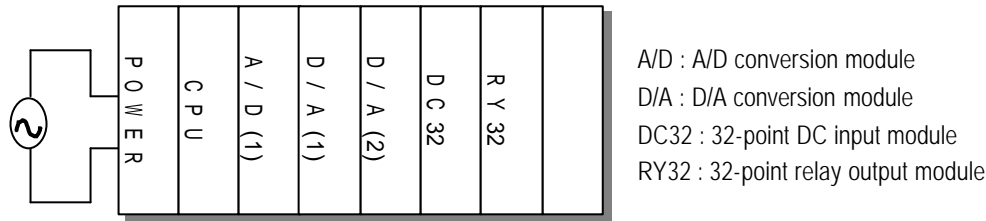
- ? In order to the operations of special modules on the remote base unit, use remote function blocks offered for control of each module in programming. Initialization and control of the module are similar with those of special modules on the extension base unit.
- ? As, in remote base unit, mounting or dismounting is possible during its operation, initialization and data restore programs are requested, which should have the condition flags of the remote base unit as its start-up conditions.

5) Restart Program Example

(1) System Configuration

The followings give an example for writing the initialization program of the system where a special module has been loaded onto its basic base unit shown as below figure.

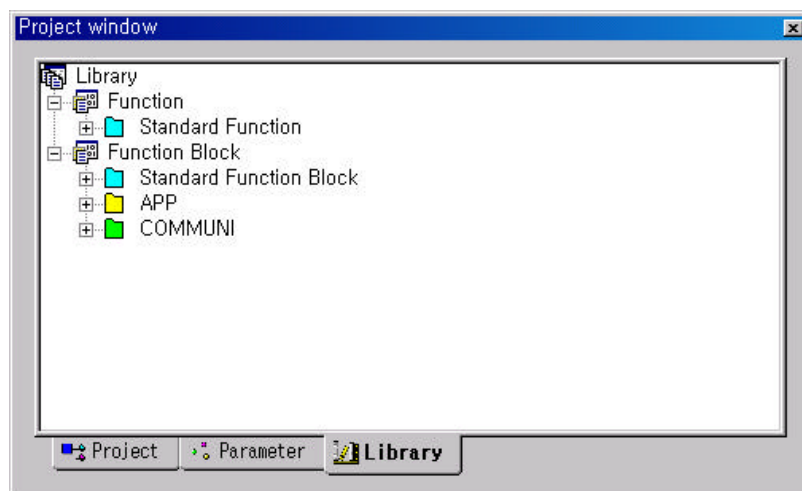
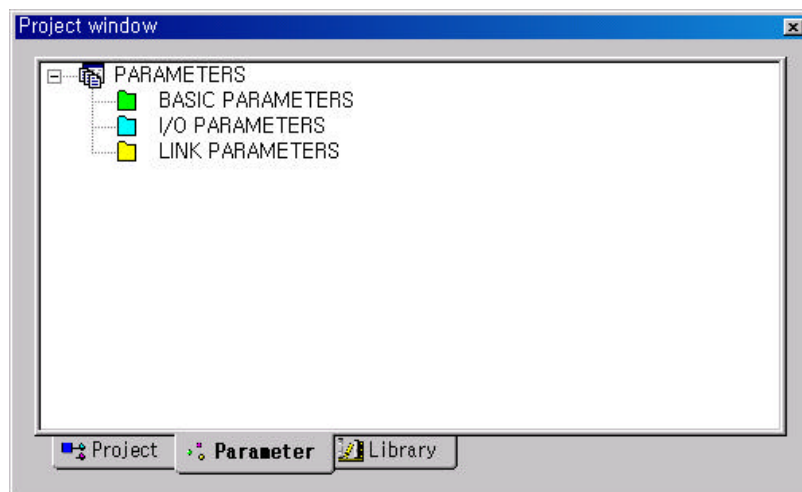
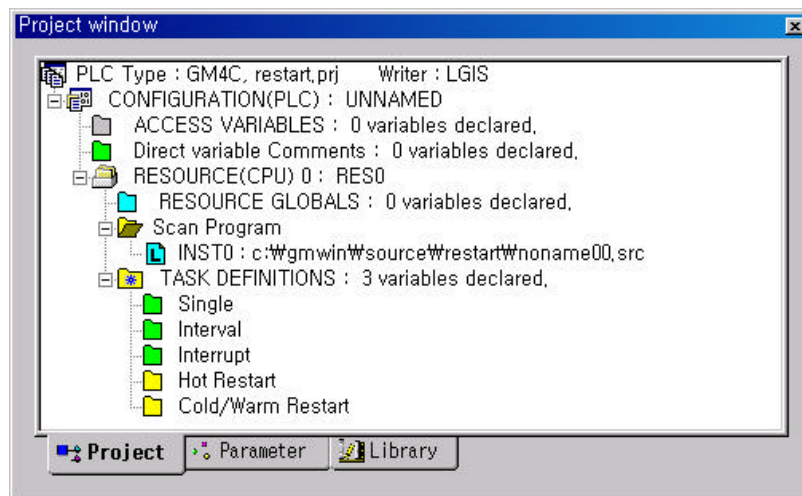
The followings describe an example for writing the 'cold/warm restart program', 'hot restart program' and 'scan program' for the scan program where the 'D/A 02' outputs data every scan and the 'D/A 03' outputs data only when the data has been changed.



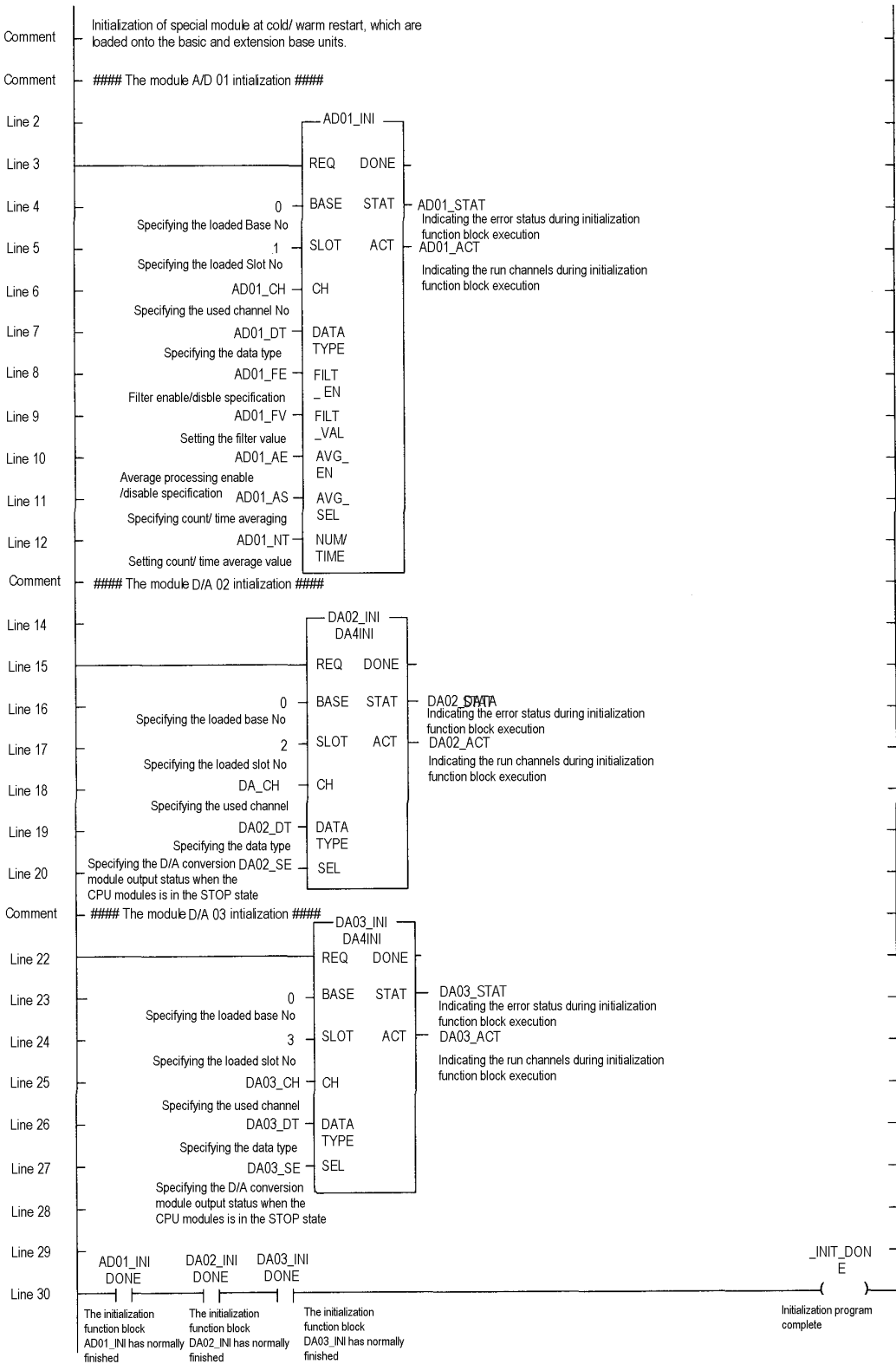
- ? As cold/warm restart makes the whole system restart, the 'cold/warm restart program' consists of only initialization program of special module.
- ? Initialization of special modules by the hot restart program' is needed before the scan program which has been stopped at the hot restart will continue its execution. It is possible that the output conditions of the module 'D/A 03', which outputs data only when the data has been changed, are restored to the state before the stop of the program.

(2) program

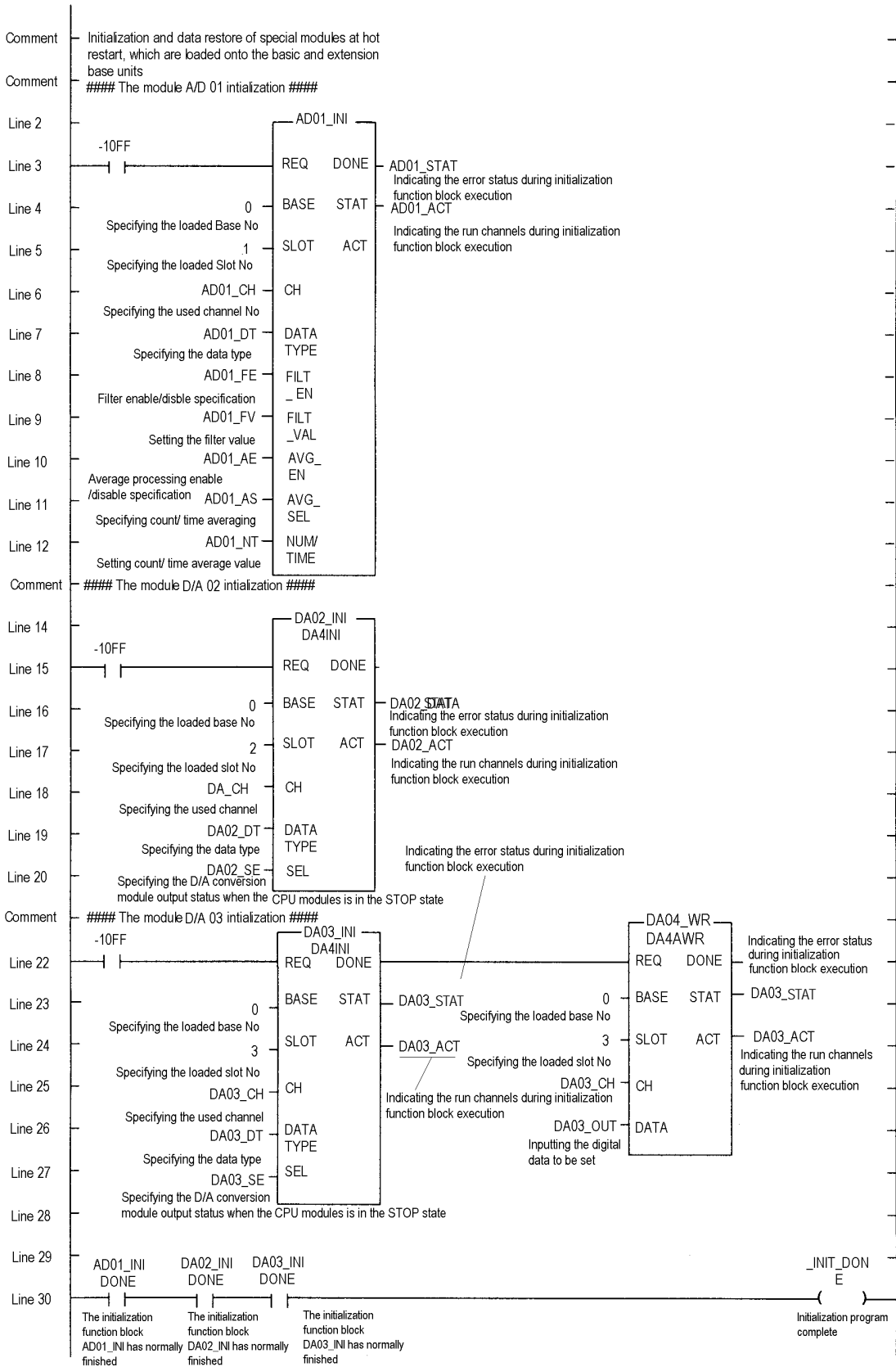
? Project Configuration : Restart.prj



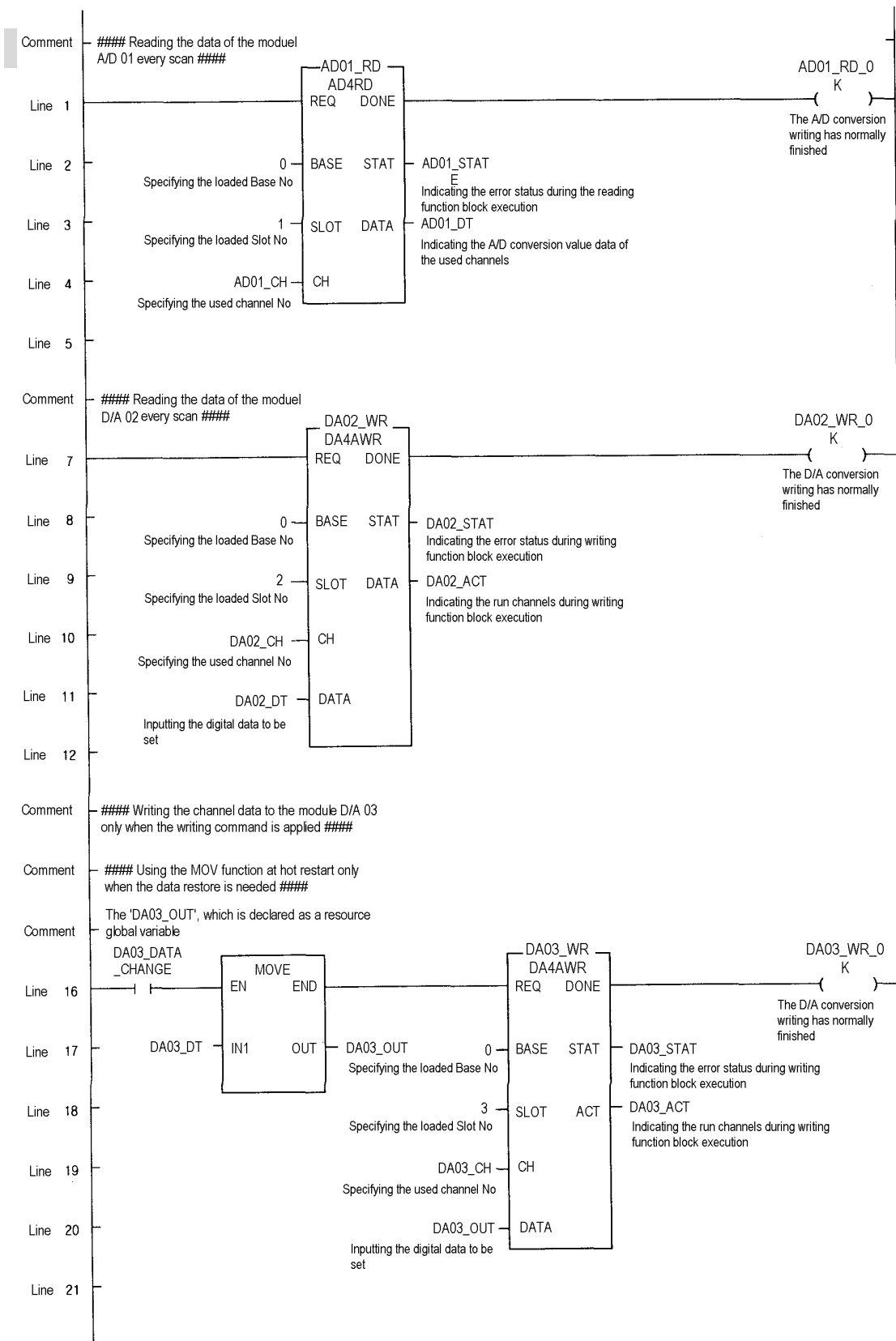
? Program : cw_rst.src (cold/warm restart initialization program)



? Program : hot_rst.src (hot restart initialization program)



? Program : scan.src (scan program)

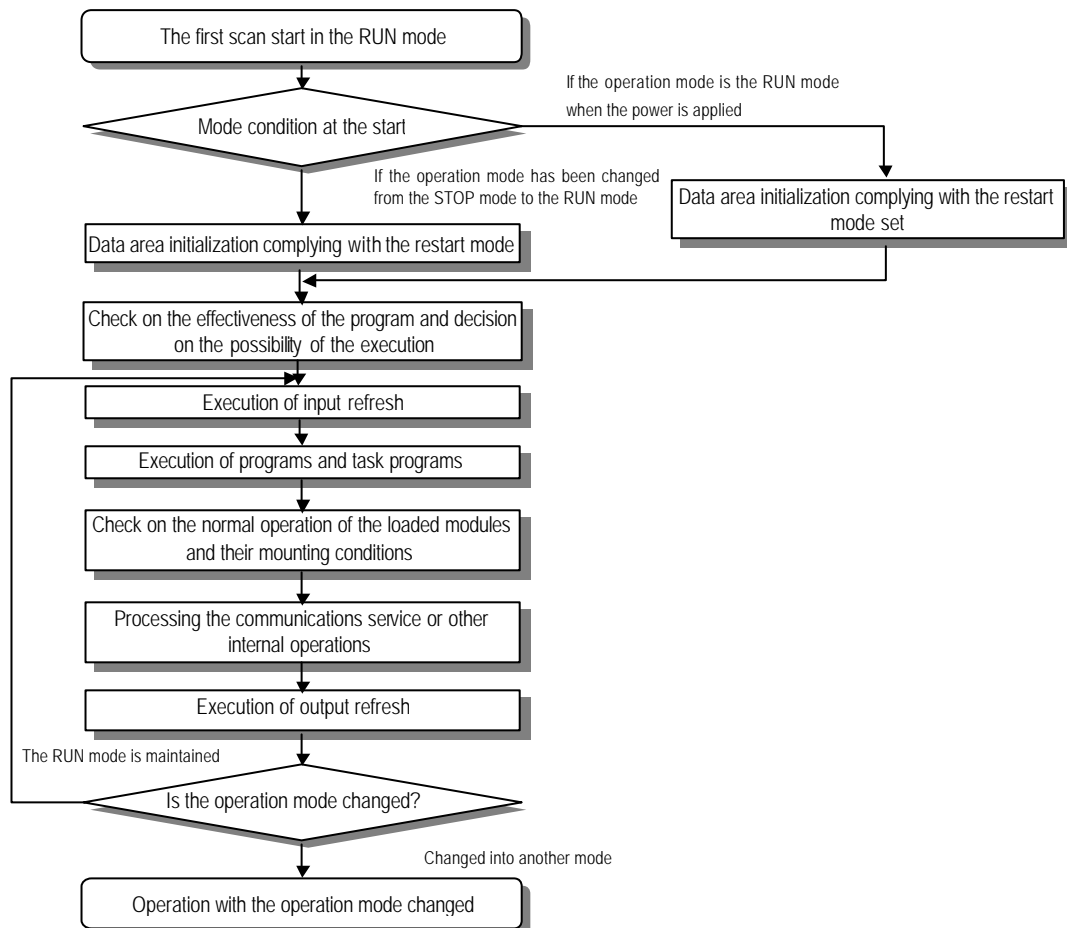


4.5 Operation Modes

The CPU module operates in one of the four modes - the RUN, STOP, PAUSE and DEBUG mode. The following describes the PLC operation processing in each operation mode.

4.5.1 RUN mode

In this mode, programs are normally operated.



1) Processing when the operation mode changes.

Initialization of data area is executed when the first scan starts.

- (1) If the PLC is in the RUN mode when applying the power :
- (2) If the operation mode has been changed into from the STOP mode into the RUN mode : the initialization is executed complying with the restart mode set. (cold / warm / hot)
- (3) The possibility of execution of the program is decided with check on its effectiveness.

2) Operation processing contents

I/O refresh and program operation are executed.

- (1) Task programs are executed with the detection of their start-up conditions.
- (2) Normal or abnormal operation and mounting conditions of the loaded module are checked.
- (3) Communications service or other internal operations are processed.

4.5.2 STOP mode

In this mode, programs are not operated. Program sending through the GMWIN is available only in the remote STOP mode.

1) Processing when the operation mode changes

The output image area is cleared and output refresh is executed.

2) Operation processing contents

- (1) I/O refresh is executed.
- (2) Normal or abnormal operation and mounting conditions of the loaded module are checked.
- (3) Communications service or other internal operations are processed.

4.5.3 PAUSE mode

In this mode, the program operation is temporarily stopped. If it returns to the RUN mode, the operation continues from the state before the stop.

1) Processing when the operation mode changes

Data area clear and input image clear are not executed and the operating conditions just before the mode change is maintains.

2) Operation processing contents

- (1) I/O refresh is executed.
- (2) Normal or abnormal operation and mounting conditions of the loaded module are checked.
- (3) Communications service or other internal operations are processed.

4.5.4 DEBUG mode

In this mode, errors of a program are searched and the operation sequence is traced. Changing into this mode is only possible in the STOP mode. In this mode, a program can be checked with examination on its execution state and contents of each data.

1) Processing when the operation mode changes

- (1) Data area is initialized at the starting time of the mode change complying with the restart mode, which has been set on the parameters.
- (2) The output image area is cleared and output refresh is executed.

2) Operation processing contents

- (1) I/O refresh is executed.
- (2) Debug operation is executed complying with the setting status.
- (3) Output refresh is executed after the debug operation has been executed to the end of a program.
- (4) Normal or abnormal operation and mounting conditions of the loaded module are checked.
- (5) Communications service or other internal operations are processed.

3) Debug operation conditions

? Two or more of the following four operation conditions can be simultaneously specified.

Operation conditions	Description
Executed by the one operation unit, (step over)	If an operation command is ordered, the system operates one operation unit and stops.
Executed to the specified breakpoint.	? If breakpoints are specified in the program the operation stops at those breakpoints. ? Up to 32 breakpoints can be specified.
Executed according to the contact state	If the contact area to be watched and the condition (Read, Write, Value) where the operation has to stop are specified, the operation stops when the specified operation occurs at the specified contact.
Executed by the specified scan number.	If the number of scan that will be operated is specified, the operation stops after it has operated by the specified scan number.

4) Operation method

- (1) Execute the operation after the debug operation conditions have been set in the GMWIN.
- (2) In task programs, each task can be specified to operation enable/disable.(For detailed operation method, refer to the GMWIN User's Manual Chapter 9.

4.5.5 Operation mode change

1) Operation mode change methods

The following method are used to change the operation mode.

- (1) Change by the CPU module mode keys.
- (2) Change by the GMWIN connected with the CPU module communications port.
- (3) Change by the GMWIN connected to the remote CPU module through Fnet.
- (4) Change by the user's command using FAM or computer link module, etc.
- (5) Change by the 'STOP function' during program execution.

2) Operation mode change by the CPU module mode keys

The following shows the operation mode change by the CPU module mode keys.

Mode key position	Operation mode
RUN	Local RUN
STOP	Local STOP
STOP ? PAU/REM	Remote STOP
PAU/REM ? RUN *1	Local RUN
RUN ? PAU/REM	Local PAUSE
PAU/REM ? STOP	Local STOP

HINT

- 1) *1 : If the operation mode changes from RUN mode to local RUN mode by the mode key, the PLC operates continuously without stop.

3) Remote operation mode change

Remote operation mode change is available only when the operation mode is set to the remote STOP mode (i.e., the mode key position is in the 'STOP ? PAU/REM').

Mode key position	Mode Change	Mode change by the GMWIN	Mode change using FAM or computer link, etc.
PAU/REM	Remote STOP ? Remote RUN	?	?
	Remote STOP ? Remote PAUSE	?	?
	Remote STOP ? DEBUG	?	?
	Remote RUN ? Remote PAUSE	?	?
	Remote RUN ? Remote STOP	?	?
	Remote RUN ? DEBUG	?	?
	Remote PAUSE ? Remote RUN	?	?
	Remote PAUSE ? Remote STOP	?	?
	Remote PAUSE ? Remote DEBUG	?	?
	DEBUG ? Remote STOP	?	?
	DEBUG ? Remote RUN	?	?
	DEBUG ? Remote PAUSE	?	?

4) Remote operation mode change enable/disable

It is possible to disable the mode change for system protection so that some parts of the operation mode sources cannot change the mode. If remote operation mode change has been disabled, the operation mode change is possible only by the mode key and GMWIN. To enable the remote operation change, set the parameter 'Enabling the PLC control by communications' to enable.

(For details, refer to the Appendix 1. System Definitions)

4.5.6 System Starting Method

1) Starting Method

The follows show the methods to start PLC systems stably. In order to improve system reliability, observe the starting rules.

(1) Starting by local key :

Download the program in the stop mode, and then set key switch to 'RUN'.

(2) Starting by GMWIN :

Set key switch to 'PAU/REM', and then select 'RUN' in the GMWIN 'Online' menu.

(3) Starting by turning on power :

Set key switch to 'RUN', and then turn on power. On the other hand, if key switch was 'Remote RUN' mode just before turning off PLC, and it is 'PAU/REM' mode right now, it is available to start when to turn on power.

(4) Restarting by reset key :

There are two kinds of reset, 'Reset' and 'Overall reset'.

? Reset : It is operated by pushing reset switch in front of CPU module. It is same operation with turning on power (off \rightarrow on)

? Overall reset : It is operated by pushing reset switch in front of CPU module over 5 seconds.

2) Starting method by system setting

(1) Normal starting

? When turning on power, CPU module checks system configurations. If it is late to turn on power of expansion bases, it waits turning on power of them.

In the 'STOP' mode, after 10 seconds waiting, error is occurred.

? After editing program, the first starting is cold restart.

? When restarting the system which was stopped by normal method, it restarts according to set-up parameter. There are key switch, GMWIN, turning off power, and reset in the starting methods.

? If it was stopped by error on running, restart method is decided according to kinds of error and release method.

(2) When I/O module skip function is set up

? In case of I/O module, which is set up I/O module skip function, it is excluded in operation on running, and error diagnosis function is not executed. If skip function is released on running, the I/O module is included to normal operation. For details, refer to '4.6.10 I/O module skip function' and '4.6.11 module changing function on operation'.

(3) When error mask function is set up

? The module, which is set up error mask, is included on operation and executed error diagnosis function. However, when system starts, if module type disagreement error is occurred, operation is continued. For details, refer to '4.6.9 error mask function'

4.6 Functions

4.6.1 Restart mode

The restart mode defines how to initialize variables and the system and how to operate in the RUN mode when the system starts its operation with the RUN mode by re-application of the power or mode change. Three restart modes, cold, warm and hot restart are available and the execution condition for each restart mode is given below.

(For details, refer to the '4.5.1 Basic Parameters Edit' of the GMWIN User's Manual Section 4.5 Parameters Edit.

1) Cold Restart

- (1) It is executed when the restart mode parameter has been set to the cold restart mode.
- (2) All data are cleared with '0' and only the variables to which their initial value has been defined will be set to their initial value.
- (3) Though the parameter has been set to the warm restart mode, cold restart will be executed at the first execution of a program after it has been changed.
- (4) Pressing the manual reset switch(the reset command in the GMWIN performs same function) makes the system operate with the cold restart mode regardless of the restart mode set by the parameter.

2) Warm Restart

- (1) It is executed when the restart mode parameter has been set to the warm restart mode.
- (2) If a data is specified so that it can retain its previous value, the value remains during the warm restart. If a data has been set to an initial value, the value will be set during the warm restart. All other data will be cleared with '0'.
- (3) Though the parameter has been set to the warm restart mode, cold restart will be executed at the first execution of a program after it has been stopped due to its down load and error.
- (4) Though the parameter has been set to the warm restart mode, cold restart will be executed if data contents are abnormal (i.e., the data does not remain at a power failure)

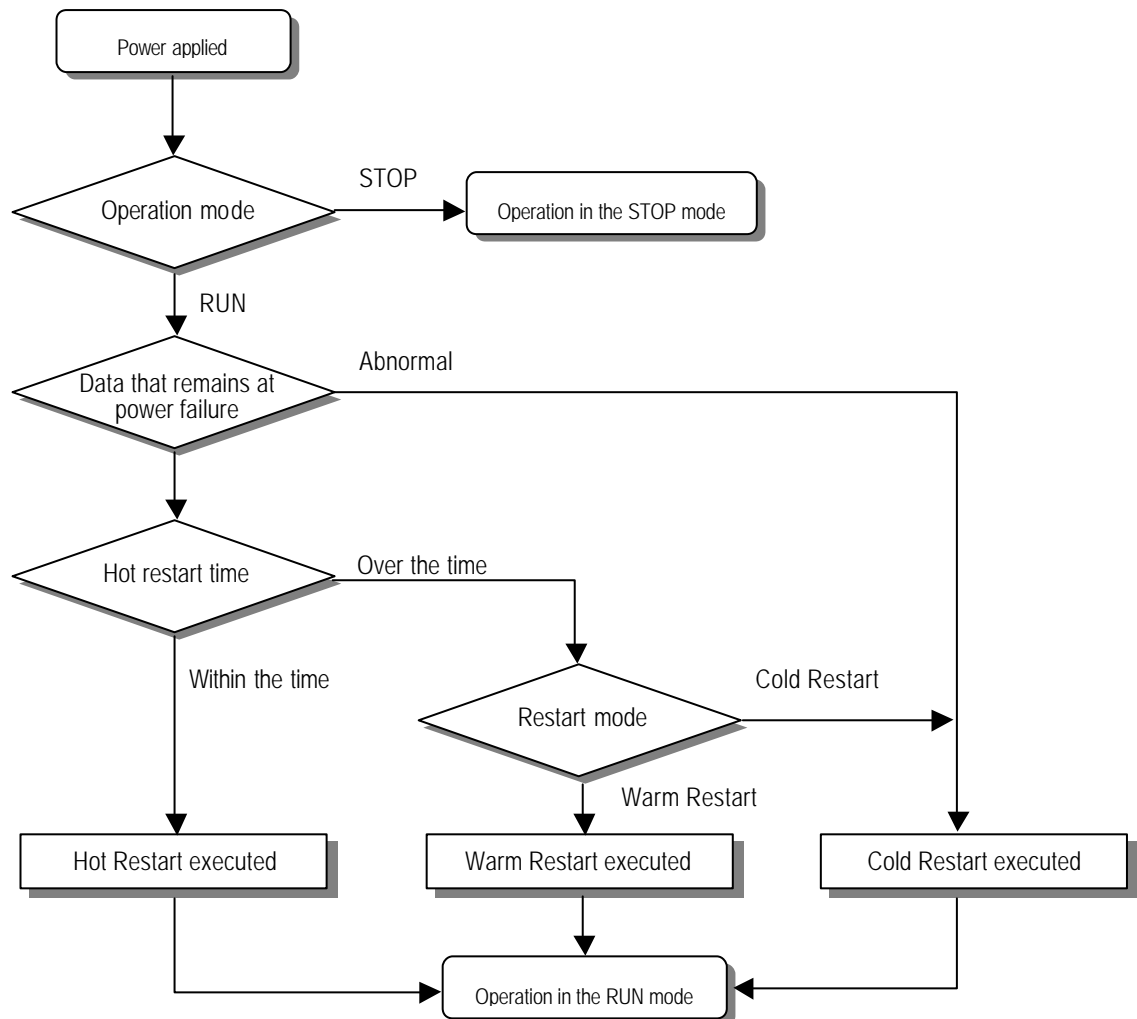
3) Hot Restart

- (1) If the operation mode is in the RUN mode when the power is re-applied after a power failure and the time from power failure to re-application of the power falls into within the allowable hot restart time, the operation starts with the hot restart mode.
- (2) All data and program execution elements will be restored to their state before the power failure. As the program is executed from the state just before the power failure, continuity of the program is maintained even at the momentary power failure
- (3) If the allowable hot restart time has been overrun, the restart mode which has been set by the parameter will be executed.
- (4) Cold restart will be executed if data contents are abnormal (i.e., the data does not remain at a power failure)

HINT

- 1) Consider the followings when setting the allowable hot restart time.
 - (1) The system executes the hot restart initialization program if the time from a power failure to completion of system check after the restore is less than the setting time.
 - (2) If a power failure occurs again before the hot restart initialization program completes its execution, the hot restart program executes again. If a power failure of 20 ms or more has occurred, about 0.5 sec delay can occur until the system operates normally after it has been restored from the power failure. The allowable hot restart time is set by the second.

? Restart mode is executed as the figure given below when the power has been re-applied during execution of the CPU module



4) Data initialization according to the restart mode

The variables relating to the restart mode are classified into three types, i.e., default variable, initialization variable and retain variable. The following table shows the initialization method for each type variable.

Variable type \ Mode	Cold	Warm	Hot
Default	Initialized with '0'	Initialized with '0'	Previous value is retained
Retain	Initialized with '0'	Previous value is retained	Previous value is retained
Initialization	Initialized with the user defined value	Initialized with the user defined value	Previous value is retained
Retain & Initialization	Initialized with the user defined value	Previous value is retained	Previous value is retained

HINT

1) Definitions

(1)Default variable : A variable whose initial value is not defined or previous value will not be retained.

(2)Initialization variable : A variable whose initial value is defined.

(3)Retain variable : A variable whose previous value will be retained.

4.6.2 Self-diagnosis

1) Functions

- (1) The self-diagnosis function permits the CPU module to detect its own errors.
- (2) Self-diagnosis is carried out when the PLC power supply is turned on and when an error occurs the PLC is in the RUN state. If an error is detected, the system stops operation to prevent faulty PLC operation.

2) Error flag

If an error occurs, it will be stored to the following flags and the STOP LED flickers.

? Representative system error flag : _CNT_ER

? Representative system warning flag : _CNF_WAR

HINT

1) Refer to 12.5 Error Code List of Chapter 12. Troubleshooting for details of contents of self-diagnosis and corrective actions.

4.6.3 Clock function

A clock device(RTC) is basically included in the CPU module. The RTC continues its operation by the backup battery when the power turns off or at the 20msec or more momentary power failure.

The clock data of the RTC can be used for time control of system or of error history. The system operation status information flag is updated with the RTC present time every scan.

1) Clock Data

Item	Data
Year	2 digit (solar calendar)
Month	1 to 12
Day	1 to 31
Hour	0 to 23 (the twenty-four-hour system)
Minute	0 to 59
Second	0 to 59
1/100 sec	0 to 99
Day of the week	0 to 6 (Monday to Sunday)

2) Timer error

?5 sec per month

3) Clock data Read/Write

Clock data can be read from/written to the PLC information in the GMWIN on-line mode.

(For details, refer to the GMWIN User's Guide Section 7.10 PLC information)

HINT

- 1) The RTC, at first, has no written clock data.
When using the CPU module, be sure to set exactly the RTC with a clock data.
- 2) Battery error can cause the RTC to stop or error in it.
In this case, writing a new clock data to the RTC removes the error.
- 3) If a RTC error occurs, the flag _RTC_ERR of the system warning flag _CNF_WAR turns on.
If the RTC is restored to normal state, the flag _RTC_ERR turns off.

4.6.4 Remote function

The CPU module can be controlled by external operations (from GMWIN and computer link module, etc. For remote operation, set the SPU module mode setting key to remote position.

1) Remote RUN/STOP

- (1) The remote RUN/STOP permits external operations to RUN/STOP the CPU module under the condition that the CPU module key switch is in the remote position.
- (2) This function is convenient when the CPU module is located on the place where it is difficult to control the CPU module or the user want to control the CPU module in the control panel from outside.

2) Remote PAUSE

- (1) The remote PAUSE permits external operations to execute PAUSE operations under the condition that the CPU module key switch is in the remote position. The PAUSE operations stop the CPU module operation processing while maintaining the On/Off state of the output module.
- (2) This function is convenient when the user wants to maintain the ON state of the output module under the condition the CPU module has been stopped.

3) Remote DEBUG

- (1) This function permits external operations to execute DEBUG operations under the condition that the CPU module key switch is in the remote position. The DEBUG operations execute programs complying with the specified operation conditions.
- (2) This function is convenient when program execution or contents of any data are checked for debugging of the program.

4) Remote reset

- (1) This function permits remote operations to reset the CPU module, which locates in the place where direct operations cannot be applied, when an error has occurred.

HINT

- 1) For remote function operations, refer to the GMWIN User's Manual Chapter 7. On-line.

4.6.5 I/O Force On/Off function

1) Force On/Off setting method

Force on/off setting is applied to input area and output area.

Force on/off should be set for each input and output, the setting operates from the time that 'Force I/O setting enable' is set.

This setting can be done when I/O modules are not really loaded.

2) Force on/off Processing timing and method

(1) Force Input

? After data have been read from input modules, at the time of input refresh the data of the junctions which have been set to force on/off will be replaced with force setting data to change the input image area. And then, the user program will be executed with real input data and force setting data.

(2) Force output

? When a user program has finished its execution the output image area has the operation results. At the time of output refresh the data of the junctions which have been set to force on/off will be replaced with force setting data and the replaced data will be output. However, the force on/off setting does not change the output image area data while it changes the input image area data.

(3) Force on/off processing area

? Input/output areas for force on/off setting are larger than the real I/O areas. If remote I/O is specified using this area, the force on/off function is as just available in it as in the basic I/O areas.

(4) Precautions

? Turning the power off and on, changed of the operation mode or operations by reset key does not change the previous force on/off setting data. They remain within the CPU module and operation is executed with the same data.

? Force I/O data will not be cleared even in the STOP mode.

? If a program is downloaded or its backup breaks, the force on/off setting data will be cleared. The operating program in memory differs from the program in the flash memory so that if operation restarts with the program in the flash memory the on/off setting data will be also cleared.

? When setting new data, disable every I/O settings using the setting data 'clear' function and set the new data.

HINT

1) For detailed operation, refer to the GMWIN User's Manual Chapter 7 'Force I/O setting'

4.6.6 Direct I/O Operation function

This function is usefully available when an input junction state is directly read during execution of a program and used in the operation, or the operation result is directly output to an output junction.

1) Direct input

? Direct input is executed by use of the 'DIRECT_IN' function. If this function is used, the input image area will be directly updated and applied to the continuing operations.

2) Direct output

? Direct output is executed by use of the 'DIRECT_O' function. If this function is used, the data of the output image area, which has the operation results by the time, will be directly output to the direct output module.

3) Force on/off

? Force on/off settings are still effective when processing direct I/O.

HINT

1) For detailed direct I/O functions, refer to the GLOFA-GM commands.

4.6.7 History Log-In

History Log-In is classified into three types, i.e., error history, mode change history and power off history. Up to latest 16 histories are stored.

1) Error recording time and content

(1) Error history

? Recording time : When an error has occurred during operation.

? Stored content : Occurrence time and error code

(2) Mode change history

? Recording time : When an operation mode change has occurred

? Stored content : Occurrence time, operation mode and restart mode

(3) Power off history

? Recording time : When a power off has been occurred during operation in the RUN mode.

? Stored content : Occurrence time(16), Occurrence count(1)

2) Stored History Data Reset

The stored history data will not be cleared until it is cleared by menu selection in the GMWIN.

HINT

1) For detailed instructions, refer to the 'PLC information' in the GMWIN User's Manual Chapter 7 On-line.

4.6.8 External Device Error Diagnosis function

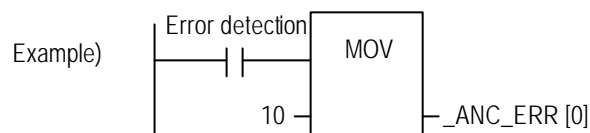
Flags are given for the user to implement easily the program in which the error detection of external devices and system stop and warning are coded. By use of these flags, error indication of external devices is possible without complex programming and monitoring of the error location can be done without special tools (GMWIN, etc.) or source programs.

1) External device fault detection and classification

- (1) The user program detects external device faults. The faults are classified into fatal fault(error), where the PLC stops its operation, and ordinary fault(warning), where operation continues.
- (2) The flag ANC_ERR[n] is used to indicate error. The flag ANC_WN[n] is used to indicate warning.

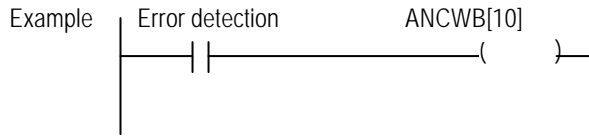
2) External Device Fatal-fault (Error) Processing.

- (1) If an error of external device is detected and the error type, where other value than 0 is used, is written to the system flag ANC_ERR[n], the flag will checked at the time that scan program finishes its execution. If an error is indicated on the flag, it will be also indicated on the _ANNUN_ER of the representative system error flag _CNF_ER, the PLC turns all output modules off and the error state will be same as the PLC selfdiagnosis.
- (2) The user can know the cause of error by use of the GMWIN, and also by direct monitoring of the flag _ANC_ERR[n].
- (3) As the flag _ANC_ERR[n] has sixteen elements(n : 0 to 15), the user can classify error states largely. User defined error No. can be written to the elements. A number of 1 to 65535 is usable.



3) External device Ordinary-fault (Warning) Processing.

- (1) If a warning of external device is detected and the corresponding flag of the system flag _ANC_WB[n] is set to on, the flag will checked from the _ANC_WB[0] at the time that scan program finishes its execution. If an error is indicated on the flag, it will be also indicated on the _ANNUN_WR of the representative system warning flag _CNF_WAR. External device warning numbers will be written to from _ANC_WAR[0] to _ANC_WAR[7] according to occurrence sequence.
- (2) The user can know the cause of error by use of the GMWIN, and also by direct monitoring of the flags _ANC_WAR[n] and _ANC_WB[n].
- (3) If an external device warning is removed, that is, the elements of _ANC_WAR[n] are released from warning, the corresponding _ANC_WAR[n] will be automatically cleared. If all element flags are cleared, the flag _ANNUN_WR of the system flag _CNF_WAR will be reset.



<pre> ANNUN_WR = 1 ANC_WAR[0] = 10 ANC_WAR[1] = 0 ANC_WAR[2] = 0 ANC_WAR[3] = 0 ANC_WAR[4] = 0 ANC_WAR[5] = 0 ANC_WAR[6] = 0 ANC_WAR[7] = 0 </pre>	<p>If the user program had detected a system fault and set <code>_ANC_WB[10]</code> to ON, the states of <code>_ANNUN_WR</code> and <code>_ANN_WAR [0..7]</code> will be shown as left after the scan has been finished</p>
---	---

<pre> ANNUN_WR = 1 ANC_WAR[0] = 10 ANC_WAR[1] = 0 ANC_WAR[2] = 0 ANC_WAR[3] = 0 ANC_WAR[4] = 0 ANC_WAR[5] = 0 ANC_WAR[6] = 0 ANC_WAR[7] = 0 </pre>	<p>After the next scan has been finished, if the numbers 1, 2, 3, 10, 15 , 40 , 50, 60 and 75 of <code>_ANC_WB[n]</code> are turned on <code>_ANC_WAR[n]</code> will be shown as left</p> <p>As the number 10 has turned on (has occurred) in the previous scan, though the number 10 has lower priority than the numbers 1, 2 and 3, it will be the lower element of <code>_ANC_WAR[n]</code>. The <code>_ANC_WB[75]</code> is not indicated as it is turned on and the warning that occurred before has written to the <code>_ANC_WAR[n]</code>.</p>
---	--

<pre> ANNUN_WR = 1 ANC_WAR[0] = 10 ANC_WAR[1] = 0 ANC_WAR[2] = 0 ANC_WAR[3] = 0 ANC_WAR[4] = 0 ANC_WAR[5] = 0 ANC_WAR[6] = 0 ANC_WAR[7] = 0 </pre>	<p>After the next scan has been finished, if the numbers 1, 2, 3, 10, 15 , 40 , 50, 60 and 75 of <code>_ANC_WB[n]</code> are turned on <code>_ANC_WAR[n]</code> will be shown as left.</p> <p>The No. 10 warning has been released the content of <code>_ANC_WAR[0]</code> will be cleared and the contents of <code>_ANC_WAR[1..7]</code> will shift into the lower elements. The content of <code>_ANC_WAR[7]</code> will has been cleared by the shifting and the content of <code>_ANC_WB[75]</code> will be written to <code>_ANC_WAR[7]</code>.</p>
---	---

<pre> ANNUN_WR = 1 ANC_WAR[0] = 10 ANC_WAR[1] = 0 ANC_WAR[2] = 0 ANC_WAR[3] = 0 ANC_WAR[4] = 0 ANC_WAR[5] = 0 ANC_WAR[6] = 0 ANC_WAR[7] = 0 </pre>	<p>If all warnings indicated on the <code>_ANC_WB[n]</code> are released during operation, the <code>_ANNUN_WR</code> and <code>_ANC_WAR[n]</code> will be shown as left.</p>
---	---

4.7 GM4-CPUC Dedicated Functions

4.7.1 Error Mask Function

1) Uses and operation introductions

Error mask function is the function which makes program to be continued and ignores the error even if the specific module makes error on operation. The module, which is assigned to error mask, renews the I/O data normally and executes error diagnosis until the error is occurred. If the module makes error on operation, CPU module indicates the error to flag or GMWIN and continues operating. (blinking RUN LED : 40ms)

2) Error mask setting up

? Error mask function can be set up module error and user generated error.

(For details, refer to 'Appendix 2. Flag List'.)

? Error mask function can be set up by GMWIN and user programs.

? Error mask function can be set up in advance or set up by the error task program.

HINT

- 1) Even if the cause of error is removed, if error flag of CPU module is not initialized and then error mask is released, system is shut down. Before error mask flag is released, check error flag.
- 2) Even if there are power on/off, changing operation mode and handling reset key, error mask data is operated because the state is maintained in the CPU. Therefore, in case of revision of error mask function, use GMWIN or user programs.
- 3) In case of the follow, error mask data is erased.
 - (1) In case of re-operating after downloading program by GMWIN.
 - (2) In case of memory backup is broken up because battery is dead.

4.7.2 I/O Module Skip Function

1) Uses and operation introductions

I/O module skip function is the function which excludes the specific module in the operation. I/O data revision and error diagnosis are not executed in the specific module. It can be useful for temporary operation where erroneous part is excluded.

2) Configurations and I/O data processing

? It can be set up about each of I/O modules (For details, refer to GMWIN User's Manual)

? Because input refreshing is stopped, input image area maintains the previous values when I/O module skip function is set up. However, also in this case, I/O image area handling by force On/Off function is available.

? Real outputs of output modules are set to 'Off' when setting I/O module skip function, but output image area is variable by operation of user program. After skip function is set, outputs of output modules can not be altered by force On/Off.

? When using direct I/O operation function, the operation of I/O skip function is same.

HINT

- 1) Even if there are turning on/off power, changing operation mode and handling reset key, the previously set I/O skip data operates as it did because the state in the CPU module is maintained. Cancellation of I/O skip function is available by GMWIN or user program.
- 2) I/O skip data can be erased in follow cases.
 - (1) In case of re-operating after downloading program by GMWIN..
 - (2) In case of memory backup is broken up because battery is dead.

4.7.3 Online Module Changing Function

Online module changing function is available in the GM4C system. However, because online module changing can be the reason of the system error, extra attentions are required. Be sure to follow the steps of the User's manual.

1) Precautions for use

- ? The modules in the main base can not be changed.
- ? Base, power and communication module can not be changed.
- ? When changing module, be sure to insert the module correctly.
- ? All of I/O modules can be changed and the follow special modules can be changed.
 - G4F-AD2A, G4F-AD3A, G4F-DA1A, G4F-TC2A, G4F-RD2A
 - G4F-DA2V, G4F-DA2I, G4F-DA3V, G4F-DA3I, G4F-AD3A

2) Module changing method

The method of changing module is as follow.

- (1) Using GMWIN, set I/O skip function about the slot of the base where the changing module is mounted.
- (2) Using GMWIN, set error mask function about the slot of the base where the changing module is mounted.
- (3) Change the module.
- (4) In case of special module, Initialize by GMWIN.
- (5) Using GMWIN, release the slot from I/O skip function.
- (6) After checking the normal operation (and also the error flag), release error mask function.

HINT

- 1) In case of using I/O skip function in order to change module, cut off the loaded power, and in case of using I/O force On/Off function, deliberate to set input image.
- 2) In order to prevent the overall system error caused by changing module or module error when handling module change, be sure to set error mask function as above steps.

Warning

- 1) In case of mounting module, if the module is mounted incorrectly, it can cause malfunctions of the other modules. Be sure to that above hook of module is inserted to above joint of base entirely.

3) Initialization of special module

Special module is necessary to initialize again in case of being reset special module on CPU operation because special modules have initialization function of channel specification by S/W.

(1) Initialization of special module by GMWIN

? In case of changing special module as the above module changing method '(4)', select 'Initialize special module' in the Online menu of GMWIN, and then initialize as follow method.

(G4F-DA2V, G4F-DA2I, G4F-DA3V and G4F-DA3I are not necessary to initialize.)

- ☐ Assign slots of the special module to initialize.
- ☐ Assign the value which is the same with initial value of initial function block in the program.

4) Changing remote base

Remote base can be attached and detached on operation, so when changing module, extra handling is not necessary because there is initialization program of special module on operation program.

4.7.4 I/O Reservation Function

1) Uses and operation introductions

I/O Reservation Function is the function which can be used in order to add other I/O modules without stopping systems when adding the I/O modules later on.

? I/O Reservation Function can be applied to digital I/O module and D/A conversion module.

2) Operation

The method of I/O Reservation Function is as follow.

- (1) Using GMWIN, check 'Use Reserved I/O Function' in the GMWIN basic parameter.
- (2) Download the basic parameter to PLC.
- (3) Using GMWIN, set I/O parameter about the modules which will be added later on.
- (4) Download the I/O parameter to PLC.
- (5) Using GMWIN, set I/O module skip function and error mask function about the specific I/O slots which the additional modules will be mounted in later on.
- (6) Execute H/W Reset (by PLC Reset Switch) or S/W Reset (by GMWIN), or turn on the PLC
- (7) Start operation.

In case of mounting the additional module :

- (8) Mount the additional module to the I/O slot, which was set in the step (3), without stopping system.
- (9) In case of mounting D/A conversion module, execute 'Initialize Special Module' about the module.
- (10) Release I/O module skip function in the slot of the additional module.
- (11) Confirm the normal operation of 'I/O module writing/reading', 'module loading/unloading error flag' and other relative flags. (For more details, refer to App 2-7 'Detailed System Error and Warning Flag List'.)
- (12) Release error mask function in the slot of the additional module.

HINT

The I/O Reservation Function can be applied in the following environment

- (1) GM4-CPUC O/S version : Version 2.1 or over.
- (2) GMWIN version : Version 4.03 or over.
- (3) GM4 high performance main base (GM4-BxMH) and high performance expansion base (GM4-BxEH)

Warning

In case of mounting module using I/O reservation function, be sure to follow the above steps of the operation, in order to prevent malfunction of the whole PLC system.

4.7.5 FEnet Reset Function

1) Uses and operation introductions

FEnet Reset Function is the function which clears FEnet module only without reset of the whole system, when the communication of the FEnet does not work correctly by the certain trouble.

2) Operation

In order to reset FEnet only, set the appropriate flag of the following flag list by using variable monitor on GMWIN or using coil in the scan program. When the reset operation is ended, the flag is cleared to '0' again.

? FENET_RESETx : To use for reset FEnet of the slot No. x.

- (1) _FENET_RESET_Mx : Main base
- (2) _FENET_RESET_Ex : Expansion base

? RCV_SERx_CHy : To display setting slot No. x and channel No. y by using dedicated service.

- (1) _RCV_SERVx_M_CH : Main base
- (2) _RCV_SERVx_E_CH : Expansion base

? RCV_SERx_COUNT : Receiving count of slot No. x by using dedicated service.

- (1) _RCV_SERV_CNT_M : Main base
- (2) _RCV_SERV_CNT_E : Expansion base

? x (Slot) : 0 ~ 55 (GM4-CPUC), y (Channel) : 0 ~ 15

HINT

The FEnet Reset Function can be applied in the following environment.

- (1) GM4-CPUC O/S version : Version 2.1 or over.
- (2) GMWIN version : Version 4.04 or over.
- (3) Fast Enet O/S version : Version 1.1 or over.

Warning

- 1) After the FEnet reset operation is finished, it takes minimum 5 to 6 more seconds to stabilize the system. After the FEnet reset operation, make sure NOT to retry the FEnet reset function immediately. If the FEnet reset function is retried immediately without waiting minimum 5 to 6 seconds when the previous FEnet reset operation is ended, it can cause the whole system reset.
- 2) In case of using the scan program in order to set the FEnet reset flag, be sure to use 'Positive transition-sensing contact (---| P |---)' for the executing condition of the coil. If the FEnet reset function is retried, be sure to use set the FEnet reset flag after minimum 5 to 6 seconds from the end of the previous FEnet reset operation. Do NOT retry the FEnet reset operation immediately without waiting 5 to 6 seconds when the previous FEnet reset operation is ended.
- 3) The FEnet reset function should be executed within the limit of the emergency, and also it is need to be executed very cautiously. For more details, refer to 'FEnet User's Manual'.

4.8 Memory Configuration

The CPU module includes two types of memory that are available by the user. One is program memory which is used to store the user programs written to implement a system by the user. The other is data memory which stores data during operation.

1) Program memory configuration

The table given below shows the contents to be stored and the storage capacity of program memory.

Item	GM4-CPUA/B	GM4-CPUC
Overall program memory area	129K byte	1M byte
System area : ? System program area ? Backup area	1.5K byte	13K byte
Parameter area ? Basic parameter area ? I/O parameter area ? High speed link parameter area ? Interrupt setting information area	3.5K byte	10K byte
Program area ? Scan program area ? Task program area ? User defined function/function block area ? Standard library area ? Access variable area ? Variable initialization information area ? Protective variable specification information area	123K byte	977K byte

2) Data memory Configuration

The table given below shows the contents to be stored and the storage capacity of program memory.

Item	GM4-CPUA	GM4-CPUB	GM4-CPUC
Overall data memory area	64K byte	64K byte	512K byte
System area ? I/O information table ? Force I/O table	7.5K byte	6.5K byte	50K byte
System flag area	1.5K byte	1.5K byte	4,096 byte
Input image area (%IX)	512 byte	1K byte	4,096 byte
Output image area (%QX)	512 byte	1K byte	4,096 byte
Direct variable area (%M)	2 to 16K byte	2 to 16K byte	8 to 64K byte
Symbolic variable area (maximum)	52K byte – the size of direct variable area	50K byte – the size of direct variable area	428K byte – the size of direct variable area
Stack area	4K byte	4K byte	4K byte

3) Purpose

(1) System area

Used to store the selfcreated data of the CPU module for system management and GEMWIN system control data.

(2) System flag area

Used to user flags and system flags. The user operates it with flag name.

(3) Input image area

Used to store input data read from input modules. Overall size is %IX0.0.0 to %IX63.7.63, however, the area %IX0.0.0 to %IX3.7.63 is really used for input module area.

The area that is not used by the real input module loaded is a free area that the program can use. Especially, it will be convenient to use that free area for storing remote input data through high speed link.

(4) Output image area

Used to store operation results. The stored data are automatically output to output modules. Overall size is %QX0.0.0 to %QX63.7.63, however, the area %QX0.0.0 to %QX3.7.63 is really used for output module area in the GM3/4 series.

The area that is not used by the real output module loaded is a free area that the program can use. Especially, it will be convenient to use that free area for storing remote output data through high speed link.

(5) Direct variable area

The user can use this area to access direct memory data through the variable names such as %MX0, %MB0, %MW0, %MD0 and %ML0, which was pre-defined by the system.

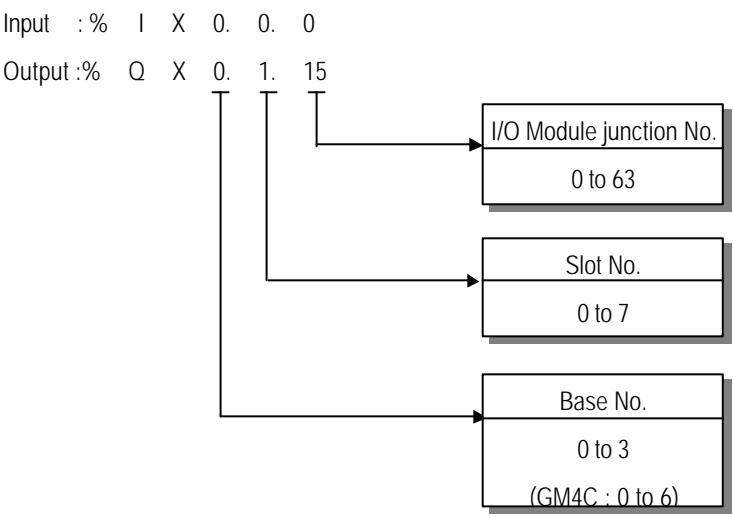
(6) Symbolic variable area

Used to store the variables that the user created, that is, whose names the user defined when writing a program. Global variables and instance memory are located in this area. The variables used in program blocks locates in the 'PB instance memory' of the program, and the memory used in function block locates in the 'FB instance memory'.

The maximum size of the PB instance memory is 32K byte. If the used size overruns the maximum size, divide the program blocks or use global variables.

4.9 I/O No. Allocation Method

- 1) I/O No. allocation means to give an address to each module in order to read data from input modules and output data to output modules.
- 2) Fixed 64 points are allocated to each module for I/O points.
- 3) Fixed 64 points are allocated regardless of mounting/dismounting or type of modules.
- 4) The following shows I/O No. allocation method.



HINT

The main base having 12 I/O slots is recognized as base no. 1.

	Power	CPU	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	I/O	
Slot no.			0	1	2	3	4	5	6	7	8	9	10	11
Base no.			0							1				

Chapter 5. BATTERY

5.1 Specifications

Item	Specifications
Normal voltage	3.0 VDC
Warranty life time	5 years
Application	Programs and data backup, and RTC runs in power failure
Specifications	Lithium Battery, 3 V
External dimension (mm)	? 14.5 ? 26

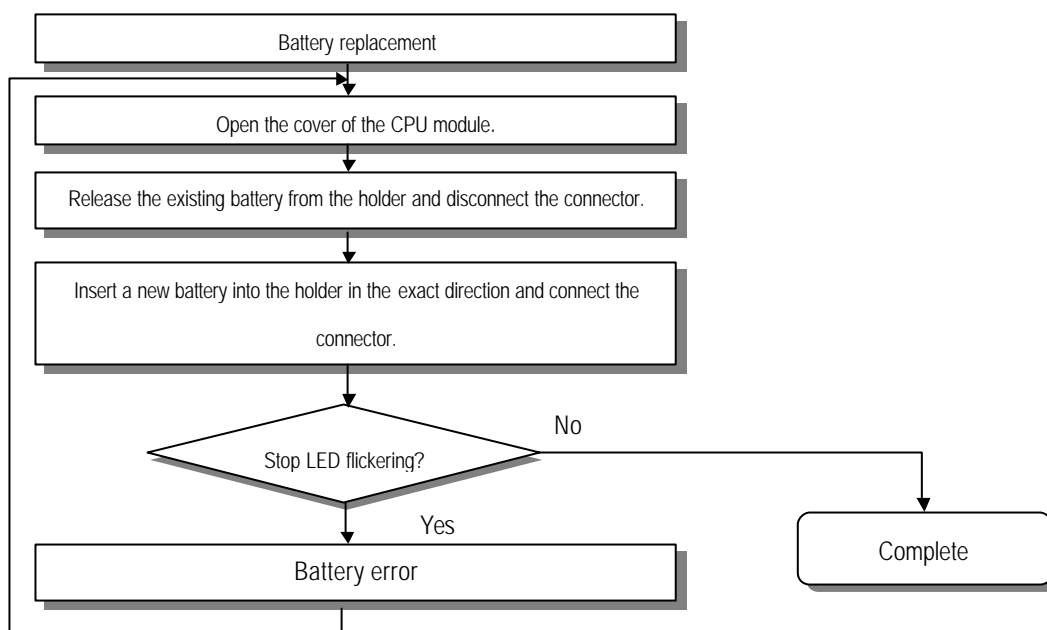
5.2 Precautions for use

- 1) Do not heat or solder its terminals.
- 2) Do not measure its voltage with a tester or short circuit.
- 3) Do not disassemble.

5.3 Battery Replacement

Backup battery needs periodic replacement. Programs and power failure retain data remains for about 30 minutes by the super capacitor though the battery is removed at a power failure, but the battery has to be replaced as soon as possible.

The following shows the battery replacement procedure.



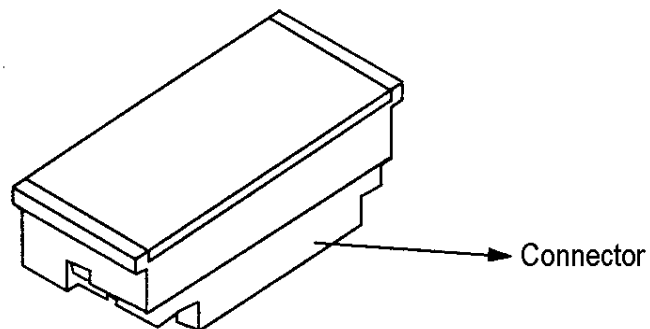
Chapter. 6 Memory Module And Built-in Flash Memory

This chapter describes user programs storage method and operation method of the PLC mounted with the memory module. Flash memory is being used for the memory module in this PLC.

Operation methods are different according to types of CPU module.

6.1 GM4-CPUA (Using Memory Module)

6.1.1 Memory module

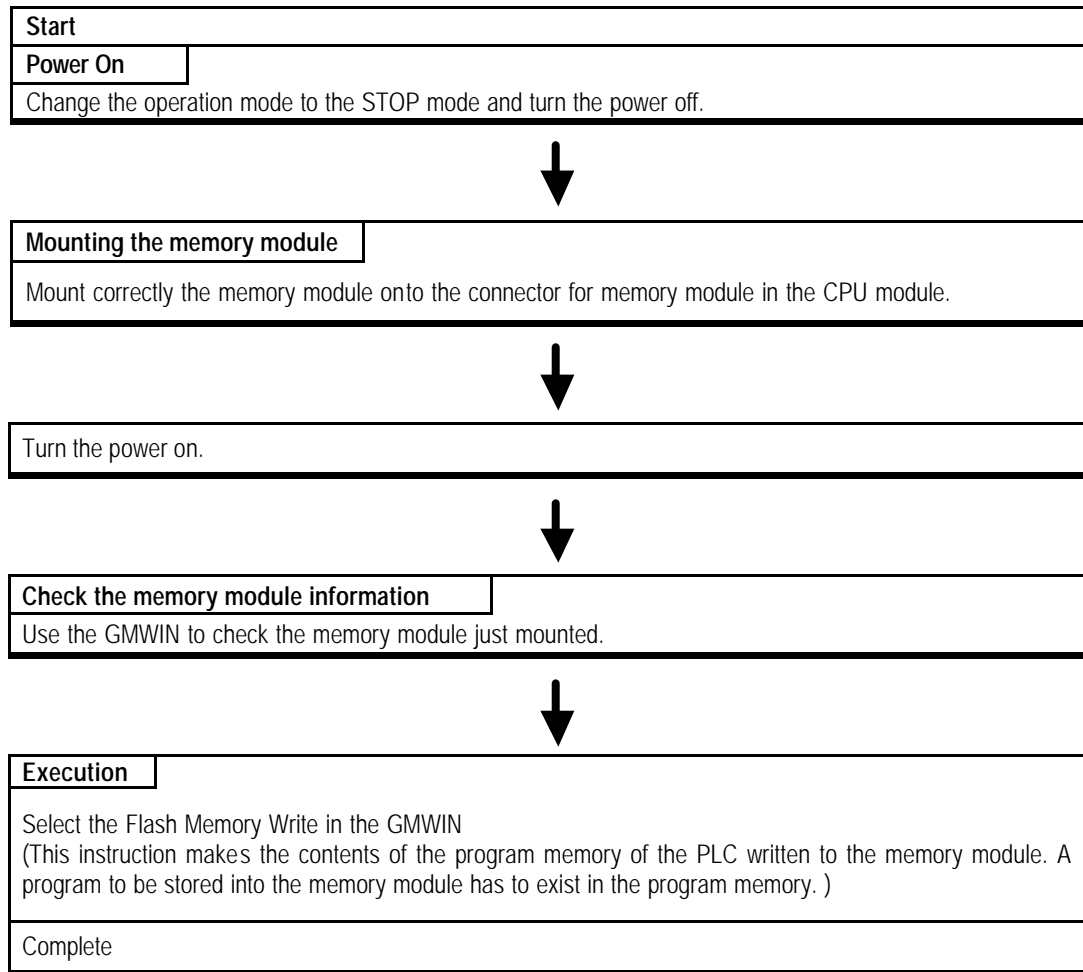


Items	Models	G4M-M032
Memory type		Flash memory
Memory capacity		128K bytes (32K steps)
Weight (Kg)		0.01

6.1.2 Method of writing a user program to the memory module

Be sure to turn the power off when mounting the memory module onto the CPU module. It means to store the user program in the program memory of the CPU module to the memory module. That is only available when the operation mode is the STOP mode.

? The following shows the method of writing a user program to the memory module,

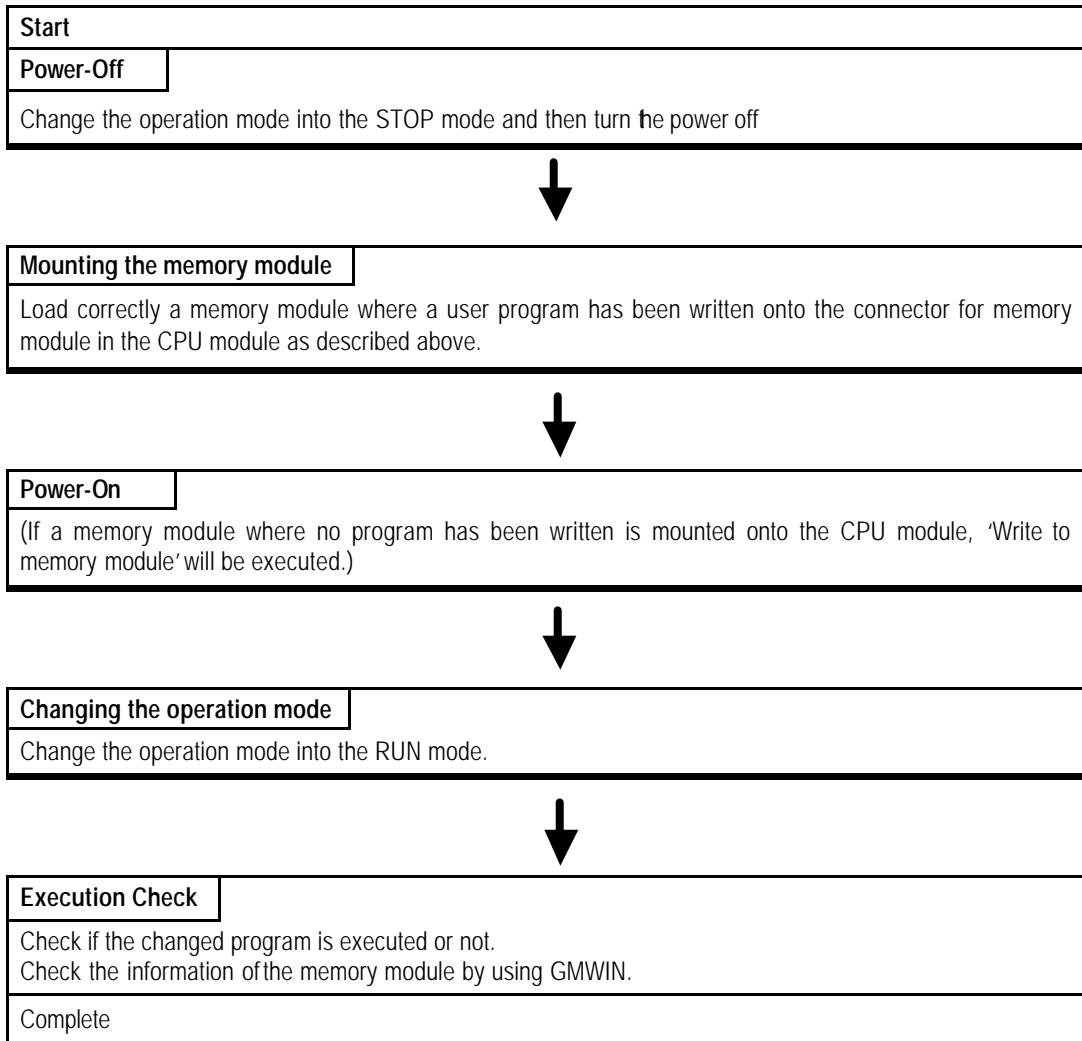


HINT

1) For detailed handling instructions, refer to the chapter 7 "Flash Memory" of the GMWIN User's Manual.

6.1.3 Operation method

- ? Be sure to turn the power off when mounting the memory module onto the CPU module.
- ? If the operation mode is the RUN mode when the power is turned on or the operation mode changes from other mode into the RUN mode after the power has turned on, a user program in the memory module starts its operation after it has been written to the program memory of the CPU module.



HINT

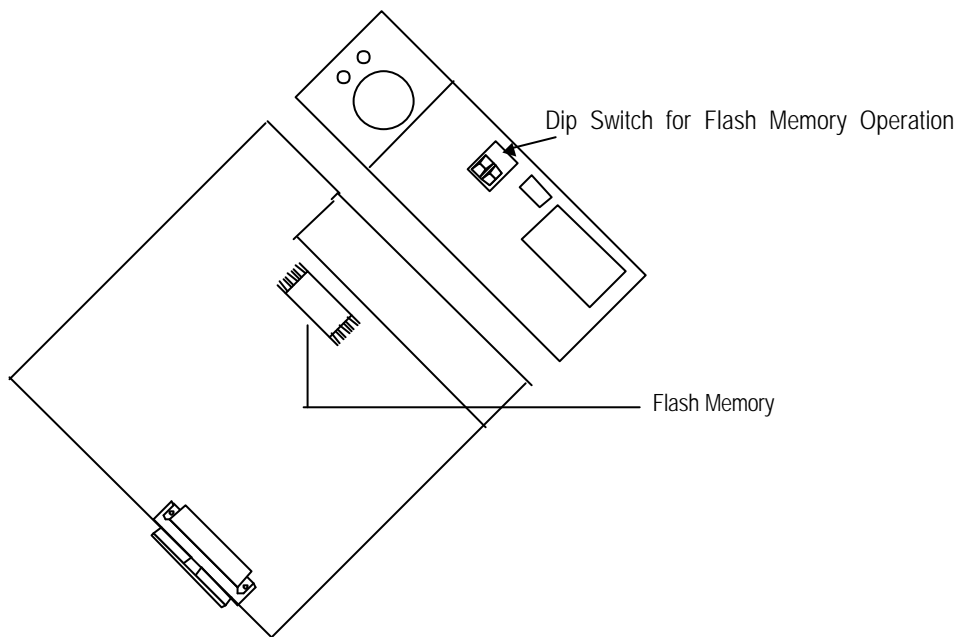
1) If the operation mode was the RUN mode when the power has been turned on then mounting a memory module makes the contents in the memory module will be written to the program area of the CPU module. Be cautious when mounting a memory module to write a user program to the memory module. It will be convenient to operate the PLC without memory module during debugging and to mount a memory module after the debugging.

6.2 GM4-CPUB (Using Built-in Flash Memory)

6.2.1 Operation mode setting

GM4-CPUB does not use separate memory module in order to operate the ROM operation function of GM4-CPUB. Using Built-in flash memory of GM4-CPUB instead of memory module, it can execute the function which stores user program or corresponds to ROM operation function of GM4-CPUB.

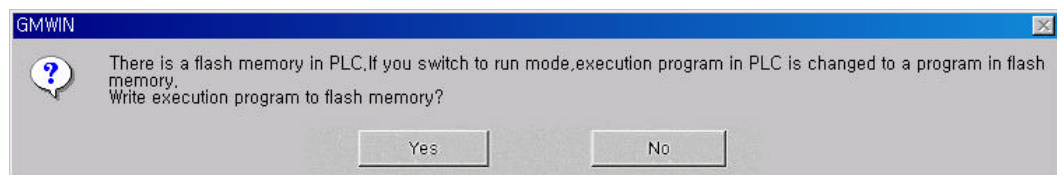
GM4-CPUB executes ROM operation function by using dip switch for flash memory operation



6.2.2 Storing program in the built-in flash memory and operation method

- 1) Change operation mode of GM4-CPUB module to STOP mode.
- 2) There are two methods to write program in the GM4-CPUB.

(1) In general, when writing program to the GM4-CPUB, GMWIN shows the below message.



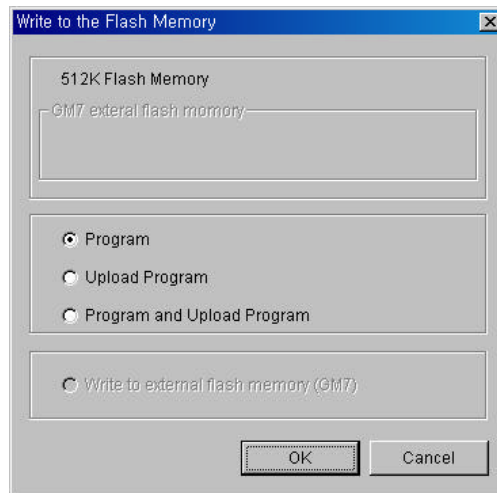
In case of storing downloading program to flash memory, click Yes(Y).

HINT

The above message is displayed in case of selecting Online – Write – Parameter and program in the GMWIN menu.

(2) The follow shows the method to store in the flash memory without overwriting program.

The below message is displayed in case of selecting Online – Flash memory(F) – Write(W) in the GMWIN menu.



Select the item which should be stored to flash memory, and then click OK.

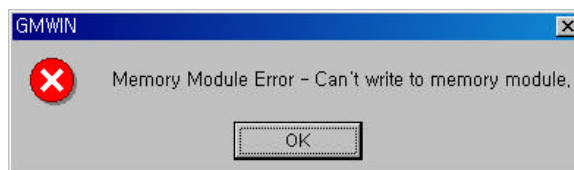
(3) In case of restarting PLC system, operate as follow according to dip switch for flash memory operation.

Selection of DIP switch	Operation
	CPU is operated by the program in flash memory when power on or PLC reset.
	CPU recognizes that no program is in flash memory and is operated by program which is stored in program memory.

(Caution : Lower switch should be at the off position.)

HINT

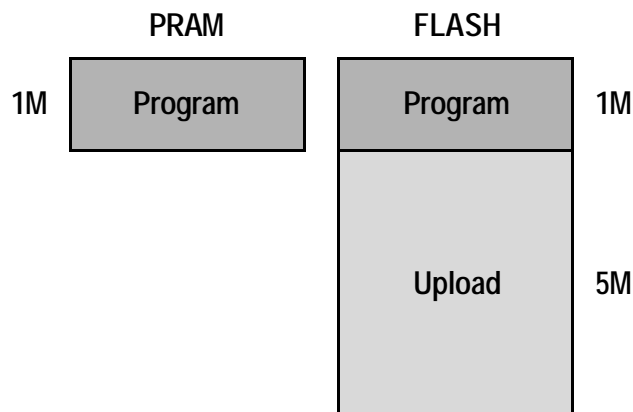
State of dip switch for flash memory is not concerned with storing program.
In case of storing program in the flash memory, set GM4-CPUB to STOP mode.
In case of trying to store in the RUN mode, the follow message is displayed.



6.3 GM4-CPUC (Using Built-in Flash Memory)

GM4-CPUC does not use separate memory module in order to operate ROM operation function of GM4-CPUA. Using Built-in flash memory of GM4-CPUC instead of memory module, it can execute the function which stores user program or corresponds to ROM operation function of GM4-CPUA.

Moreover, GM4-CPUC has built-in flash memory of large capacity. Upload program is stored in the storing area for upload program in the flash memory. In short, the follow shows flash memory structure.

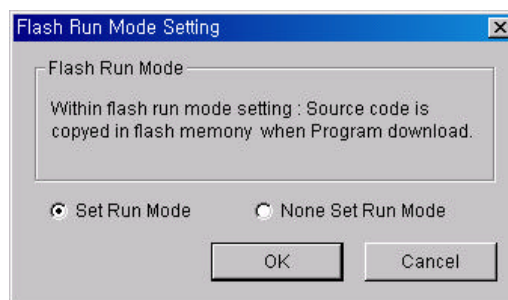


6.3.1 Program storing method by using built-in flash memory

1) Flash operation mode setting

GM4-CPUC executes ROM operation function by using flash operation mode setting in the GMWIN menu.

Using 'Online – Flash memory – Set Mode', check Flash Run Mode Setting, and then click OK.



In case of selecting 'None Set Run Mode', flash operation does not work.

Initial setting is 'Set Run Mode'.

HINT

What is Flash operation mode? It means that PLC is operated by backup program in the flash memory in case of that data in the program RAM get damaged. In case of selecting 'Flash Memory operation', when PLC restarts or operation mode is changed to RUN, data are copied to program memory in the CPU module and then operation is started.

After setting once in the GMWIN, flash operation mode is maintained if it is not set to Off by GMWIN.

GM4-CPUC is available to write to flash memory in the RUN mode.

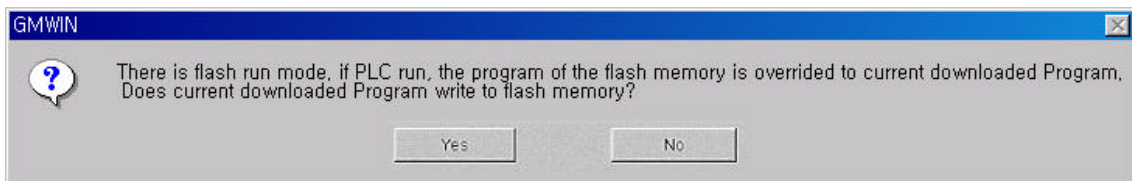
On program debugging, operate in the state of flash operation mode is set to Off. After completion of debugging, if flash operation mode is set up, it is convenient to write flash memory.

2) Program storing method in the built-in flash memory

There are three methods to store program in the built-in flash memory.

2.1) When downloading program.

When flash operation mode is set, if program is written to GM4-CPUC, the following message is displayed in the GMWIN.

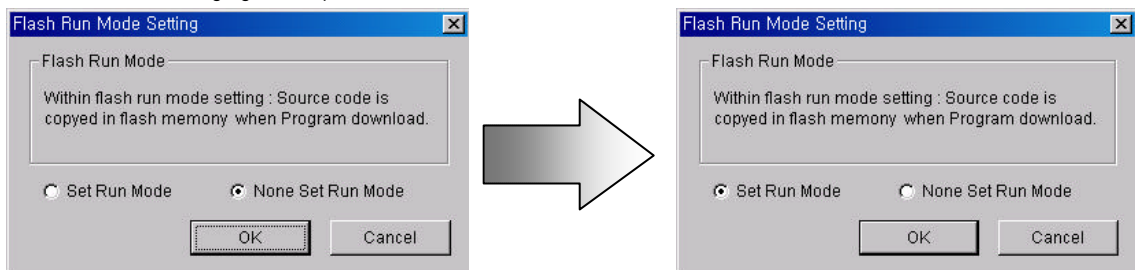


In case of storing downloaded program to the flash memory, click Yes(Y).

HINT

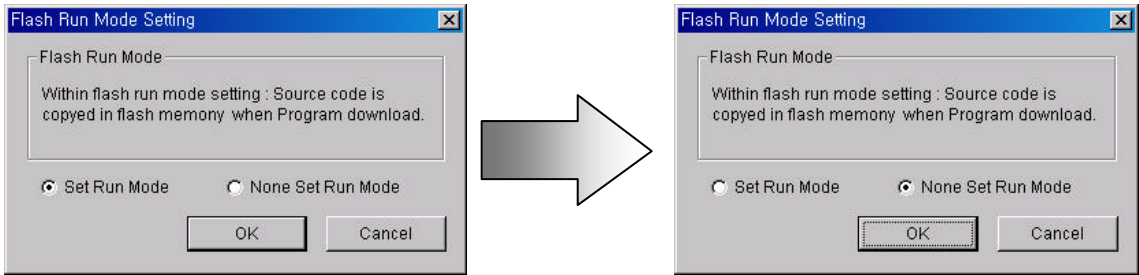
If not click Yes(Y), flash operation mode is released, and the program in the flash memory is erased.

2.2) In case of changing flash operation mode from 'None Set Run Mode' to 'Set Run Mode'



Flash function is activated, and program in the program memory is stored to flash memory

HINT In case of changing flash operation mode from 'Set Run Mode' to 'None Set Run Mode'

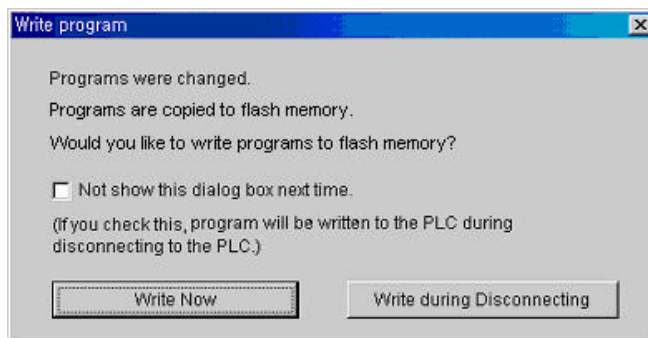


The diagram illustrates the process of changing the flash operation mode. On the left, the 'Flash Run Mode Setting' dialog box shows 'Set Run Mode' selected. An arrow points to the right, where the same dialog box shows 'None Set Run Mode' selected. The 'OK' button in the second dialog box is highlighted with a dashed border.

Flash function is inactivated, and program in the flash memory is erased.

2.3) In case of online editing

GM4-CPUC supports writing flash memory during online editing. If 'write' in online editing is clicked after online editing in case of setting flash operation mode, the follow message is displayed.



'Write Now' / 'Write during Disconnecting'. Choose one of them.

HINT

In case of using online editing very often, if 'Write during Disconnecting' is selected, the program is copied to flash memory in case of 'disconnecting / changing operation mode' only.

In case of writing program to flash memory during online editing, flash service is executed for 1/8 of the scan time in order NOT to have an effect on executing time of scan program. Therefore the execution requires much time, and it is variable according to the scan program.

In case of online editing in the remote mode, it can cause losing data. Therefore, Use online editing in the local connecting as possible.

6.3.2 Setting operation mode

In case of re-operating PLC systems or changing operation mode to Run mode, it operates like the follows according to flash operating mode setting.

Flash operating mode setting	Operation
ON	The program, which is stored in the flash memory, operates after downloading it to program memory. (In case of that programs in the flash memory and program memory are equal, downloading operation is not executed.)
OFF	CPU recognizes that there is not a program in the flash memory, and it is operated by the program, which is stored in the program memory.

6.3.3 Upload program storing method by using built-in flash memory

Basically, the upload program is stored to the flash memory in the GM4-CPUC, and there are 4 kinds of methods to store upload program to the flash memory. When to write upload program, flash operation mode setting has no effect on it.

- 1) In case of choosing 'Upload Program' together when to download program



- 2) In case of choosing 'Upload Program' together when to download parameter and program

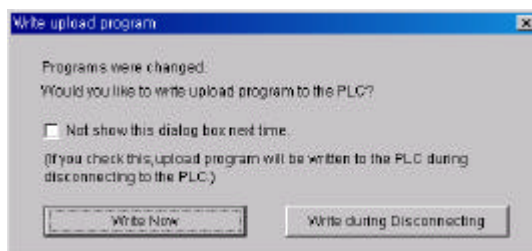


3) In case of choosing 'Upload Program' when PLC is running

If 'Online' > 'Write' menu is chosen when PLC is running, 'Upload Program' menu is activated. Using this menu, the upload program can be written separately. This function is supplied for the user who does not need to write upload program in the stop mode, but need to write the upload program without stopping PLC when it is running.



4) In case of online editing when an upload program has been already written.



'Write Now' / 'Write during Disconnecting'. Choose one of them.

HINT

In case of using online editing very often, if 'Write during Disconnecting' is selected, the upload program is copied to flash memory in case of 'disconnecting' only.

In case of writing the upload program during running, the operation time is variable according to the scan time.

Chapter. 7 INPUT AND OUTPUT MODULES

7.1 Notes on Selecting Input and Output Modules

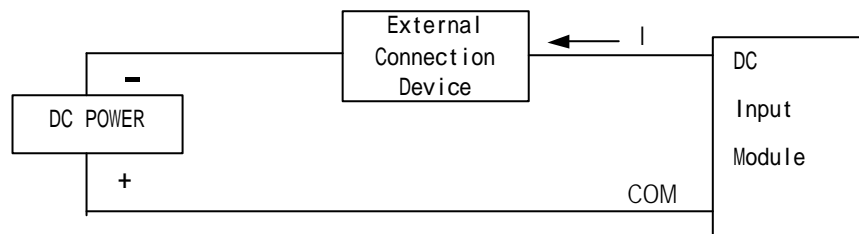
The followings describe instructions for selection of digital I/O modules that will be used in the GLOFA-GM4 series.

- 1) The types of digital input are current sink input and current source input.

When selecting DC input modules consider the specifications of those input devices as the wiring method of the external input power supply varies complying with the type of digital input.

In the GM4 series, the types are dedicated source input and source/sink common DC input.

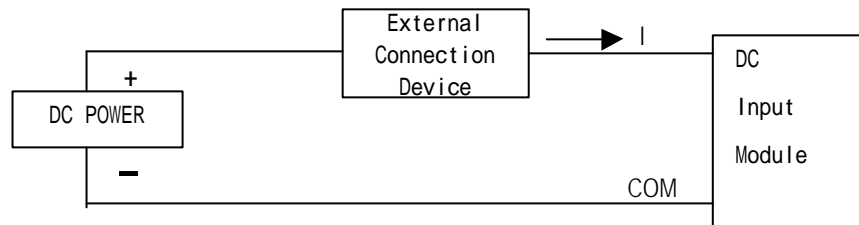
- (1) The method to connect sink type external connection device to Source type DC input module



? The external connection device is located between negative(-) terminal of DC input module and DC power.

? In case of turning on input, current flows to external connection device from DC input module terminal.

- (2) The method to connect sink type external connection device to Source type DC input module



? The external connection device is located between positive(+) terminal of DC input module and DC power.

? In case of turning on input, current flows to DC input module terminal from external connection device.

- 2) The number of maximum simultaneous input points differs with the type of a module. Check the specifications of the input module to be applied before use.

- 3) Use the interrupt module if high speed input response is requested.

But, only one interrupt module can be mounted in each CPU module.

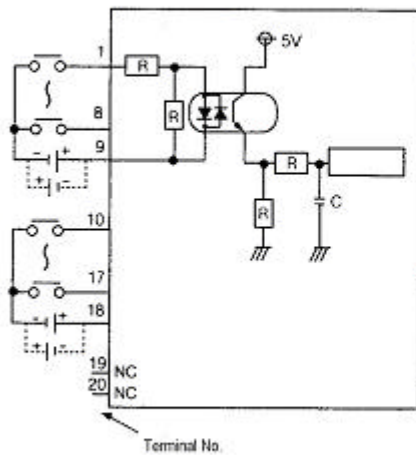
- 4) Use transistor output modules or triac output modules with a load that is frequently opened and closed or with an inductive load as, in those cases, the life span of a relay output module will become shorter than specified.

7.2 Digital Input Module Specifications

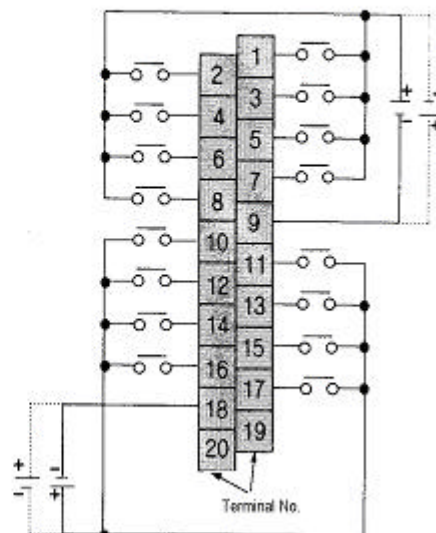
7.2.1 16-points 12/24 VDC input module (source/sink type)

Specifications	Model	GM4
		G4I-D22A
Number of input points		16 points
Insulation method		Photo coupler
Rated input voltage		12/24 VDC
Rated input current		5/11 mA
Operating voltage range		10.2 to 26.4 VDC (ripple: less than 5%)
Maximum simultaneous input points		100% simultaneously ON
ON voltage/ON current		9.5 VDC or higher/4.0 mA or higher
OFF voltage/OFF current		6 VDC or lower/1.0 mA or lower
Input impedance		Approx. 2.2 k Ω
Response time	OFF \rightarrow ON	10 msec or less
	ON \rightarrow OFF	10 msec or less
Common terminal		8 points/common(COM)
Internal current consumption		70 mA
Operating indicator		LED turns on at ON state of input
External connections		20-points terminal block connector(M3 \times 6 screws)
Weight		0.25 kg

Circuit configuration



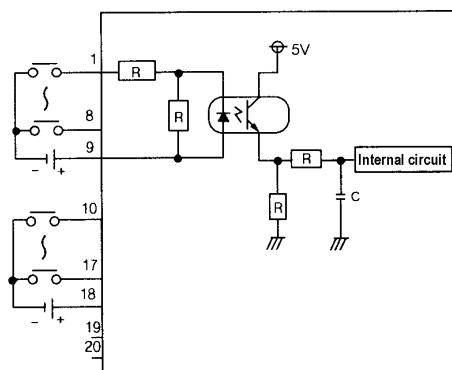
External connections



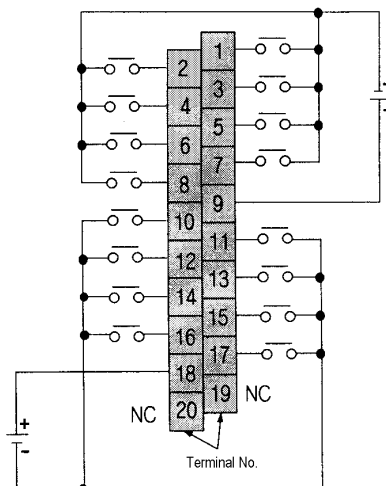
7.2.2 16-points 12/24 VDC input module (source type)

Specifications		Models	GM4	
		G4I-D22B		
Number of input points		16 points		
Insulation method		Photo coupler		
Rated input voltage		12 VDC	24 VDC	
Rated input current		5 mA	11 mA	
Operating voltage range		10.2 to 26.4 VDC (ripple: less than 5%)		
Maximum simultaneous input points		100% (8 points/COM) simultaneously ON		
ON voltage/ON current		9.5 VDC or higher/4.0 mA or higher		
OFF voltage/OFF current		6 VDC or lower/1.0 mA or lower		
Input impedance		Approx. 2.2 k?		
Response time	OFF ? ON	10 msec or less		
	ON ? OFF	10 msec or less		
Common terminal		8 points/COM		
Internal current consumption		70 mA		
Operating indicator		LED turns on at ON state of input		
External connections		20-point terminal block connector(M3 ? 6 screws)		
Weight		0.25 kg		

Circuit configuration



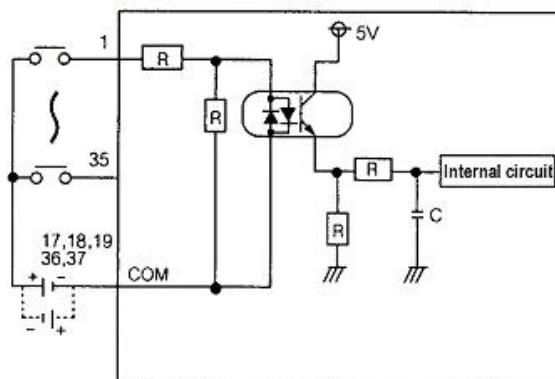
External connections



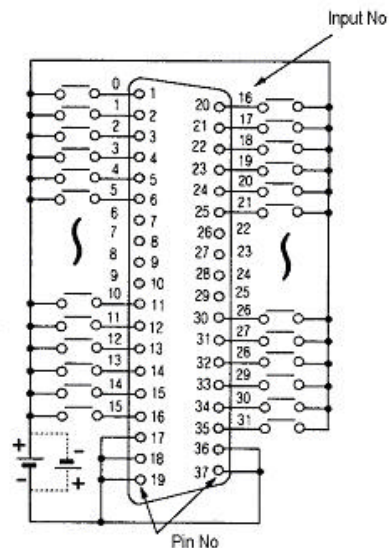
7.2.3 32-points 12/24 VDC input module (source/sink type)

Specifications	Model	GM4
		G4I-D24A
Number of input points		32 points
Insulation method		Photo coupler
Rated input voltage		12/24 VDC
Rated input current		3/7 mA
Operating voltage range		10.2 to 26.4 VDC (ripple: less than 5%)
Maximum simultaneous input points		60% simultaneously ON (19 points/COM)
ON voltage/ON current		9.5 VDC or higher/3.0 mA or higher
OFF voltage/OFF current		6 VDC or lower/1.5 mA or lower
Input impedance		Approx. 3.3 k Ω
Response time	OFF \rightarrow ON	10 msec or less
	ON \rightarrow OFF	10 msec or less
Common terminal		32 points/common
Internal current consumption		75 mA
Operating indicator		16-points indication by selection switch.
External connections		37-pin D-Sub connector
Weight		0.19 kg

Circuit configuration



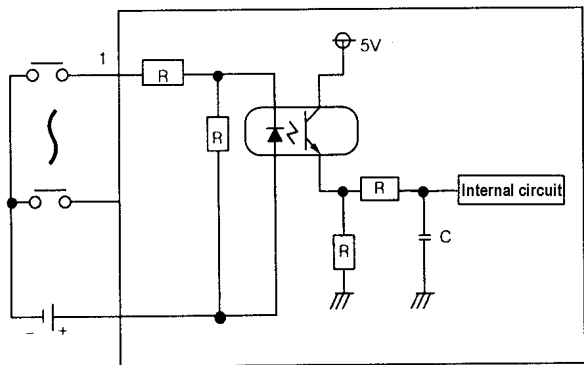
External connections



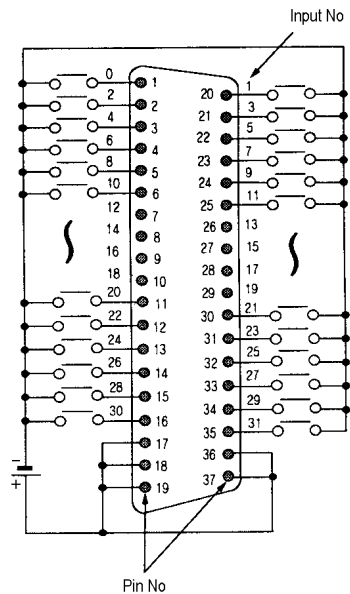
7.2.4 32-points 12/24 VDC input module (source type)

Specifications	Model	GM4	
		G4I-D24B	
Number of input points		32 points	
Insulation method		Photo coupler	
Rated input voltage		12 VDC	24 VDC
Rated input current		3 mA	7 mA
Operating voltage range		10.2 to 26.4 VDC (ripple: less than 5%)	
Maximum simultaneous input points		60% (19 points/ 1 COM) simultaneously ON	
ON voltage/ON current		9.5 VDC or higher/3.0 mA or higher	
OFF voltage/OFF current		6 VDC or lower/1.5 mA or lower	
Input impedance		Approx. 3.3 k Ω	
Response time	OFF \rightarrow ON	10 msec or less	
	ON \rightarrow OFF	10 msec or less	
Common terminal		32 points/1 COM(common)	
Internal current consumption		70 mA	
Operating indicator		LED turns on at ON state of input	
External connections		37-pin D-sub connector	
Weight		0.19 kg	

Circuit configuration



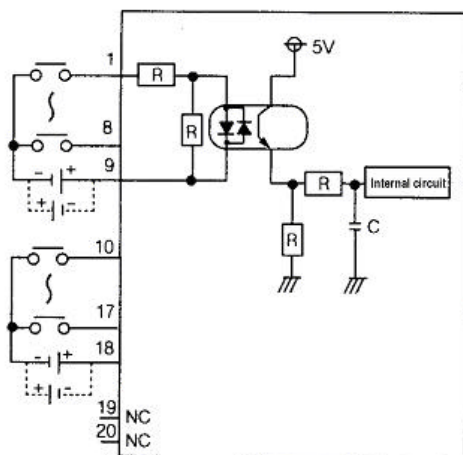
External connections



7.2.5 16-points 24 VDC input module (source/sink type)

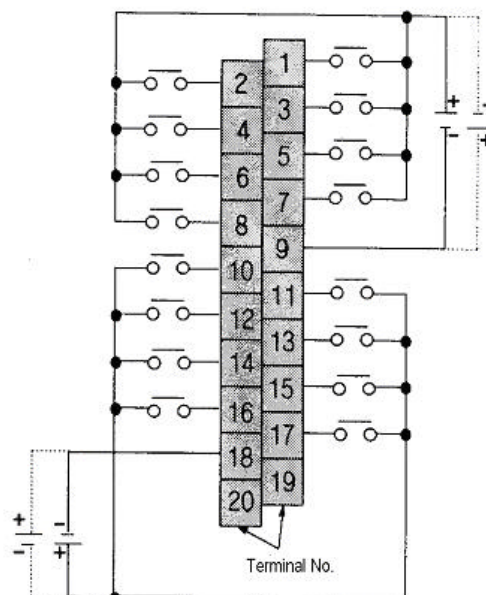
Specifications		Model
		GM4
		G4I-D24C
Number of input points		16 points
Insulation method		Photo coupler
Rated input voltage		24 VDC
Rated input current		7 mA
Operating voltage range		20.4 to 28.8 VDC (ripple: less than 5%)
Maximum simultaneous input points		100% simultaneously ON
ON voltage/ON current		17 VDC or higher/5.2 mA or higher
OFF voltage/OFF current		8 VDC or lower/2.4 mA or lower
Input impedance		Approx. 3.3 k Ω
Response time	OFF \rightarrow ON	10 msec or less
	ON \rightarrow OFF	10 msec or less
Common terminal		8 points/1 COM(common)
Internal current consumption		70 mA
Operating indicator		LED turns on at ON state of input
External connections		20-point terminal block connector(M3 \times 6 screws)
Weight		0.25 kg

Circuit configuration



Terminal No.

External connections

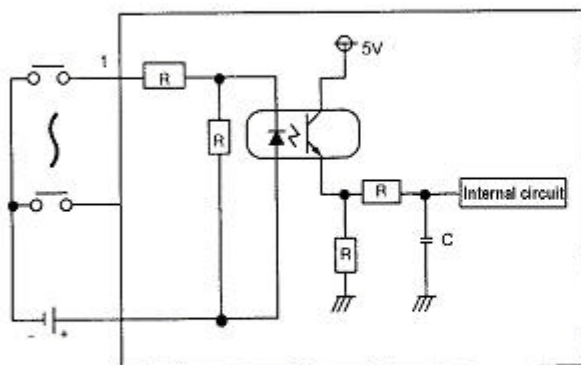


Terminal No.

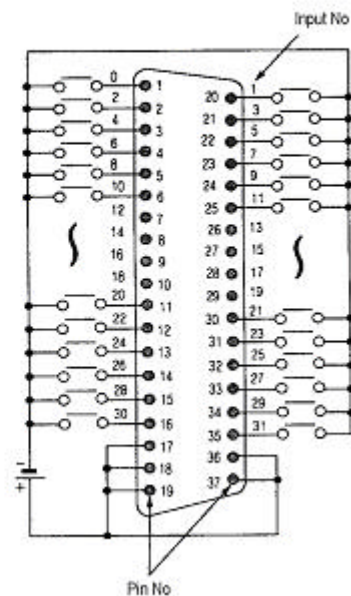
7.2.6 32-points 24 VDC input module (source/sink type)

Specifications		Model	GM4
			G4I-D24C
Number of input points		32 points	
Insulation method		Photo coupler	
Rated input voltage		24 VDC	
Rated input current		7 mA	
Operating voltage range		20.4 to 28.8 VDC (ripple: less than 5%)	
Maximum simultaneous input points		60% (19 points/ 1 COM) simultaneously ON	
ON voltage/ON current		17 VDC or higher/5.2 mA or higher	
OFF voltage/OFF current		8 VDC or lower/2.4 mA or lower	
Input impedance		Approx. 3.3 k?	
Response time	OFF ? ON	10 msec or less	
	ON ? OFF	10 msec or less	
Common terminal		32 points/1 COM(common)	
Internal current consumption		75 mA	
Operating indicator		16-points indication by selection switch.	
External connections		37-pin D-sub connector	
Weight		0.19 kg	

Circuit configuration

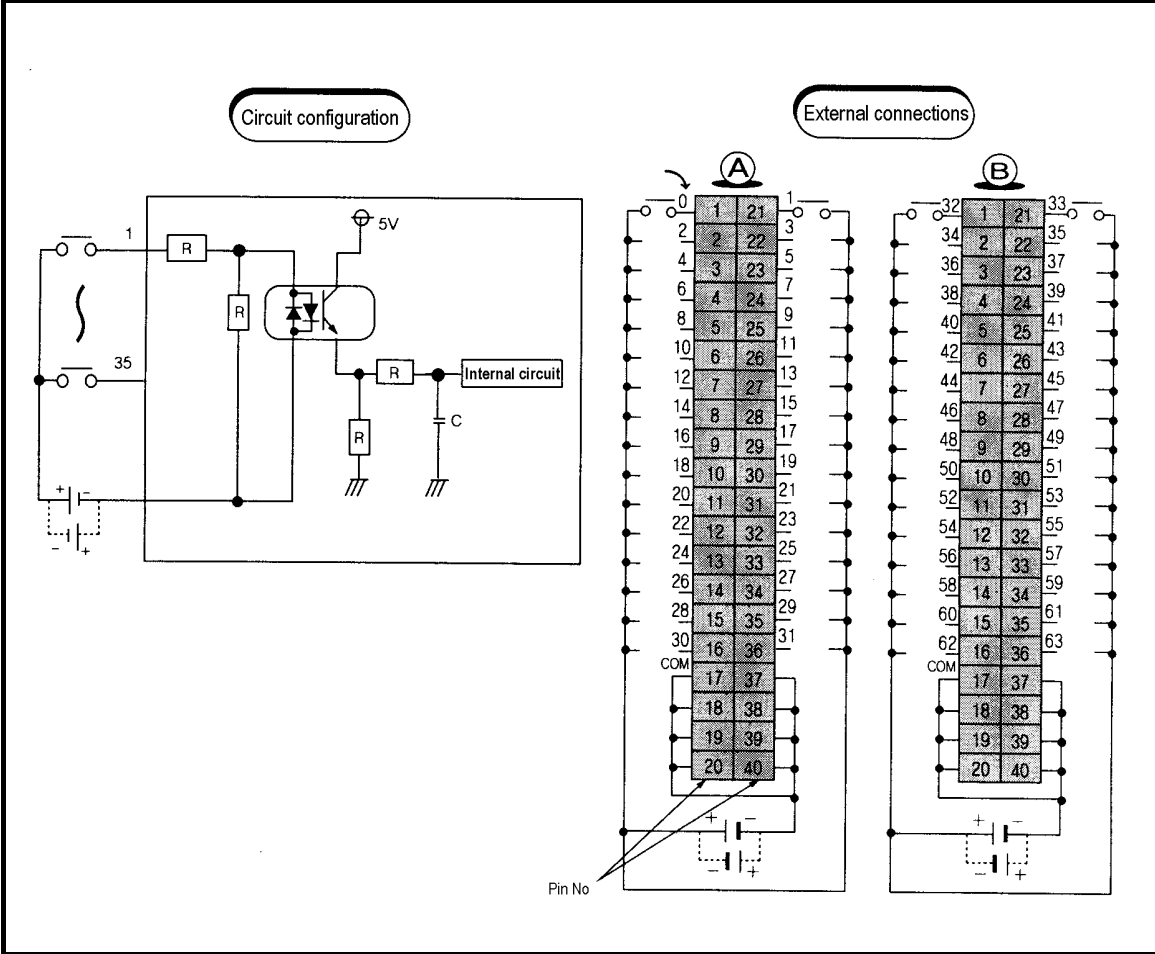


External connections



7.2.7 64-points 12/24 VDC input module (source/sink type)

Specifications		Model
		GM4
		G4I-D28A
Number of input points		64 points
Insulation method		Photo coupler insulation
Rated input voltage		12 / 24 VDC
Rated input current		3 / 7 mA
Operating voltage range		10.24 ~ 26.4 VDC (ripple: 5% or less)
Maximum simultaneous input points		19 points / 1COM (60%)
ON voltage/ON current		9.5 VDC /3.0 mA
OFF voltage/OFF current		6 VDC / 1.5 mA
Input impedance		About 3.3k?
Response time	10 msec or less	10 msec or less
	10 msec or less	10 msec or less
Common terminal		32 points / 1 com
Internal current consumption		250 mA
Operating indicator		LED display
External connections		40-pin D-sub connector (2 connectors)
Weight		0.46 kg



7.2.8 16-points 110 VAC input module

Specifications		Models	GM4
			G4I-A12A
Number of input points			16 points
Insulation method			Photo coupler
Rated input voltage			100 to 120 VAC (50/60 Hz)
Rated input current			11 mA (110 VAC / 60 Hz)
Operating voltage range			85 to 132 VAC (50/60 Hz \pm 3 Hz)
Maximum simultaneous input points			100% simultaneously ON
Inrush current			600 mA, 0.12 msec or lower (264 VAC)
ON voltage/ON current			80 VAC or higher/6 mA or higher
OFF voltage/OFF current			30 VAC or lower/3 mA or lower
Input impedance			Approx. 10 k Ω
Response time	OFF \rightarrow ON		15 msec or less
	ON \rightarrow OFF		25 msec or less
Common terminal			8 points/1 COM
Internal current consumption			70 mA
Operating indicator			LED turns on at ON state of input
External connections			20-point terminal block connector(M3 \times 6 screws)
Weight			0.29 kg

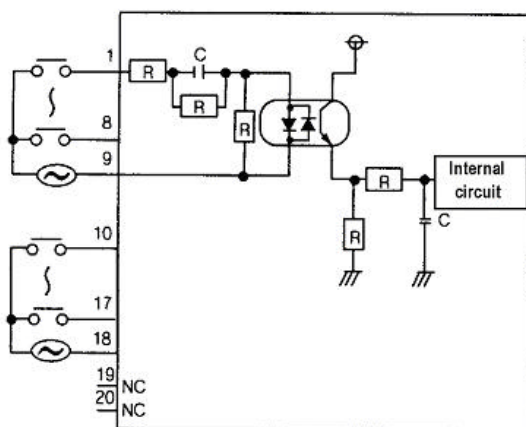
Circuit configuration

External connections

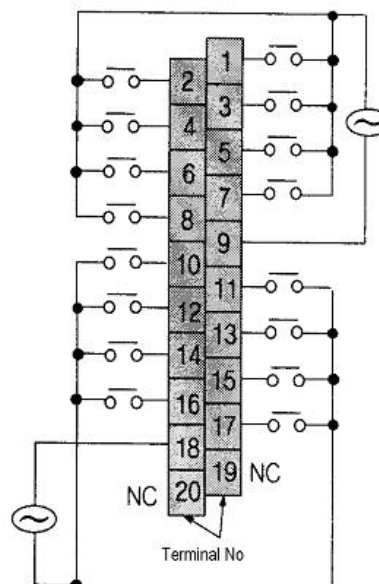
7.2.9 16-points 220 VAC input module

Specifications		Model	GM4
			G4I-A22A
Number of input points			16 points
Insulation method			Photo coupler
Rated input voltage			200 to 240 VAC (50/60 Hz)
Rated input current			11 mA (220 VAC / 60 Hz)
Operating voltage range			170 to 264 VAC (50/60 Hz \pm 3 Hz)
Maximum simultaneous input points			100% simultaneously ON (8 points / 1 COM)
Inrush current			600 mA, 0.12 msec or lower (264 VAC)
ON voltage/ON current			150 VAC or higher/4.5 mA or higher
OFF voltage/OFF current			50 VAC or lower/3 mA or lower
Input impedance			Approx. 10 k Ω
Response time	OFF \rightarrow ON		15 msec or less
	ON \rightarrow OFF		25 msec or less
Common terminal			8 points/1 COM
Internal current consumption			70 mA
Operating indicator			LED turns on at ON state of input
External connections			20-point terminal block connector(M3 \times 6 screws)
Weight			0.3 kg

Circuit configuration



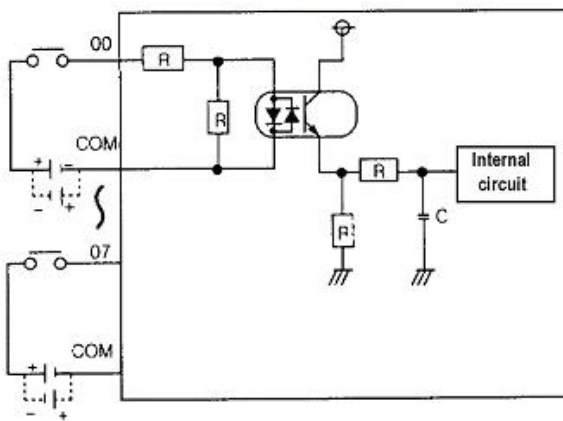
External connections



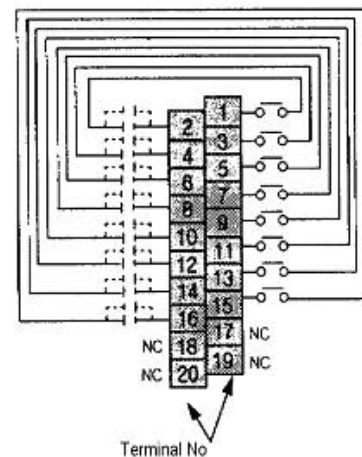
7.2.10 Interrupt input module

Specifications	Model	GM4
		G4F-INTA
Number of input points		8 points
Insulation method		Photo coupler
Rated input voltage		24 VDC
Rated input current		10 mA
Input impedance		Approx. 2.4 k Ω
Operating voltage range		21.6 to 26.4 VDC
Maximum simultaneous input points		100% simultaneously ON
ON voltage/ON current		15 VDC or higher/6.5 mA or higher
OFF voltage/OFF current		5 VDC or lower/2.0 mA or lower
Response time	OFF \rightarrow ON	0.5 msec or less
	ON \rightarrow OFF	0.5 msec or less
Common terminal		1 point/ 1COM
Internal current consumption		Ascending or descending edge (Setting Dip switch by the channel)
Internal current consumption		65 mA
Operating indicator		LED turns on at ON state of input
External connections		20-point terminal block connector(M3 \times 6 screws)
Weight		0.16 kg

Circuit configuration



External connections

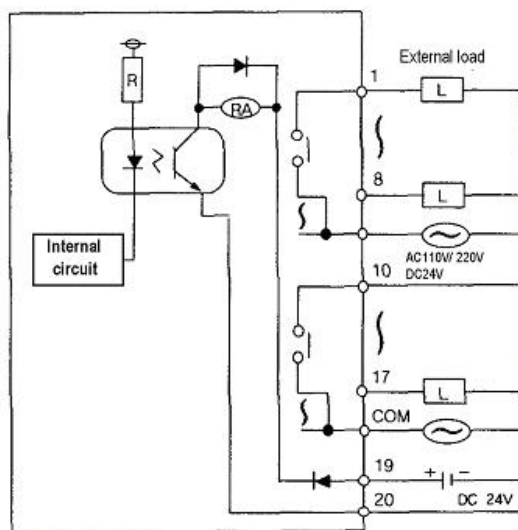


7.3 Digital Output Module Specifications

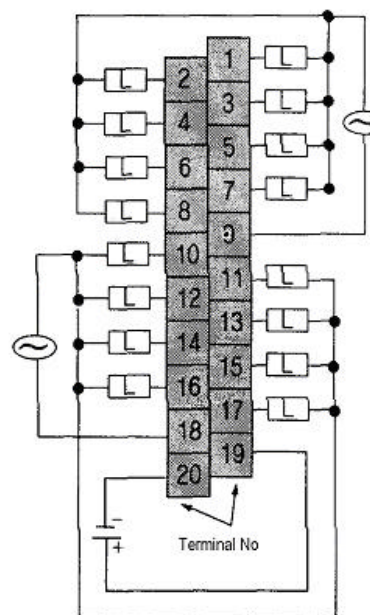
7.3.1 16-point relay output module

Specifications	Models	GM4
		G4Q-RY2A
Number of output points		16 points
Insulation method		Photo coupler
Rated load voltage/current		24 VDC 2A(load resistance)/1 point, 4 A/ 1 COM 220 VAC 2A(COS ϕ = 1)
Minimum load voltage/current		5 VDC / 1 mA
Maximum load voltage/current		250 VAC, 125 VDC
Off leakage current		0.1 mA (220 VAC, 60 Hz)
Maximum switching frequency		3600 times per hour
Surge absorber		None
Service life	Mechanical	20 million times or more
	Electrical	Rated load voltage/current 100000 times or more
		200 VAC 1.5 A, 240 VAC 1 A (COS ϕ = 0.7) 100000 times or more
		200 VAC 1 A, 240 VAC 0.5 A (COS ϕ = 0.35) 100000 times or more
Response time	Off ? On	10 msec or less
	On ? Off	12 msec or less
Common terminal arrangement		8 points/common
Internal current consumption		100 mA (24 VDC all points ON)
External power supply	Voltage	24 VDC \pm 10 % (ripple voltage : 4VP-P or less)
	Current	150 mA (24 VDC all points ON)
Operation indicator		LED turns on at ON state of output
External connections		20-point terminal block connector (M3 ϕ 6 screws)
Weight		0.31 kg

Circuit configuration



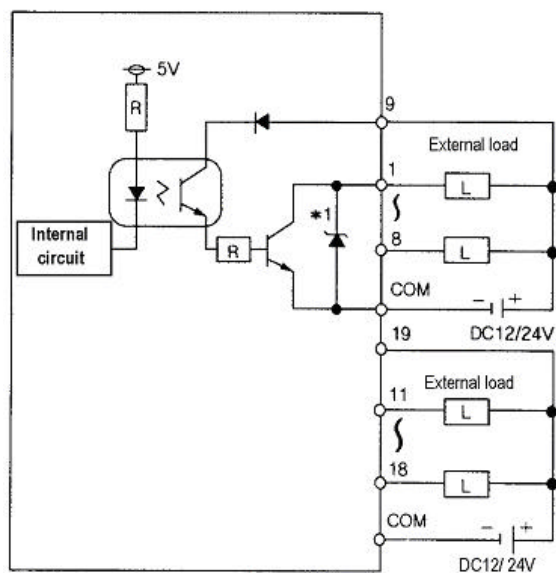
External connections



7.3.2 16-point transistor output module (sink type)

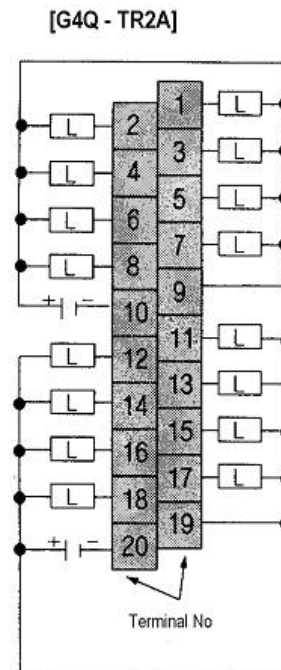
Specifications	Models	GM4
		G4Q-TR2A
Number of output points		16 points
Insulation method		Photo coupler
Rated load voltage/current		12/24 VDC
Operating load voltage range		10.2 to 26.4 VDC
Maximum load current		0.5 A / 1 point, 3 A / 1 COM
Off leakage current		0.1 mA
Maximum inrush current		4 A / 10 msec or less
Maximum voltage drop at ON circuit		1.5 VDC
Surge absorber		Barrister
Response time	Off ? On	2 msec or less
	On ? Off	2 msec or less
Common terminal arrangement		8 points/1 COM
Internal current consumption		110 mA (24 VDC all points ON)
External power supply	Voltage	24 VDC ? 10 % (ripple voltage : 4VP-P or less)
	Current	100 mA or less (24 VDC per COM)
Operation indicator		LED turns on at ON state of output
External connections		20-point terminal block connector (M3 ? 6 screws)
Weight		0.27 kg

Circuit configuration



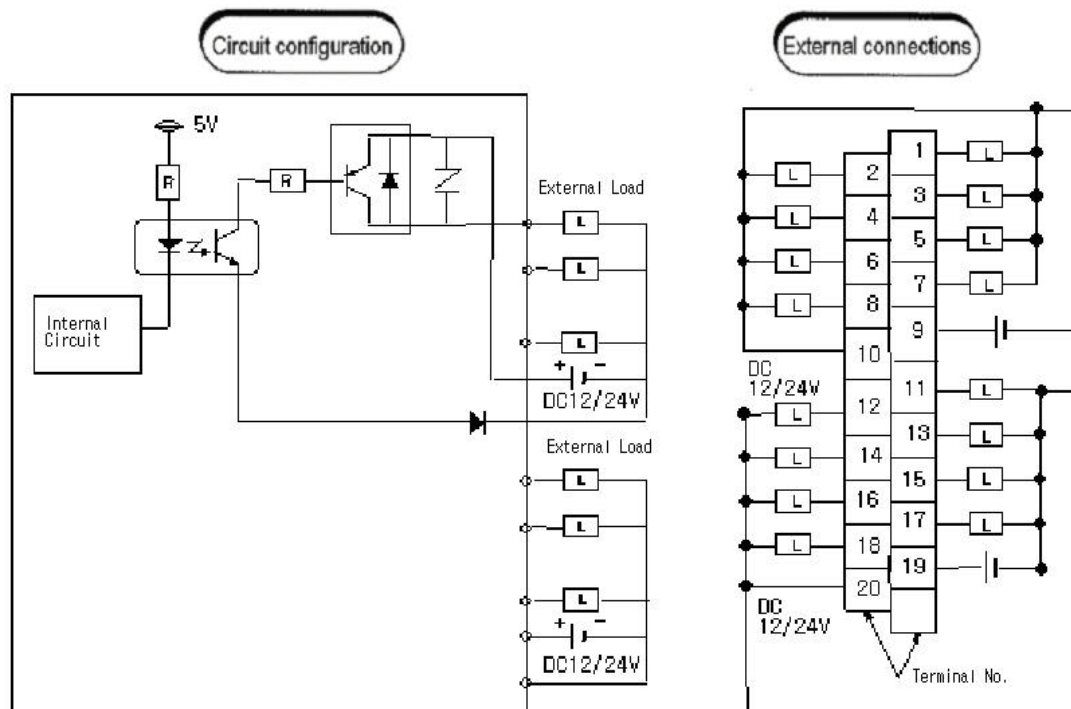
*1 : G4A-TR2A includes a barrister as s surge absorber.

External connections



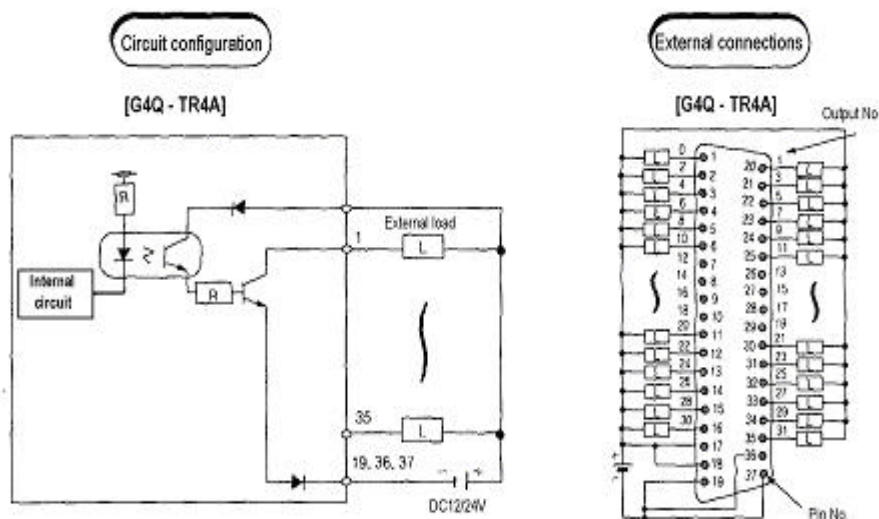
7.3.3 16-point transistor output module (source type)

Specifications		Models	GM4
			G4Q-TR2B
Number of output points			16 points
Insulation method			Photo coupler
Rated load voltage/current			12/24 VDC
Operating load voltage range			10.2 to 26.4 VDC
Maximum load current			0.5 A / 1 point, 3 A / 1 COM
Off leakage current			0.1 mA
Maximum inrush current			4 A / 10 msec or less
Maximum voltage drop at ON circuit			1.5 VDC
Surge absorber			Barrister
Response time	Off ? On		2 msec or less
	On ? Off		2 msec or less
Common terminal arrangement			8 points/1 COM
Internal current consumption			110 mA (24 VDC all points ON)
External power supply	Voltage		24 VDC ? 10 % (ripple voltage : 4VP-P or less)
	Current		100 mA or less (24 VDC per COM)
Operation indicator			LED turns on at ON state of output
External connections			20-point terminal block connector (M3 ? 6 screws)
Weight			0.27 kg



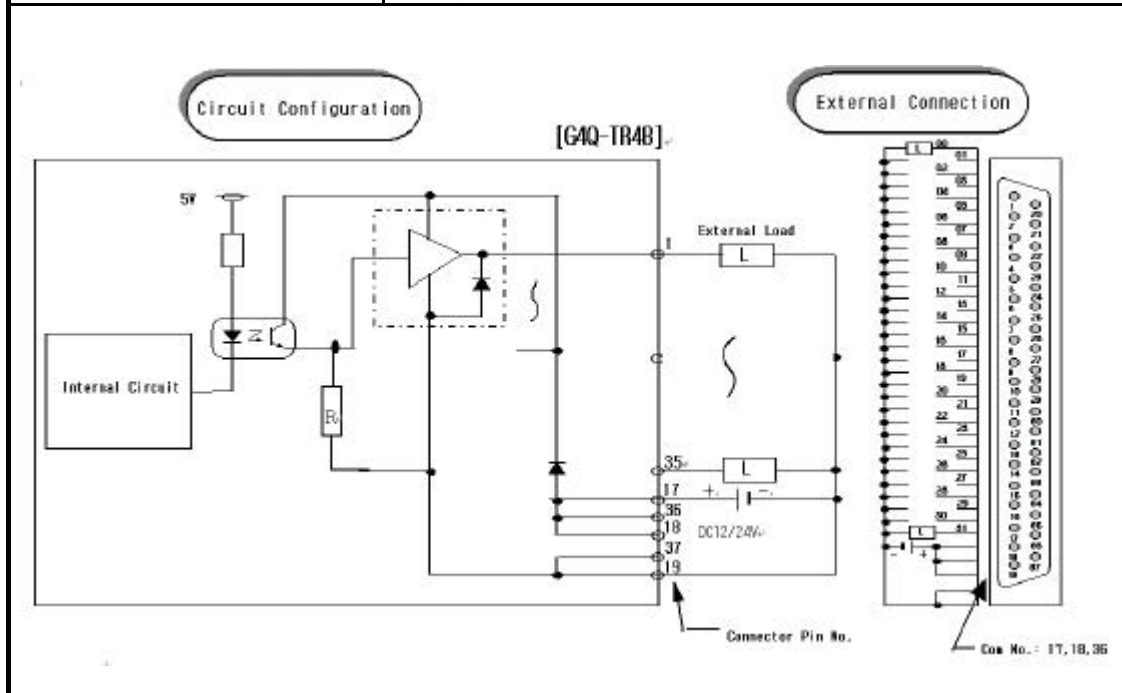
7.3.4 32-point transistor output module (sink type)

Specifications		Models	GM4
			G4Q-TR4A
Number of output points			32 points
Insulation method			Photo coupler
Rated load voltage/current			12/24 VDC
Operating load voltage range			10.2 to 26.4 VDC
Maximum load current			0.1 A / 1 point, 2 A / 1 COM
Off leakage current			0.1 mA or less
Maximum inrush current			4 A / 10 msec or less
Maximum voltage drop at ON circuit			1.0 VDC
Surge absorber			None
Response time	Off ? On		2 msec or less
	On ? Off		2 msec or less
Common terminal arrangement			32 points/1 COM
Internal current consumption			160 mA (all points ON)
External power supply	Voltage		24 VDC ? 10 % (ripple voltage : 4VP-P or less)
	Current		100 mA or less (24 VDC per COM)
Operation indicator			16-points indication by selection switch.
External connections			37-pin D Sub-connector
Weight			0.18 kg



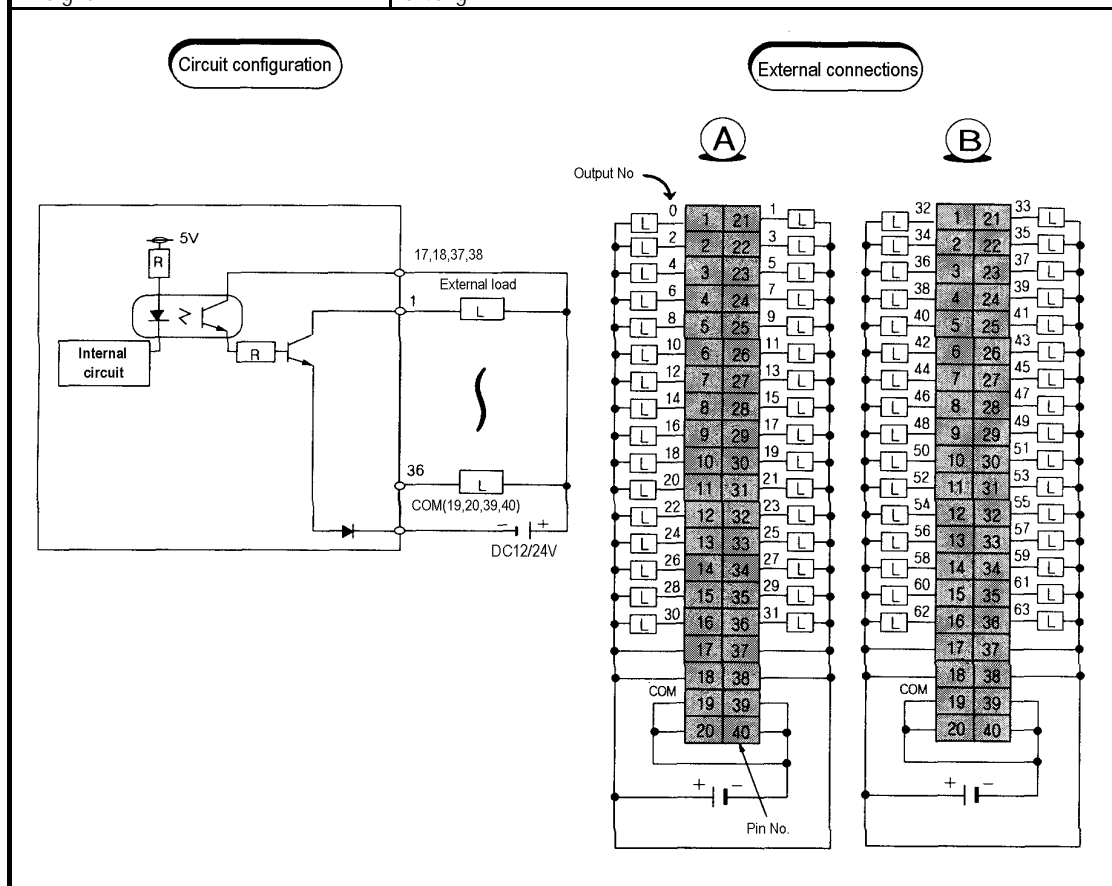
7.3.5 32-point transistor output module (source type)

Specifications	Models	GM4
		G4Q-TR4B
Number of output points		32 points
Insulation method		Photo coupler
Rated load voltage/current		12/24 VDC
Operating load voltage range		10.2 to 26.4 VDC
Maximum load current		0.1 A / 1 point, 2 A / 1 COM
Off leakage current		0.1 mA or less
Maximum inrush current		4 A / 10 msec or less
Maximum voltage drop at ON circuit		1.0 VDC
Surge absorber		None
Response time	Off ? On	2 msec or less
	On ? Off	2 msec or less
Common terminal arrangement		32 points/1 COM
Internal current consumption		160 mA (all points ON)
External power supply	Voltage	24 VDC ? 10 % (ripple voltage : 4VP-P or less)
	Current	100 mA or less (24 VDC per COM)
Operation indicator		16-points indication by selection switch.
External connections		37-pin D Sub-connector
Weight		0.18 kg



7.3.6 64-point transistor output module (sink type)

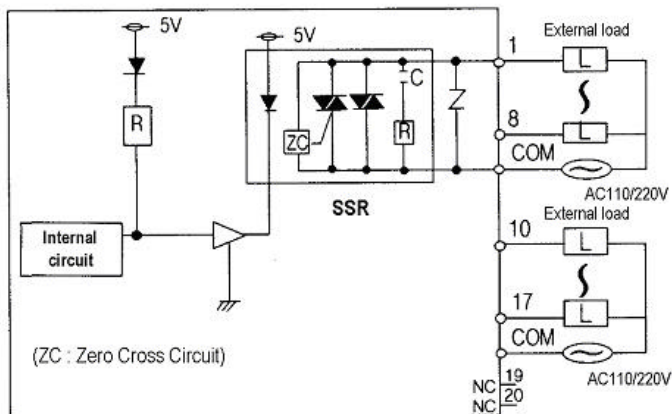
Specifications	Model	GM4
		G4Q-TR8A
Number of output points		64 points
Insulation method		Photo coupler
Rated load voltage/current		12/24 VDC
Operating load voltage range		10.2 to 26.4 VDC
Maximum load current		0.1 A / 1 point, 2 A / 1 COM
Off leakage current		0.1 mA or less
Maximum inrush current		0.4 A / 10 msec or less
Maximum voltage drop at ON circuit		1.0 VDC
Surge absorber		None
Response time	Off ? On	2 msec or less
	On ? Off	2 msec or less
Common terminal arrangement		32 points/1 COM
Internal current consumption		300 mA (all points ON)
External power supply	Voltage	10.2 to 26.4 VDC
	Current	100 mA (24 VDC per COM)
Operation indicator		LED turns on at ON state of output
External connections		Two 40-point connectors
Weight		0.40kg



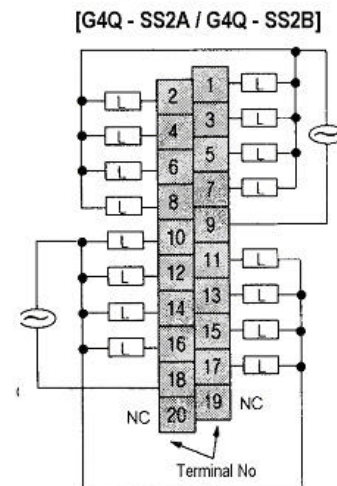
7.3.7 16-point triac output module

Specifications	Models	GM4	
		G4Q-SS2A	G4Q-SS2B
Number of output points		16 points	
Insulation method		Photo coupler	
Rated load voltage		100 to 240 VAC (50 to 60 Hz)	
Minimum load voltage		264 VAC	
Maximum load current		1 A / 1 point, 5 A / 1 COM	0.6 A / 1 point, 2.4 A / 1 COM
Minimum load current		20 mA	10 mA
Off leakage current		25 mA (220 VAC, 60 Hz)	
Maximum inrush current		25 A 10 msec or less	20 A 10 msec or less
Maximum voltage drop at ON circuit		1.5 VAC or less (1 A)	1.5 VAC or less (0.6 A)
Surge absorber		Barrister (387 to 473 V), C.R absorber	
Response time	Off ? On	0.5 cycle + 1 msec or less	
	On ? Off	0.5 cycle + 1 msec or less	
Common terminal arrangement		8 points/1 COM	
Internal current consumption		330 mA (all points ON)	
Operation indicator		LED turns on at ON state of output	
External connections		20-point terminal block connector (M3 ? 6 screws)	
Weight		0.35 kg	

Circuit configuration



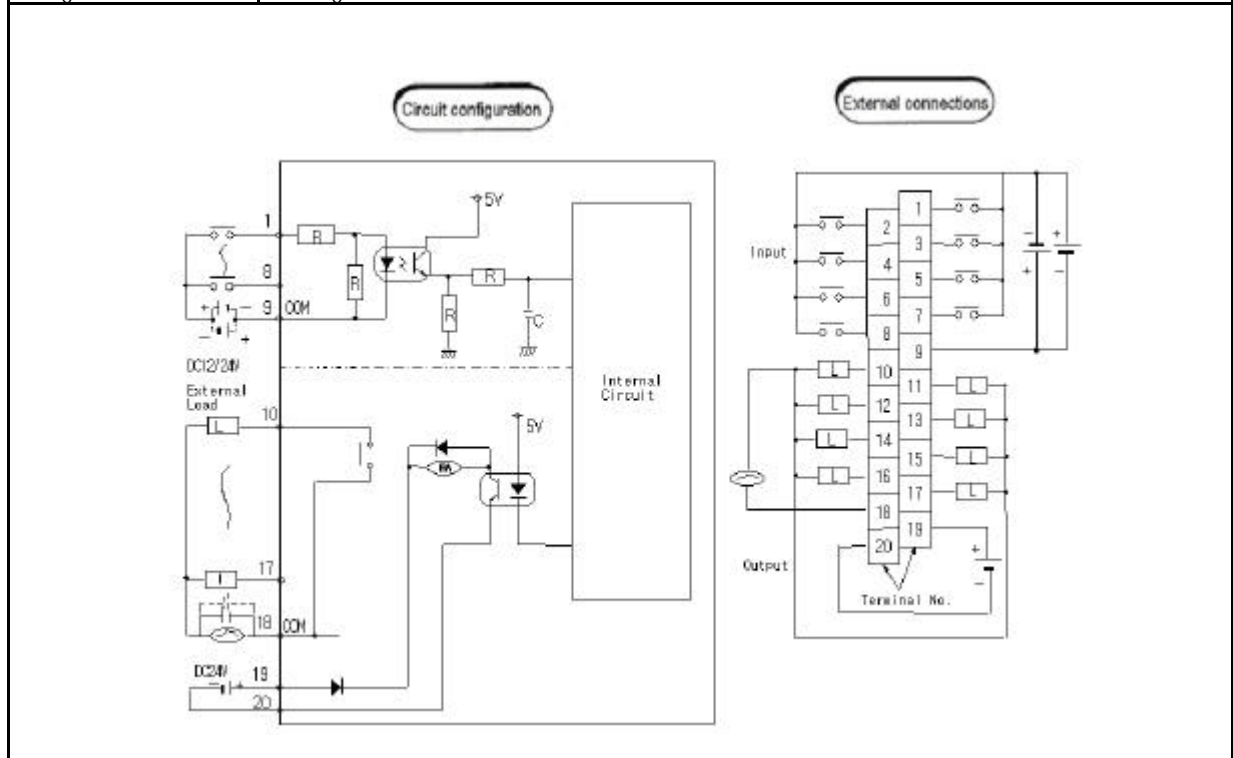
External connections



7.4 Digital Input / Output Hybrid Module Specifications

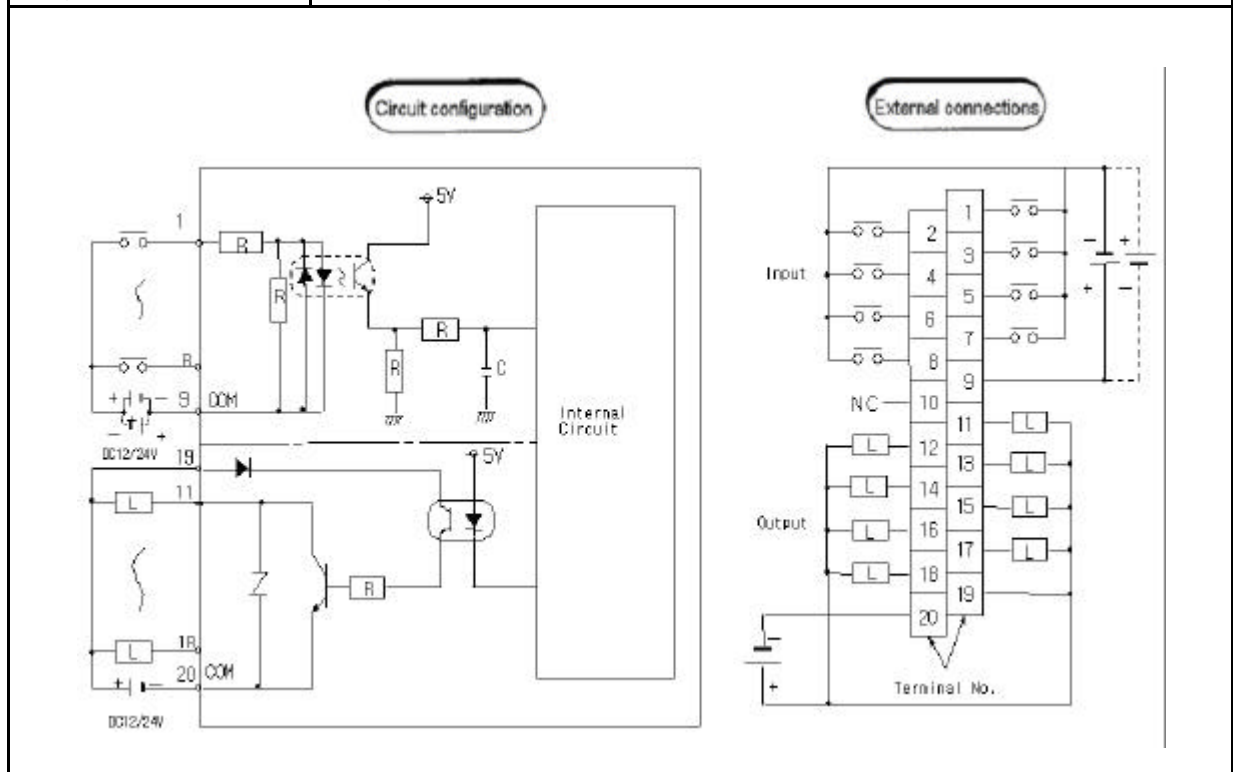
7.4.1 8 points 12/24VDC input + 8 points relay output module

G4H-DR2A				
Input			Output	
Input point		8 points	Output points	
Insulation method		Photo coupler insulation	Insulation method	
Rated input voltage		DC12 / 24V	Rated load voltage / current	
Rated input current		5 / 11 mA	Min. load voltage / current	
Operating voltage		DC10.2~26.4V	Max. load voltage / current	
Max. simultaneously on		100% simultaneously on	Leakage current	
On voltage / current		9.5 VDC / 3.5 mA	Max. switching frequency	
Off voltage / current		5 VDC / 1.5 mA	Surge absorber	
Input impedance		About 2.2 k?	Lifetime of	Mechanical
Response time	Off \rightarrow On	10 ms or less	contact	Electrical
	On \rightarrow Off	10 ms or less		Same as G4Q-RY2A
Common		8 points / 1COM	Response time	Off ? On
				On ? Off
			Common	
			External power supply	Voltage
				Current
Operation Indicator		LED		
External wiring		20 points terminal block connector (M3 × 6 screw)		
current consumption		100 mA		
Weight		0.26 kg		



7.4.2 8 points 12/24VDC input + 8 points transistor output module

G4H-DT2A					
Input			Output		
Input point		8 points	Output points		8 points
Insulation method		Photo coupler insulation	Insulation method		Photo coupler insulation
Rated input voltage		DC12 / 24V	Rated load voltage		DC12 / 24V
Rated input current		5 / 11 mA	Operating load voltage		DC10.2 ~ 26.4V
Operating voltage		DC10.2~26.4V	Max. load current		0.5A / 1 point, 3A / 1COM
Max. simultaneously on		100% simultaneously on	Leakage current		0.1 mA (AC220V, 60Hz)
On voltage / current		9.5 VDC / 3.5 mA	Max. inrush current		4A / 10ms or less
Off voltage / current		5 VDC / 1.5 mA	On state voltage drop		1.5 VDC or less
Input impedance		About 2.2 k?	Surge absorber		Barrister
Response time	Off \rightarrow On	10 ms or less	Response time	Off ? On	2 ms or less
	On \rightarrow Off	12 ms or less		On ? Off	2 ms or less
Common		8 points / 1COM	Common		8 points / 1COM
-		-	External power supply	Voltage	DC24V \pm 10%
-		-		Current	50 mA
Operation Indicator		LED			
External wiring		20 points terminal block connector (M3 \times 6 screw)			
Internal consumption current		100 mA			
Weight		0.26 kg			



Chapter 8. POWER SUPPLY MODULE

This chapter describes the selection method, type and specifications of the power supply module.

8.1 Selection of power supply module

Selection of the power supply module is determined by the total current consumption of digital input modules, special modules and communications modules, etc. whose powers are supplied by the power supply module.

If total load overrun the rated output capacity, the system will not normally operate. When configuring a system, select a power supply module with due consideration of current consumption of each module.

Current consumption of GM4 series modules

(unit: mA)

Modules	Models	Current Consumption	Modules	Models	Current Consumption
CPU Module	GM4-CPUA	130	A/D Conversion Module	G4F-AD2A	400
	GM4-CPUB	130		G4F-AD3A	500
	GM4-CPUC	700	D/A Conversion Module	G4F-DA1A	450
DC12/24V Input Module	G4I-D22A	70		G4F-DA2V	400
	G4I-D22B	125		G4F-DA2I	680
	G4I-D22C	125		G4F-DA3V	700
	G4I-D24A	125		G4F-DA3I	60
	G4I-D24B	70	High Speed Counting Module	G4F-HSCA	300
	G4I-D24C	70		G4F-HO1A	400
	G4I-D28A	100		G4F-HD1A	450
110VAC Input Module	G4I-A12A	70	Positioning Module	G4F-POPA	400
220VAC Input Module	G4I-A22A	70		G4F-POPB	400
Relay Output Module	G4Q-RY2A	100		G4F-PP1O	730
Transistor Output Module	G4Q-TR2A	120		G4F-PP2O	760
	G4Q-TR2B	120		G4F-PP3O	770
	G4Q-TR4A	160		G4F-PP1D	700
	G4Q-TR4B	160		G4F-PP2D	720
	G4Q-TR8A	250		G4F-PP3D	740

(unit: mA)

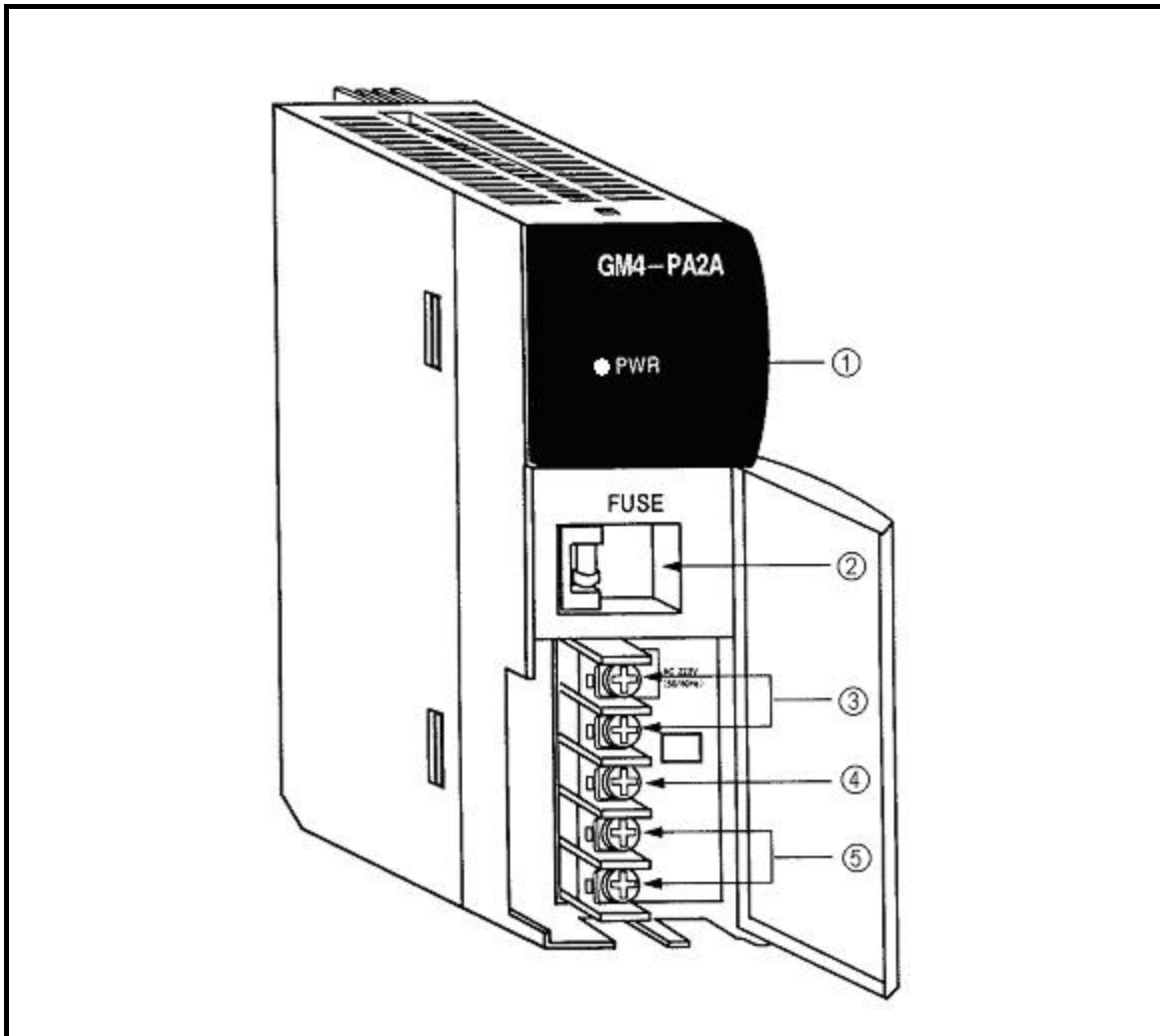
Modules	Models	Current Consumption	Modules	Models	Current Consumption
Triac Output Module	G4Q-SS2A	330	Thermocouple Input Module	G4F-TC2A	450
	G4Q-SS2B	330	Temperature-measuring Resistor input Module	G4F-RD2A	600
Input Output Hybrid Module	G4H-DR2A	100	PID Control Module	G4F-PIDA	200
	G4H-DT2A	100		G4F-PIDB	600
Interrupt Module	G4F-INTA	65	Analog Timer Module	G4F-AT3A	200
Process control Module	G4F-TMCA	360	Fnet I/F Module	G4L-FUEA	160
Fnet Remote I/F Module	G4L-RBEA	150	Cnet I/F Module	G4L-CUEA	100
Rnet I/F Module	G4L-RUEA	160	Enet I/F Module	G4L-EUEA	270
Pnet I/F Module	G4L-PUEB	680	Dnet I/F Module	G4L-DUEA	270
Fast Enet I/F Module	G4L-EUxB	600	Fast Dedicated-Enet I/F module (Master)	G4L-EuxC	600
-	-	-	Fast Dedicated-Enet I/F module (Slave)	G4L-ERxC	600

8.2 Specifications

Item		GM4-PA1A	GM4-PA2A	GM4-PA1B	GM4-PA2B	GM4-PA2C	GM4-PD3A
Input	Input voltage	110 VAC (85 to 132 V)	220 VAC (170 to 264 V)	110 VAC (85 to 132 V)	220 VAC (170 to 264 V0	220 VAC (170 to 264 V0	24VDC
	Input frequency	50 / 60 Hz (47 to 63 Hz)					-
	Input current	1.3 A (110 VAC)	0.8 A (220 VAC)	0.65 A (110 VAC)	0.35 A (220 VAC)	0.6 A (220 VAC)	1.2A
	Inrush current	40 A or less				60A or less	100A or less
	Efficiency	65% or more (rated load, 110/220 VAC)					
	Input fuse	3 A/ Slow / 250 VAC					5A/Slow /250VAC
	Allowable momentary power failure	20 msec or less				10msec or less	1msec or less
Output (1)	Output voltage	5 VDC				5VDC	5VDC
	Output current	5 VDC : 4 A		3A		8A	4A
	Over-current protection	5 VDC : 4.4 A or more		3.2 A or more		4.4A or more	4.4A or more
Output (2)	Output voltage	24 VDC				-	-
	Output current	0.7 A		0.5 A		-	-
	Over-current protection	0.8 A or more		0.6 A or more		-	-
Voltage status indicator		LED is turned ON at normal output voltage.					
Used wire specifications		0.75 to 2 mm²					
Weight		0.4 kg					

8.3 Names of Parts

The followings describe names of parts and their purposes of the power supply module.



No.	Name	Purpose
1	Power LED	Use to indicate the 5 VDC power supply.
2	Power fuse or fuse holder	Used to fix the AC power input 3 A fuse onto the holder.
3	Power input terminal	Used to connect 110 or 220 VAC power.
4	LG terminal	Use to ground the power supply filter.
5	24 VDC and DC24G terminal	Use to the 24 VDC power to the output module as the internal power supply.

Chapter 9. BASE BOARD AND EXPANSION CABLE

9.1 Specifications

9.1.1 Main base board

Items \ Models	GM4-B04M GM4-B4MH	GM4-B06M GM4-B6MH	GM4-B08M GM4-B8MH	GM4-B12M
Loaded I/O modules	4 modules	6 modules	8 modules	12 modules
Outer dimensions (mm)	289 ? 135 ? 17	367 ? 135 ? 17	437 ? 135 ? 17	540 ? 135 ? 17
Panel installation hole size	?4.5 (for M4 screw)			
FG terminal connection screws specifications	BHM ? 6 washer			
Weight (kg)	0.85	1.1	0.73	0.85
Accessory	Connector cover			

HINT

1) Expansion cable cannot be connected in the GM4-B12M.

9.1.2 Expansion Base board

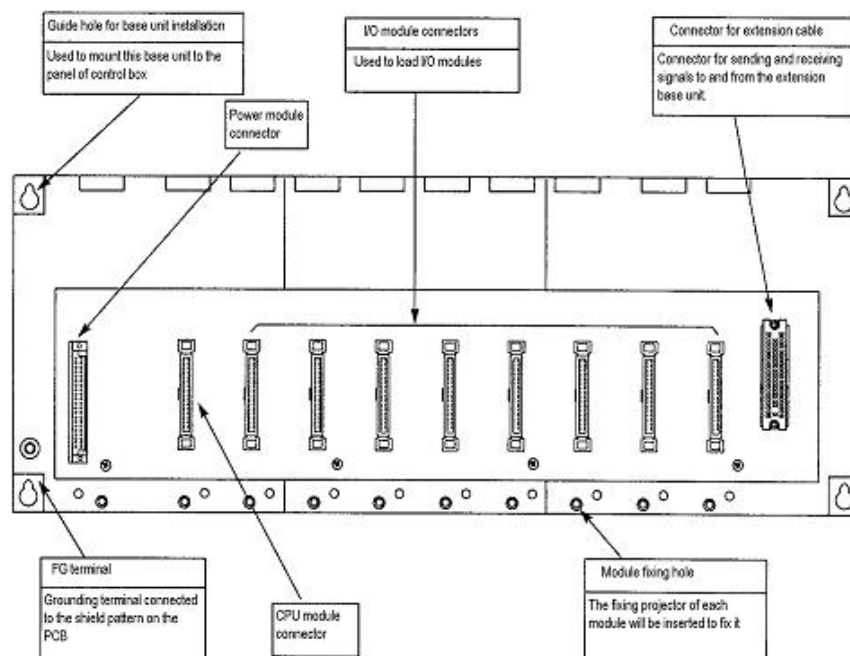
Item \ Model	GM4-B04E GM4-B4EH	GM4-B06E GM4-B6EH	GM4-B08E GM4-B8EH
Loaded I/O modules	4 modules	6 modules	8 modules
Outer dimensions (mm)	297 ? 135 ? 17	367 ? 135 ? 17	437 ? 135 ? 17
Panel installation hole size	?4.5 (for M4 screw)		
FG terminal connection screws specifications	BHM 3 ? 6 washer		
Weight (kg)	0.9	1.15	1.4
Accessory	Dust Cover, Connector cover		

9.1.3 Expansion Cable

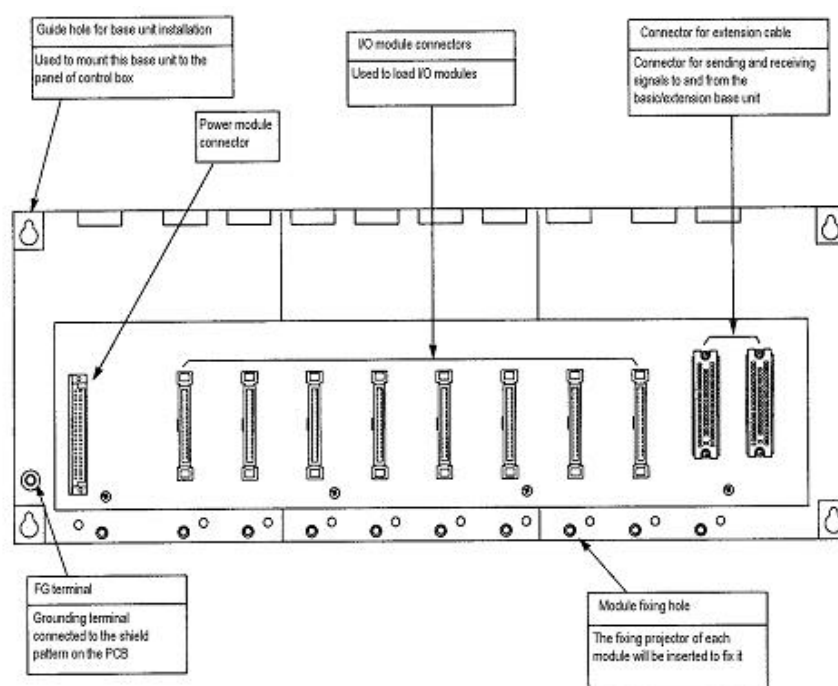
Models \ Items	G4C-E041	G4C-E061	G4C-E121	G4C-E301	G4C-E601	G4C-E102	G4C-E152
Length(m)	0.4	0.6	1.2	3.0	6.0	10.0	15.0
Weight(kg)	0.21	0.32	0.52	1.09	1.86	2.98	4.39

9.2 Names of Parts

9.2.1 Main base board



9.2.2 Expansion Base board



Chapter 10. INSTALLATION AND WIRING

10.1 Installation

10.1.1 Installation Environment

This unit has high reliability regardless of its installation environment, but be sure to check the following for system reliability and stability.

1) Environment requirements

Avoid installing this unit in locations which are subjected or exposed to :

- (1) Water leakage and dust.
- (2) Continuous shocks or vibrations.
- (3) Direct sunlight.
- (4) Dew condensation due to rapid temperature change.
- (5) Higher or lower temperatures outside the range of 0 to 55 °C
- (6) Relative humidity outside the range of 5 to 95 %
- (7) Corrosive or flammable gases

2) Precautions during installing.

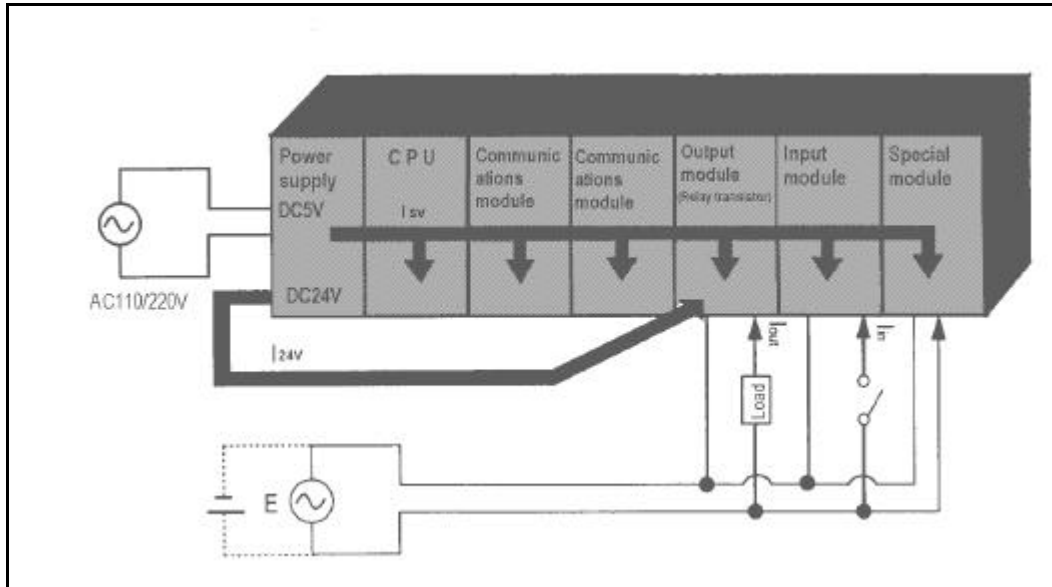
- (1) During drilling or wiring, do not allow any wire scraps to enter into the PLC.
- (2) Install it on locations that are convenient for operation.
- (3) Make sure that it is not located on the same panel that high voltage equipment located..
- (4) Make sure that the distance from the walls of duct and external equipment be 50 mm or more.
- (5) Be sure to be grounded to locations that have good ambient noise immunity.

3) Heat protection design of control box

- (1) When installing the PLC in a closed control box, be sure to design heat protection of control box with consideration of the heat generated by the PLC itself and other devices.
- (2) It is recommended that filters or closed heat exchangers be used.

The following shows the procedure for calculating the PLC system power consumption.

1) PLC system power consumption block diagram



2) Power consumption of each part

(1) Power consumption of a power supply module

Approximately 70% of the power supply module current is converted into power and 30% of that 70% dissipated as heat, i.e., $\frac{3}{7}$ of the output power is actually used.

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

where, I_{5V} = 5 VDC circuit current consumption of each module

I_{24V} = 24 VDC circuit average current consumption of output modules (with points simultaneously switched ON). Not for 24 VDC power supplied from external or power supply modules that has no 24 VDC output.

(2) Total 5 VDC power consumption

The total power consumption of all modules is the power of the 5 VDC output circuit of the power supply module.

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

(3) Average 24 VDC power consumption (with points simultaneously switched ON)

The total power consumption of all modules is the average power of the 24 VDC output circuit of the power supply module.

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

(4) Average power consumption by voltage drop of output modules (with points simultaneously switched ON)

$$W_{out} = I_{out} \times V_{drop} \times \text{output points} \times \text{the rate of points switched on simultaneously (W)}$$

- I_{out} : output current (actual operating current) (A)
- V_{drop} : voltage dropped across each output load (V)

(5) Average power consumption of input circuits if input modules (with points simultaneously switched ON)

? $W_{in} = I_{in} \times E \times$ input points ? the rate of points switched on simultaneously (W)

{ I_{in} : input current (effective value for AC) (A)
 { E : input voltage (actual operating voltage) (V)

(6) Power consumption of the special module power supply

? $W_s = I_{5V} \times 5 \times I_{24V} \times 24 \times I_{100V} \times 100$ (W)

The sum of the above values is the power consumption of the entire PLC system.

? $W = W_{PW} + W_{5V} + W_{24V} + W_{OUT} + W_{IN} + W_s$ (W)

Check the temperature rise within the control panel with calculation of that total power consumption(W).

The temperature rise in the control panel is expressed as:

$$T = W/UA \text{ [}^\circ\text{C]}$$

{ W : Power consumption of the entire PLC system (obtained as shown above)
 { A : Control panel inside surface area (m²)
 { U : 6 (if the control panel temperature is controlled by a fan, etc.)
 4 (if control panel air is not circulated)

10.1.2 Handling Instructions

To installing each module, be sure to check the following:

- ? Do not drop it off, and make sure that strong shock should not be applied.
- ? Do not unload the PCB from its case. It can cause faults.
- ? During wiring, be sure to check any foreign matter like wire scraps should not enter into the upper side of the PLC. If any foreign matter has entered into it, always eliminate it.
- ? Do not load or unload the module while the power supply is being connected.

1) I/O module handling instructions

The followings explain instructions for handling or installing the input module.

(1) I/O module specifications re-check

Re-check the input voltage for the input module. If a voltage over the maximum switching capacity is applied, it can cause faults, destruction or fire.

(2) Used wire

Select the wire with due consideration of ambient temperature and rated current. Its minimum specifications should be AWG22(0.3 mm²) or more.

(3) Environment

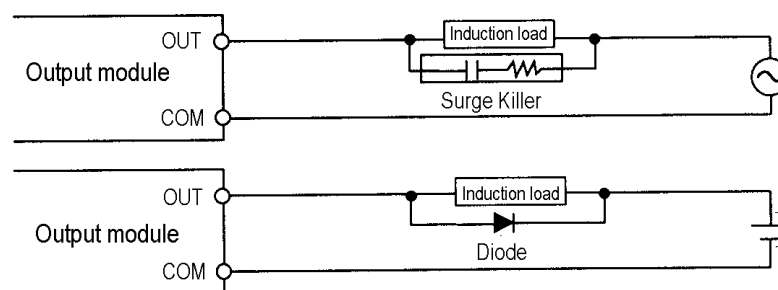
When wiring the I/O module, if it locates near a device generating an cause short circuit, destruction or malfunction.

(4) Polarity

Before applying the power to a module that has polarities, be sure to check its polarities.

(5) Wiring

- ? Wiring I/O wires with high voltage cable or power supply line can cause malfunction or disorder.
- ? Be sure that any wire does not pass across during input LED (I/O status will not be clearly identified).
- ? If an inductive load has been connected to output module, connect parallel surge killer or diode to a load. Connect the cathode part of diode to the ? part of the power supply.



(6) Terminal block

Check its fixing. During drilling or wiring, do not allow any wire scraps to enter into the PLC. It can cause malfunction and fault.

(7) Be cautious that strong shock does not applied to the I/O module. Do not separate the PCB from its case.

2) Base board mounting instructions

The following explains instructions for mounting the PLC onto the control panel.

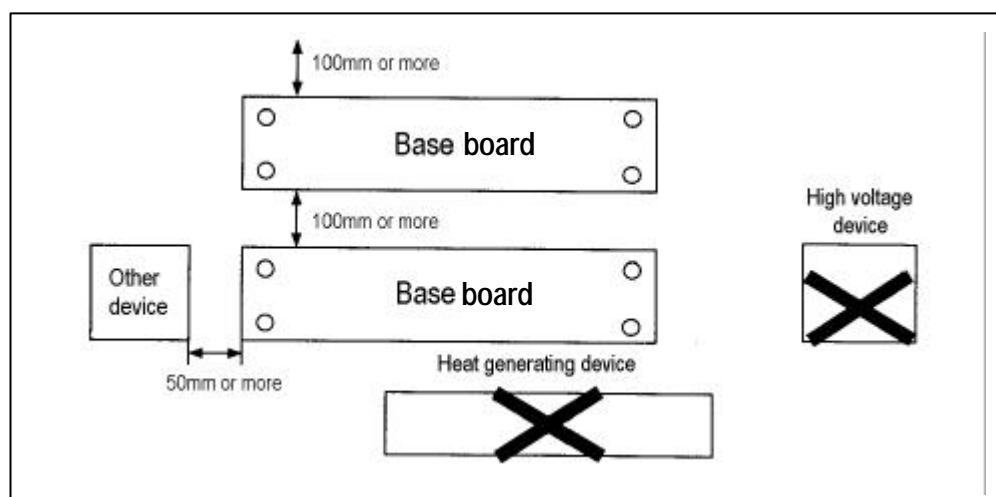
- (1) Allow sufficient distance from the upper part of the module for easy module replacement.
- (2) Do not mount the PLC in a vertical or horizontal position because it affects on ventilation.
- (3) Do not mount the base board together with a large-sized electromagnetic contactor or no-fuse breaker, which produces vibration, on the same panel. Mount them on different panels, or keep the base board away from such a vibration source.
- (4) Mount the wire duct as it is needed.

If the clearances are less than those in Fig 10.1, follow the instructions shown below.

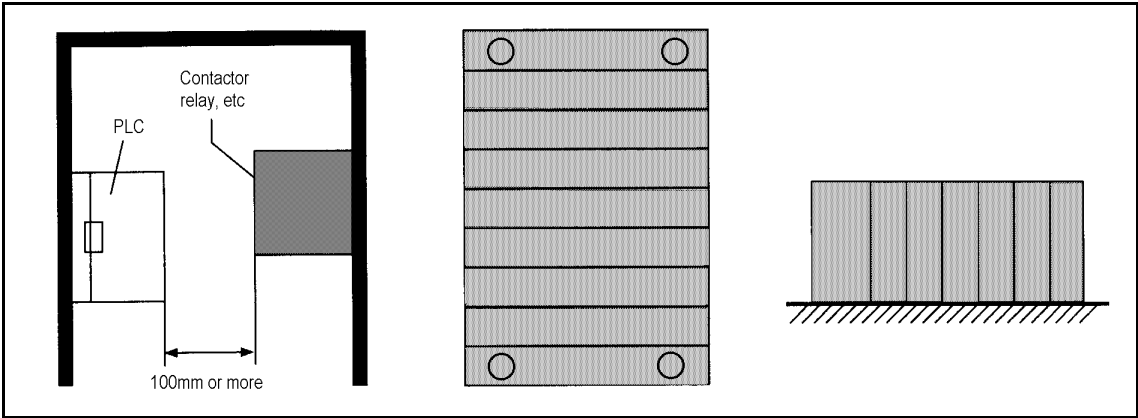
? If the wire duct is mounted on the upper part of the PLC, make the wiring duct clearance 50mm or less for good ventilation. Also, allow the distance enough to press the hook in the upper part from the upper part of the PLC.

? If the wire duct is mounted on the lower part of the PLC, make optic or coaxial cables contact it and consider the minimum diameter of the cable.

- (5) To protect the PLC from radiating noise or heat, allow 100 mm or more clearances between it and parts. Left or right clearance and clearance from other device in the left or right side should be 50 mm or more.



[Fig. 10.1] PLC mounting



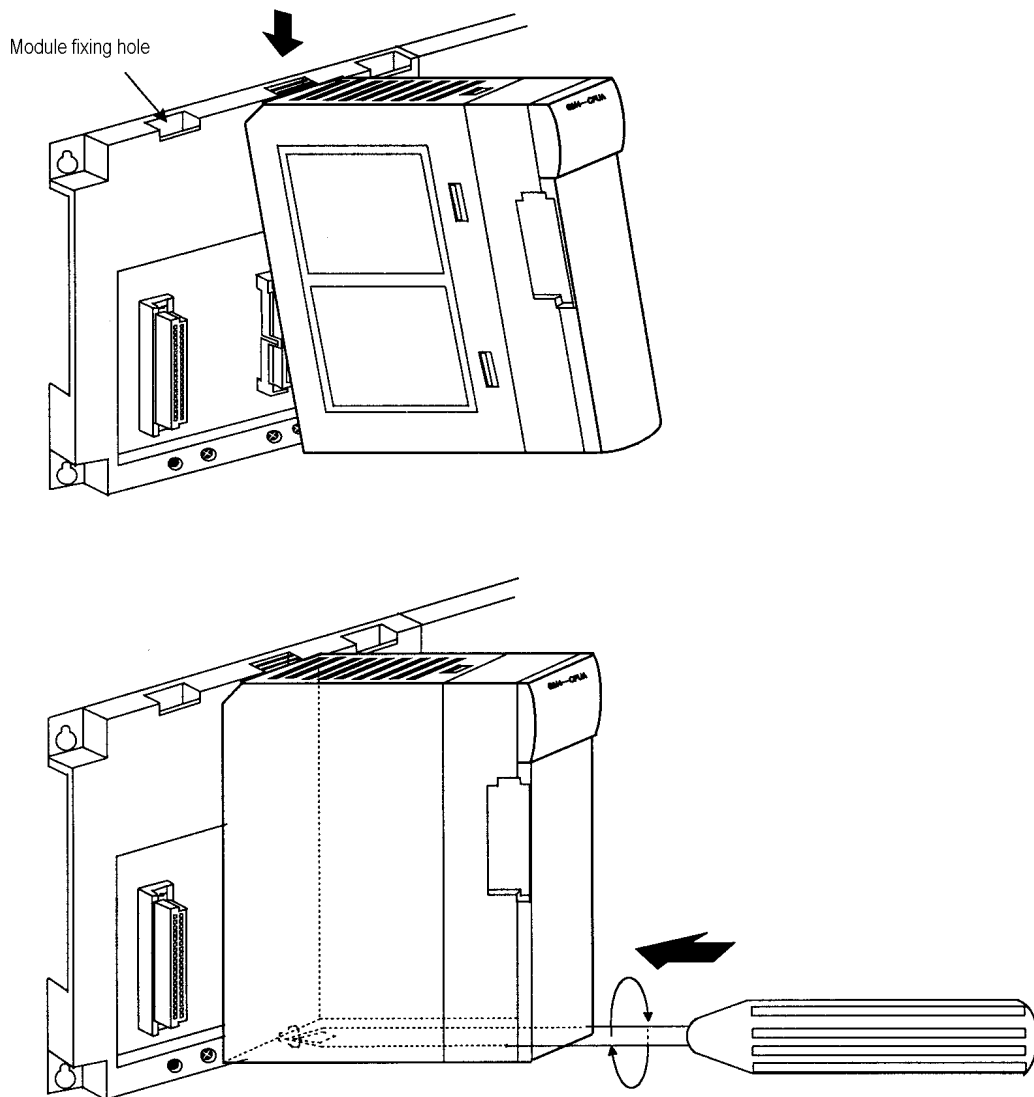
[Fig.10.2] Clearance from the front device [Fig. 10.3] Vertical mounting (Bad) [Fig 10.4] Horizontal mounting (Bad)

10.1.3 Mounting and Dismounting of module

The following explains the mounting and dismounting of various modules.

1) Module mounting

- ? Insert the module fixing projections in the upper part into the module fixing hole in the base board.
- ? Install the module onto the base board by pushing the bottom forward and fix it onto the base board with module fixing screws.
- ? Check that the module is firmly mounted onto the base board by pulling the upper part of the module.

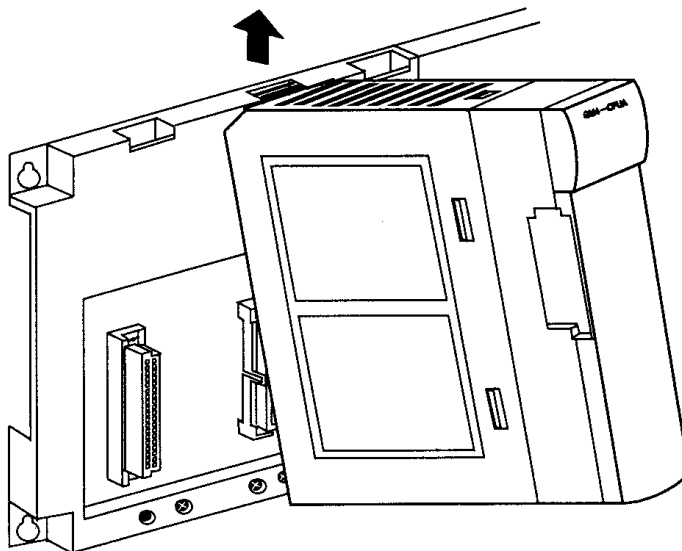
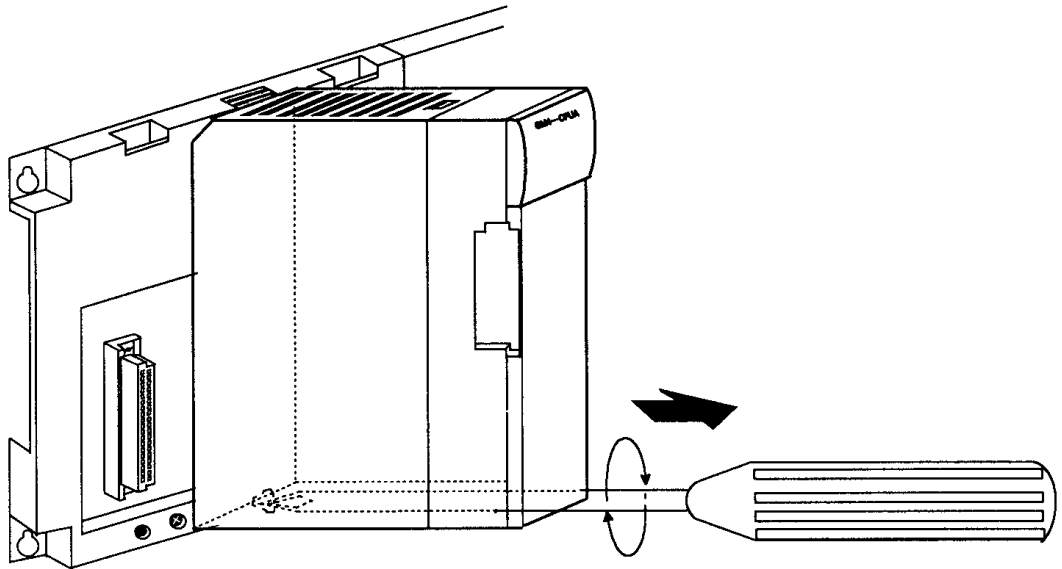


HINT

- 1) When installing the module, make sure that the module fixing projections are inserted into the module fixing hole and fixed. If the module is forcibly mounted the pins in the module connector may be bent or damaged.

2) Module dismounting

- ? First, release the module fixing screws in the bottom from the base board.
- ? While pushing the hook latch, pull the upper part of the module toward you.
- ? While lifting the module upwards and remove the module hook from the module fixing hole.

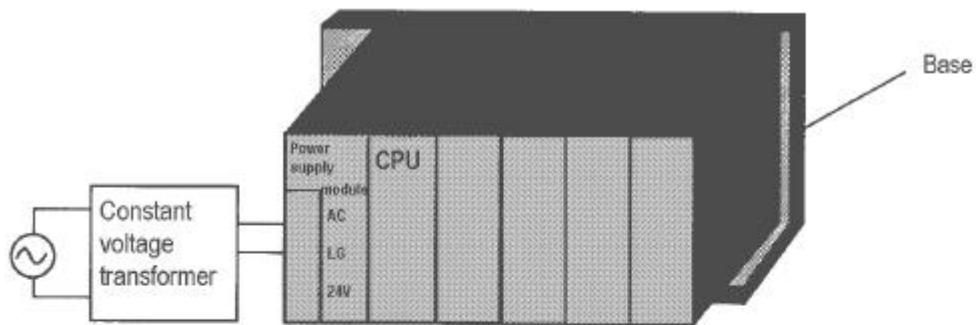


10.2 Wiring

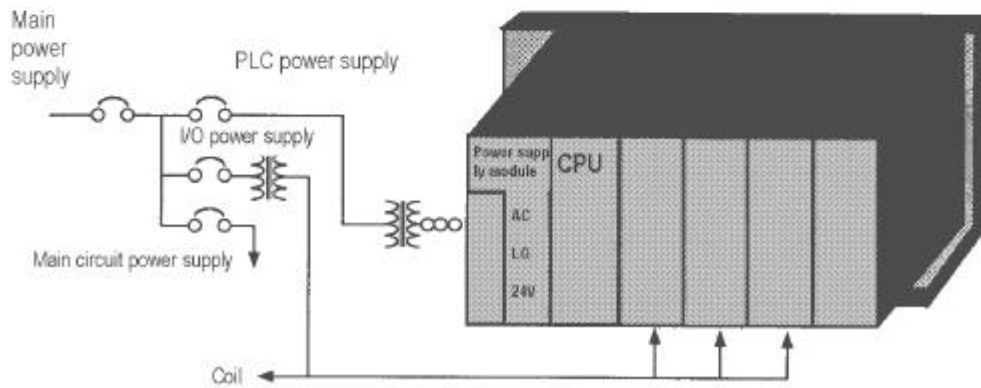
The followings explains the wiring instructions for use of the system.

10.2.1 Power Supply Wiring

- 1) When voltage fluctuations are larger than the specified value, connect a constant-voltage transformer.

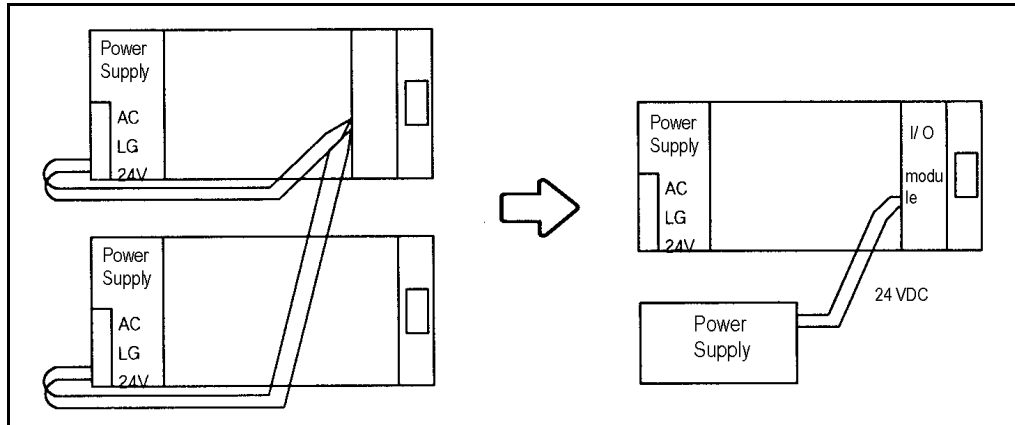


- 2) Use a power supply which generates minimal noise across wire and across PLC and ground. (When excessive noise is generated, connect an insulating transformer)
- 3) When wiring, separate the PLC power supply from the I/O and power device as shown below.

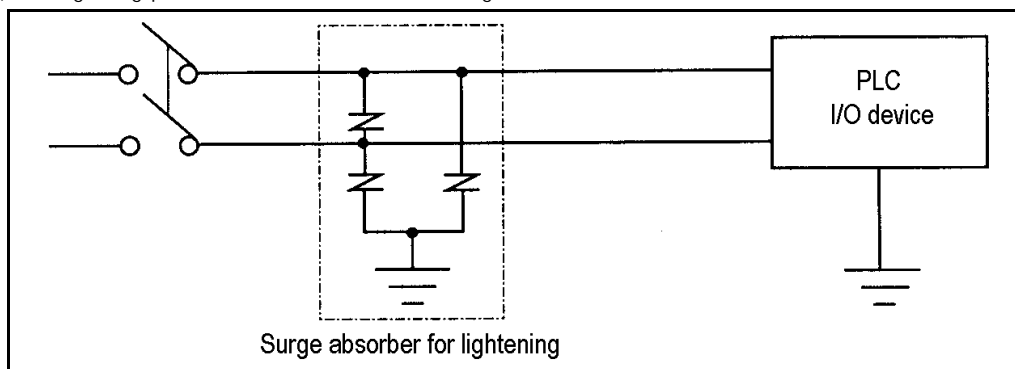


4) Notes on using 24 VDC output of the power supply module

- ? To protect the power supply modules, do not supply one I/O module with 24 VDDC from several power supply modules connected in parallel.
- ? If 24 VDC output capacity is sufficient for one power supply module, supply 24 VDC from the external 24 VDC power supply as shown below.



- 5) Twist the 110 VAC, 220 VAC, and 24 VDC cables as closely as possible. Connect modules with the shortest possible wire lengths.
- 7) To minimize voltage drop, use the thickest (max. 2 mm²) wires possible for the 100 VAC, 200VAC and 24 VDC cables.
- 8) Do not bundle the 100 VAC and 24 VDC cables with main-circuit(high voltage, large current) wires or the I/O signal wires. If possible, provide more than 100 mm distance between the cables and wires.
- 8) As a lightning-protection measure, connect a surge absorber as shown below.



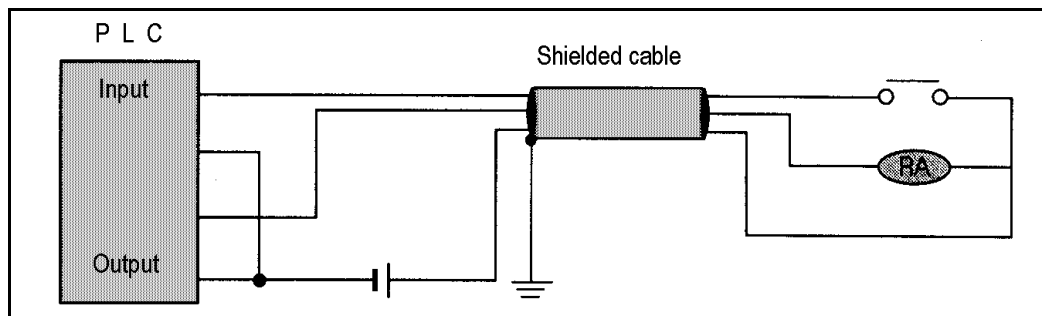
HINT

- 1) Ground the surge absorber (E1) and the PLC(E2) separately from each other.
- 2) Select a surge absorber making allowances for power voltage rises.

- 9) Use a insulating transformer or noise filter for protection against noise .
- 10) Twist every input power supply wires as closely as possible. Do not allow the transformer or noise filter across the duct.

10.2.2 Input and Output Devices Wiring

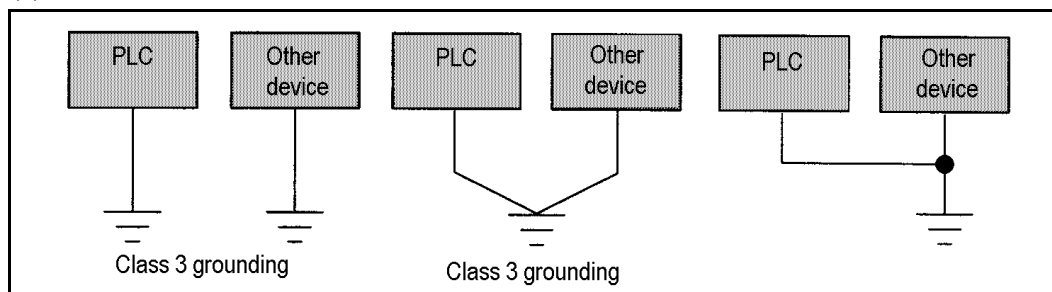
- 1) Applicable size of wire for I/O wiring is 0.3 to 2 mm². However, it is recommended to use wire of 0.3mm² for convenience.
- 2) Separate the input and output lines.
- 3) I/O signal wires must be at least 100 mm away from high voltage and large current main circuit wires.
- 4) When the I/O signal wires cannot be separated from the main circuit wires and power wires, ground on the PLC side with batch-shielded cables.



- 5) If wiring has been done with a piping, ground the piping.
- 6) Separate the 24 VDC I/O cables from the 110 VAC and 220 VAC cables.
- 7) If wiring over 200 m or longer distance, problems can be caused by leakage currents due to line capacity. Refer to the Section 12.4 Examples.

10.2.3 Grounding

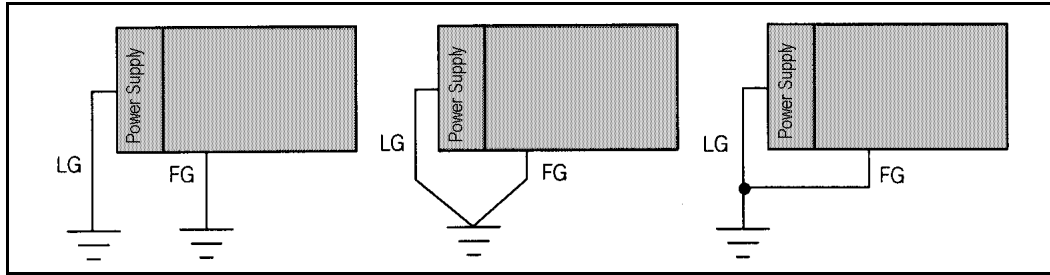
- 1) This PLC has sufficient protection against noise, so it can be used without grounding except for special much noise. However, when grounding it should be done conforming to below items.
- 2) Ground the PLC as independently as possible. Class 3 grounding should be used (grounding resistance 100 Ω or less).
- 3) When independent grounding is impossible, use the joint grounding method as shown in the figure below (B).



(A) Independent grounding : Best (B) Joint grounding : Good (C) Joint grounding : Not allowed

- 4) Use 2 mm² or more wire for grounding line. Make the distance as short as possible with the grounding point located to nearest to the PLC.

5) Ground LG (Power Supply Module) separately with FG (Base board).



(A) Independent grounding : BEST (B) Joint grounding : GOOD (C) Joint Grounding : Not Allowed

6) If a malfunction occurs depend on grounding point, separate FG (Base Board) with ground.

10.2.4 Cable Specifications for wiring

Kinds of external connection	Cable Specifications (mm ²)	
	Minimum	Maximum
Digital Input	0.18 (AWG 24)	1.5 (AWG16)
Digital Output	0.18 (AWG24)	2.0 (AWG14)
Analog Input/Output	0.18 (AWG24)	1.5 (AWG16)
Communication	0.18 (AWG24)	1.5 (AWG16)
Main Power	1.5 (AWG16)	2.5 (AWG12)
Grounding	1.5 (AWG16)	2.5 (AWG12)

Chapter 11. MAINTENANCE

Be sure to perform daily and periodic maintenance and inspection in order to maintain the PLC in the best conditions.

11.1 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
Ambient environment	Temperature	0 to +55°C	Adjust the operating temperature and humidity with the defined range
	Humidity	5 to 95%RH	
	Vibration	No vibration	Use vibration resisting rubber or the vibration prevention method
Play of modules		No play allowed	Securely engage the hook
Connecting conditions of terminal screws		No loose allowed	Retighten terminal screws
Change rate of input voltage		-15% to 15%	Hold it with the allowable range
Spare parts		Check the number of spare parts and their storage conditions	Cover the shortage and improve the storage condition

11.2 Daily Inspection

The following table shows the inspection and items which are to be checked daily

Check Items		Check points	Judgment	Corrective Actions
Base unit mounting conditions		Check for loose mounting screws	The base unit should be securely mounted	Retighten Screws
Mounting conditions of I/O modules		? Check if the hook is securely engaged ? Check if the upper cover is securely mounted	The hook should be securely engaged	Securely engage the hook
Connecting conditions of terminal block or extension cable		Check for loose terminal screws	Screws should not be loose	Retighten terminal screws
		Check the distance between solderless terminals	Proper clearance should be provided	Correct
		Check connectors of extension cable	Connectors should not be loose	Correct
Indicating LED	Power LED	Check that the LED is ON	ON(OFF indicates an error)	See chapter 12
	Run LED	Check that the LED is ON during Run	ON(ON or flickering indicates an error)	"
	Stop LED	Check that the LED is OFF during Run	OFF(ON indicates an error)	"
	Input LED	Check that the LED turns ON and OFF	ON when input is ON, OFF when input is off	"
	Output LED	Check that the LED turns ON and OFF	ON when output is ON. OFF when output is OFF	"

11.3 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	temperature	Measure with thermometer and hygrometer Measure corrosive gas	0 to 55°C	
	Ambient humidity		5 to 95% RH	
	Ambience		There should be no corrosive gases	
PLC conditions	Looseness, play	Move the unit	The module should be mounted securely	Retighten screws
	Ingress of dust or foreign material	Visual check	No dust or foreign material	
Connecting conditions	Loose terminal screws	Retighten	Screws should not be loose	Retighten
	Distance between solderless terminals	Visual check	Proper clearance	Correct
	Loose connector	Visual check	Connectors should not be loose	Retighten connector mounting screws
Line voltage check		Measure voltage across 110/ 220 VAC terminal	85 to 132VAC 170 to 264VAC	Change supply power
Battery		Check battery replacement time and battery capacity reduction	? Check total power failure time and the specified source life ? Battery capacity reduction should not be indicated	If battery capacity reduction is not indicated, Change the battery when specified service life is exceeded
Fuse		Visual check	No melting disconnection	If fuse melting disconnection, change the fuse periodically because a surge current can cause heat

Chapter 12. TROUBLESHOOTING

The following explains contents, diagnosis and corrective actions for various errors that can occur during system operation

12.1 Basic Procedures of Troubleshooting

System reliability not only depends on reliable equipment but also on short down-times in the event of faults.

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 motion(In stop and operating status)
- ? Power ON or 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, STOP LED and I/O LED). After checking them, connect the 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.

- ? Set the key switch to the STOP position, and then turn the power ON and OFF

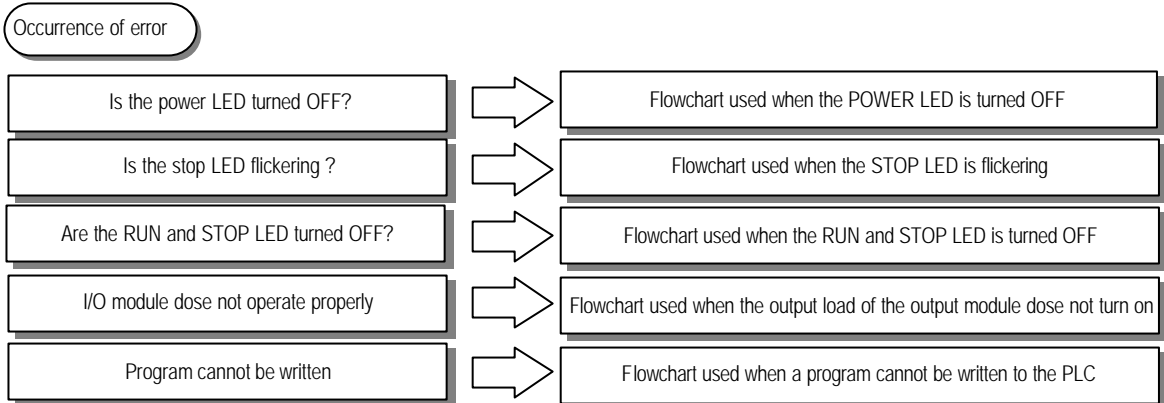
3) Narrow down the possible causes of the trouble

Deduce where the fault lies, i. e:

- ? Inside or outside of the PLC
- ? I/O module or another module
- ? PLC program ?

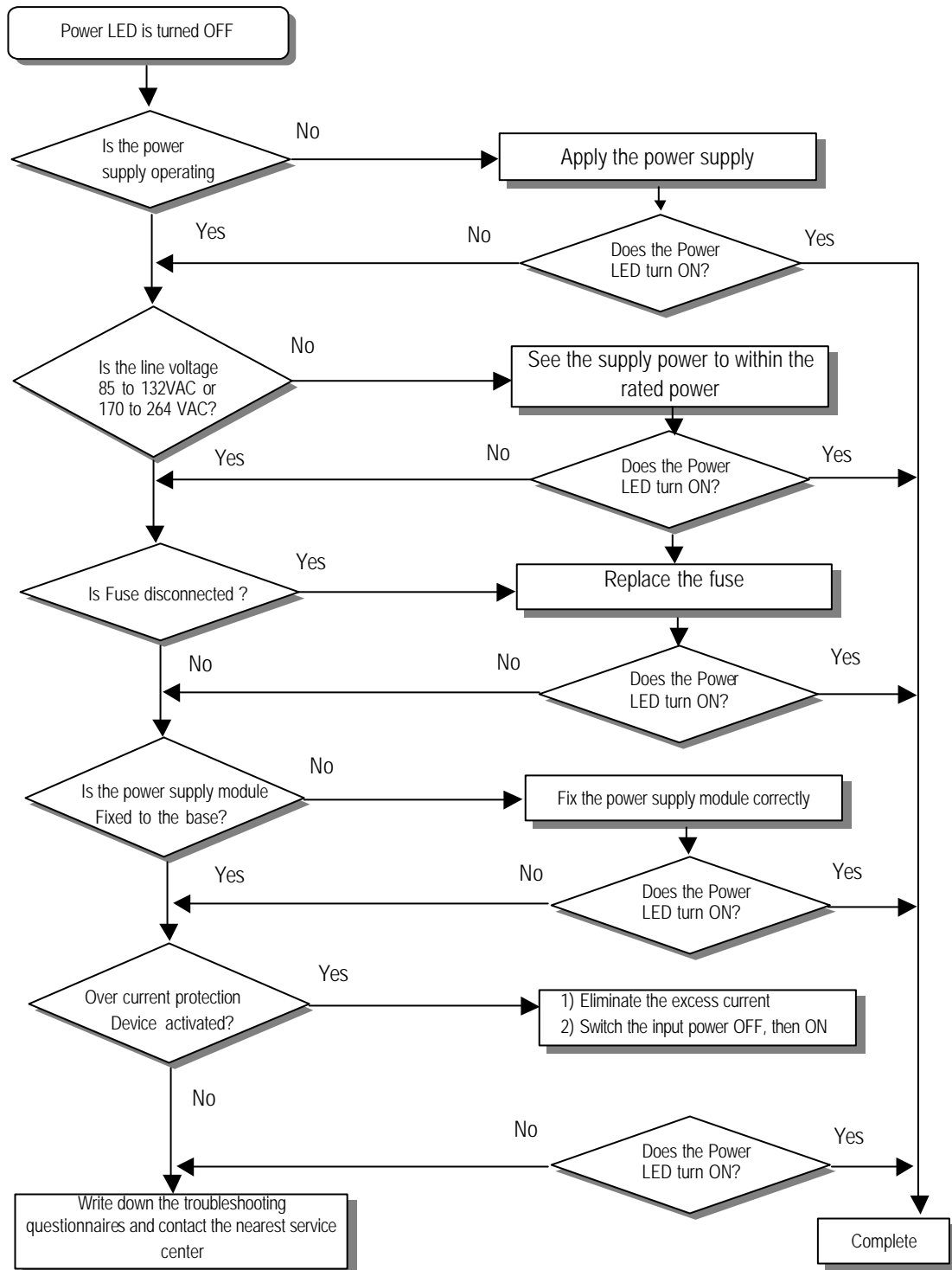
12.2 Troubleshooting

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



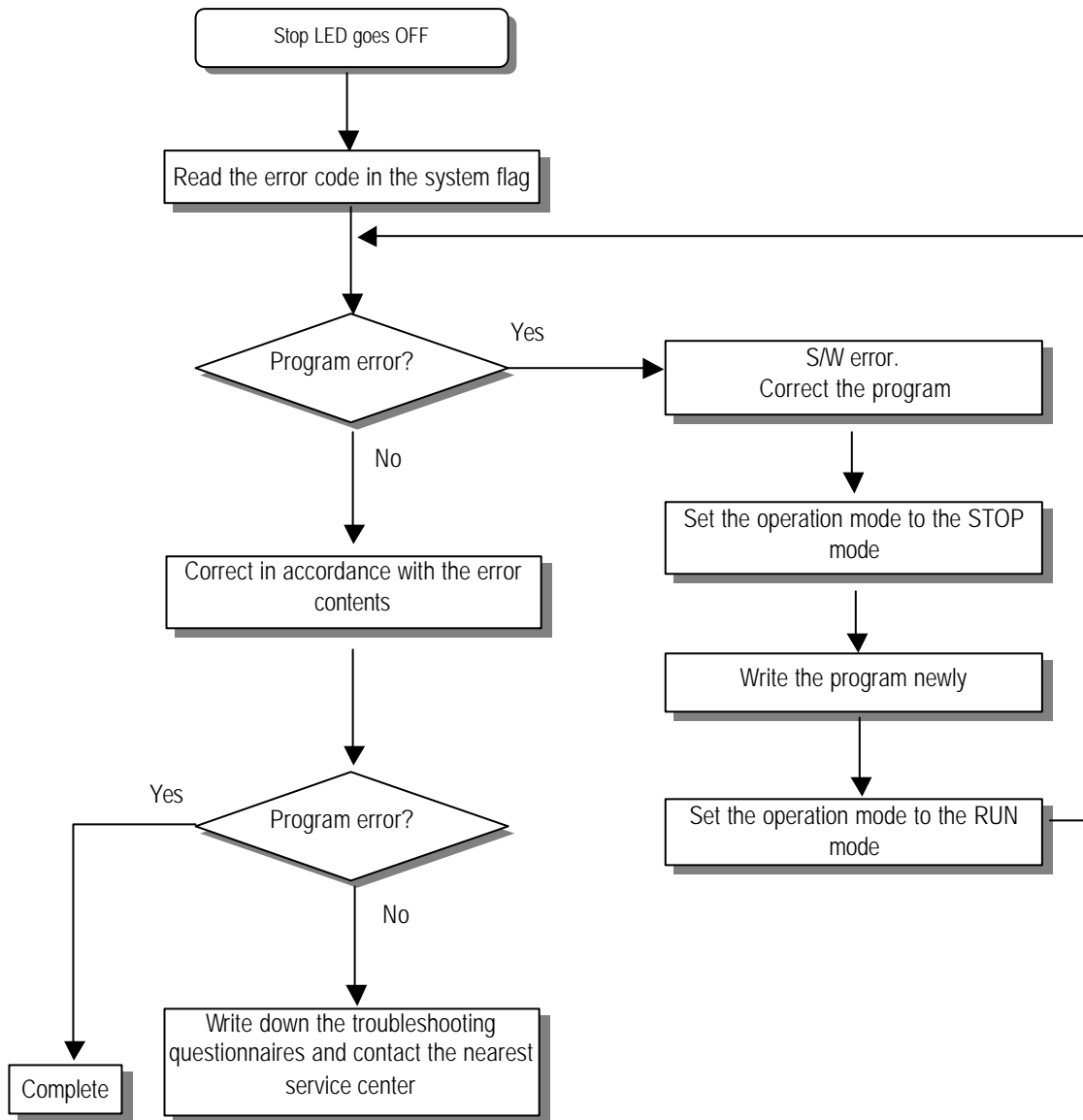
12.2.1 Troubleshooting flowchart used when the POWER LED turns OFF.

The following flowchart explains corrective action procedure used when the power is all lied or the POWER LED turns OFF during operation



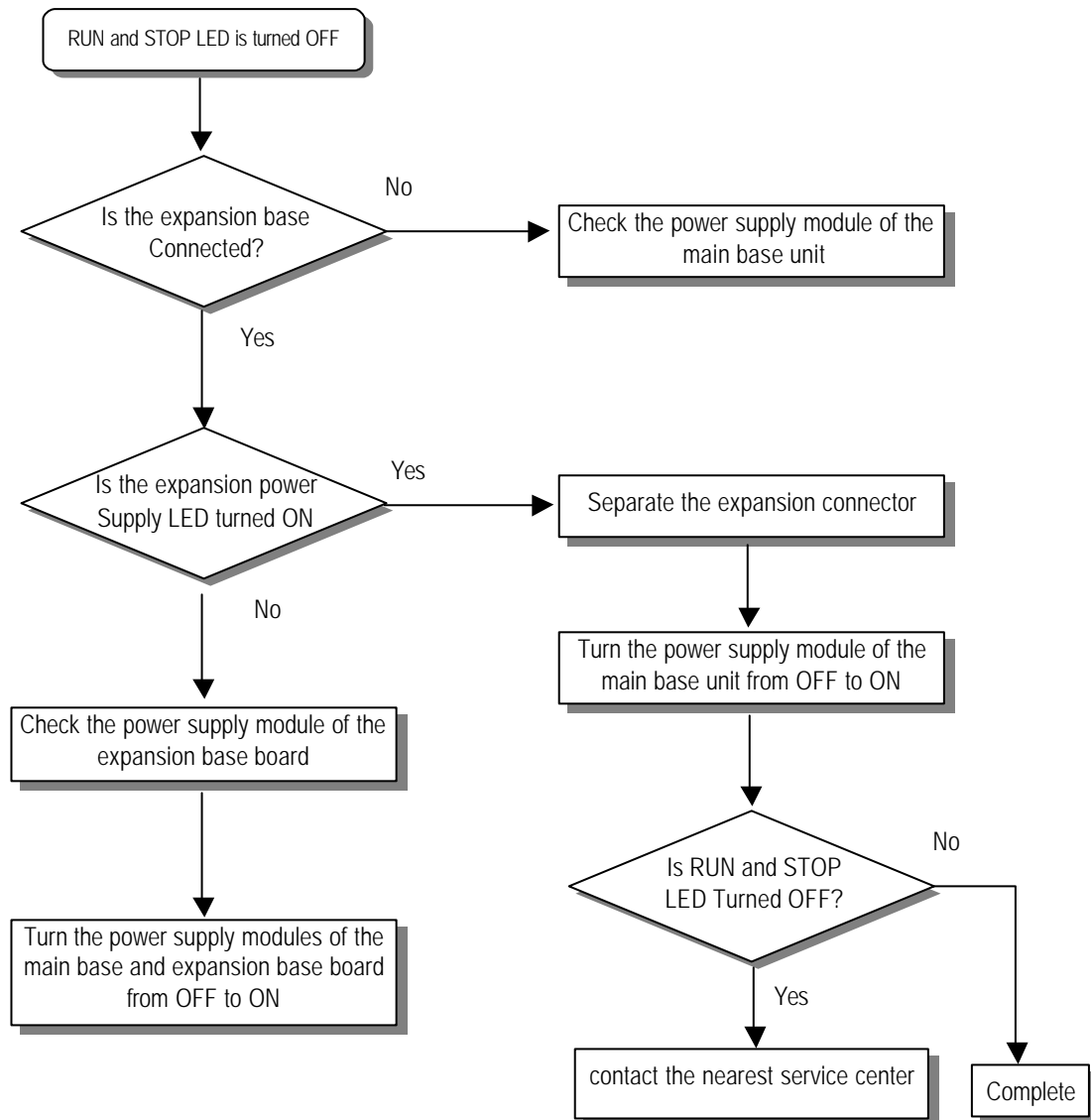
12.2.2 Troubleshooting flowchart used when the STOP LED is flickering

The following flowchart explains corrective action procedure use when the power is applied starts or the STOP LED is flickering during operation



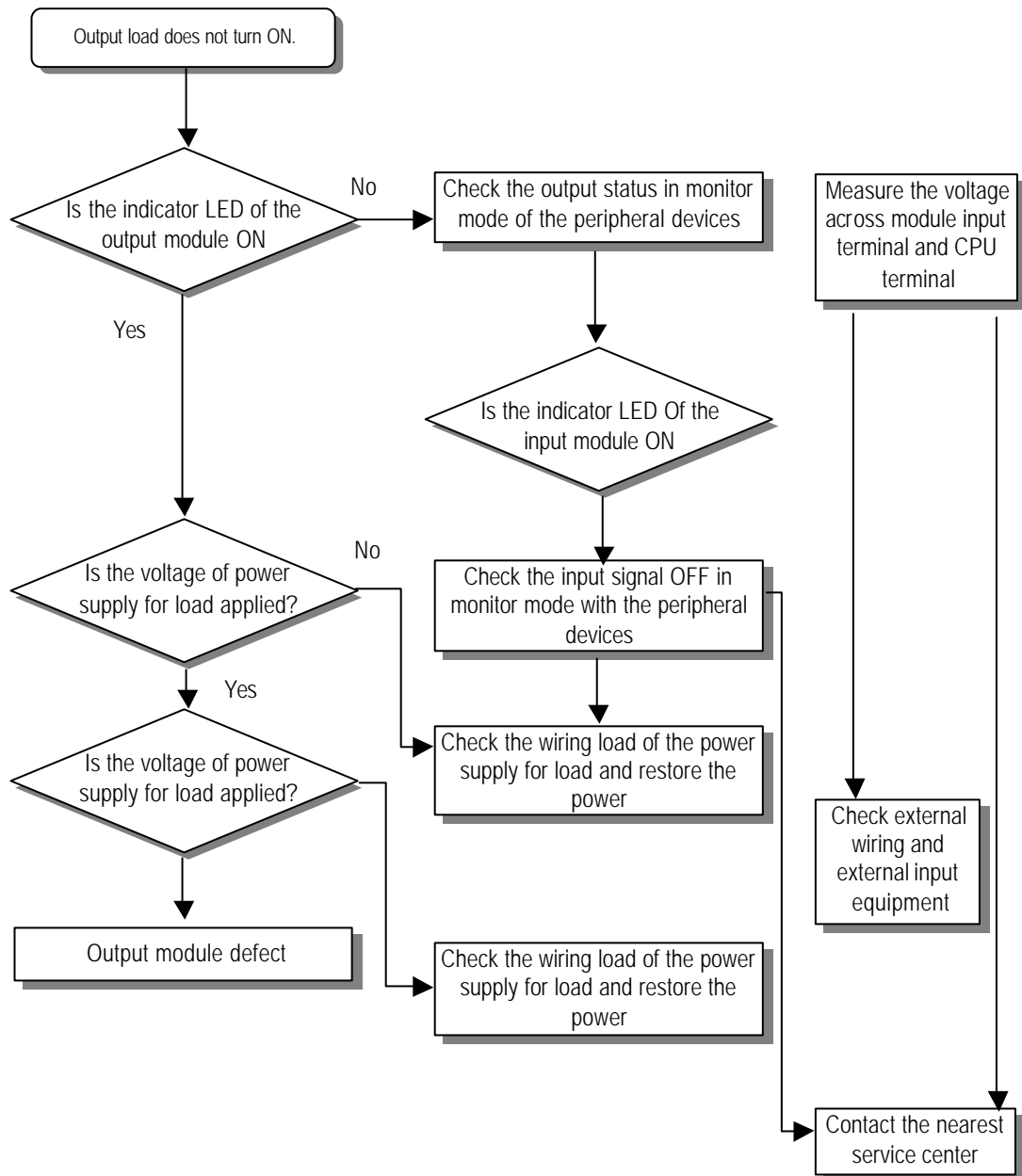
12.2.3 Troubleshooting flowchart used when the RUN and STOP LEDs turn off.

The following flowchart explains corrective action procedure use when the power is applied starts or the RUN and STOP LED is turned OFF is flickering during operation



12.2.4 Troubleshooting flowchart used when the output load of the output module does not turn on.

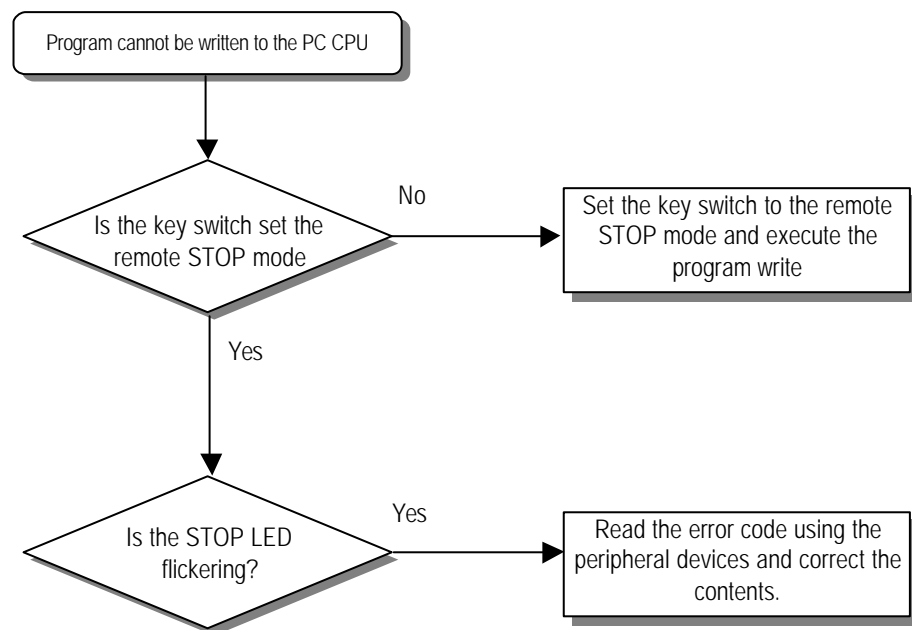
The following flowchart explains corrective action procedure used when the output load of the output module does not turn ON during operation

**HINT**

1) If the input or load signals are not switched OFF, see Section 12.4.1

12.2.5 Troubleshooting flowchart used when a program cannot be written to the CPU module.

The following flowchart shows the corrective action procedure used when a program cannot be written to the PLC module



12.3 Troubleshooting Questionnaire

When problems have been met during operation of the GM4 series PLC, please write down this questionnaires and contact the service center via telephone or facsimile

? For errors relating to special or communications modules, use the questionnaire included in the user's Manual of the unit

1. Telephone & FAX No. Tel) _____
FAX) _____

2. Used Equipment ()

3. Details of used Equipment

- CPU module : - OS version No.(), - Serial No.()
- GMWIN version No. used to compile programs

4. General description of the device or system used as the control object

5. Operations used by the CPU module

- Operation by the key switch(), - Operation by the GMWIN or communications.()
- Memory module operation()

6. Is the STOP LED of the CPU module turned ON? Yes(), No()

7. GMWIN error message :

8. Used initialization program : initialization program()

9. History of corrective actions for the error message in the article 7.

10. Other tried corrective actions

11. Error character sties

- ? Repetitive() : Periodic(), Related to a particular sequence(), Related to environment()
- ? Sometimes() : General error assurance interval

12. Detailed Description of error contents :

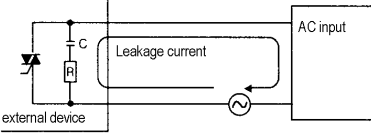
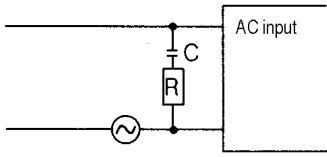
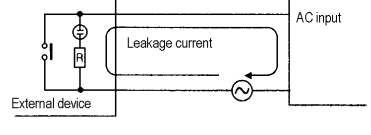
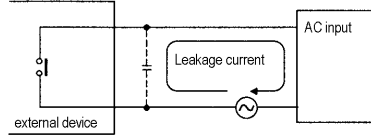
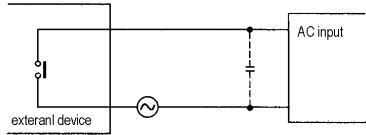
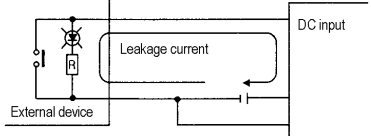
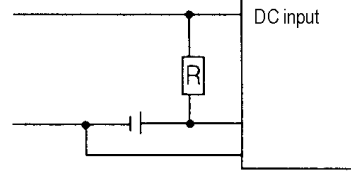
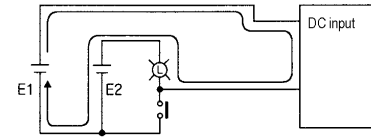
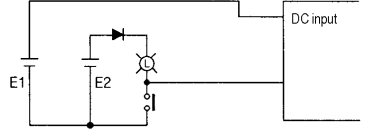
13. Configuration Diagram for the applied system :

12.4 Troubleshooting Examples

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

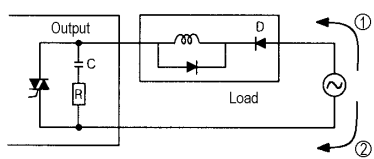
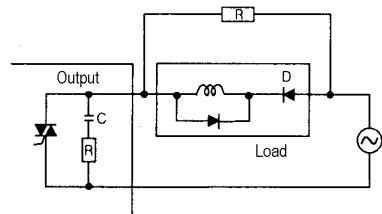
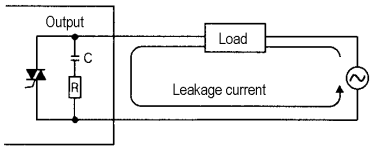
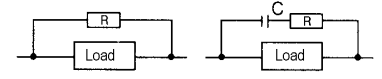
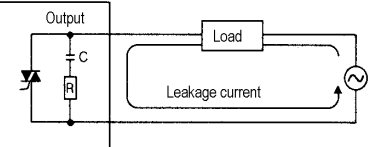
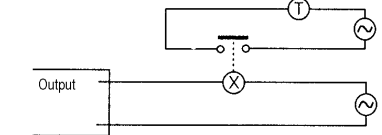
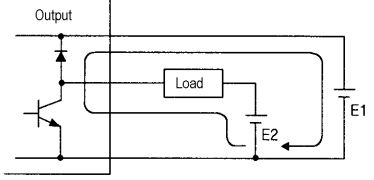
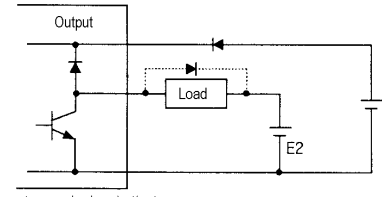
12.4.1 Input circuit troubles and corrective actions

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

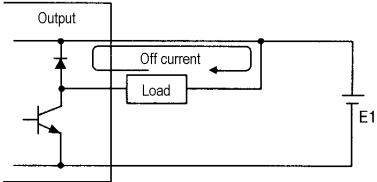
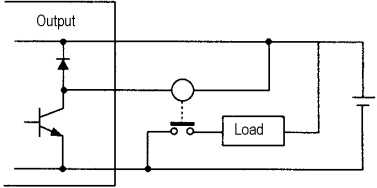
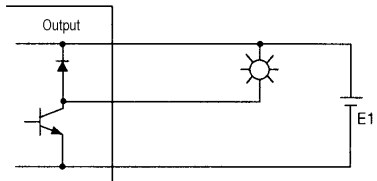
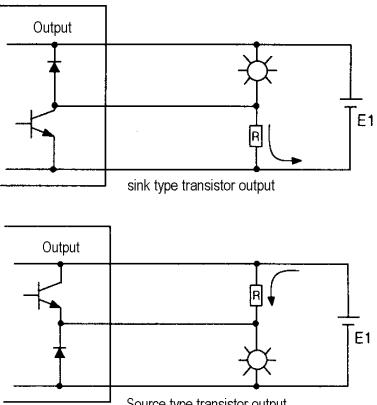
Condition	Cause	Corrective Action
Input signal close not turn OFF	Leakage current of external device (such as a drive by non-contact switch) 	? Connect an appropriate register and capacity which will make the voltage across the terminals of the input module lower than 
Input signal does not turn OFF	Leakage current of external device (Drive by a limit switch with neon lamp) 	? C and R values are determined by the leakage current value - Reminded value C : 0.1 ~ 0.47 μF R : 47 ~ 120 Ω (1/2W) Or make up another independent display circuit
Input signal does not turn OFF	Leakage current due to line capacity of wiring cable 	? Power supply is located on the external device side as shown below 
Input signal does not turn OFF	Leakage current of external device (Drive by switch with LED indicator) 	? Connect an appropriate register which will make the voltage across input module terminal and common higher than the OFF voltage, as shown below 
Input signal does not turn OFF	? Sneak current due to the use of two different power supplies  ? E1 ? E2, Sneaked	? Use only one power supply ? Connect a sneak current prevention diode, as shown below 

12.4.2 Output circuit troubles and corrective actions

The following describes possible troubles with output circuits, as well as corrective actions

Condition	Cause	Corrective Action
When the output is Off, excessive voltage is applied to the load	<p>? Load is half-wave rectified inside (in some cases, it is true of a solenoid)</p> <p>? When the polarity of the power supply is as shown in □, C is charged. When the polarity is as shown in □, the voltage charged in C plus the line voltage are applied across D. Max voltage is approx.</p>  <p>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</p>	<p>? Connect registers of tens to hundreds kΩ across the load in parallel</p> 
The load does not turn OFF	<p>? Leakage current by surge absorbing circuit which is connected to output element in parallel</p> 	<p>? Connect C and R across the load, which are of registers of tens kΩ</p> <p>When the wiring distance from the output module to the load is long, there may be a leakage current due to the line capacity</p> 
When the load is C-R type timer, time constant fluctuates	<p>? Leakage current by surge absorbing circuit which is connected to output element in parallel</p> 	<p>? Drive the relay using a contact and drive the C-R type timer using the since contact</p> <p>? Use other timer than the C-R contact</p> <p>Some timers have half-wave rectified internal circuits therefore, be cautious .</p> 
The load does not turn OFF	<p>? Sneak current due to the use of two different power supplies</p>  <p>? E1 ? E2 : sneak current</p> <p>? E1 is switched Off and E2 is switched ON : sneak current</p>	<p>? Use only one power supply</p> <p>? Connect a sneak current prevention diode(Figure below)</p>  <p>If the load is the relay, etc, connect a counter-electromotive voltage absorbing code as show by the dot line</p>

Output circuit troubles and corrective actions(continued)

Condition	Cause	Corrective Action
The load off response time is long	<p>? Over current at Off state [The large solenoid current fluidic load (L/R is large) such as is directly driven with the transistor output]</p>  <p>? The off response time can be delayed by one or more second as some bads make the current flow across the diode at the off time of the transistor output</p>	<p>? Insert a small L/R magnetic contact and drive the load using the same contact</p> 
Output transistor is destroyed	<p>Surge current of the white lamp</p>  <p>A surge current of 10 times or more when turned ON.</p>	<p>? To suppress the surge current make the dark current of 1/3 to 1/5 rated current flow</p>  <p>sink type transistor output</p> <p>Source type transistor output</p>

12.5 Error code list

Error code	Cause	Corrective Action	Operation status	STOP LED Flickering cycle	Diagnosis time	Re-start mode
2	OS ROM error	Contact the service center if it reactively occurs when the power is re-applied.	Defect	0.4 sec	When power is applied	-
3	OS ROM error	"	Defect	0.4 sec	When power is applied	-
4	RTC fault	"	Defect	0.4 sec	When power is applied	-
5	Dedicated processor fault	"	Defect	0.4 sec	When power is applied	-
6	Program memory fault	"	Defect	0.4 sec	When power is applied	-
7	Data memory fault	"	Defect	0.4 sec	When power is applied	-
10	Watch dog error due to OS program congestion	Re-apply the power	Reset	0.4 sec	During run	Cold
20	Program memory backup error	Replace the battery if it has error check the program after cc-loading it, and if an error is detected replace the CPU module	STOP	0.4 sec	When power is applied	Cold
21	Memory module defect	Check and correct the memory module mounting condition Re-apply the power and if an error occurs, replace the memory module	STOP	0.4 sec	When power is applied	Cold
22	Memory module program fault	Correct the memory module program and re-operate the system	STOP	0.4 sec	Change into the RUN mode	Cold
23	An normal program	Re-load the program and start it	STOP	0.4 sec	Change into the RUN mode	Cold
30	Inconsistency between the specified modules by parameters and the loaded modules	Module type inconsistency error Refer to the flags(_IO_TYER,_IO_DEER_N, _IO_TYER [n]) and correct the incorrective slot, and re-start the system	STOP	0.4 sec	Change into the RUN mode	Cold
31	Module dismounting or additional mounting during run	Module mounting/ dismounting error Refer to the flags(_IO_DEER,_IO_DEER_N, _IO_DEER [n]) and correct the in corrective slot, and re-start the system	STOP	0.4 sec	When scan completes	Cold
32	Fuse disconnection during run	Fuse disconnection error Refer to the flags(_FUSE_ER,_FUSE_ER_N, _FUSE_ER[n]) and correct the in corrective slot, and re-start the system	STOP	0.4 sec	When scan completes	Cold
33	Abnormal I/D module data access during run	I/O module read/ write error Refer to the flags(_IO_RWER, _IP_RWER_N, _IO_RWER [n]) and restart the system	STOP	0.4 sec	When scan completes During execution of program	cold
34	Abnormal special/ link module data access during run	Special/ link module interface error Refer to the flags(_SP_IFER,_IP_IFER_N,_IP_IFER [n]) and restart the system	STOP	0.4 sec	When power is applied When scan completes During execution of program	cold
40	During run, Scan time over than the scan delay time specified by parameters	Check the scan delay time specified by parameters and correct the parameters or the program, and then re-start the program	STOP	0.4 sec	During execution of program	cold
41	Unreadable instructions in the user program	Re-load the program and re-start it	STOP	0.4 sec	During execution of program	cold
50	External device fatal error	Refer to the external device fatal error flags(_ANNUN_ER,_ANC_ERR[n]) and correct the fault devices and then re-start the system	STOP	0.4 sec	When scan completes	cold
60	The 'E-STOP' function has been executed	Correct the program so that the error elements that invoked the 'E_STOP' function can be eliminated in the program and re-start the system(Cold re-start)	STOP	-	During execution of program	cold
100	Communications module configuration error	If the number of computer 4communications module is included, then adjust the maximum number with in 8	STOP	0.4 sec	When power is applied	cold
101	Special/ Communications module initialization failure	Adjust the number of high speed communications modules loaded	STOP	0.4 sec	When power is applied	cold
500	Data memory backup error	If the battery has no error	RUN	-	When power is applied	cold
501	RTC data error	If the battery has no error, re-set the time using the GMWIN	RUN	2 sec	When power is applied When scan completes	-
502	Lower battery voltage	Replace the battery which the power is being applied.	RUN	4 sec	When power is applied When scan completes	-

Appendix 1. System Definitions

1) Option

(1) Communication port configuration

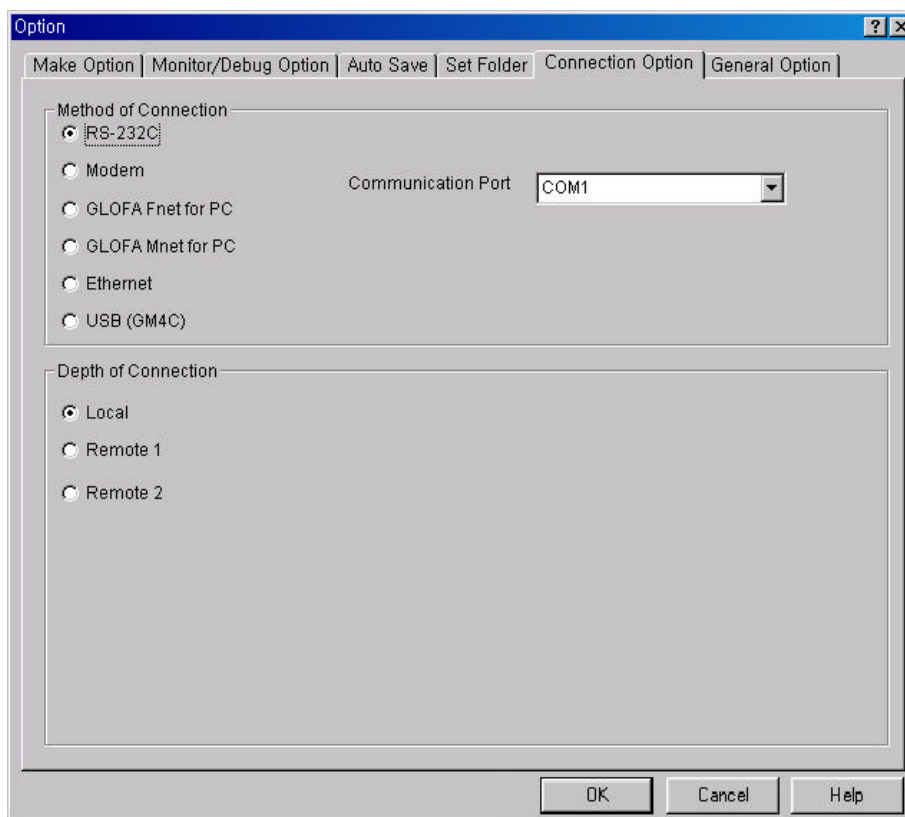
In order to communicate with PLC, set up communication port(COM 1-8) in GMWIN

The follow shows the method to set up the configuration.

? In the menu, select Project – Option – Connection Option.

? In the initial screen, Method of Connection is RS-232C for default.

? For details, refer to GMWIN User's Manual.



(2) Folder configuration

In the GMWIN, 4 kinds of folder configurations are available. The follow shows each of uses.

The configuration is in order of Project – Option – Set Folder.

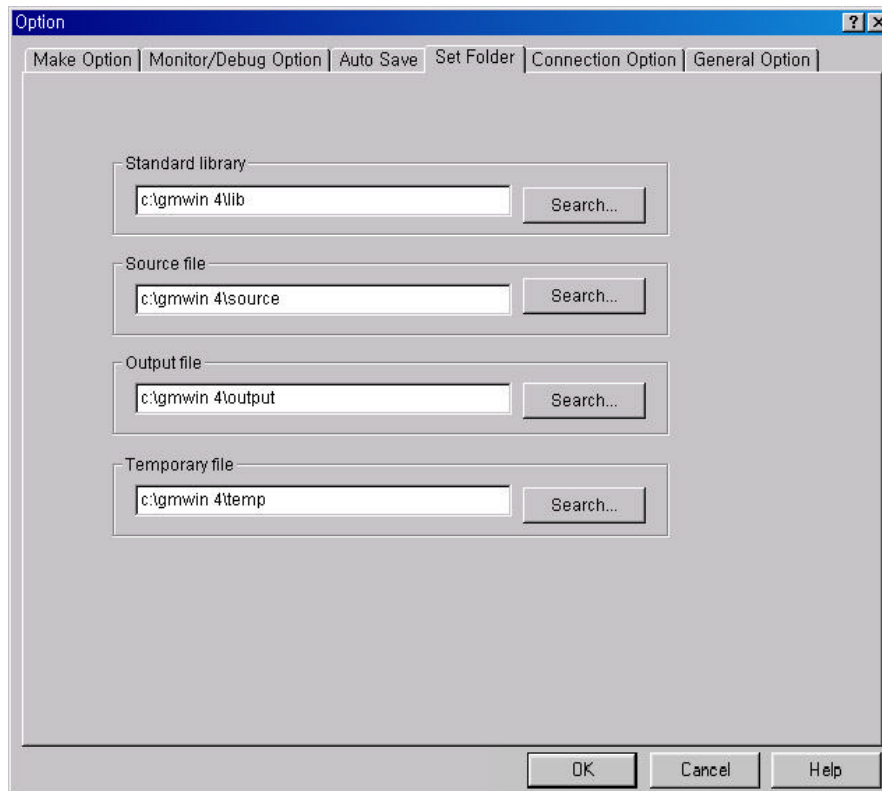
? Standard library : This is the folder where the library for GMWIN is saved and also user defined library is saved.

? Source file : Various kinds of programs, functions, function blocks, which is made by users, are saved.

? Output file : When source file is compiled, the object file is saved.

? Temporary file : Various kinds of temporary files, which are made on operation of GMWIN, are saved.

For details, refer to GMWIN User's Manual.



Appendix 1. System Definitions

(3) Auto Save

Auto Save is the function which sets up auto save time cycle to save the contents when editing or modifying program. The auto-saved file is saved for the expansion file name 'ASV' in the same folder where the program exists. The auto-saved file delete automatically when closing the program window. Therefore, if 'Program Error' is occurred before saving program, it can be restored up to certain point by using the auto-saved file.

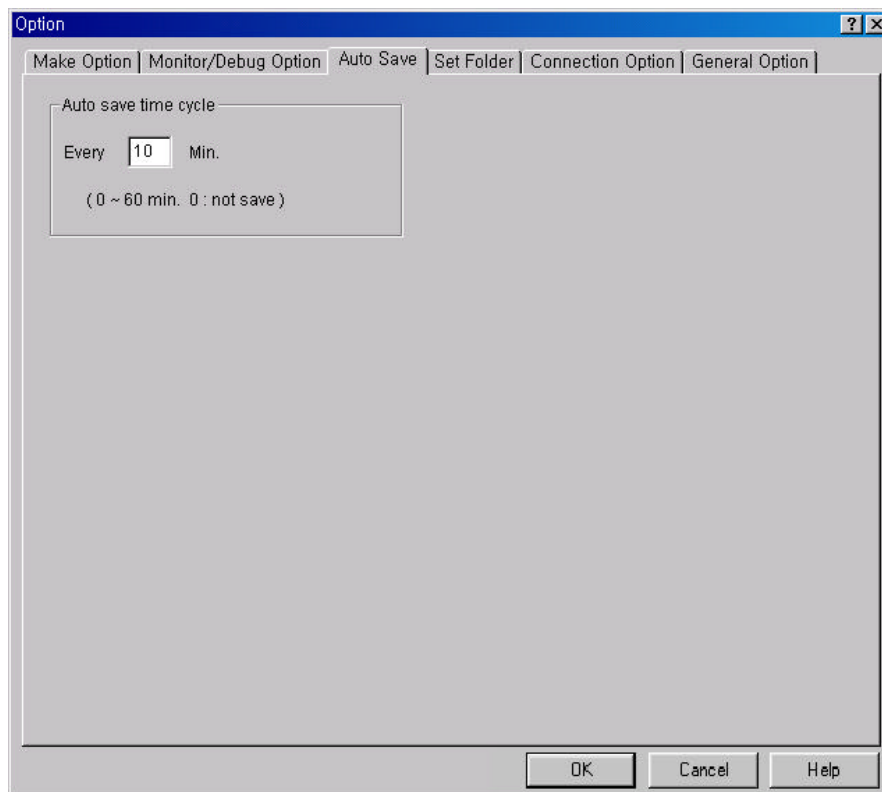
The follow shows the configuration method.

? Select Project – Option – Auto Save in the menu.

? Set up the Auto save time cycle.

Setting 0 to 60 minutes is available. In case of set '0', auto-save function is not executed.

? Click OK button.



(4) Monitor / Debug Option

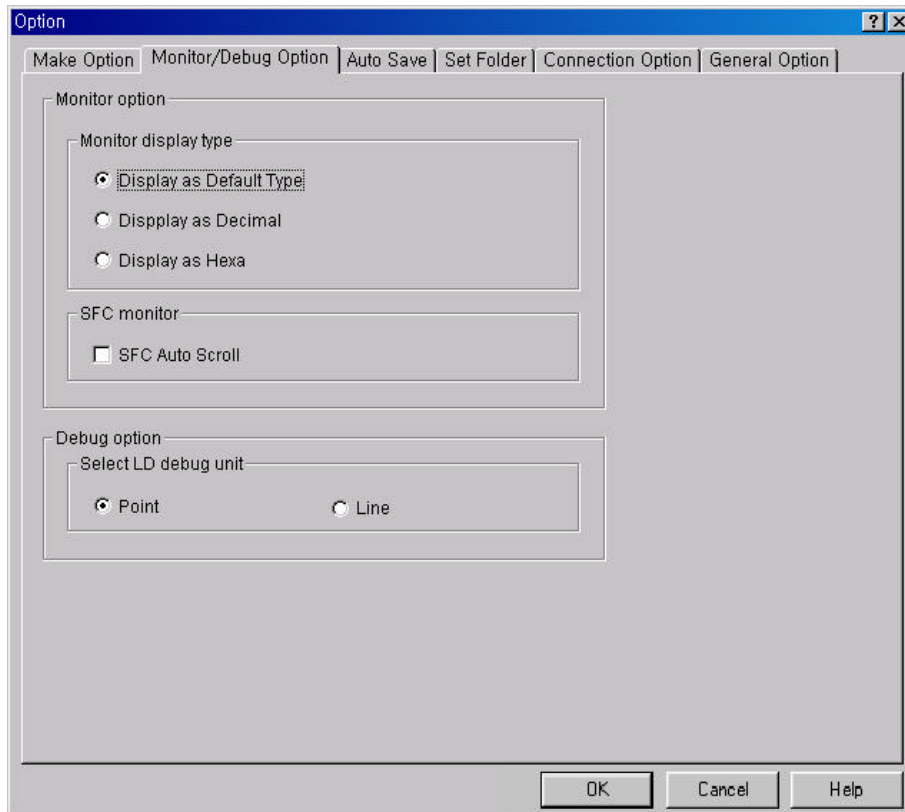
Various kinds of monitor and debug option is available to set up. The follow shows the configuration method.

? Select Project – Option – Monitor / Debug Option in the menu.

? Monitor display type : the type which displays the monitored variables.

? SFC monitor : On monitoring, it is scrolled automatically according to monitoring locations.

? Debug option : On LD debugging, debug unit can be divided by point or line as required types.



(5) Make Option

In the Make Option, compile type, output file, and %M area size are available to set up. The follow shows the configuration method.

? Select Project – Option – Make Option in the menu.

? Select compile type

All Compile :

-Compile is executed again from beginning without regard to editing source program.

Incremental Compile :

-.Only modified part of source program is compiled based on previous compiled information.

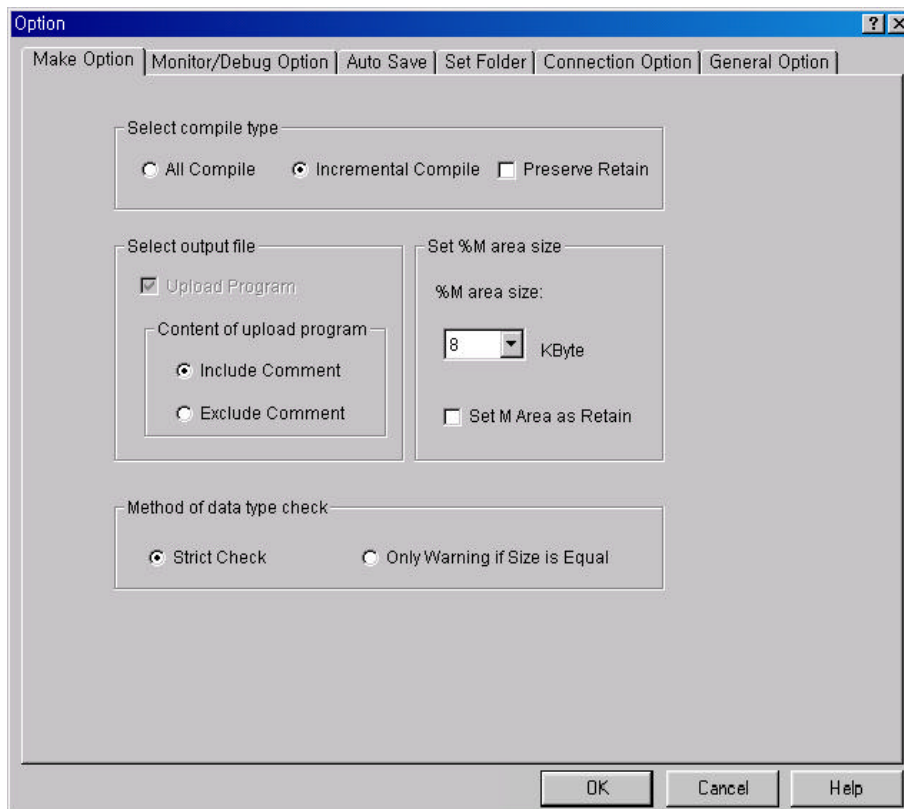
Preserve Retain :

-.In case of PLC restarts in warm mode when selecting preserve retain, the variable which is defined to retain variable.

? Select output file : It is available to select whether to include comment when executing Make. (Upload program is always generated.)

? Set %M area size : Set up %M area size which is available to use in the program.

? Method of data type check : If 'Only Warning if Size is Equal' is selected, if variable size is equal even though variable type is different, error is not generated, and warning is generated.



2) Basic Parameters

The basic parameters are necessary for operation of the PLC and used to allocate memory, set the restart mode and set the scan watch dog time, etc.

Basic Parameter

Configuration(PLC) name: UNNAMED

PLC version: v1.0 ☒ Remote Access Right

☐ Hot Restart
hr min sec

Restart mode
☐ Cold Restart
☒ Warm Restart

Resource(CPU) property

	Name	Type	Scan W.D timer
Resource 0	RES0		200 ms

OK Cancel Help

(1) Configuration (PLC) Name

? It is a representative name for the PLC system. It is used to designate this PLC system when a network system is configured using communication modules.

(2) Enabling/Disabling the control of the PLC via communications

? This parameter is used to enable or disable the remote control of this PLC system through the FAM or computer link module, etc. except for the GMWIN. If this parameter has been set to enable, change of the operation mode and download of programs are available via communications.

(3) % M area

This parameter is used to set the size of the direct variable area of the CPU module's data buffer. This buffer area is an area where direct addressing is available by the direct addressing parameter %M when writing a program. The buffer size set by the parameter limits the buffer area that can be addressed directly by %M.

Appendix 1. System Definitions

(4) Restart Mode

? This parameter is used to set the restart mode in the PLC system. When the system re-starts, one of the 'cold restart' or 'warm restart' is selected in compliance with the parameter setting.

(5) Hot Restart

? This parameter is used to set the 'hot restart mode' and 'hot restart allowable time'. The allowable time can be set to up to the '23 hour 59 minutes 59 second' by the 1 second.

(6) Resource (CPU) Name

? Resource Name is the name that each CPU module configuring the PLC has. When configuring a network system the name is used to designate each CPU module that is used the system.

? Only one CPU module can be mounted in the GM4 series, therefore, only the resource 0 is valid.

(7) Scan Watch Dog Time

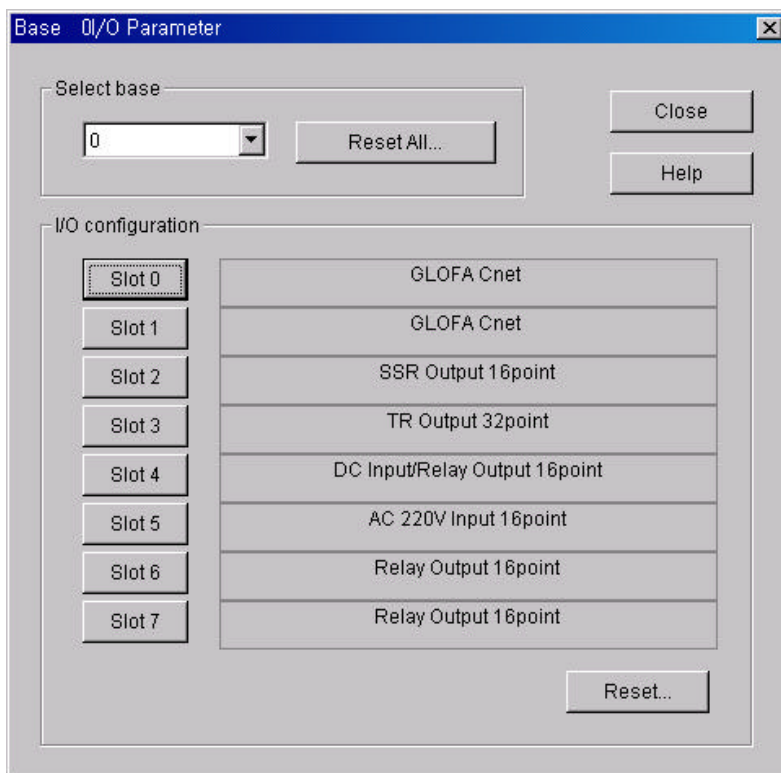
? This parameter is used to set the maximum allowable execution time of an user program in order to supervisor its normal or abnormal operation.

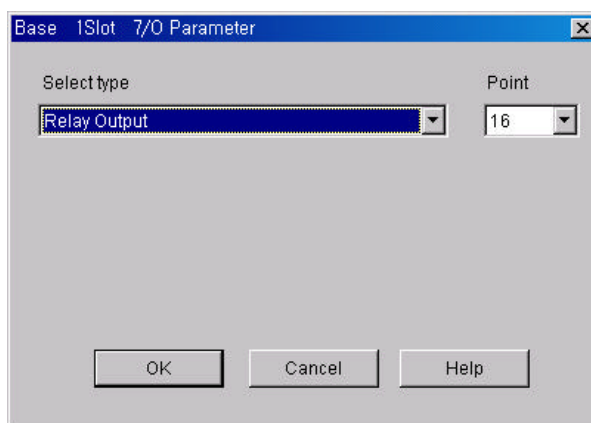
? Only one CPU module can be mounted in the GM4 series, therefore, scan watch dog is valid to only the resource 0.

3) I/O Configuration Parameter

These parameters are used to set the configuration of a system that will be operated. They set the modules that will be mounted and operated onto their own slot in the base unit. If a parameter that has been set and the real mounted module are different, the operation will not be executed. When writing a new project I/O configuration parameters will be all set to default (DEF_MODULE).

If I/O configuration parameters are set to default, the operation starts on the basis of the configuration of the real mounted module when the power is applied. Therefore, though a power failure had occurred during normal operation or the system configuration had been changed due to slip-out of a mounted module, operation starts and continues when the power has been re-applied because the system considers that it is a normal operation state. To prevent this error, be sure to set correctly the I/O configuration parameters complying with the real modules that shall be mounted and operated.





<I/O Parameters Setting List>

Keywords	Description	Applicable Modules
DC input	DC input module	G4I-D22A(16 points), G4I-D24A(32 points), G4I-D22B(16 points) G4I-D24B(32 points)
110 VAC input	110 VAC input module	G4I-A12A(16 points)
220 VAC input	220 VAC input module	G4I-A22A(16 points)
Relay output	Relay output module	G4Q-RY2A(16 points)
SSR output	Triac output module	G4Q-SS2A(16 points), G4Q-SS2B(16 points)
TR output	Transistor output	G4Q-TR2A(16 points), G4Q-TR4A(32 points), G4Q-TR8A(64 points)
Interrupt input	Interrupt input module	G4F-INTA(8 points)
Analog timer	Analog timer module	G4F-AT3A(8 points)
A/D	A/D conversion module	G4F-AD2A(4 channels), G4F-AD3A(8 channels)
DAV, DAI	D/A conversion module	G4F-DA2V(4 channels, voltage type), G4F-DA2I(8 channels, current type) G4F-DA1A(2 channels, voltage/current type)
T/C	Thermocouple input module	G4F-TC2A(4 channels)
RTD	Temperature-measuring resistor input module	G4F-RD2A(4 channels)
PID	PID input module	G4F-PIDA(8 loops)
HSC	High speed counting module	G4F-HSCA(1 channel)
Position Control (Pulse)	Positioning module (pulse output)	G4F-POPA(1 axes), G4F-POPB(2 axes), G4F-PP10/20/30(1 / 2 / 3 axes), G4F-PP1D/2D/3D(1 / 2 / 3 axes)
Process	Process control module	G4F-TMCA
GLOFA Fnet	Fnet I/F module	G4L-FUEA
GLOFA Enet	Enet I/F module	G4L-EUEA

Appendix 1. System Definitions

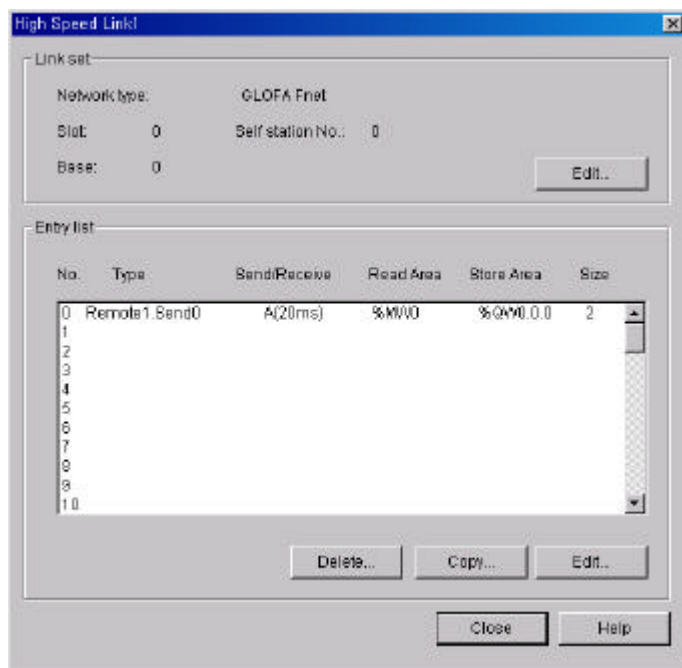
<I/O Parameters Setting List> (continued)

Keyword	Description	Applicable Module
DEF_I	All input modules	G4I-D22A(16 points), G4I-D22B(16 points), G4I-D22C(16 points), G4I-D24A(32 points), G4I-D24B(32 points), G4I-D24C(32 points), G4I-D28A(64 points), G4I-A12B(16 points), G4I-A22A(16 points)
DEF_O	All output modules	G4Q-RY2A(16 points), G4Q-SS2A(16 points), G4Q-SS2B(16 points) G4Q-TR2A(16 points), G4Q-TR2B(16 points), G4Q-TR4A(32 points) G4Q-TR4B(32 points), G4Q-TR8A(16 points)
DEF_IO	All mixed I/O modules	G4H-DR2A(16 points), G4H-DT2A (16 points)
DEF_SP	All communications / special modules	? All special modules ? All communications modules
DEF_MODULE	All modules	? All input modules ? All output modules ? All mixed I/O modules ? All special modules ? All communications modules
DEF_EMPTY	Empty slot	?

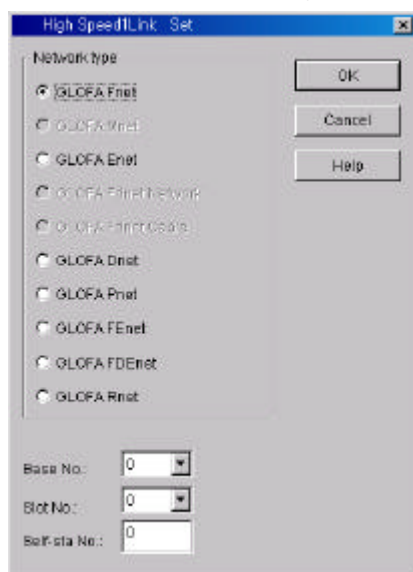
3) Communications Parameters

These high speed link parameters are used to set the opposite station for data communications, data and communications cycle when communicating a defined data repeatedly through communication modules.

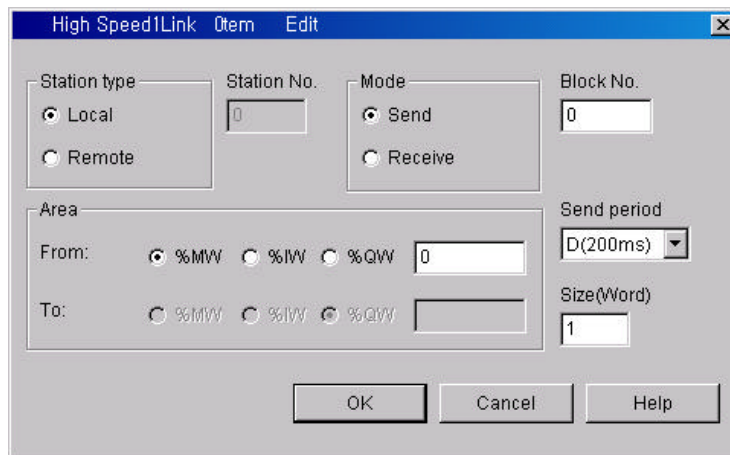
(For detailed descriptions, refer to the User's Manual relating to data communications)



Select Edit, and then set up High Speed Link module



- (1) Network type : Used to set the type of the communications module
- (2) Base No. : Base number of slot where the communications module has been mounted.
- (3) Slot No. : Slot number of the module where the communications module has been mounted.
- (4) Self-station No. : Self-station number of the module which executes high speed link communication.



The image shows a software dialog box titled "High Speed1Link" with a standard Windows-style title bar containing "High Speed1Link", "Item", and "Edit" menus, and a close button. The dialog is divided into several sections. The "Station type" section has two radio buttons: "Local" (selected) and "Remote". The "Station No." section has a text box containing the number "0". The "Mode" section has two radio buttons: "Send" (selected) and "Receive". The "Block No." section has a text box containing the number "0". The "Area" section is divided into "From:" and "To:" sub-sections. The "From:" sub-section has three radio buttons: "%MW" (selected), "%IW", and "%QW", followed by a text box containing "0". The "To:" sub-section has three radio buttons: "%MW", "%IW", and "%QW" (selected), followed by an empty text box. The "Send period" section has a dropdown menu showing "D(200ms)". The "Size(Word)" section has a text box containing the number "1". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

- (1) Station type : Type of the communications module in the opposite station. Local or remote will be set.
- (2) Station No. : Used to indicate the station that has invoked data during communications.
- (3) Mode : Used to set the communications mode to Send or Receive.
- (4) Block No. : Designating number for identification of a data block in the same communications module.
- (5) Data communications cycle : Used to set the cycle of sending and receiving of data.
- (6) Area : I, Q and M areas should be set by the decimal number or word.
- (7) Size : Number of words that will be sent and received.

Appendix 2. Flag List

1) User Flag List

Keyword	Type	Write	Name	Description
_LER	BOOL	Enable	Operation error latch flag	Operation error latch flag by the program block(BP). Error indication occurred while executing a program block
_ERR	BOOL	Enable	Operation error latch flag	Operation error flag by the operation function (FN) or function block(FB). It is newly changed whenever an operation is executed.
_T20MS*	BOOL	?	20 msec Clock	These clock signals are used in the user programs, toggles on/off every half cycle. The clock signal can be delayed or distorted in accordance with program execution time as the signal toggles after scan has been finished, therefore, it is recommended that clock of enough longer than scan time be used. Clock signals starts from Off when the initialization program or scan program starts ? Example : _T100MS clock
_T100MS*	BOOL	?	100 msec Clock	
_T200MS*	BOOL	?	200 msec Clock	
_T1S*	BOOL	?	1 sec Clock	
_T2S*	BOOL	?	2 sec Clock	
_T10S*	BOOL	?	10 sec Clock	
_T20S*	BOOL	?	20 sec clock	
_T60S*	BOOL	?	60 sec Clock	Usable in user programs.
_ON*	BOOL	?	Always On	
_OFF*	BOOL	?	Always Off	Usable in user programs
_1ON*	BOOL	?	First scan On	Turn On only during the first scan after the operation has started.
_1OFF*	BOOL	?	First scan Off	Turn Off only during the first scan after the operation has started.
_STOG*	BOOL	?	Scan Toggle	Toggles On/Off at every scan while a user program is being executed. (On at the first scan)
_INT_DONE	BOOL	Enable	Initialization Program Complete	If this flag is set to on in the initialization program in an user program, the initialization program stop its operation and the scan program will starts.
_INT_DATE	DATE	?	RTC present date	Date Data of standard format (Reference date – Jan. 1, 1984)
_RTC_TOD	TOD	?	RTC present time	Time Data(Reference time – 00:00:00)
_RTC_WEEK	UNIT	?	RTC present day	Day data (0: Monday, 1:Tuesday, 2: Wednesday, 3: Thursday, 4: Friday, 5: Saturday, 6:Sunday)
HINT				
1) Flags with the mark '*' are initialized when the initialization program starts, and after its execution has been completed the flags will change in accordance with the restart mode set.				
? If cold or warm restart has been set, the flags will be initialized when the scan program starts its execution.				
If hot restart has been set, the flags will be restored to the state before the last stop when the scan program starts its execution.				

2) Representative System Error Flag List

Keyword	Type	Bit No.	Name	Description
_CNF_ER	WORD	Representative keyword	System error (fatal error)	This flag handles the following operation stop error flags in batch.
_IO_TYER	BOOL	Bit 1	Module type inconsistency error	This representative flag indicates that I/O configuration parameters differ from the real loaded module or that a certain module is loaded onto a slot where it should not be loaded. (Refer to _IO_TYER_N and _IO_DEER[n])
_IO_DEER	BOOL	Bit 2	Module loading/unloading error	This representative flag indicates that module configuration of each slot has been changed during operation. (Refer to _IO_DEER_N and _IO_DEER[n])
_FUSE_ER	BOOL	Bit 3	Fuse disconnection error	This representative flag indicates that one of fuses of slots including them has disconnection. (Refer to _FUSE_ER_N and _FUSE_ER[n])
_IO_RWER	BOOL	Bit 4	I/O module read/write error	This representative flag indicates that a I/O module does normally executes read/write. (Refer to _IP_RWER_N and _IP_IFER[n])
_SP_IFER	BOOL	Bit 5	Special/communications module interface error	This representative flag indicates that special or communications module has failed in initialization or normal interface is impossible due to module malfunction. (Refer to _IP_IFER_N and _IP_IFER[n])
_ANNUN_ER	BOOL	Bit 6	External device fatal fault detection error	This representative flag indicates that an external device has fatal error. The error code has been written to _ANC_ERR[n].
?	?	Bit 7	?	?
_WD_ER	BOOL	Bit 8	Scan watch dog error	This flag indicates that the scan time of a program has overrun the scan watchdog time specified by the parameter.
_CODE_ER	BOOL	Bit 9	Program code error	This flag indicates that an unreadable instruction has been met while executing an user program.
_P_BCK_ER	BOOL	Bit 11	Program error	This flag indicates that program execution is impossible due to destroyed memory or program error.

Appendix 2. Flag List

3) Error Mask Flag (GM4C Only)

Keyword	Type	Bit No.	Name	Description
_CNF_ER_M	BYTE	Represent Keyword	System Error Release (fatal error)	This flag processes operation stop error release flag collectively.
_ANNUN_ER_M	BOOL	BIT 6	Error Release	This flag detects fatal error of external devices Therefore, in case of occurring _ANNUN_ER, in order to ignore it, set it to ON.

4) Module Error Mask Flag (GM4C Only)

Keyword	Type	Bit No.	Name	Description																																																
<div>_BASE_M[n]</div>	<div>B00L ARRAY</div>	<div>n: 0~6</div>	<div>Error Mask setting based on base unit</div>	<div>In case of occurring error of the base or the module which is mounted to base on operation, it can be used in order to ignore it and keep up its operation. Set up the location of base which is masked.</div> <div><div>_BASE_M[n]</div><table><tr><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table></div>	6	5	4	3	2	1	0																																									
6	5	4	3	2	1	0																																														
<div>_SLOT_M[n]</div>	<div>BYTE ARRAY</div>	<div>n: 0~6</div>	<div>Error Mask setting based on slot unit</div>	<div>In case of occurring error of the base or the module which is mounted to base on operation, it can be used in order to ignore it and keep up its operation. Set up the location of slot which is masked</div> <div><div><div><div>_SLOT_M[0]</div><div>_SLOT_M[1]</div><div></div><div>_SLOT_M[6]</div></div><table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table><div><div>BASE 0</div><div>BASE 1</div><div>BASE 6</div></div></div></div>	7	6	5	4	3	2	1	0																																								
7	6	5	4	3	2	1	0																																													

5) Module Skip Flag (GM4C Only)

Keyword	Type	Bit No.	Name	Description																																
<div>_BASE_S[n]</div>	<div>BOOL ARRAY</div>	<div>n: 0~6</div>	<div>Module Skip setting based on base unit</div>	<div>In case of excluding the specific expansion base, this flag can be used. If this flag is set, CPU stop the expansion base accessing. When changing expansion base, power, and module on operation, this flag can be used.</div> <div><div>_BASE_S[n]</div><table><tr><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table></div>	6	5	4	3	2	1	0																									
6	5	4	3	2	1	0																														
<div>_SLOT_S[n]</div>	<div>BYTE ARRAY</div>	<div>n: 0~6</div>	<div>Module Skip setting based on slot unit</div>	<div>In case of excluding the specific expansion module, this flag can be used. If this flag is set, CPU stop the module accessing. When changing expansion base, power, and module on operation, this flag can be used.</div> <div><div><div><div>_SLOT_S[0]</div><div>_SLOT_S[1]</div><div><div><div><div>7</div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div><div>0</div></div><table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></div><div><div>BASE 0</div><div>BASE 1</div><div><div></div></div><div>BASE 6</div></div></div></div></div></div>																																

Appendix 2. Flag List

6) Representative System Warning Flag List

Keyword	Type	Bit No.	Name	Description
_CNF_WAR	WORD	Representative keyword	System warning	This flag treats the below warning flags relating to continuous operation in batch.
_RTC_ERR	BOOL	Bit 0	RTC data error	This flag Indicates that RTC data has error.
_D_BCK_ER	BOOL	Bit 1	Data backup error	This flag indicates
_H_BCK_ER	BOOL	Bit 2	Impossible hot restart error	This flag indicates that hot restart time had been overrun or backup of the operation data needed in hot restart had not normally performed at restoration from power failure and hot restart was impossible so that a restart operation by the parameters (warm or cold restart) has been started. .
_AB_SD_ER	BOOL	Bit 3	Abnormal shutdown	This flag indicates that the program had been stopped during restore from power failure due to causes such as power off, and then cold restart has been executed and the continuous operation which retains the data is impossible. Usable in the initialization program. Automatically reset when the initialization program has finished. (The same things given above will be applied when the program has been stopped by the 'ESTOP' function)
_TASK_ERR	BOOL	Bit 4	Task collision (plus cycle and external tasks)	This flag indicates that task collision has occurred as execution request for a same task had been repeatedly invoked. (Refer to the flag _TC_BMAP[n] and _TC_CNT[n])
_BAT_ERR	BOOL	Bit 5	Battery fault	This flag detects and indicates that the voltage of the battery, which is used to backup user programs and data memory, is lower than the defined value.
_ANNUN_WR	BOOL	Bit 6	External device warning detection	This representative flag indicates that the user program has detected an ordinary fault of external devices and has written it to the flag _ANC_WB [n].
?	?	Bit 7	?	?
_HSPMT1_ER	BOOL	Bit 8	High speed link parameter 1 error	This representative flag detects error of each high speed link parameter when the high link has been enabled and indicates that high speed link cannot be executed. It will be reset when the high speed link is disabled. According to the CPU type, the flag is different as follow GM4A: 1~2, GM4B: 1~4, GM4C: 1~8
_HSPMT2_ER	BOOL	Bit 9	High speed link parameter 2 error	
_HSPMT3_ER	BOOL	Bit 10	High speed link parameter 3 error	
_HSPMT4_ER	BOOL	Bit 11	High speed link parameter 4 error	
_HSPMT5_ER	BOOL	Bit 12	High speed link parameter 5 error	
_HSPMT6_ER	BOOL	Bit 13	High speed link parameter 6 error	
_HSPMT7_ER	BOOL	Bit 14	High speed link parameter 7 error	
_HSPMT8_ER	BOOL	Bit 15	High speed link parameter 8 error	

Appendix 2. Flag List

7) Detailed System Error and Warning Flag List

Keyword	Type	Data setting range	Name	Description
_IO_TYER_N	UINT	GM4A/B: 0 to 31 GM4C: 0 to 56	The number of slot whose module type is inconsistent.	This flag detects that I/O configuration parameters of each slot differ from the real loaded module configuration or a particular module is loaded onto the slot where modules cannot be loaded, and indicates the lowest slot No. of the detected slot numbers.
_IO_TYERR[n]	BYTE	n: GM4A/B: 0 to 3 GM4C: 0 to 6	The location of slot where module type is inconsistent.	This flag detects that I/O configuration parameters of each slot differ from the real loaded module configuration or a particular module is loaded onto the slot where modules cannot be loaded, and indicates the slot locations in the bit map of base units.
_IO_DEER_N	UINT	GM4A/B: 0 to 31 GM4C: 0 to 56	The number of slot where module mounting/dismounting error occurred.	This flag detects that module configuration of each slot has been changed, that is, module mounting/dismounting error has been occurred, and indicates the lowest slot No. of the detected slot numbers.
_IO_DEERR[n]	BYTE	n: GM4A/B: 0 to 3 GM4C: 0 to 6	The location of slot where module mounting/dismounting error occurred.	This flag detects that module configuration of each slot has been changed, that is, module mounting/dismounting error has been occurred, and indicates the slot locations in the bit map of base units.
_FUSE_ER_N	UINT	GM4A/B: 0 to 31 GM4C: 0 to 56	The number of slot where fuse breaks.	This flag detects that fuses of fuse-mounted modules has broken, and indicates the lowest slot No. of the detected slot numbers.
_FUSE_ERR[n]	BYTE	n: GM4A/B: 0 to 3 GM4C: 0 to 6	The location of slot where fuse breaks.	This flag detects that fuses of fuse-mounted modules has broken, and indicates the slot locations in the bit map of base units.
_IO_RWER_N	UINT	GM4A/B: 0 to 31 GM4C: 0 to 56	The number of slot where I/O module read/write occurred.	This flag detects that input modules of a slot cannot be normally read from or written to, and indicates the lowest slot No. of the detected slot numbers.
_IO_RWERR[n]	BYTE	n: GM4A/B: 0 to 3 GM4C: 0 to 6	The location of slot where I/O module read/write occurred.	This flag detects that input modules of a slot cannot be normally read from or written to, and indicates the slot locations in the bit map of base units.
_SP_IFER_N	UINT	GM4A/B: 0 to 31 GM4C: 0 to 56	Special/link module interface error slot No.	This flag detects that initialization cannot be executed for special or link module of a slot, or normal interface is impossible due to module malfunction, and indicates the lowest slot No. of the detected slot numbers.
_SP_IFERR[n]	BYTE	n: GM4A/B: 0 to 3 GM4C: 0 to 6	Special/link module interface error location	This flag detects that initialization cannot be executed for special or link module of a slot, or normal interface is impossible due to module malfunction, and indicates the slot locations in the bit map of base units.
_ANC_ERR[n]	UINT	n : 0 to 15	External device fatal error	This flag detects fatal error of external devices and its content is written to this flag. A number that identifies error type will be written to each of the sixteen locations. (The number 0 is not allowed)
_ANC_WAR[n]	UINT	n : 0 to 7	External device ordinary error	If the user program indicates a warning on the flag _ANC_WB[n], the bit locations are sequentially written to _ANC_WAR[n] from _ANC_WAR[0] complying with their occurrence sequence.
_ANC_WB[n]	BIT	n: 0 to 255	External device ordinary error bitmap	The user program detects ordinary error of external device and the errors are indicated on a bitmap. (The number 0 is not allowed)
_TC_BMAP[n]	BIT	n : 0 to 47	Task collision bitmap Plus cycle (n : 0 to 31) External (n : 32 to 47)	The flag detects that task collision has occurred because, while a task was being executed or ready for execution, an execution request has occurred for the same task, indicates the errors on a bitmap.
_TC_CNT[n]	UINT	n : 0 to 47	Task collision counter	This flag detects task collision occurrence time for each task when executing a user program, indicates the task collision occurrence time.
_BAT_ER_TM	DATE & TIME	?	Batter voltage drop time	The first detection date and time of battery voltage drop are written to this flag. It will be reset if the battery voltage has been restored.
_AC_F_CNT	UINT	0 to 65535	Momentary power failure occurrence count	The accumulated momentary power failure occurrence times during operation in the RUN mode is written to this flag.
_AC_F_TM[n]	DATE & TIME	n : 0 to 15	Momentary power failure history	The times of the latest sixteen momentary power failures are written.
_ERR_HIS[n]		n : 0 to 15	Error history	The times and error codes of the latest sixteen errors are written to this flag. ? Stop time : DATE & TIME (8 bytes) ? Error code : UINT (2 bytes)
_MODE_HIS[n]		n : 0 to 15	Operation mode change history	The times, operation modes and restart modes of the latest sixteen operation mode changes are written to this flag ? Change time : DATE & TIME (8 bytes) ? Operation mode : UINT (2 bytes) ? Restart : UINT (2 bytes)

* Write is available in user programs.

Appendix 2. Flag List

8) System Operation status Information Flag List

Keyword	Type	Data setting range	Name	Description
_CPU_TYPE	UINT	0 to 16	System type	GM1 : 0, GM2 : 1, (GM3 : 2, GM4 : 3, GM% : 4) (FSM : 5,6), Twofold : 16
_VER_NUM	UINT	?	O/S version No.	System O/S version No.
_MEM_TYPE	UINT	1 to 5	Memory module type	Type of program memory module (0: Unloading state, type : 0 to 5)
_SYS_STATE	WORD	Representative keyword	PLC mode and operation status	System operation mode and operation state information
		Bit 0	Local control	Operation mode change is possible only by mode key or GMWIN CPU module operation state
		Bit 1	STOP	
		Bit 2	RUN	
		Bit 3	PAUSE	Operation mode change by key
		Bit 4	DEBUG	
		Bit 5	Operation mode change factor	
		Bit 6	Operation mode change factor	Operation mode change by GMWIN
		Bit 7	Operation mode change factor	Operation mode change by remote GMWIN
		Bit 8	Operation mode change factor	Operation mode change by communications
		Bit 9	STOP by STOP function	Operation in the RUN mode is stopped by STOP function after the scan has finished
		Bit 10	Force input	Input junction force On/Off is being executed.
		Bit 11	Force output	Output junction force On/Off is being executed
		Bit 12	STOP by ESTOP function	Operation in the RUN mode is directly stopped by ESTOP function.
		Bit 13	?	?
_GMWIN_CNF	BYTE	Representative keyword	GMWIN connection state	Connection state between CPU module and GMWIN
		Bit 0	Local GMWIN connection	Local GMWIN connection state
		Bit 1	Remote GMWIN connection	Remote GMWIN connection state
		Bit 2	Remote communications connection	Remote communications connection state
_RST_TY	BYTE	Representative keyword	Restart mode information	Restart type of program which is being executed in present. (History)
		Bit 0	Cold restart	See the Section 4.6.1
		Bit 1	Warm restart	
		Bit 2	Hot restart	
_INIT_RUN	BOOL	Bit 3	During initialization	An initialization program written by the user is being executed
_SCAN_MAX	UINT	?	Maximum scan time (msec)	Maximum scan time is written during operation.
_SCAN_MIN	UINT	?	Minimum scan time (msec)	Minimum scan time is written during operation.
_SCAN_CUR	UINT	?	Present scan time (msec)	Present scan time is continuously updated during operation.
_RTC_TIME[n]	BYTE	N : 0 to 7	Present time	BCD data of present time of RTC (Example : 96-01-12-00-00-00-XX) _RTC_TIME[0] : year, _RTC_TIME[1] : month, _RTC_TIME[2] : day, _RTC_TIME[3] : hour, _RTC_TIME[4] : minute, _RTC_TIME[5] : second, _RTC_TIME[6] : day of the week, _RTC_TIME[7] : unused Day of the week : 0 : Mon., 1: Tue., 2: Wed., 3: Thur., 4: Fri., 5: Sat., 6: Sun.
_SYS_ERR	UINT	Error code	Error type	See the Section 12.5 Error Code List

Appendix 2. Flag List

9) System Configuration status Information Flag

(1) User Program Status Information

Keyword	Type	Data setting range	Name	Description
_DOMAIN_ST	BYTE	Representative keyword	System S/W configuration information	Indicates the status of system parameter and user program configuration.
		Bit 0	Basic parameter error	Checks and indicates Basic parameter error
		Bit 1	I/O configuration parameter error	Checks and indicates I/O configuration parameter error
		Bit 2	Program error	Checks and indicates Program error
		Bit 3	Access variable error	Checks and indicates Access variable error
		Bit 4	High speed link parameter error	Checks and indicates High speed link parameter error

(2) Operation Mode Key Status Information

Keyword	Type	Data Setting range	Name	Description
_KEY_STATE	BYTE	Representative keyword	Key setting position	Indicates CPU module key switch state
		Bit 0	KEY_STOP	Indicates that the key switch is in the STOP state.
		Bit 1	KEY_RUN	Indicates that the key switch is in the RUN state.
		Bit 2	KEY_PAUSE/REMOTE	Indicates that the key switch is in the PAUSE/REMOTE state.

(3) I/O Module Installation Status Information

Keyword	Type	Data Setting range	Name	Description
_IO_INSTALL[n]	BYTE	n : 0 to 3	I/O module installation location	Locations of slots where I/O modules are loaded are indicated in the bitmap of base units.

Appendix 2. Flag List

10) Communications Flag

- GLOFA Fnet / Cnet / Enet / Dnet / Pnet / Rnet / FEnet / FDEnet Flag List

(1) Communication Module Information Flag List

? n is the number of slot where communication module is loaded.(n = GM4A:0 to 7, GM4B:0 to 31, GM4C:0 to 55)

Keyword	Type	Applicable Net	Name	Description
_CnVERNO	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Communications module version No.	? Communications module O/S version No.
_CnSTNOH _CnSTNOL	UINT UDINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Communications module station No.	? Indicates the number which is set on communications module station switch. Mnet : MAC station No. marked on the front of communication module. Fnet : Station switch No. marked on the front of communications module. Cnet : Station No. set by the frame editor _CnSTNOH : Station No. set on the side of RS-232C _CnSTNOL : Station No. set on the side of RS-422
_CnTXECNT	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Communications frame sending error	? Increments by one whenever sending error of communications frame occurs. ? Connection condition of network is evaluated by this value. ? In Cnet, this value is the sum of errors occurred during receiving through RS-232 and RS-422.
_CnRXECNT	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Communications frame receiving error	? Increments by one whenever communications service fails. ? Connection condition of network is evaluated by this value. Overall network communications quantity and program stability are also evaluated by this value.
_CnSVCFCNT	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Communications service processing error	? Increments by one whenever communications service fails. ? Connection condition of network is evaluated by this value. Overall network communications quantity and program stability are also evaluated by this value.
_CnSCANMX	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Maximum communications scan time (unit : 1 msec)	? Indicates the maximum time that is spent until every station connected to network has the token at least one time and sends a sending frame.
_CnSCANAV	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Maximum communications scan time (unit : 1 msec)	? Indicates the average time that is spent until every station connected to network has the token at least one time and sends a sending frame.
_CnSCANMN	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Average communications scan time (unit : 1 msec)	? Indicates the minimum time that is spent until every station connected to network has the token at least one time and sends a sending frame.
_CnLINF	UINT	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Minimum communications scan time (unit : 1 msec)	? Indicates operation state of communications module with a word.
_CnLNKMOD	BIT 15		Operation mode (RUN=1, TEST=0)	? Indicates that operation mode of communications module is in the normal operation mode or test mode.
_CnINRING	BIT 14		In-ring (IN_RING = 1)	? Indicates that the communications module can communicates(IN_RING = 1) with other station or not.
_CnIFERR	BIT 13		Interface error (error = 1)	? Indicates that interface with communications modules has been stopped.
_CnSVBSY	BIT 12		Insufficient common RAM (Insufficient = 1)	? Indicates that service cannot be offered due to insufficient common RAM. ? Indicates communications module hardware defect or system O/S error.
_CnCRDER	BIT 11		Communications module system error (error = 1)	
_NETn_LIV[k] (k = 0 to 63, k:Station No.)	BIT ARRAY	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Stations connected to the network (1=connected, 0=disconnected)	? Indicates whether k remote station or local PLC is connected to the network or not. The state value is written to each bit. These values shows present state of the network. (Write is disabled)
_NETn_RST[k] (k = 0 to 63, k:Station No.)	BIT ARRAY	Fnet/Cnet/Dnet/ Pnet/Rnet/Fenet /FDEnet	Re-connection of a station (1=re-connected, 0=no changed condition)	? Indicates re-connected stations, which had been disconnected before, on a bitmap. Because this value has been replaced with '1' when re-connected, the user program has to clear this value with '0' so that next re-connection can be detected. (Write is enabled)
_NETn_232[k] (k = 0 to 63, k:Station No.)	BIT ARRAY	Cnet	The indication that the user defined frame has been received. Indicated at each setting No. (Received = 1).	? When a receiving frame is received through RS-232C while the part of RS-232C in Cnet is operating in the user-defined mode, the bit corresponding to setting No. is turned ON. If RCV_MSG F/B has read that, that bit will be cleared with 0.
_NETn_422[k] (k = 0 to 63, k:Station No.)	BIT ARRAY	Cnet	The indication that the user defined frame has been received. Indicated at each setting No. (Received = 1).	? When a receiving frame is received through RS-422 while the part of RS-232C in Cnet is operating in the user-defined mode, the bit corresponding to setting No. is turned ON. If RCV_MSG F/B has read that, that bit will be cleared with 0.

Appendix 2. Flag List

(1) Communications Module Information Flag List (continued)

Keyword	Type	Applicable Net	Name	Description
_ECMn_CHx_FLAG[k] (x=0 to 15, k=0 to 7, k: Station No.)	BIT ARRAY	Ene/FEnet/ FDEnet	The indication of received frame about each of channels. Indicated at each setting No. (Received = 1).	? When a receiving frame is received through using Enet function is received, in each channels, defined No.(Bit) of frame editor(RCV) is set to 1. If F/B has read that, that bit will be cleared with 0
_RCVn_ECM[k] (k=0 to 7, k: Station No.)	BIT ARRAY	Ene/FEnet/ FDEnet	The indication of even one of received frame about each of channels. Indicated at each channels (Received = 1).	? When a receiving frame is received through using Enet function is received, in each channels, if there is even one of receiving frame, No.(Bit) in channel is set to 1. If F/B has read that, that bit will be cleared with 0. (If _ECMn_CHnCHx_FLAG[k] is set, _RCVn_ECM[k] (x=k) is set to 1)
_SERVn_CH_EN	BIT	Ene/FEnet/ FDEnet	The indication of connection for dedicated communication(in case of connection, set to 1)	? When communicating for dedicated service in the high ranked PC or MMI, in case of connection, it set to 1, and when connection is released, it will be cleared with 0.
_FSMn_reset	BIT	Fnet	Remote I/O station S/W reset	? Requests reset for remote I/O station (Write is enabled) Request can be done individually or wholly complying with the settings in the FSMn_st_no.
_FSMn_io_reset	BIT	Fnet	Remote I/O station digital output reset	? Requests output reset for remote I/O station (Write is enabled) Request can be done individually or wholly complying with the settings in the FSMn_st_no.
_FSMn_hs_reset	BIT	Fnet	Remote I/O station high speed link information initialization	? If a momentary power failure occurs in the remote I/O station, the operation mode bit of high speed link information turns off and link trouble has the value 1. If the bit is turned on to clear that bit, the operation mode bit turns on and link trouble is cleared with 0. ? Request can be done individually or wholly complying with the settings in the FSMn_st_no.
_FSMn_st_no	USINT	Fnet	Numbers of I/O stations where _FSMn_reset, _FSMn_io_reset and _FSMn_hs_reset will be executed. (Write is enabled)	? Sets the numbers of I/O stations where _FSMn_reset, _FSMn_io_reset and _FSMn_hs_reset will be executed. (Write is enabled) ? 00 to 63 => individual station No. setting ? 255 => Whole station No. setting

(2) Detailed High Speed Link Information Flag List

n is slot No. where high speed link module is mounted. (n = GM4A: 1 to 2, GM4B : 1 to 4, GM4C : 1 to 8)

Keyword	Type	Applicable Net	Name	Description
_HSmRLINK	Bit	Fnet/Cnet/Dnet/Pnet/Rnet/ Fenet/FDEnet	High speed link RUN link information	? Indicates that all stations are normally operating complying with the parameter set in the high speed link. This flag turns on under the following conditions. 1) All stations set in the parameter are in the RUN mode and have no error, and 2) All blocks set in the parameter normally communicate, and 3) The parameter set in all stations, which are set in the parameter, normally communicate. ? Once this flag is turned on, it maintains that state as long as link enable does not make that state stopped.
_HSmLTRBL	Bit	Fnet/Cnet/Dnet/Pnet/Rnet/ Fenet/FDEnet	High speed link trouble information	? This flag turns on when, under the condition that _HSmRLINK is turned on, communications of the stations and data blocks set in the parameter is under the following conditions. 1) A station set in the parameter is not in the RUN mode, or 2) A station set in the parameter has an error, or 3) The communications of data blocks set in the parameter does not normally operate. ? This flag turns on if the above conditions 1), 2) and 3) occur. If those conditions are restored, it will turn off again.
_HSmSTATE[k] (k = 0 to 63, k: Station No.)	Bit Array	Fnet/Cnet/Dnet/Pnet/Rnet/ Fenet/FDEnet	K Data Block overall communications state information	? Indicates overall communications state of every blocks of the parameters set. _HSmSTATE[k] = _HSmMOD[k] & _HSmTRX[k] & _HSmERR[k]
_HSmMOD[k] (k = 0 to 63, k: Station No.)	Bit Array	Fnet/Cnet/Dnet/Pnet/Rnet/ Fenet/FDEnet	K Data Block setting stations mode information. (RUN = 1, others = 0)	? Indicates the operation modes of stations set the K data block of parameters.
_HSmTRX[k] (k = 0 to 63, k: Station No.)	Bit Array	Fnet/Cnet/Dnet/Pnet/Rnet/ Fenet/FDEnet	K Data Block communications state information (Normal = 1, abnormal = 0)	? Indicates that communications of the K data block of parameters are normally operating as set or not.
_HSmERR[k] (k = 0 to 63, k: Station No.)	Bit Array	Fnet/Cnet/Dnet/Pnet/Rnet/ Fenet/FDEnet	K Data Block setting stations state information. (Normal = 1, abnormal = 0)	? Indicates that the stations set in the K data block of parameters have an error or not.

Appendix 2. Flag List

(3) FEnet Reset Flag List (GM4-CPUC)

Keyword	Type	Applicable Net	Name	Description
_FENET_RESET_Mx	BIT ARRAY	FEnet	To reset FEnet module in the slot No. x of main base.	? Using the variable monitor or using coil in the scan program, FEnet reset function is available by setting the flags to '1'. ? If the flags is set to '1' in order to reset FEnet, they are cleared to '0' again after the FEnet reset operation is finished. ? The flags which are used for monitor of the status of the FEnet in order to reset FEnet
_FENET_RESET_Ex	BIT ARRAY	FEnet	To reset FEnet module in the slot No. x of expansion base.	
_RCV_SERVx_M_CH	BIT ARRAY	FEnet	The indication of channel of module in the slot No. x of main base	
_RCV_SERVx_E_CH	BIT ARRAY	FEnet	The indication of channel of module in the slot No. x of expansion base	
_RCV_SERV_CNT_M	BIT ARRAY	FEnet	The indication of count value of receiving of the module in the main base	
_RCV_SERV_CNT_E	BIT ARRAY	FEnet	The indication of count value of receiving of the module in the expansion base	

11) Access Pass Configuration of Flag (GM4 - CPUC)

The parts of flags is registered for access variables automatically, so variable service through network is available without special handling in the user's program.

(1) Access variable configuration

Flag Group	Access Variable Name	Possibility of writing data
User Flag	_INIT_DONE, _RTC_DATE, _RTC_TOD, _RTC_WEEK	Available to write INIT_DONE only
System Error Represent Flag	_CNF_ER	Unavailable
System Error Mask Flag	_CNF_ER_M, _ANNUN_ER_M, _BASE_M[n], _SLOT_M[n]	Available
System Warning Represent Flag	_CNF_WAR	Unavailable
System Error and Warning Details Flag	_IO_TYER_N, _IO_TYERR[n], _IO_DEER_N, _IO_DEERR[n], _FUSE_ER_N, _FUSE_ERR[n], _IO_RWER_N, _IO_RWERR[n], _SP_IFER_N, _SP_IFERR[n], _ANC_ERR[n], _ANC_WAR[n], _ANC_WB[n], _TC_BMAP[n], _TC_CNT[n], _BAT_ER_TM, _AC_F_CNT, _AC_F_TM[n]	Available to write only _ANC_ERR[n], _ANC_WAR[n], _ANC_WB[n], _TC_BMAP[n], _TC_CNT[n], _AC_F_CNT
System Operation Status Information Flag	_CPU_TYPE, _VER_NUM, _MEM_TYPE, _SYS_STATE, _PADT_CNF, _RST_TY, _INIT_RUN, _SCAN_MAX, _SCAN_MIN, _SCAN_CUR, _STSK_NUM, _STSK_MAX, _STSK_MIN, _STSK_CUR, _RTC_TIME[n], _SYS_ERR	Available to write only _SCAN_MAX, _SCAN_MIN, _SCAN_CUR, _STSK_NUM, _STSK_MAX, _STSK_MIN, _STSK_CUR
System Configuration Status information Flag	_DOMAIN_ST, _KEY_STATE, _CPU_CNF, _IO_INSTALL[n]	Unavailable
Communication Flag	_FSMn_RESET, _FSMn_IO_RESET, _FSMn_HS_RESET, _FSMn_ST_NO	Available

(2) Method of access array variables

Method of access BOOL array variables (example : _ANC_WB[n])

- In case of requiring overall data : _ANC_WB
- In case of requiring an individual unit : _ANC_WB[1]

Method of access BYTE array variables (example : _SLOT_S[n])

- In case of requiring overall data : _SLOT_S
- In case of requiring an individual unit : _SLOT_S[1]
- In case of requiring to read 1 Bit in the individual unit : _SLOT_[1][0]

Appendix 3. Function/Function Block List

1) Function List (GM4-CPUA / B)

Name	Function	Size of PB (byte) *1	Size of library (byte) *2	Processing speed (? sec) *3
ABS (int)	Absolute value operation	24	-	1.2
ADD(int)	Addition	24	-	1.7
AND (word)	Logical multiplication	16	-	4.3
DIV(int)	Division	32	-	32.9
DIV(dint)	Division	32	-	62.9
EQ (int)	'Equality' comparison	30	-	1.6
LIMIT(int)	To output upper and lower limits	48	794	11.8
MAX(int)	To output the maximum input value	48	738	12.9
MOVE	To copy data	8	-	1.0
MUL(dint)	Multiplication	24	-	65.9
MUL (int)	Multiplication	24	-	35.9
MUX (int)	To output a selected input value	56	682	15.8
MUX(dint)	To output a selected input value	84	682	53.2
ROL	To rotate left	40	160	9.7
BCD_TO_DINT	Conversion of BCD type into DINT type	12	300	273.9
BCD_TO_INT	Conversion of BCD type into INT type	12	200	111.9
BCD_TO_SINT	Conversion of BCD type into SINT type	12	140	40.9
BYTE_TO_SINT	Conversion of BCD type into SINT type	8	-	0.4
DATE_TO_STRING	Conversion of DATE type into string	48	458	205.9
DINT_TO_INT	Conversion of DINT type into INT type	8	-	1.3
DINT_TO_BCD	Conversion of DINT type into BCD type	12	278	446.9
DT_TO_DATE	Conversion of DT type into DATE type	16	-	3.3
DT_TO_TOD	Conversion of DT type into TOD type	16	12	4.1
DT_TO_STRING	Conversion of DT type into string	48	780	524.9
DWORD_TO_WORD	Conversion of DWORD type into WORD type	8	-	1.3
INT_TO_DINT	Conversion of INT type into DINT type	12	-	0.9
INT_TO_BCD	Conversion of INT type into BCD type	12	180	129.9
NUM_TO_STRING (int)	Conversion of number into string	52	808	159.9
SINT_TO_BCD	Conversion of SINT type into BCD type	12	140	67.9
STRING_TO_INT	Conversion of string into INT type	16	1308	281.9
CONCAT	To concatenate strings	72	248	54.9
DELETE	To delete string	68	298	63.9
EQ	'Equality' comparison	20	788	38.3
FIND	To find a string	40	222	73.9
INSERT	To insert a string	68	524	418.9
LEFT	To obtain the left part of a string	56	158	33.4
LEN	To obtain the length of a string	16	48	17.5
LIMIT (str)	To output upper or lower limits	80	794	80.9
MAX (str)	To output the maximum input value	76	738	68.4
MID	To obtain the middle part of a string	64	236	47.1
REPLACE	To replace a string with another	73	584	97.9
RIGHT	To obtain the right part of a string	56	226	53.9
ADD_TIME (time)	Time addition	40	280	11.6
DIV_TIME(i1 = time)	Time division	40	266	67.9

HINT

1) The items marked with "*" has following meaning.

*1 : The size of the program memory which a program occupies when it uses the function once.

*2 : The size of the program memory which a program occupies only one time though it uses the function many times.

*3: of IL programs (2 input variables, 10 strings)

2) The above shows the function list when programs are written with IL (Instruction List) language. If programs are written with LD (Ladder diagram), the following differences occur.

(1) 16 byte will be added to the size of the PB.

(2) In non-execution, 0.4 will be added to the processing speed. In execution, 0.8 ?sec will be added.

Appendix 3. Function/Function Block List

Function List (GM4-CPUC)

Name	Function	Size of PB (byte) *1	Size of library (byte) *2	Processing speed (? sec) *3
ABS (int)	Absolute value operation	44	-	1.36
ADD (int,dint)	Addition	36	-	1.12
ADD (lint)	Addition	60	-	2.36
AND (word,dword)	Logical multiplication	24	-	0.76
AND (lword)	Logical multiplication	28	-	0.88
DIV (int,dint)	Division	36	-	1.12
DIV (lint)	Division	48	-	85
EQ (int,dint)	'Equality ' comparison	32	-	1.00
LIMIT(int,dint)	To output upper and lower limits	60	964	7.9
MAX (int,dint)	To output the maximum input value	60	1120	10.0
MOVE (int)	To copy data	20	-	0.64
MUL (int,dint)	Multiplication	36	-	1.12
MUL (lint)	Multiplication	40	-	29
MUX (int,dint)	To output a selected input value	68	552	9.0
MUX (lint)	To output a selected input value	76	-	12.6
ROL	To rotate left	52	392	2.44
SUB (int,dint)	Subtraction	36	-	1.12
SUB (lint)	Subtraction	60	-	2.36
BCD_TO_DINT	Conversion of BCD type into DINT type	24	280	10.6
BCD_TO_INT	Conversion of BCD type into INT type	24	136	10.6
BCD_TO_SINT	Conversion of BCD type into SINT type	24	84	10.6
BYTE_TO_SINT	Conversion of BYTE type into SINT type	20	-	0.64
DATE_TO_STRING	Conversion of DATE type into STRING type	48	60	360
DINT_TO_INT	Conversion of DINT type into INT type	76	-	2.32
DINT_TO_BCD	Conversion of DINT type into BCD type	24	172	18.0
DT_TO_DATE	Conversion of DT type into DATE type	20	-	0.64
DT_TO_TOD	Conversion of DT type into TOD type	24	12	1.24
DT_TO_STRING	Conversion of DT type into STRING type	48	60	442
DWORD_TO_WORD	Conversion of DWORD type into WORD type	20	-	0.64
INT_TO_DINT	Conversion of INT type into DINT type	24	-	0.76
INT_TO_BCD	Conversion of INT type into BCD type	24	108	6.6
NUM_TO_STRING(int)	Conversion of number into string	56	312	280
SINT_TO_BCD	Conversion of SINT type into BCD type	24	84	6.6
STRING_TO_INT	Conversion of STRING type into INT type	24	48	360
CONCAT	To concatenate strings	68	168	32.0
DELETE	To delete string	64	328	22.1
EQ(str)	'Equality ' comparison	64	752	14.1
FIND	To find a string	48	228	7.7
INSERT	To insert a string	68	348	41.5
LEFT	To obtain the left part of a string	56	140	19.2
LEN	To obtain the length of a string	24	88	7.1
LIMIT(str)	To output upper or lower limits	90	964	39.0
MAX(str)	To output the maximum input value	76	1120	20.4
MID	To obtain the middle part of a string	64	208	32.2
REPLACE	To replace a string with another	76	424	37.9
RIGHT	To obtain the right part of a string	56	220	29.0
ADD_TIME (time)	Time addition	52	220	3.7
DIV_TIME (i1=time)	Time division	52	436	7.5

HINT

1)The items marked with *1 has following meaning.

*1 : The size of the program memory which a program occupies when it uses the function once.

*2 : The size of the program memory which a program occupies only one time though it uses the function many times.

*3: of IL programs (2 input variables, 10 strings)

2)The above shows the function list when programs are written with LD(Ladder Diagram).

Expansion available functions (ADD, MUL, MAX, MN, MUX, EQ, etc) are standardized to 2 input variables

String operation functions are standardized to 10 characters.

Input variables of trigonometric functions are standardized to average values which are MAX ?.

Appendix 3. Function/Function Block List

Floating-point Arithmetic Function List (GM4-CPUC)

Name	Function	Size of PB (byte) *1	Size of library (byte) *2	Processing speed (? sec) *3
ABS (real/ lreal)	Absolute value operation	36	-	7
ACOS (real/ lreal)	Arc Cosine operation	36	-	150/ 200
ADD (real/ lreal)	Addition	36	-	7
ASIN (real/ lreal)	Arc Sine operation	36	-	120/ 200
ATAN (real/ lreal)	Arc Tangent operation	36	-	100/ 140
COS (real/ lreal)	Cosine operation	36	-	75/ 100
DINT_TO_LREAL	Conversion of DINT type into LREAL type	24	-	7
DINT_TO_REAL	Conversion of DINT type into REAL type	24	-	3.5
DIV (real/ lreal)	Division	48	-	10/ 12
EQ (real/ lreal)	'Equality' comparison	32	-	9
EXP (real/ lreal)	Natural exponential operation	36	-	110
EXPT (real/ lreal)	Exponential operation	32	-	230/ 260
INT_TO_LREAL	Conversion of INT type into LREAL type	24	-	9
INT_TO_REAL	Conversion of INT type into REAL type	24	-	5
LINT_TO_LREAL	Conversion of LINT type into LREAL type	24	-	50
LINT_TO_REAL	Conversion of LINT type into REAL type	24	-	50
LN (real/ lreal)	Natural logarithm operation	36	-	50/ 68
LOG (real/ lreal)	Logarithm operation	36	-	50/ 75
LREAL_TO_DINT	Conversion of LREAL type into DINT type	36	-	16
LREAL_TO_INT	Conversion of LREAL type into INT type	36	-	20
LREAL_TO_LINT	Conversion of LREAL type into LINT type	36	-	80
LREAL_TO_REAL	Conversion of LREAL type into REAL type	36	-	20
LREAL_TO_SINT	Conversion of LREAL type into SINT type	36	-	20
LREAL_TO_UDINT	Conversion of LREAL type into UDINT type	36	-	80
LREAL_TO_UINT	Conversion of LREAL type into UINT type	36	-	16
LREAL_TO_ULINT	Conversion of LREAL type into ULINT type	36	-	76
LREAL_TO_USINT	Conversion of LREAL type into USINT type	36	-	20
MUL (real/ lreal)	Multiplication	48	-	5/ 7
REAL_TO_DINT	Conversion of REAL type into DINT type	36	-	18
REAL_TO_INT	Conversion of REAL type into INT type	36	-	14
REAL_TO_LINT	Conversion of REAL type into LINT type	36	-	80
REAL_TO_LREAL	Conversion of REAL type into LREAL type	36	-	7
REAL_TO_SINT	Conversion of REAL type into SINT type	36	-	20
REAL_TO_UDINT	Conversion of REAL type into UDINT type	36	-	17
REAL_TO_UINT	Conversion of REAL type into UINT type	36	-	20
REAL_TO_ULINT	Conversion of REAL type into ULINT type	36	-	76
REAL_TO_USINT	Conversion of REAL type into USINT type	36	-	20
SIN (real/ lreal)	Sine operation	36	-	75/ 100
SINT_TO_LREAL	Conversion of SINT type into LREAL type	24	-	9
SINT_TO_REAL	Conversion of SINT type into REAL type	24	-	3.5
SQRT (real/ lreal)	Square root operation	36	-	7/ 11
SUB (real/ lreal)	Subtraction	48	-	7/ 9
TAN (real/ lreal)	Tangent operation	36	-	90/ 120
TRUNC(real/ lreal)	Truncation operation	44	-	18/ 74
UDINT_TO_LREAL	Conversion of UDINT type into LREAL type	24	-	7
UDINT_TO_REAL	Conversion of UDINT type into REAL type	24	-	7
UINT_TO_LREAL	Conversion of UINT type into LREAL type	24	-	5
UINT_TO_REAL	Conversion of UINT type into REAL type	36	-	5

Appendix 3. Function/Function Block List

Floating-point Arithmetic Function List (GM4-CPUC) (Continued)

ULINT_TO_LREAL	Conversion of ULINT type into LREAL type	36	-	50
ULINT_TO_REAL	Conversion of ULINT type into REAL type	36	-	55
USINT_TO_LREAL	Conversion of USINT type into LREAL type	36	-	5
USINT_TO_REAL	Conversion of USINT type into REAL type	36	-	3.5

HINT

- 1) The items marked with "*" has following meaning.
 *1 : The size of the program memory which a program occupies when it uses the function once.
 *2 : The size of the program memory which a program occupies only one time though it uses the function many times.
 *3: of IL programs (2 input variables, 10 strings)
- 2) The above shows the function list when programs are written with LD(Ladder Diagram).
 ## Expansion available functions (ADD, MUL, MAX, MIN, MUX, EQ, etc) are standardized to 2 input variables
 ## String operation functions are standardized to 10 characters.
 ## Input variables of trigonometric functions are standardized to average values which are MAX ?.

2) Function Block List

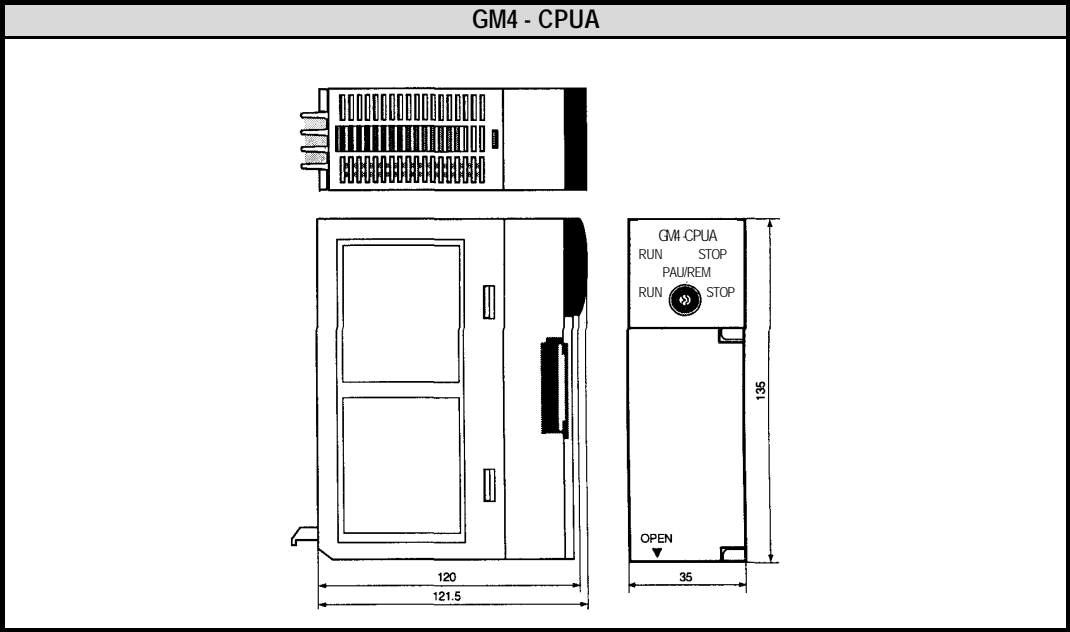
Name	Function	Size of PB (byte) *1	Size of library		Processing speed (? sec)	
			Size (byte) *2	Size of instance memory *3	GM4-CPUA/B	GM4-CPUC
CTU	Addition counter	72	110	6	12.8	6.4
CTUD	Addition/subtraction counter	112	186	6	18.4	10.4
F_TRIG	Descending edge detection	40	38	1	6.6	2.6
RS	Preference reset table	48	72	2	8.7	2.9
TON	ON delay timer	56	200	20	11.1	6.2

HINT

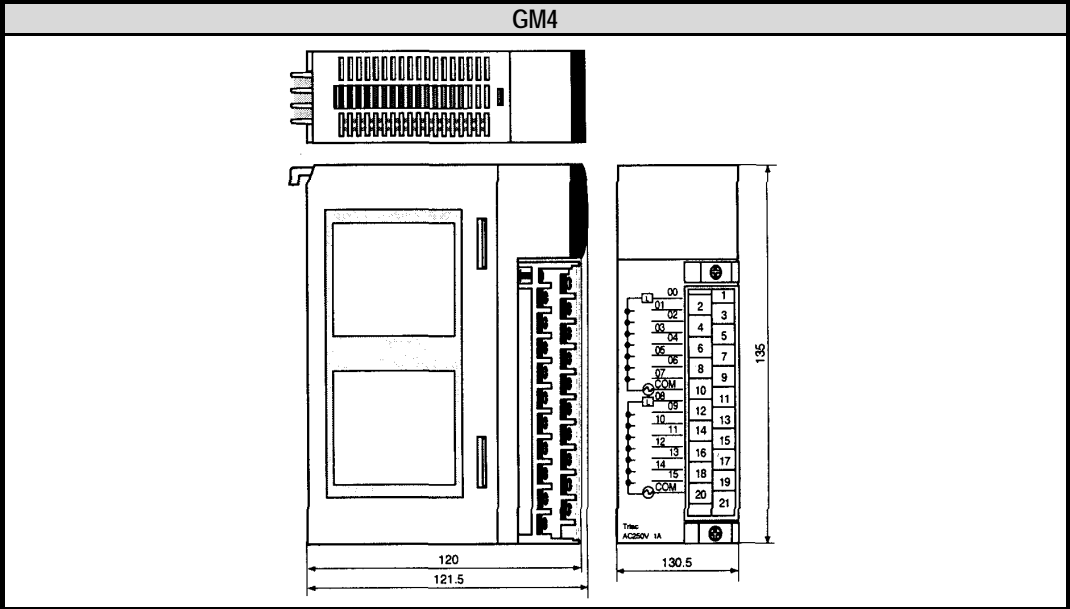
- 1) The items marked with "*" has following meaning.
 *1 : The size of the program memory which a program occupies when it uses the function once.
 *2 : The size of the program memory which a program occupies only one time though it uses the function many times.
 *3: The size of the program memory which a program occupies whenever it uses the function block once.
- 2) The occupied memory size and processing speed of IL programs are same as LD programs.

Appendix 4. Dimensions (Unit : mm)

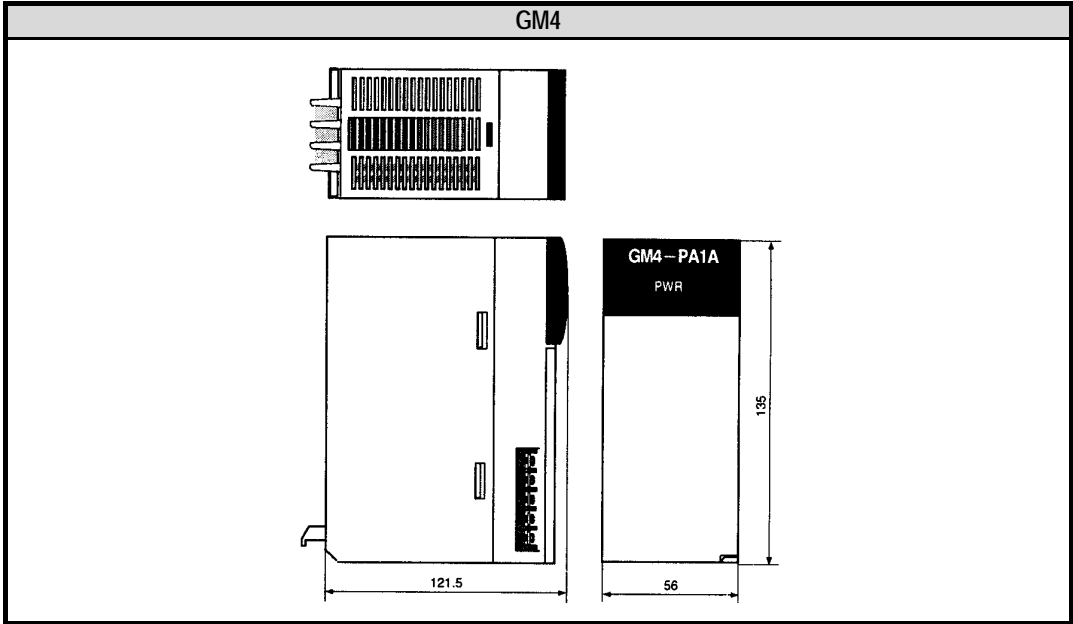
1) CPU Module



2) Input / Output Module



3) Power Module



4) Main / Expansion Base Unit

