HITACHI PROGRAMMABLE CONTROLLER

H-SERIES

CPU MODULE

INSTRUCTION MANUAL
(HARDWARE EDITION)

PRODUCT NAME : H-2002, H-702, H-302 Series
H-2000, H-700, H-300 Series

TYPE : CPU2-20H | CPU2-07H | CPU2-03H
CPUP-20H | CPUP-07H | CPUP-03H
CPU-20Ha | CPU-07Ha | CPU-03Ha

NOTICE : Make sure to have this manual available to the person directly responsible for use and maintenance of this unit. After installation and initialization, file the manual for future reference.

Hitachi, Ltd.

NB322BX

Warranty Period and Scope of Warranty

The warranty period of the delivered Module is one (1) year after delivery to the place specified by the purchaser. Should any failure occur during this warranty period during use under normal conditions within the range of the product specification in accordance with the instructions given in this instruction manual, repair or replacement of the failed portion(s) will be made at no cost to the purchaser.

However, if said failure occurred due to any of the following factors, it will be excluded from the scope of this warranty.

(1) The failure was caused by improper handling and/or by use by the user.
(2) The failure was caused by an external factor/.
(3) The failure was caused by modification or repair made by other than the supplier.
(4) The failure was caused by natural calamities or disasters for which the supplier is not responsible.

Repair for Value

Investigation and repair will be made for value in all cases after said warranty period has elapsed. Even during the warranty period, repair and investigation for the cause of the failure (except for the case where it is covered by warranty) for the reasons outside of the scope of warranty stated above will be made for value by your dealer.

Placement of Orders for Parts and Inquiries

Kindly inform the following particulars to your dealer on occurrence of a failure to the product, for placement or orders for parts and/or for other inquiries.

(1) Type
(2) Manufacturing No. (MFG. No.)
(3) Description of failure

The contents of this manual may be modified without previous notice.

INTRODUCTION

We appreciate that you have selected the H-series CPU Module of the Hitachi programmable controller (hereinafter abbreviated to PC). This instruction manual outlines each module including the H-series CPU module of the Hitachi programmable controller. The manual consists of the following five parts according to contents. Carefully read the manual to familiarize yourself with the procedures respectively of installation, operation, and maintenance and inspection.

The instruction manual consists of the following two separate volumes.

Hardware Edition

Part I	Outline of H-series Programmable Controller: Concept on H-series
Part II	System Device Specification: Specification of each module of H-series
Part III	Installation, Mounting, Wiring, and Preparation for Running: From installation to trial run of H-series
Part IV	Maintenance, Inspection, and Error Recovery Processing: Maintenance, etc. of H-series
Appendix	List of error code, error recovery processing, and special internal output

Software Edition

Chapter 1	Input/output signal: Allocation of I/O signals of H-series and special internal output
Chapter 2	Processing Method and Concept on Scanning: Processing method of H-series and concepts on scanning
Chapter 3	Ladder/Command: H-series Ladder/Command programming language
Chapter 4	Flow Language: Language used in the flow chart method of H-series
Chapter 5	BASIC Language: BASIC language of H-series
Chapter 6	Communication with Host Computer: Communication function of the CPU module of H-series
Appendix	List of error code, error recovery processing, and special internal output

For H-100M, H-200, or HB-700 of the H-series CPU module, refer to the dedicated instruction manual.

Note:

(1) No part of this manual may be reproduced without the prior permission of Hitachi, Ltd., Japan.

(2) Parts of this manual may be changed without notice in the future.

(3) If any doubtful or omitted parts are found in this manual, please inform Hitachi.

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BEFORE USE

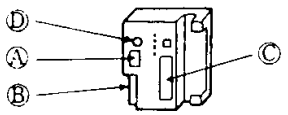
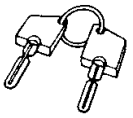
This product has been carefully manufactured, but you are kindly advised to make the following checks immediately after purchase. (Carefully handle the product, at the occasion of unpacking, not to apply impact or vibration to the product.)

(1) Check if the type meets the order specification.
(2) Check if there is any portion which was damaged during transport.
(3) Check for looseness of screws and for attachment of foreign matters.
(4) Check for any missing article among the packaged articles.

PACKAGED ARTICLES

Check in accordance with the following table if all the articles are complete in the package.

List of package articles of CPU module

No.	Description	Q'ty	Remarks
1	CPU module (main unit)	1	
2	Peripheral connector cover (Attached to the part A shown in the Remarks column of the main unit)	1	
3	Additional base connector cover (Attached to the part B shown in the Remarks column of the main unit)	1	
4	Blind cover or general purpose port cover (Attached to the part C shown in the Remarks column of the main unit)	1	
5	Key switch (Attached to the part D shown in the Remarks column of the main unit)	2	
6	Instruction manual • Hardware edition • Software edition	1 copy per each	

CONTENTS

Part III Installation, Mounting, Wiring, and Preparation for Running

Part IV Maintenance, Inspection, Error Recovery

Chapter 1 System Configuration

1.1 General Specification of H-series (PC body and modules)

Table 1.1 General Specification of H-series

<table>
<tr><th>Item</th><th colspan="3">Specification</th></tr>
<tr><td>Power supply</td><td colspan="3">Supplied from the power module</td></tr>
<tr><td>Operating temperature</td><td>0 to 55°C (Peripheral equipment excluded)</td><td rowspan="2">Storage temperature</td><td rowspan="2">–10 to 75°C (Memory data can be guaranteed only in the operating temperature range.)</td></tr>
<tr><td>Operating humidity</td><td>20 to 90% RH without dew condensation (Peripheral equipment excluded)</td></tr>
<tr><td>Vibration resistance</td><td>JIS C 0911 (16.7 Hz, double amplitude 3 mm, 2 hours in each of X, Y, and Z directions)</td><td>Storage humidity</td><td>10 to 90% RH without dew condensation</td></tr>
<tr><td>Noise resistance</td><td colspan="3">• Noise voltage 1500 Vp-p, noise pulse width 100 ns and 1 μs (Test method: Noise caused by a noise simulator is applied between the input terminals of the power module.)
• Based on NEMA ICS 2-230-42 to 45 (Input module excluded)
• Electrostatic noise 3000 V applied to bare metal</td></tr>
<tr><td>Insulation resistance</td><td colspan="3">20 MΩ min. between external AC terminal and frame ground (FG) terminal
(Test method: Using a 500 VDC megger)</td></tr>
<tr><td>Withstand voltage</td><td colspan="3">1 minute at 1500 VAC between external AC terminal and frame ground (FG) terminal</td></tr>
<tr><td>Grounding</td><td colspan="3">Class 3 dedicated grounding (Power module used for grounding)</td></tr>
<tr><td>Atmosphere</td><td colspan="3">The equipment should be free of corrosive gases, oils, and excessive dust.</td></tr>
<tr><td>Structure</td><td colspan="3">Open wall mounting type</td></tr>
<tr><td>Cooling</td><td colspan="3">Natural cooling</td></tr>
</table>

1.2 Positioning of H-series

H-2002, H-702, and H-302 are modules which are obtained by adding various functions to H-2000, H-700, and H-300 and have the following features.

Features

1. Functions added to H-2002, H-702, and H-302
   - A PID control function is provided for the standard type.
   - Trigonometric functions, data conversion, and advanced function module instructions are added.
   - A clock function is provided for the standard type. (Time display)
   - A general purpose serial port is provided for the standard type.
   - A trace monitor function is added (when the system software of the peripheral equipment is HL-GPCL or HL-PC**).
   - A running program high-speed changing function is added (when the memory cassette is RAM3-**H).
   - The computing speed is increased by 20%.
2. Features of H-series
   - The H-series is a miniature module which has advanced functions and a visible LED display.
   - The H-series is compatible with HB-700 in program and peripheral equipment and also in a part of I/O module.
   - The number of control points can be easily extended.
   - The flow chart language and ladder language (command) can be mixed together.

The positioning of the H-series programmable controller can be expressed by a concept as shown in the drawing below.

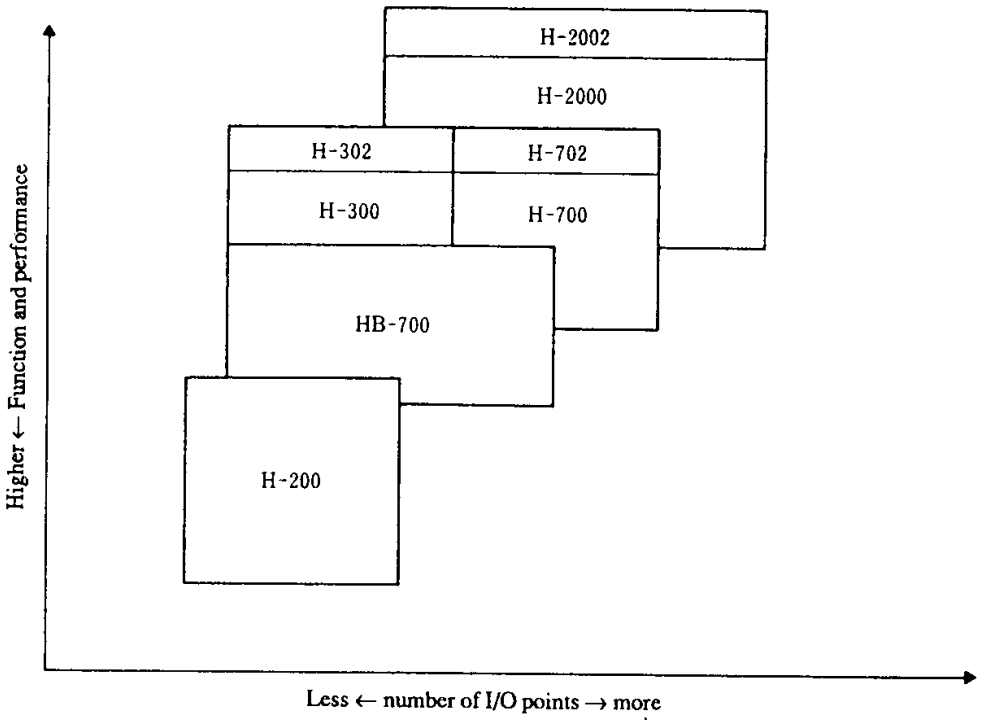
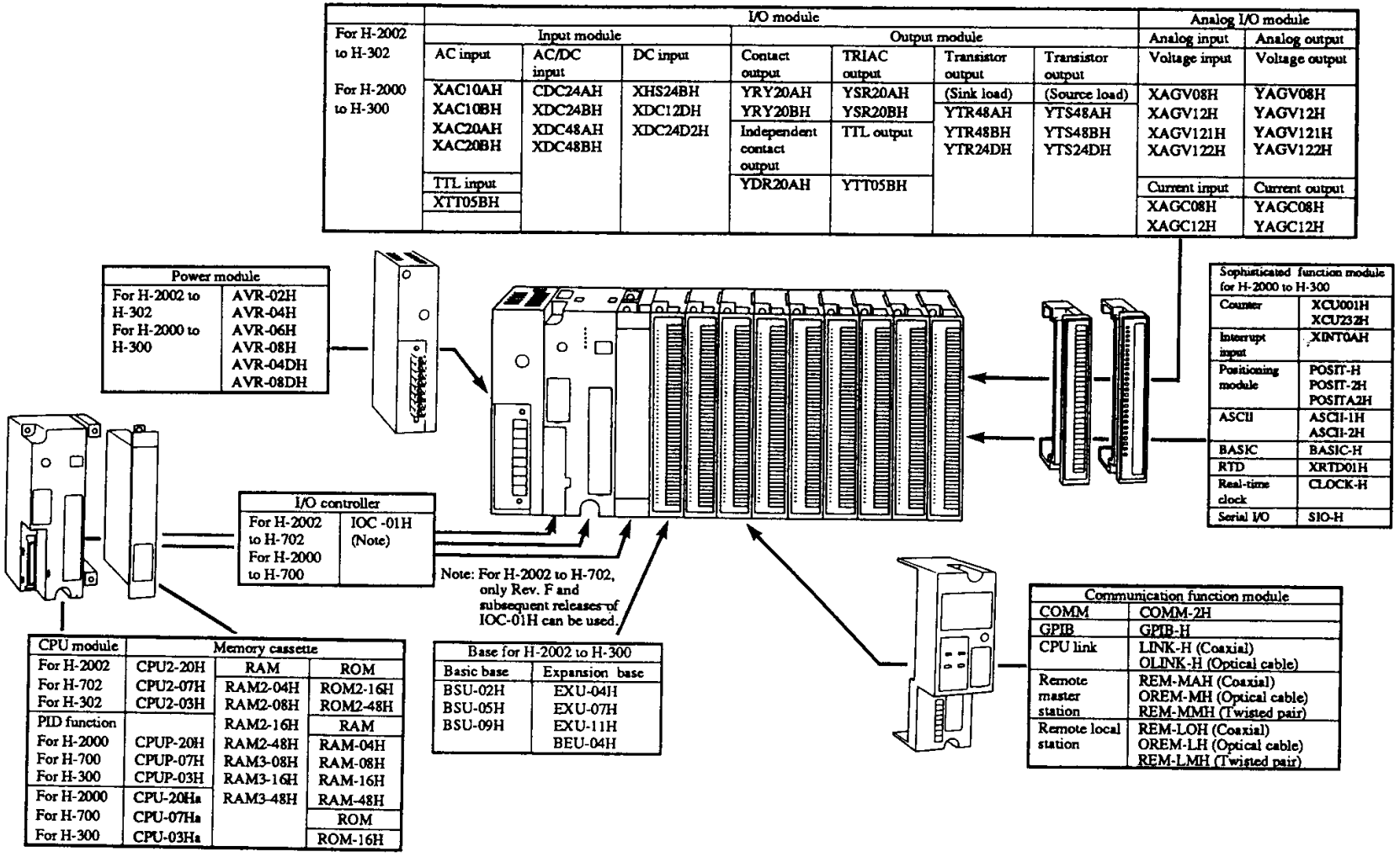


Figure 1.1 Positioning of H-series

1.3 Related Drawing of Modules and Peripheral Equipment

The H-series constitutes a unit by combining the devices and modules shown on the next page. The base unit for supporting the power module and other modules can be used for every unit. The basic base of the base unit requires a CPU module and memory cassette. The additional base requires an I/O controller or remote local station (communication function module) depending on the system configuration method.

A hierarchical system of H-series can be configured by combining communication function modules.



	I/O module							Analog I/O module	
	Input module			Output module				Analog input	Analog output
For H-2002 to H-302	AC input	AC/DC input	DC input	Contact output	TRIAC output	Transistor output	Transistor output	Voltage input	Voltage output
For H-2000 to H-300	XAC10AH XAC10BH XAC20AH XAC20BH	CDC24AH XDC24BH XDC48AH XDC48BH	XHS24BH XDC12DH XDC24D2H	YRY20AH YRY20BH Independent contact output	YSR20AH YSR20BH TTL output	(Sink load) YTR48AH YTR48BH YTR24DH	(Source load) YTS48AH YTS48BH YTS24DH	XAGV08H XAGV12H XAGV121H XAGV122H	YAGV08H YAGV12H YAGV121H YAGV122H
	TTL input XTT05BH			YDR20AH	YTT05BH			Current input XAGC08H XAGC12H	Current output YAGC08H YAGC12H

Power module	
For H-2002 to H-302 For H-2000 to H-300	AVR-02H AVR-04H AVR-06H AVR-08H AVR-04DH AVR-08DH

Sophisticated function module for H-2000 to H-300	
Counter	XCU001H XCU232H
Interrupt input	XINT0AH
Positioning module	POSIT-H POSIT-2H POSITA2H
ASCII	ASCII-1H ASCII-2H
BASIC	BASIC-H
RTD	XRTD01H
Real-time clock	CLOCK-H
Serial I/O	SIO-H

I/O controller	
For H-2002 to H-702 For H-2000 to H-700	IOC -01H (Note)

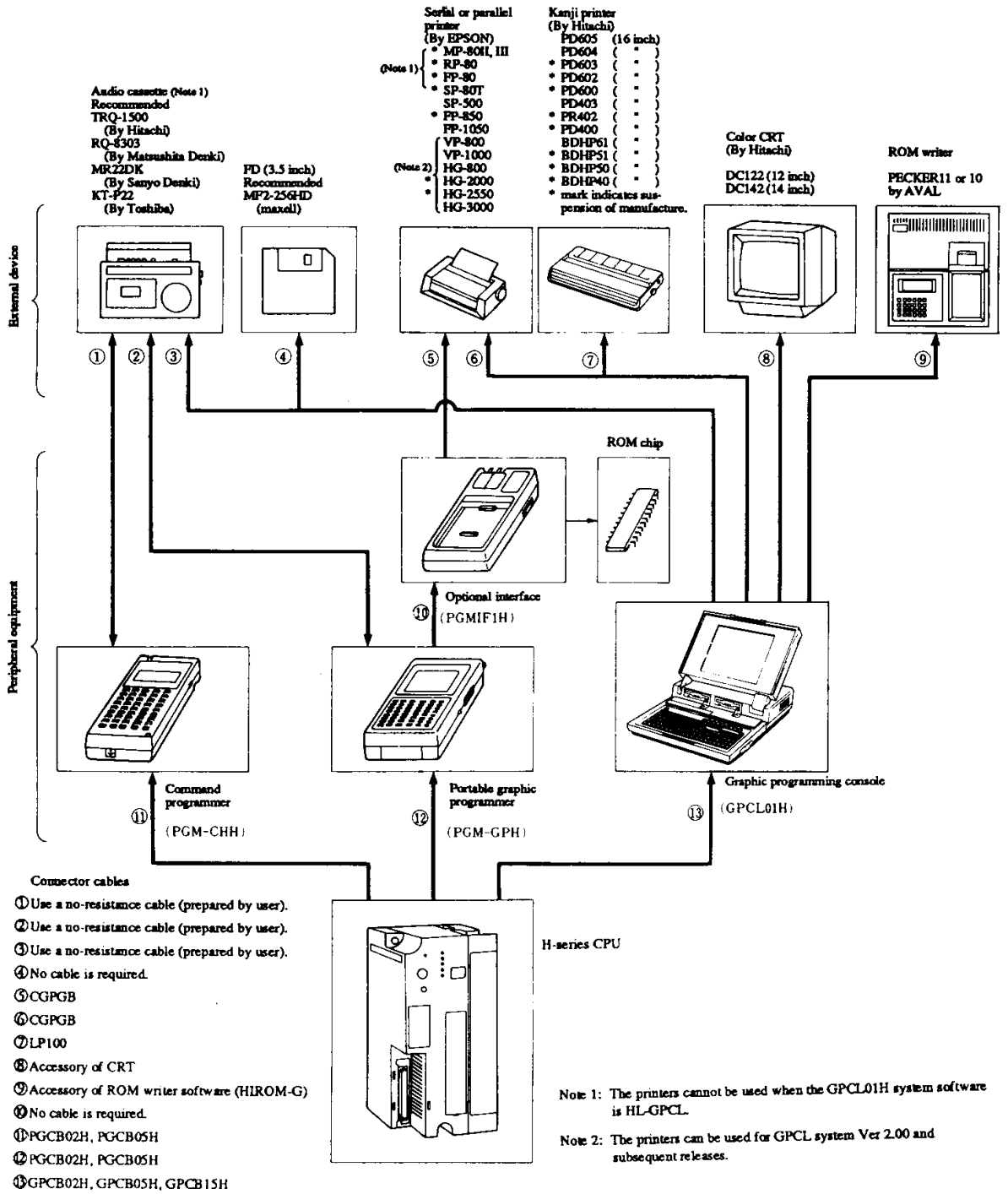
Note: For H-2002 to H-702, only Rev. F and subsequent releases of IOC-01H can be used.

CPU module	Memory cassette		
For H-2002	CPU2-20H	RAM	ROM
For H-702	CPU2-07H	RAM2-04H	ROM2-16H
For H-302	CPU2-03H	RAM2-08H	ROM2-48H
PID function		RAM2-16H	RAM
For H-2000	CPUP-20H	RAM2-48H	RAM-04H
For H-700	CPUP-07H	RAM3-08H	RAM-08H
For H-300	CPUP-03H	RAM3-16H	RAM-16H
For H-2000	CPU-20Ha	RAM3-48H	RAM-48H
For H-700	CPU-07Ha		ROM
For H-300	CPU-03Ha		ROM-16H

Base for H-2002 to H-300	
Basic base	Expansion base
BSU-02H	EXU-04H
BSU-05H	EXU-07H
BSU-09H	EXU-11H
	BEU-04H

Communication function module	
COMM	COMM-2H
GPIB	GPIB-H
CPU link	LINK-H (Coaxial) OLINK-H (Optical cable)
Remote master station	REM-MAH (Coaxial) OREM-MH (Optical cable) REM-MMH (Twisted pair)
Remote local station	REM-LOH (Coaxial) OREM-LH (Optical cable) REM-LMH (Twisted pair)

The peripheral equipment is a command programmer, portable graphic programmer, and graphic programming console. They have different functions and are connected to different external devices (printer, auxiliary memory, CRT, etc.). Use them according to the purpose.



Connector cables

①Use a no-resistance cable (prepared by user).
②Use a no-resistance cable (prepared by user).
③Use a no-resistance cable (prepared by user).
④No cable is required.
⑤CGPGB
⑥CGPGB
⑦LP100
⑧Accessory of CRT
⑨Accessory of ROM writer software (HIROM-G)
⑩No cable is required.
⑪PGCB02H, PGCB05H
⑫PGCB02H, PGCB05H
⑬GPCB02H, GPCB05H, GPCB15H

Note 1: The printers cannot be used when the GPCL01H system software is HL-GPCL.

Note 2: The printers can be used for GPCL system Ver 2.00 and subsequent releases.

1.4 System Device List

(1) Basic devices (1/3)

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
H-2002 CPU	CPU2-20H	2048 I/O points (32-point module), FUN instruction, PID function	–	2.75	–	O	–	–	–	–	–	–	–	–	The supply current is the one when the memory cassette is included.
H-2000 with PID	CPUP-20H	2048 I/O points (32-point module), PID function	–	2.75	–	–	–	–	O	–	–	–	–	–	
H-2000 CPU	CPU-20Ha	2048 I/O points (32-point module)	–	2.75	–	–	–	–	–	–	–	O	–	–	
H-702 CPU	CPU2-07H	640 I/O points (32-point module), FUN instruction, PID function	–	2.05	–	–	O	–	–	–	–	–	–	–	
H-700 with PID	CPUP-70H	640 I/O points (32-point module), PID function	–	2.05	–	–	–	–	–	O	–	–	–	–	
H-700 CPU	CPU-07Ha	640 I/O points (32-point module)	–	2.05	–	–	–	–	–	–	–	–	O	–	
H-302 CPU	CPU2-03H	288 I/O points (32-point module), FUN instruction, PID function	–	2.05	–	–	–	O	–	–	–	–	–	–	
H-300 with PID	CPUP-03H	288 I/O points (32-point module), PID function	–	2.05	–	–	–	–	–	–	O	–	–	–	
H-300 CPU	CPU-03Ha	288 I/O points (32-point module)	–	2.05	–	–	–	–	–	–	–	–	–	O	
RAM cassette	RAM2-04H	3.5k steps, 2048 words, with a clock	–	–	–	O	O	O	Δ	Δ	Δ	Δ	Δ	Δ	When the RAM cassette is used for the CPU module of H-2000, H-700, or H-300, the clock function cannot be used.
	RAM2-08H	7.6k steps, 2048 words, with a clock	–	–	–	O	O	O	Δ	Δ	Δ	Δ	Δ	Δ	
	RAM2-16H	15.7k steps, 18432 words, with a clock	–	–	–	O	O	x	Δ	Δ	x	Δ	Δ	x	
	RAM2-48H	48.5k steps, 51200 words, with a clock	–	–	–	O	x	x	Δ	x	x	Δ	x	x	
	RAM3-08H	7.6k steps, 2048 words, with clock and high-speed running changing functions	–	–	–	O	O	O	x	x	x	x	x	x	
	RAM3-16H	15.7k steps, 18432 words, with clock and high-speed running changing functions	–	–	–	O	O	x	x	x	x	x	x	x	
	RAM3-48H	48.5k steps, 51200 words, with clock and high-speed running changing functions	–	–	–	O	x	x	x	x	x	x	x	x	
	RAM-04H	3.5k steps, 2048 words	–	–	–	x	x	x	O	O	O	O	O	O	
	RAM-08H	7.6k steps, 2048 words	–	–	–	x	x	x	O	O	O	O	O	O	
	RAM-16H	15.7k steps, 18432 words	–	–	–	x	x	x	O	O	x	O	O	x	
	RAM-48H	48.5k steps, 51200 words	–	–	–	x	x	x	O	x	x	O	x	x	
ROM cassette	ROM2-16H	15.7k steps (EPROM), 18432 words, with a clock	–	–	–	O	O	O	Δ	Δ	Δ	Δ	Δ	Δ	When the ROM cassette is used for the CPU module of H-2000, H-700, or H-300, the clock function cannot be used. For H-300, a ROM of up to 7.6K steps is available.
	ROM2-48H	48.5k steps (EPROM), 51200 words, with a clock	–	–	–	O	x	x	Δ	x	x	Δ	x	x	
	ROM-16H	15.7k steps (EPROM), 18432 words	–	–	–	x	x	x	O	O	O	O	O	O	For H-300 or H-302, a ROM of up to 7.6k steps is available.
I/O controller	IOC-01H	I/O controller module (1 unit per additional installation)	–	0.22	–	O	O	–	O	O	–	O	O	–	* Partially restricted
Basic base	BSU-02H	Basic 2-slot mounted base	–	–	–	O	O	O	O	O	O	O	O	O	
	BSU-05H	Basic 5-slot mounted base	–	–	–	O	O	O	O	O	O	O	O	O	
	BSU-09H	Basic 9-slot mounted base	–	–	–	O	O	O	O	O	O	O	O	O	
Expansion base	EXU-04H	Additional 4-slot mounted base (3-slot mounted base when a remote local station is mounted)	–	–	–	O	O	Δ	O	O	Δ	O	O	Δ	For H-300 or H-302, an additional base or special additional base can be used only when a remote local station is used.
	EXU-07H	Additional 7-slot mounted base (6-slot mounted base when a remote local station is mounted)	–	–	–	O	O	Δ	O	O	Δ	O	O	Δ	
	EXU-11H	Additional 11-slot mounted base (10-slot mounted base when a remote local station is mounted)	–	–	–	O	O	Δ	O	O	Δ	O	O	Δ	
Special additional base	BEU-04H	4-slot base where a remote master station can be mounted (2 master stations can be mounted.)	–	–	–	O	O	Δ	O	O	Δ	O	O	Δ	Local station programming is impossible.
Power module	AVR-02H	Input 100 or 240 VAC, output 5 VDC at 2 A, 24 VDC at 2 A (for addition installation)	–	–	–	O	O	O	O	O	O	O	O	O	One power module is required for each base.
	AVR-04H	Input 100 or 240 VAC, output 5 VDC at 4 A, 24 VDC at 1.5 A	–	–	–	O	O	O	O	O	O	O	O	O	
	AVR-06H	Input 100 or 240 VAC, output 5 VDC at 6 A, 24 VDC at 1 A	–	–	–	O	O	O	O	O	O	O	O	O	
	AVR-08H	Input 100 or 240 VAC, output 5 VDC at 9 A, 24 VDC at 0.5 A	–	–	–	O	O	O	O	O	O	O	O	O	
	AVR04DH	Input 24 VDC, output 5 VDC at 4 A, 24 VDC at 1.5 A	–	–	–	O	O	O	O	O	O	O	O	O	
	AVR08DH	Input 24 VDC, output 5 VDC at 9 A, 24 VDC at 0.5 A	–	–	–	O	O	O	O	O	O	O	O	O	
AC input module	XAC10AH	16 points, 100 VAC input	16	0.12	–	O	O	O	O	O	O	O	O	O	
	XAC20AH	16 points, 200 VAC input	16	0.12	–	O	O	O	O	O	O	O	O	O	
	XAC10BH	32 points, 100 VAC input	32	0.15	–	O	O	O	O	O	O	O	O	O	
	XAC20BH	32 points, 200 VAC input	32	0.15	–	O	O	O	O	O	O	O	O	O	

* When using the H-2002 or H-702 CPU together with the I/O controller, the I/O controller should be Rev. "F" or a subsequent release.

O: Usable –: Unusable Δ: Some functions are restricted.

Basic devices (2/3)

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
AC/DC input module	XDC24AH	16 points, 12 to 24 VAC or VDC input	16	0.12	–	O	O	O	O	O	O	O	O	O	
	XDC48AH	16 points, 48 VAC or VDC input	16	0.12	–	O	O	O	O	O	O	O	O	O	
	XDC24BH	32 points, 12 to 24 VAC or VDC input	32	0.15	–	O	O	O	O	O	O	O	O	O	
	XDC48BH	32 points, 48 VAC or VDC input	32	0.15	–	O	O	O	O	O	O	O	O	O	
DC input module	XHS24BH	32 points, 12 to 24 VDC high-speed input	32	0.15	–	O	O	O	O	O	O	O	O	O	
	XDC12DH	64 points, 12 VDC high-speed input	64	0.30	–	O	O	O	O	O	O	O	O	O	
	XDC24D2H	64 points, 24 VDC high-speed input	64	0.30	–	O	O	O	O	O	O	O	O	O	
TTL input module	XTT05BH	32 points, 3 to 15 VDC high-speed input	32	0.15	–	O	O	O	O	O	O	O	O	O	
Contact output module	YRY20AH	16 points, 240 VAC, 24 VDC at 2 A, relay output	16	0.12	0.16	O	O	O	O	O	O	O	O	O	
	YRY20BH	32 points, 240 VAC, 24 VDC at 2 A, relay output	32	0.18	0.16	O	O	O	O	O	O	O	O	O	
Independent contact output	YDR20AH	16 points, 240 VAC, 24 VDC at 2 A, independent relay output	16	0.12	0.16	O	O	O	O	O	O	O	O	O	
TRIAC output module	YSR20AH	16 points, 100 to 240 VAC at 1.7 A, TRIAC output	16	0.38	–	O	O	O	O	O	O	O	O	O	
	YSR20BH	32 points, 100 to 240 VAC at 1 A, TRIAC output	32	0.80	–	O	O	O	O	O	O	O	O	O	
Transistor output (Sink load)	YTR48AH	16 points, 24 to 48 VDC at 2 A, sink load Tr output	16	0.12	–	O	O	O	O	O	O	O	O	O	Load current flowing-in type
	YTR48BH	32 points, 24 to 48 VDC at 0.7 A, sink load Tr output	32	0.18	–	O	O	O	O	O	O	O	O	O	
	YTR24DH	64 points, 12 to 24 VDC at 0.1 A, sink load Tr output	64	0.38	–	O	O	O	O	O	O	O	O	O	
Transistor output (Source load)	YTS48AH	16 points, 24 to 48 VDC at 2 A, source load Tr output	16	0.12	–	O	O	O	O	O	O	O	O	O	Load current flowing-out type
	YTS48BH	32 points, 24 to 48 VDC at 0.7 A, source load Tr output	32	0.18	–	O	O	O	O	O	O	O	O	O	
	YTS24DH	64 points, 12 to 24 VDC at 0.1 A, source load Tr output	64	0.38	–	O	O	O	O	O	O	O	O	O	
TTL output module	YTT05BH	32 points, 4 to 15 VDC at 20 mA, TTL output (sink load)	32	0.18	–	O	O	O	O	O	O	O	O	O	
Analog input module	XAGV08H	8 channels, +0 to +10 VDC, 8-bit voltage input	128	0.06	0.07	O	O	O	O	O	O	O	O	O	
	XAGV12H	8 channels, -10 to +10 VDC, 12-bit voltage input	128	0.06	0.17	O	O	O	O	O	O	O	O	O	
	XAGV121H	8 channels, +0 to +10 VDC, 12-bit voltage input	128	0.06	0.17	O	O	O	O	O	O	O	O	O	
	XAGV122H	8 channels, +1 to +5 VDC, 12-bit voltage input	128	0.06	0.17	O	O	O	O	O	O	O	O	O	
	XAGC08H	8 channels, 4 to 15 VDC at 20 mA, 8-bit current input	128	0.06	0.07	O	O	O	O	O	O	O	O	O	
	XACG12H	8 channels, 4 to 15 VDC at 20 mA, 12-bit current input	128	0.06	0.19	O	O	O	O	O	O	O	O	O	
Analog output module	YAGV08H	4 channels, +0 to +10 VDC, 8-bit voltage output	64	0.07	0.10	O	O	O	O	O	O	O	O	O	
	YAGV12H	4 channels, -10 to +10 VDC, 12-bit voltage output	64	0.06	0.10	O	O	O	O	O	O	O	O	O	
	YAGV121H	4 channels, +0 to +10 VDC, 12-bit voltage output	64	0.06	0.10	O	O	O	O	O	O	O	O	O	
	YAGV122H	4 channels, +1 to +5 VDC, 12-bit voltage output	64	0.06	0.10	O	O	O	O	O	O	O	O	O	
	YAGC08H	4 channels, 4 to 15 VDC at 20 mA, 8-bit current output	64	0.07	0.17	O	O	O	O	O	O	O	O	O	
	YAGC12H	4 channels, 4 to 15 VDC at 20 mA, 12-bit current output	64	0.06	0.19	O	O	O	O	O	O	O	O	O	
Intelligent COMM	COMM-2H	One port of each of RS 232C and RS 422 (2-slot width)	32	*1 0.80	–	O	O	O	O	O	O	O	O	O	1 unit per each CPU basic base
Intelligent GPIB	GPIB-H	One port of IEEE-488 GPIB (2-slot width)	32	0.35	–	O	O	O	O	O	O	O	O	O	1 unit per each CPU basic base
CPU link module	LINK-H	CPU link (coaxial) (2-slot width)	–	0.80	–	O	O	O	O	O	O	O	O	O	2 loops per each CPU basic base
	OLINK-H	CPU link (optical fiber) (2-slot width)	–	0.80	–	O	O	O	O	O	O	O	O	O	
Remote I/O module	REM-MAH	Remote I/O (coaxial) master station (2-slot width)	–	0.60	–	O	O	O	O	O	O	O	O	O	4 master stations per each CPU
	OREM-MH	Remote I/O (optical fiber) master station (2-slot width)	–	0.60	–	O	O	O	O	O	O	O	O	O	10 local stations per each master station
	REM-LOH	Remote I/O (coaxial) local station (2-slot width)	–	*2 1.60	–	O	O	O	O	O	O	O	O	O	
	OREM-LH	Remote I/O (optical fiber) local station (2-slot width)	–	*2 1.60	–	O	O	O	O	O	O	O	O	O	
Remote I/O MINI module	REM-MMH	Remote I/O MINI (twisted pair) master station	64/128	0.15	–	O	O	O	O	O	O	O	O	O	
	REM-LMH	Remote I/O MINI (twisted pair) local station	64/128	0.15	–	O	O	O	O	O	O	O	O	O	
BASIC module	BASIC-H	Module corresponding to BASIC language (3-slot width)	–	1.50	–	O	O	O	O	O	O	O	O	O	1 unit per each CPU basic base

*1: When PGM-GPH or PGM-CHH is connected, the current is 1.3 A. PGMIF1H cannot be used. O: Usable –: Unusable Δ: Some functions are restricted.

*2: The supply current of the peripheral equipment (PGM-GPH or PGM-CHH) is included. PGMIF1H cannot be used.

Basic devices (3/3)

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
Positioning module	POSIT-H	1-axis pulse train output, 25 to 100k pulse/s	128	0.10	–	O	O	O	O	O	O	O	O	O	Remote station unmountable
	POSIT-2H	2-axis pulse train output, 25 to 200k pulse/s	128	0.35	–	O	O	O	O	O	O	O	O	O	
	POSITA2H	2-axis analog output positioning (2-slot width)	128	0.55	–	O	O	O	O	O	O	O	O	O	
Interrupt input module	XINT0AH	Interrupt input module	32	0.15	–	O	O	O	O	O	O	O	O	O	1 unit per each CPU Remote station unmountable
High-speed counter input	XCU001H	16-bit 1-channel counter input, 50 kHz	128	0.30	0.10	O	O	O	O	O	O	O	O	O	
	XCU232H	32-bit 2-channel counter input, 100/5 kHz	128	0.16	–	O	O	O	O	O	O	O	O	O	
ASCII module	ASCII-1H	CRT terminal, in correspondence with serial printer (2-slot width)	128	1.00	–	O	O	O	O	O	O	O	O	O	
	ASCII-2H	In correspondence with bar code reader (2-slot width)	128	1.00	–	O	O	O	O	O	O	O	O	O	
Resistance temp. detector input	XRTD01H	Input in correspondence with 8- or 4-channel switching resistance thermometer bulb (PT 100 Ω)	128/64	0.16	0.10	O	O	O	O	O	O	O	O	O	
Serial time clock	CLOCK-H	With a real-time clock timer function	128	0.10	–	O	O	O	O	O	O	O	O	O	
Serial I/O module	SIO-H	One port of each of RS-232C and RS-422 insulated, non-protocol	128	1.00	–	O	O	O	O	O	O	O	O	O	
Lithium battery	LIBAT-H	Lithium battery for memory backup	–	–	–	O	O	O	O	O	O	O	O	O	
50P connector cover	CV-1H	Connector cover for base free slots	–	–	–	O	O	O	O	O	O	O	O	O	
80Pconnector cover	CV-2H	Connector cover for base free slots	–	–	–	O	O	O	O	O	O	O	O	O	
Dummy module	DUMMY-H	Dummy module for base free slots	–	–	–	O	O	O	O	O	O	O	O	O	For slot cover
Board fuse PCB	FUSE-H	Fuse for base 24 VDC supply	–	–	–	O	O	O	O	O	O	O	O	O	
ROM for ROM-16H	ROMIC-01H	ROM chip for ROM-16H (2 each)	–	–	–	x	x	x	O	O	O	O	O	O	A combination with the CPU module depends on the memory cassette type.
ROM for ROM2-16H	ROMC216H	ROM chip for ROM2-16H (2 each)	–	–	–	O	O	O	O	O	O	O	O	O	
ROM for ROM2-48H	ROMC248H	ROM chip for ROM2-48H (2 each)	–	–	–	O	O	O	O	x	x	O	x	x	

(2) Peripheral equipment

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
Graphic input device	GPCL01H	Power failure guarantee program memory, click sense keyboard, plasma display (640x400 dots), two 3.5" floppy disk drives, RS232C board, parallel board	–	–	–	O	O	O	O	O	O	O	O	O	With a 2-m cable
Portable graphic programmer	PGM-GPH	EL back light, audio CMT interface	–	0.40	–	O	O	O	O	O	O	O	O	O	With a 2-m cable
Optional interface	PGMIF1H	ROM writer, printer interface	–	*1 1.1	–	O	O	O	O	O	O	O	O	O	PGM-GPH
ROM pack	PGMPK2H	Program running changing function	–	–	–	O	O	O	O	O	O	O	O	O	PGM-GPH
Command programmer	PGM-CHH	EL back light, audio CMT interface	–	0.50	–	O	O	O	O	O	O	O	O	O	

*1: PGM-GPH is included.

(3) Software package (1/2)

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
HI-LADDER/ HI-COMMAND	HILDRL	Accessory of H-series ladder, command system disk, and graphic input device (GPCL01H)	–	–	–	O	O	O	O	O	O	O	O	O	
	HIDRL-LE	System disk in correspondence with English of HI-LADDER or HI-COMMAND	–	–	–	O	O	O	O	O	O	O	O	O	
LADDER EDITOR	HL-GPCL	Ladder Editor system disk	–	–	–	O	O	O	O	O	O	O	O	O	For GPCL01H
	HL-PC**	Ladder Editor system disk (Put on sale soon)	–	–	–	O	O	O	O	O	O	O	O	O	For PC98. **depends on the type.
HI-FLOW	HIFLLL	H-series flow chart language system disk	–	–	–	O	O	O	O	O	O	O	O	O	
HI-BASIC	HIBSC	H-series BASIC language system disk	–	–	–	O	O	O	O	O	O	O	O	O	
ASCII-1H	HIASC	H-series ASCII-1H online editor system disk	–	–	–	O	O	O	O	O	O	O	O	O	

O: Usable x: Unusable Δ: Some functions are restricted.

Software package (2/2)

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
Sequence CAD software	HSCADL	H-series drawing making software system disk	–	–	–	O	O	O	O	O	O	O	O	O	
ROM writer software	HIROMW-G	H-series ROM writer software system disk	–	–	–	O	O	O	O	O	O	O	O	O	With a cable
Double coil check software	HICOIL-G	H-series double coil check software system disk	–	–	–	O	O	O	O	O	O	O	O	O	
I/O trace software	HITRAC-G	H-series I/O trace software system disk	–	–	–	O	O	O	O	O	O	O	O	O	
I/O batch change software	HICHNG-G	H-series I/O number batch change software system disk	–	–	–	O	O	O	O	O	O	O	O	O	

(4) Connector cable

Cables to be connected to the modules and devices which are not listed below and their connectors (connectors of some modules are attached to the product) should be prepared by the user. For cables and connectors required, refer to the instruction manual of each product.

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
Basic and additional bases	CBL-05H	Between CPU module and I/O controller, 0.5 m long	–	–	–	O	O	x	O	O	x	O	O	x	Not applicable to H-302 and H-300
	CBL-10H	Between CPU module and I/O controller, 1 m long	–	–	–	O	O	x	O	O	x	O	O	x	
	CBL-20H	Between CPU module and I/O controller, 2 m long	–	–	–	O	O	x	O	O	x	O	O	x	
	CBL-40H	Between CPU module and I/O controller, 4 m long	–	–	–	O	O	x	O	O	x	O	O	x	
Additional and additional bases	CBE-05H	Between I/O controllers, 0.5 m long	–	–	–	O	x	x	O	x	x	O	x	x	Not applicable to H-302, H-702, H-300, and H-700
	CBE-10H	Between I/O controllers, 1 m long	–	–	–	O	x	x	O	x	x	O	x	x	
	CBE-20H	Between I/O controllers, 2 m long	–	–	–	O	x	x	O	x	x	O	x	x	
Programmer cable	PGCB02H	Between CPU module and programmer, 2 m long	–	–	–	O	O	O	O	O	O	O	O	O	Cables for PGM-GPH and PGM-CHH
	PGCB05H	Between CPU module and programmer, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
Graphic input device cable	GPCB02H	Between CPU module and graphic input device, 2 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	GPCB05H	Between CPU module and graphic input device, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	GPCB15H	Between CPU module and graphic input device, 15 m long	–	–	–	O	O	O	O	O	O	O	O	O	
For printer	CBPGB	Between graphic input device and serial printer, 2 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	LP100	Between graphic input device and kanji printer, 2 m long	–	–	–	O	O	O	O	O	O	O	O	O	
For JIS key	KBDADPH	Between graphic input device and JIS keyboard, 15 cm long	–	–	–	O	O	O	O	O	O	O	O	O	
GPIB cable	GCBL-2H	Between (host) GPIB and GPC module, 2m	–	–	–	O	O	O	O	O	O	O	O	O	
ASCII-1H cable	AGPC-05H	Between ASCII-1H and graphic input device, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	CAS-05H	Between ASCII-1H and CRT terminal, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	CH-05B	Between ASCII-1H and cylinder printer, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
ASCII-2H cable	ABD-05H	Between ASCII-2H and bar code reader (1), 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	AHR-05H	Between ASCII-2H and bar code reader (2), 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
BASIC-H cable	BGCB-02H	Between BASIC-H and graphic input device, 2 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	BTCB-05H	Between BASIC-H and CRT, CGT, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
	BPCB-05H	Between BASIC-H and serial printer, 5 m long	–	–	–	O	O	O	O	O	O	O	O	O	
LED cover cable	CB-LEDH	For extension of LED cover of I/O module, 4 m long	–	–	–	O	O	O	O	O	O	O	O	O	
For 64-point module	CBEM-05	Between 40P connector at one end and non-shielded cable at the other end, 5 m long, 1 each (for 32 points)	–	–	–	O	O	O	O	O	O	O	O	O	2 cables are required for 64 points.
For PC98	PCCB02H	Between CPU module and PC9801 NS/NSE	–	–	–	O	O	O	O	O	O	O	O	O	

O: Usable x: Unusable Δ: Some functions are restricted.

(5) Others

Product name	Type	Specification	No. of occupied points	Supply current (A)		Additional function			PID function			Basic function			Remarks
				DC 5V	DC 24V	H-2002	H-702	H-302	H-2000	H-700	H-300	H-2000	H-700	H-300	
Graphic monitor system GM-4000 series	GM4***	CPU link built-in 20" CRT graphic monitor	–	–	–	O	O	O	O	O	O	O	O	O	
Graphic monitor display	GMD-100H	Connected to touch panel liquid crystal display CPU and COMM module	–	–	–	O	O	O	O	O	O	O	O	O	
B16 COMM link interface	BCOM-H	COMM interface board for B16	–	–	–	O	O	O	O	O	O	O	O	O	
B16 optical CPU link interface	BOLIN-H	Only for optical CPU link interface board B16FX-II	–	–	–	O	O	O	O	O	O	O	O	O	
Corresponding to GPCL01H P-500E or 250E	PGPLV1H	Kit corresponding to GPCL01H P-500E or 250E	–	–	–	O	O	O	O	O	O	O	O	O	A set of cable, key sheet, and software

O: Usable x: Unusable Δ: Some functions are restricted.

1.5 Compatibility

(1) Hardware compatibility

The H-2002, H-702, or H-302 system is compatible with the H-2000, H-700, or H-300 system except the CPU module, memory cassette, and I/O controller.

Table 1.2 Compatible List

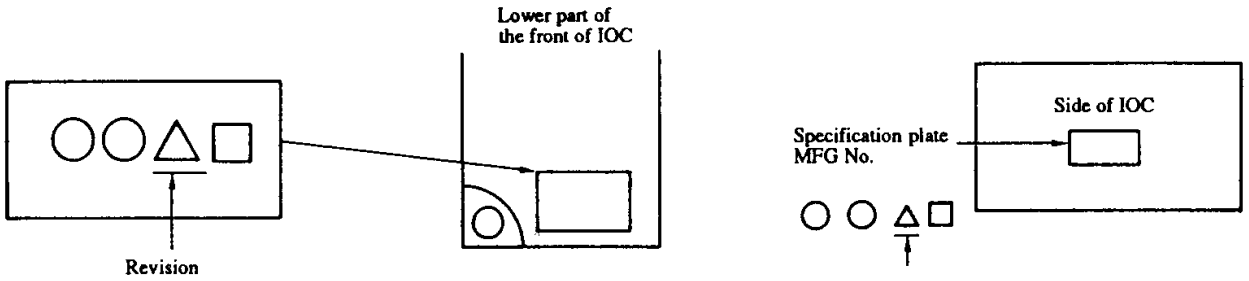
CPU type / Memory cassette	H－2002	H－702	H－302	H－2000	H－700	H－300
	CPU2－20H	CPU2－07H	CPU2－03H	CPUP－20H CPU－20Ha	CPUP－07H CPU－07Ha	CPUP－03H CPU－03Ha
RAM2－04H	○	○	○	△	△	△
RAM2－08H	○	○	○	△	△	△
RAM2－16H	○	○	×	△	△	×
RAM2－48H	○	×	×	△	×	×
RAM3－08H	○	○	○	×	×	×
RAM3－16H	○	○	×	×	×	×
RAM3－48H	○	×	×	×	×	×
ROM3－16H	○	○	※1 ○	△	△	※1 △
ROM2－48H	※2 ○	×	×	※2 △	×	×
RAM －04H	×	×	×	○	○	○
RAM －08H	×	×	×	○	○	○
RAM －16H	×	×	×	○	○	×
RAM －48H	×	×	×	○	×	×
ROM －16H	×	×	×	○	○	※1 ○
IOC －01H	※3 Rev. F and subsequent releases	Rev. F and subsequent releases	–	○	○	–

Δ The clock function cannot be used. O: Usable x: Unusable Δ: Some functions are restricted.

*1: For H-302 and H-300, the program capacity in which the ROM data can be stored is up to 7.6k steps.

*2: When storing ROM data in a 48k-step program, either "GPCL01H + ROM writer software" or "portable graphic programmer + optional interface", and ROM writer (Pecker 11: by AVAL, Ltd.), and 512k-bit ROM check (MBM27C512-20: by Fujitsu) are necessary.

*3: Revision of IOC-01H
IOC-01H of the H-2002 or H-702 system which can be combined is Rev. F or a subsequent release.



The revision is displayed on the lower part of the front of IOC-01H or on the specification plate. Be sure to check it. When there is no display on the lower part of the front of IOC-01H, the revision is E or a previous release. It cannot be used for H-2002 and H-702.

(2) Software compatibility

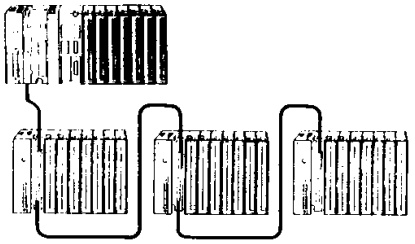
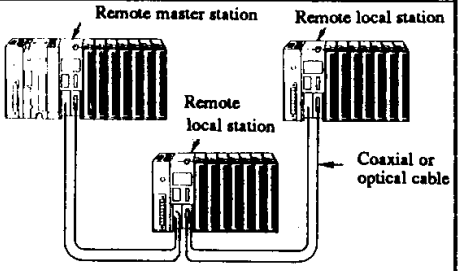
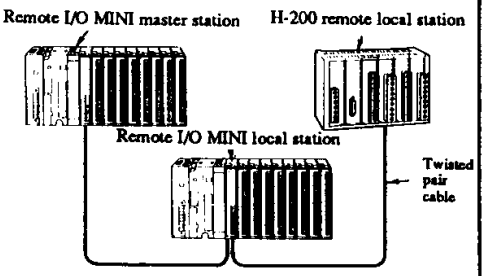
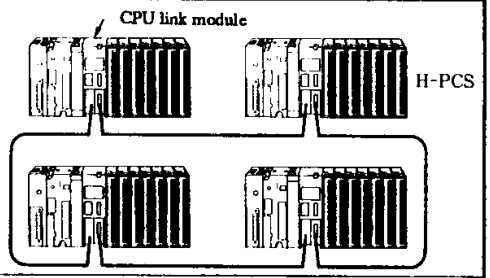
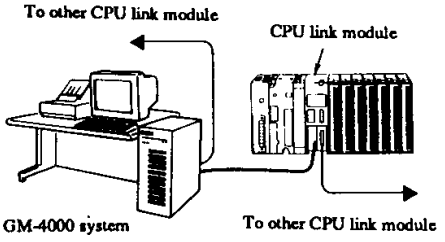
Programs of H-2002, H-702, or H-302 are upward compatible from programs of H-2000, H-700, or H-300. All the programs used in H-2000, H-700, or H-300 can be executed in H-2002, H-702, or H-302.

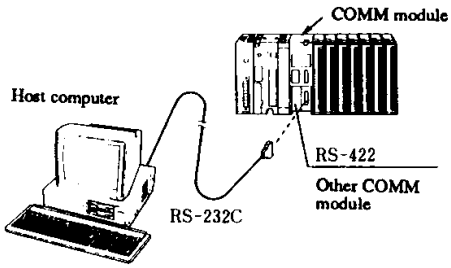
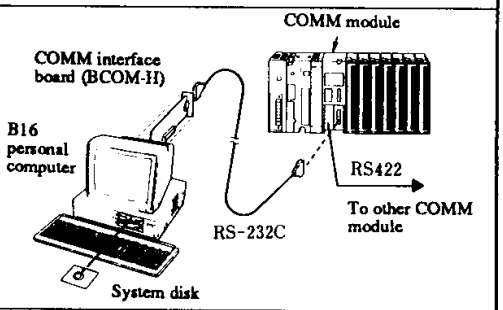
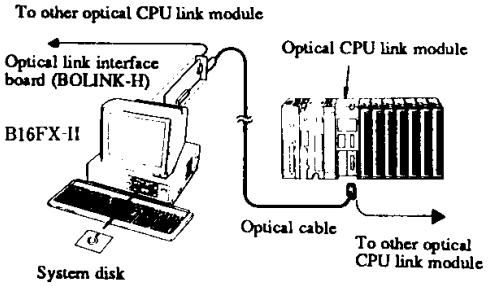
The dynamic timing (the part which is well timed by arithmetic) is required to change for an increase in the computing speed. When the sophisticated function module or any communication module has a wait using no timer, great care should be taken.

Chapter 2 Concept on Construction of Each System

2.1 Outline of System Configuration

Systems using H-series are as follows:

System name	Explanation of system	Configuration example
Independent system	This is a system which consists of modules other than the communication module and one CPU. By using the additional base, the number of I/O points can be extended. (H-300 and H-302 are excluded.)	
Remote I/O system	This is a system which is used to set an I/O module farther away (more than 4 m) from the basic base (the base where the CPU is mounted). The basic base requires a remote master station and the remote expansion base requires a remote local station.	
Remote I/O MINI system	A plurality of basic bases are connected to the master and local stations of the remote I/O MINI module and to the H-200 remote local station to control I/O. The local stations are connected to each other with a twisted pair cable. Products by other companies can be connected.	
CPU link system	This is a system in which a plurality of basic bases are connected in a loop form. They are connected via CPU link modules respectively. The modules are connected to each other with a coaxial or optical cable.	
GM-4000 CPU link monitor system	This is a system in which one or a plurality of H-series CPU modules are connected to a GM-4000 system to monitor and control data. A link system is constructed with a CPU link module (optical or coaxial) and GM-4000 system to transmit or receive data.	

System name	Explanation of system	Configuration example
Host link system	This is a system in which one or a plurality of H-series CPU modules are connected to a host computer (personal computer, etc.) to control data. One of the COMM module, BASIC module, and GPIB module is used.	
Host link system using BCOM-H	This is a system in which one or a plurality of H-series CPU modules are connected to a B16 series personal computer with RS-232C to control data. The CPU module or COMM module and B16 series personal computer containing a COMM interface board are used.	
Host link system using BOLINK-H	This is a system in which one or a plurality of H-series CPU modules and a B16FX-II personal computer are connected by the CPU link method to control data. An optical CPU link module and B16FX-II personal computer containing an optical CPU link interface board are used.	
Composite system	This is a system in which a remote I/O system, CPU link system, and host link system are combined.	

Reference:

When an independent CPU is used, the system name may be expressed by the CPU used such as "H-2002 system".

2.2 Independent System (H-2002, H-702, H-302, H-2000, H-700, H-300)

Outline

One CPU is used to control input or output.

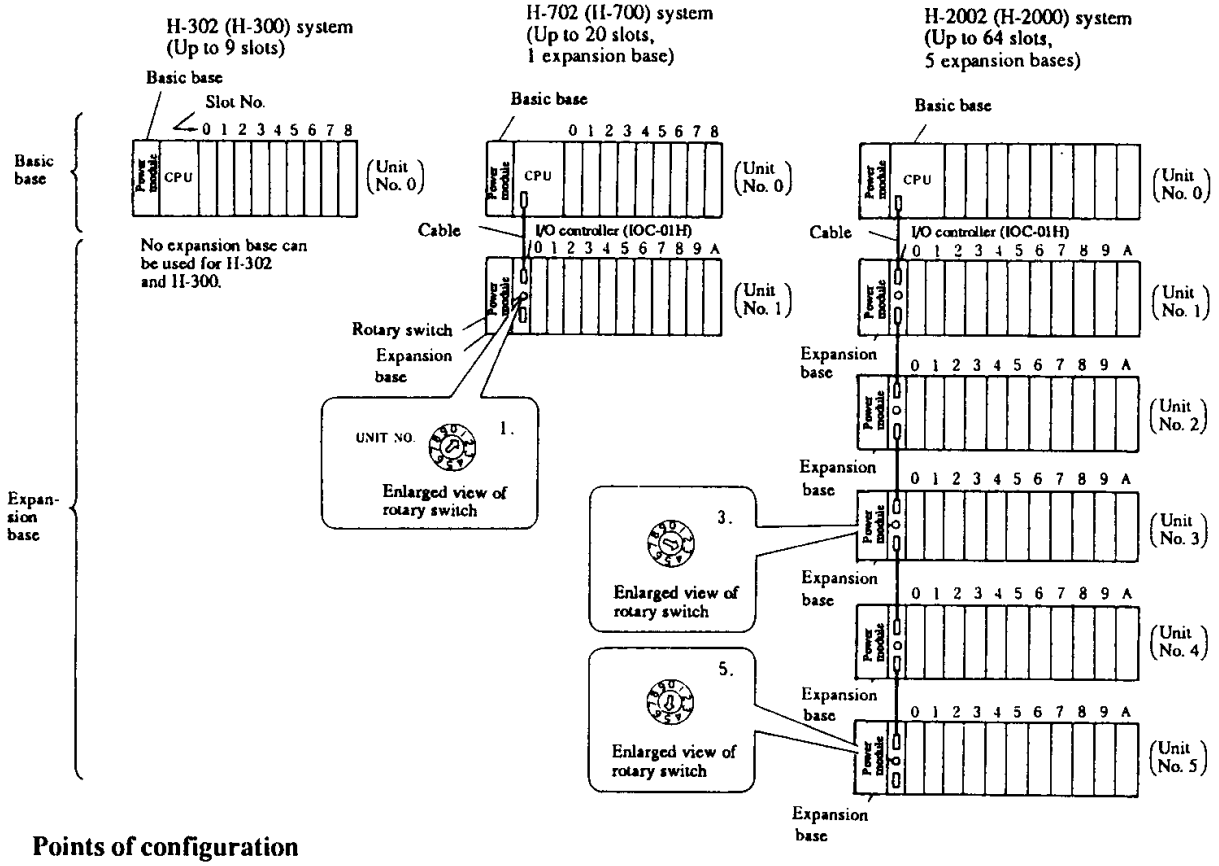
When a small number of I/O points are used, the system is constructed with only a basic base. There are three types available for the number of mounted I/O modules of the basic base, such as 2 slots, 5 slots, and 9 slots. Select the suitable type depending on the number of modules to be controlled (see Chapter 7, "Base").

When the number of modules to be controlled increases and the basic base becomes insufficient, expansion bases are used to extend the I/O module mounting location. There is a limit to the number of extensible modules depending on the capability of CPU.

Configuration example

On the basic base: Power module, CPU module, I/O module, sophisticated function module

On the expansion bases: Power module, I/O controller, I/O module, sophisticated function module



Points of configuration

[1] When one or more expansion bases are used, set the rotary switch of the I/O controller to each unit number. The unit number of the basic base is 0 and the unit numbers of the expansion bases are 1, 2, ---, and 5 starting with the closet one to the basic base.

[2] One expansion base can be connected to H-702 (H-700) and up to five expansion bases can be connected to H-2002 (H-2000). For the number of I/O modules mounted of each expansion base, 4 slots (BEU-04H, EXU-04H). 7 slots (EXU-07H), and 11 slots (EXU-11H) are available. Any of them can be combined freely.

[3] The total cable length when the expansion bases are used is up to 4 m. (H-302 and H-300 are excluded.)

Comparison table of independent system construction specifications

(O: Suitable Δ: Only CPUP-**H or CPU-**Ha function suitable x: Unsuitable)

Item \ System name		H-302 system	H-300 system	H-702 system	H-700 system	H-2002 system	H-2000 system
Maximum number of expansion bases		No bases can be added		Up to 1 base		Up to 5 bases	
Maximum number of I/O modules mounted (Expansion bases included)		9 modules		20 modules		64 modules	
Maximum number of I/O points	Only 32-point modules used	288 points (= 32 points x 9 modules)		640 points (= 32 points x 20 modules)		2048 points (= 32 points x 64 modules)	
	Only 64-point modules used	576 points (= 64 points x 9 modules)		1280 points (= 64 points x 20 modules)		4096 points (= 64 points x 64 modules)	
Memory cassette usable (For mounting CPU)	RAM2-04H	O	Δ	O	Δ	O	Δ
	RAM2-08H	O	Δ	O	Δ	O	Δ
	RAM2-16H	x	x	O	Δ	O	Δ
	RAM2-48H	x	x	x	x	O	Δ
	RAM3-08H	O	x	O	x	O	x
	RAM3-16H	x	x	O	x	O	x
	RAM3-48H	x	x	x	x	O	x
	ROM2-16H	O (Up to 7.6K steps)	O (Up to 7.6K steps)	O	Δ	O	Δ
	ROM2-48H	x	x	x	x	O	Δ
	RAM-04H	x	O	x	O	x	O
	RAM-08H	x	O	x	O	x	O
	RAM-16H	x	x	x	O	x	O
	RAM-48H	x	x	x	x	x	O
	ROM-16H	x	O (Up to 7.6K steps)	x	O	x	O
Base usable	Basic base	BSU-□□H		BSU-□□H□		BSU-□□H	
	Expansion base	—		EXU-□□H		EXU-□□H	
	Special expansion base	—		BEU-04H		BEU-04H	
I/O controller		—		*O	O	*O	O
Cable	Between basic base and expansion base	—		CBL-05H (for 0.5 m) CBL-10H (for 1.0 m) CBL-20H (for 2.0 m) CBL-40H (for 4.0 m)		CBL-05H (for 0.5 m) CBL-10H (for 1.0 m) CBL-20H (for 2.0 m) CBL-40H (for 4.0 m)	
	Between expansion base and expansion base	—		—		CBE-05H (for 0.5 m) CBE-10H (for 1.0 m) CBE-20H (for 2.0 m)	
Precautions		① No expansion base can be connected. ② When ROM-16H is used in the H-320 or H-300 system, the maximum program capacity is 7.6K steps.		① Set the rotary switch of the I/O controller on the expansion base to 1. Note that when the rotary switch is set to another numeral, a malfunction may be caused.		① Set the rotary switch of the I/O controller on the expansion bases to one of 1 to 5. (No numeral should be duplicated. Note that when the rotary switch is set to another numeral, a malfunction may be caused. ② The total length of the cables between the bases should not be more than 4 m.	
Assignment of I/O numbers		(1) The I/O numbers are assigned from left to right. (2) A 0 point is assigned to each free slot. (The total number of points is not affected.)					

* In the H-2002, H-702, or H-302 system, the revision of IOC-01H should be F or a subsequent release.

2.3 Remote I/O System

(1) Remote I/O module system

Outline

This is a system which is used to set I/O modules farther away (more than 4 m) from the basic base. When an optical cable is used, input and output at a distance of 10 km can be controlled.

This system is constructed with a basic base and one or a plurality of expansion bases. A remote I/O master station is mounted in the basic base or special expansion base and (a) remote I/O local station(s) is(are) mounted in the expansion base(s).

One remote I/O master station can control up to 512 I/O points of a remote station. Up to 10 local stations (10 expansion bases) having up to 512 I/O points each can be added.

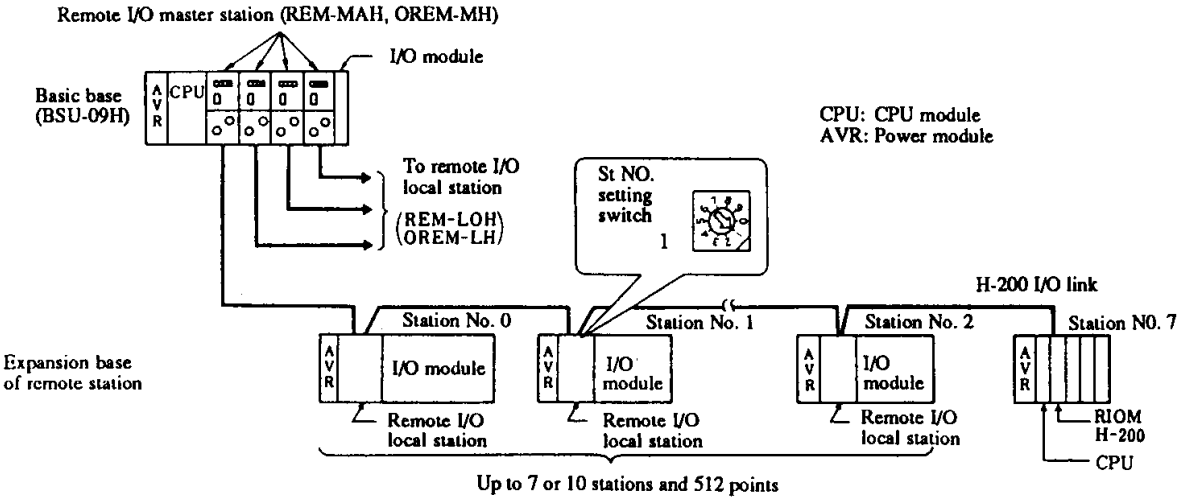
Even if remote I/O modules are mounted, the sequence program is not affected in execution.

When a basic base (BSU-09H) for 9 slots is used, up to 4 remote I/O master stations can be mounted. The master stations occupy a location of two slots of I/O modules. However, since one master station can control an I/O module of 512 points, the number of I/O points can be extended.

When 4 remote master stations and a 32-point module are mounted on the basic base (BSU-09H) in the H-302 (H-300) system, up to 2080 points (512 points x 4 + 32 points) can be controlled.

Each remote I/O local station module can be used for programming and monitoring. (A system in which a remote I/O master station is mounted in a special expansion base is excluded. H-200 remote local stations cannot be used.)

Configuration example



{ Basic base ..... Power module, CPU module, remote master station (at least one each) I/O module, sophisticated function module
{ Expansion bases ..... Power module, remote local station, I/O module, sophisticated function module

Points of configuration

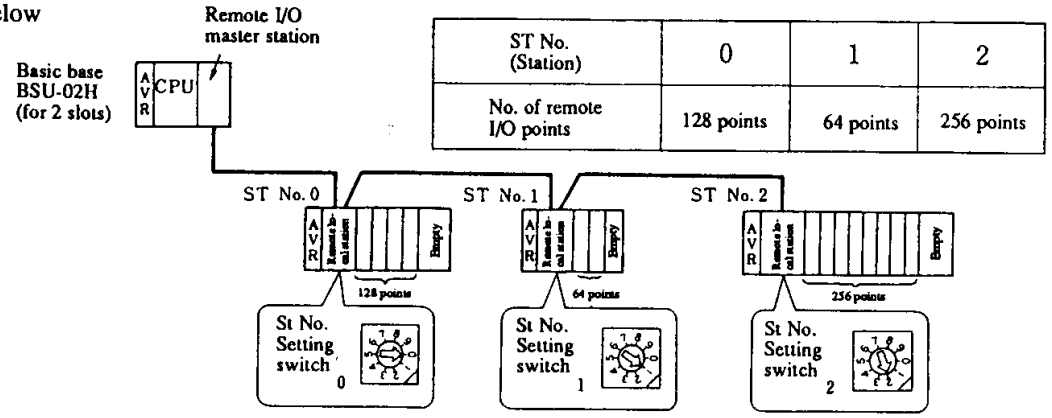
[1] For one master station, up to 10 local stations and 512 I/O points

[2] 500 m (10 km when an optical cable is used) between master station and remotest local station and up to 500 m (1 km when an optical cable is used) between stations

[3] Set the rotary switch number of each remote local station to the station number. Assign station numbers so that they are not duplicated.

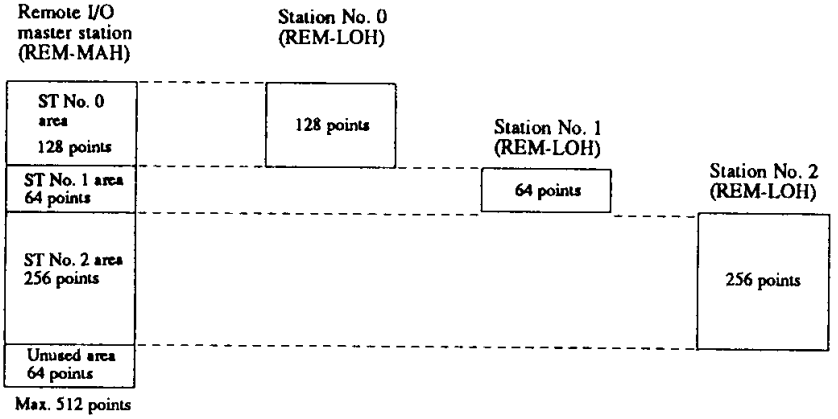
Concept on the number of I/O points of the remote I/O module

When three remote I/O local stations are used for a remote I/O master station and the local stations are assigned as shown below



ST No. (Station)	0	1	2
No. of remote I/O points	128 points	64 points	256 points

Control status of the number of I/O points of the remote I/O master station



Specification of the remote I/O system

No. of master stations mounted on basic base		BSU-02H	BSU-05H	BSU-09H	BEU-04H
		Max. 1 station	Max. 2 stations	Max. 4 stations	Max. 2 stations
CPU		CPU2-**H, CPUP-**H, CUP-**Ha			
Remote master station		REM-MAH, OREM-MH (Max. 4 stations)			
Remote local station		REM-MAH, OREM-LH (Max. 10 stations x 4 = 40 stations)			
Max. No. of local stations / master station		10 stations (1 station / additional base)			
Max. number of remote points		512 points (32 words) / master station			
Transmission speed		1.5M bits /s			
Refresh time		About 15 ms / 512 points (when 10 local stations are connected)			
Max. cable length		Total extension length 500 m (500 m between stations): When coaxial cables are used Total extension length 10 km (1 km between stations): When optical cables are used			
* Cable to be used	Coaxial	Recommended cables are shielding 5D2VTxE or equivalent (by Fujikura Densen), 5D2VCCY or equivalent (by Showa Densen), and ECXF-5D-2VSV (by Hitachi Densen) and recommended cable connectors are BNC-P-5DV (by Hirose Denki).			
	Optical	Between modules: CA9003-□M-□L□ (By Hitachi) Last stage local station: CA9103-1M-AL (By Hitachi)			
Services of peripheral equipment		Possible (A remote local station connected to the peripheral equipment can program or monitor a CPU connected to the remote master station. In this case, the local station should be assigned to I/O of the CPU.)			Impossible

* Neither cables nor connectors are supplied together with the product. Prepare them beforehand.

(2) Remote I/O MINI module system

Outline

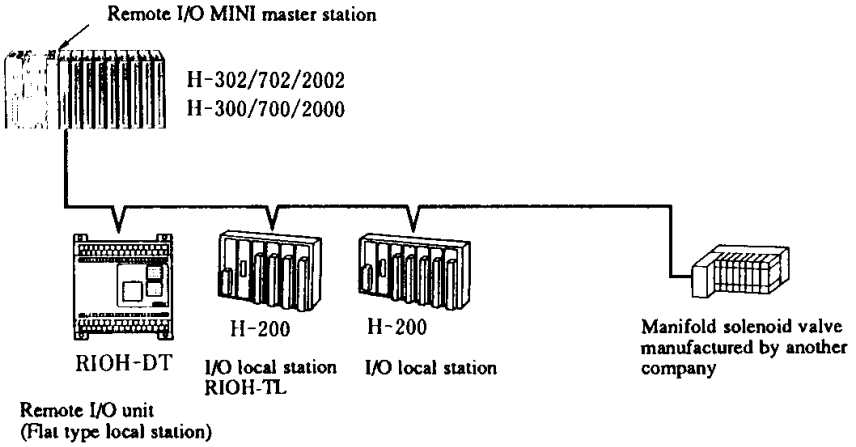
This is a system which is used to set I/O modules farther away (more than 4 m) from the basic base. Twisted pair cables are used to connect the remote I/O MINI modules. Input and output at a distance of maximum 300 m (between stations or total extension) can be controlled.

This system can perform a remote I/O operation or CPU link operation depending on the module to be used, so that various system configurations are available. As local stations, H-200 remote local stations and manifold solenoid valves of other companies can be connected and controlled.

One remote I/O MINI master station occupies 128 I/O points and can control an I/O module of up to 1028 input points and 1028 output points.

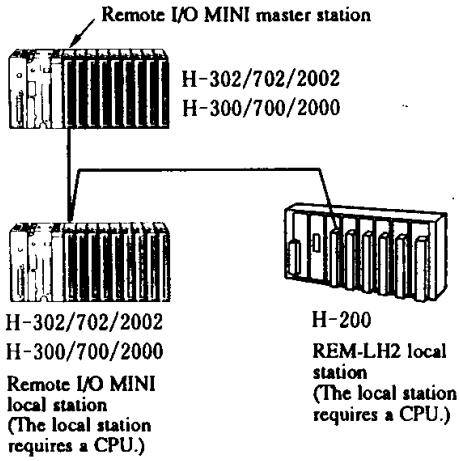
Configuration example

(a) Example using the remote operation



Configuration example

(b) Example using the CPU link operation



Points of configuration

[1] Up to 12 local stations for a master station

[2] Cable length

Total length 150 m (150 m between stations): 0.3 mm^2

Total length 300 m (300 m between stations): 0.75 mm^2

[3] The address (channel) of each local station is assigned by the rotary switch on the local station or the DIP switch. Each address should not be duplicated.

Specification comparison between remote I/O MINI and remote I/O

		Remote I/O MINI		Remote I/O	
Module type	Master station	REM-MMH		REM-MAH (coaxial), OREM-MH (optical)	
	Local station	REM-LMH		REM-LOH (coaxial), OREM-LH (optical)	
No. of transmission points		Max. 1024 input points Max. 1024 output points	64 words input and 64 words output	512 I/O points / master station	
No. of mountable master stations		Max. 32 modules / H-2002 or H-2000 system		Max. 4 modules / CPU	
No. of mountable local stations		12 stations / master station		10 stations / master station, 7 stations / master station (H-200)	
Transmission rate		768K bits/s		1.5M bits/s	
Transmission refresh time		3 to 45 ms		Max. 15 ms	
Transmission method		Half duplex serial transmission frame synchronization		Same as left	
Error check		Inverted dual transmission		CRC sum check	
Occupied slot, I/O points		1 slot, 128 points		2 slots, 0 point	
Cable		Twisted pair cable with common shield		Coaxial cable or optical cable	
Transmission distance		0.3 mm^2	150 m between stations, total extension length 150 m	Coaxial	500 m between stations, total extension length 500 m
		0.75 mm^2	300 m between stations, total extension length 300 m	Optical	1 km between stations, total extension length 10 km
Local station type		Connectable with products by other companies		Dedicated to H-series	
Peripheral equipment support		Impossible		Possible from local station	

2.4 CPU Link System

(1) CPU link module system

Outline

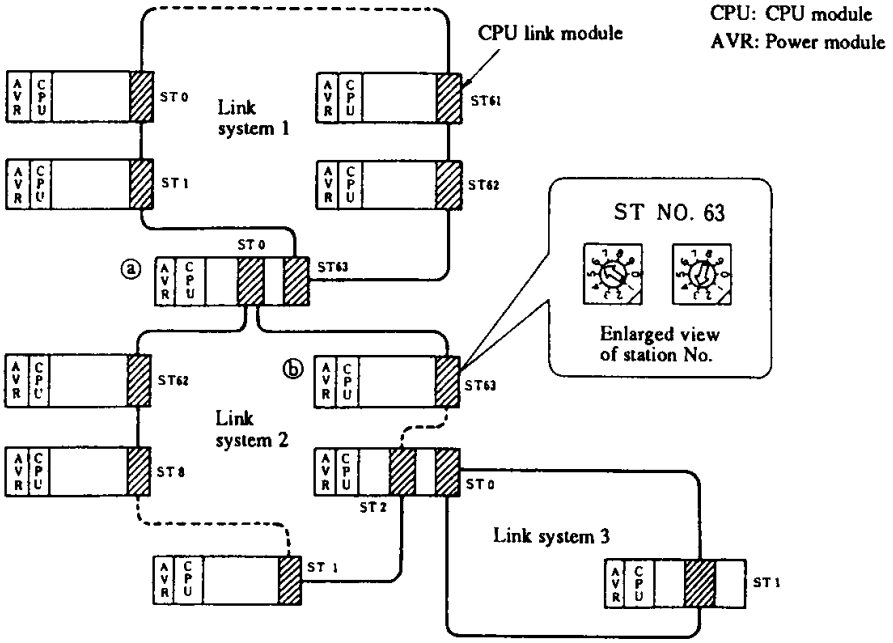
A plurality of CPUs (up to 64 CPUs) are connected in a loop form using CPU link modules and data (up to 1024 words) is transmitted or received among the connected CPUs so as to realize related operations between the CPUs.

Up to two CPU link modules can be mounted to one CPU so as form two loops.

CPU link areas (WL0 to WL3FF and WL10000 to WL13FF) are used to transmit or receive data and can be used as bit or word internal output when the CPU link modules are not used.

Between the CPUs of the stations constituting the link system, the CPU of any station can program or monitor the CPU of another station.

Configuration example



Points of configuration

[1] Up to two link modules can be mounted on the basic base regardless of the CPU type. I/O slots for inserting them in can be selected optionally.

[2] Up to 64 CPU modules can be linked to one link system.

[3] Station Nos. 0 to 63 are assigned to the CPU link modules of one link system without duplicated, though station No. 0 (master station) is necessary. Each station No. is set by the rotary switch of the CPU link module.

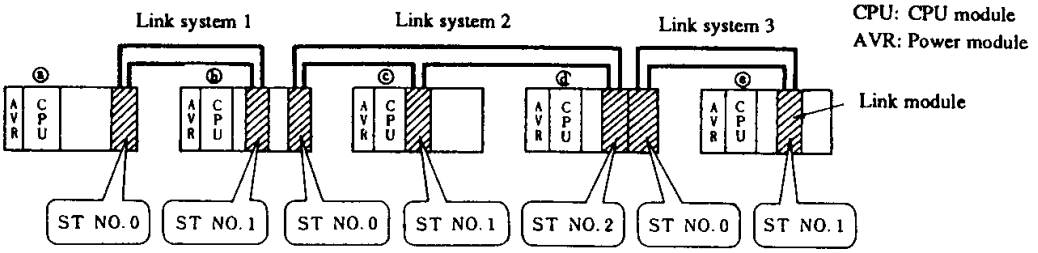
[4] Total cable length: Coaxial cable: 1 km (max. 500 m between stations), optical cable: 15 km (max. 1 km between stations)

[5] The CPU module ⓐ can program or monitor the CPU of any station in the link systems 1 and 2 and the CPU module ⓑ can program or monitor the CPU of any station in the link systems 2 and 3.

Concept on link area

It is assumed that the CPU link areas are assigned as shown below. (Each area is set by the peripheral equipment. For further details, refer to the operation manual of peripheral equipment.)

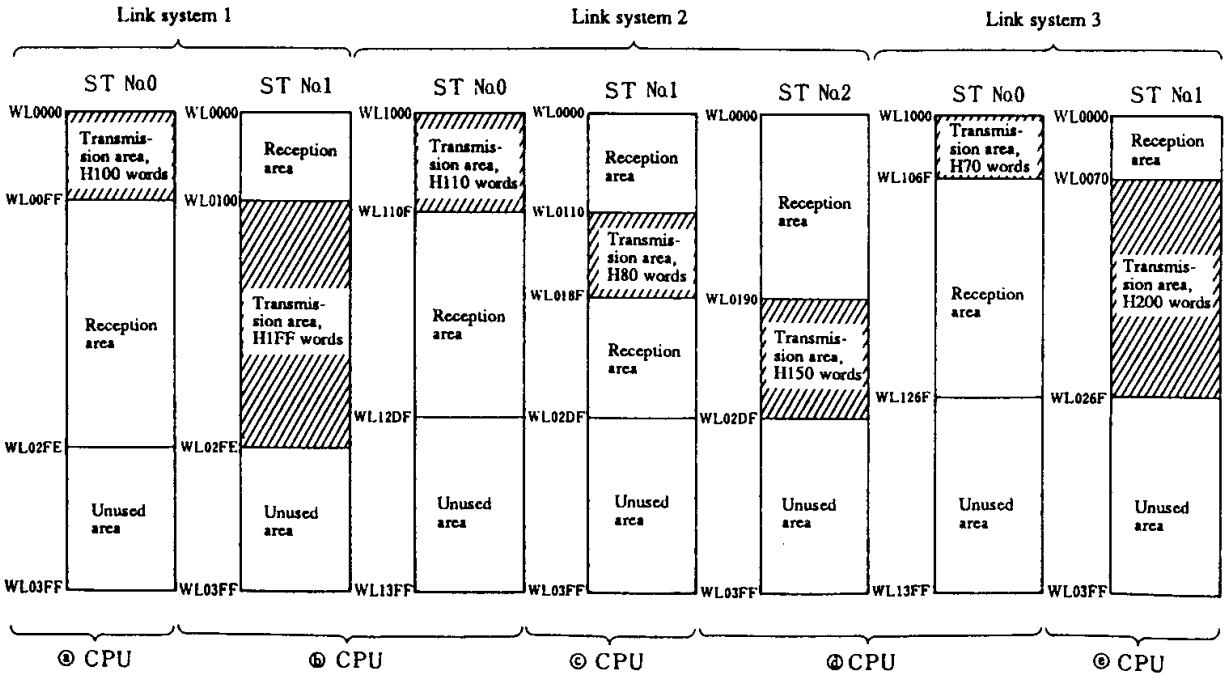
	Link system 1		Link system 2			Link system 3	
	ST No. 0	ST No. 1	ST No. 0	ST No. 1	ST No. 2	ST No. 0	ST No. 1
Assignment count	H100 words	H1FF words	H110 words	H80 words	H150 words	H70 words	H200 words



The link area of each CPU is divided into a transmission area and reception area. In the transmission area, data of the ST (station) No. of the self station is set. This data is transferred successively to each link area in the same link. Namely, the CPUs in the same link have the same data.

The status when two link modules are mounted to one CPU is as follows: The two types of link areas (WL0000 to WL03FF, WL1000 to WL13FF) in the CPU are used and a method that CPU 1 (WL000 to WL03FF) and CPU 2 (WL1000 to WL13FF) correspond to the links is used. When the CPU extends across two links, it assigns and controls data to each link area.

Note: The numerical values shown below are hexadecimal numbers.



Specification of CPU link system

Item			Specification
Module type			LINK-H (coaxial), OLIK-H (optical)
Connectable CPU type			CPU22-**H, CPUP-**H, CPU-**Ha
No. of connectable CPUs			Max. 64 CPUs per system by 2 loops
Max. link data count / loop			1024 words (WL0 to WL3FF or WL1000 to WL13FF)
Max. link data count / CPU			1024 words by 2 loops
Data transfer method			Common data area method
Transmission and reception area assignment			Parameter set by peripheral equipment
Station No. specification			Specification by rotary switch (0 to 63)
Transmission speed			1.0M bits/s
Actual data update cycle			Max. 390 ms
Com-munication method	Communication method		Half duplex bit serial
	Transmission line type		Talken passing
	Loop length	Coaxial	Total extension length 1 km (500 m between stations)
		Optical	Total extension length 15 km (1 km between stations)
	Faulty station recovery processing		Bypass method
	Cable and connector	Coaxial	Prepare shielding cables. Recommended cables: 5D2VTxE or equivalent (By Fujikura Densen) 5D2VCCY or equivalent (By Showa Densen) ECXF, 5D2V-SV (By Hitachi Densen) Recommended cable connectors are BNC-P-5DV (By Hirose Denki).
		Optical	CA9103-( )M-□L□ (By Hitachi) (For further details, refer to the CPU link module manual.)
Services of peripheral equipment			A CPU connected to the peripheral equipment can program or monitor a CPU connected to the same link system.

* Neither cables nor connectors are supplied together with the product. Prepare them beforehand.

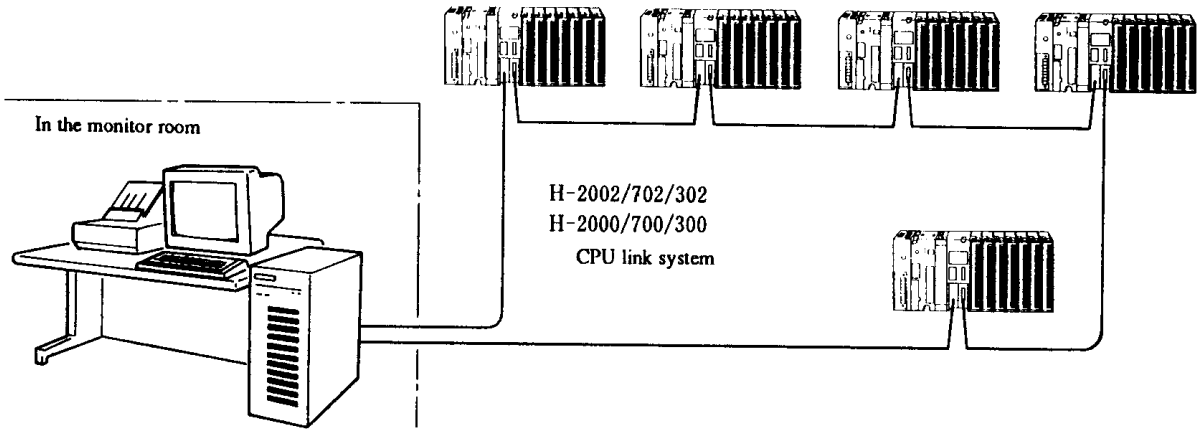
(2) Monitoring system by GM-4000 (Domestic market only)

Outline

The GM-4000 system is a graphic monitoring system having a large 20" graphic CRT and dust-proof keyboard. Since the CPU link areas are used to transmit or receive data to or from the H-series programmable controller, a large capacity of data can be handled at high speed.

The GM-4000 graphic monitoring system is a program-free system which can be handled simply by a beginner.

Configuration example



GM-4000 graphic monitoring system

Points of configuration

[1] Various options are set in the GM-4000 body depending on the system.

[2] Up to 2 loops of CPU links can be connected to the GM-4000 system regardless of the CPU type. (Optional)

[3] Up to 64 CPU modules can be linked to one link system.

[4] Station Nos. 0 to 63 are assigned to the CPU link modules of one link system without duplicated, though station No. 0 (master station) is necessary. Each station No. is set by the rotary switch of the CPU link module.

[5] Total cable length:

Coaxial cable: 1 km (500 m between stations)

Optical cable: 15 km (1 km between stations)

Specification of GM-4000

Item		Specification
System to be connected		H-302, H-702, H-2002, H-300, H-700, or H-2000 system
Image generation memory content		Standard 512K bytes, extension 2M bytes
Image memory content		Standard 1M bytes (for 2 screens of CRT), extension 2M bytes (for 4 screens of CRT)
User memory capacity		Standard 512K bytes, extension 2M bytes
Kanji ROM		JIS 1st level (158 types)
Display	Character	92 characters by 56 lines (5152 characters)
	Graphic	736 x 560 dots (on CRT), scroll max. 1600 x 1600 dots
Interface with PC		LINK-H or OLINK-H, max. 2 loops
Man-machine interface	CRT	20", analog RGB, H (SYNC) raster scan, non-interlace
	Keyboard	RS-422, 9600 bits/s, serial interface
	Tablet	DT-4103 (Seiko Denshi Kogyo, Ltd., optional)
	Printer	Centronics VP-1000, 2550 (EPSON, optional), etc.
	Floppy disk	3.5" double-sided high density (HD type)
Others		With a calendar and clock function

The GM-4000 system may have different optional functions.

2.5 Host Link System

Outline

A personal computer or host computer is connected to the CPU module or communication function module of the programmable controller so as transmit or receive data. The communication function module is an intelligent serial port (COMM) module, intelligent GPIB module, or BASIC module.

Their features are as follows:

- The CPU module is equipped with a peripheral port and general purpose port (only CPU2-**H), which can be used for communication.
- The intelligent serial port (COMM) module has a two-way start function for starting communication with a personal computer from the programmable controller and can be connected to Field net (FNT) 600 (2-port LAN) which is an LAN manufactured by Hitachi Engineering, Ltd.
- The intelligent GPIB module is used to construct an automatic measuring system by connecting various measuring instruments and I/O devices to the same interface bus.
- The BASIC module can process data necessary for programmable controller processing.

(1) System using CPU module

Outline

The H-series CPU module has a communication function. There are two communication ports (*1) in the CPU. One is a peripheral port (port for connecting the peripheral equipment) and the other is a general purpose serial port (general purpose port). These ports are based on the RS-232C serial interface. The ports can be used to communicate with the host computer.

For detailed specification of each port, see Section 3.2. For examples using the peripheral port, refer to Chapter 6 of the software edition.

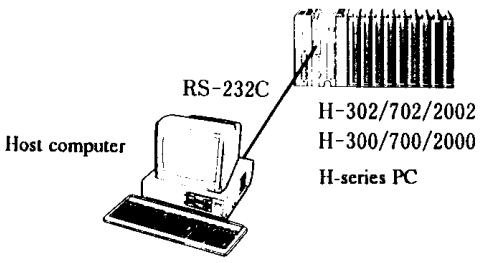
For examples using the general purpose port, refer to the TRNS 0 and RECV 0 instructions described in the detailed section of the instruction specification in Chapter 3 of the software edition.

*1: Only CPU2-**H has a general purpose port. CPUP-**H and CPU-**Ha have only a peripheral port.

(a) System using the peripheral port

The communication procedure of the peripheral port of the CPU module is a special procedure which is the same as that of the COMM module. The interface is based on RS-232C. The peripheral port is used to connect the peripheral equipment, though it can be connected to a personal computer.

Configuration example



Points of configuration

[1] RS-232C is used to connect a personal computer to the peripheral port.

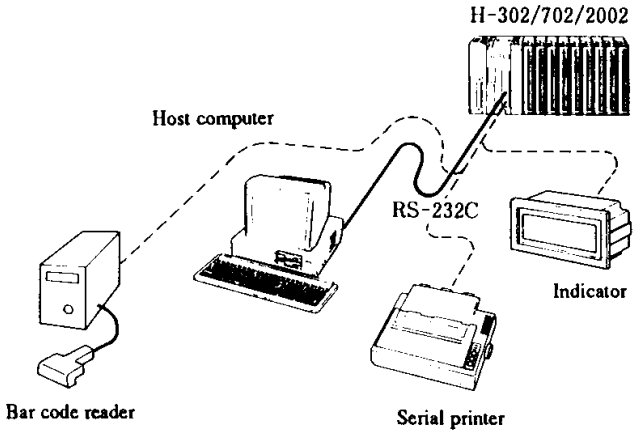
[2] When the peripheral port is used for communication, no peripheral equipment can be connected to the CPU module.

[3] The transmission rate is 19.2k bits/s or 4800 bits/s.

(b) System using the general purpose port

This function is used when the CPU type is CPU2-**H. The communication procedure of the general purpose port of the CPU module is a non-protocol. When a data transmission and reception instruction is executed when the CPU module is in operation, data is transmitted or received. The interface is based on RS-232C.

Configuration example



Points of configuration

[1] RS-232C is used to connect a personal computer to the general purpose port.

[2] An indicator, printer, or bar code reader which has an RS-232C port can be connected to the general purpose port in place of the host computer so as to transmit or receive data.

[3] The transmission rate is max. 4800 bits/s (variable).

(2) System using the intelligent serial port (COMM) module

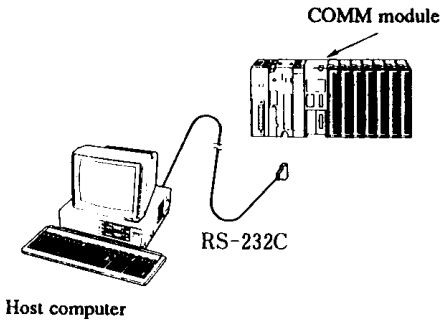
Outline

Only one COMM module can be mounted on the basic base of the H-series CPU and a data request can be received from the host computer or a start request can be transmitted to the host computer. Field net (FNT) 600 (2-port LAN) which is an LAN manufactured by Hitachi Engineering, Ltd. can be connected via the COMM module.

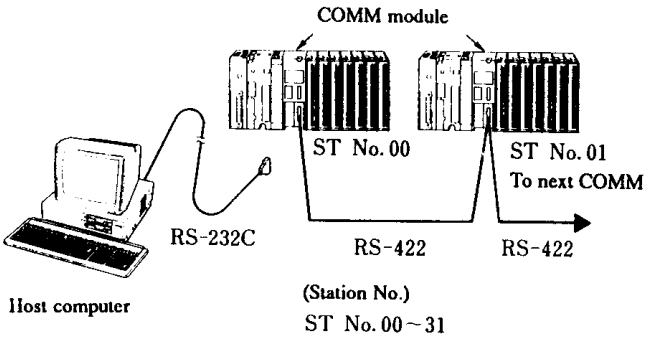
Using the RS-232C port of the COMM module, the CPU module can be programmed or monitored.

Configuration example

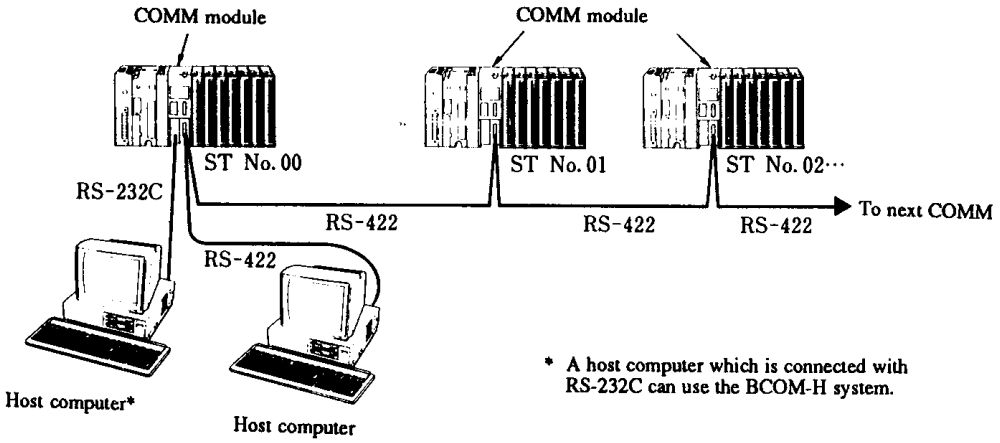
[1] In the case of 1:1



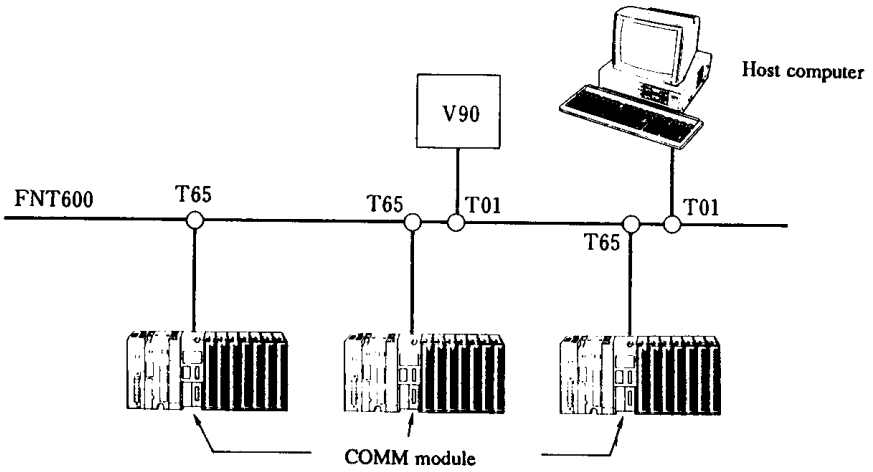
[2] In the case of 1:N (N ≤ 32)



[3] In the case of 2:1 or 2:N (N ≤ 32)



[4] When connected to FNT600 (2-port LAN)



Points of configuration

[1] Only one COMM module can be mounted to the basic base. The mounting slot can be selected optionally. The module cannot be mounted on the expansion base.

[2] RS-232C or RS-422 is used between the host computer and COMM module. When connecting the COMM modules to each other, RS-422 is used.

[3] As to the set number of nodes on FNT600, up to 64 modules can be connected, including those for the personal computer (T01) and those for COMM module (T65).

[4] The COMM interface board of BCOM-H can be connected to the peripheral port of the CPU or remote local station module.

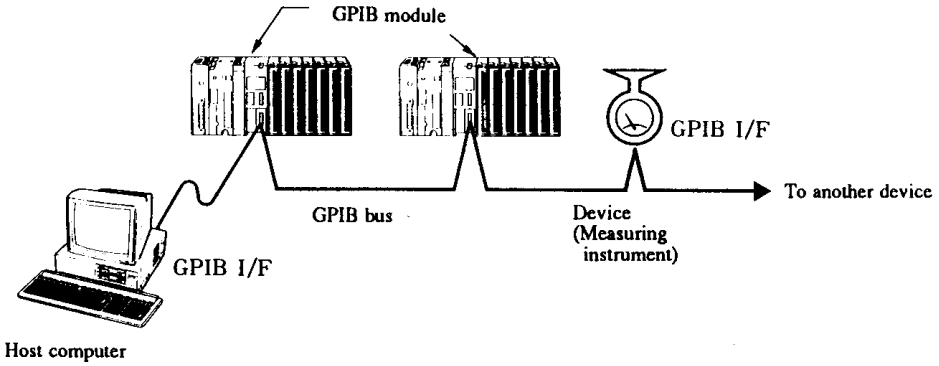
(3) System using the intelligent GPIB module (GPIB-H)

Outline

GPIB is an interface which is used most generally so as to construct an automatic measuring system by connecting various measuring instruments, I/O devices, and a personal computer onto a bus.

The GPIB module is a device having this interface. When the communication protocol is of the same method, up to 15 devices can be combined as a system.

Configuration example



Points of configuration

[1] Only one GPIB module can be mounted to the basic base.

[2] The transfer rate of the GPIB module is the same as the one of a slowest device among the devices in operation.

[3] The cable length for connecting the devices is restricted as shown below.

Basic specification of GPIB

No.	Item	Description
1	Requirements	IEEE-488-1975/78/80
2	Transfer rate	1M bytes/s max.
3	No. of devices to be connected	15 devices
4	Cable length between devices	4 m max.
5	Total cable length	$L \leq 2N$ m and $L \leq 20$ m

L: Total cable length N: No. of devices to be connected

(4) System using the BASIC module

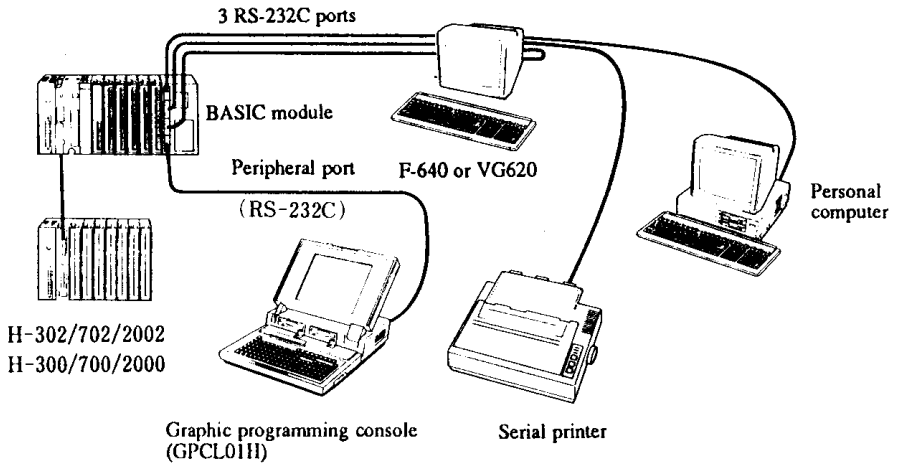
Outline

The BASIC module can be programmed in the HI-BASIC language and operates in asynchronization with the CPU module of the H-series PCS.

Necessary data (information) can be inputted or outputted directly into or from the internal output area (M, WM, R, WR, L, WL) of the programmable controller (H-series CPU) by the BASIC program. Therefore, the data of the programmable controller can be processed at high speed.

A task which requires the BASIC program can be started from the sequence program or each I/O terminal. Therefore, necessary processing can be performed when necessary.

Configuration example



Points of configuration

[1] Only one BASIC module can be mounted to the basic base. It is desirable to use the three slots at the right end for mounting. The module cannot be mounted on the expansion base.

[2] Connect external devices to ports 0 to 2 of the BASIC module. (The CGT can be connected only to port 0.)

[3] Note that even if the CPU module is write occupied by the peripheral equipment, the BASIC module can be freely accessed directly by the BASIC program.

[4] The transmission rate when the three ports can be used for transmission or reception at the same time is up to 4800 bits/s. When the transmission rate is 9600 bits/s, only transmission is available.

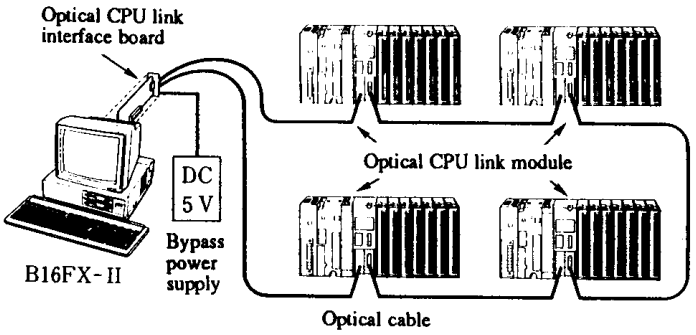
(5) System using BOLINK-H (Domestic market only)

Outline

BOLINK-H communicates with the CPU at high speed by using the H-series optical CPU link when the optical CPU link interface board is mounted in B16FX-II.

Two optical CPU link interfaces (for two loops) can be mounted in a personal computer, so that the system can be extended easily. Since optical fiber communication is used, the system is suitable for long distance transmission and superior in noise resistance.

Configuration example



Points of configuration

[1] When it is required to keep the link system on even if the B16FX-II body is turned off, a supply voltage of 5 V for bypass is necessary.

[2] The maximum transmission distance of the optical link communication system is 1 km between stations and 15 km in total extension.

[3] To load the communication software in B16FX-II, an extended FDD component is necessary.

(BOLINK-H consists of a set of an optical CPU link interface board and control software.)

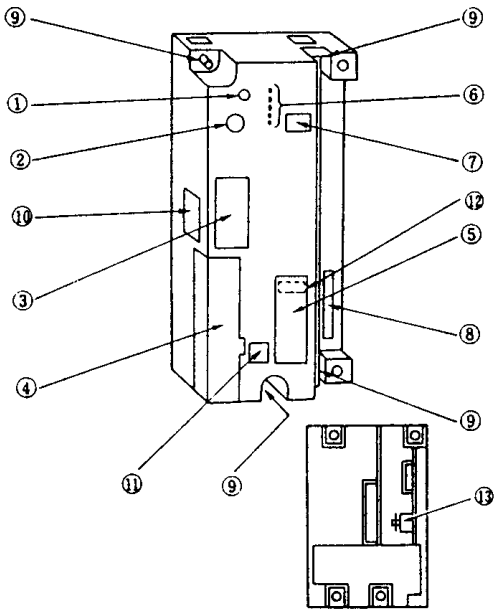
Chapter 3 CPU Module

The CPU module inputs or outputs control data and operates and stores data. Therefore, it is necessary to mount a CPU module in the programmable controller.

When the CPU module is purchased, no memory cassette is supplied. The CPU function is performed together with the memory cassette. Please purchase a memory cassette in correspondence with the user's memory size (see Chapter 4, "Memory Cassette").

3.1 Structure

Parts Name

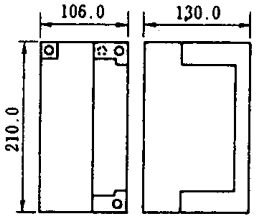


Back of CPU
(Example of H-302)

Type and Name

Type	Product name	Weight	Internal supply current
CPU2-20H	H-2002CPU	950 g	2.75 A
CPU2-07H	H-702CPU	800 g	2.05 A
CPU2-03H	H-302CPU	800 g	2.05 A
CPUP-20H	H-2000CPU	950 g	2.75 A
CPUP-07H	H-700CPU	800 g	2.05 A
CPUP-03H	H-300CPU	800 g	2.05 A
CPU-20Ha	H-2000CPU	950 g	2.75 A
CPU-07Ha	H-700CPU	800 g	2.05 A
CPU-03Ha	H-300CPU	800 g	2.05 A

Dimensions (mm)



No.	Name	Function
⑪	Power failure storage reset push button	The power failure storage area is reset. (Invalid when the RUN lamp is on)
⑫	Mode changing key switch	RUN: The sequence program is operated. REMOTE: The CPU is operated by the peripheral equipment and host computer. STOP: The sequence program is stopped to operate.
⑬	Peripheral port connector (cover)	Connectors for the peripheral equipment and host computer. PERIPHERAL
⑭	Expansion base connector cover)	Connector for the I/O controller
⑮	General purpose port connector (cover)	General purpose port connector (Only CPU2-**H). SERIAL I/O
⑯	Status indication LED	The CPU operation status is indicated. RUN: CPU on-line HLT: Halt status (Temporary stop) SIM: Simulation mode FRC: Force mode ERR: CPU error BTE: Battery error (Only CPU2-**H)
⑰	Error code indication 7-segment indicator	The error code of the error cause is displayed in 2 digits when a CPU error occurs.
⑱	Memory cassette connector	Connector for the memory cassette
⑲	Module set screw	Set screws for fixing the module to the basic base
⑩	Specification plate	The manufacturing No. of the product is entered.
⑪	Recipe plate	The manufacturing No. stated on the specification plate is entered.
⑫	RUN-ERR contact output changing switch	The power contact ON condition on the basic base is switched. (Only CPU2-**H)
⑬	General purpose port LB check changing switch	The switch is set to CHECK for LB check. It is generally set to the opposite side. (Only CPU2-**H)

LB: Loop back

3.2 Specification of RS-232C Ports

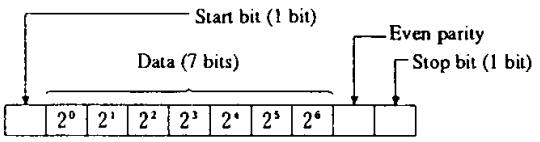
(1) Specification of the peripheral (special communication procedure) port

Outline

The peripheral port is connected to the peripheral equipment of the H-series and can transmit or receive various data to or from the CPU module as a communication port by the special H-series procedure (high protocol).

For the special H-series communication procedure, refer to Chapter 6, "Communication with Host Computer" of the software edition.

Specification of the peripheral port

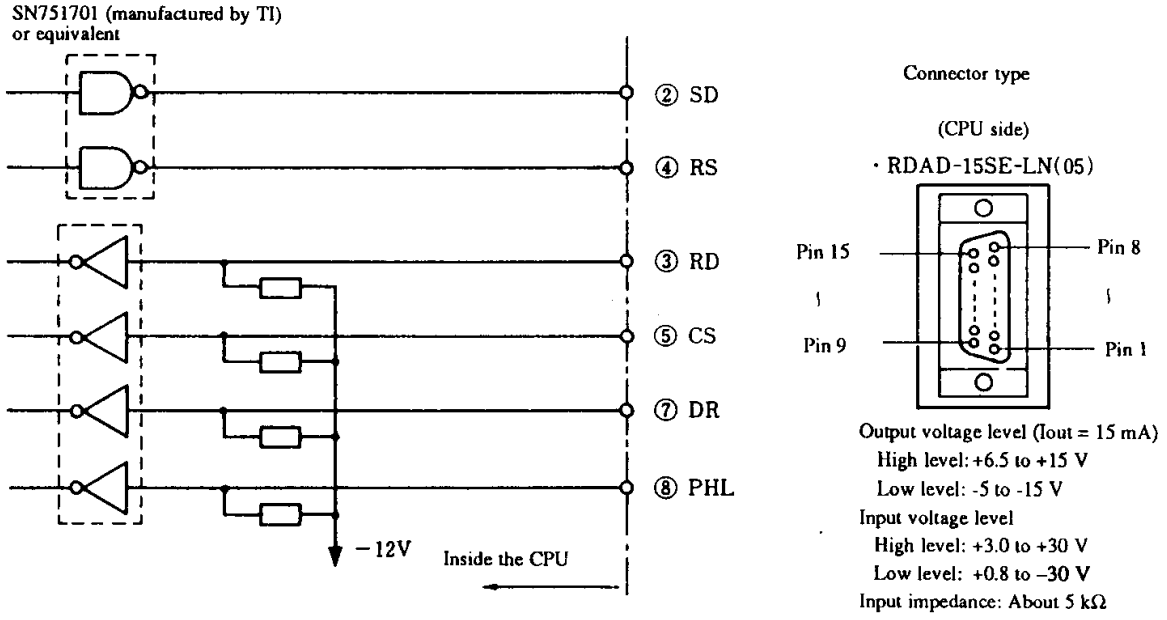
Item	Specification
Transmission rate	4800 bits/s, 19200 bits/s (Selected by the PIIL signal)
Communication method	Half duplex method
Synchronization method	Start-stop synchronization method
Start method	One-side start method by a command of the host computer
Transmission method	Serial transmission (bit serial transmission)
Transmission code	ASCII
Transmission code configuration (fixed)	
Transmission code sending order	Sent starting with the lower bit (2^0) in character units
Error control	Vertical parity check (even), sum check, overrun check, framing error check
Transmission unit	In message units (variable length)
Longest message	503 bytes per message (transmission control character included)
Interface	Based on RS-232C (maximum cable length 15 m, 15-pin connector used)
Control procedure	Special H-series procedure (high protocol). Refer to Chapter 6 of the software edition.
Connector and cable	• Connector on the CPU side: RDAD-15SE-LN(05) by Hirose Denki • Connector on the cable side: HDAB-15P (Case: HDA-CTF1) by Hirose Denki • Use 7-pair to 12-pair twisted pair cables (with common shield).

Peripheral port connector signal name list

Pin No.	Abbreviation of signal	Direction		Meaning	Connection method
		CPU	Host		
1	NC	→		Unused	Keep the cable unconnected.
2	SD	→		CPU transmission data	Connect the cable to the RD terminal of the host computer.
3	RD	←		CPU reception data	Connect the cable to the SD terminal of the host computer.
4	RS*	→		When the CPU is ready for reception, the signal goes high.	Connect the cable to the CS terminal of the host computer.
5	CS*	←		When the CPU transmits data, the signal should be high.	Connect the cable to the RS terminal of the host computer or fix it high.
6	RV1	—	—	Unused	Keep the cable unconnected.
7	DR	←		When the CPU is ready for transmission and reception, the signal goes high.	Connect the cable to the ER terminal of the host computer.
8	PHL	←		Transmission rate changing Low level: 4800 bits/s High level: 19200 bits/s	Set the signal low or high according to the transmission rate to be used.
9·10	SG	—	—	Signal ground	Connect the cable to the SG terminal of the host computer.
11·12	PV5	—	—	5 V output	Keep the cable unconnected.
13	NV12	—	—	-12 V output	Keep the cable unconnected.
14	PV12	—	—	+12 V output	Keep the cable unconnected.
15	NC	—	—	Unused	Keep the cable unconnected.

* Note that the RS and CS signals are different from those under the normal RS-232C specification. (See Item (2), "Specification of the general purpose port".)

The circuit diagram of the RS-232C interface of the peripheral port of the CPU module is shown below.



RS-232C interface circuit (peripheral port)

(2) Specification of the general purpose (non-protocol) port (Valid only when the CPU type is CPU2-**H)

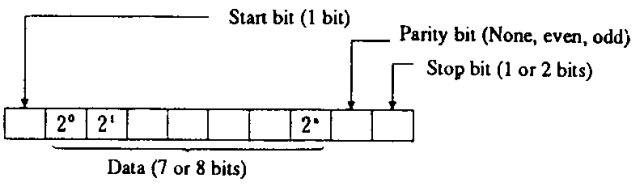
Outline

The general purpose port is a communication port which is started by the sequence program and can transmit or receive I/O data between the CPU module and connected device. The communication procedure and control character can be specified freely by the user program.

For instructions (TRNS 0, RECV 0) using the general purpose port, refer to Section 3.3, "Detailed Instruction Specification" of the software edition.

The general purpose port has a loopback check function for separation in case of a failure. For details of the loopback check function, see Chapter 16, "Troubleshooting".

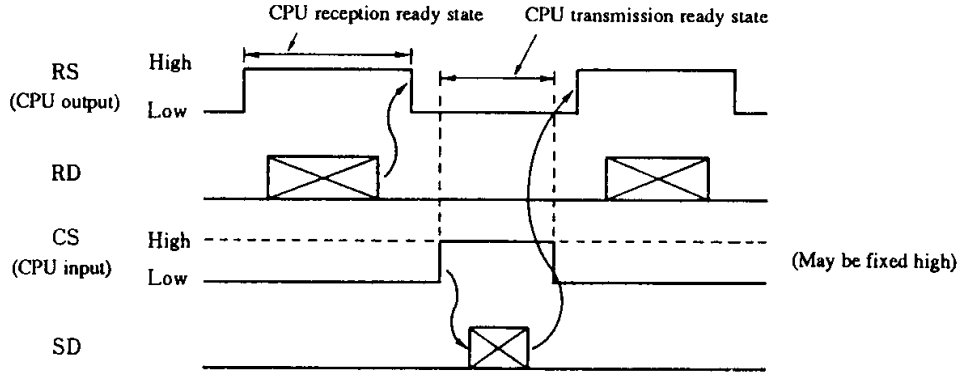
Specification of the general purpose port

Item	Specification
Transmission rate	4800, 2400, 1200, 600, 300 bits/s
Communication method	Half duplex method
Synchronization method	Start-stop synchronization method
Start method	One-side start method by a command of the host computer
Transmission method	Serial transmission (bit serial transmission)
Transmission code	User definition
Transmission code configuration	
Transmission code sending order	Sent starting with the lower bit (2^0) in character units
Error control	Vertical parity check, overrun check, framing error check
Transmission unit	In message units (variable length)
Longest message	503 bytes per message (transmission control character included)
Interface	Based on RS-232C (maximum cable length 15 m, 15-pin connector used)
Control procedure	Non-protocol
Control code	User definition
Connector and cable	• Connector on the CPU side: SDBG-15S by Hirose Denki • Connector on the cable side: HDAB-15P (Case: HDA-CTF1) by Hirose Denki • Use 7-pair to 12-pair twisted pair cables (with common shield).

CPU2-H module general purpose port connector signal name list**

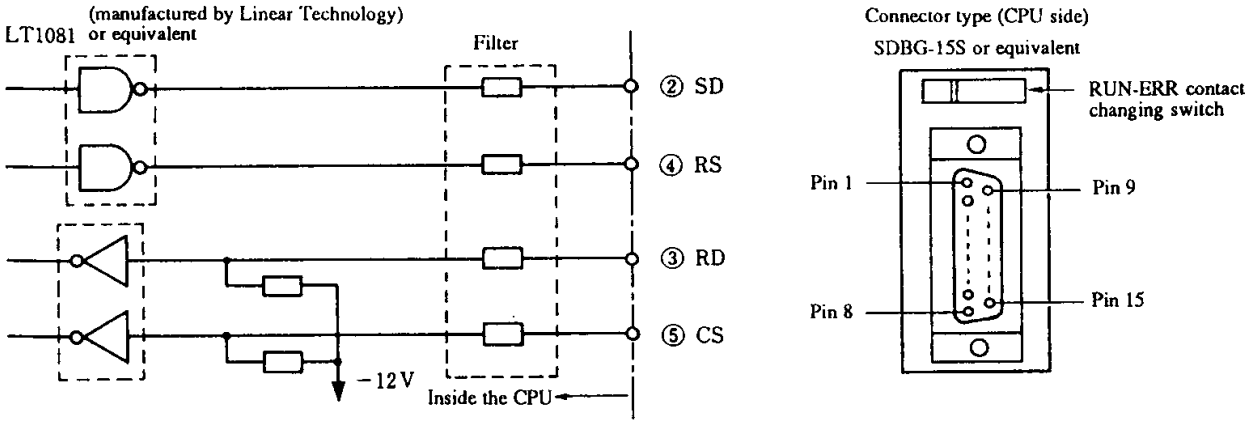
Pin No.	Abbreviation of signal	Direction		Meaning	Connection method
		CPU	Host		
1	NC	—	—	Unused	Keep the cable unconnected.
2	SD	→		CPU transmission data	Connect the pin to the RD terminal of the external device.
3	RD	←		CPU reception data	Connect the pin to the SD terminal of the external device.
4	RS*	→		When the CPU is ready for reception, the signal goes high.	Connect the pin to the CS terminal of the external device.
5	CS*	←		When the CPU transmits data, the signal should be high.	Connect the pin to the RS terminal of the external device or fix it high.
9	SG	—	—	Signal ground	Connect the pin to the SG terminal of the host computer.
7, 8 10 - 15	NC			Unused	Keep the pin unconnected.

* Note that the signals RS and CS are different in the following points compared with the normal RS-232C specification.



Meanings of the signals RS and CS

The circuit diagram of the RS-232C interface of the general purpose port of the CPU2-**H module is shown below.



Output voltage level (Iout = 15 mA)
High level: +6.5 to +15 V
Low level: -5 to -15 V

Input voltage level
High level: +3.0 to +30 V
Low level: +0.8 to −30 V

Input impedance:
About 5 kΩ

RS-232C interface circuit

3.3 Performance List

Item \ Type				Specification					
				CPU2-20H	CPUP-20H CPU-20Ha	CPU2-07H	CPUP-07H CPU-07Ha	CPU2-03H	CPUP-03H CPU-03Ha
Control specification	Max. No. of slots to be used			64		20		9	
	No. of I/O points	32-point I/O module		Max. 2048 points		Max. 640 points		Max. 288 points	
		64-point I/O module		Max. 4096 points		Max. 1280 points		Max. 576 points	
		128-point I/O module		Max. 4096 points		Max. 2560 points		Max. 1152 points	
		64-point + remote I/O		Max. 5632 points		Max. 2816 points		Max. 2112 points	
	Command, ladder diagram	Processing method		Stored program cyclic method					
		Processing speed (μs)	Sequence instruction	0.4 to 4.1	0.5 to 4.9	0.9 to 8.1	1.1 to 9.7	0.9 to 8.1	1.1 - 9.7
			Arithmetic application instruction	3.6 to 2690	4.4 to 3224	6.9 to 3951	8.6 to 4737	6.9 to 3951	8.6 - 4737
		User program capacity		*1 48.5k steps max.		*1 15.7k steps max.		7.6k steps max.	
	HI-FLOW	Processing method		Stored program flow chart method					
		Processing speed		Statement: several μs to several tens μs Arithmetic operation: Several μs to several hundreds μs / instruction (same as command and ladder)					
		User program capacity		*1 Max. 27k steps		*1 Max. 13.7k steps		Max. 5.6k steps	
I/O processing specification	External I/O			4096 points / 256 words (X0 to X5A95, Y0 to Y5A95 / WX0 to WX5A7, WY0 to WY5A7) direct processing					
	Internal output	Bit		1984 points (R0 to R7BF)					
		Word		*1 50k words (WR0 to WRC3FF)		*1 17k words (WR0 to WR43FF)		1k words (WR0 to WR3FF)	
		Special	Bit	64 points (R7C0 to R7FF)					
			Word	512 words (WRF000 to WRF1FF)					
		CPU link		1024 words (16384 points) x 2 loops (L0 to L3FFF / L10000 to L13FFF; WL0 to WL3FFF / WL10000 to WL13FFF)					
		Remote I/O		512 points (32 words) x 4 systems					
		Both bit and word		16384 points / 1024 words (M0 to M3FFF/WM0 to WM3FF)					
	Timer, counter	No. of points		512 points (TD + CU) (Timer: 0 to 255)					
		Timer set value		0 to 65535 s, time base 0.01, 0.1, 1 s (0.01 s: Timer Nos. 0 to 63)					
		Counter set value		0 to 65535					
	65 Edge detection			Leading edge: 512 points, trailing edge: 512 points (dedicated to HI-ladder)					
Peripheral function	Program method			Command, ladder symbol, for HI-flow and BASIC					
	Peripheral equipment			Command programmer, portable graphic programmer, graphic programming console					
Maintenance function	Self diagnosis			• PC error (LED indication): Microcomputer error, watch dog timer error, memory error, program error, system RAM or ROM error, scan time monitor • Battery voltage drop detection, protection in case of power error, system reset, output module fuse blown-out detection (contact output excluded)					
	External failure diagnosis			Watch dog timer instruction					
5 V supply current (A)				*2 2.75 max.		*2 2.05 max.		*2 2.05 max	

*1: The value varies with the memory cassette type. *2: The supply current includes the supply current of the memory cassette.

Memory cassette type	Program (steps)	Data (word)
RAM*-48H, ROM*-48H	48.5 k	50 k
RAM*-16H, ROM*-16H	15.7 k	17 k
RAM*-08H	7.6 k	1 k
RAM*-04H	3.5 k	1 k

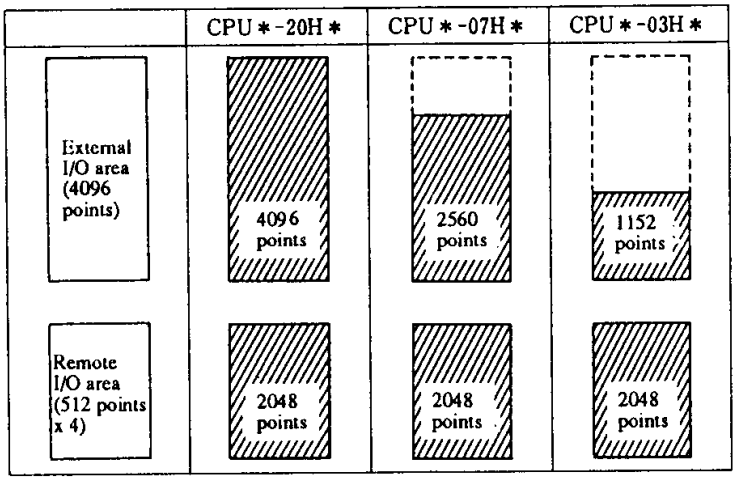
The capacity of the program (steps) is the total capacity of the ladder/command and HI-Flow.
The capacity of HI-Flow is set by the graphic programming console (GPCL01H).

Concept on the number of I/O points

The number of I/O points is determined under the following two conditions.

1. Maximum number of slots to be used
2. Number of mounted remote I/O modules (remote I/O MINI modules excluded)

Each CPU is provided with an external I/O area (4096 points) and remote I/O area (2048 points). The maximum number of I/O points which can be used under the above conditions is as shown in each hatched part.



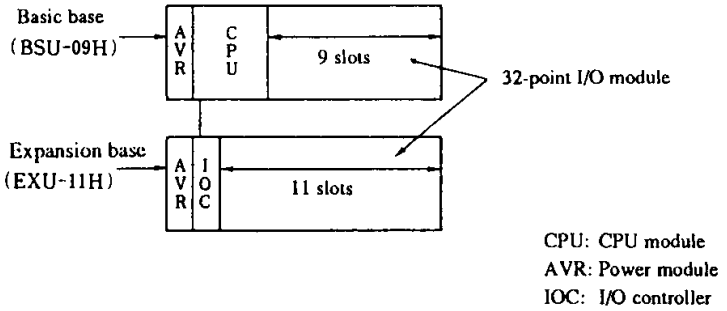
When CPU*-20* is used, the number of I/O points in the external I/O area may be more than the maximum number (4096 points) depending on the module selection method (see Example 2 on the next page). When many modules occupying 128 points are to be used, mount them in consideration of the maximum number of I/O points.

(1) When only the external I/O area is used (Concept on an independent system)

Example 1: When CPU*-07H* uses only 32-point I/O modules

32 points x 20 (maximum No. of slots) = 640 points

The number of I/O points is max. 640.



Example 2: When CPU*-20H* uses 128-point analog modules

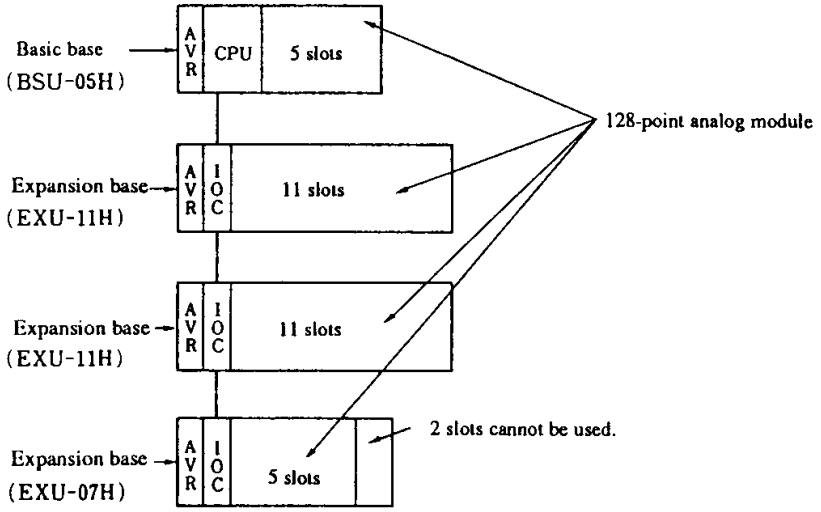
128 points x 64 (maximum No. of slots) = 8192 points

Since the number of I/O points is more than the maximum number of points 4096 in the external I/O area, they cannot be mounted.

When 128-point analog modules are mounted:

4096 points ÷ 128 points = 32

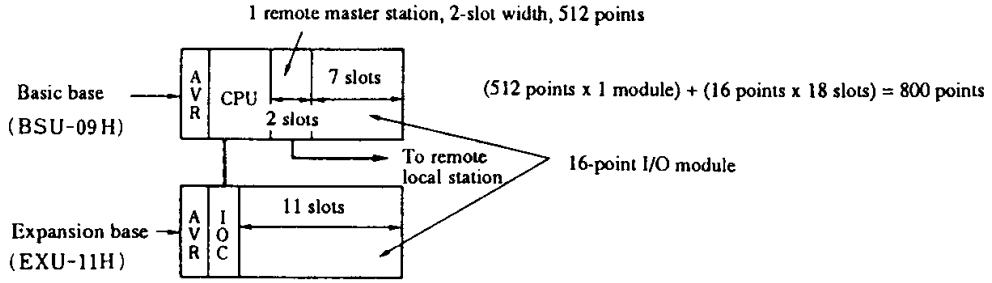
Therefore, CPU*-20H can mount up to 32 128-point analog modules.



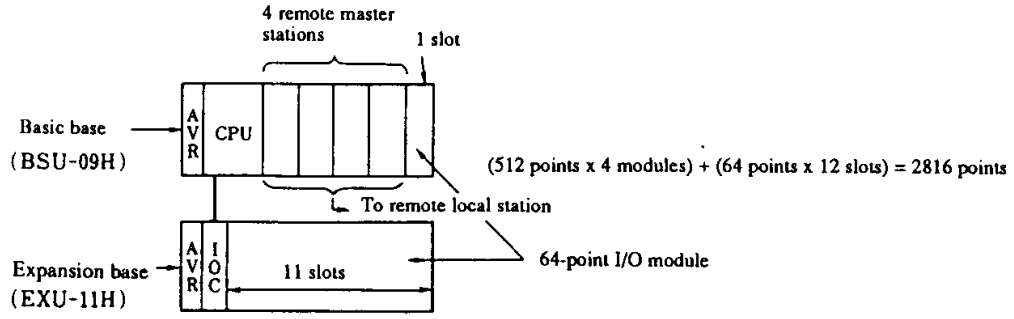
(2) When the external I/O area and remote I/O area are used (Concept on a remote I/O system)

No. of I/O points = (512 points x No. of remote master stations) + (No. of I/O points per slot x No. of slots to be used)

Example 1: When CPU*-07H* uses one remote I/O module and 18 16-point I/O modules



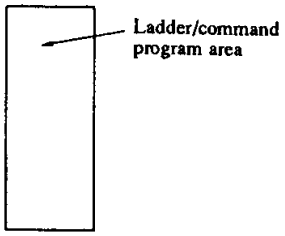
Example 2: When CPU*-07H* uses 4 remote I/O modules and 12 64-point I/O modules



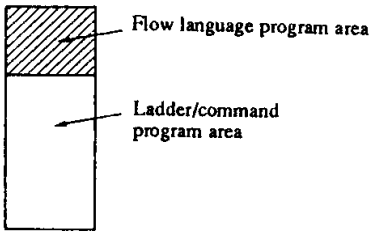
Concept on user program area

The CPU user program capacity indicates the value of ladder/command user program. When the flow language is used, a part of the above user program area is allocated to the flow language user program area. When no allocation is specified, the user program area is all used for ladder/command.

<When only ladder/command is used>



<When the flow language is used together>



When the flow language is used, the user program area is allocated using the graphic programming console (GPCL01H). For the allocation method, refer to the software edition (CPU Setting) of the instruction manual of the graphic programming console (GPCL01H).

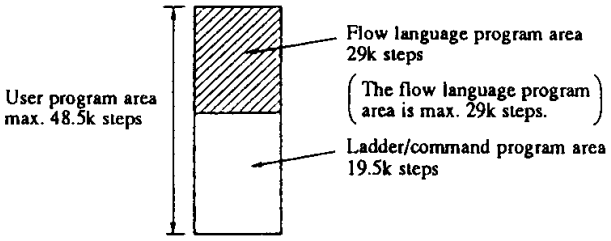
Example 1: When the flow language is used by using the following combination

CPU module: CPU*-20H*

Memory cassette: RAM*-48H

In this case, the user program capacity is 48.5k steps.

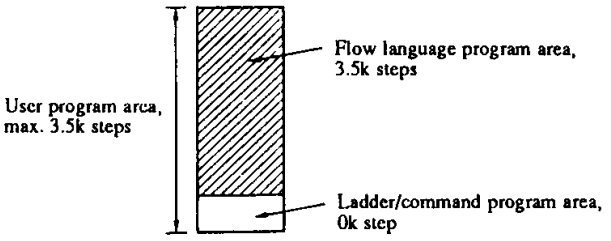
Note:
When an attempt is made to execute a program in the flow language unless it is written after the flow language is allocated in the program area, an error is caused.



CPU module: CPU*-20H*

Memory cassette: RAM*-04H

In this case, the user program capacity is 3.5k steps.



3.4 Function List

Item No.	Detailed description (1/7)	CPU2-**H	CPUP-**H	CPU-**Ha, H
1	Remote running, control function Explanation 1. Purpose: The host computer controls and monitors running of the programmable controller (PC). 2. Description • The host computer issues (communicates) a task code to the H-series PC. • There are three communication configuration methods available between the host computer and PC; between the host computer and peripheral port of the CPU module, between the host computer and COMM module, and between the host computer and remote I/O module local station. Operating condition 1. The key switch of the CPU module should be set at REMOTE. 2. The special internal output R7C3 (remote RUN enable) and R7C4 (remote STOP enable) should be ON. 3. The special internal output R7E9 (RUN disable) should be OFF. 4. No CPU error (a light failure or heavier) should be caused. 5. When running control input is specified by the running parameter, the input should be ON. 6. No program should be written or transferred by another peripheral device. Others 1. When the PC starts running, the RUN LED lights. 2. Data is transmitted between the host computer and PC according to the communication procedure dedicated to the H-series. 3. For further details, refer to Chapter 6, "Communication with Host Computer" of the software edition or the COMM module manual (instruction manual).	O	O	O
2	Running control function at a special contact Explanation 1. Purpose: The running of the PC is controlled by special external input or bit internal output which is specified by the peripheral equipment. 2. Description • The CPU setting running control parameter is set to "Input defined" by the peripheral equipment. • One of X, R, L, and M is specified as a set I/O No. Operating condition 1. The key switch of the CPU module should be set at RUN. 2. The special internal output R7E9 (RUN disable) should be OFF. Others 1. When the PC starts running, the RUN LED lights. 2. For further details, refer to the peripheral equipment manual (instruction manual), "CPU setting, running parameter".	O	O	O
3	Simulation function Explanation 1. Purpose: This function is used to debug the user program after wiring or to adjust the program. 2. Description • The peripheral equipment sets the CPU module in the simulation mode. Operating condition 1. The special internal output R7C6 (simulation enable) should be ON. 2. When the additional unit is used, the power supply of the additional unit should be started normally. Others 1. When the CPU module enters the simulation mode, the SIM LED lights. 2. External input is the same as normal arithmetic. External output is not turned ON and only the LED lights. 3. The simulation function is valid only for the bit I/O modules. (16-point. 32-point, and 64-point modules (X and Y)) 4. For further details, refer to the peripheral equipment manual (instruction manual).	O	O	O

<table>
<tr><th>Item No.</th><th>Detailed description (2/7)</th><th>CPU2-**II</th><th>CPUP-**II</th><th>CPU-**IIa, II</th></tr>
<tr><td>4</td><td>
Running continuation function

[Explanation]
1. Purpose: Even in case of an I/O allocation error, remote error, or delay error, the PC continues running.
• The peripheral equipment sets a CPU module setting parameter.

[Operating condition]
1. In case of a CPU setting error, an I/O allocation dismatch of the running mode should be OK.
2. In case of a CPU setting error, a remote error of the running mode should be OK.
3. The CPU setting delay check time should be set. (When it is not set, the check time is 100 ms.)

[Others]
1. When the function is not set, the PC stops operation when one of the above error occurs.
2. The delay check time is max. 2 seconds (10 ms *200).
3. For further details, refer to the peripheral equipment manual (instruction manual), "CPU setting, running parameter".
</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>5</td><td>
On-line program change function

[Explanation]
1. Purpose: This function is used to change the subprogram when the PC is on-line.
2. Description
• The function is executed by an operation of the peripheral equipment. When the on-line change function is executed, the CPU halts the execution of the user program with the output held when it ends the scanning and executes scanning of the user program once again from the beginning after the user program is changed.
• The set values of the timer and counter can be changed without halting. (When one of the CPUs CPU-**IIa, CPUP-**II, and CPU2-**II and the IIILDRL system disk, Version 2.** or any subsequent release are combined)

[Operating condition]
1. Other peripheral devices should not perform on-line changing or debugging. (An occupied error is caused.)
2. When the debugging function is in use, the CPU module should be in the debug halt mode.
3. When the set values of the timer and counter are to be changed, other peripheral devices should not monitor. (An occupied error is caused.)

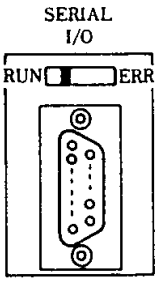
[Others]
1. When the CPU starts on-line changing, the RUN LED and IIALT LED light.
2. The Halt time is as shown below. (The time is not a maximum value. Unit: Second)
<table>
<tr><th colspan="2">Peripheral equipment</th><th colspan="3">*1 Graphic programming console</th><th colspan="3">*1 Portable graphic programmer</th><th colspan="3">*2 Command programmer</th></tr>
<tr><th colspan="2" rowspan="2">CPU type</th><th>II-2002</th><th>II-702</th><th>II-302</th><th>II-2002</th><th>II-702</th><th>II-302</th><th>II-2002</th><th>II-702</th><th>II-302</th></tr>
<tr><th>II-2000</th><th>II-700</th><th>II-300</th><th>II-2000</th><th>II-700</th><th>II-300</th><th>II-2000</th><th>II-700</th><th>II-300</th></tr>
<tr><td rowspan="8">Memory capacity</td><td rowspan="2">4k steps</td><td>0.49</td><td>0.56</td><td>0.56</td><td>1.88</td><td>1.94</td><td>1.94</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>0.88</td><td>0.96</td><td>0.96</td><td>2.61</td><td>2.66</td><td>2.66</td><td>3.90</td><td>3.42</td><td>3.42</td></tr>
<tr><td rowspan="2">8k steps</td><td>0.90</td><td>1.09</td><td>1.09</td><td>2.28</td><td>2.44</td><td>2.44</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>1.57</td><td>1.67</td><td>1.67</td><td>3.23</td><td>3.32</td><td>3.32</td><td>4.02</td><td>3.70</td><td>3.70</td></tr>
<tr><td rowspan="2">16k steps</td><td>1.74</td><td>2.05</td><td>—</td><td>3.08</td><td>3.41</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>2.77</td><td>3.03</td><td>—</td><td>4.64</td><td>4.67</td><td>—</td><td>4.32</td><td>4.30</td><td>—</td></tr>
<tr><td rowspan="2">48k steps</td><td>4.92</td><td>—</td><td>—</td><td>6.27</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>7.27</td><td>—</td><td>—</td><td>9.16</td><td>—</td><td>—</td><td>5.55</td><td>—</td><td>—</td></tr>
</table>
Upper row CPU2-**H
Lower row CPU-**IIa CPUP-**II

*1: Each value of the graphic programming console and portable graphic programmer is a value when a 10-step circuit is inserted at the beginning of the circuit.
*2: Each value of the command programmer is a value when one step is changed.
3. Note that even if the I/O No. which is used for external output is changed on-line and the output coil command is deleted during execution of the program, the output status before changing is kept as it is.
4. If the program or timer and counter are changed when the debugging function is in use or if the debugging is halted during execution of the program and the halt is canceled, the program is executed from the beginning.
5. In II-2002 or II-2000, the program is transferred to the high-speed memory area. Therefore, a partial change of the program may require much time compared with that in II-702 or II-700.
6. For further details, refer to the peripheral equipment manual (instruction manual).
</td><td>O</td><td>O</td><td>O</td></tr>
</table>

Item No.	Detailed description (3/7)	CPU2-**II	CPUP-**II	CPU-**IIa, II
6	**Debugging function** **Explanation** 1. Purpose: The function checks the operation of the user program. 2. Description (1) Breakpoint specification: One breakpoint is specified in the program and when the debugging is executed up to the breakpoint, it is halted. (2) Continuation from stop: The debugging is restarted from the debugging halt status and the CPU module enters the debug RUN status. (3) Execution halt: The execution of the program is stopped when the scanning ends and the CPU module enters the debug HALT status. (4) Scanning run: Scanning is executed by the specified count from the debug HALT status and the CPU module enters the debug HALT status. (5) Step run: 1 symbol or 1 instruction is executed from the debug HALT status and the CPU module enters the debug HALT status. • Debug run: ..... The program is executed by the graphic programming console. The RUN and HLT LEDs light. • Debug halt: ..... The program is stopped by the graphic programming console. The HLT LED lights. 3. Restrictions (1) Common to all the CPU modules • The ladder/command program and flow program cannot use the debugging function at the same time. (2) When the CPU module is other than CPU2-**II • When the ladder/command program is being debugged, the flow program will not operate. When the flow program is being debugged, the ladder/command program will not operate. **Operating condition** 1. The key switch of the CPU module should be set at REMOTE. 2. The special internal output R7C5 (debugging enable) should be ON. 3. The special internal output R7E9 (RUN disable) should be OFF. 4. No CPU error (a light failure or heavier) should be caused. 5. When running control input is specified by the running parameter, the input should be ON. 6. No program should be written or transferred by another peripheral device. **Others** 1. The debugging function can be used only by the graphic programming console. 2. The flow program can be used only for (1) to (3). 3. The timer is not updated during debug halt. The special internal outputs R7E5 to R7E7 (0.01 to 1 second clock) also perform no processing. Also during step run, the timer and special internal outputs perform no processing. 4. During scan run, the timer and special internal outputs perform processing. However, when Run and Halt are repeated alternately, a correct clock cannot be obtained. 5. For further details, refer to the graphic programming console manual (instruction manual).	O	O	O
7	**Forcing function** **Explanation** 1. Purpose: The function checks, troubleshoots, or debugs the operation of the user program. 2. Description • Input or output can be fixed to the specified data regardless of the program and input. **Operating condition** 1. The key switch of the CPU module should be set at REMOTE. 2. When setting data, the I/O should be specified forcibly. **Others** 1. Up to 64 I/O points including bits and words can be specified forcibly. 2. When the common bit and word area (X, WX, M, WM, L, WL) is accessed in word even if force data is specified in bit, bit data is changed. When the common area is accessed in bit even if force data is specified in word, word data is changed. 3. For further details, refer to the peripheral equipment manual (instruction manual).	O	O	O

Item No.	Detailed description (4/7)	CPU2-**H	CPUP-**H	CPU-**Ha, H
8	Power failure storage clear function (function by the hardware) Explanation 1. Purpose: The power failure storage specification area is cleared to 0. 2. Description • When the PC is stopped, the "R.CL" switch on the surface of the CPU module is pressed. Operating condition 1. The function is valid when the PC is stopped and cleared when the running starts. 2. Also the special internal area (regular power failure storage) is initialized. Others 1. Even if the "R.CL" switch is pressed when the PC is on-line, it is ignored. 2. The same function is provided also in the bit special internal output.	O	O	O
9	Interruption processing function Explanation 1. Purpose: The interruption program is executed. 2. Description • The interruption program is executed using the interruption input module. • The periodic interruption program of 10 ms, 20 ms, or 40 ms is executed. Operating condition 1. The interruption module should be used and a program equivalent to the interruptions INT16 to INT31 should be defined. 2. The periodic interruption program of INT0 to INT2 (10 ms, 20 ms, 40 ms) should be defined. Others 1. Note that when the interruption program is started, the execution time of the scan program is generally increased and a delay error may occur.	O	O	O
10	PID arithmetic function Explanation 1. Purpose: The process amount of the plant is controlled. 2. Description • The process amount is controlled by a combination of proportion (P), integration (I), and differential (D). Operating condition 1. Execution of PID arithmetic requires a WR area continuous (5 + No. of loops x 47) words in length and an R area (No. of loops x 16) bits in length. Reserve the areas at the time of system design. 2. Do not use INT0 (10-ms periodic scan) and INT16 to INT31 (interruption program). 3. Program only a PID arithmetic instruction and its start condition for INT1 (20-ms periodic scan). When it is forced to perform processing other than PID arithmetic, it is necessary to increase the PID arithmetic sampling time as much as possible so as to let the processing time excluding PID arithmetic satisfy one of the following formulas. When the CPU module is CPU2-03H or CPU2-07H • Processing time (ms) ≤ 9.2 ms = 20 ms - system periodic processing (3 ms, two times) - PID arithmetic time 4.8 ms When the CPU module is CPU2-20H • Processing time (ms) ≤ 14 ms = 20 ms - system periodic processing (2 ms, two times) - PID arithmetic time 2.0 ms When the CPU module is CPUP-03H or CPUP-07H • Processing time (ms) ≤ 6.2 ms = 20 ms - system periodic processing (4 ms, two times) - PID arithmetic time 5.8 ms When the CPU module is CPUP-20H • Processing time (ms) ≤ 10.0 ms = 20 ms - system periodic processing (3 ms, two times) - PID arithmetic time 3.0 ms Others 1. The PIS arithmetic sampling time is 20 ms or more or 40 ms (remote local station) or more. 2. When the CPU arithmetic stops due to an error, the output value (MV) is turned OFF. When it is necessary to retain the output value, use the external equipment of the PC. 3. During on-line program change, the output value (MV) is retained temporarily. Change it when the PID control system is stable. 4. For details of the arithmetic method, refer to the supplementary explanation and the software edition.	O	O	O

<table>
<tr><th>Item No.</th><th>Detailed description (5/7)</th><th>CPU2-**II</th><th>CPUP-**II</th><th>CPU-**IIa, II</th></tr>
<tr><td>11</td><td>
In-high-speed-running program changing
Explanation
1. Purpose: This function is used to change the user program when the PC is on-line.
2. Description
• The function is performed by operating the peripheral equipment. When the function is executed, the CPU changes the user program by executing it. When the changing is finished, the program is interchanged by the scan END of the user program and the scanning of the user program is executed from the beginning. When the system software of the graphic programming console is LADDER EDITOR, the changed program can be returned to the program before changing.
Operating condition
1. The function is valid only when the CPU module CPU2-**II, memory cassette RAM3-**II, and graphic programming console are combined.
2. Under an operating condition other than the above, the function is the same as the on-line change function in Item No. 5.
Others
1. When the CPU starts on-line changing, the RUN LED and HALT LED light.
2. The Halt time is less than 0.5 s.
3. Note that even if the I/O No. which is used for external output is changed on-line and the output coil command is deleted during execution of the program, the output status before changing is kept as it is.
4. When a combination other than that in Operating Condition 1 is used, the function is the same as the on-line program change function in Item No. 4.
</td><td>O</td><td>x</td><td>x</td></tr>
<tr><td>12</td><td>
Clock function
Explanation
1. Purpose: The function is used to control the time and date of data of the PC.
2. Description
• Clock data is set in the word special internal outputs WRF00B to WRF00F in a BCD code and updated every second. (Since the CPU module updates data regardless of the timing of the user program, there is no data simultaneity between words.)
• When 1 is set in the bit special internal output R7F8, clock read data is set in the word special internal outputs WRF01B to WRF01F in a BCD code. The data is retained until 1 is set in R7F8 once again.
• When 1 is set in the bit special internal output R7F9, the data which is set in the word special internal outputs WRF01B to WRF01F in a BCD code is set in the clock.
• When 1 is set in the bit special internal output R7FA, the clock data is subjected to 30-second adjustment. (00 to 29 s are adjusted to 00 s and 30 to 59 s are adjusted to 1 minute or 00 s.)
Operating condition
1. The function is valid only when the CPU module CPU2-**II, R*M2-**II, and memory cassette RAM3-**II or ROM2-**II are combined.
Others
1. When data is set in other than a BCD code, a data error is caused, and 1 is set in the bit special internal output R7FB, and no clock data is set. When correct data is set, R7FB is set to 0.
2. The clock accuracy is affected by the ambient temperature. The accuracy per month when the CPU is energized is -175 to +70 s at 0 to 55°C, -110 to +70 s at 5 to 45°C, and -55 to +70 s at 20 to 30°C. When the CPU is not energized (at the time of battery backup), a delay time of about 20 s is added to each value. Adjust the accuracy properly in accordance with the operating condition of the system.
3. Special internal output relating to the clock and meaning
<table>
<tr><th>I/O No.</th><th>Bit special internal output</th></tr>
<tr><td>R7F8</td><td>Data reading</td></tr>
<tr><td>R7F9</td><td>Data writing</td></tr>
<tr><td>R7FA</td><td>Clock adjustment</td></tr>
<tr><td>R7FB</td><td>Data error</td></tr>
</table>
*: After 1 is set, it is reset by the system software.
<table>
<tr><th>I/O No.</th><th colspan="2">Word special internal output
b15 b0</th></tr>
<tr><td>WRF00B</td><td colspan="2">Gregorian calendar (4 digits)</td></tr>
<tr><td>WRF00C</td><td>Month</td><td>Day</td></tr>
<tr><td>WRF00D</td><td>0 0 0</td><td>Weekday</td></tr>
<tr><td>WRF00E</td><td>Hour</td><td>Minute</td></tr>
<tr><td>WRF00F</td><td>0 0</td><td>Second</td></tr>
</table>
<table>
<tr><th>I/O No.</th><th colspan="2">Word special internal output
b15 b0</th><th>Example</th></tr>
<tr><td>WRF01B</td><td colspan="2">Gregorian calendar (4 digits)</td><td>19 91</td></tr>
<tr><td>WRF01C</td><td>Month</td><td>Day</td><td>09 21</td></tr>
<tr><td>WRF01D</td><td>0 0 0</td><td>Weekday</td><td>000 6</td></tr>
<tr><td>WRF01E</td><td>Hour</td><td>Minute</td><td>08 05</td></tr>
<tr><td>WRF01F</td><td>0 0</td><td>Second</td><td>00 00</td></tr>
</table>
• Gregorian calendar: 2-digit BCD, month and day: 2-digit BCD, weekday: 0: Sunday, 1: Monday, 2: Tuesday, 3: Wednesday, 4: Thursday, 5: Friday, 6: Saturday
• Hour: 24-hour system, 2-digit BCD, minute and second: 2-digit BCD
• The example indicates 8:50 a.m., Sept. 21 (Saturday), 1991.
4. The battery of the memory cassette is used for the clock and memory retention. Note that when an error occurs in the battery, the clock data is not guaranteed.
</td><td>O</td><td>x</td><td>x</td></tr>
</table>

Item No.	Detailed description (6/7)	CPU2-**H	CPUP-**H	CPU-**Ha, H
13	**Trace monitor function** **Explanation** 1. Purpose: The function is used to debug the user program. 2. Description • The function is performed by operating the peripheral equipment. The trace monitor function is provided with the following subfunctions. (1) Continuous time chart (2) Trigger time chart (3) Continuous trace (4) Trigger trace (5) CPU instruction trace (6) Trigger circuit monitor **Operating condition** 1. The function is valid only when the CPU module CPU2-**H and memory cassette RAM2-**H or ROM2-**H are combined and furthermore the ladder/command programming software Ladder Editor is used. **Others** 1. For further details, refer to the supplementary explanation or the Ladder Editor instruction manual.	O	x	x
14	**Contact RUN-ERR switching function** **Explanation** 1. Purpose: The operation of the contact of the power module on the basic base is switched. 2. Description • The switch shown in the drawing on the right is changed. (At the upper part of the general purpose port) **Operating condition** 1. When the switch is set to the RUN position, the RUN LED lights and the contact is turned ON. 2. When the switch is set to the ERR position, the ERR LED lights and the contact is turned ON. **Others** 1. Before switching the setting, turn the PC off. 	O	x	x
15	**Battery error display function** **Explanation** 1. Purpose: Even when a priority error occurs, the LED indicates a battery error. 2. Description • When the voltage of the memory backup battery drops, the BTE LED lights. **Operating condition** **Others** 1. When the BTE LED lights, replace the battery as soon as possible (within 50 hours). ☐RUN ☐HLT ☐SIM ☐FRC ☐ERR ■BTE	O	x	x
16	**General purpose serial port function** **Explanation** 1. The function is performed by the user program (TRNS0 or RECV0 instruction). **Operating condition** 1. The function is valid only when the CPU module CPU2-**H and memory cassette RAM2-**H or ROM2-**H are combined and furthermore the ladder/command programming software Ladder Editor is used. **Others** 1. The transmission rate is 4800 bits/s max. on the basis of RS-232C. For further details, see Section 3.2. 2. For details of the TRNS0 and RECV0 instructions, refer to the software edition. 3. When an error occurs in the general purpose port, execute a loopback check. (See Chapter 16, "Troubleshooting".)	O	x	x

Item No.	Detailed description (7/7)	CPU2-**H	CPUP-**H	CPU-**Ha, H
17	Advanced function module data transfer instruction Explanation 1. Purpose: Data transfer between the advanced function module and CPU module is simplified. 2. Description • TRNS, RECV, or QTRNS instruction Operating condition Others 1. For detailed instructions, refer to the software edition.	O	x	x
18	Addition of FUN instruction Explanation 1. Purpose: A special function instruction is supported. 2. Trigonometric function, data retrieval, data conversion, special shift instruction, etc. Operating condition Others 1. For detailed instructions, refer to the software edition.	O	x	x

Supplementary explanation

1. Program on-line change function

(1) Features

The ladder/command program can be edited as shown below from the HI-LADDER / HI-COMMAND system V2.** or by the Ladder Editor when the PC is on-line.

[1] WRITE NEXT (Circuit insertion)

[2] WRITE FIRST (First circuit insertion)

[3] CHANGE (Circuit change)

[4] DELETE (Circuit deletion)

[5] I/O batch change

[6] Returned to program before changing (When CPU2-**H, RAM3-**H, and Ladder Editor are combined)

However, if an attempt is made to change a circuit which causes a syntax error or which has a possibility of syntax conflict, the following are executed and the circuit will not be changed.

[1] Display of an error message and checked instruction

[2] Display of an alarm message

[3] Generation of an error buzzer sound

* Checked instruction

MCS, MCR, END, CEND, JMP, CJMP, RSRV, FREE, LBL, FOR, NEXT, CAL, SB, RTS, START, INT, RTI

When the password is entered, the above checked instructions (MCS and MCR are excluded) can be changed during running. Note that when an error occurs due to changing, the CPU is stopped.

(2) Precautions

Changing the program when the CPU is on-line is changing the content when the system is on-line and it is a dangerous operation basically. When changing it actually, confirm the content and effect thoroughly and take the following precautions.

[1] When the program is changed, the CPU is halted (halt: running stopped and output retained). Select suitable timing.

[2] When a program is added or the program is changed for a system in which the user program is executed just within the delay check time, the program scan time after changing is increased. Therefore, the CPU may be stopped due to a delay error.

Therefore, turn the special internal output R7C0 (continued when a delay error occurs) ON by forced output or fully investigate whether the delay check time is suitable with reference to the actual cycle time (special internal output: WRF010 to WRF-12) beforehand.

2. PID control

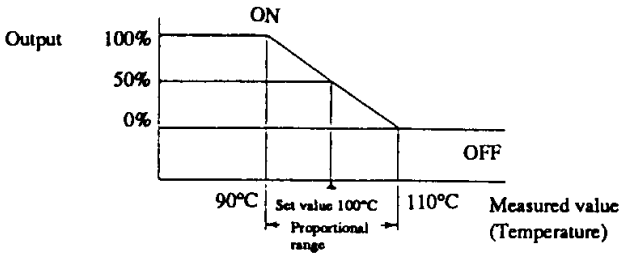
(1) Outline

PID control is to control proportional, integral, and differential operations on process control data (e.g., temperatures, pressures, flow rates, and liquid levels). These operations are explained in detail below.

[1] Proportional operation (P)

This function provides a proportional range for a set value so that the process value (output value) may be proportional to the difference between the set value and the measured value.

In the example below, a set value is 100°C and its proportional range is 90°C to 110°C. When the current temperature (measured value) is lower than 90°C (the low limit of the proportional range), the process value is always 100%. As the current temperature goes higher from 90°C, the process value goes lower from 100%. When the current temperature reaches 100°C (set value), the process value is 50%. Thus, controlling with the less hunting (than on/off operation) can be performed.



Concept of proportional operation

[Example]

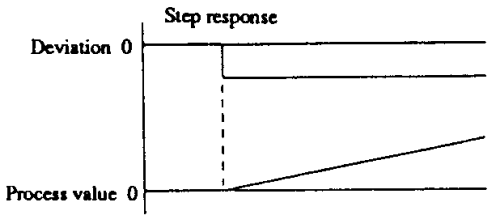
- Thermoregulator: 0°C to 400°C
- Proportional range: 5% (20°C)
- Set value: 100°C

Under this condition, the status output varies as follows:

- Temp. = 90°C 100% ON
- 90°C Temp. 100°C 50% ON 100%,
  0% OFF 50%
- Temp. = 100°C 50% ON, 50% OFF
- 100°C Temp. 110°C 0% ON 50%,
  50% OFF 100%
- 110°C Temp. 100% OFF

[2] Integral operation (I)

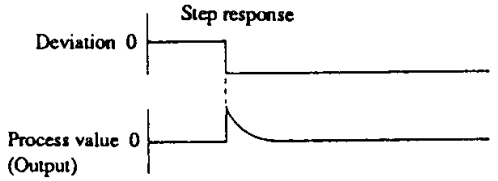
Offsets (e.g., between a control temperature and a preset temperature) will inevitably occur in proportional operations. To eliminate the unwanted offsets, the proportional operation is combined with an integral operation. As the time goes by, the offset reduces and finally the control temperature matches the preset value.



Concept of integral operation

[3] Differential operation (D)

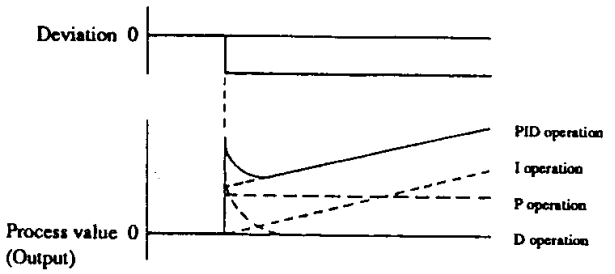
The proportional and integral operations are operations to correct control results. Therefore, the step response cannot be so quick. The differential operation is provided to eliminate such response delays. The differential operation corrects control results with a process value (output) proportional to the gradient (diffential coefficient) due to the deviation. For example, this operation gives a great process value (output) to a step transition to regulate the control status.



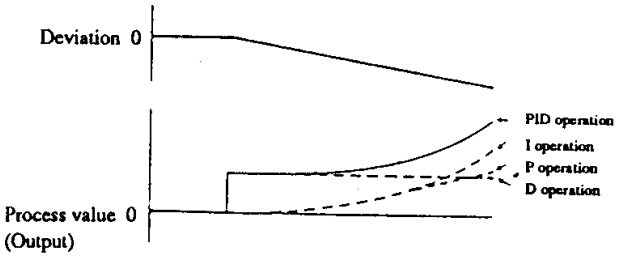
Concept of differential operation

[4] PID operation

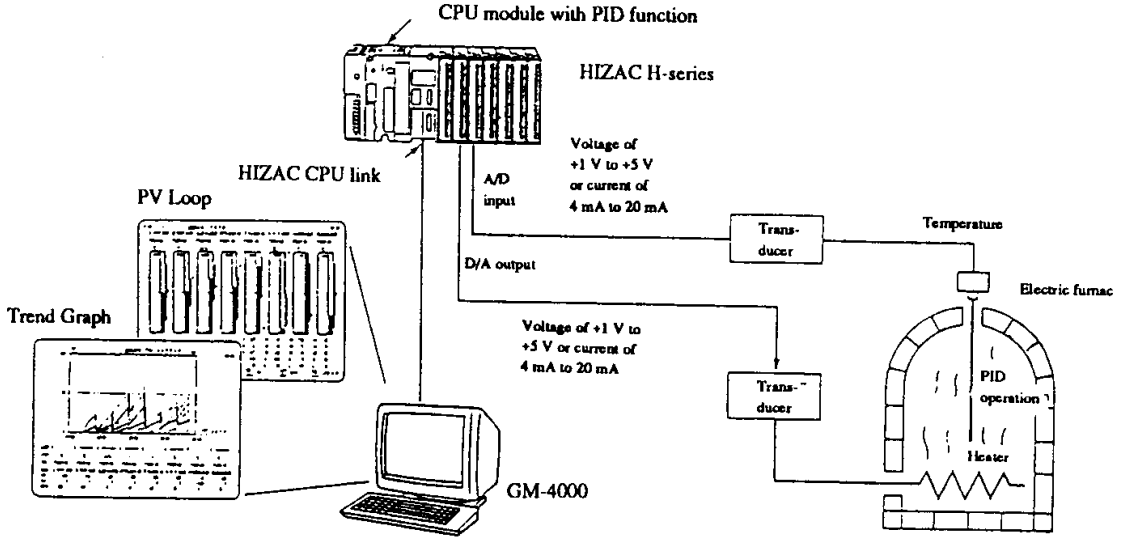
The PID operation is a combination of proportional, integral, and differential operations. This operation is very effective to control processes having dead time. This operation performs hunting-less smooth control (by proportional opeation), automatic correction (by integral operation), and quick response to external disturbances (by differential operation). The Figures shown in the next page show a process value (output) of the PID operation to the step-like deviation and lump-like deviation.



PID opeation on step-like deviation

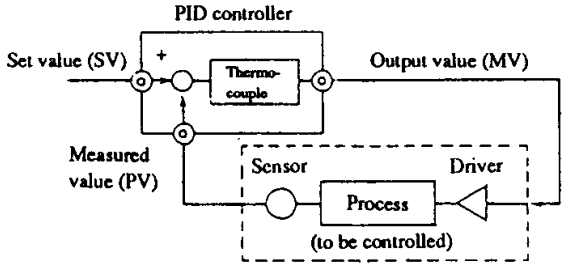


PID operation on lump-like deviation



Electric furnance tempeature control (example)

The basic block diagram of the PID control is shown below



PID control system

In the Figure above, the sensors sense control status such as temperature, pressure, and flow rate in a selected process and sends it as an analog signal (usually 4 mA to 20 mA) to the PID controller.

The PID controller subtracts the measured values (sent as an analog signal from the sensors) from the preset values, performs an adequate PID operation on the differences, then outputs the result as an analog signal (usually 4 mA to 20 mA) to the driver.

(2) PID operation

The output of the PID controller is basically expressed by

$$MV(t) = \{ Kp(SV - PV) + \frac{1}{T_i}\int (SV - PV)dt + T_D \frac{d}{dt}(SV - PV) \} \quad \ldots \text{Eq. (1.1)}$$

Trsnsform of Eq. (1.1) by a Laplace operator S yields Eq. (1.2).

$$\frac{MV(S)}{E(S)} = Kp(1 + \frac{1}{T_i S} + T_D S) \quad \ldots \text{Eq. (1.2)}$$

Proportional term — Integral term — Differential term

where $E(S) = [f(SV\text{-}PV)]^{-s}$

where MV(t), MV(S): Output
(SV-PV), E(S): Deviation
Kp: Proportional gain
($Kp = \frac{100(\%)}{PB(\%)}$, PB: proportional range)
T_i: Integration time
T_D: Differentiation time
SV: Set value
PV: Measured value

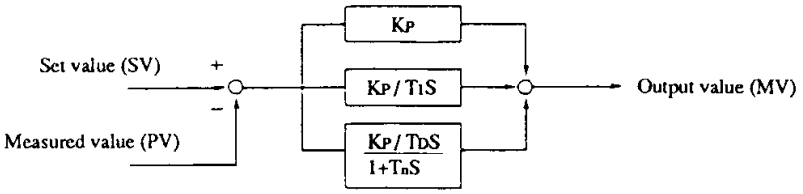
However, as the output of a pure differential operation (expressed by $T_D \frac{d}{dt}$ or $T_D S$) is pulses and is not effective to control objects having inertia (such as control valves), the PID controller handles "Constant - (Primary delay element)" as a dummy differential output. Accordingly, replacement of $T_D S$ of Eq. (1.2) by $\frac{T_D S}{1 + \frac{T_D}{n} S}$ yields Eq. (1.3).

$$\frac{MV(S)}{E(S)} = Kp\{1 + \frac{1}{T_i S} + \frac{T_o S}{1 + \frac{T_o}{n} S}\} \quad \ldots \text{Eq. (1.3)}$$

where n is a differential gain (usually about 10). By replacing $\frac{T_D}{n}$ of Eq. (1.3) by Tn, we obtain

$$\frac{MV(S)}{E(S)} = Kp\{1 + \frac{1}{T_iS} + \frac{T_oS}{1+Tn \cdot S}\} \quad \ldots \text{Eq. (1.4)}$$

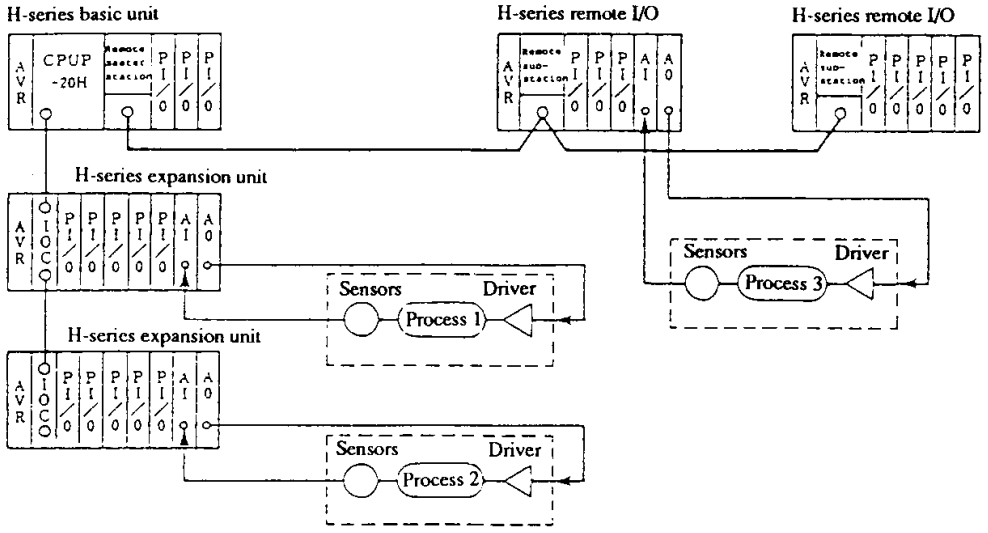
The above PID operation can be illustrated as shown below.



Block diagram of PID operation

(3) System configuration

An example of a PID loop control system which controls some control loops is shown below.



AI: H-series analog input module
AO: H-series analog output module
PI / O: H-series output module
AVR: H-series power supply module
IOC: H-series I/O controller

System configuration (example)

The CPUP-**H (like an H-series standard CPU module) directly reads data from or writes data in the analog I/O modules mounted in the basic, expansion, and remote I/O units.

The CPUP-**H causes the H-series analog I/O modules to fetch various sensor signals (as SV and PV) from target processes and the H-series analog output modules to output the result of PID operations (as MV) to the processes for control.

The CPUP-**H manages timing to control the loops by the PID Execution Control instructions of the CPUP-**H. The CPUP-**H performs a PID operation on data of one loop in each 20-ms periodic scanning. In other words, each process loop is controlled cyclically at a time interval of 20 ms by the number of loops (for the specification of a minimum sampling time).

(4) Functional specification

The functinal specifications of the CPUP-**H are shown below.

Functional specifications of the PID control system

Item	Specification	Description
Number of loops	1 to 64 (1 to 20 when the memory cassette is on RAM04H or RAM08H)	The PID control instruction requires a parameter area, a WR area (5 words + number of loops × 49 words), and an R area (16 bits × the number of loops) for execution.
Sampling time (TZ)	1 to 200 (a multiple of 20) (when the AI ro AO module is mounted on the basic or expansion unit)	• The minimum sampling time of each loop is n × 20 ms (n: number of loops.) • Loops can have different sampling times if the sampling times are multiples of the minimum sampling time (the number of loops). (Example) Setting of sampling times (TZ) of 4 loops Loop 1: 4, 4, 8, 4, 3* Loop 2: 4, 4, 24, 4, 12 Loop 3: 4, 8, 16, 4, 48 Loop 4: 4, 8, 40, 10*, 24 Ex. 1 Ex. 2 Ex. 3 Ex. 4 Ex. 5 Ex. 1 to Ex. 3: Valid Ex. 4 to Ex. 5: Not valid
	4 to 200 (a multiple of 20) (required for refreshing when the AI or AO module is mounted on the remote I/O substation) AI: Analog Input Module AO: Analog Output Module	
PID constants		
Kp	-1000 to +1000 (%)	Proportional gain (%)
T_I/TZ	1 to 32767	Ratio of integration time (T_I) to sampling time (TZ)
T_D/TZ	1 to 32767	Ratio of differentiation time (T_D) to sampling time (TZ)
Tn/TZ	1 to 32767	Ratio of differentiation delay time (Tn) to sampling time (TZ)
Set value (SV)	-32767 to +32767	Analog input bit pattern (after conversion)
Measure value (PV)	-32767 to +32767	Analog input bit patter (after conversion)
Output value (MV)	-32767 to +32767	Analog output bit patter (before conversion)
High output limit UL	-32767 to +32767	High limit of output value
Low output limit LL	-32767 to +32767	Low limit of output value
Initial value (INIT)	-32767 to +32767	Initial output value

Note: The available range of the internal output area (WR) is limited (on a memory cassette).

3. Trace monitor function

(1) Outline

The trace monitor has six monitor functions and can monitor the change status of bit, word, or double word data. The functions are used to check the operation of a program or the operation timing of an external device.

(2) Functions

The functions are valid when the CPU of CPU2-**H, memory cassettes RAM2, RAM3-**H, and ROM2-**H, and Ladder Editor are combined.

[1] List of I/O which can be used by the trace monitor

A list of I/O which can be used by the trace monitor is shown below.

I/O usable	Bit	X, Y, R, L, M, timer and counter *
	Word	WX, WY, WR, WL, WM, TC
	Double word	DX, DY, DR, DL, DM

* Specify the timer by TD and the counter by CU.

[2] Explanation of trace monitor functions

Next, each function of the trace monitor will be explained.

(I) Continuous time chart

The function monitors the ON or OFF state of the specified bit I/O in a time chart form.

(II) Trigger time chart

When the trigger-specified bit I/O satisfies the specified condition (ON or OFF), the function monitors the ON or OFF state of the I/O which is specified separately in a time chart form.

(III) Continuous trace

The function monitors the change status of the specified bit, word, or double word I/O data.

(IV) Trigger trace

When the trigger-specified I/O satisfies the specified condition (set value), the function monitors the change status of the bit, word, or double word I/O data which is separately specified.

(V) CPU instruction trace

When the trace instruction (FUN 51 (s)) in the ladder program is executed, the function monitors the change status of the bit, word, or double word I/O data which is separately specified.

(VI) Trigger circuit monitor

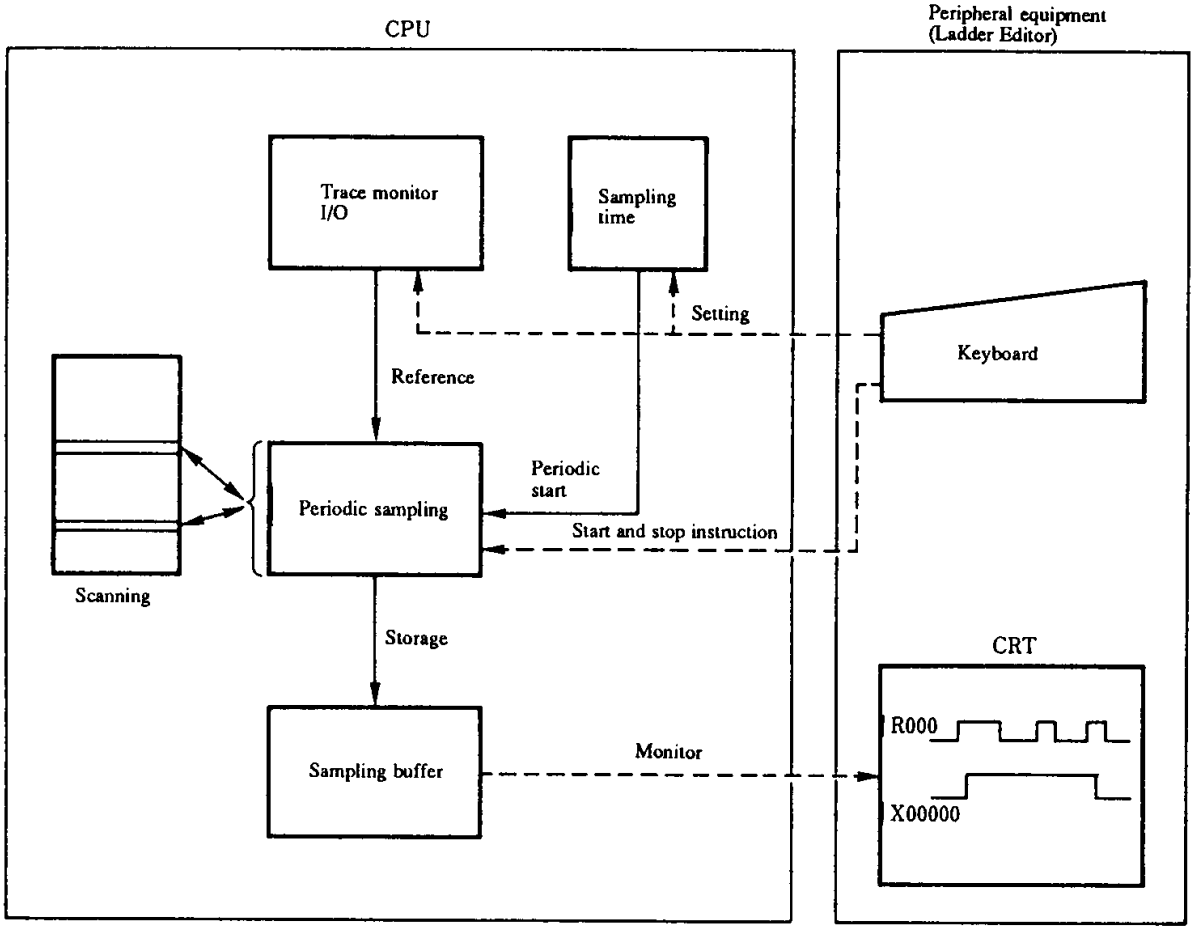
When the trigger-specified I/O satisfies the specified condition (set value), the function stores the status of the circuit which is separately specified and monitors the circuit.

(3) Explanation of operations of the trace monitor

[1] (I) Continuous time chart, (III) Continuous trace

Each of the above functions reads the content of the specified I/O (trace monitor I/O) in a specified cycle (sampling time) and stores it in the sampling buffer. The stored data is monitored by the peripheral equipment (in a time chart trace form).

In this case, data which is sampled periodically can be monitored continuously. (The parameters are set by the Ladder Editor.)

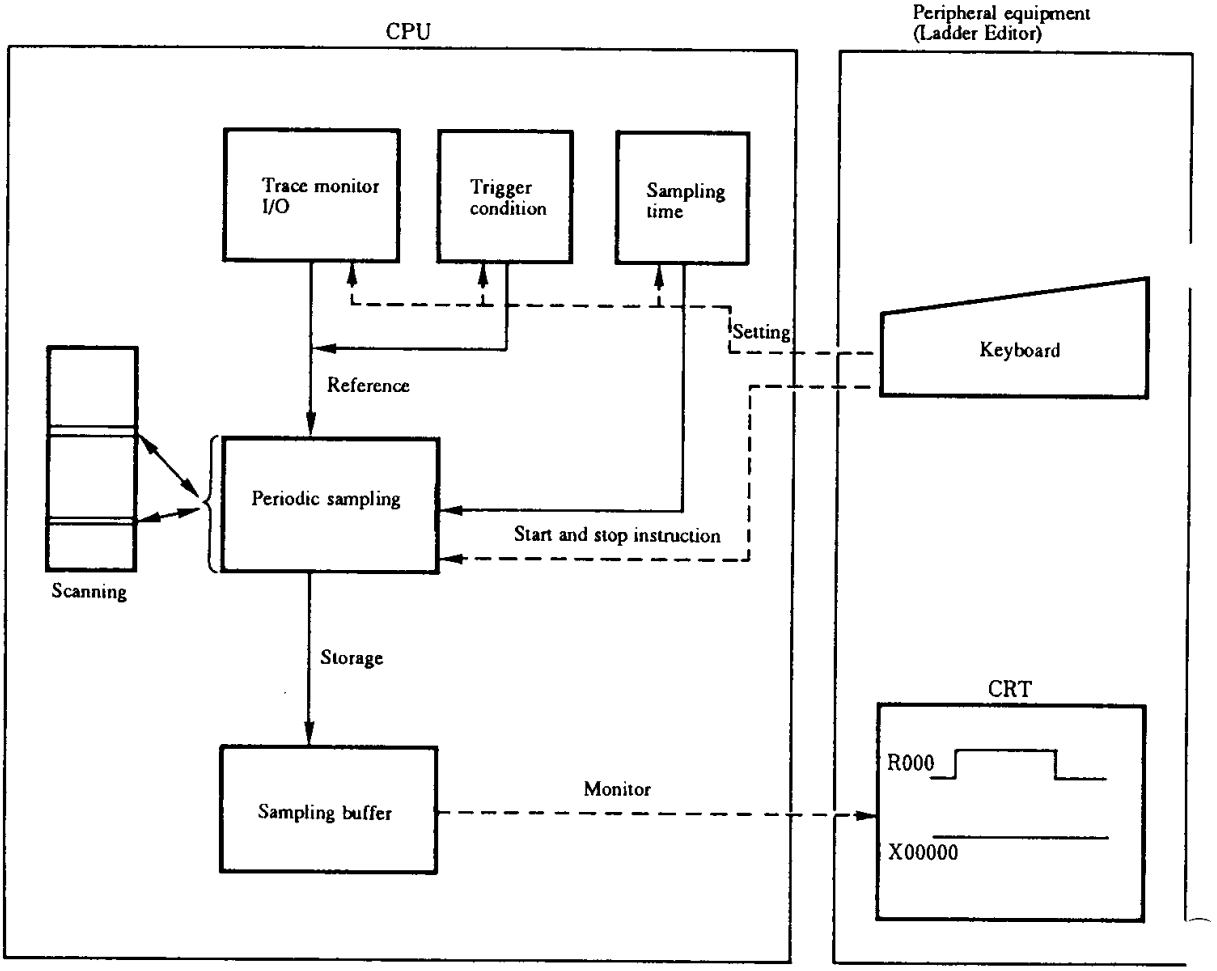


Note: When data is being monitored by the continuous time chart function or continuous trace function, the trace status may be changed to the STOP mode. The reason is that the data amount becomes larger than the data amount which is stored in the sampling buffer by the CPU within a specified time and no data can be written into the sampling buffer any more.

If this occurs, decrease the trace monitor I/O set count or increase the sampling program set time and restart the monitoring.

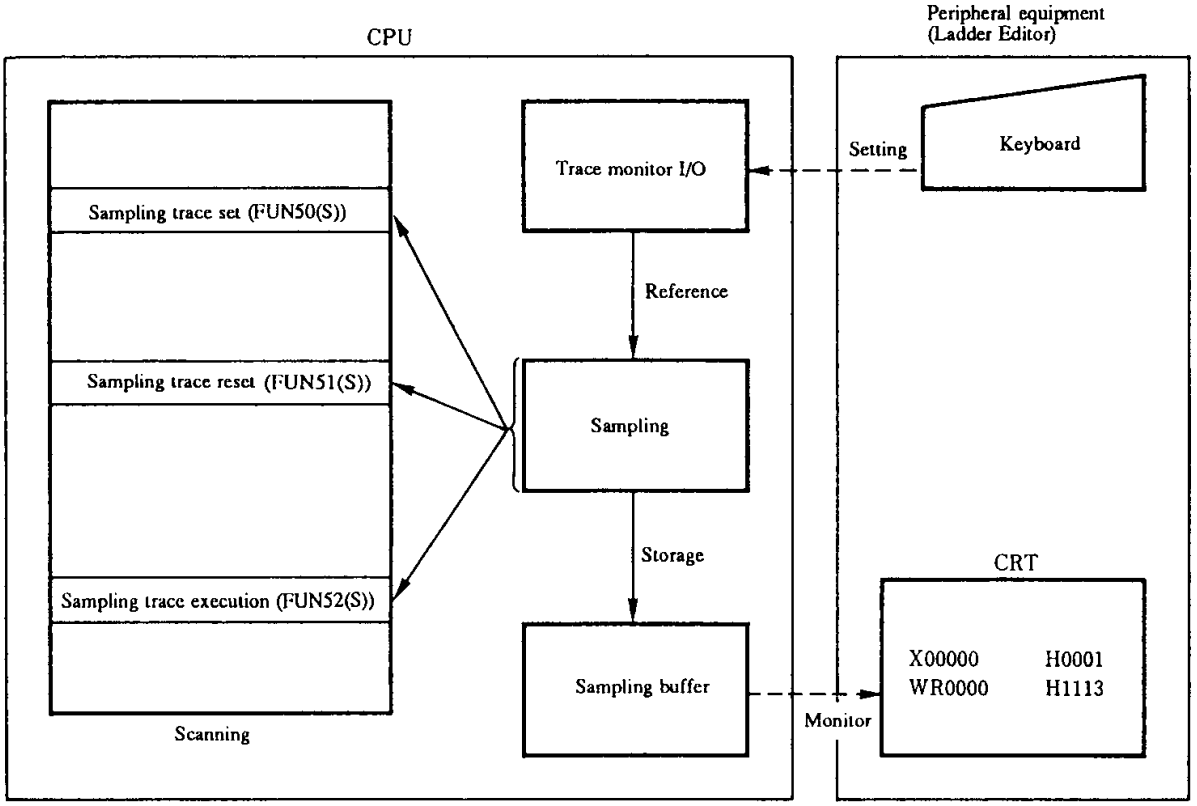
[2] (II) Trigger time chart, (IV) Trigger trace

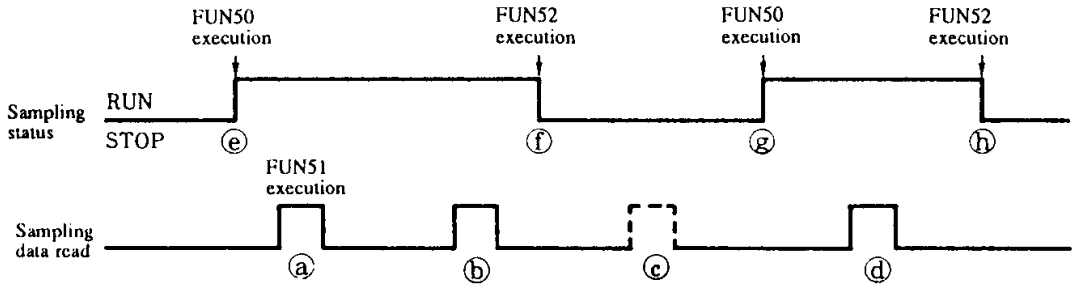
Each of the above functions reads the content of the specified I/O (trace monitor I/O) in a specified cycle (sampling time) and stores it in the sampling buffer. When the stored data satisfies the trigger condition, data is sampled continuously for the half capacity of the sampling buffer and the sampling is terminated. When the stored data does not satisfy the trigger condition, the sampling is continued until the instruction is stopped.



[3] (V) CPU instruction trace

The CPU instruction trace function reads the content of the specified I/O (trace monitor I/O) whenever the FUN51(S) instruction which is written in the ladder program is executed and stores it in the sampling buffer. The stored data is monitored by the peripheral equipment (in a trace form).



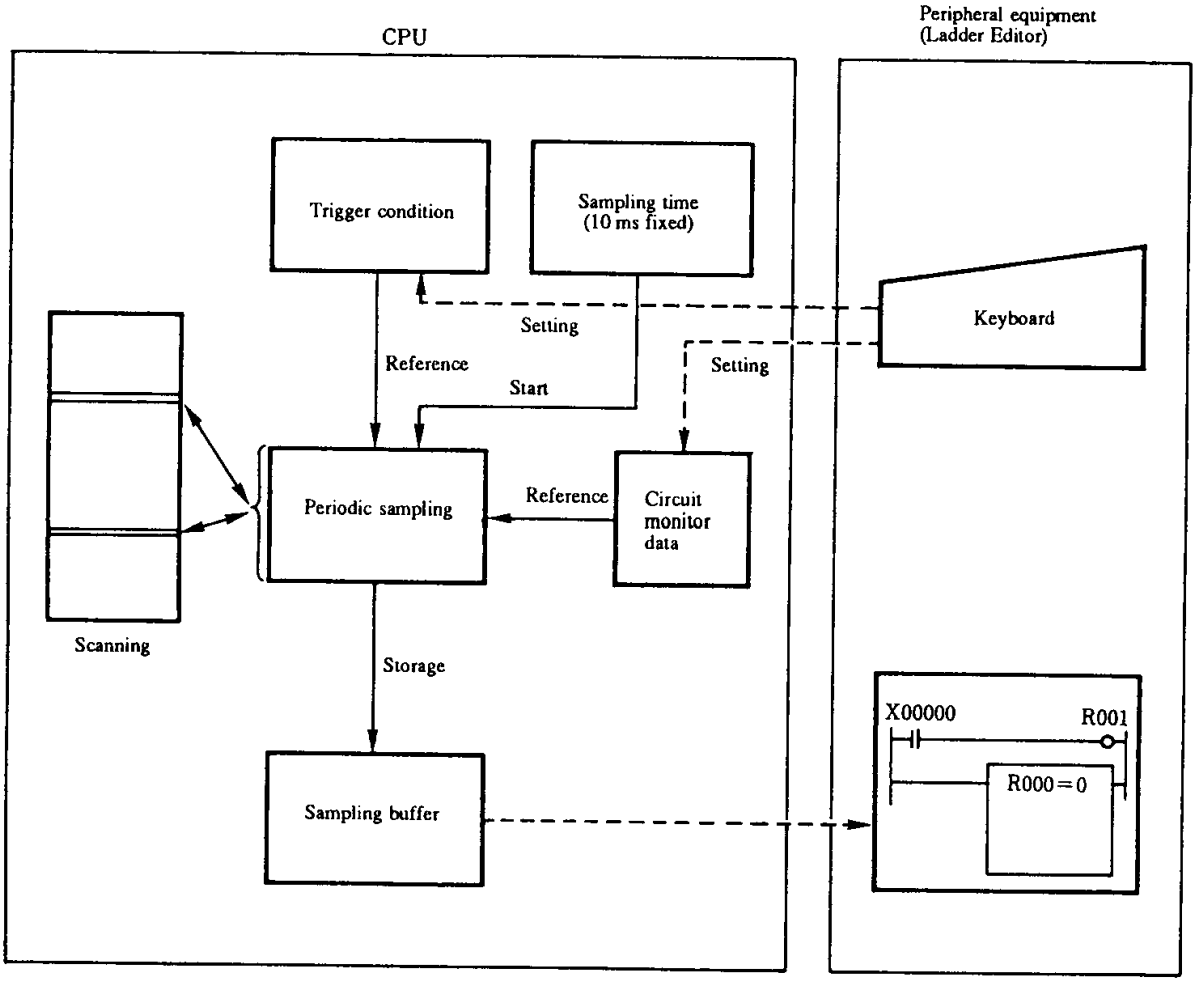


In the CPU instruction trace function, as shown in the CPU instruction trace outline operation time chart indicated above, by executing the sampling trace setting instruction FUN50(S), the sampling status (R7FD) becomes RUN (between [e] and [f] and between [g] and [h]) and sampling by the sampling trace instruction FUN51(S) is ready. In this period, by execution ([a], [b], and [d]) of the sampling trace instruction, the content of the specified I/O is stored in the sampling buffer. By executing the sampling trace reset instruction FUN52(S), when the sampling status is STOP (between [f] and [g]), the content of the specified I/O is not sampled even if the sampling trace instruction FUN51(S) is executed.

[4] (IV) Trigger circuit monitor

The trigger circuit monitor function reads the content of the I/O which is set under the trigger condition in a specified cycle (10 ms fixed) and when the read data satisfies the trigger condition, stores the circuit monitor data of the circuit which is specified beforehand in the sampling buffer and stops the reading operation.

When the read data does not satisfy the trigger condition, the function continues to monitor the circuit.



(4) Sampling buffer

The capacity of the sampling buffer is 8192 words. One (1) word (Note) is used for one I/O point as sampling data.

For example, when four I/O points are specified, assuming that the four points constitute a set, data of up to 2048 sets can be stored.

A list of the relationship between the number of trace monitor I/O points and the number of sampling sets is shown below.

No. of trace monitor I/O No. data points	1	2	3	4	5	6	7	8	9
No. of sampling sets	8192	4096	2730	2048	1638	1365	1170	1024	910

No. of trace monitor I/O No. data points	10	11	12	13	14	15	16
No. of sampling sets	819	744	682	630	585	546	512

Note: Since double word I/O is handled as two-word I/O, two words are used for a double word I/O point. When double word I/O is specified to all the four points in the above example, the number of trace monitor I/O No. data points is max. 8 points and the number of sampling sets at that time is 1024.

(5) Trigger

[1] Trigger

Trigger means that when some I/O data satisfies the specified requirement, the I/O status which is preset is sampled.

[2] Trigger requirements

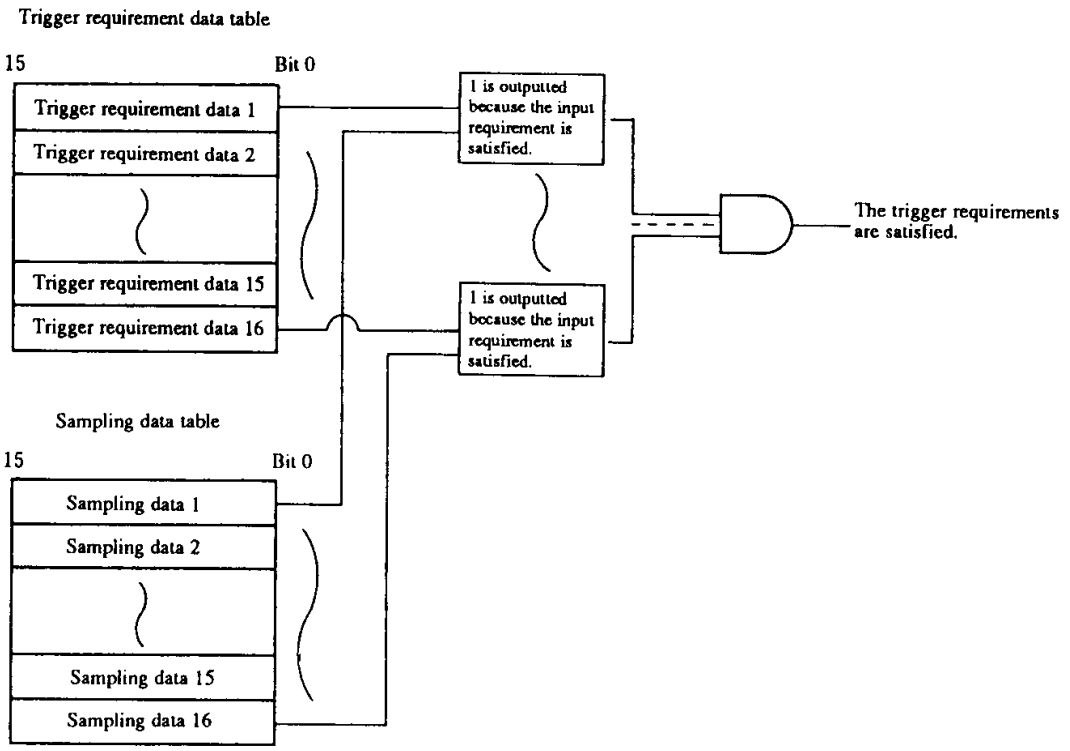
The number of data points to be set for triggering is up to 16. Double words, words, and bits can be set for I/O.

The I/O type which can be set for triggering is as follows:

	Trigger time chart	Trigger circuit monitor Trigger trace
I/O type which can be set	Bit I/O	Bit I/O Word I/O

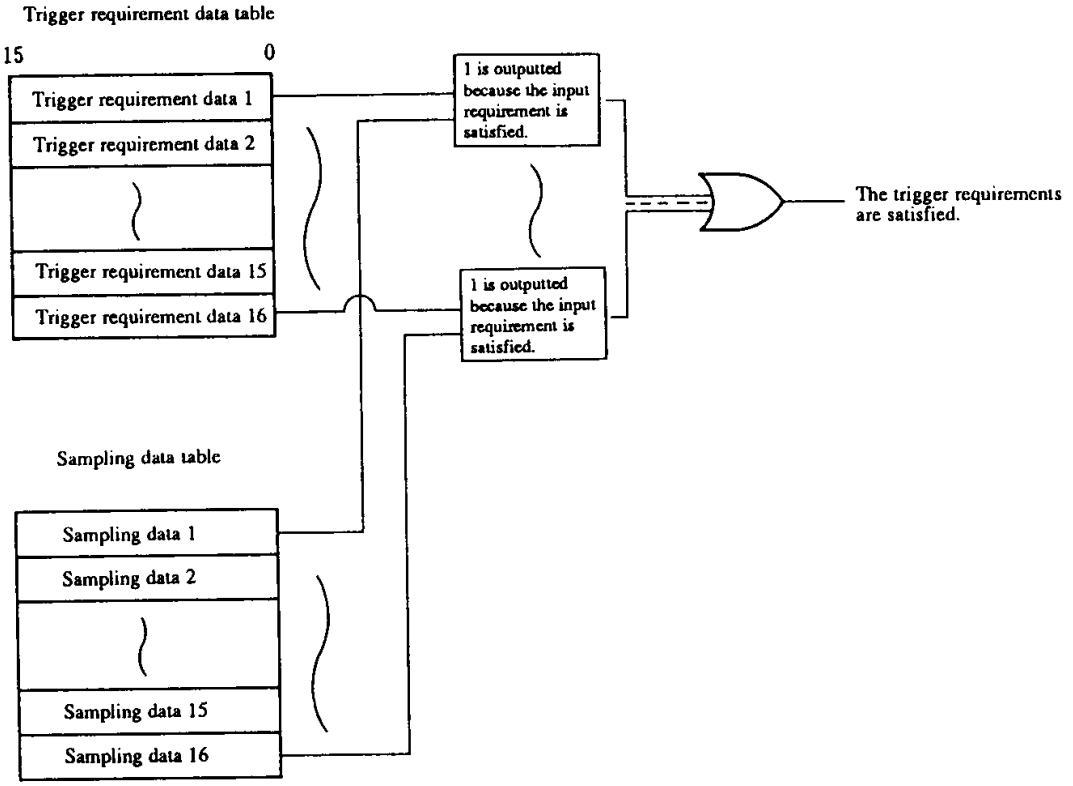
[3] Trigger AND and OR requirements

- AND requirements



The trigger AND requirements mean that when all the trigger requirement data which is set in each I/O matches with all the I/O sampling data, the trigger requirements are satisfied.

- OR requirements



The trigger OR requirements mean that when there is at least one set of the trigger requirement data which is set in each I/O and the sampling data corresponding to the I/O which match with each other, the trigger requirements are satisfied.

(6) List of data which is set before execution of the trace monitor

Parameters which are required to be set by the peripheral equipment (system software: Ladder Editor) before the trace monitor executes are as follows:

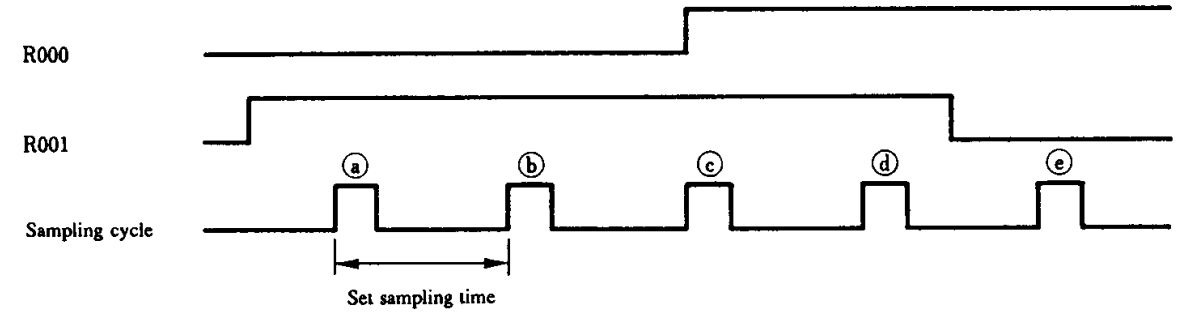
O: Required, X: Not required

Parameter to be set / Trace monitor function	Sampling time	Trace monitor I/O No.	Trigger requirement AND, OR	Trigger requirement data
Continuous time chart	O	O	X	X
Trigger time chart	O	O	O	O
Continuous trace	O	O	X	X
Trigger trace	O	O	O	O
CPU instruction trace	X	O	X	X
Trigger circuit monitor	X	X	O	O

(7) Trace monitor operation time chart

[1] Continuous time chart

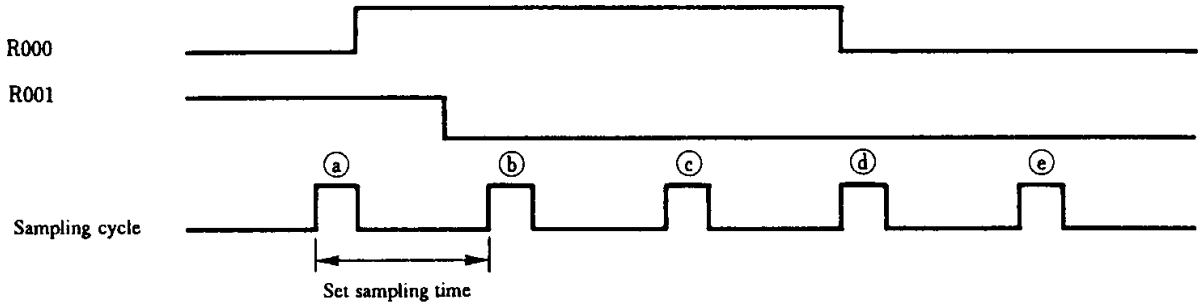
An operation time chart of the continuous time chart function for the bit I/O R000 and R001 is shown below.



The sampling cycle is determined by the set sampling time. At [a] and [b] during data sampling, R000 is OFF, though R001 is ON and data is sampled.

[2] Trigger time chart

Assuming that the trigger requirements are that the bit I/O R000 is ON and R001 is OFF, changes of R000 and R001 and an operation time chart of the trigger time chart function are shown below.



The sampling cycle is determined by the set sampling time. At [b] during data sampling, the trigger requirements are satisfied and the trigger time chart function is stopped.

[3] Continuous trace

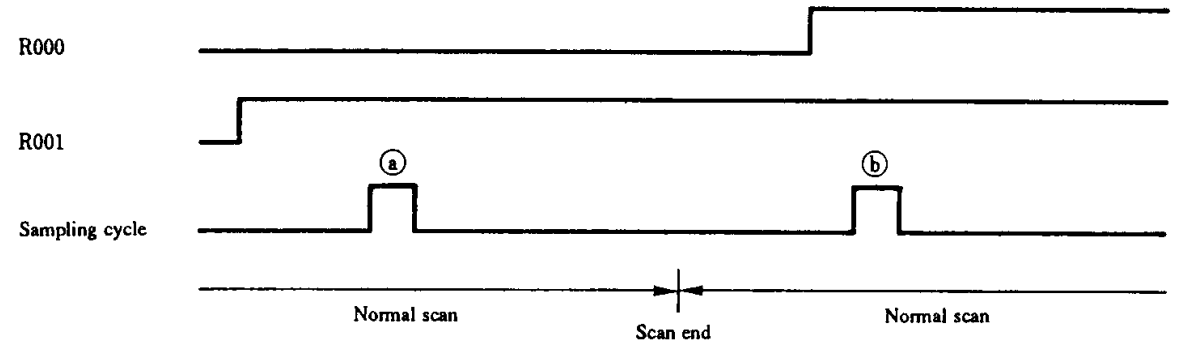
The operation time chart of the continuous trace function is basically the same as that of the continuous time chart function. A difference between both functions is that the continuous time chart function samples only bit I/O, though the continuous trace function can sample bit I/O, word I/O, and double word I/O.

[4] Trigger trace

The operation time chart of the trigger trace function is basically the same as that of the trigger time chart function. A difference between both functions is that the trigger time chart function samples only bit I/O, though the trigger trace function can sample bit I/O, word I/O, and double word I/O.

[5] CPU instruction trace

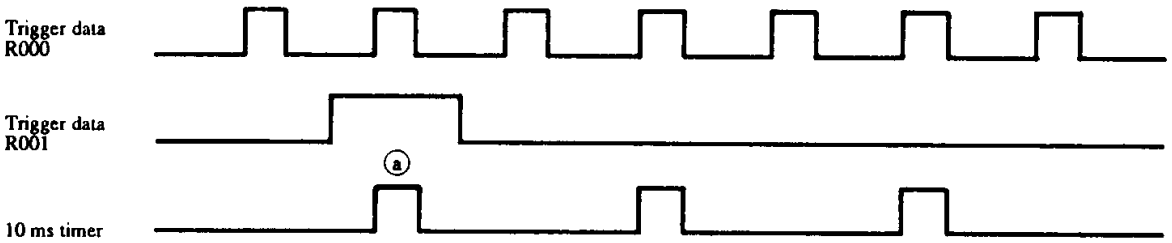
Changes of the bit I/O R000 and R001 and an operation time chart of the CPU instruction trace function are shown below.



When the sampling trace instruction provided in the ladder program is executed at [a] or [b], the CPU instruction trace function samples the set I/O data.

[6] Trigger circuit monitor

Assuming that the trigger requirements are that the bit I/O R000 is ON and R001 is ON, an operation time chart when the trigger circuit monitor function is performed for a circuit is shown below.



When the 10-ms timer is started, the trigger circuit monitor function checks the I/O which is set in the trigger requirements. When the I/O matches with the trigger data, the function samples the I/O data which is used in the specified circuit. In the above case, when the trigger data bit I/O R000 and R001 are in the ON state or at [a], the function samples the I/O data which is used in the set circuit.

(8) List of sampling operations in each CPU status

No.	CPU status	CPU operation mode	CPU arithmetic	I/O LED	I/O output	CPU sampling
1	STOP	Stop	Stop	No indication	No output	Disabled
2	RUN	Run	Execution	Indication	Output	Enabled
3	HLT	Halt	Stop	Indication	Output	Disabled
4	ERR	Error	Stop	No indication	No output	Disabled
5	D. RUN	Debug run	Execution within range	Indication	Output	* Partially enabled
6	D. HLT	Debug halt	Stop	Indication	Output	Disabled
7	S. STOP	Simulation stop	Stop	No indication	No output	Disabled
8	S. RUN	Simulation run	Execution	Indication	No output	Enabled
9	S. HLT	Simulation halt	Stop	Indication	No output	Disabled
10	S. ERR	Simulation error	Stop	No indication	No output	Disabled
11	S. D. RUN	Simulation debug run	Execution within range	Indication	No output	* Partially enabled
12	S. D. HLT	Simulation debug halt	Stop	Indication	No output	Disabled

* Sampling in the D. RUN or S.D. RUN status

[1] In the case of n scan RUN or 1 scan RUN, the time chart and I/O sampling functions sample data when the scan time is longer than the set sampling time.

When the CPU run time is longer than 10 ms, the trigger circuit monitor function samples data during scan run.

[2] In the case of 1 step RUN, when the instruction sampling function is in execution and the instruction to be executed is sampling trace FUN5 (S), data is sampled.

Note: All the trace monitor functions are stopped during the halt time in the on-line change mode.

(9) List of processing time of each trace monitor function

No.	Function name	Measuring conditions	H-2002	H-702 H-302
1	Continuous time chart Continuous trace	• No. of trace monitor I/O points: 1 • Sampling time: 10 ms	91 μs	188 μs
		• No. of trace monitor I/O points: 16 • Sampling time: 10 ms	340 μs	681 μs
2	Trigger time chart Trigger trace (Trigger requirement AND)	• No. of trace monitor I/O points: 1 • Sampling time: 10 ms • Trigger requirement: 1 point	129 μs	269 μs
		• No. of trace monitor I/O points: 16 • Sampling time: 10 ms • Trigger requirement: 16 points	614 μs	1288 μs
3	Trigger circuit monitor (Trigger requirement AND)	• Sampling point: 1 point • Trigger requirement: 1 point	85 μs	190 μs
		• Sampling time: 50 points • Trigger requirement: 16 points	2469 μs	5184 μs

Precautions

In the case of the continuous time chart, trigger time chart, continuous trace, or trigger circuit monitor function, when sampling starts, the 10-ms periodic system processing time of the CPU module is increased. Since the CPU instruction trace samples data by the ladder instruction, the scan time is increased by the execution time of the sampling instruction. (The 10-ms periodic system processing time will not be increased.)

Therefore, when using one of the functions, design the system in consideration of the time beforehand.

(10) Trigger matching flag, matching time, and sampling status

[1] Trigger matching flag

When one of the trace monitor functions such as the trigger time chart, trigger trace, CPU instruction trace, or trigger circuit monitor function is selected and the trigger-specified I/O satisfies the specified condition, the special internal output R7FC is turned ON and the trigger matching flag indicates that the trigger match occurs.

[2] Trigger matching time

The trigger matching time is the time that the trigger matching flag (R7FC) is turned ON and can be seen by the peripheral equipment.

[3] Sampling status

The sampling status is such that the special internal output R7FD is ON during execution of the trace monitor or OFF during stop of the trace monitor.

(11) Trace monitor setting data which is stored at the time of power failure

Trace monitor setting data which is stored at the time of power failure is as follows:

[1] Sampling time

[2] Trace monitor I/O No.

[3] Trigger condition data

[4] Trigger matching flag (R7FC)

[5] Trigger matching time

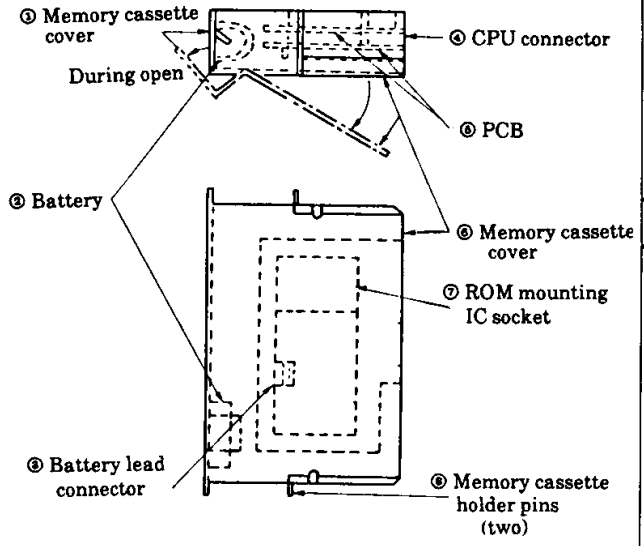
[6] Sampling status (R7FD)

[7] Sampling data

Chapter 4 Memory Cassette

4.1 Memory Cassette Parts Name

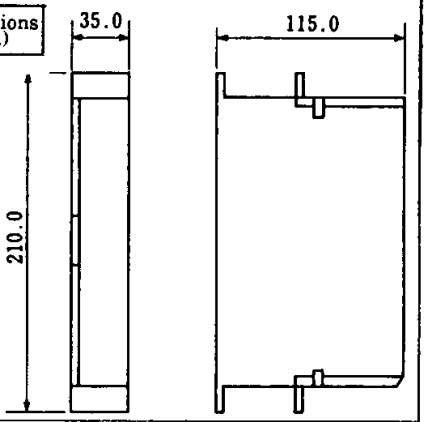
Parts Name



Type and Name

Type	Name
RAM−04H	RAM memory, 4K-step
RAM−08H	RAM memory, 8K-step
RAM−16H	RAM memory, 16K-step
RAM−48H	RAM memory, 48K-step
ROM−16H	ROM memory, 16K-step

Dimensions (mm)



Weight	Approx. 350 g

Parts Name and Functions

No.	Name	Function
①	Memory cassette cover	Memory cassette front cover (also used for memory backup battery support)
②	Battery	Memory backup battery
③	Battery lead connector	Connects the battery leads to the memory. These leads are disconnected during delivery.
④	CPU connector	Connects the memory cassette to the CPU.
⑤	PCB	Contains the ROM, RAM, and other component devices.
⑥	Memory cassette cover	Memory cassette side cover
⑦	ROM mounting IC socket	* ROM memory cassette only
⑧	Memory cassette support	Holds the memory cassette on the CPU support holes.

4.2 Memory Cassette Specifications

The CPU module requires memory cassettes. Suitability or unsuitability of each memory cassette with the CPU is shown below.

(○: Suitable, △: CPUP-**H, Only CPUP-**H or CPU-**Ha function suitable, x: Unsuitable)

Item \ Memory cassette		RAM2 -04H	RAM2 -08H	RAM2 -16H	RAM2 -48H	RAM3 -08H	RAM3 -16H	RAM3 -48H	ROM2 -16H	ROM2 -48H	RAM -04H	RAM -08H	RAM -16H	RAM -48H	ROM -16H
Memory type		RAM							ROM		RAM				ROM
Program capacity (k steps)		3.5	7.6	15.7	48.5	7.6	15.7	48.5	15.7	48.5	3.5	7.6	15.7	48.5	15.7
Data memory capacity (word)		1024		17408	50176	1024	17408	50176	17408	50176	1024		17408	50176	17408
[Range of word internal output]		WR0000 to WR03FF		WR0000 to WR43FF	WR0000 to WRC3FF	WR0000 to WR03FF	WR0000 to WR43FF	WR0000 to WRC3FF	WR0000 to WR43FF	WR0000 to WRC3FF	WR0000 to WR03FF		WR0000 to WR43FF	WR0000 to WR43FF	WR0000 to WR43FF
Word shared by bit and word		1024 words (WR000 to WR3FF)													
Suitable CPU	CPU2-20H	○	○	○	○	○	○	○	*2 ○	○	x	x	x	x	x
	CPU2-07H	○	○	○	x	○	○	x	○	x	x	x	x	x	x
	CPU2-03H	○	○	x	x	○	○	x	*1 ○	x	x	x	x	x	x
	CPUP-20H CPU-20H, Ha	△	△	△	△	*7 x	x	x	*2 △	△	○	○	○	○	*2 ○
	CPUP-07H CPU-07H, Ha	△	△	△	x	x	x	x	△	x	○	○	○	x	○
	CPUP-03H CPU-03H, Ha	△	△	x	x	x	x	x	*1 △	x	○	○	x	x	*1 ○
*3 Clock function		○	○	○	○	○	○	○	○	○	x	x	x	x	x
*4 Program change in high speed running		x	x	x	x	○	○	○	x	x	x	x	x	x	x
*5 Trace monitor function		○	○	○	○	○	○	○	○	○	x	x	x	x	x
*6 Battery life (hour)	Guaranteed value	6300	6300	4200	4200	4200	3200	3200	4200	4200	12500 (3000)	12500 (2000)	6300 (1500)	2400	12500 (3000)
	Practical value	15000	15000	10000	10000	10000	7800	7800	10000	10000	28000 (6800)	28000 (4800)	15300 (3700)	5600	28000 (6800)

1: In the case of CPU-03H*, the program size in which the ROM data can be stored is up to 7.6 k steps. The word internal output range is from WR0000 to WR03FF.

2: When ROM-16H is used in CPU*-20H which uses RAM*-48H, the program size in which the ROM data can be stored is up to 15.7 k steps and the word internal output range is from WR0000 to WR43FF.

*3: The clock function can be used only when CPU2-**H, ROM2-**H, RAM2-**H, and RAM3-**H are combined.

*4: The in-high-speed-running program change function can be used only when CPU2-**H and RAM3-**H are combined.

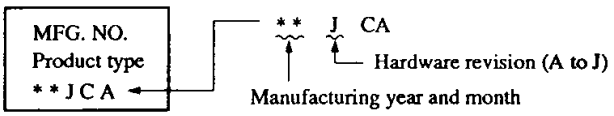
*5: The trace monitor functions can be used only when CPU2-**H and RAM2-**H, ROM2-**H, or RAM3-**H are combined when the ladder/instruction word programming software is Ladder Editor. For further details, refer to the Ladder Editor manual (instruction manual).

*6: • The battery life time indicates the total time that the power switch of the base where the CPU module is mounted is OFF.

- The bit special internal output R7D9 of the CPU is a flag for indicating a battery error, which is turned ON when the battery life has expired or when no battery is mounted.

  If this occurs, the CPU displays Error Code 71 and the BTE lamp (only CPU2-**H) lights.

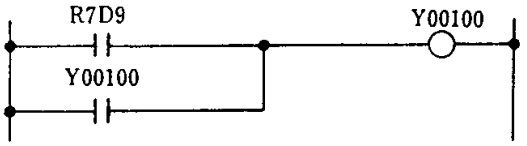
- When a battery error occurs, replace the battery within 50 hours. If the battery cannot be replaced immediately under unavoidable circumstances, keep the power switch of the CPU on.
- The battery storage period is one year after purchasing. Two years after operation start of the battery, replace it even if the life has not expired. (The guaranteed period of the battery is not two years.)
- Keep the power switch of the CPU on during battery replacement. (The PC may be on-line.)
- The value in each parentheses in the column of battery life indicates a value when the hardware revision of the product management number (manufacturing number) on the front of the memory cassette is one of A to J.



- Since even the ROM cassette backs up power failure storage specified internal output data and special internal output, it requires a battery. When using an ROM cassette newly, be sure to execute "CPU initialize" from the peripheral equipment.

  A circuit example using R7D9 is shown below.

  By using it, a battery error can be outputted to the external output Y00100.



*7: RAM3-**H (a memory cassette with an in-high-speed-running program change function) cannot be used for CPUP-**H and CPU-**Ha. Note that when it is used, a malfunction may be caused.

4.3 ROM

The H-series is provided with an ROM cassette. The user program may be changed from an RAM to an ROM so as to operate the PC or the program may be stored.

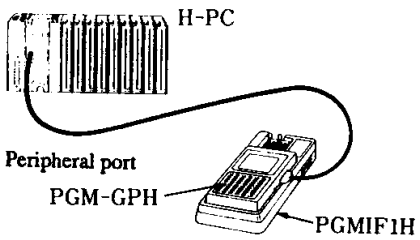
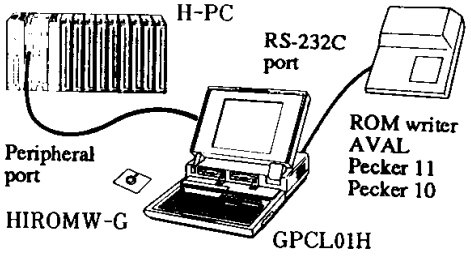
> **NOTE:** When ROM-48H is used, to edit 4 512 k-bit ROM chips and a 512 k-bit ROM chip to 1M bits, an ROM writer (Pecker 11 by AVAL, Ltd.) is necessary. Prepare 512 k-bit ROM chips of MBM27C512-20 (FUJITSU) or equivalent.
>
> Since even the ROM cassette backs up special internal output, it requires a battery.

The following methods are available to write an RAM into an ROM.

(1) A combination of a portable graphic programmer (PGM-GPH) and optional interface (PGMIF1H)

(2) A combination of a graphic programming console (GPCL01H), ROM writer software (HIROMW-G), and ROM writer (Peckers 10, 11)

Comparison between (1) and (2) is shown in the table below.

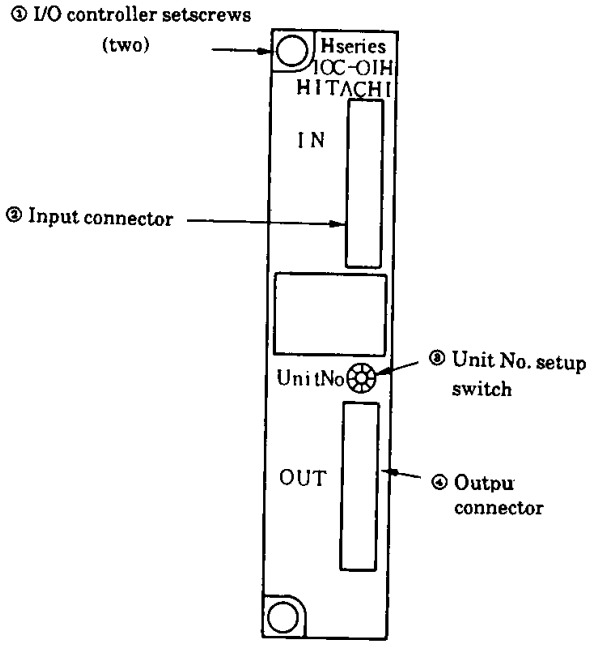
	Portable graphic programmer, optional interface	Graphic input device, ROM writer, ROM writer software
Corresponding ROM	ROM-16H, ROM2-16H, ROM2-48H*1	ROM-16H, ROM2-16H, ROM2-48H*1
Program in which RAM can be changed to ROM	Only ladder diagram / instruction word program	The ladder diagram / instruction word program may be used together with the flow program.
How to use	Connect the programmer to the CPU module and change the RAM to an ROM.	Change the program floppy disk to an ROM (ladder / instruction word) or connect the CPU to GPCL01H and change the RAM to an ROM (flow program and coexisting program).
System configuration		

*1: When changing the RAM to an ROM for ROM2-48H, write it into the four 512 k-bit ROM chips by this function. Thereafter, edit it by the ROM writer (Pecker 11 by AVAL, Ltd.) and then write it into two 1M-bit ROM chips (ROMC248H supplied together with the product).

Chapter 5 I/O Controller

5.1 I/O Controller Parts Name

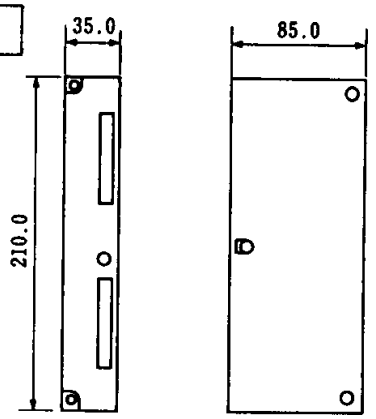
Parts Name



Type and Name

Type	Name
IOC-01H	I/O controller

Dimensions (mm)



Weight	Approx. 250 g

Parts Name and Functions

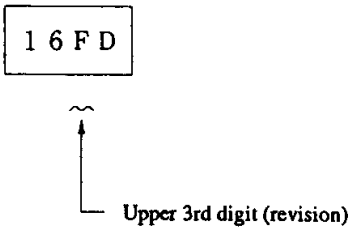
No.	Name	Function
①	I/O controller setscrew	Fixes the I/O controller to the expansion base.
②	Input connector	Cable connector to the CPU or another I/O controller
③	Unit No. setup switch	Rotary switch which sets the unit number of the expansion base. Rotate the arrow to the desired unit number position.
④	Output connector	Cable connector to another I/O controller

5.2 Suitability with the CPU Module

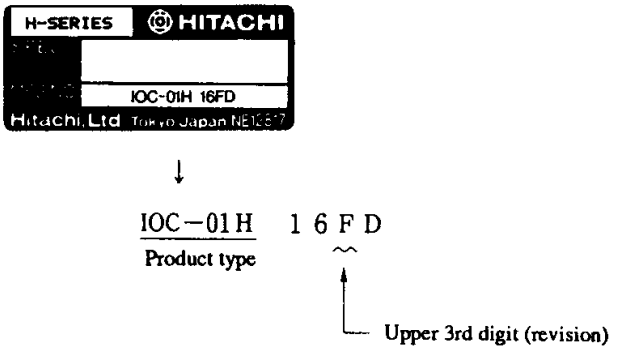
In the case of the H-2002, H-702, or H-302 system (the CPU module is CPU2-**H), an I/O controller of Revision F or subsequent release should be used.

When IOC-01H of Revision E or previous release is combined, a "51" error (I/O module error) or a "41" error (I/O information check error) may occur in the CPU module or incorrect I/O data may be obtained.

[1] Revision plate:



[2] Specification plate:



Suitability of I/O controller with CPU

Revision of IOC-01H	CPU2-**H	CPUP-**H CPU-**Ha
"A" - "E" (E or previous release)	Disabled	Enabled
"F" - ("F" or subsequent release)	Enabled	Enabled

Chapter 6 Power Module

To operate the H-series programmable controller (PC), the following two batteries are necessary.

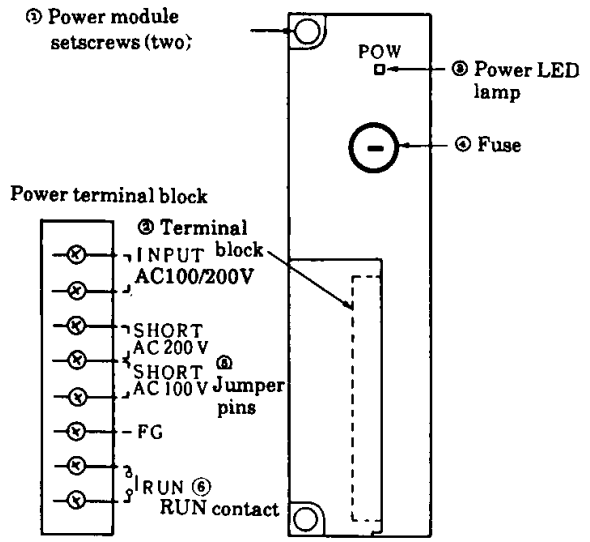
1. For H-series PC body: This battery is a power source to operate the H-series PC. One battery is necessary for each PC base so as to supply 5 VDC and 24 VDC to each PC module.

2. For I/O signal: This battery is a power source for I/O of the I/O module.

When the capacity of 24 VDC in Item 1 is insufficient, an external power source of 24 VDC is necessary. The power module is used for the battery in Item 1. As to the battery in Item 2, prepare it according to the specification.

6.1 Power Module Parts Name

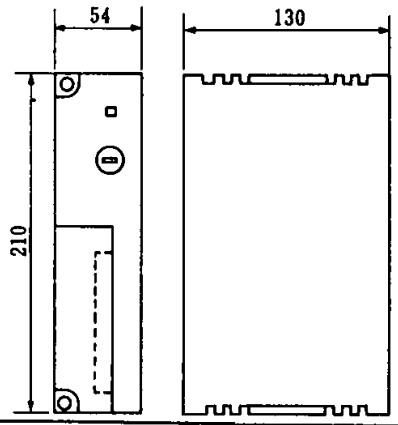
Parts Name



Type and Name

Type	Name
AVR02H	Power module (5VDC 2A, 24VDC 2A)
AVR04H	Power module (5VDC 4A, 24VDC 1.5A)
AVR06H	Power module (5VDC 2A, 24VDC 0.8A)
AVR08H	Power module (5VDC 2A, 24VDC 0.5A)

Dimensions (mm)



Weight	Approx. 1 kg

Parts Name and Functions

No.	Name	Function
①	Power module setscrew	Fixes the power module to the basic or expansion base.
②	Terminal block	Connect the 100 or 200-VAC power cable.
③	Power LED lamp	Lights when the power supply is turned on. Goes out when turned off.
④	Fuse	Protects the power circuit from overvoltage.
⑤	Jumper pin	Select the input voltage (100 or 200 VAC) according to the source voltage. (The jumper pin is set to 200 VAC during delivery.)
⑥	RUN contact	Outputs the signal when the CPU RUN LED lights. (The contact is closed when the RUN LED lights.) Note: This contact does not function on the power module mounted on the expansion base.

6.2 Specification

		AVR-02II	AVR-04	AVR-06II	AVR-08H	AVR-04DH*2	AVR-08DH*2
Output capacity	5 V	2 A	4 A	6 A	9 A	4 A	9 A
	24 V	2 A	1.5 A	1.0 A	0.5 A	1.5 A	0.5 A
	Voltage	85 - 135 VAC (Short 100 VAC), 170 - 264 VAC (Short 200 VAC)				19.2 - 30 VDC (ripple voltage included)	
Input	Frequency	47 - 63 Hz (sine wave)				Direct current	
	Rush current	30 A (rated load, input 132 VAC), 40 A (rated load, input 264 VAC)				35 A (rated load, input 30 VDC)	
Power consumption		150 V A					
Protection		[1] AC receiving part Fuse (250 VAC, 5 A)*1 [2] DC receiving part Fuse (7 A)*1 [3] 5 V output Overcurrent and overvoltage protection [4] 24 V output Overcurrent protection					
RUN contact output*3		24 VDC, 100 VAC, 200 VAC (resistance load), COS ø = 0.4 0.5 A(L load)					
Mounting location		Slot at the left end of the base					
Dimensions		54 (W) x 210 (H) x 130 (D) mm					
Weight		Approx. 1 kg					

*1: Glass tube fuse of 5.2 mm diameter and 20 mm length. A spare fuse is attached to the power module.

*2: AVR-04DH and AVR-08DH are power sources dedicated to battery receiving.

*3: In the case of CPU2-**H, it can be set by the CPU module that when the ERR lamp lights, the contact output is turned ON.

6.3 How to select the Power Module

Obtain the total supply current of the modules to be mounted in the unit and select the power module from the above six modules.

AVR-02H has an output capacity for the expansion base. Do not use it for the basic base.

Selection procedure

[1] Pick up the type and quantity of modules to be used for each base and obtain the total of supply currents from the supply current list (in Section 1.4).

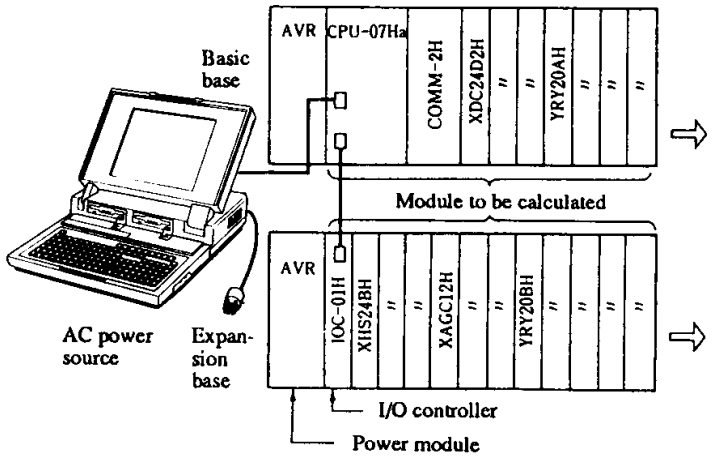
Some modules use both 5 V and 24 V. Pick up and calculate each current.

[2] Calculate a current having a margin of 10% in units of 5 V or 24 V from the result in [1].

[3] Select a power module which satisfies each current obtained in [2] from the above table.

[Selection example 1]

The drawing below shows a configuration example of the H-700 system. A graphic programming console (GPCL01H) is used as a peripheral device.



Basic base

Type	Q'ty	5 V supply current	24 V supply current
CPU-07Ha	1	2.05 x 1	—
COMM-2H	1	0.8 x 1	—
XDC24D2H	3	0.3 x 3	—
YRY20AH	4	0.12 x 4	0.16 x 4
Total current (A)		4.23	0.64

Expansion base

Type	Q'ty	5 V supply current	24 V supply current
IOC-01H	1	0.22 x 1	—
XHS24BH	3	0.15 x 3	—
XAGC12H	3	0.06 x 3	0.19 x 3
YRY20BH	5	0.18 x 5	0.285 x 5
Total current (A)		1.75	1.995

[1] Selection of the power module for the basic base

4.23 A (5 V supply current) x 1.1 (margin of 10%) = 4.653 A → AVR-06H, AVR-08H

0.64 A (24 V supply current) x 1.1 (margin of 10%) = 0.704 A→ AVR-06H

Select AVR-06H

Firstly as a power module which satisfies a current of 4.653 A at 5 V, AVR-06H which is suitable for up to 6 A and AVR-08H which is suitable for up to 9 A are obtained.

Next, a power module which satisfies a current of 0.70 A at 24 V is AVR-06H among the two. Therefore, select AVR-06H.

[2] Selection of the power module for the expansion base

1.75 A (5 V supply current) x 1.1 (margin of 10%) = 1.925 A → Every module suitable

1.995 A (24 V supply current) x 1.1 (margin of 10%) = 2.195 A → No module suitable

Select AVR-02H for 5 V supply and prepare an external power source for 24 V supply

Checking a power module which satisfies a current of 1.925 A at 5 V in the same way as [1] shows that every module is suitable.

On the other hand, there is no power module which satisfies a current of 2.195 A at 24 V found. Select AVR-02H so as to supply only a current at 5 V and prepare an external power source for a current at 24 V. (For connection of an external power source, see Section 12.1.(2), "Base Installation".)

By replacing the I/O module mounting location as shown below, the H-series power module may be substituted.

[3] Replacement of the I/O module between units

Each power module is restricted on its output capacity and some power module may not satisfy the supply current of one unit at 24 VDC as shown in [2].

However, by interchanging the I/O modules between the units, they may be used.

Interchange two YRY20AH modules in the basic base with two YRY20BH modules in the expansion base in the previous system example and obtain the supply current in each unit.

Basic base

Type	Q'ty	5 V supply current	24 V supply current
CPU-07IIa	1	2.05 x 1	—
COMM-2II	1	0.8 x 1	—
XDC24D2II	3	0.3 x 3	—
YRY20AII	2	0.12 x 2	0.16 x 2
YRY20BII	2	0.18 x 2	0.285 x 2
Total current (A)		4.35	0.89

Expansion base

Type	Q'ty	5 V supply current	24 V supply current
IOC-01H	1	0.22 x 1	—
XIIS24BH	3	0.15 x 3	—
XAGC12II	3	0.06 x 3	0.19 x 3
YRY20BH	3	0.18 x 3	0.285 x 3
YRY20AII	2	0.12 x 2	0.16 x 2
Total current (A)		1.63	1.745

AVR for the basic base

4.35 (5 V supply current) x 1.1 = 4.785 → AVR-06H, AVR-08H

0.83 (24 V supply current) x 1.1 = 0.979 → AVR-06H

Select AVR-06H

AVR for the expansion base

1.63 (5 V supply current) x 1.1 = 1.793 → AVR-02H, ABR-04H, AVR-06H, AVR-08H

1.745 (24 V supply current) x 1.1 = 1.920 → AVR-02H

Select AVR-02H

As shown above, the output capacities of the power modules in both basic and expansion bases are suitable for running.

(Points of selection)

1. Select suitable power modules which satisfy the supply current at 5 VDC and then select and determine suitable power modules which satisfy the supply current at 24 VDC from them.

2. When the supply current at 24 VDC from the power module is insufficient, take one of the measures (1) and (2) shown below.

   (1) Replace the I/O modules between the units and adjust them so that they are suited to the output capacity of the power module.

   (2) Prepare an external power source of 24 VDC. In this case, use a suitable power module for 5 VDC. See Section 12.1.(2), "Base Installation".

6.4 Precautions for Operation

(1) Life of power modules

Many electrolytic capacitors are used in each power module. Each electrolytic capacitor has a life span and it is said that when the ambient temperature rises 10°C, the life span is halved.

The life span of each power module is about 5 years at an ambient temperature of 35°C. Fix the spares in consideration of the operational temperature requirements. Mount the power modules in consideration of the ventilation and ambient temperature to lengthen the life span.

(2) Breaking the power for module replacement

For module replacement or layout change, be sure to break the power of the PC body and the power of the external I/O module.

If any module is removed or inserted (hot-line work) with power on, electronic parts may be destroyed or you may get an electric shock. Be sure to replace the module after the power is broken.

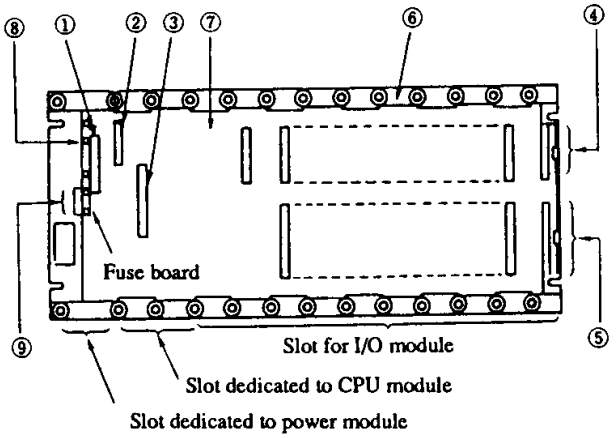
Chapter 7 Base

The base is used to fix various modules and to transmit or receive signals between the modules. It receives an external voltage of 24 VDC as required for operation of the H-series body.

There are three types of bases available depending on the operational purpose, such as a basic base (see Section 7.1) for mounting a CPU module, an expansion base (see Section 7.2) for adding I/O modules, and a special expansion base (see Section 7.3) for mounting a remote I/O master station. Three types of basic bases and expansion bases different in size are available respectively so as to select suitably according to the number of mounting I/O modules. (The special expansion base is only for 4 slots.)

7.1 Structure of the Basic Base

Parts Name

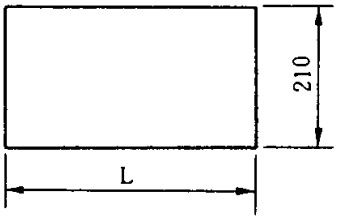


No.	Name	Function
①	Power module connector	• 5 VDC and 24 VDC are supplied to each module from the power module. • Transmission line of instantaneous stop monitor and RUN contact signals
②	CPU I/O bus connector	• The I/O bus of the CPU module is connected.
③	CPU system bus connector	• The system bus of the CPU module is connected.
④	I/O bus connector	• The I/O bus of each module is connected.
⑤	System bus connector	• The system bus of each module is connected.
⑥	Mount base	• This is a basic part for mounting the mother board and fixing each module. • The four corners of the base are tightened with screws to mount inside the board.
⑦	Mother board	• This is a circuit board for relaying the I/O bus and system bus between the CPU module and each module.
⑧	PG terminal	• This is a PG cable terminal for stabilizing the potential between the units when the expansion base is used.
⑨	External 24 VDC supply terminal	• This is a terminal for receiving an external supply voltage when the 24 VDC output capacity of the power module is insufficient.

Type

Type	No. of P I/O slots
BSU-02H	2
BSU-05H	5
BSU-09H	9

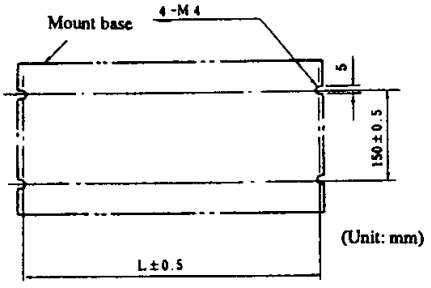
Dimensions (mm)



Type	L dimension	Weight
BSU-02H	231.5	Approx. 550 g
BSU-05H	338	Approx. 780 g
BSU-09H	480	Approx. 1,200 g

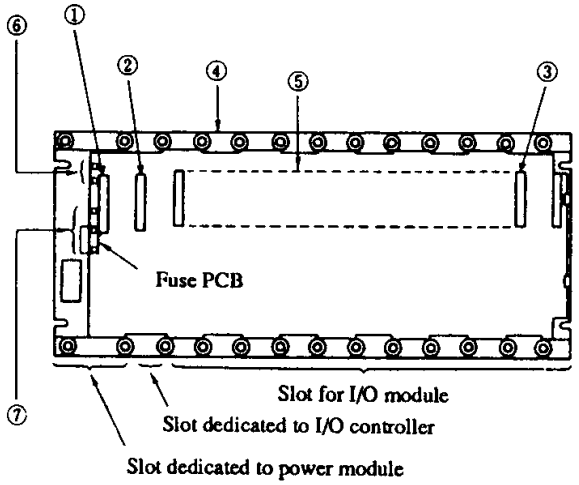
Mounting dimensions

Product name	Type	L dimension
	BSU-02H	211.5
Basic base	BSU-05H	318
	BSU-09H	460



7.2 Structure of the Expansion Base

Parts Name

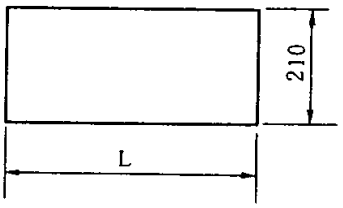


No.	Name	Function
①	Power module connector	• 5 VDC and 24 VDC are supplied to each module from the power module. Transmission line of instantaneous monitor and I/O signals
②	I/O controller connector	• The I/O controller (IOC-01H) or remote I/O local station is connected.
③	I/O bus connector	• The I/O bus of the CPU module is connected.
④	Mount base	• This is a basic part for mounting the mother board and fixing each module. • The four corners of the base are tightened with screws to mount inside the board.
⑤	Mother board	• This is a circuit board for relaying the I/O bus between the I/O controller or remote I/O local station and each module.
⑥	PG terminal	• This is a PG cable terminal for stabilizing the potential between the units (between the basic base and expansion base or between the expansion base and expansion base).
⑦	External 24 VDC supply terminal	• This is a terminal for receiving an external supply voltage when the 24 VDC output capacity of the power module is insufficient.

Type

Type	No. of P I/O slots
EXU-04H	4
EXU-07H	7
EXU-11H	11

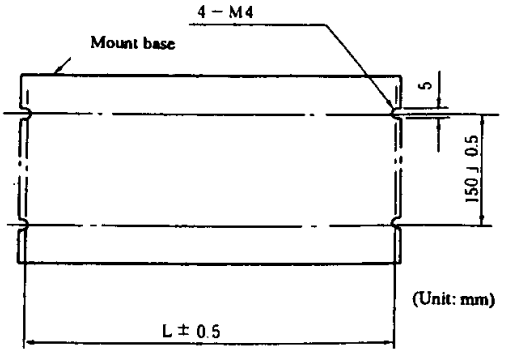
Dimensions (mm)



Type	L dimension	Weight
EXU-04H	231.5	Approx. 480 g
EXU-07H	338	Approx. 700 g
EXU-11H	480	Approx. 1,100 g

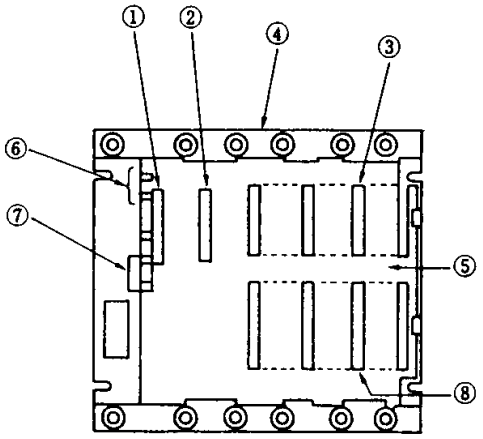
Mounting dimensions

Product name	Type	L dimension
Expansion base	EXU-04H	211.5
	EXU-07H	318
	EXU-11H	460



7.3 Structure of the Special Expansion Base

Parts Name



No.	Name	Function
①	Power module connector	• 5 VDC and 24 VDC are supplied to each module from the power module. • Transmission line of instantaneous monitor and I/O signals
②	I/O controller module connector	• The I/O controller (IOC-01H) or remote I/O local station is connected.
③	I/O bus connector	• The I/O bus of the CPU module is connected.
④	Mount base	• This is a basic part for mounting the mother board and fixing each module. • The four corners of the base are tightened with screws to mount inside the board.
⑤	Mother board	• This is a circuit board for relaying the I/O bus between the I/O controller or remote I/O local station and each module.
⑥	PG terminal	• This is a PG cable terminal for stabilizing the potential between the units (between the basic base and expansion base or between the expansion base and expansion base).
⑦	External 24 VDC supply terminal	• This is a terminal for receiving an external supply voltage when the 24 VDC output capacity of the power module is insufficient.
⑧	System connector	• In the case of BEU-04H, the connector is subjected to the signal termination processing.

NOTE: (1) When a remote I/O local station is mounted to the connector [2], no remote I/O master station can be mounted to the I/O module connector [3].

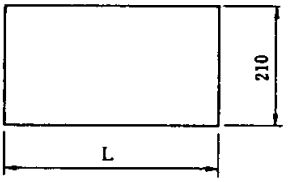
(2) The special expansion base is only for 4 slots.

(3) When a remote system is structured by mounting a remote I/0 master station to the special expansion base, no programming can be performed from a local station connected to the master station.

Type

Type	No. of P I/O slots
BEU-04H	4

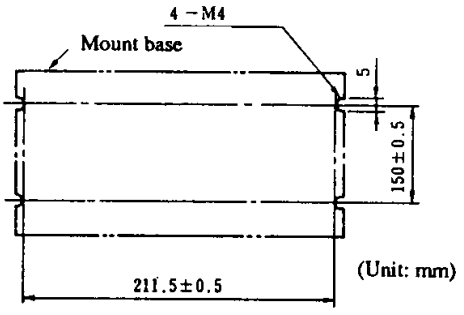
Dimensions (mm)



Type	L dimension	Weight
BEU-04H	231.5	Approx. 550 g

Mounting dimensions

Product name	Type	L dimension
Special expansion base	BEU-04H	211.5



Chapter 7

7.4 No. of Slots for Mounting I/O Modules

The basic base, expansion base, and special expansion base which have the same dimensions are different from each other in the number of I/O modules which can be mounted.

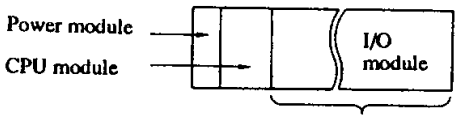
In the basic base, a power module and CPU module are always mounted.

In the expansion base, there are three combinations available.

- Power module + I/O controller: Independent system
- Power module + remote I/O local station: Remote I/O system

  In the case of the special expansion base, a remote I/O master station can be mounted additionally.
- Power module + I/O controller + remote I/O master station: Remote I/O system

(1) Basic base



No. of slots which can be used: 2, 5, or 9

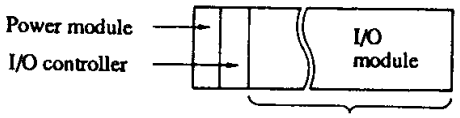
In the I/O module slots of the basic base, a communication function module (remote local station excluded) and sophisticated function module can be mounted in addition to I/O modules.

Note: The system connector of slot 0 of the basic base cannot be used.

Type	Dimensions	No. of I/O module slots
BSU-02H	231.5 (W) x 210 (H)	2
BSU-05H	338 (W) x 210 (H)	5
BSU-09H	480 (W) x 210 (H)	9

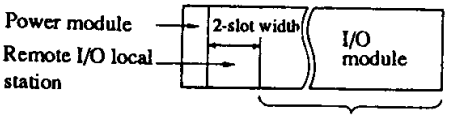
(2) Expansion base, special expansion base

[1] When an I/O controller is used



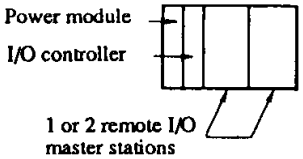
No. of slots which can be used: 4, 7, or 11

[2] When a remote I/O local station



No. of slots which can be used: 3, 6, or 10

[3] When a remote I/O master station



No. of slots which can be used: 2 or 0

Type	Dimensions	No. of I/O module mounting slots		
		①	②	③
EXU-04H	231.5 (W) x 210 (H)	4	3	No remote I/O master station can be mounted.
EXU-07H	338 (W) x 210 (H)	7	6	
EXU-11H	480 (W) x 210 (H)	11	10	
BEU-04H	231.5 (W) x 210 (H)	4	3	2 or 0

In the remote I/O system in [2], a remote I/O local station is used in the expansion base. The remote I/O local station occupies a width of two slots. Therefore, the number of slots which can be used is smaller than that in [1] by one.

In the remote I/O system in [3], (a) remote I/O master station(s) is(are) used in place of the I/O module(s) in [1]. Up to 2 remote I/O master stations can be mounted in BEU-04H.

Chapter 8 I/O Module

8.1 Outline

There are various I/O modules available depending on the input power type (24 VDC, 100 VAC, 200 VAC, etc.) and the number of points (16, 32, and 64 points).

When mounting I/O modules on the base or connecting signal cables, remove the module cover beforehand.

When using input modules or output modules, it is necessary to supply two types of voltages. One of them is a voltage for module body running and the other is a voltage for input signals and output loads. When each module is mounted to the base, 5 V and 24 V for body running are automatically supplied to it from the power module for running. Select the power module according to the supply current of modules to be used. When the capacity of 24 VDC is insufficient, an additional capacity can be supplied externally.

As to a voltage for input signals and output loads, prepare a one which is suitable for the specification of each module.

8.2 I/O Module List

An input module list and output module list are shown below.

[Input module]

Module name			No. of input (X) points			Input voltage (V)									Input response time ON↔OFF		Internal supply current (A)	
						AC (50/60), sine wave					DC							
Product name	Module name	Type	16	32	64	12	24	48	100	200	5	12	24	48	1 ms	16 ms	DC 5 V	DC 24 V
AC input	100 VAC input module	XAC10AH	O						O							O	0.12	–
	200 VAC input module	XAC20AH	O							O						O	0.12	–
	100 VAC input module	XAC10BH		O					O							O	0.15	–
	200 VAC input module	XAC20BH		O						O						O	0.15	–
AC or DC input	12 or 24 VAC or VDC input module	XDC24AH	O			O	O					O	O			O	0.12	–
	48 VAC or VDC input module	XDC48AH	O					O						O		O	0.12	–
	12 or 24 VAC or VDC input module	XDC24BH		O		O	O					O	O			O	0.15	–
	48 VAC or VDC input module	XDC48BH		O				O						O		O	0.15	–
DC input	High-speed DC input module	XHS24BH		O								O	O		O		0.15	–
	64-point DC input module	XDC12DH			O							O			O		0.30	–
		XDC24D2H			O								O		O		0.30	–
TTL input	TTL level input module	XTT05BH		O							O	O			O		0.15	–

[Output module]

Module name			No. of output points			Output voltage (V)						Output delay (ms)						Internal supply current (A)	
						AC		DC				OFF↔ON			ON↔OFF				
Product name	Module name	Type	16	32	64	100	200	5	12	24	48	0.3 max.	1 max.	7 max.	1 max.	12 max.	1/2 cycle + 1 max.	DC 5 V	DC 24 V
Contact output	Relay output module with varister	YRY20AH	O			O	O	O	O	O				O		O		0.12	0.16
	Relay output module	YRY20BH		O		O	O	O	O	O				O		O		0.18	0.29
	Independent contact output	YDR20AH	O			O	O	O	O	O				O		O		0.12	0.16
TRIAC output	SSR output module	YSR20AH	O			O	O						O				O	0.38	–
		YSR20BH		O		O	O						O				O	0.80	–
Transistor output (sink load)	Sink type transistor output module	YTR48AH	O							O	O	O			O			0.12	–
		YTR48BH		O						O	O	O			O			0.18	–
	64-point sink type DC output module	YTS24DDH			O				O	O		O			O			0.38	–
Transistor output (source load)	Source type transistor output module	YTS48AH	O							O	O	O			O			0.12	–
		YTS48BH		O						O	O	O			O			0.18	–
	64-point source type DC output module	YTS24DH			O				O	O		O			O			0.38	–
TTL output (source load)	TTL output module	YTT05BH		O				O	O				O		O			0.18	–

[Analog I/O module]

Module name			No. of I/O points		I/O voltage			I/O current	Total accuracy		Resolution		Chang-ing time	Internal supply current (A)	
					DC V			DC mA	%		Bit				
Product name	Input or output name	Type	X8W	Y4W	0 - 10	±10	1 - 5	4 - 20	±1	±0.5	8	12	ms	DC 5 V	DC 24 V
8-channel analog input	Voltage input	XAGV08H	O		O				O		O		5	0.06	0.07
		XAGV12H	O			O				O		O	5	0.06	0.17
		XAGV121H	O		O					O		O	5	0.06	0.17
		XAGV122H	O				O			O		O	5	0.06	0.17
	Current input	XAGC08H	O					O	O		O		5	0.06	0.07
		XAGC12H	O					O		O		O	5	0.06	0.19
4-channel analog output	Voltage output	YAGV08H		O	O				O		O		5	0.07	0.10
		YAGV12H		O		O				O		O	5	0.06	0.10
		YAGV121H		O	O					O		O	5	0.06	0.10
		YAGV122H		O			O			O		O	5	0.06	0.10
	Current output	YAGC08H		O				O	O		O		5	0.07	0.17
		YAGC12H		O				O		O		O	5	0.06	0.19

[Resistance temperature detector input]

Module name		No. of input points	Connected to	Conversion time	Internal supply current (A)	
Resistance temperature detector input	XRTD01H	X8W or X4W	Platinum resistance temperature detector (Pt 100 Ω 2 mA)	1 s / 8 channels	5 VDC	24 VDC
					0.16	0.10

8.3 Application Notes

(1) I/O modules

① The SSR output module is recommended to use if a load having the low power factor is used, the AC load of the output module is switched frequently, and if a large capacity of AC load such as an electric magnet is used. (The relay output may reduce the service life.)

② Turn on or off the output module for load L driving at the 1-second on and 1-second off interval or longer.

③ When using a counter or timer having the DC-to-DC converter as load, an inductance or resistor must be connected in serial to the load to minimize the rush current or use an output module having a larger capacity. Such counter or timer generates a rush current at a certain time interval when turned on or during operation. If an output module is selected by considering the average current only, a problem may occur.

④ If an input module is used, the total number of points that can simultaneously turn on varies depending on the input voltage and ambient temperature. Determine the total number of these points by using the derating curve (see Subsection 3.5.2 "Input module specifications").

⑤ If an output module is used, the maximum load current varies depending on the ambient temperature. Determine the maximum load current by using the derating curve (see Subsection 3.6.5 "Output module specifications").

⑥ Determine the output module rating by considering the rush current. The rush current ten times greater than the steady state current may generate in the lamp load.

⑦ The total current consumption of modules mounted on a single base must not exceed the capacity of the power module.
The total number of modules that can be inserted into slots of a single base may be restricted due to power module capacity.

Example
If the YRY20BH contact output module (having the current consumption of 0.18 A (5 VDC) or 0.27 A (24 VDC)) is used.

If the AVR-02H (5/24VDC, 2A) power module is used on the YRY20BH module, up to 7 modules can be mounted on a single base. (5 VDC ~ 0.18 A × 7 = 1.26 A < 2 A; 24 VDC ~ 0.27 A × 7 = 1.89 A < 2 A)

⑧ The crimp terminal for external I/O module connection should be covered with an insulation tube to prevent short-circuiting.

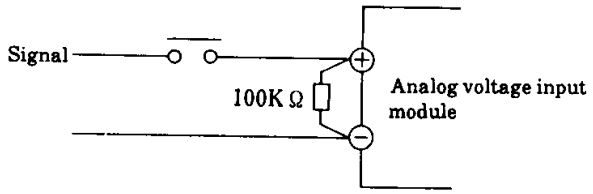
⑨ A fuse is mounted in each common line on the SSR output and transistor output modules. This prevents burnout of PCB patterns, but the SSR and transistor circuits themselves are not protected completely. A fuse having an appropriate capacity should be used for each output to prevent possible errors due to jumpered external circuits.

Output module having a fuse

SSR output	YSR20AH	Transistor output	YTR24DH
	YSR20BH		YTS48AH
Transistor output	YSR48AH		YTS48BH
	YSR48BH		YTS24DH

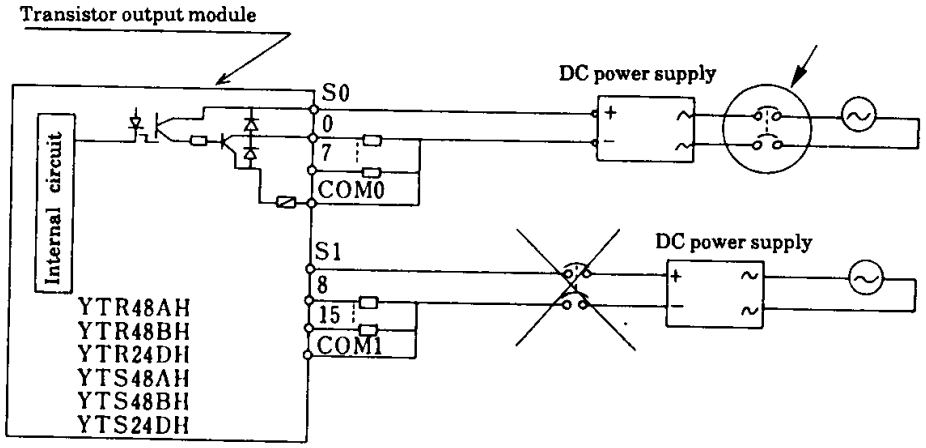
⑩ If the fuse is removed from an output module that should have the fuse (listed in Item 9 above), the fuse blowout alarm is not issued (by the fuse blowout lamp of the output module or 7-segment LED of the CPU module).

⑪ An analog voltage input module provides the high input impedance. If the input is open, invalid data may be read by the CPU due to inductance. A resistor should be connected to the input terminal if the input signal line is disconnected or if the signal poewr supply is turned off.

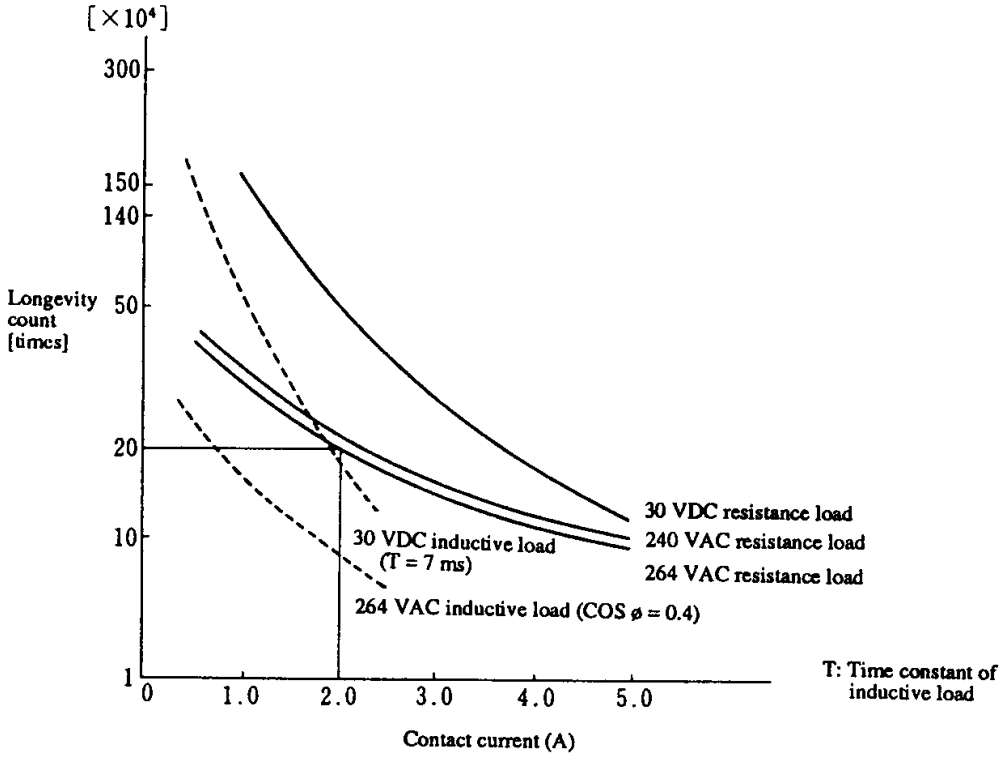


Set the input voltage within the range defined by the specifications. An excessive input may cause a serious affect onto data of other channels.

⑫ Always connect the power switch to the AC input terminal of DC power supply when inserting the power switch into the power line of the transistor output module.



(12) Electrical life curve of the H-series output relay (Reference)

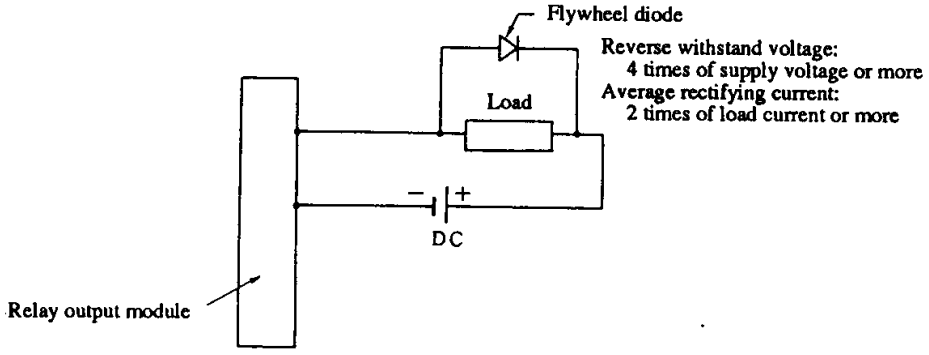


Module to be checked

- Relay output module with varister (YRY20AH)
- Relay output module (YRY20BH)
- Independent contact output (YDR20AH)

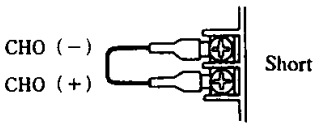
When the output relay contact is used at a rated load (240 V and 2 A, 24 VDC and 0.5 A), the longevity count of the contact is about 200000 times. The mechanical longevity count is 10000000 times.

When a DC voltage is used, the contact may be locked depending on the use frequency and the life span may be shortened. To prevent it, insert a flywheel diode between both ends of the external load.



(13) Analog I/O module

[1] When using an unused channel of the analog input module (XAGV08H, XAGC08H, XAGV12H, XAGC12H, XAGV121H, XAGV122H), short the input terminals.



[2] When turning the power switch (on the PC side) of the analog input module (YAGV08H, YAGC08H, YAGV12H, YAGC12H, YAGV121H, YAGV122H) off, be sure to turn the power switch on the machine side off first to prevent maloutput.

[3] Use a load resistance of 500 Ω or less (an error is included) for the analog current output module (YAGC08H, YAGC12H) (when the resistance is more than 510 Ω, the output current may not reach 20 mA)). When using an unused channel, short the output terminals.

[4] Spike noise (several μS) may be introduced in the output current of the analog current output module (YAGC08H, YAGC12H). Therefore, when connecting a rapid response device, mount a capacitor of 3.3 μF (rated voltage 25 V min.) on the receiving side.

[5] An oscillation sound may be heard from the module when the power is turned ON or OFF. It is not a failure.

(14) Resistance temperature detector input (RTD) module

[1] When using an unused channel of the RTD module, short the input terminals. In this case, data becomes indefinite. However, when the current terminal In and voltage terminal Vn are connected (2 locations), the data becomes H7FFF. (H of H7FFF indicates that the subsequent data is a hexadecimal number.)

[2] In the case of a three-wire system or two-wire system, the temperature data is increased slightly due to the wire resistance. In the case of the three-wire system, the resistance of one wire is added. In the case of the two-wire system, the resistance of two wires is added. (The temperature rises about 0.27°C per 0.1 Ω of wire resistance.)

Since the three-wire system or two-wire system may cause an error of an external wire resistance due to temperature, use a four-wire system which is little affected by wires if possible as a connection method of a resistance temperature detector.

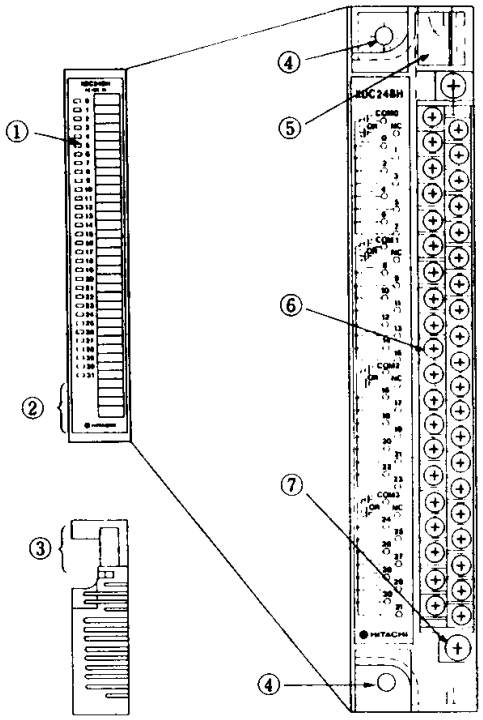
[3] Set the external wire length to 200 m or less for each channel.

Set the total resistance (total of 8 channels) of the wires to be connected to the current terminals (I0 to I7) to 400 Ω or less. For further details of external wire resistance, refer to the module instruction manual.

8.4 Structure of I/O Modules

Standard I/O modules

Parts Name

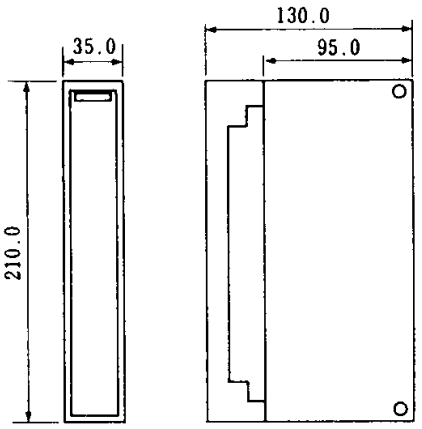


Type and Name

Type	Name
XAC10AH	AC input
XAC20AH	
XAC10BH	
XAC20BH	
XDC24AH	AC or DC input
XDC48AH	
XDC24BH	
XDC48BH	
XHS24BH	DC input
XDC12DH	
XDC24D2H	
XTT05BH	TTL input

Type	Name
YRY20AH	Contact output
YRY20BH	
YDR20AH	Independent contact output
YSR20AH	SSR output
YSR20BH	
YTR48AH	Transistor output (sink load)
YTR48BH	
YTR24DH	
YTS48AH	Transistor output (source load)
YTS48BH	
YTS24DH	
YTT05BH	TTL output (source load)

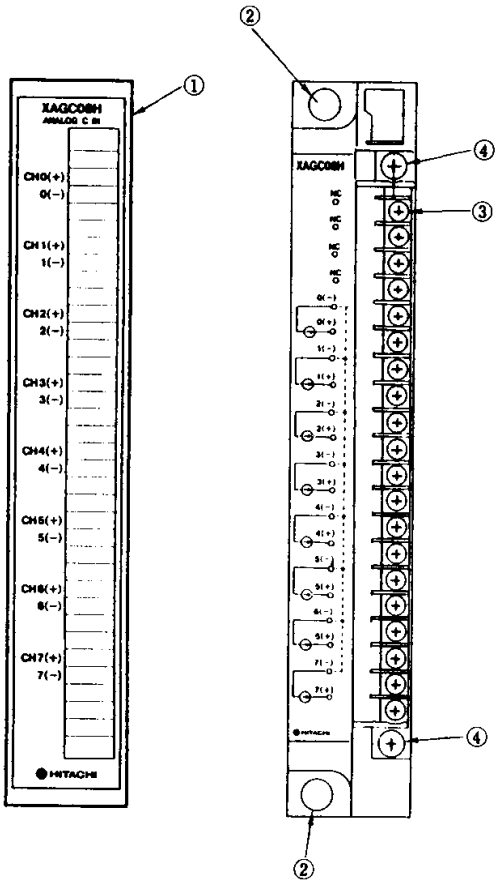
Dimensions (mm)



No.	Name	Function
①	I/O indicator LED	Light emission diode for indicating the I/O ON or OFF state. When the I/O state is ON, the LED is on.
②	Fuse blown-out alarm LED	When the fuse which is inserted for each common terminal is blown out, the LED lights. (Only SSR output and transistor output mounted)
③	Module cover	Module cover with a LED indication function
④	Module fixing screw	Screws for fixing modules to the basic and expansion bases
⑤	LED board transfer connector	Connectors for connecting the LED board on the terminal block cover side
⑥	Terminal screw	The terminal screws are cable crimp terminal fixing screws (M3 x 6 ℓ) and the 64-point I/O modules are dedicated connectors (XDC12DH, XDC24D2H, YTR24DH, YTS24DH).
⑦	Terminal block fixing screw	Screws for mounting and fixing the terminal block to the module

Analog I/O module, resistance temperature detector input module

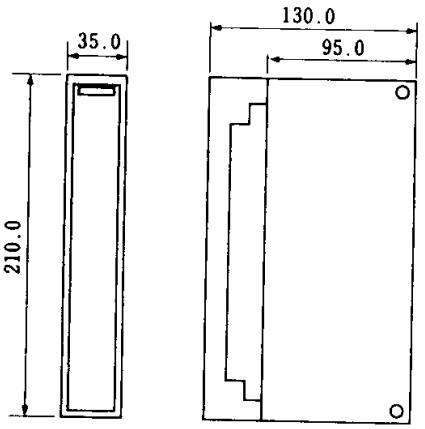
Parts Name



Type and Name

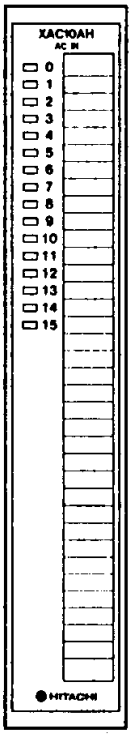
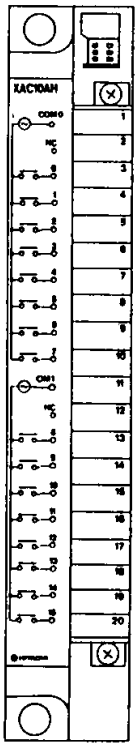
Type	Name
XAGV08H XAGV12H XAGV121H XAGV122H	Analog voltage input module
XAGC08H XAGC12H	Analog current input module
YAGV08H YAGV12H YAGV121H YAGV122H	Analog voltage output module
YAGC08H YAGC12H	Analog current output module
XRTD01H	Resistance temperature detector input module

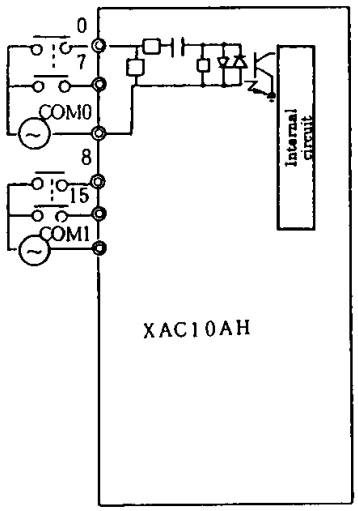
Dimensions (mm)



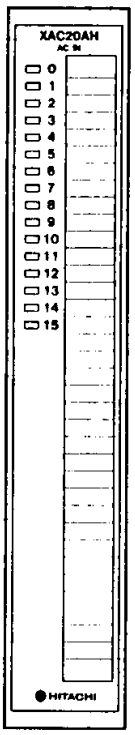
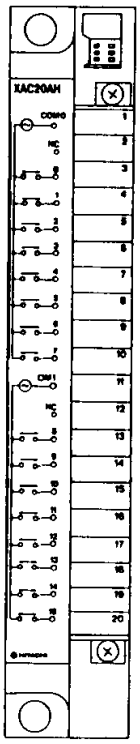
No.	Name	Function
①	Module cover	For display of the module cover function and the part to be connected to. There is no LED provided.
②	Module fixing screw	Screws for fixing modules to the basic and expansion bases
③	Terminal screw	Screws for fixing the cable crimp terminal (M3 x 6 ℓ)
④	Terminal block fixing screw	Screws for mounting and fixing the terminal block to the module

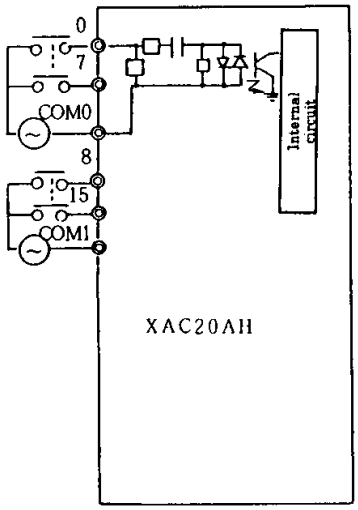
8.5 I/O Module Specification

Item	Type	XAC10AH	External view	Terminal assignment
Module name		100 VAC input module		
Input voltage		85 to 132 VAC (50/60 Hz, sine wave)		
Input impedance		17 kΩ (50 Hz), 15 kΩ (60 Hz)		
Input current		6 mA (100 V, 50 Hz)		
Operating voltage	Min. ON	75 V		
	Max. OFF	30 V		
Input delay	ON → OFF	16 msec		
	OFF → ON	16 msec		
No. of input points		16 points/module (8 points/common, insulated between two common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.12 A		
Weight		Approx. 380 g		

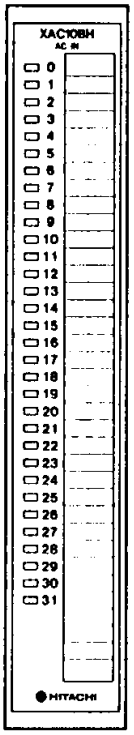
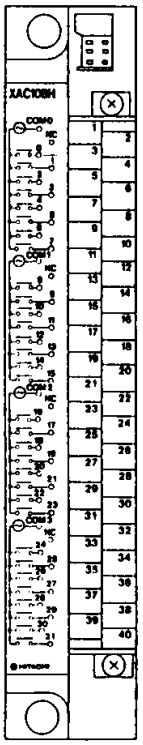


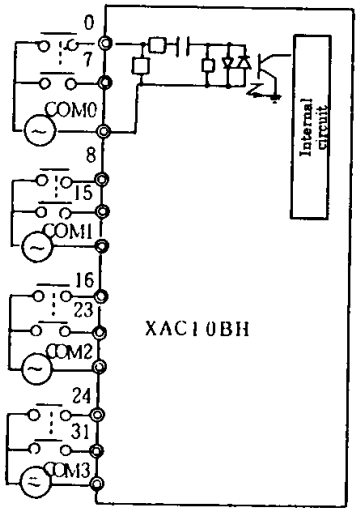
Terminal No.	Signal name
1	COM0
2	NC
3	X00
4	X01
5	X02
6	X03
7	X04
8	X05
9	X06
10	X07
11	COM1
12	NC
13	X08
14	X09
15	X10
16	X11
17	X12
18	X13
19	X14
20	X15

Item	Type	XAC20AH	External view	Terminal assignment
Module name		200 VAC input module		
Input voltage		170 to 264 VAC (50/60 Hz, sine wave)		
Input impedance		31 kΩ (50 Hz, 26 kΩ (60 Hz)		
Input current		7 mA (200 V, 50 Hz)		
Oper-ating voltage	Min. ON	150 V		
	Max. OFF	60 V		
Input delay	ON → OFF	16 msec		
	OFF → ON	16 msec		
No. of input points		16 points/module (8 points/common, insulated between two common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.12 A		
Weight		Approx. 380 g		

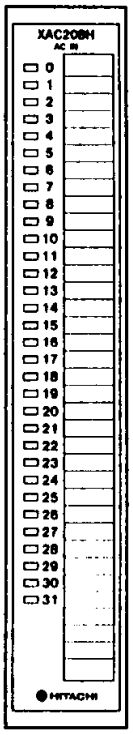
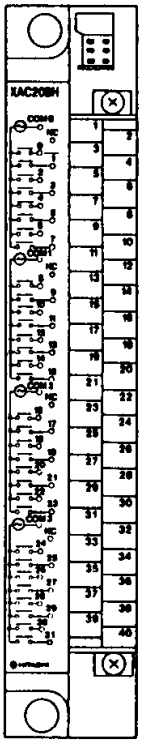


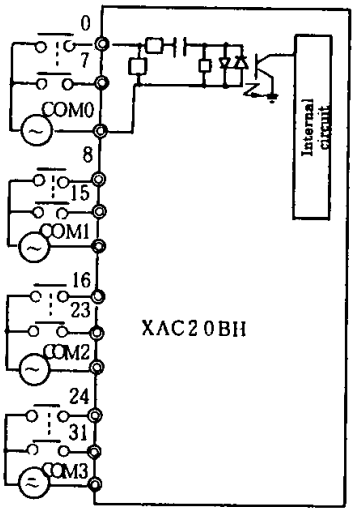
Terminal No.	Signal name
1	COM0
2	NC
3	X00
4	X01
5	X02
6	X03
7	X04
8	X05
9	X06
10	X07
11	COM1
12	NC
13	X08
14	X09
15	X10
16	X11
17	X12
18	X13
19	X14
20	X15

Item	Type	XAC10BH	External view	Terminal assignment
Module name		100 VAC input module		
Input voltage		85 to 132 VAC (50/60 Hz, sine wave)		
Input impedance		17 kΩ (50 Hz, 15 kΩ (60 Hz)		
Input current		6 mA (100 V, 50 Hz)		
Oper-ating voltage	Min. ON	75 V		
	Max. OFF	30 V		
Input delay	ON → OFF	16 msec		
	OFF →ON	16 msec		
No. of input points		32 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 400 g		

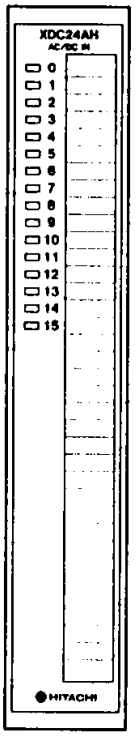
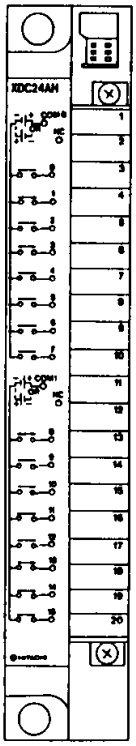


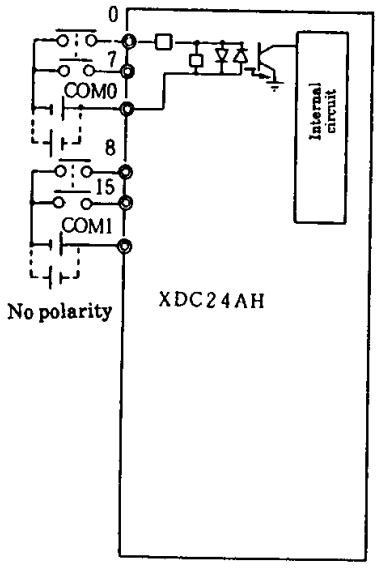
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

Item	Type	XAC20BH	External view	Terminal assignment
Module name		200 VAC input module		
Input voltage		170 to 264 VAC (50/60 Hz, sine wave)		
Input impedance		31 kΩ (50 Hz, 26 kΩ (60 Hz)		
Input current		7 mA (200 V, 50 Hz)		
Oper-ating voltage	Min. ON	150 V		
	Max. OFF	60 V		
Input delay	ON → OFF	16 msec		
	OFF →ON	16 msec		
No. of input points		32 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 400 g		

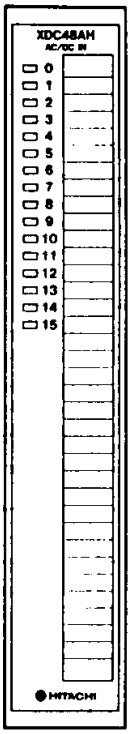
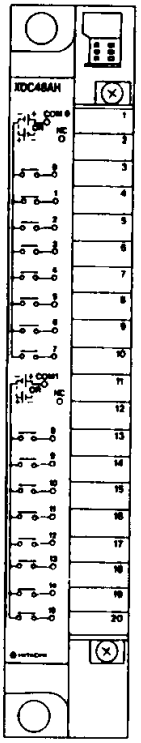


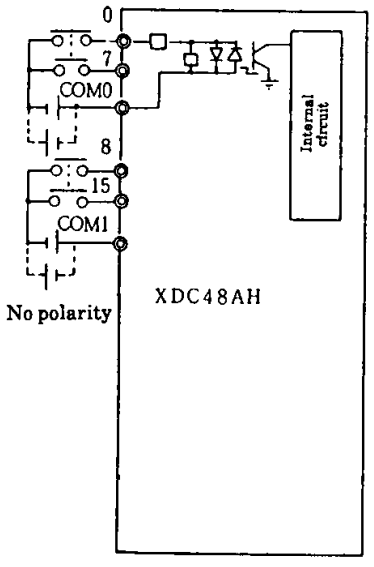
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

Item	Type	XDC24AH	External view	Terminal assignment
Module name		12/24 VAC/DC input module		
Input voltage		10 to 30 VAC (50/60 Hz, sine wave), 10 to 30 VDC		
Input impedance		2.2 kΩ		
Input current		5 mA (12 VAC/DC), 10 mA (24 VAC/DC)		
Operating voltage	Min. ON	9V		
	Max. OFF	3.6 V		
Input delay	ON → OFF	16 msec		
	OFF →ON	16 msec		
No. of input points		16 points/module (8 points/common, insulated between two common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.12 A		
Weight		Approx. 360 g		

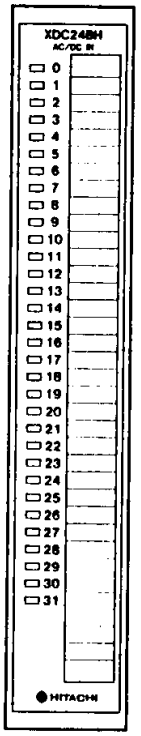
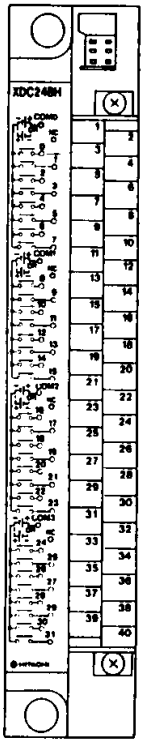


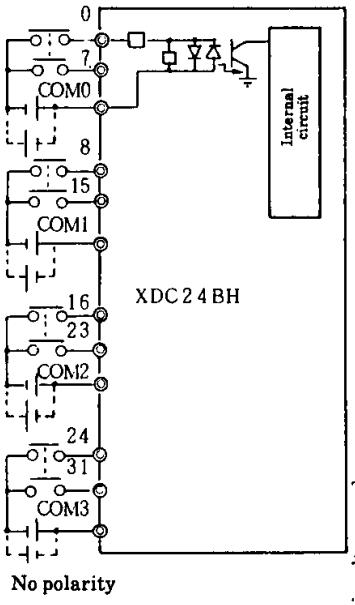
Terminal No.	Signal name
1	COM0
2	NC
3	X00
4	X01
5	X02
6	X03
7	X04
8	X05
9	X06
10	X07
11	COM1
12	NC
13	X08
14	X09
15	X10
16	X11
17	X12
18	X13
19	X14
20	X15

Item	Type	XDC48AH	External view	Terminal assignment
Module name		48 VAC/DC input module		
Input voltage		33 to 60 VAC (50/60 Hz, sine wave) 33 to 60 VDC		
Input impedance		8.2 kΩ		
Input current		6 mA (48 VAC/DC)		
Operating voltage	Min. ON	28 V		
	Max. OFF	9 V		
Input delay	ON → OFF	16 msec		
	OFF → ON	16 msec		
No. of input points		16 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.12 A		
Weight		Approx. 360 g		

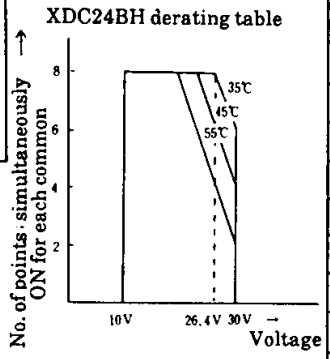


Terminal No.	Signal name
1	COM0
2	NC
3	X00
4	X01
5	X02
6	X03
7	X04
8	X05
9	X06
10	X07
11	COM1
12	NC
13	X08
14	X09
15	X10
16	X11
17	X12
18	X13
19	X14
20	X15

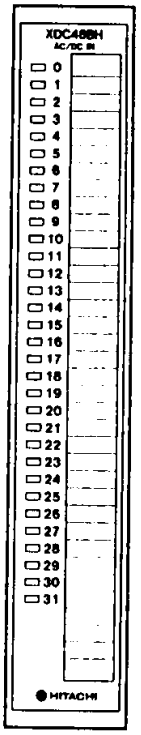
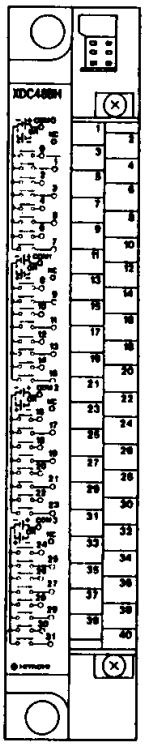
Item	Type	XDC24BH	External view	Terminal assignment
Module name		12/24 VAC/DC input module		
Input voltage		10 to 30 VAC (50/60 Hz, sine wave) 10.8 to 30 VDC		
Input impedance		2.2 kΩ		
Input current		5 mA (12 VAC/DC), 10 mA (24 VAC/DC)		
Operating voltage	Min. ON	9V		
	Max. OFF	3.6 V		
Input delay	ON → OFF	16 msec		
	OFF → ON	16 msec		
No. of input points		32 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 380 g		

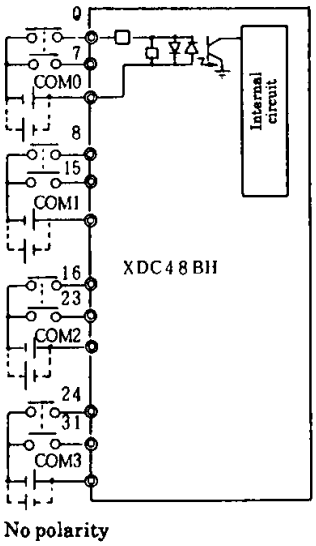


No polarity



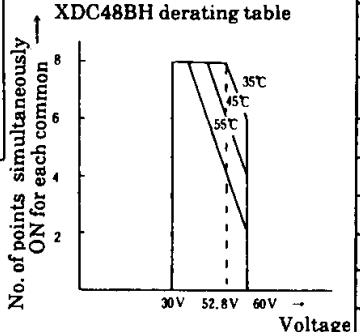
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

Item	Type	XDC48BH	External view	Terminal assignment
Module name		48 VAC/DC input module		
Input voltage		33 to 60 VAC (50/60 Hz, sine wave) 33 to 60 VDC		
Input impedance		8.2 kΩ		
Input current		6mA (48 VAC/DC)		
Operating voltage	Min. ON	28 V		
	Max. OFF	9 V		
Input delay	ON → OFF	16 msec		
	OFF →ON	16 msec		
No. of input points		32 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 400 g		

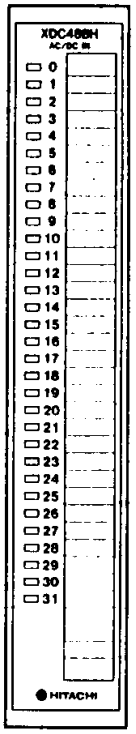
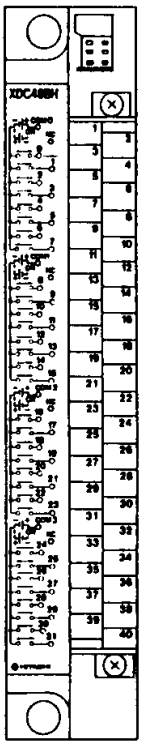


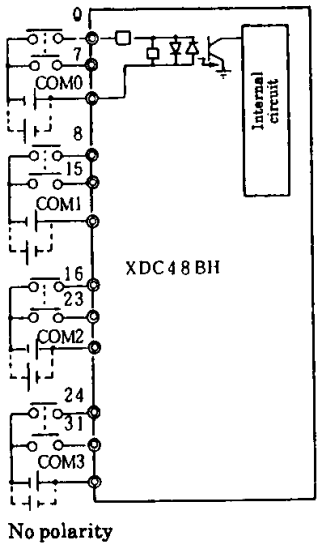
No polarity

XDC48BH derating table



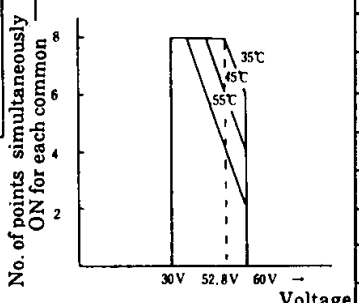
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

Item	Type	XDC48BH	External view	Terminal assignment
Module name		48 VAC/DC input module		
Input voltage		33 to 60 VAC (50/60 Hz, sine wave) 33 to 60 VDC		
Input impedance		8.2 kΩ		
Input current		6mA (48 VAC/DC)		
Oper-ating voltage	Min. ON	28 V		
	Max. OFF	9 V		
Input delay	ON → OFF	16 msec		
	OFF →ON	16 msec		
No. of input points		32 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 400 g		

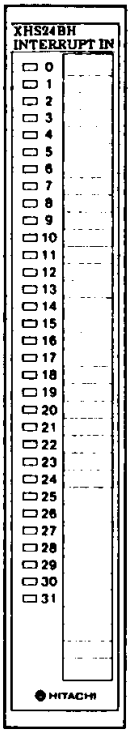
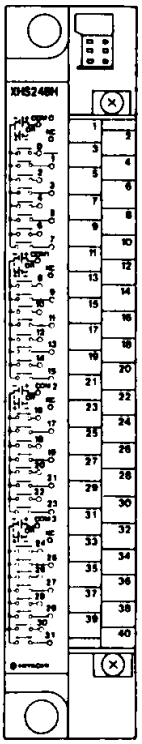


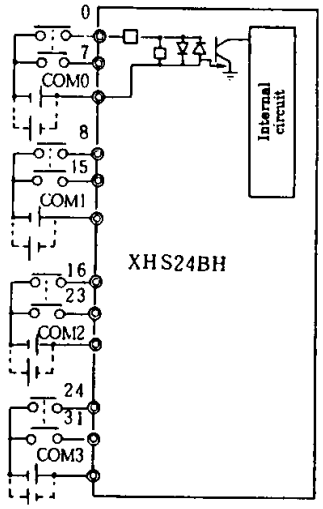
No polarity

XDC48BH derating table

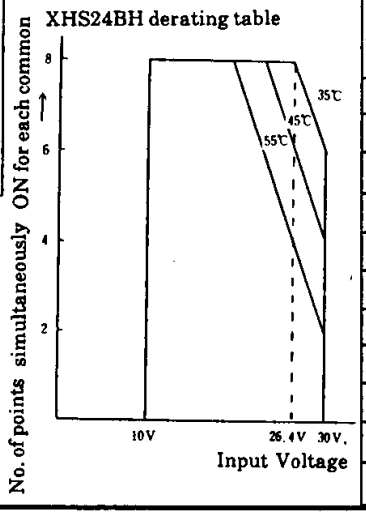


Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

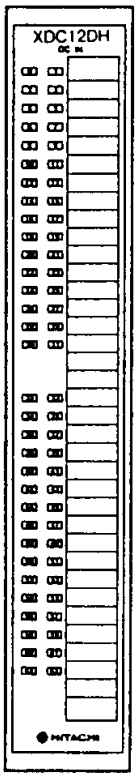
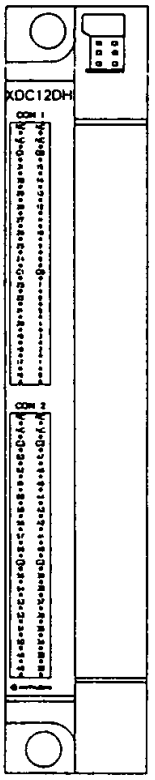
Item	Type	XHS24BH	External view	Terminal assignment
Module name		High-speed DC input module		
Input voltage		10 to 30 VDC		
Input impedance		2.2 kΩ		
Input current		5mA (12 VDC), 10 mA (24 VDC)		
Operating voltage	Min. ON	9V		
	Max. OFF	3.6 V		
Input delay	ON → OFF	1 msec		
	OFF → ON	1 msec		
No. of input points		32 points/module (8 points/common, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 380 g		

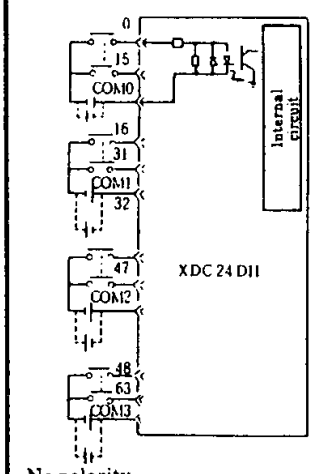


No polarity



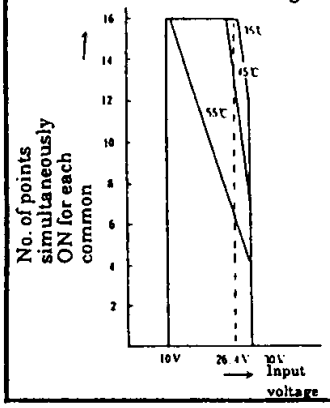
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

Item	Type	XDC12DH	External view	Terminal assignment
Module name		64-point DC input		
Input voltage		10.8 tol 15 VDC		
Input impedance		2.2 kΩ		
Input current		3 mA (12 VDC)		
Operating voltage	Min. ON	9V		
	Max. OFF	3.6 V		
Input delay	ON → OFF	1 msec		
	OFF →ON	1 msec		
No. of input points		64 points/module (16 points/com-mon, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.3 A		
Weight		Approx. 530 g		
External wiring connector		Use the Hirose's connector or equivalent having gold-plated pins. Socket: HIF3C-40D-2.54C Connector pin: HIF3-2226SC, Cable diameter: AWG 22~26 Connector pin: HIF3-2428SC, Cable diameter: AWG 24~26 The special press fitting tool is required.		

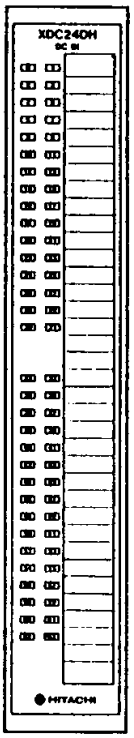
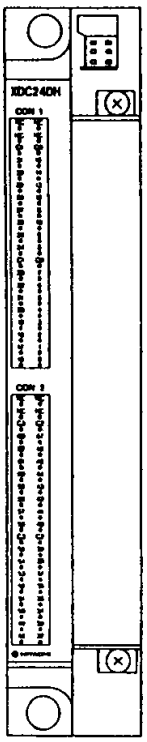


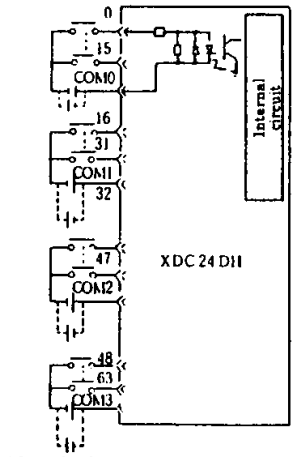
No polarity

XDC24DH derating table



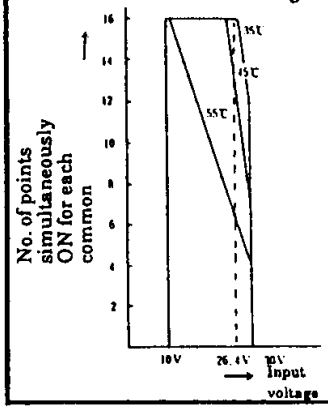
CON1				CON2			
Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name
40	NC	39	NC	40	NC	39	NC
38	NC	37	NC	38	NC	37	NC
36	C1	35	C0	36	C3	35	C2
34	X31	33	X15	34	X63	33	X47
32	X30	31	X14	32	X62	31	X46
30	X29	29	X13	30	X61	29	X45
28	X28	27	X12	28	X60	27	X44
26	X27	25	X11	26	X59	25	X43
24	X26	23	X10	24	X58	23	X42
22	X25	21	X09	22	X57	21	X41
20	X24	19	X08	20	X56	19	X4
18	C1	17	C0	18	C3	17	C2
16	X23	15	X07	16	X55	15	X39
14	X22	13	X06	14	X54	13	X38
12	X21	11	X05	12	X53	11	X37
10	X20	9	X04	10	X52	9	X36
8	X19	7	X03	8	X51	7	X35
6	X18	5	X02	6	X50	5	X34
4	X17	3	X01	4	X49	3	X33
2	X16	1	X00	2	X48	1	X32

Item	Type	XDC24D2H	External view	Terminal assignment
Module name		64-point DC input		
Input voltage		21.6 to 30 VDC		
Input impedance		2.2 kΩ		
Input current		6 mA (24 VDC)		
Operating voltage	Min. ON	9V		
	Max. OFF	3.6 V		
Input delay	ON → OFF	1 msec		
	OFF →ON	1 msec		
No. of input points		64 points/module (16 points/com-mon, insulated between common lines)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.3 A		
Weight		Approx. 530 g		
External wiring connector		Use the Hirose's connector or equivalent having gold-plated pins. Socket: HIF3C-40D-2.54C Connector pin: HIF3-2226SC, HIF3-2428SC; Cable diameter: AWG 22~26, AWG 24~26 The special press fitting tool is required.		

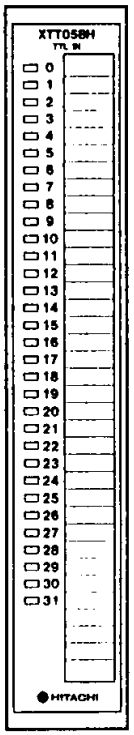
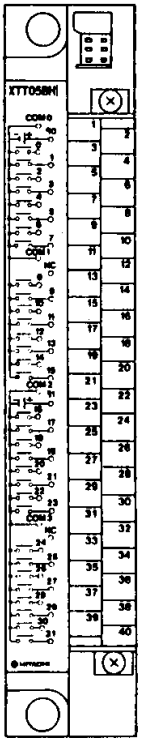


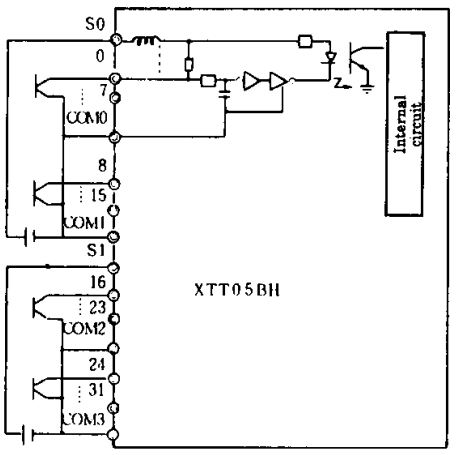
No polarity

XDC24DH derating table

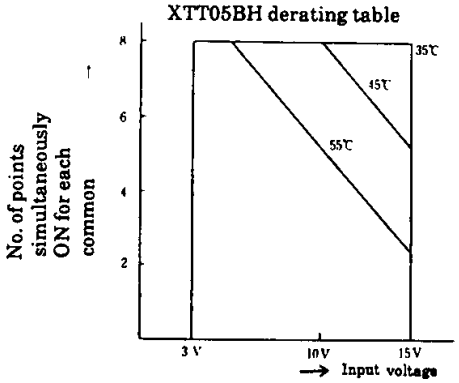


CON1				CON2			
Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name
40	NC	39	NC	40	NC	39	NC
38	NC	37	NC	38	NC	37	NC
36	C1	35	C0	36	C3	35	C2
34	X31	33	X15	34	X63	33	X47
32	X30	31	X14	32	X62	31	X46
30	X29	29	X13	30	X61	29	X45
28	X28	27	X12	28	X60	27	X44
26	X27	25	X11	26	X59	25	X43
24	X26	23	X10	24	X58	23	X42
22	X25	21	X09	22	X57	21	X41
20	X24	19	X08	20	X56	19	X4
18	C1	17	C0	18	C3	17	C2
16	X23	15	X07	16	X55	15	X39
14	X22	13	X06	14	X54	13	X38
12	X21	11	X05	12	X53	11	X37
10	X20	9	X04	10	X52	9	X36
8	X19	7	X03	8	X51	7	X35
6	X18	5	X02	6	X50	5	X34
4	X17	3	X01	4	X49	3	X33
2	X16	1	X00	2	X48	1	X32

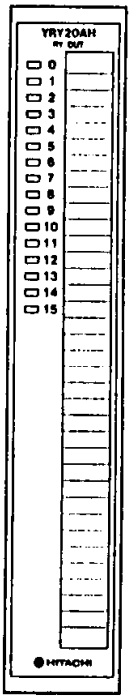
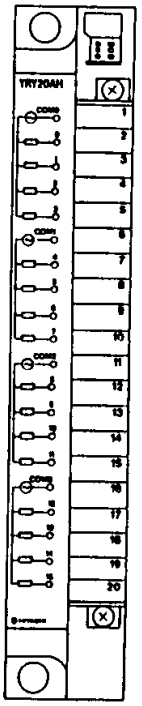
Item	Type	XTT05BH	External view	Terminal assignment
Module name		TTL level input module		
Input voltage		3 to 15 VDC		
Input impedance		820 Ω		
Input current		6 mA (if external feed voltage is 5 VDC and input signal is ON)		
Operating voltage	Min. ON	1.5 VDC (if external feed voltage is 5 VDC), 4.5 VDC (if 15 VDC)		
	Max. OFF	3.5 VDC (if external feed voltage is 5 VDC), 11 VDC (if 15 VDC)		
Input delay	ON → OFF	1 msec		
	OFF → ON	1 msec		
No. of input points		32 points/module (8 points/com-mon) (2 internal common lines are not insulated.)		
Polarity		Negative logic input (common)		
Insulation		Photocoupler		
Current consumption		0.15 A		
Weight		Approx. 420 g		
External feed voltage		0.35 A (5 VDC external power), 0.9A (15 VDC)		

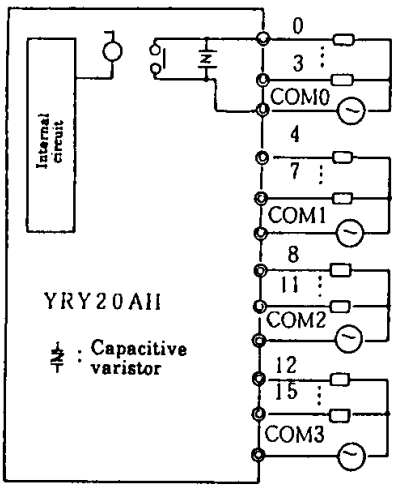


XTT05BH derating table

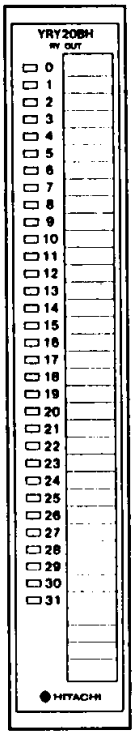
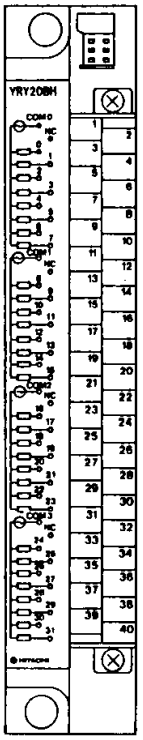


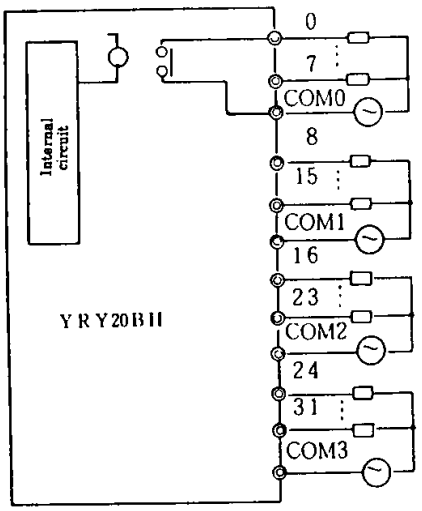
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	X16
4	X01	24	X17
5	X02	25	X18
6	X03	26	X19
7	X04	27	X20
8	X05	28	X21
9	X06	29	X22
10	X07	30	X23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	X24
14	X09	34	X25
15	X10	35	X26
16	X11	36	X27
17	X12	37	X28
18	X13	38	X29
19	X14	39	X30
20	X15	40	X31

Item	Type	YRY20AH	External view	Terminal assignment
Module name		Contact output module with varistor		
Output voltage		No-voltage contact output		
Rated load current	1 circuit	2 A (240 VAC/24 VDC, resistance load) 0.5 A (240VAC/24VDC COSϕ = 0.4)		
	8 circuits	5 A (AC/DC/common, resistance load)		
Max. leakage current		1mA		
Min. switching voltage and current		1mA, 5 VDC (except after switching with excessive current)		
Electric contact service life		200,000 times of switching with rated load voltage and current		
Max. switching voltage and current		2 A (264 VAC/30 VDC, resistance load)		
Max. surge current		5 A		
Output delay	ON→OFF	12 msec or less		
	OFF→ON	7 msec or less		
No. of output points		16 points/module (4 points/common, insulated between common)		
Current consumption		0.12 A 5 VDC (logic side) 0.16 A 24 VDC (for internal relay drive)		
Output polarity		None		
Surge suppressor circuit		Capacitive Varistor		
Weight		Approx. 400 g		
Fuse		None		

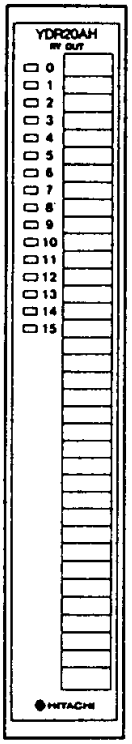
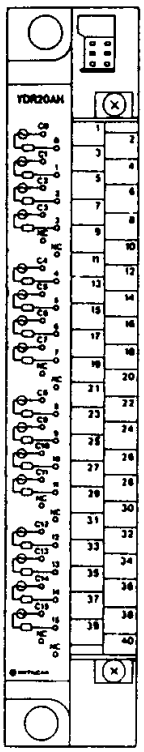


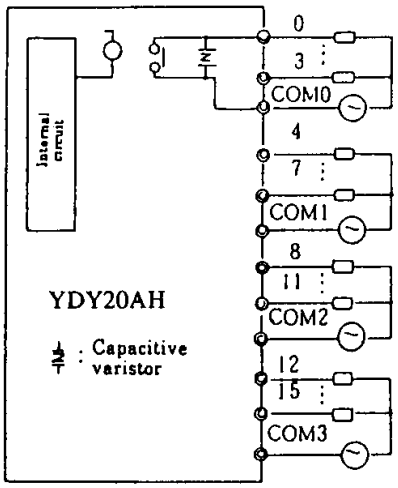
Terminal No.	Signal name
1	COM0
2	Y00
3	Y01
4	Y02
5	Y03
6	COM1
7	Y04
8	Y05
9	Y06
10	Y07
11	COM2
12	Y08
13	Y09
14	Y10
15	Y11
16	COM3
17	Y12
18	Y13
19	Y14
20	Y15

Item	Type	YRY20BH	External view	Terminal assignment
Module name		Contact output module varister		
Output voltage		No-voltage contact output		
Rated load current	1 circuit	2 A (240 VAC/24 VDC, resistance load) 0.5 A (240VAC/24VDC COSϕ = 0.4)		
	8 circuits	5 A (AC/DC/common, resistance load)		
Max. leakage current		None		
Min. switching voltage and current		1mA, 5 VDC (except after switching with excessive current)		
Electric contact service life		200,000 times of switching with rated load voltage and current		
Max. switching voltage and current		2 A (264 VAC/30 VDC, resistance load)		
Max. surge current		5 A		
Output delay	ON→OFF	12 msec or less		
	OFF→ON	7 msec or less		
No. of output points		32 points/module (8 points/common, insulated between common)		
Current consumption		0.18 A 5 VDC (logic side) 0.27 A 24 VDC (for internal relay drive)		
Output polarity		None		
Surge suppressor circuit		None		
Weight		Approx. 530 g		
Fuse		None		

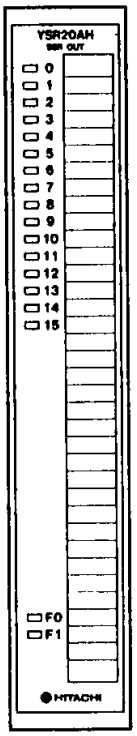
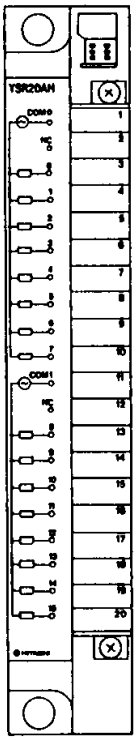


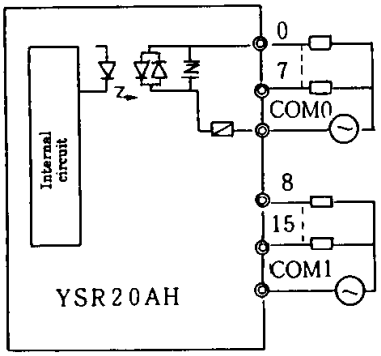
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	Y16
4	X01	24	Y17
5	X02	25	Y18
6	X03	26	Y19
7	X04	27	Y20
8	X05	28	Y21
9	X06	29	Y22
10	X07	30	Y23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	Y24
14	X09	34	Y25
15	X10	35	Y26
16	X11	36	Y27
17	X12	37	Y28
18	X13	38	Y29
19	X14	39	Y30
20	X15	40	Y31

Item	Type	YDY20AH	External view	Terminal assignment
Module name		Contact output module with varistor		
Output voltage		No-voltage contact output		
Rated load current	1 circuit	2 A (240 VAC/24 VDC, resistance load) 0.5 A (240VAC/24VDC COSϕ = 0.4)		
	8 circuits	20 A (AC/DC/common, resistance load)		
Max. leakage current		16 circuits		
Min. switching voltage and current		1mA, 5 VDC (except after switching with excessive current)		
Electric contact service life		200,000 times of switching with rated load voltage and current		
Max. switching voltage and current		2 A (264 VAC/30 VDC, resistance load)		
Max. surge current		5 A		
Output delay	ON→OFF	12 msec or less		
	OFF→ON	7 msec or less		
No. of output points		16 points/module (4 points/common, insulated between common)		
Current consumption		0.12 A 5 VDC (logic side) 0.16 A 24 VDC (for internal relay drive)		
Output polarity		None		
Surge suppressor circuit		Capacitive Varistor		
Weight		Approx. 400 g		
Fuse		None		

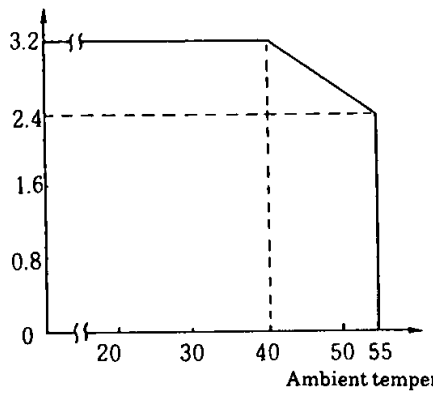


Terminal No.	Signal name
1	COM0
2	Y00
3	Y01
4	Y02
5	Y03
6	COM1
7	Y04
8	Y05
9	Y06
10	Y07
11	COM2
12	Y08
13	Y09
14	Y10
15	Y11
16	COM3
17	Y12
18	Y13
19	Y14
20	Y15

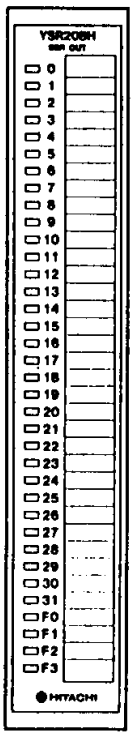
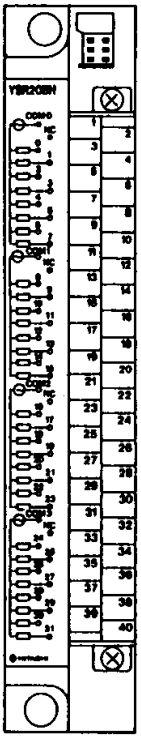
Item	Type	YSR20AH	External view	Terminal assignment
Module name		SSR output module		
Output voltage		85 to 264 VAC		
Max. load current	1 circuit	1.7 A / circuit		
	8 circuits	3.2 A / common		
Max. leakage current		1 mA (264 VAC, 60 Hz)		
Min. load current		3 mA (240 VAC)		
Max. ON voltage		2 V		
Max. rush current		20 A (1 cycle)		
Output delay	ON → OFF	1/2 cycle + 1 msec or less		
	OFF →ON	1 msec or less		
No. of output points		16 points/module (8 points/common, insulated between each common)		
Current consumption		0.38 A (5 VDC)		
Output polarity		None		
Surge suppressor circuit		Capacitive varistor		
Weight		Approx. 500 g		
Fuse		250 VAC/DC, 5 A (Daito's HP50 or equivalent)		

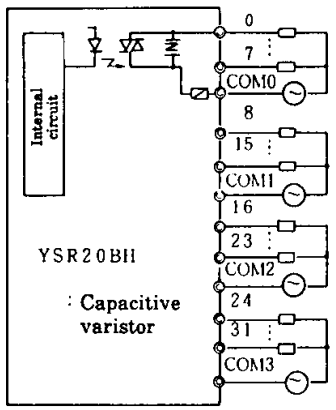


Maximum load current (A) per common

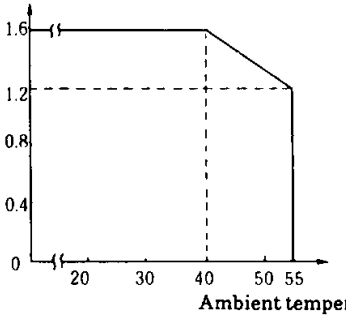


Terminal No.	Signal name
1	COM0
2	Y00
3	Y01
4	Y02
5	Y03
6	COM1
7	Y04
8	Y05
9	Y06
10	Y07
11	COM2
12	Y08
13	Y09
14	Y10
15	Y11
16	COM3
17	Y12
18	Y13
19	Y14
20	Y15

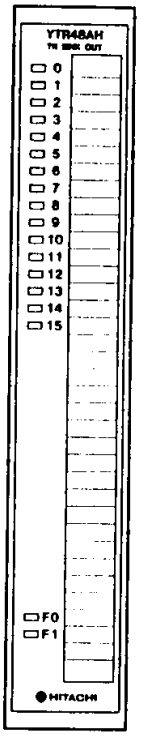
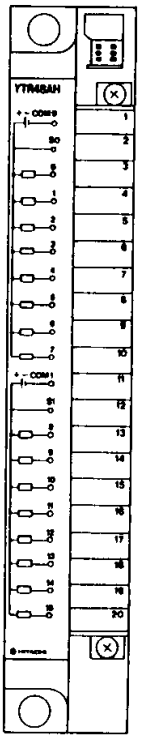
Item	Type	YSR20BH	External view	Terminal assignment
Module name		SSR output module		
Output voltage		85 to 264 VAC		
Max. load current	1 circuit	1 A / circuit		
	8 circuits	1.6 A / common		
Max. leakage current		1 mA (264 VAC, 60 Hz)		
Min. load current		3 mA (240 VAC)		
Max. ON voltage		2 V		
Max. rush current		20 A (1 cycle)		
Output delay	ON → OFF	1/2 cycle + 1 msec or less		
	OFF → ON	1 msec or less		
No. of output points		32 points/module (8 points/common, insulated between two common lines)		
Current consumption		0.57 A		
Output polarity		None		
Surge suppressor circuit		Capacitive varistor		
Weight		Approx. 550 g		
Fuse		250 VAC/DC, 5 A (Daito's HP50 or equivalent)		

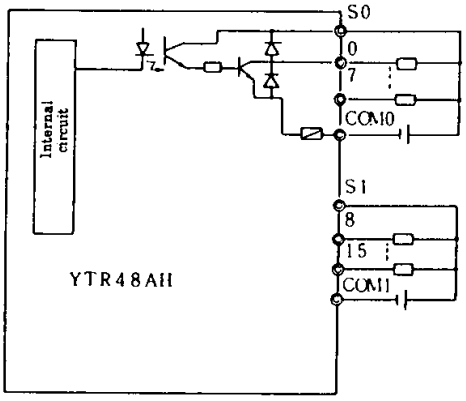


Maximum load current (A) per common

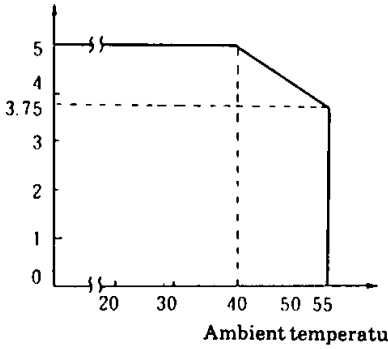


Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	NC	22	NC
3	X00	23	Y16
4	X01	24	Y17
5	X02	25	Y18
6	X03	26	Y19
7	X04	27	Y20
8	X05	28	Y21
9	X06	29	Y22
10	X07	30	Y23
11	COM1	31	COM3
12	NC	32	NC
13	X08	33	Y24
14	X09	34	Y25
15	X10	35	Y26
16	X11	36	Y27
17	X12	37	Y28
18	X13	38	Y29
19	X14	39	Y30
20	X15	40	Y31

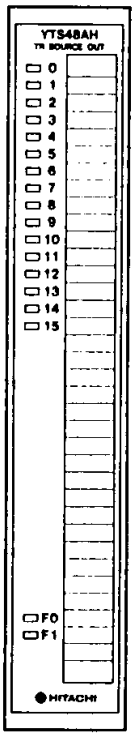
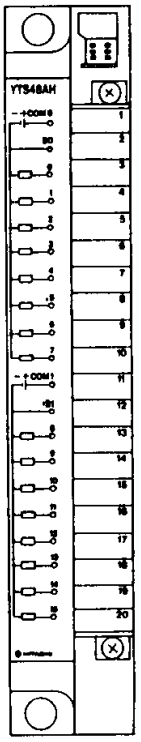
Item	Type	YTR48AH	External view	Terminal assignment
Module name		Sink type transistor output module		
Output voltage		21 to 60 VDC		
Max. load current	1 circuit	2 A / circuit		
	8 circuits	5 A / common		
Max. leakage current		1 mA		
Min. load current		–		
Max. ON voltage		1.5 V		
Max. rush current		3 A		
Output delay	ON → OFF	1.0 msec or less		
	OFF → ON	0.3 msec or less		
No. of output points		16 points/module (8 points/common, insulated between two common lines)		
Current consumption		0.12 A		
Output polarity		Sink output (negative common)		
Surge suppressor circuit		Diode		
Weight		Approx. 530 g		
Fuse		125 VAC/DC, 7.5 A (Daito's MP75 or equivalent)		

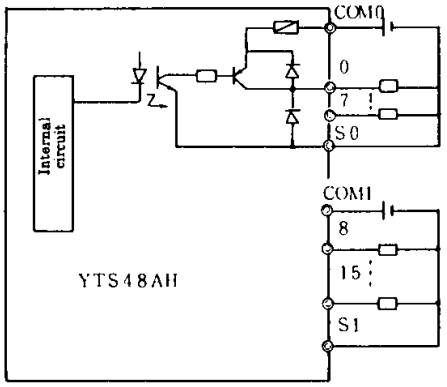


Maximum load current (A) per common

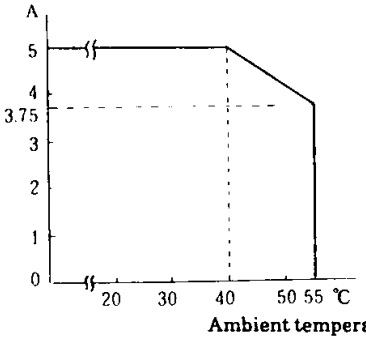


Terminal No.	Signal name
1	COM0
2	S0
3	Y00
4	Y01
5	Y02
6	Y03
7	Y04
8	Y05
9	Y06
10	Y07
11	COM1
12	S1
13	Y08
14	Y09
15	Y10
16	Y11
17	Y12
18	Y13
19	Y14
20	Y15

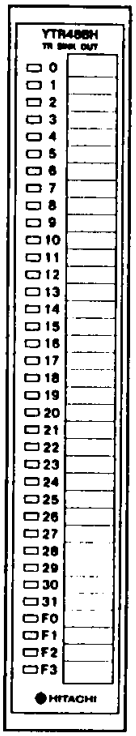
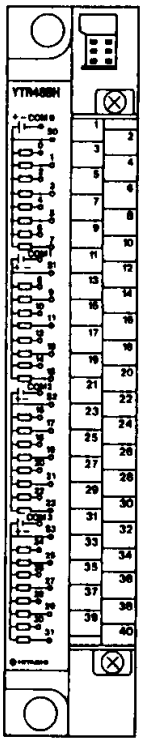
Item	Type	YTS48AH	External view	Terminal assignment
Module name		Source type transistor output		
Output voltage		21 to 60 VDC		
Max. load current	1 circuit	2 A / circuit		
	8 circuits	5 A / common		
Max. leakage current		1 mA		
Min. load current		–		
Max. ON voltage		1.5 V		
Max. rush current		3 A		
Output delay	ON → OFF	1.0 msec or less		
	OFF → ON	0.3 msec or less		
No. of output points		16 points/module (8 points/common, insulated between each common lines)		
Current consumption		0.12 A		
Output polarity		Source output (positive common)		
Surge suppressor circuit		Diode		
Weight		Approx. 530 g		
Fuse		125 VAC/DC, 7.5 A (Daito's MP75 or equivalent)		

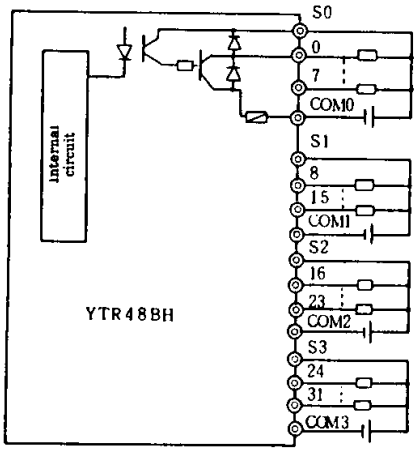


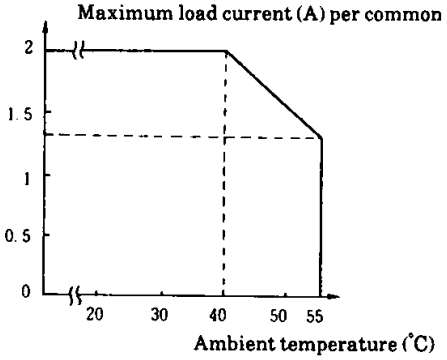
Maximum load current (A) per common



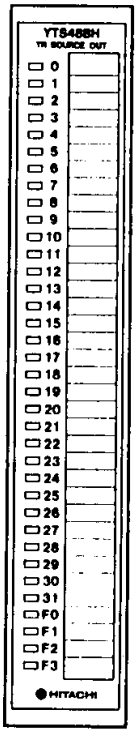
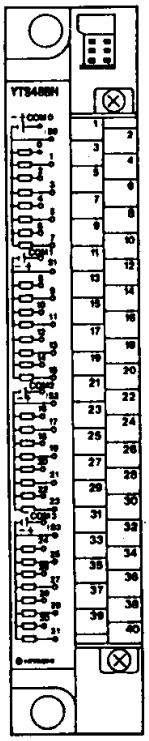
Terminal No.	Signal name
1	COM0
2	S0
3	Y00
4	Y01
5	Y02
6	Y03
7	Y04
8	Y05
9	Y06
10	Y07
11	COM1
12	S1
13	Y08
14	Y09
15	Y10
16	Y11
17	Y12
18	Y13
19	Y14
20	Y15

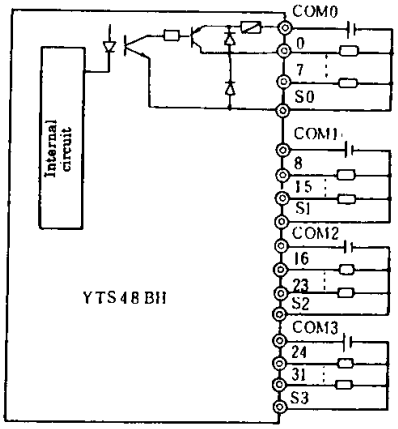
Item	Type	YTR48BH	External view	Terminal assignment
Module name		Sink type transistor output module		
Output voltage		21 to 60 VDC		
Max. load current	1 circuit	0.7 A / circuit		
	8 circuits	2.0 A / common		
Max. leakage current		1 mA		
Min. load current		–		
Max. ON voltage		1.5 V		
Max. rush current		3 A (1 cycle)		
Output delay	ON → OFF	1.0 msec or less		
	OFF →ON	0.3 msec or less		
No. of output points		32 points/module (8 points/common, insulated between two common lines)		
Current consumption		0.18 A		
Output polarity		Sink output (negative common)		
Surge suppressor circuit		Diode		
Weight		Approx. 490 g		
Fuse		125 VAC/DC, 5 A (Daito's MP50 or equivalent)		



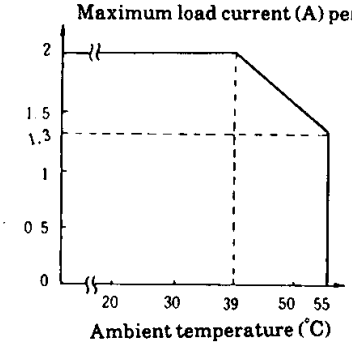


Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	S0	22	S2
3	Y00	23	Y16
4	Y01	24	Y17
5	Y02	25	Y18
6	Y03	26	Y19
7	Y04	27	Y20
8	Y05	28	Y21
9	Y06	29	Y22
10	Y07	30	Y23
11	COM1	31	COM3
12	S1	32	S3
13	Y08	33	Y24
14	Y09	34	Y25
15	Y10	35	Y26
16	Y11	36	Y27
17	Y12	37	Y28
18	Y13	38	Y29
19	Y14	39	Y30
20	Y15	40	Y31

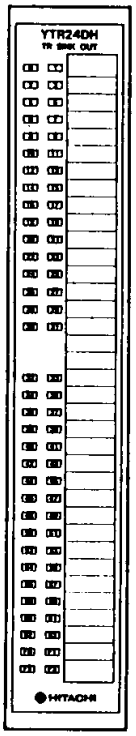
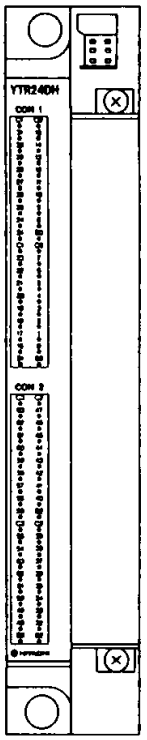
Item	Type	YTS48BH	External view	Terminal assignment
Module name		Source type transistor output		
Output voltage		21 to 60 VDC		
Max. load current	1 circuit	0.7 A / circuit		
	8 circuits	2.0 A / common		
Max. leakage current		1 mA		
Min. load current		–		
Max. ON voltage		1.5 V		
Max. rush current		3 A		
Output delay	ON → OFF	1.0 msec or less		
	OFF → ON	0.3 msec or less		
No. of output points		32 points/module (8 points/common, insulated between common lines)		
Current consumption		0.18 A		
Output polarity		Source output (positive common)		
Surge suppressor circuit		Diode		
Weight		Approx. 490 g		
Fuse		125 VAC/DC, 5 A (Daito's MP50 or equivalent)		

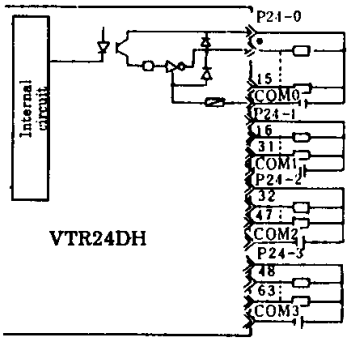


Maximum load current (A) per common



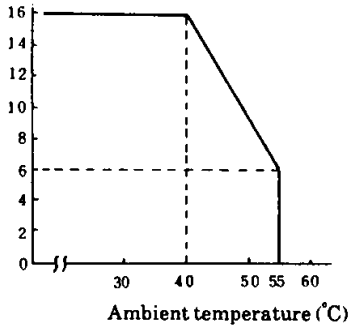
Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	S0	22	S2
3	Y00	23	Y16
4	Y01	24	Y17
5	Y02	25	Y18
6	Y03	26	Y19
7	Y04	27	Y20
8	Y05	28	Y21
9	Y06	29	Y22
10	Y07	30	Y23
11	COM1	31	COM3
12	S1	32	S3
13	Y08	33	Y24
14	Y09	34	Y25
15	Y10	35	Y26
16	Y11	36	Y27
17	Y12	37	Y28
18	Y13	38	Y29
19	Y14	39	Y30
20	Y15	40	Y31

Item	Type	YTR24DH	External view	Terminal assignment
Module name		64-point sinkc type DC output modul		
Output voltage		10 to 30 VDC		
Max. load current	1 circuit	0.1 A / citcuit		
	16 circuits	0.4 A / common		
Max. leakage current		0.5 mA		
Min. load current		–		
Max. ON voltage		1.1 V or less		
Max. rush current		0.2 A		
Output delay	ON → OFF	1 msec or less		
	OFF →ON	1 msec or less		
No. of output points		64 points/module (16 points/common, insulated between two ommon lines)		
Current consumption		0.38 A		
Output polarity		Sink output (negative common)		
Surge suppressor circuit		Diode		
Weight		Approx. 550 g		
Fuse		125 VAC/DC, 1 A (Daito's MP10 or equivalent)		
External cable connector		Same as XDC24DH		

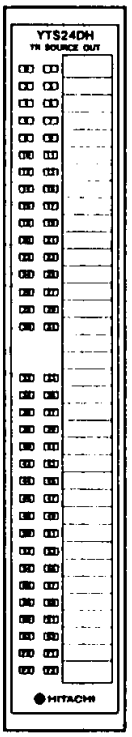
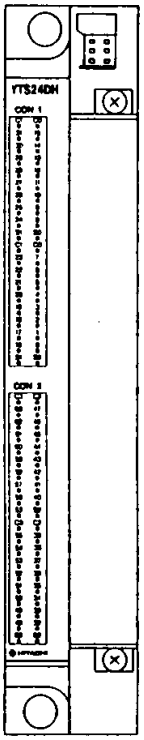


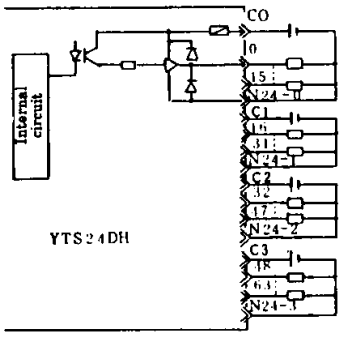
VTR24DH

Maximum No. of points simultaneously ON per common

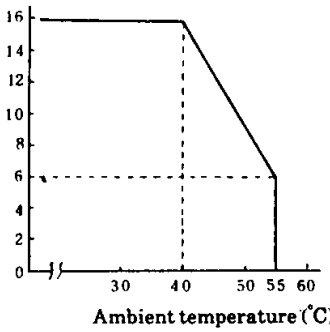


CON1				CON2			
Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name
40	C1	39	C0	40	C3	39	C2
38	Y31	37	Y15	38	Y63	37	Y47
36	Y30	35	Y14	36	Y62	35	Y46
34	Y29	33	Y13	34	Y61	33	Y45
32	Y28	31	Y12	32	Y60	31	Y44
30	Y27	29	Y11	30	Y59	29	Y43
28	Y26	27	Y10	28	Y58	27	Y42
26	Y25	25	Y09	26	Y57	25	Y41
24	Y24	23	Y08	24	Y56	23	Y40
22	S1	21	S0	22	S3	21	S2
20	C1	19	C0	20	C3	19	C2
18	Y23	17	Y07	18	Y55	17	Y39
16	Y22	15	Y06	16	Y54	15	Y38
14	Y21	13	Y05	14	Y53	13	Y37
12	Y20	11	Y04	12	Y52	11	Y36
10	Y19	9	Y03	10	Y51	9	Y35
8	Y18	7	Y02	8	Y50	7	Y34
6	Y17	5	Y01	6	Y49	5	Y33
4	Y16	3	Y00	4	Y48	3	Y32
2	S1	1	S0	2	S3	1	S2

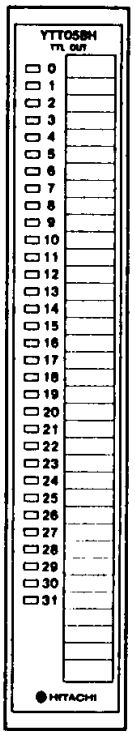
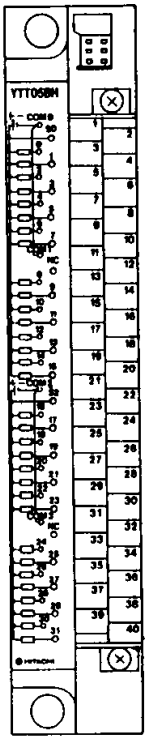
Item	Type	YTS24DH	External view	Terminal assignment
Module name		64-point source type DC output modul		
Output voltage		10 to 30 VDC		
Max. load current	1 circuit	0.1 A / circuit		
	8 circuits	0.4 A / common		
Max. leakage current		0.5 mA		
Min. load current		–		
Max. ON voltage		1.8 V or less		
Max. rush current		0.2 A		
Output delay	ON → OFF	1 msec or less		
	OFF → ON	1 msec or less		
No. of output points		64 points/module (16 points/com-mon, insulated between common lines)		
Current consumption		0.38 A		
Output polarity		Source output (positive common)		
Surge suppressor circuit		Diode		
Weight		Approx. 550 g		
Fuse		125 VAC/DC, 1 A (Daito's MP10 or equivalent)		
		Same as XDC24DH		

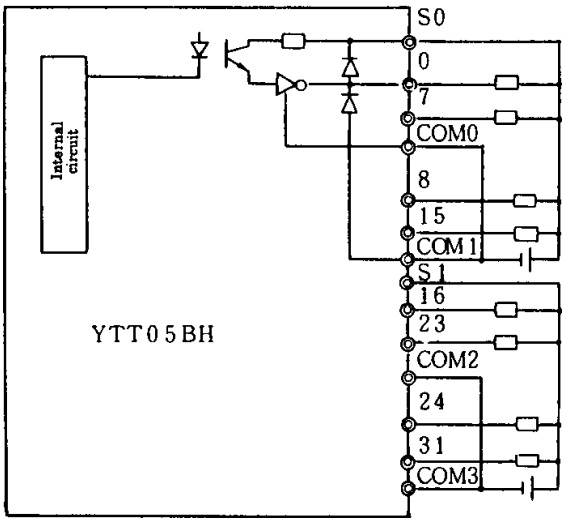


Maximum No. of points simultaneously ON per common

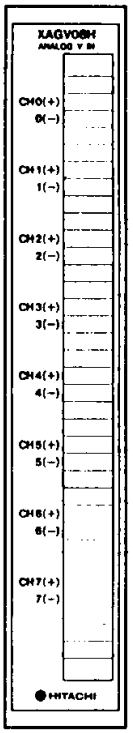
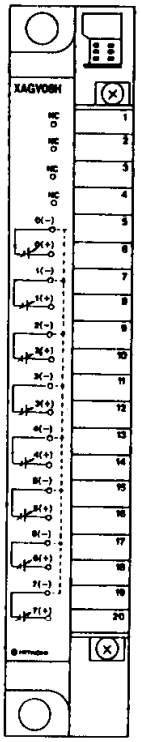


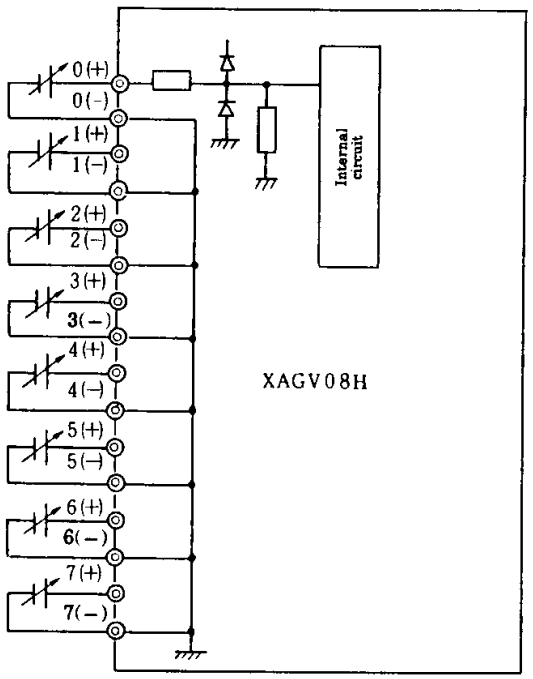
CON1				CON2			
Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name	Terminal No.	Signal name
40	C1	39	C0	40	C3	39	C2
38	Y31	37	Y15	38	Y63	37	Y47
36	Y30	35	Y14	36	Y62	35	Y46
34	Y29	33	Y13	34	Y61	33	Y45
32	Y28	31	Y12	32	Y60	31	Y44
30	Y27	29	Y11	30	Y59	29	Y43
28	Y26	27	Y10	28	Y58	27	Y42
26	Y25	25	Y09	26	Y57	25	Y41
24	Y24	23	Y08	24	Y56	23	Y40
22	S1	21	S0	22	S3	21	S2
20	C1	19	C0	20	C3	19	C2
18	Y23	17	Y07	18	Y55	17	Y39
16	Y22	15	Y06	16	Y54	15	Y38
14	Y21	13	Y05	14	Y53	13	Y37
12	Y20	11	Y04	12	Y52	11	Y36
10	Y19	9	Y03	10	Y51	9	Y35
8	Y18	7	Y02	8	Y50	7	Y34
6	Y17	5	Y01	6	Y49	5	Y33
4	Y16	3	Y00	4	Y48	3	Y32
2	S1	1	S0	2	S3	1	S2

Item	Type	YTT05BH	External view	Terminal assignment
Module name		TTL output module		
Output voltage		4 to 15 VDC		
Max. load current	1 circuit	20 mA / circuit		
	8 circuits	160 mA / common		
Max. leakage current		50 μA		
Min. load current		–		
Max. ON voltage		0.2 V or less		
Max. rush current		–		
Output delay	ON → OFF	1.0 msec or less		
	OFF →ON	1.0 msec or less		
No. of output points		16 points/module, 8 points/common (not insulated between two common lines)		
Current consumption		0.18 A		
Output polarity		Sink output (negative common)		
Surge suppressor circuit		Diode		
Weight		Approx. 390 g		

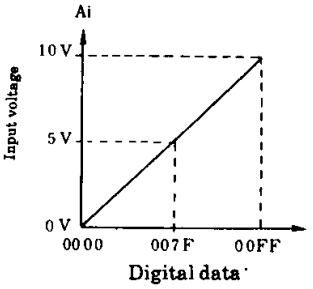


Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	COM2
2	S0	22	S2
3	Y00	23	Y16
4	Y01	24	Y17
5	Y02	25	Y18
6	Y03	26	Y19
7	Y04	27	Y20
8	Y05	28	Y21
9	Y06	29	Y22
10	Y07	30	Y23
11	COM1	31	COM3
12	S1	32	S3
13	Y08	33	Y24
14	Y09	34	Y25
15	Y10	35	Y26
16	Y11	36	Y27
17 .	Y12	37	Y28
18	Y13	38	Y29
19	Y14	39	Y30
20	Y15	40	Y31

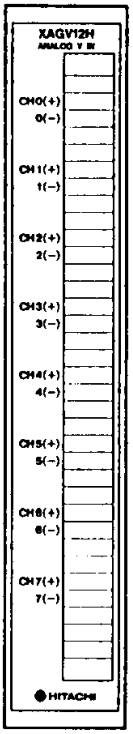
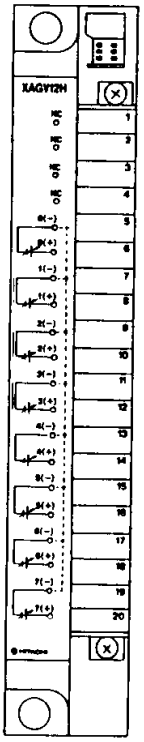
Item	Type	XAGV08H	External view	Terminal assignment
Module name		8 bit analog voltage input module		
Input voltage range		0 to 10 VDC		
Resolution		8 bits		
Conversion time		5 ms		
Total accuracy		±1% (full scale)		
Input impedance		100 kΩ		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
No. of channels		8 channels/module		
Current consumption		60 mA (5V), 70 mA (24 V)		
Weight		Approx. 400 g		
External wiring		2-core shielded (50 m maximum)		

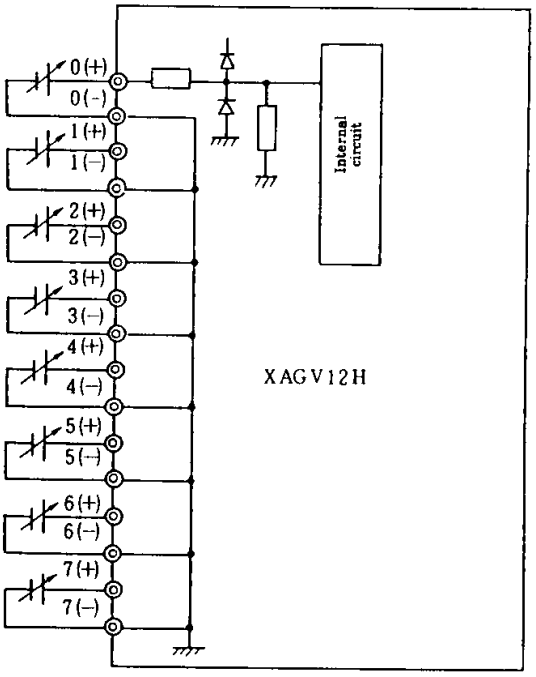


Relationship between analog and digital data

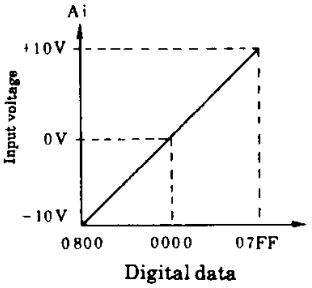


Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	4(−)
14	4(+)
15	5(−)
16	5(+)
17	6(−)
18	6(+)
19	7(−)
20	7(+)

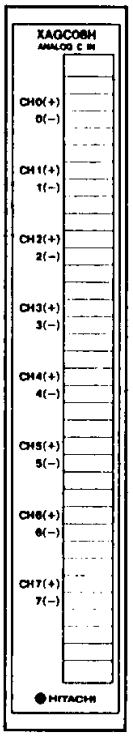
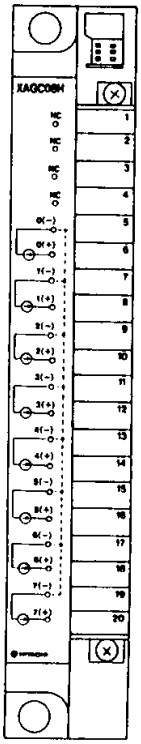
Item	Type	XAGV12H	External view	Terminal assignment
Module name		12 bit analog voltage input module		
Input voltage range		−10 to +10 VDC		
Resolution		12 bits		
Conversion time		5 ms		
Total accuracy		±0.5% (full scale)		
Input impedance		100 kΩ		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
No. of channels		8 channels/module		
Current consumption		60 mA (5 V), 170 mA (24 V)		
Weight		Approx. 400 g		
External wiring		2-core shielded (20 m maximum)		

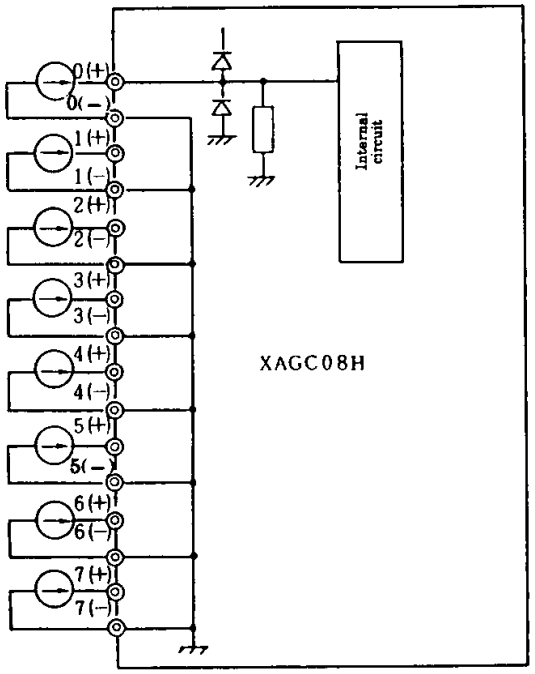


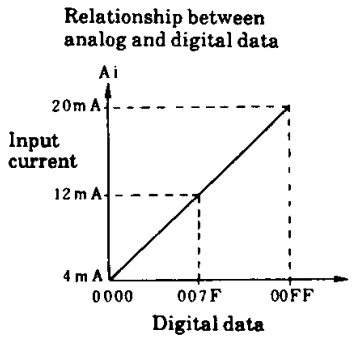
Relationship between analog and digital data



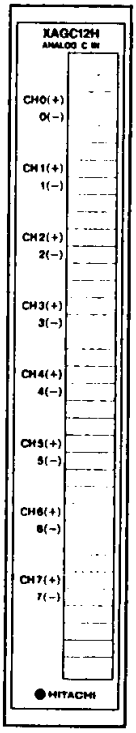
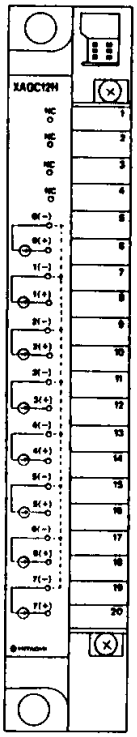
Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	4(−)
14	4(+)
15	5(−)
16	5(+)
17	6(−)
18	6(+)
19	7(−)
20	7(+)

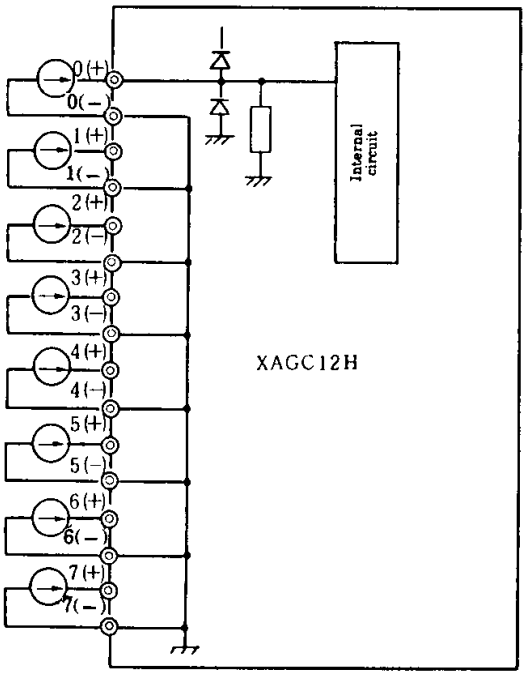
Item	Type	XAGC08H	External view	Terminal assignment
Module name		8 bit analog current input module		
Input current range		4 to 20 mA VDC		
Resolution		8 bits		
Conversion time		5 ms		
Total accuracy		±1% (full scale)		
Input impedance		100 Ω		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
No. of channels		8 channels/module		
Current consumption		60 mA (5V), 70 mA (24 V)		
Weight		Approx. 400 g		
External wiring		2-core shielded (50 m maximum)		



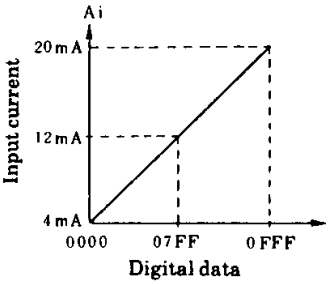


Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	4(−)
14	4(+)
15	5(−)
16	5(+)
17	6(−)
18	6(+)
19	7(−)
20	7(+)

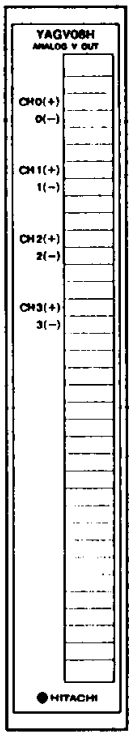
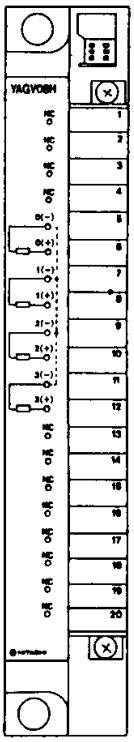
Item	Type	XAGC12H	External view	Terminal assignment
Module name		12 bit analog current input module		
Input current range		4 to 20 mA VDC		
Resolution		12 bits		
Conversion time		5 ms		
Total accuracy		±0.5% (full scale)		
Input impedance		100 Ω		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
No. of channels		8 channels/module		
Current consumption		60 mA (5V), 190 mA (24 V)		
Weight		Approx. 400 g		
External wiring		2-core shielded (50 m maximum)		

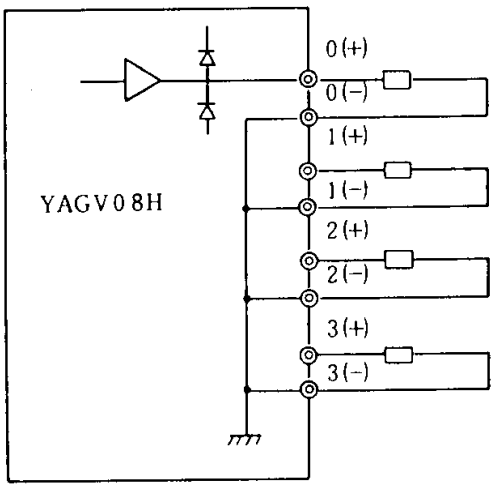


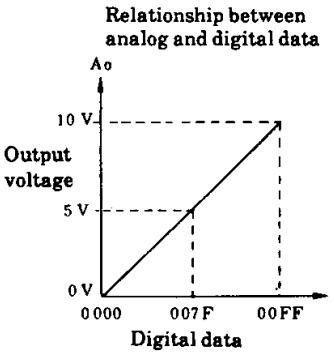
Relationship between analog and digital data



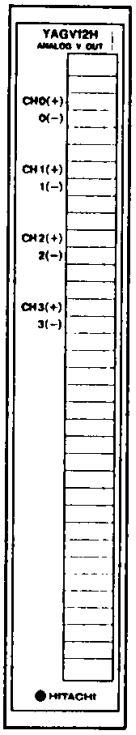
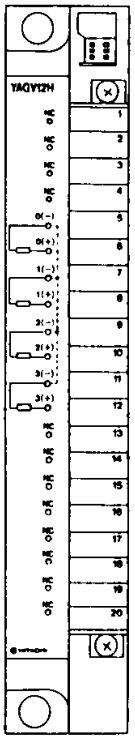
Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	4(−)
14	4(+)
15	5(−)
16	5(+)
17	6(−)
18	6(+)
19	7(−)
20	7(+)

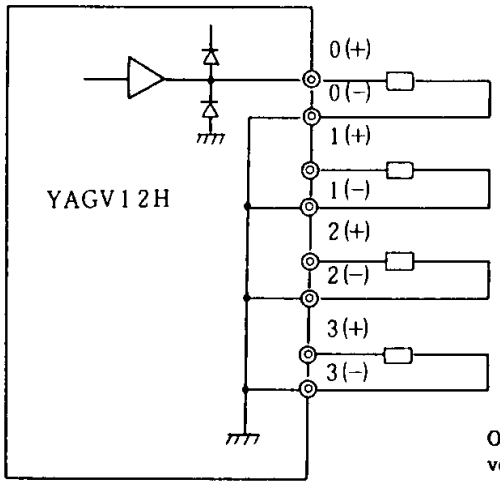
Item	Type	YAGV08H	External view	Terminal assignment
Module name		8 bit analog voltage output module		
No. of channels		4 channels/module		
Output voltage range		0 to 10 VDC		
Resolution		8 bits		
Conversion time		5 ms		
Total accuracy		±1% (full scale)		
External load resistance		10KΩ or more		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
Current consumption		70 mA (5V), 80 mA (24 V)		
External wiring		2-core shielded (20 m or less)		
Weight		Approx. 420 g		

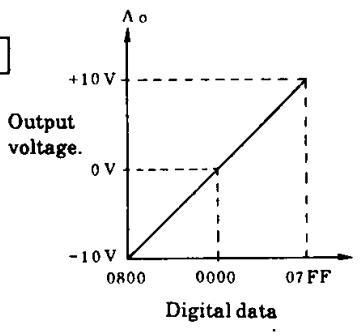




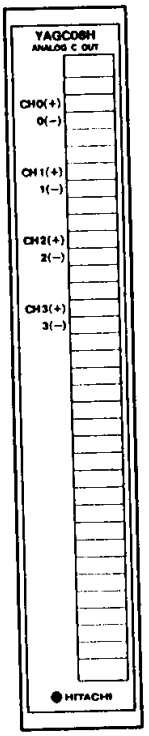
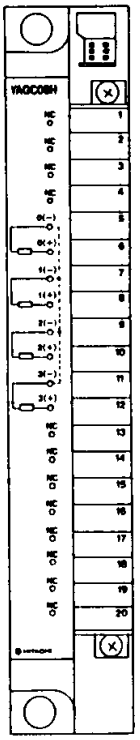
Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC

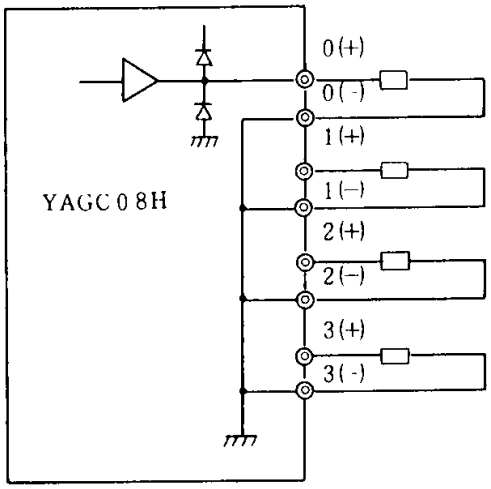
Item	Type	YAGV12H	External view	Terminal assignment
Module name		12 bit analog voltage output module		
No. of channels		4 channels/module		
Output current range		−10 to +10 VDC		
Resolution		12 bits		
Conversion time		5 ms		
Total accuracy		±0.5% (full scale)		
External load resistance		10KΩ or more		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
Current consumption		60 mA (5V), 100 mA (24 V)		
External wiring		2-core shielded (20 m or less)		
Weight		Approx. 420 g		



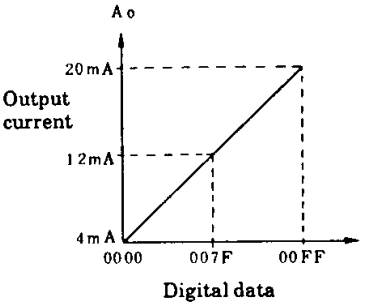


Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC

Item	Type	YAGC08H	External view	Terminal assignment
Module name		8 bit analog current output module		
No. of channels		4 channels/module		
Output current range		4 to 20 mA		
Resolution		8 bits		
Conversion time		5 ms		
Total accuracy		±1% (full scale)		
External load resistance		0 to 500 Ω		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
Current consumption		70 mA (5V), 170 mA (24 V)		
External wiring		2-core shielded (50 m or less)		
Weight		Approx. 420 g		

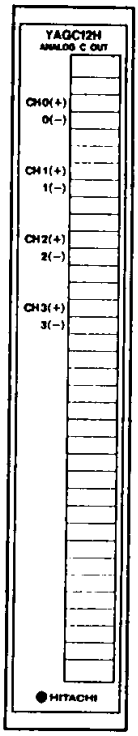
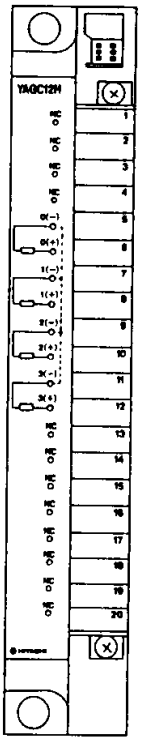


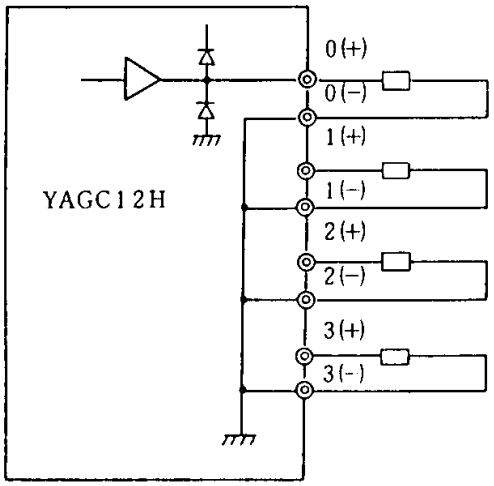
Relationship between analog and digital data

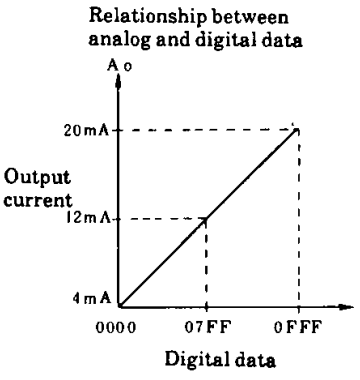


If the external load resistance exceeds 510 Ω, the 20 mA maximum current requirements may not be satisfied.
Unused channels must be jumpered.

Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC

Item	Type	YAGC12H	External view	Terminal assignment
Module name		12 bit analog current output module		
No. of channels		4 channels/module		
Output current range		4 to 20 mA DC		
Resolution		12 bits		
Conversion time		5 ms		
Total accuracy		±0.5% (full scale)		
External load resistance		0 to 500Ω		
Insu-lation	Channel-to-PC	Photocoupler		
	Bet. channels	Conductive		
Current consumption		60 mA (5V), 190 mA (24 V)		
External wiring		2-core shielded (50 m or less)		
Weight		Approx. 420 g		

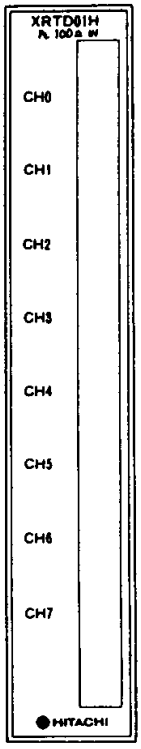
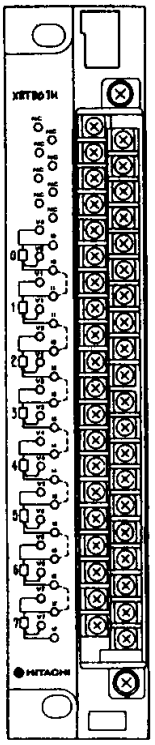


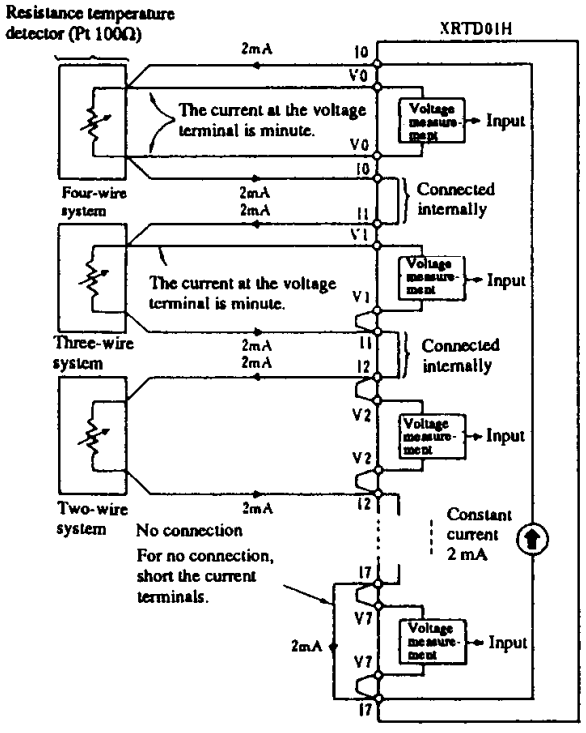


If the external load resistance exceeds 510 Ω, the 20 mA maximum current requirements may not be satisfied.
Unused channels must be jumpered.

Terminal No.	Signal name
1	NC
2	NC
3	NC
4	NC
5	0(−)
6	0(+)
7	1(−)
8	1(+)
9	2(−)
10	2(+)
11	3(−)
12	3(+)
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC

8.6 Specification of the Resistance Temperature Detector Input Module

Item		Specification	Surface shape	Terminal shape
Type		XRTD01H		
Resistance temperature detector		Platinum resistance temperature detector (Pt, 100 Ω, 2 mA)		
Temperature conversion data		15 signed bits (lower 2 bits 0 in the normal state)		
Conversion time		1 s / 4 or 8 channels max.		
Accuracy		±0.6°C (0 to 100°C)		
Measuring temperature range		-50°C to 400°C		
Insulation	Between channel and internal circuit	Photocoupler dielectric strength: 1 minute at 550 VAC		
	Between channels	Non-isolation		
No. of channels		8 or 4 channels switching		
Internal supply current		0.16 A (DC 5 V), 0.1 A (DC 24 V)		
Weight		About 500 g		
External cable		Shielding cable (Max. 200 m for each channel)		
External cable resistance		Total resistance of 8 channels max. 400 Ω		
No. of occupied points		128 points (8 channels), 64 points (4 channels)		



Pin No.	Signal name	Pin No.	Signal name
1	N C	21	V 3
2	N C	22	I 3
3	N C	23	V 3
4	N C	24	I 3
5	N C	25	V 4
6	N C	26	I 4
7	N C	27	V 4
8	N C	28	I 4
9	V 0	29	V 5
10	I 0	30	I 5
11	V 0	31	V 5
12	I 0	32	I 5
13	V 1	33	V 6
14	I 1	34	I 6
15	V 1	35	V 6
16	I 1	36	I 6
17	V 2	37	V 7
18	I 2	38	I 7
19	V 2	39	V 7
20	I 2	40	I 7

Chapter 9 Communication Function Module

9.1 Outline

The communication function module is used to transmit control information between the host computer and programmable controller (PC) or between PCs.

When constructing a host link system, CPU link system, or remote I/O system, the communication function module (COMM-2H, LINK-H, REM-MAH, etc.) corresponding to it is used.

A BASIC module which performs arithmetic using the BASIC program and sets the result in the internal output as I/O information of the PC and a GPIB module which constructs an automatic measuring system are available.

BCOM-H and BOLINK-H in which a COMM interface board which is used to allow easy connection of the above communication function module to a B16 series personal computer, optical CPU link interface board, and support software for the two are set are available.

Furthermore, a graphic display system GM-4000 system which transmits or receives data to or from the CPU link module and displays and monitors those data on a large (20 inch) graphic display at high speed is available.

A liquid crystal graphic monitor display GMD-100H which uses a liquid crystal display with a small touch panel is also available.

As mentioned above, the H-series PC may be equipped with not only the communication function module for control but also various systems for supporting the communication function.

9.2 Communication Function Module List

Product name	Type	Specification	No. of occupied points	Supply current (A)		Remarks
				DC 5 V	DC 24 V	
Intelligent COMM module	COMM-2H	One port of each of RS232C and RS422 (2-slot width)	32	※1 0.80	–	1 module / basic base of CPU
Intelligent GPIB module	GPIB-H	One IEEE-488 GPIB port (2-slot width)	32	0.35	–	1 module / basic base of CPU
XCPU link module	LINK-H	CPU link (coaxial) (2-slot width)	–	0.80	–	No cable and connector attached.
	OLINK-H	CPU link (optical fiber) (2-slot width)	–	0.80	–	2 loops / basic base of CPU
Remote I/O module	REM-MAH	Remote I/O (coaxial) master station (2-slot width)	–	0.60	–	No cable and connector attached.
	OREM-MH	Remote I/O (optical fiber) master station (2-slot width)	–	0.60	–	4 modules / basic base of CPU
	REM-LOH	Remote I/O (coaxial) local station (2-slot width)	–	※2 1.60	–	No cable and connector attached.
	OREM-LH	Remote I/O (optical fiber) local station (2-slot width)	–	※2 1.60	–	10 local stations / master station
Remote I/O MINI module	REM-MMH	REM Remote I/O MINI (twisted pair) master station (1-slot width)	128	0.15	–	No cable attached. 13 local stations / master station
	REM-LMH	Remote I/O MINI (twisted pair) local station (1-slot width)	128	0.15	–	
BASIC module	BASIC-H	BASIC language corresponding module (3-slot width)	–	1.50	–	1 module / basic base of CPU
B16 COMM interface	BCOM-H	COMM interface card for B16	–	–	–	
B16 OLINK interface	BOLINK-H	OLINK interface card dedicated to B16FX-II	–	–	–	
XGraphic monitor system GM-4000	GM4***	20" CRT graphic monitor contained in CPU link	–	–	–	
Graphic monitor system display	GMD-100H	Touch panel liquid crystal display. CPU, COMM, and remote I/O local station module connected.	–	–	–	

※1: The supply current of the COMM module when the programmer (PGM-GPH, PGM-CHH) is connected is 1.3 A. (No optional interface should be used.)

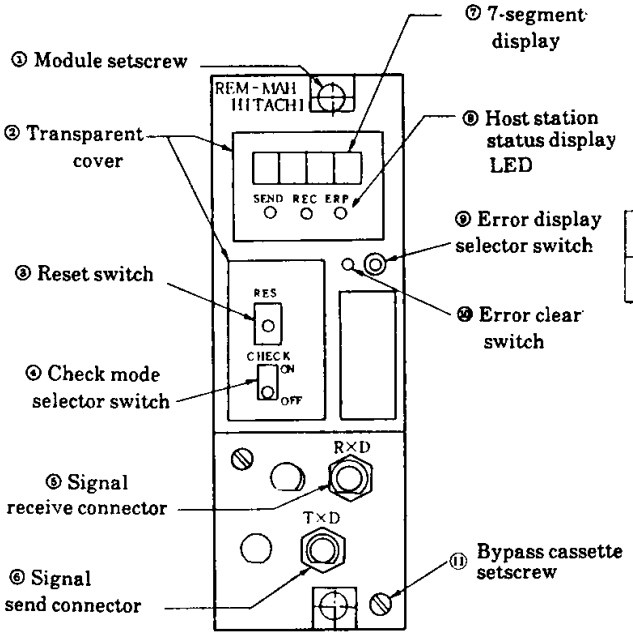
※2: The supply current of the remote I/O module local station is the one when the programmer (PGM-GPH, PGM-CHH) is connected. (No optional interface should be used.)

For details of each communication function module, refer to each module manual (instruction manual).

9.3 Structure and Specification of Communication Function Module

9.3.1 Remote I/O module of host station

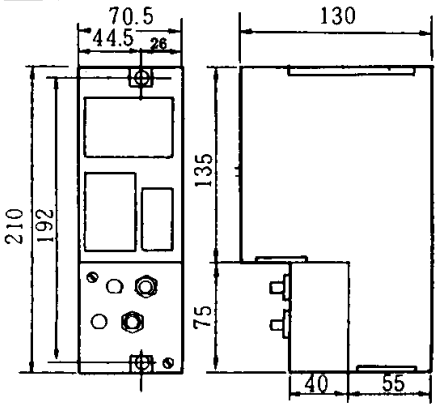
Parts Name



Type and Name

Type
REM−MAH

Weight	Approx. 660 g
Dimensions (mm)	

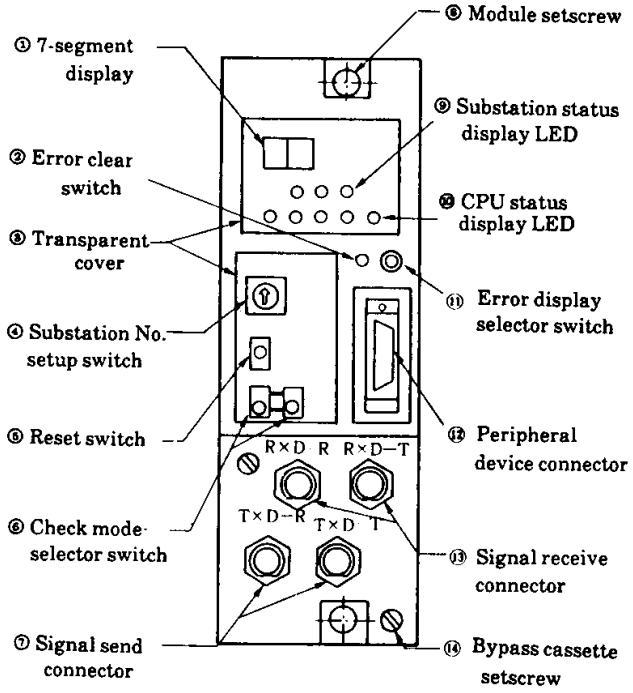


Parts Name and Functions

No.	Name	Functions
①	Module setscrew	Fixes the module to the basic base.
②	Transparent cover	LED and switch cover
③	Reset switch	Hardware reset switch of remote host station
④	Check mode selector switch	Check mode select/release switch
⑤	Signal receive connector	Coaxial cable connector for RxD signal reception
⑥	Signal send connector	Coaxial cable connector for TxD signal transmission
⑦	7-segment display	Displays a 4-digit error code as follows: During normal operation: Not displayed During error: An error code is displayed.
⑧	Host station status display LED	SEND: Displays sending data. (Hardware) REC: Displays receiving data. (Hardware) ERR: Lights only when an error occurs.
⑨	Error display selector switch	Displays error thorugh switch selection.
⑩	Error clear switch	Clears the error display.
⑪	Bypass cassette setscrew	Fixes the bypass relay cassette to the module.

9.3.2 Remote I/O module of substation

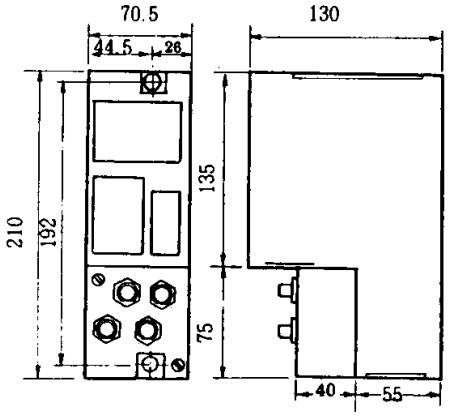
Parts Name



Type and Name

Type
REM–LOH

Weight	Approx. 660 g
Dimensions (mm)	



Parts Name and Functions

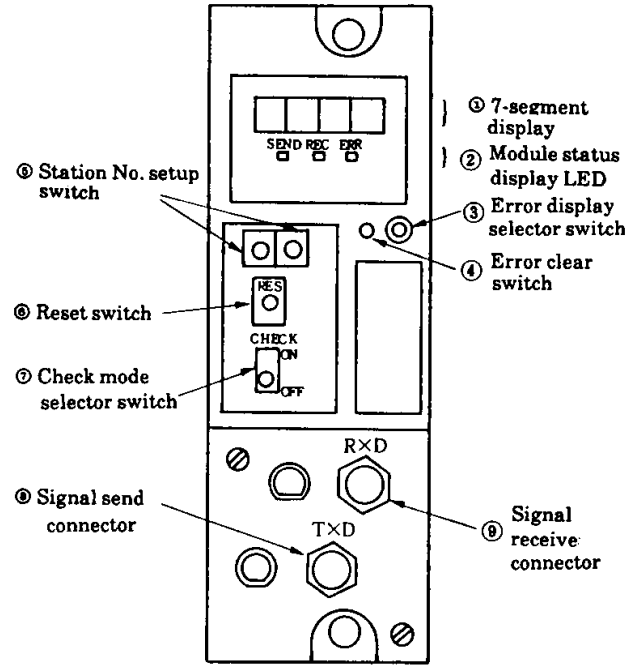
No	Name	Functions
①	7-segment display	Lights when connected to the remote link. Goes out when disconnected from the remote link. Displays an error information if an error occurs.
②	Error clear switch	Clears the error display.
③	Transparent cover	LED, switch and connector cover
④	Substation No. setup switch	Sets a substation number (0 to 9) by using the rotary switch.
⑤	Reset switch	Hardware reset switch of remote substation module
⑥	Check mode selector switch	Check mode on/off switching and selecting switch
⑦	Signal send connector	Coaxial cable connector for TxD signal transmission
⑧	Module setscrew	Fixes the module to the basic base.
⑨	Substation status display LED	SEND: Displays sending data. (Hardware) REC: Displays receiving data. (Hardware) ERR: Lights only when an error occurs.
⑩	CPU status display LED	Displays the CPU operation status (Run, Simulation, Halt, Error, or Force).
⑪	Error display selector switch	Displays error through switch selection.
⑫	Peripheral device connector	RS-232C port connector for pheripheral device and host computer connection
⑬	Signal receive connector	Coaxial cable connector for RxD signal reception
⑭	Bypass cassette setscrew	Fixes the bypass relay cassette to the module.

Remote I/O Module Specifications

Item			Host station (REM-MAH)	Substation (REM-LOH)
General	Operating temperature		0 to 55`C	
	Storage temperature		-10 to +75`C	
	Operating humidity		20 to 90% RH (without condensation)	
	Storage humidity		10 to 90% RH (without condensation)	
	Current consumption		Approx. 600 mA (5 VDC)	Approx. 1.6 A (5 VDC)
	Dimensions		70.5W x 210H x 130D (mm)	
	Weight		Approx. 680 g	Approx. 760 g
Functions	Maximum No. of modules		Up to 4 per CPU	Up to 10 per host station(REM-MAH)
	Maximum No. of remote points		512 points or 32 words (for each host station)	
	Baud rate		1.5M bps	
	Protocol		Half-duplex, serial transmission frame synchronization	
	Modulation		Base band	
	Refresh time		Up to 15 msec per 512 points (when 10 substations are connected)	
	Error check		CRC	CRC sum check
	Self-diagnosis		System ROM/RAM check Watchdog timer check Transmission loopback check	
Transmissi on path	Cable length	Between stations	500 m	
		Total length	500 m	
	Error station processing		Bypassing	
	Cable and connector used		AMP 227222-3 remote host and substation connectors 5D-2V shielded coaxial cable (optional) Hirose's BNC-P-5DV cable connector or equivalent (optional)	

9.3.3 CPU link module

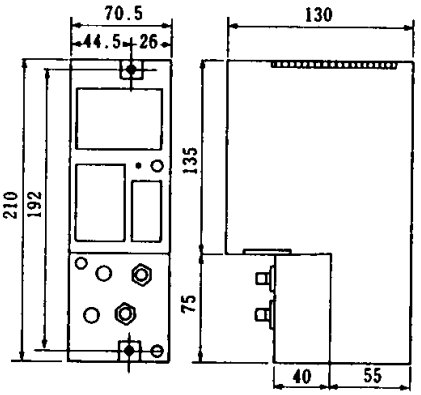
Parts Name



Type and Name

Type
L I NK−H

Weight	Approx. 670 g
Dimensions (mm)	



Parts Name and Functions

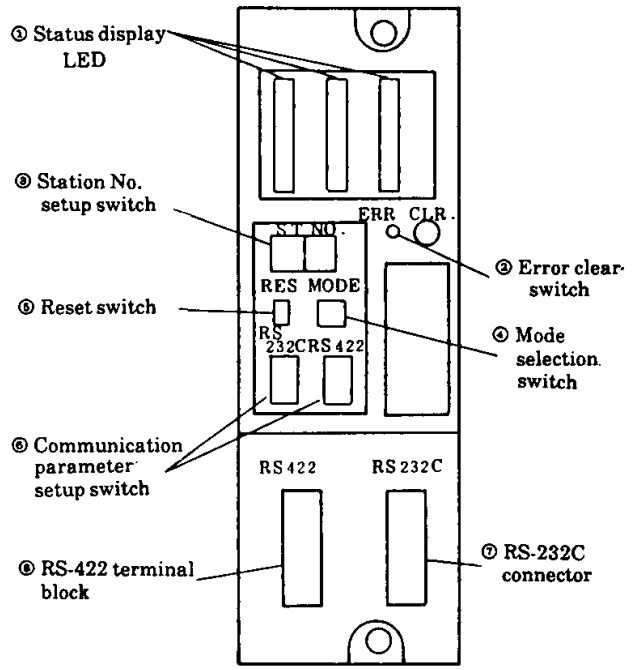
No.	Name	Functions
①	7-segment (4-digit) display	Normal operation: The link connection/disconnection information is displayed. During error: An error information is displayed.
②	Module status display LED	SEND: Displays sending data. (Hardware) REC: Displays receiving data. (Hardware) ERR: Lights only when an error occurs.
③	Error display selector switch	Displays errors through switch selection.
④	Error clear switch	Clears the error display.
⑤	Station No. setup switch	Link station number setup switch
⑥	Reset switch	Link module reset switch
⑦	Check mode selector switch	Chech mode select/release switch
⑧	Signal send connector	Coaxial cable connector for TxD signal transmission
⑨	Signal receive connector	Coaxial cable connector for RxD signal reception

CPU Link Module Specifications

Item			Specifications
General	Operating temperature		0 to 55°C
	Storage temperature		−10 to +75°C
	Operating humidity		20 to 90% RH (without condensation)
	Storage humidity		10 to 90% RH (without condensation)
	Current consumption		Approx. 800 mA (5 VDC)
	Dimensions		70.5W x 210H x 130D (mm)
	Weight		Approx. 690 g
Functions	No. of link modules connected		Up to 64 per system (per an loop)
	No. of modules mounted		Up to 2 per CPU (2 loops per CPU)
	No. of link points		1K words per loop (2K words per 2 loops)
	Data transmission and reception		Shared data area
	Data area assignment identification		Set the parameter from a peripheral device
	Station number setup		0 to 63 by rotary switch
	Baud rate		1.0Mbps
	Protocol		Half-duplex, serial data transmission with frame synchronization
	Communication method		Talken passing
	Modulation		Base band
	Refresh time		Approx. 270 msec (maximum) for 1K-word data transmission if 64 stations are connected (except for simultaneous access from peripherals via the link)
	Error check		CRC, overrun check, timeout, line disconnection, and parameter error (such as duplicated station number setup and overlaid link area)
	Self-diagnosis		System ROM/RAM check Watchdog timer check Transmission loopback check
Transmis-sion path	Transmission path type		Loop
	Cable length	Between stations	500m
		Total length	1,000 m
	Error station processing		Bypassing
	Cable and connector used		AMR 227222-3 CPU link module connector 5D-2V shielded coaxial cable (optional) Hirose's BNC-P-5DV cable connector or equivalent (optional)

9.3.4 Intelligent serial port module

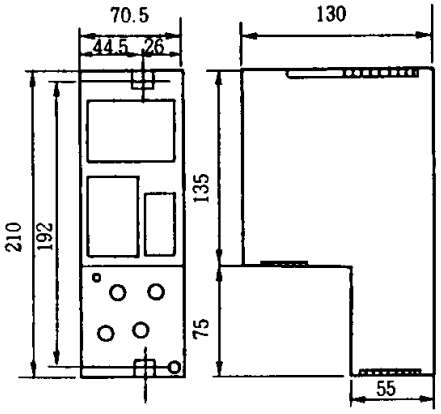
Parts Name



Type and Name

Type
COMM－2H

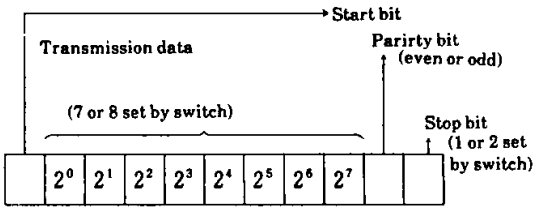
Weight	Approx. 510 g
Dimensions (mm)	



Parts Name and Functions

No.	Name	Function
①	Status display LED	Displays the RS-232C or RS-422 status and module status by LEDs during communication.
②	Error clear switch	Clears the error display.
③	Station No. setup switch	Sets a station number (0 to 31) by the rotary switch.
④	Mode selection switch	Selects the check mode and start method.
⑤	Reset switch	Hardware reset switch of COMM module
⑥	RS-232C and RS-422 communication parameter setup switch	Sets the RS-232C and RS-422 data transmission speed, parity, and data length by DIP switches.
⑦	RS-232C connector	For peripheral and host station connection
⑧	RS-422 terminal block	For host controller connection

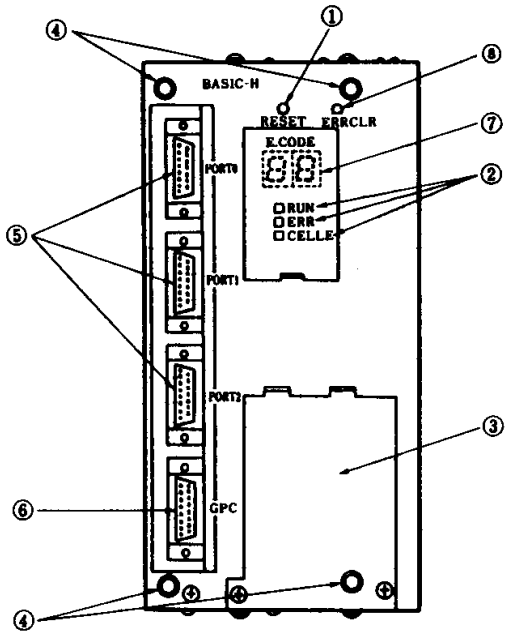
Specifications of Intelligent Serial Port Module

Item		Specifications
General	Operating temperature	0 to 55`C
	Storage temperature	-10 to +75`C
	Operating humidity	20 to 90% RH (without condensation)
	Storage humidity	10 to 90% RH (without condensation)
	Current consumption	Approx. 800 mA (5 VDC)
	Dimensions	70.5W x 210H x 130D (mm)
	Weight	Approx. 650 g
Functions	No. of link modules connected	1 per CPU
	Interface	RS-232C port: 1 RS-422 port: 1
	Baud rate	300, 600, 1200, 2400, 4800, 9600, or 19200 bps (switch selectable)
	Communication	Half-duplex
	Synchronization	Start-stop
	Activation	Started by the command from host controller (Can also be requested to start from H-series)
	Transmission	Serial transmission (bit serial)
	Transmission code	ASCII
	Transmission code configuration	
	Transmission code send sequence	From low-order bits 2^0 of each character
	Error control	Vertical parity check (even or odd set by switch) Overrun check Framing check Sum check (set by switch)
	Transmission unit	In units of messages (variable-length)
	Maximum message length	503 bytes/message (including transmission control characters)
	Communication mode	Untransparent mode (No binary data can be sent or received.)
Transmission path	Cable connection	RS-232C : 1:1 RS-422 : 1:n (up to 32)
	Cable and connector used	RS-232C : 12-pair twisted cable (entire shielding, 15 m long maximum) RS-422 : 2-pair twisted cable (shielded, 250 m long maximum) Cable connector RS-232C: Hirose's HDAB-15P connector or equivalent (option) RS-422 : HDA-CTF housing type or equivalent (option) COMM-H connector RS-232C : Hirose's RDAB-15S-LN or equivalent RS-422 : 6-pole terminal block

BASIC module

(a) Structure of the BASIC module

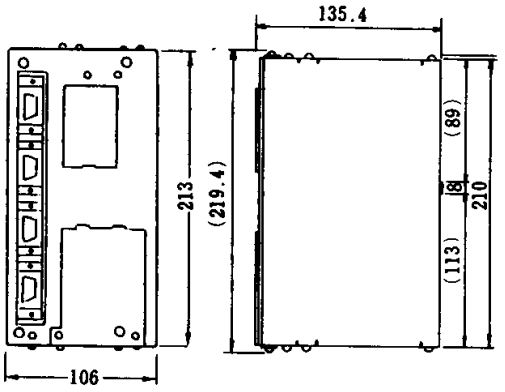
Parts Name

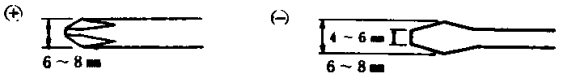


Type BASIC-H

Weight Approx. 2.0 kg

Dimensions (mm)



No.	Name	Function	
①	Reset switch	The BASIC module is reset on a hardware base.	
②	Status indication LED	RUN	The LED is on in the RUN status.
		ERR	The LED is turned on when an error occurs in the microcomputer in the BASIC module.
		CELL. E	The LED is turned on when the RAM backup battery is replaced.
③	Battery cover	Open the cover when replacing the battery.	
④	Module fixing screw	Screws for fixing the module. Tighten them securely. Use a Phillips screwdriver to tighten the set screws if possible. The suitable driver size is as follows: 	
⑤	Terminal connecting connector	Connectors for connecting the terminal device and host computer	
⑥	Peripheral equipment connecting connector	Connector for the cable (GPCB-02H) for connecting the peripheral equipment (GPCL01H)	
⑦	7-segment indicator	Error code indicator of the BASIC module	
⑧	Error clear switch	The switch clears the content of the 7-segment indicator and error history. (When a severe failure occurs, the switch will not function.)	

(b) Basic specification of the BASIC module

Item		Specification
CPU		HD68HC000-8 (8 MHz) or equivalent
Memory	System ROM	System program area: 128k bytes
	System RAM	System memory area: 64k bytes (backup)
	User RAM	User program area: 64k bytes (backup)
		Symbol area: 51k bytes (backup)
	System common RAM	Communication area with CPU module: 2k bytes
Language		III-BASIC (special real-time multitask)
Interface	General purpose terminal connection port	General purpose port (based on RS232C), 3 each (non-isolated), asynchronous method, half duplex communication method, cable length 15 m max., 300, 600, 1200, 2400, 4800, 9600 bits/s (9600 bits/s only for transmission)
	Peripheral equipment connection port (for GPCJ)	Peripheral equipment connection port (based on RS232C), 1 each (non-isolated), asynchronous method, half duplex communication method, 4800 bits/s (fixed)
	H-series PC connection interface	Directly connected to the system bus (on the basic base)
Maintenance function	Hardware detection	Forced stop of the microcomputer by the watch dog timer RAM area parity check Battery voltage error detection Undefined address access detection
	Software detection	Program area sum check RAM read or write check Error history read Power error detection
General specification	Ambient temperature	0 to 55°C (during operation), -10 to 75°C (during storage. The memory contents are not guaranteed.)
	Humidity	0 to 90% RH (no dew condensation)
	Supply voltage	5 VDC (supplied from the H-series basic base)
	Internal supply current	1.5 A (5 VDC)
	Dimensions (mm)	106 (W) x 219.4 (H) x 135.4 (D) (for 3 slots)
	Weight	Approx. 2.0 kg
Instruction	Statement	48 types including PRINT, INPUT, START, STOP, TASK, CIRCLE, etc.
	Command	11 types including AUTO, RUN, LIST, CHECK, RENUM, etc.
	Function	36 types including SIN, COS, BCD, BIN, SQR, EXP, LEN, etc.

Note: Based on RS-232C: The connector is a 15-pin D subconnector. For further details, refer to the BASIC module manual (instruction manual).

NOTE: When the BASIC module is to be used, a CPU module corresponding to the BASIC module is necessary. The CPU module corresponding to the BASIC module is as shown below.

[1] CPU-**Ha, CPUP-**H, CPU2-**H

[2] CPU-**H which has an indication of FOR BASIC on the front of the case

(c) Function specification of the BASIC module

Running method	RUN Debug RUN	Synchronized with running (RUN) of the CPU Specification of execution from the peripheral equipment (GPCL)
Task control	No. of tasks Processing method	Max. 17 tasks Priority processing method in the order of task numbers (0 to 16)
Timer control	Time base	In units of 10 ms (I/O time-out check: in units of second)
Status display	LED lamp	RUN: BASIC-H on-line ERROR: BASIC-H emergency stop CELL.E: BASIC-H battery error
	7-segment	2 digits: Troubleshooting error code
	Special internal output	ERROR: BASIC-H emergency stop RUN: BASIC-H on-line READY: BASIC-H start completion CELL.E: BASIC-H battery error
General purpose port	Asynchronous transfer	1 start bit, 1 stop bit
	Transmission sign	IS 7 (even parity) JIS 8 (no parity)
	Task start	By receiving a start code (2FH)
	Non-protocol terminal	The procedure is prepared by the user.
	(CRT)	VG620 by Victor Data Systems, Ltd.
	(Printer)	XSP80T by EPSON (A serial interface board is necessary.)
	(CGT)	One of CGT560NR, F560J, F640J, and F740J by Nihon Computer Kogyo, Ltd.
	(Personal computer)	B16 series by Hitachi, Ltd.
CPU relations	Common P I/O	Word and bit common internal output, 1024 words (WM000 to WM3FF, M0000 to M3FF)
		Bit internal output, 1986 bits (R000 to R7BF)
		Bit special internal output, 64 bits (R7C0 to R7FF)
		Word internal output (The output varies with the memory cassette type.), Max. 50176 words (WR0000 to WRC3FF)
		Special word internal output, 512 words (WRF000 to WRF1FF)
		Link area, 1034 words, 2 loops (WL0000 to WL03FF, WL1000 to WL13FF) (L00000 to L03FFF, L10000 to L13FFF)
	Exclusive control management	RESERVE/FREE
	Task start	By the START instruction of the sequence program. The ☑ key of the terminal is used to start the task.
Peripheral function	(1) Definition of the communication port (2) Display of self diagnosis information (3) Recording, regeneration, integration, check, deletion, and name change of a floppy disk (4) Initialization (5) Preparation, correction, display, and printing of a program (6) Transfer and check of a program (7) End of use	

Chapter 10 Sophisticated Function Module

10.1 Outline

The following sophisticated function modules are available.

(1) Counter module

The counter module reads and counts high-speed pulses which cannot be read by a normal input module or program. Conditions can be outputted by entering a set value by the sequence program. The following two types of counter modules are available depending on the function.

(a) 16-bit and 1-channel counter module (Type: XCU001H)

(b) 32-bit and 2-channel counter module (Type: XCU232H)

(2) Interruption input module (Type: XINT0AH)

The module halts the normal scanning of the CPU module for an external interruption and executes the interruption handling program on a priority basis.

(3) Positioning module

The module controls highly accurate positioning of the pulse motor or servo motor. The following three types of positioning modules are available depending on the function.

(a) 1-axis pulse train output positioning module (Type: POSIT-H)

(b) 2-axis pulse train output positioning module (Type: POSIT-2H)

(c) 2-axis analog output positioning module (Type: POSITA2H)

(4) ASCII module

The module transmits or receives data to or from the programmable controller (PC) in the ASCII code. The following two types of ASCII modules are available depending on the function.

(a) ASCII module (Type: ASCII-1H) which outputs data in a format which is registered in the CRT or printer

(b) ASCII module (Type: ASCII-2H) which reads and stores ASCII data from a bar code reader

(5) Real-time clock module (Type: CLOCK-H)

The module controls data by time using the clock function and timer function.

(6) Serial I/O module (Type: SIO-H)

The module can connect and control various external devices by the non-protocol communication port (RS-232C, RS-422).

10.2 Sophisticated Function Module List

Product name	Type	Specification	No. of occupied points	Supply current (A)		Remarks
				5 VDC	24 VDC	
Counter module	XCU001H	32-bit and 1-channel counter input 50 kHz	128	0.30	0.10	External 10 to 30 VDC required
	XCU232H	32-bit and 2-channel counter input 100/5 kHz	128	0.16	–	
Positioning module	POSIT-H	1-axis pulse train output 25 to 100 k pulses/s	128	0.10	–	※1: Remote local station unmountable External 5 VDC required
	POSIT-2H	2-axis pulse train output up to 200 k pulses/s	128	0.35	–	
	POSITA2H	2-axis analog output positioning (2-slot width)	128	0.55	–	External 24 VDC required
Interruption input module	XINTOAH	Interruption input module	32	0.12	–	1 module / CPU, remote local station unmountable
ASCII module	ASCII-1H	Corresponding to CRT terminal or serial printer (2-slot width)	128	1.00	–	Remote local station unmountable
	ASCII-2H	Corresponding to bar code reader (2-slot width)	128	1.00	–	
Serial time clock	CLOCK-H	With serial time clock timer function	128	0.10	–	
Serial I/O module	SIO-H	One port of each of RS-232C and RS-422, insulated, non-protocol	128	1.00	–	

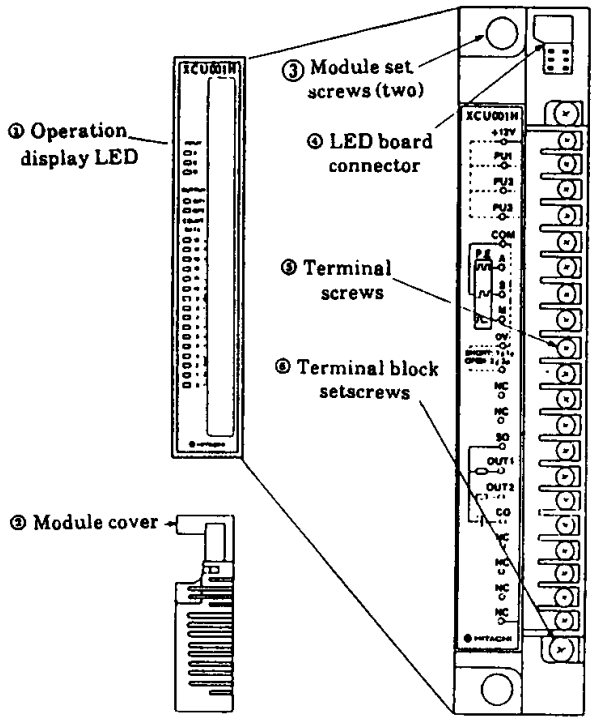
※1: "Remote local station" indicates a remote I/O local station or a local station of a remote I/O MINI module.

For further details of each module, refer to each manual (instruction manual).

10.3 Structure and Specification of Sophisticated Function Module

10.3.1 High-speed counter module

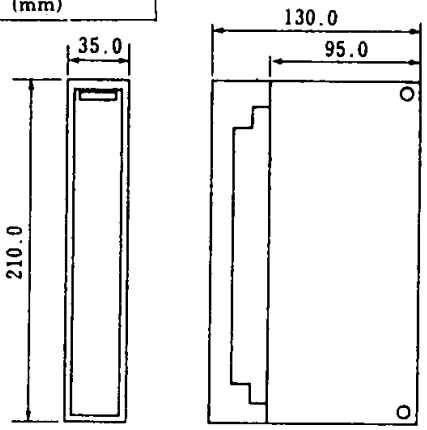
Parts Name



Type and Name

Type	XCU001H	XCU232H
Name	High-speed counter module	

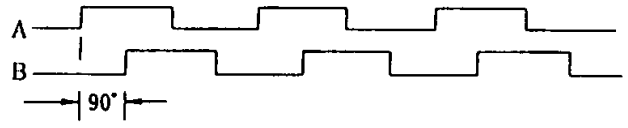
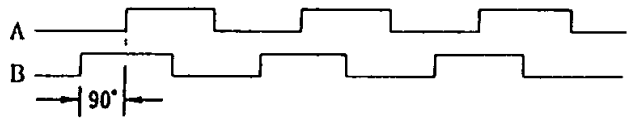
Dimensions (mm)



Parts Name and Functions

No.	Name	Function
①	Output display LED	Lights during output on.
②	Module cover	Module cover having the LED display function
③	Module setscrew	Fixes the module to the basic or expansion base.
④	LED board connector	Cable connector for LED board connection at the terminal block cover
⑤	Terminal screw	Crimp terminal setscrew (M3 x 6l)
⑥	Terminal block setscrew	Fixes the terminal block to the module.

(a) High-speed counter module specifications

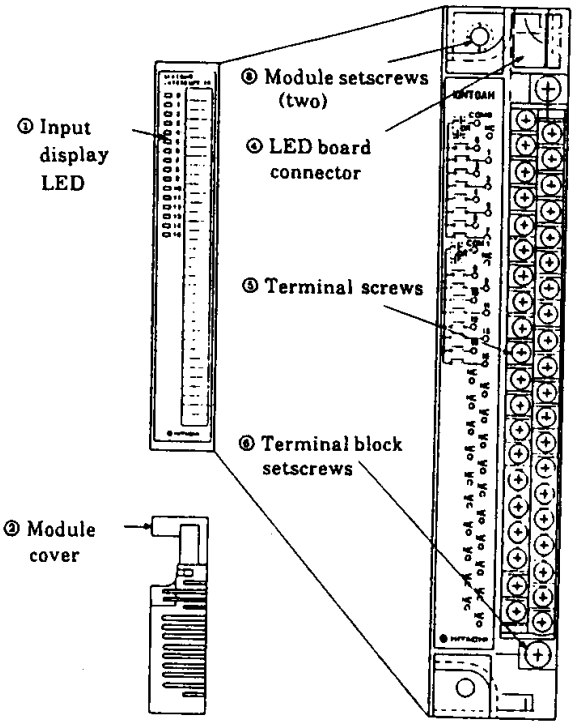
Item			Specification		
			XCU001H	XCU232H	
Input signal	Count pulse frequency		50 kHz maximum	Maximum 100 or 5 kHz can be switched. 2 channels	
	Input pulse voltage level	ON	5 to 12 VDC	Input supply voltage	10 to 26 V, 0.07 A, 2 channels
		OFF	0 to 2 VDC		1/2 or 1/4 of supply voltage (Can be switched)
	Count pulse width		5 μs minimum (for ON and OFF)	ON: 4 μs min., OFF: 4 μs min. (80 μs at 5 kHz)	
	Marker pulse width		10 μs minimum	10 μs min. (200 μs at 5 kHz), inversion function	
	Input impedance		Approx. 20 kΩ (The 2.2 kΩ, built-in pull-up resistor can be selected with external jumppr)		
	Insulation		Photocoupler	Photocoupler (The channels are not isolated from each other.)	
	No. of pulse input points		3 points A: Phase A B: Phase B M: Marker	Phase difference between A and B	Normal rotation: +90°C ± 45°C Reverse rotation: –90°C ± 45°C
	Polarity		Negative common in the module		
	2-phase input	Count up (pulse addition)	 Phase B is 90° delayed from phase A.		
		Count down (subtraction)	 Phase B is 90° delayed from phase A.		
	Built-in power supply for input		12 VDC + 10% (Maximum output current: 50 mA); pulse encoder signal power supply		
Output signal	Output voltage		10 to 30 VDC		
	Load current		0.5 A maximum		
	Signal output		Transistor (open collector)		
	Minimum load current		1 mA minimum		
	Output delay time	ON → OFF	0.5 msec maximum		
		OFF → ON	0.5 msec maximum		
	Voltage drop during ON		1.5 VDC maximum (at 0.5 A)		
	Insulation		Photocoupler		
	No. of output points		2 (OUT1 and OUT2)		
	Leakage current		0.1 mA maximum		
	Polarity		Negative common in the module		
	External power supply for signal output		10 to 30 VDC (0.05 A of current consumption)*		
Dielectric strength			1 minutes at 250 VAC between housing and external terminal		
Operating temperature			0 to 55°C		
Operating humidity			20 to 90% RH (without condensation)		
Dimensions			35W x 210H x 130D (mm)		
Weight			Approx. 500 g		

* The current flows to the SO terminal of output circuit and lost.

Item	Specifications	
	XCU001H (1-channel counter)	XCU232H (2-channel counter)
Count range	0 to 65,535 (H0000 to HFFFF)	0 to 4,294,967,295 (H00000000 to HFFFFFFFF)
Counting	• Dual-phase pulse count (up or down) • Single-phase forward/reverse pulse count (Dual or single phase switch selectable)	
Output	• 1 point per one set value (open collector) • Output holding with set value equal to counter value • Output with set value less than counter value (Switch selectable)	
Marker	1 point (The counter value is reset by this signal.)	1 point / channel, 2 channels (The count is reset directly by this signal.)
Operating display	• Counter value display (bit display) • Output and pulse input display	{A, B, M, UP, DOWN, 1ø/2ø, >, =, underflow, overflow, CE, ME, OE, OUT}, 2 channels
Register	• Count register • Set value (0) register • Set value (1) register • Status/control register	• Read register (32 bits) (for reading the current value) • Write register (32 bits) (for writing the current value and comparison value) • Status registers 1, 2 • Control registers 1, 2
Function	• Count value preset • Count value readout • Set value writing • Set value reading • Status reading Set value = Count value (latch) Set value is less than count value Overflow (carry) Underflow (borrow)	• Current value setting • Current value reading • Comparison value setting • Comparison value reading • Status reading Comparison value = current value (latch) Comparison value < current value (level) Overflow flag (latch) Underflow flag (level) • Countable or uncountable when the CPU is stopped

10.3.2 Interrupt input module

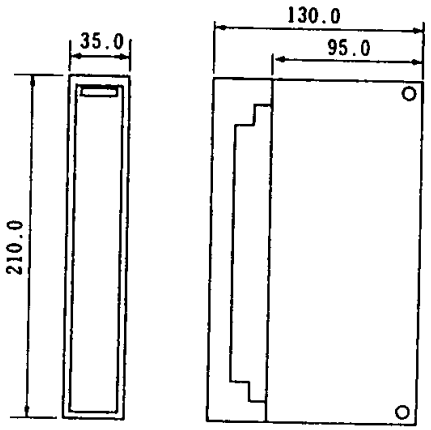
Parts Name



Type and Name

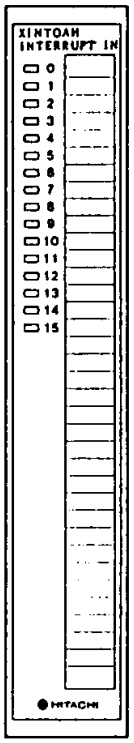
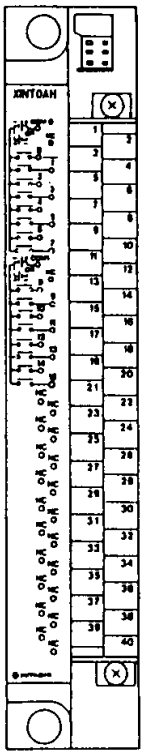
Type	Name
XINT0AH	Interrupt input module

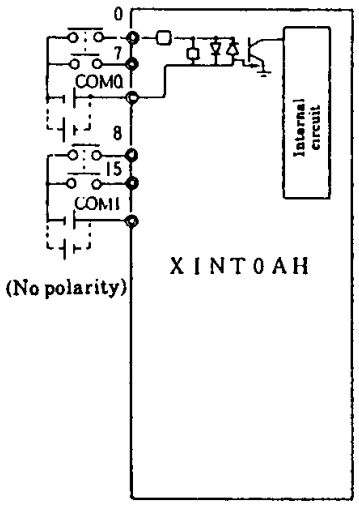
Dimensions (mm)



Parts Name and Functions

No.	Name	Function
①	Output display LED	Lights during input on.
②	Module cover	Module cover having the LED display function
③	Module setscrew	Fixes the module to the basic or expansion base.
④	LED board connector	Cable connector for LED board connection at the terminal block cover
⑤	Terminal screw	Crimp terminal setscrew (M3 x 6l)
⑥	Terminal block setscrew	Fixes the terminal block to the module.

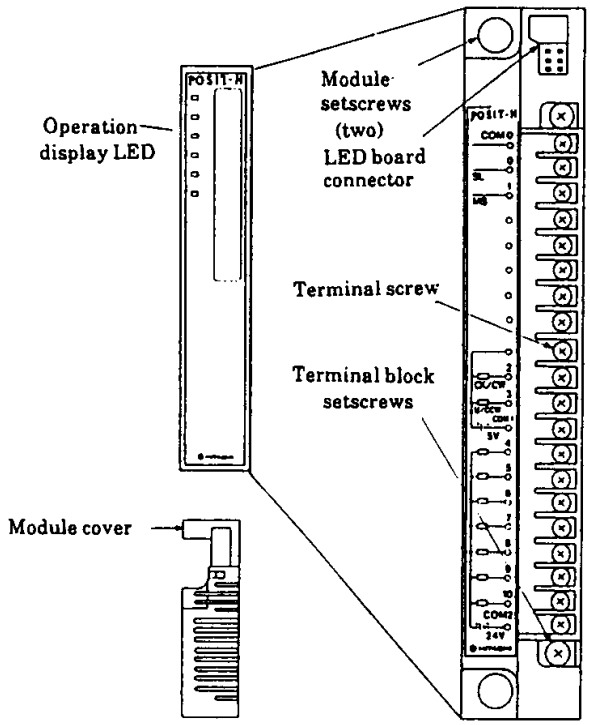
Item \ Type			External view	Terminal assignment
Module name		Interrupt input module		
Input voltage		10 to 30 VDC		
Input impedance		2.2K ohms		
Input current		5mA (12 VDC) or 10 mA (24 VDC)		
Operating voltage	Min. ON	9 VDC		
	Max. OFF	3.6 VDC		
Input delay	ON → OFF	1 msec.		
	OFF → ON	1 msec.		
No. of input points		16 points/module (8 points/common)		
Polarity		None		
Insulation		Photocoupler		
Current consumption		0.12 A (5 VDC)		
Weight		Approx. 370 g		



Terminal No.	Signal name	Terminal No.	Signal name
1	COM0	21	NC
2	NC	22	NC
3	X00	23	NC
4	X01	24	NC
5	X02	25	NC
6	X03	26	NC
7	X04	27	NC
8	X05	28	NC
9	X06	29	NC
10	X07	30	NC
11	COM1	31	NC
12	NC	32	NC
13	X08	33	NC
14	X09	34	NC
15	X10	35	NC
16	X11	36	NC
17	X12	37	NC
18	X13	38	NC
19	X14	39	NC
20	X15	40	NC

10.3.3 Positioning module

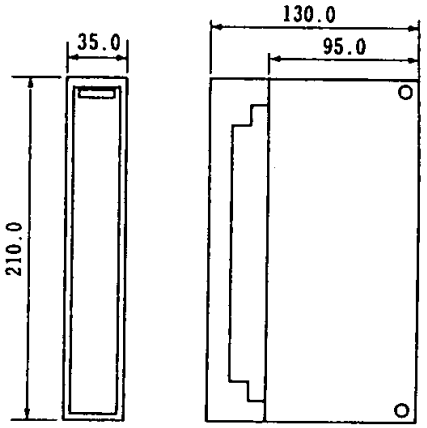
Parts Name

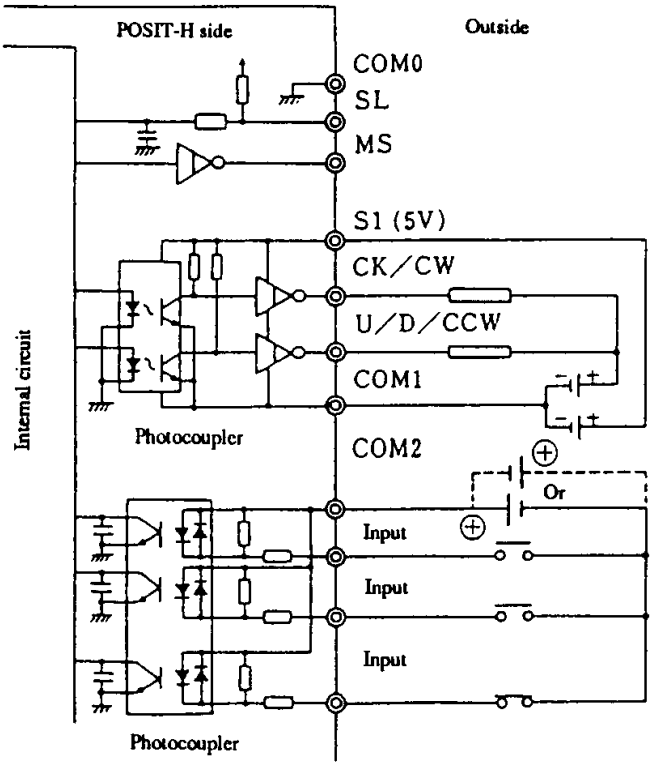


Type and Name

Type	Name
POSIT－H	Positioning module

Dimensions (mm)





Pin No.	Signal name
1	COM 0
2	SL Signal input
3	MS Signal input
4	NC
5	NC
6	NC
7	NC
8	NC
9	SI
10	CK or CW output
11	UP, DOWN, or CCW output
12	COM 1
13	COM 2
14	Deviation 0 input
15	Z phase input
16	Home position LS input
17	– OVER RUN input
18	+ OVER RUN input
19	CW manual input
20	CCW manual input

[2] Specification of the 1-axis pulse positioning module

Item			Specification
	MS SL synchronizing signal		TTL level (Non-isolated)
Output	CK/CW pulse output		Open collector output (max. 30 V, 70 mA) Photocoupler insulation (Withstand voltage: 1 minute at 250 VAC)
	U/D/C CW		The pulse output method can be changed by the DIP switch of the module.
	Maximum leakage current		100 μA max.
	Maximum voltage drop when power is turned ON		0.8 V (at an output current of 70 mA)
Input	Input voltage		10.8 to 30 VDC
	Input impedance		2.2 kΩ
	Input current		5 mA (12 VDC), 10 mA (24 VDC)
	Operating voltage	Minimum voltage when power is turned ON	9 V min.
		Maximum voltage when power is turned OFF	3.6 V max.
	Input delay	ON → OFF	1 ms max.
		OFF → ON	1 ms max.
	Polarity		None
	Insulation method		Photocoupler withstand voltage: 1 minute at 250 VAC
General	Internal supply current		0.1 A (5 VDC)
	External supply current		5 VDC ± 5% 0.1A (for pulse train output driver)
	Weight		Approx. 500 g
	No. of I/O occupied points		128 points
	Mounting restrictions		Remote local station unmountable
Basic function	No. of control axes		1 axis
	Maximum command value		±7,999,999 or 0 to 9,999,999 pulses
	Output frequency		25.0 to 100k pulses/s
	Acceleration and deceleration rate (slope)		1,250 to 20,480k pulses/s^2
	Position setting		Absolute or increment
	Output method		Pulse train and clock plus direction signal (photocoupler insulation)
Auxiliary function	Synchronous running		A synchronizing signal between the master axis and slave axis is used.
	Backlash correction		0 to 999 pulses
	Start speed		25.0 to 100k pulses/s
	Upper and lower limit setting		±7,999,999 or 0 to 9,999,999 pulses
Mode	Automatic mode		A series of position data from the PC is used for positioning.
	Manual mode		An external clockwise or counterclockwise signal is used for positioning and the position data is outputted.
	Return to origin mode		Optional return to origin
			Low-speed return to origin
			High-speed OFF engine return to origin
			High-speed 2 return to origin
			High-speed 1 return to origin

※1: The external supply current is a current flowing into the S1 terminal.

(b) 2-axis pulse positioning module

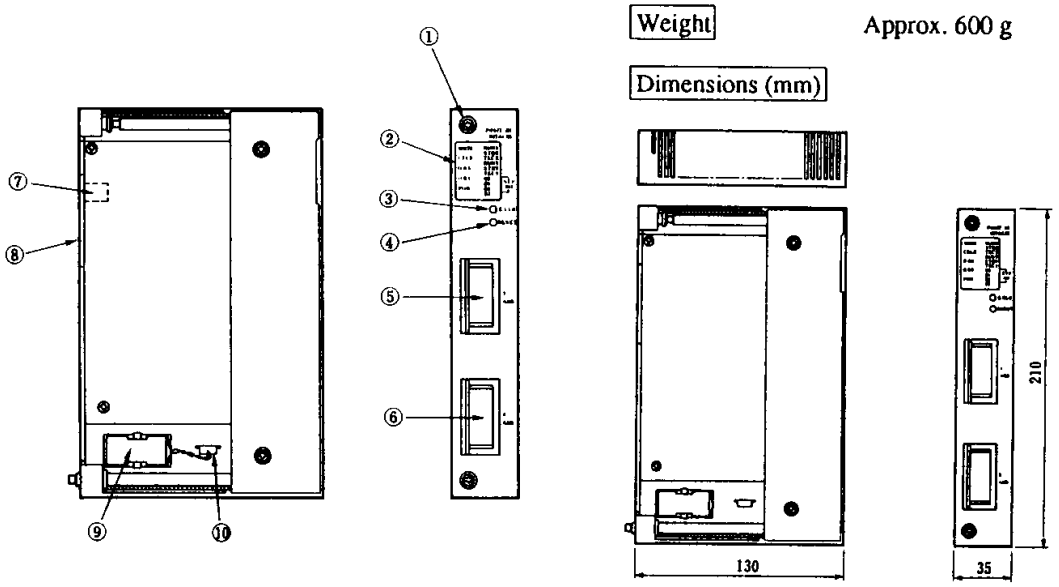
[1] Structure of the 2-axis pulse positioning module

Parts Name

Type POSIT-2H

Weight Approx. 600 g

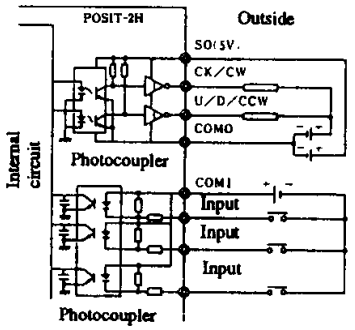
Dimensions (mm)



No.	Name	Function
①	Module fixing screw	Screws for fixing the module to the base (2 locations)
②	Status indication LED	The LED indicates the running status of the module.
③	Error clear switch	The switch clears a data error, command error, or communication error.
④	Reset switch	The switch resets the module on a hardware basis. (The backup content is retained.)
⑤	Y-axis I/O connector	This is a 16-pin connector (female) for inputting or outputting a control signal in each axis.
⑥	X-axis I/O connector	
⑦	Output setting DIP switch	The switch sets the pulse train output method.
⑧	Module mounting connector	This is a 50-pin connector for connecting the base and module.
⑨	Lithium battery	This is a battery to back up the common parameters and running data.
⑩	Battery connector	The connector is used to connect the lithium battery ⑨.

[2] Specification of the 2-axis pulse positioning module

Items				Specifications
General	Internal supply current			0.35 A (5 VDC)
	External supply current			5 VDC ± 5% 0.1 A (for pulse train output driver) ※1
	Weight			Approx. 600 g
	Mounting restrictions			Remote local station unmountable
Function	No. of occupied points / No. of slots			128 points / 1 slot
	No. of control axes			2 axes (Concurrent 2 axes, independent 2 axes)
	No. of interpolation axes			Linear interpolation function (concurrent 2 axes)
	Positioning data	Capacity		256 data in each axis
		Setting method		Sequence program
	Positioning	Method		Absolute method Absolute + increment method Increment method } Selectable in each axis
		Position command		±7999999 pulses
		Speed command		6.25 to 25k pulses/s 12.5 to 50k pulses/s 25 to 100k pulses/s 50 to 200k pulses/s } Selectable by the common paramcter
		Acceleration and deceleration		Trapezoidal acceleration and deceleration (Acceleration and deceleration can be set independently in the automatic mode.)
		Acceleration and deceleration rate		19.53 to 320k pulses/s^2 39.06 to 640k pulses/s^2 78.13 to 1280k pulses/s^2 156.3 to 2560k pulses/s^2 } Selectable by the common parameter
		Acceleration		Same as Speed command
		Backlash correction		0 to 255 pulses
		Upper and lower limits setting		±7,999,999 pulses
		Pulse output method		Pulse train and clock plus direction signal (photocoupler insulation) Selectable by the DIP switch
I/O interface	Reference point return function			Optional reference point return, low-speed reference point return, high-speed reference point return 1, high-speed reference point return 2
	Manual (JOG) running			A pulse is outputted by a manual input signal.
	Memory backup			Backup by a lithium battery (Battery replacement: 15 minutes)
	Mode at CPU stop			The module can be run. (Data should be stored in the memory of the module.)
	Output	CK/CW pulse output U/D/CCW		Open collector output (max. 30 V, 30 mA) Photocoupler insulation (Withstand voltage: 1 minute at 250 VAC)
		CK: Clock U/D: Direction signal		The pulse output method can be changed by the DIP switch of the module.
		Maximum leakage current		100 μA max.
		Maximum voltage drop when power is turned ON		0.8 V (at an output current of 30 mA)
	Input	Input voltage		10.8 to 30 VDC
		Input impedance		2.2 kΩ
		Input current		5 mA (12 VDC), 10 mA (24 VDC)
		Operating voltage	Voltage when power is turned ON	9 V min.
			Voltage when power is turned OFF	3.6 V max.
		Input delay	ON → OFF	1 ms max.
			OFF → ON	1 ms max.
		Polarity		+ component in the module
		Insulation method		Photocoupler (Withstand voltage: 1 minute at 250 VAC)

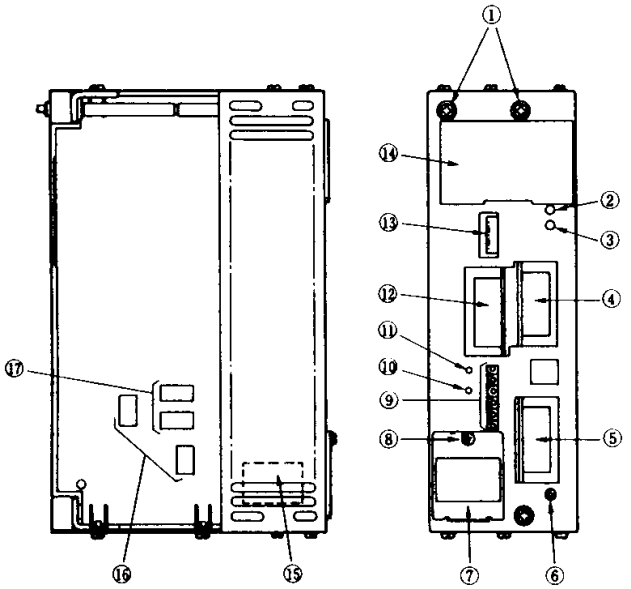


※1: The external supply current is a current flowing into the S0 terminal.

(c) 2-axis analog positioning module

[1] Structure of the 2-axis analog positioning module

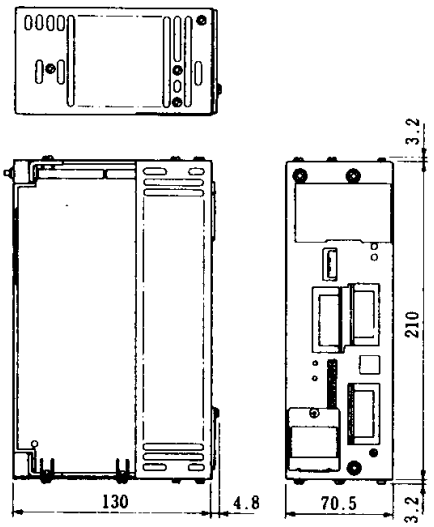
Parts Name



Type POSITA2H

Weight Approx. 1.2 kg

Dimensions (mm)



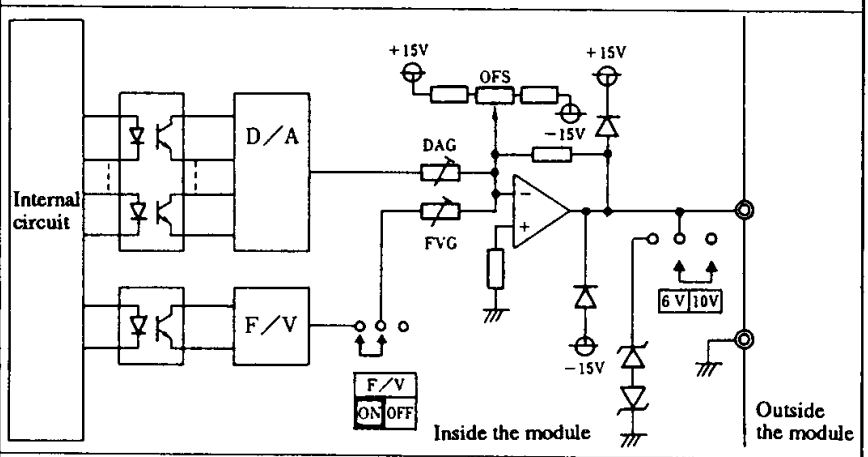
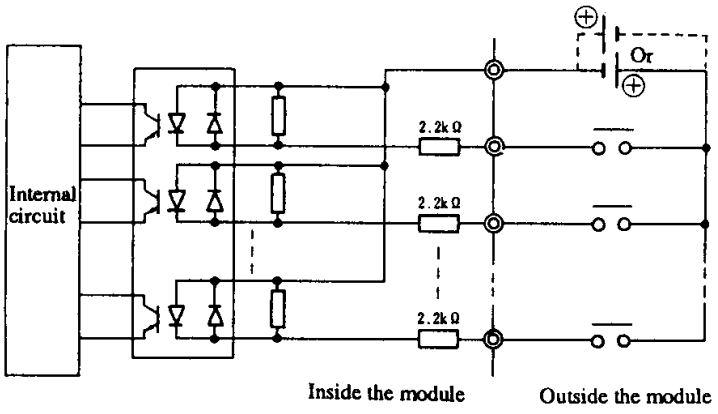
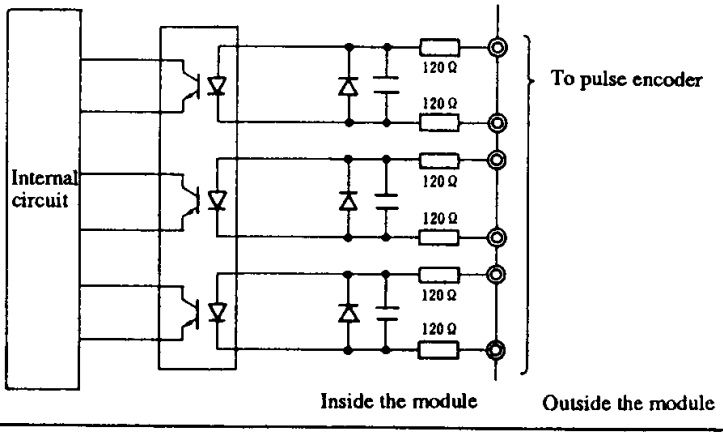
No.	Name	Function
①	Module fixing screw	Screws for fixing the module to the base (3 locations)
②	Error clear switch	The switch clears a data error, command error, or communication error.
③	Reset switch	The switch resets the module on a hardware basis. (The backup content is retained.)
④	Y-axis control input connector	This is a 16-pin connector (female) for inputting or outputting a control signal in each axis.
⑤	X-axis control input connector	
⑥	Grounding screw	Class 3 grounding may be required.
⑦	Battery cover	The battery cover is attached to the battery. When replacing the battery, remove it.
⑧	Battery cover fixing screw	The screws are used to fix the battery cover.
⑨	Adjustment knob	The adjustment knob is used to adjust the gain or offset of the analog output unit.
⑩	5 V LED	The LED is on when 5 V for the encoder is outputted.
⑪	24 V LED	The LED is on when an external voltage of 24 V is outputted.
⑫	I/O connector for X and Y axes	20-pin connector for analog voltage output, feedback pulse, 24 V supply, and 5 V output
⑬	Feedback pulse magnification setting	The magnification of a feedback pulse from the encoder is set.
⑭	Status indication LED	The LED indicates the running status of the module.
⑮	Lithium battery	This is a battery to back up the common parameters and running data.
⑯	Voltage limit setting pin	The pin is used to set the limiting value of output voltage.
⑰	F/V function setting pin	The pin is used to turn the F/V function ON or OFF.

[2] Specification of the 2-axis analog positioning module

Items				Specifications	
General	Internal supply current			0.55 A (5 VDC)	
	External supply current			24 VDC + 10 to -15%, 0.35 A (for pulse train output driver) ※1	
	Weight			Approx. 1.2 kg	
	Mounting restrictions			Remote local station unmountable	
Function	Output method			The deviation between the command pulse set by the program and the feedback pulse is converted to an analog voltage and outputted.	
	No. of occupied points / No. of slots			128 points / 1 slot	
	No. of control axes			2 axes (Concurrent 2 axes, independent 2 axes)	
	No. of interpolation axes			Linear interpolation function (concurrent 2 axes)	
	Positioning data	Capacity		256 data in each axis	
		Setting method		Sequence program	
	Positioning	Method		Absolute method, increment method, absolute + increment method, selectable in each axis	
		Position command		±7,999,999 pulses	
		Speed command		6.25 to 25k pulses/s, 12.5 to 50k pulses/s, 25 to 100k pulses/s, 50 to 200k pulses/s	
		Acceleration and deceleration		Trapezoidal acceleration and deceleration (Acceleration and deceleration can be set independently in the automatic mode.)	
		Acceleration and deceleration rate		19.53 to 320k pulses/s^2, 39.06 to 640k pulses/s^2, 78.13 to 1280k pulses/s^2, 156.3 to 2560k pulses/s^2	
		Backlash correction		0 to 255 pulses	
		Upper and lower limits setting		±7,999,999 pulses	
		Pulse output method		Analog voltage output (max. ±10 V), with output voltage limit function	
I/O interface	Reference point return function			Optional reference point return, low-speed reference point return, high-speed reference point return 1, high-speed reference point return 2	
	Manual (JOG) running			A voltage is outputted by a manual input signal.	
	Memory backup			The set data is backed up by a lithium battery. (Battery replacement: 10 minutes)	
	Mode at CPU stop			The module can be run. (Data should be stored in the memory of the module.)	
	Output	Analog voltage output		±10 V (A voltage between ±3 V and ±10 V can be set by adjustment.)	Analog output circuit
		External load resistance		2 kΩ min.	
		Total accuracy		±1% (full scale value)	
		5 V for encoder		Analog output circuit	
	Input	Input voltage		10.8 to 30 VDC	Control input circuit
		Input impedance		2.2 kΩ	
		Input current		5 mA (12 VDC), 10 mA (24 VDC)	
		Operating voltage	Voltage when power is turned ON	9 V min.	
			Voltage when power is turned OFF	3.6 V max.	
		Input delay	ON → OFF	1 ms max.	
			OFF → ON	1 ms max.	
		Polarity		None	
		Insulation method		Photocoupler (Withstand voltage: 1 minute at 250 VAC)	
	Feedback pulse input	Input voltage		5 VDC ± 5%	Feedback pulse input circuit
		Input impedance		240 Ω	
		Input current		14 mA	
		Operating voltage	Minimum voltage when power is turned ON	4.5 V	
			Maximum voltage when power is turned OFF	1.0 V max.	
		Maximum operating frequency		100 kHz	
		Insulation method		Photocoupler (Withstand voltage: 1 minute at 250 VAC)	

※1: The external supply current is a current which is supplied between the input P 24-V terminal and GND terminal.

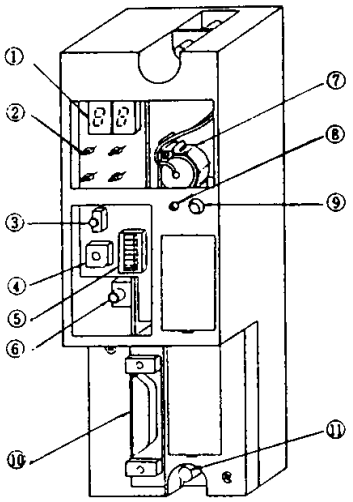
[3] I/O interface specification

	I/O circuit
Analog output circuit (I/O connector for X and Y axes)	
Control input circuit (I/O connector for X and Y axes)	
Feedback pulse input circuit (I/O connector for X and Y axes)	

10.3.4 ASCII module

(a) Construction of ASCII module

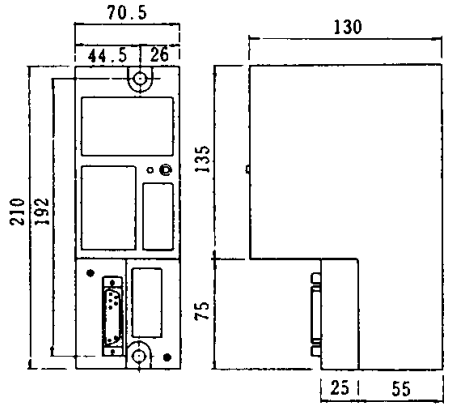
Parts Name



Type ASCII-1H
ASCII-2H

Weight Approx. 800 g

Dimensions (mm)



No.	Name		Function
①	7-segment display		Normal status: Displays the operating status of each mode. Abnormal status: Displays error information
②	Indicators (Light-emitting display)	SEND (SEND)	Lights when send data is on the line.
		REC (RECEIVE)	Lights when receive data is on the line.
		ERR (ERROR)	Lights when an error occurs and its information is displayed on the 7-segment display.
		BAT.E (BATTERY ERROR)	
③	MODE CHG/START/STOP (for change of modes and start/stop of the cassette magnetic tape unit)		This switch changes the operating mode, starts and stops the cassette magnetic tape unit.
④	MODE (for setting of the operating mode)		This switch sets the operating mode.
⑤	PARAM (for setting communication parameters)		The interface type, transmission speed, transmission code and other requirements are set. Notice that the settings are entered only when power is applied or when the RESET switch is turned on.
⑥	CMT jack (to be connected to the cassette magnetic tape unit)		The ASCII module is connected to the audio cassette tape recorder through this port (for transfer of text data between them). The transfer rate between the ASCII module and the CMT is 2400 bps.
⑦	Battery		Lithium battery (LIBAT-H) Battery to back up the user RAM If the BAT.E indicator lights, be sure to replace the battery by a new battery within one week. It is recommendable to replace batteries periodically (every two years) before the BAT.E indicator lights.
⑧	RES (Reset) switch		This switch is used to hard-reset the ASCII module. (Press this switch to forcibly stop the operation in any operating mode.)
⑨	ERR.CLR. (Error clear switch)		When pressed, this switch clears the content of the 7-segment display if the error cause is already removed. (If the error cause is not removed yet, the error code on the 7-segment display is displayed back again.)
⑩	RS-232C/RS-422/RS-423 (interface connector to be connected to a terminal)		This connector connects the ASCII module to a terminal.
⑪	Module fixing screw		This screw fixes the ASCII module to a basic base.

(b) Basic specifications of ASCII module

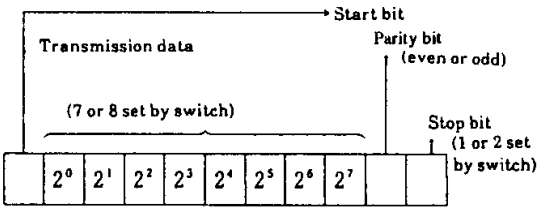
[1] ASCII-1H

Item		Specification
General specification	Operating temperature	0 to 55°C
	Storage temperature	-10 to 75°C
	Operating relative humidity	20 to 90% RH (Non-condensing)
	Storage relative humidity	10 to 90% RH (Non-condensing)
	Current consumption	5 VDC Approx. 1.0 A
	Dimensions	70.5(W) x 210(H) x 130(D) (mm)
	Weight	Approx. 800 g
Functional specification	Module location	Basic or expansion base unit (except the expansion base unit of the remote system)
	Storage capacity of user memory	24k bytes (backed up by battery)
	Port (connected to terminal)	• One port (insulated by photo-coupler) • RS-423, RS-232C, or RS-422
	Edition of text data Possible to edit by connecting CRT or GPC. (Floppy disk is also needed.)	• Formatting of text data • Insertion/addition of data to text data and deletion of data from text data • Scrolling up/down
	Reading and writing of text data	• Transfer of text data between the CPU module and the user memory of the ASCII module by the sequence program (Reading and writing) • Transfer of text data between the ASCII module and the terminal (Input and output)
	Code conversion	• BCD ↔ ASCII • BINARY ↔ BCD ↔ ASCII • BINARY ↔ ASCII
	Audio CMT I/F (Audio cassette tape recorder interface)	Interface with the audio cassette tape recorder Transfer rate: 2400 bps
	Self diagnosis	• Watch dog timer • Sum check of system ROM • System RAM check (once at power-on) • Battery check (for battery-down and battery installation)
	Floppy disk (Only when GPC is connected.)	Saving, loading and verifying the edited data to floppy disk.

[2] ASCII-2H

Item		Specification
General specification	Operating temperature	0 to 55°C
	Storage temperature	-10 to 75°C
	Operating relative humidity	20 to 90% RH (Non-condensing)
	Storage relative humidity	10 to 90% RH (Non-condensing)
	Current consumption	5 VDC Approx. 1.0 A
	Dimensions	70.5(W) x 210(H) x 130(D) (mm)
	Weight	Approx. 800 g
Functional specification	Module location	Basic or expansion base unit (except the expansion base unit of the remote system)
	Capacity of receive data buffer	20480 bytes (256 blocks) (backed up by battery)
	Port (connected to bar-code reader)	• One port (insulated by photo-coupler) • RS-423, RS-232C, or RS-422
	Writing of data from bar-code reader	• Store the bar-code data read by the bar-code reader in the buffer of the ASCII module. • The stored bar-code data is read as a program.
	Self diagnosis	• Watch dog timer • Sum check of system ROM • System RAM check (once at power-on) • Battery check (for battery-down and battery installation)

[3] Port specifications of ASCII module

Item			Specification
Port specification	Interface		• One port • RS-423, RS-232C, RS-422
	Transfer rate		300, 600, 1200, 2400, 4800, 9600, bps (Switch-selectable)
	Transmission mode		Half-duplex
	Synchronization		Start-stop
	Data transmission		Bit-serial transmission
	Transmission code		JIS7 or JIS8 code (switch-selectable)
	Code configuration		
	Code transmission sequence		From the LSB (2^0) to MSB (2^0) each character
	Error check and correction		Vertical parity check (odd or even parity, switch-selectable) Overrun check Freming check
	Cable length	RS-423 (RS-232C)	Up to 15 m
		RS-422	Up to 250 m
	Cables and connectors		• Connector on the ASCII module 25-pin connector GM-25FD (manufactured by Honda Communication) • Connector on the cable DBM-25P-ZN (manufactured by Japan Aviation Electronics, Ltd.) DB-C2-J9 • Cable 12-twisted-pair shielded cable

10.3.5 Real time clock module

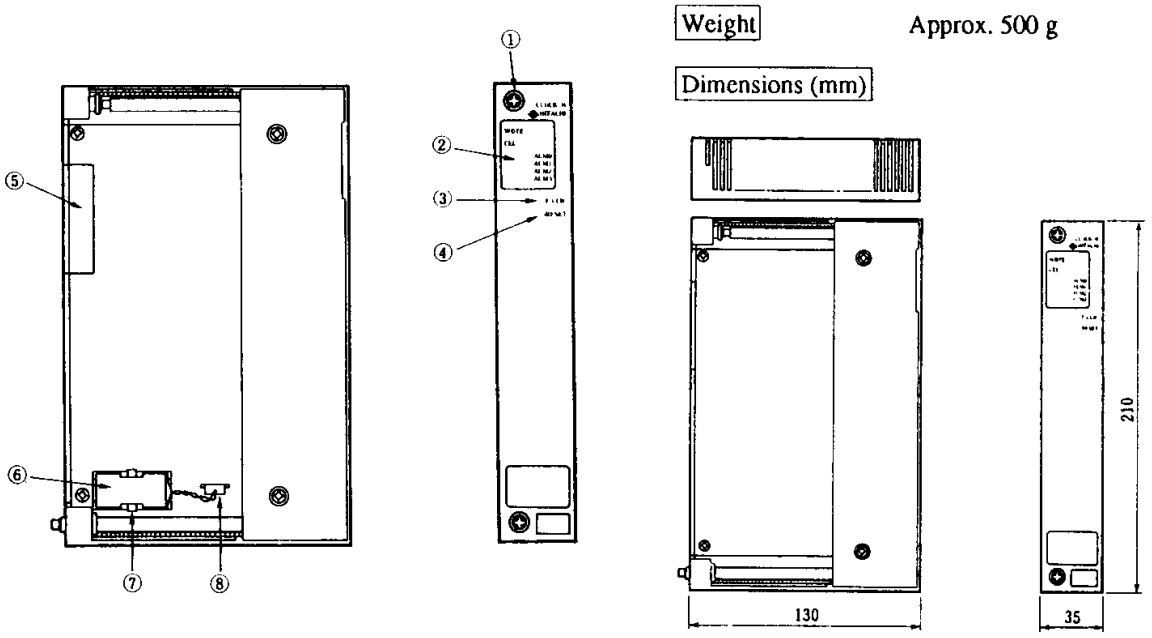
(a) Construction of real time clock module

Parts Name

Type CLOCK-H

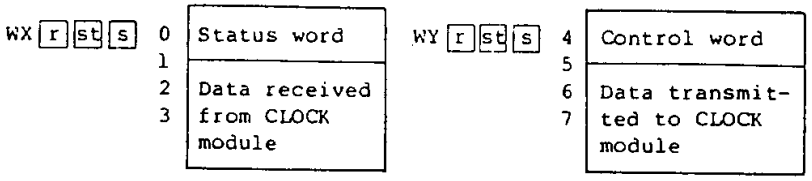
Weight Approx. 500 g

Dimensions (mm)



No.	Name	Function
①	Module setscrew	This is a screw for fixing the module to the base. (At two locations)
②	Status indicator LED	WDTE: This lamp turns on when an error occurs in the module. CELE: This lamp turns on when the voltage of the lithium battery is dropped. ALM0 to ALM3: These lamps turn on in correspondence with Timer 0 to Timer 3.
③	Error clear switch	This switch clears warning or a medium failure flag.
④	Reset switch	This is a hard reset switch, which clears a watch dog error or a critical failure flag. No backup data is cleared.
⑤	Module mounting connector	This is a 50-pin connector for connecting the base to the module.
⑥	Lithium battery	This is a backup battery for the module.
⑦	Battery holder	This holder fixes the lithim battery to the module.
⑧	Battery connector	This connector connects the lithium battery to the module. Check the polarity.

(b) Specifications of real time clock module

Item	Function specification	
Interface with CPU module	Word (4 words for both input and output) I/O interface, 128 points occupied, assignment: 4/4W (GPCL), WXY4/4 (PGM-CIIH, GPII) Note  Note: r: Remote master station number, st: Remote local station number or expansion unit number s: Slot number	
Display of clock data	By BCD code	
Calendar function	Year (lower two digits of Gregorian calendar yera, 00 to 99), month (1 to 12), day (1 to 31), week day (0: Sunday, 1: Monday, · · ·, 6: Saturday) with a leap year correction function	
Clock function	Hour (0 to 11 or 0 to 23), minute (0 to 59), second (0 to 59), clock switchable to 12 or 24 system with a 30 sec. correction function	
Timer function	Four types of programmable timers can be set at up to 7 points as bit input (alarm 0 to 6). Validity or invalidity can be set for each timer.	
	1. Identity timer	When set value matches the clock value, the alarm is turned on.
	2. Interval timer	The alarm is turned on at every set time interval.
	3. Subtraction timer	When the elapse value is zero by subtracting the clock value from the set value, the alarm is turned on.
	4. Integration timer	When the elapse value = the set value by integrating from 0, the alarm is turned on.
Clock accuracy	From -120 to +30 sec. per month at 0 to 55°C during power on	
Battery backup	The lithium battery backs up the calendar, clock, timer set and elapse values, validity or invalidity of the timer, or alarm status.	

10.3.6 Serial I/O module

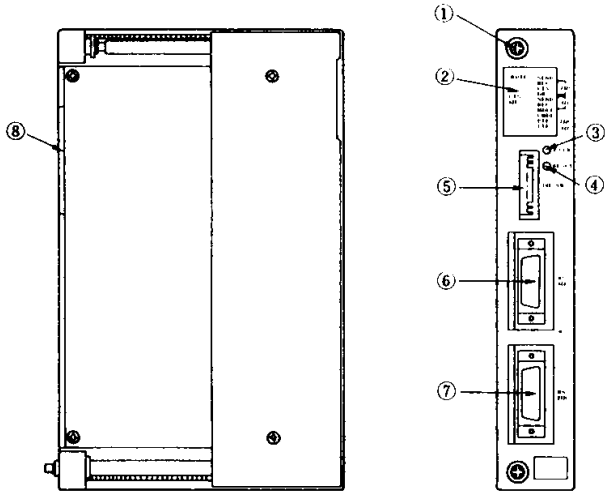
(a) Construction of serial I/O module

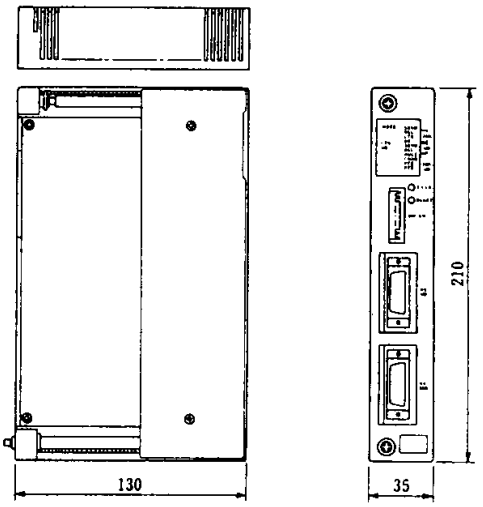
Parts Name

Type SIO-H

Weight Approx. 600 g

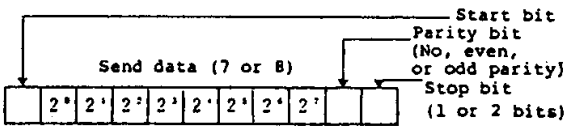
Dimensions (mm)





No.	Name	Function
①	Set screw	Fixes the SIO-II to the PCs frame (2 screws)
②	Status indicators	Displays the status of port signals and error status of the SIO-II. (12 indicators)
③	Error clear switch	Turns off the error indicators and starts a loopback test.
④	Hardware reset switch	Physically resets the SIO-H. (Never press this button while the system is in operation.)
⑤	DIP switch (for port setting)	Set the communication conditions of respective units. (10 switch bits)
⑥	RS-422 port connector	Connects the RS-432 interface cable.
⑦	RS-232C port connector	Connects the RS-232C interface cable.
⑧	Module mounting connector	50-pin connector which connects the module to the base

(b) Construction of serial I/O module

Item				Specification
General	Operating temperature			0 to 55°C
	Storage temperature			-10 to 75°C
	Operating humidity			20 to 90% RH (No condensation)
	Storage humidity			10 to 90% RH (No condensation)
	Communication port insulation			By the photocoupler and DC-DC converter (The ports are not isolated from each other.)
	Withstand voltage			1 minute at 250 VAC
	No. of occupied I/O points			128 points (GPCL-01H setting = 4/4 words. PGM-CHH, PGM-GPH setting = WXY 4/4)
	Power dissipation			1 A (5 VDC)
	Dimensions			35 W x 210 H x 130 D (mm)
	Weight			Approx. 600 g
Function	Installation			Base of basic unit, expansion nit, or remote substation
	Maximum number of SIO-H modules installed			Up to the maximum number of I/O points
	Number of occupied I/O points			128 points (4/4W for GPCL-01H and WXY4/4 for PGM-CHH and PGM-GPH)
	Error detection			Watch-dog-timer, check of undefined instructions, sum check, check of invalid data, and loopback check (in Loopback Check mode)
	Trans-mission	Interface		RS-232C port and RS-422 port (Total of 2 ports)
		Signalling speed		Any of 300, 600, 1200, 2400, 4800, 9600, and 19200 bps (Only one port is available for signalling speed of 19200 bps.)
		Transmission		Bit-serial transmission (from the lowest bit to higher bits)
		Synchronization		Start-stop synchronization
		Chracter configuration		
		Input buffer		1024 bytes per port
		Output buffer		515 bytes per port
		Error control		Overrun Error, Framing Error, Parity Error, Input Buffer Full, Message Error, Timeout Error
		RS-232C port	Connection type	1 : 1
			Connector (on SIO-H)	15-pin D subconnector, (RDAD-15SE-LN (made by HIROSE) or equivalent)
			Cable	Cable: Twisted-pairs, collectively-shielded (15 m max.) Connector: HDAB-15P (made by HIROSE) or equivalent Casing: HDA-CTF (made by HIROSE) or equivalent
		RS-422 port	Connection type	1 : N (N = 1 to 32)
			Connector (on SIO-H)	15-pin D subconnector, (RDAD-15SE-LN (made by HIROSE) or equivalent)
			Cable	Cable: Twisted-pairs, collectively-shielded (500 m max.) Connector: HDAB-15P (made by HIROSE) or equivalent Casing: HDA-CTF (made by HIROSE) or equivalent

Chapter 11 Peripheral Equipment

11.1 Outline

(a) Peripheral equipment type

There are three types of peripheral devices of the H-series programmable controller (PC) available as shown below.

Table 11.1 Peripheral Device List

	Peripheral device name	Type	Specification
①	Graphic programming console (GPCL)	GPCL01H	With power failure security program memory
②	(a) Portable graphic programmer	PGM-GPH	Programming by Ladder/ Command
	(b) Optional interface for portable graphic programmer	PGMIF1H	Tool for storing the ROM data in the program and printing. Used together with PGM-GPH.
	(c) ROM pack for portable graphic programmer	PGMPK2H	On-line program change function extension specification
③	Command programmer	PGM-CHH	Programming dedicated to command

[1] Graphic programming console

This is a most sophisticated function device among the three types of peripheral devices.

For programming of the H-series PC, the following three types of languages can be used by changing the system software.

- Ladder (HI-LADDER), Command (HI-COMMAND)
- Flow language (HI-FLOW)
- BASIC language (HI-BASIC)

Ladder and Command are supplied by the same system. There are two types of Ladder and Command systems available, attached type HIDRL to the graphic programming console and optional type HL-GPCL (product name Ladder Editor).

Double coil check software, ROM write software, and utility software (optional) such as data memory editing are also available.

[2] Portable graphic programmer

Programming can be performed by Ladder (HI-LADDER)/Command (HI-COMMAND).

A combination of (a) and (b) is used to store the ROM data of the program or print.

A combination of (a) and (c) is used to extend the on-line program change function (circuit change, etc.).

[3] Command programmer

This is a programming device dedicated to the command (HI-COMMAND). The programmer may be connected to the PC directly or with a special cable. (Refer to Section 1.4.(4) of the hardware edition.)

(b) Function comparison

Table 11.2 Function Comparison of the Peripheral Equipment

Peripheral device name	Function	CPU module programming: Ladder	CPU module programming: Command	CPU module programming: Flow language	Offline programming	Serial	Kanji	Color CRT connection	Program recording: 3.5' floppy disk	Program recording: Audio cassette	Program recording: ROM writer	Power failure security memory	Programming auxiliary function: Simulation	Programming auxiliary function: On-line change	Programming auxiliary function: Force	Programming auxiliary function: Debug	Programming auxiliary function: Monitor
Graphic programming console	GPCL01H	O	O	O	O	O	O	O	O	O	O※2	O	O	O	O	O	O
Portable graphic programmer	PGM-GPH	O	O	x	x	※1 O	x	x	x	O	※1 O	x	O	O	O	x	O
Command programmer	PGMCHH	x	O	x	x	x	x	x	x	O	x	x	O	O	O	x	O

※1: An optional interface (PGMIF1H) is necessary.
※2: ROM writer software (HIROMW-G) and an ROM writer (PECKER 10 or 11) are necessary.

(c) Connection location of the peripheral equipment

Locations which the peripheral equipment can be connected to are ① to ⑨ shown in the drawing below.

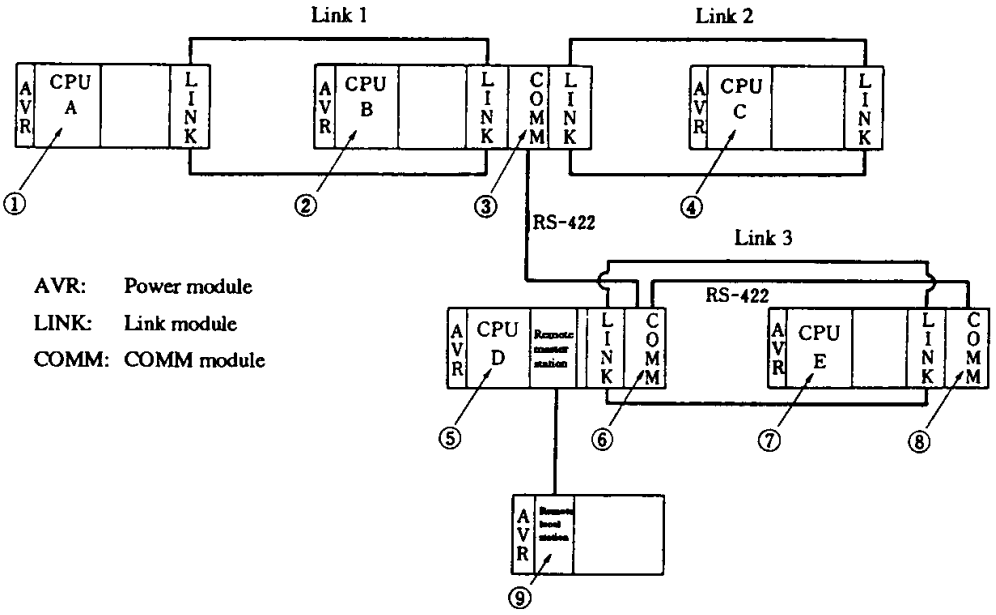


Table 11.3 Connection Location of Peripheral Equipment and Range of Programming Applicable CPU

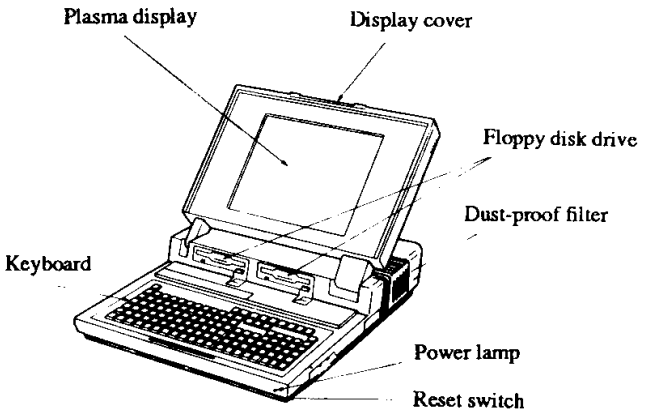
Connection location	Applicable CPU	Programming applied to: CPU A	CPU B	CPU C	CPU D	CPU E	Remarks
Connected directly to CPU	①	O	O	x	x	x	Valid to CPU of Link 1
	②	O	O	O	x	x	Valid to CPUs of Link 1 and Link 2
	④	x	O	O	x	x	Valid to CPU of Link 2
	⑤	x	x	x	O	O	Valid to CPU of Link 3
	⑦	x	x	x	O	O	Valid to CPU of Link 3
Connected to COMM module	③	x	O	x	x	x	Valid to CPU on the same base
	⑥	x	x	x	O	x	Valid to CPU on the same base
	⑧	x	x	x	x	O	Valid to CPU on the same base
Connected to remote local station	⑨	x	x	x	O	O	Same as a case that the peripheral equipment is connected to a CPU having a remote master station

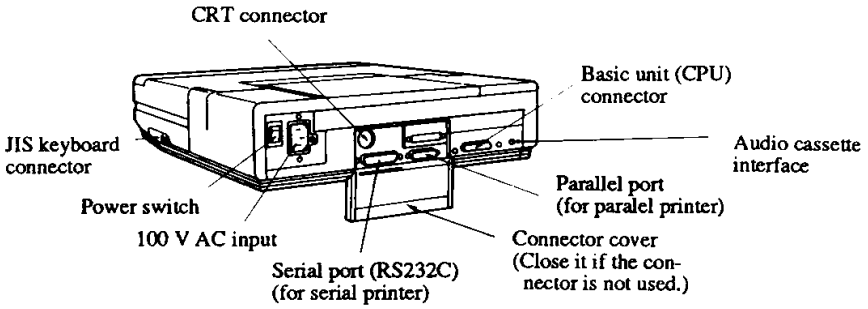
11.2 Standard and Specification of Peripheral Equipment

(1) Graphic programming console (Domestic market only)

(a) Structure of the graphic input device

Parts Name

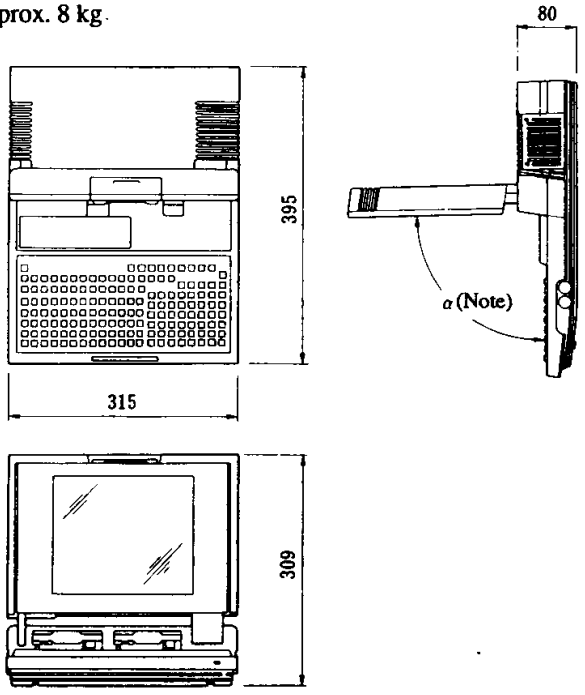




Type: GPCL01H

Weight: Approx. 8 kg.

Dimensions (mm)



(Note) The display opening angle α is 0 to 130 degrees.
(If the opening angle α becomes less than 30 degrees, the plasma display is turned off.)

(b) Specification of the graphic programming console

[1] General specifications

Power supply	90 to 110 V AC, 2 A, 50/60 Hz
Ambient temperature	5 to 35°C
Humidity	35 to 80% RH (without condensation)
Atmosphere	Free from corrosive gas and dust
Vibration resistance	As per JIS C 0911 16.7 Hz 0.9 mm (during operaton) 5 to 35 Hz 0.2 mm (during operation)
Withstand voltage	1500 V between AC external terminal and case for one minute
Noise	Noise voltage: 1000 Vp-p Noise width: 100 ns, 1 μs measured with noise simulator NEMA: As per ICS2-230-42 through -45 (excepting 42.01 and 02) Electrostatic noise: 3000 V at exposed metal portion
Insulation resistance	1 MΩ between AC external terminal and case (as measured with 500 VDC megger)
Grounding	Class 3
Dimensions	315 (W) x 80 (H) x 395 (D)
Weight	Approx. 8 kg

[2] Performance

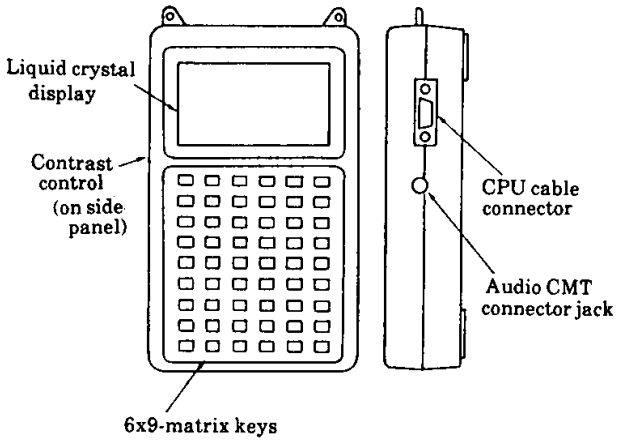
Connected to		H Series CPU, COMM module, and remte I/O local station
Connection method		Cable connection
Display	Type	Plasma display (*1)
	Screen size	202 x 154 mm (10-inch)
	Dot matrix	640 x 400 dots, 80 columns x 25 lines
Keyboard	No. of keys	158
	Stroke	1.1 mm
	Key-in check	Click feeling and beeping
Flpppy disk drive		Two 3.5-inch floppy disk drives
Interface		CPU I/F (interface with H Series CPU)
		CR I/F (interface with 12- or 14-inch CRT)
		Serial port I/F (interface with serial printer, Basic module, or ASCII module)
		Parallel port I/F (interface with parallel printer)
		Audio cassette I/F (interface with cassette deck)
		JIS key I/F (interface with standard JIS keyboard)
External memory		3.5-inch FDD (1.2 MB) x 2
		CMT audio cassette tape
Retentive prgram memory *2	Data stored	(1) Sequence program (2) Parameters Password, CPU type, operation parameter Memory assignment (Assignment of program only) I/O assignment, program name, range of retentive area (3) Port settings (CPU port address only)
	Preservation time	Approx. one hour

*1: If CRT is connected, or if the plasma display opening angle is less then 30 degrees, the plasma idsplay is turned off.

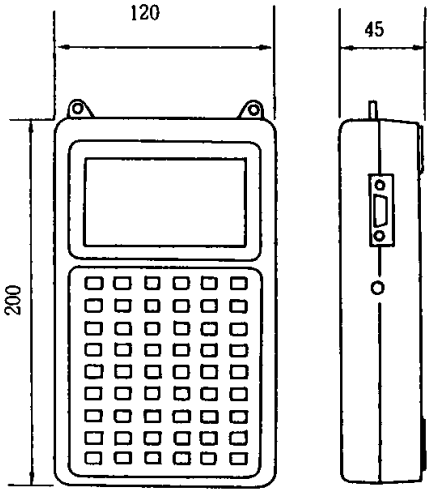
*2: The function of protection against power interruption is valid only when HI-LADDER/HI-COMMAND software is used.

(2) Portable graphic programmer (PGM-GPH)

Parts Name



Dimensions (mm)



Type	PGM – GPH
Weight	Approx. 700 g

Functions

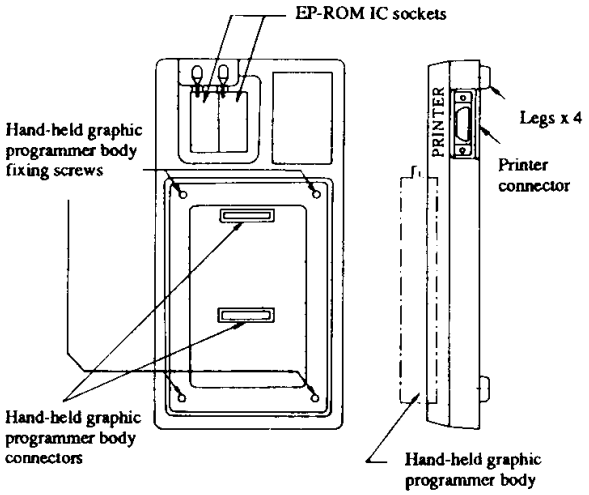
- Can input, edit, monitor, and syntactically check the ladder programs.
- The liquid crystal display has the EL back light for clear reading.
- All keys are clicked when pressed, and entries can be checked by the buzzer sound.
- The audio CMT interface is provided. (Standard) The printer interface and memory cassette interface are available as optional.

General Specifications

Item	Specifications		
Source voltage	5 VDC and ±12 VDC (fed from the CPU module)		
Operating temperature	0 to 45°C	Storage temperature	-10 to +60°C
Operating humidity	20 to 90% (RH) without condensation	Storage humidity	10 to 90% (RH) without condensation
Vibration resistance	Should meet the JIS C 0911 standards (16.7Hz, 3-mm multiple amplitude in X, Y and Z directions).		
Atmosphere	There should be no corrosive gases or excessive dusts.		
Structure	Portable electronic calculator type		
Cooling	Natural cooling		

(3) Optional interface for portable graphic programmer

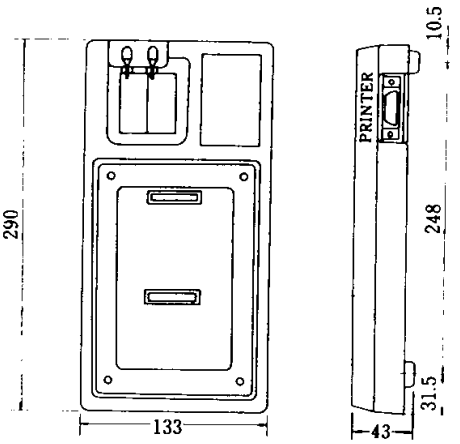
Parts Name



Type PGMIF1H

Weight Approx. 770 g

Dimensions (mm)



Function

- Printing programs (Ladder/command)
- Printing the cross reference
- Printing parameters
- Printing a timer and counter operation status list
- Printing internal output data
- Writing, checking, and reading the ROM
- PGMIF1H can be used only when PGM-GPH is connected to the CPU.

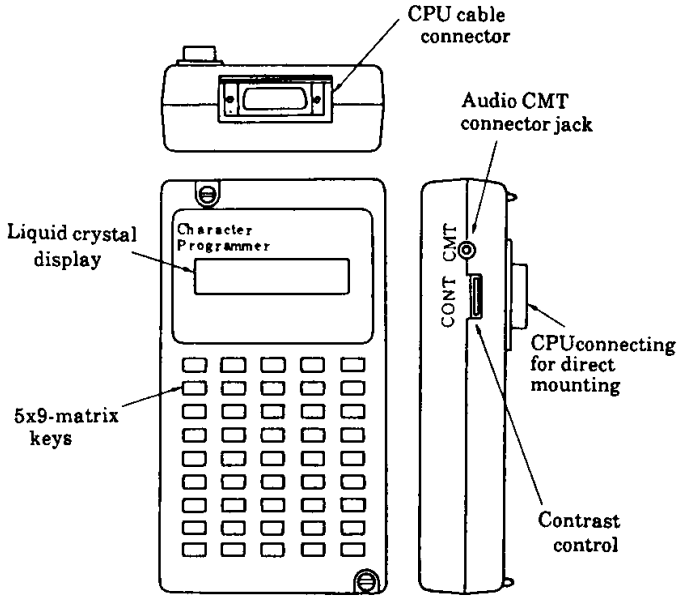
Interface specifications

Item		Specifications		
Printer interface	Applicable printers	Epson MP-80 (I, II, III), RP-80 (I, II), *EP-80T *Optional tractor unit (#8304V) required.		
	Connecting cable	Either the CBPGA optional cable or the CBPGB optional cable.		
	Interface board	Epson Cat. No. 8141 (MP-80I only) Cat. No. 8145 (other than MP-80I) *Cat. No. 8148 (other than MP-80I) *May be used only whe the optional cable CBPGB is used.		
	Baud rate	4800 bps		
	Transmission code	1 start bit, 8 data bits, 1 stop bit		
EP-ROM interface	Applicable ROM pack	MP-2S (for H-100M)		
	ROM cassette	ROM-16H (for H-300/700/2000)		
	Applicable EP-ROM	H-100M		HN27C256G-25 (Hitachi)
		H-300 H-700 H-2000	27256*	ROM IC-01H (for ROM cassette)
			27512*	MBM27C512-20 (Fujitsu)

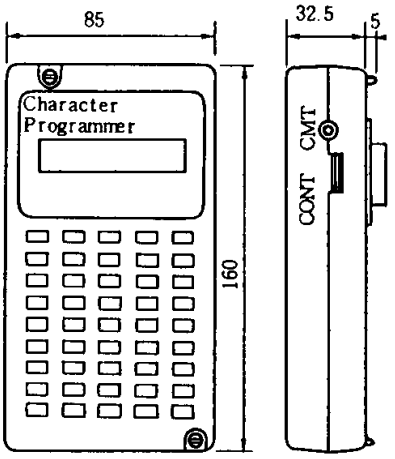
* (Caution) The 27512 is for program storage only. It cannot be used for ROM cassettes (ROM-16H). Only use products supplied by Hitachi for the 27256.

(4) Instruction language programmer (PGM-CHH)

Parts Name



Dimensions (mm)



Type	PGM – CHH
Weight	Approx. 400 g

Functions

- Can input, edit, monitor, and syntactically check the instruction language programs.
- The liquid crystal display has the EL back light for clear reading.
- All keys are clicked when pressed, and entries can be checked by the buzzer sound.
- The audio CM-T interface is provided. (Standard)

General Specifications

Item	Specifications		
Source voltage	5 VDC and ±12 VDC (fed from the CPU module)		
Operating temperature	0 to 45˚C	Storage temperature	-10 to +60˚C
Operating humidity	20 to 90% (RH) without condensation	Storage humidity	10 to 90% (RH) without condensation
Vibration resistance	Should meet the JIS C 0911 standards (16.7Hz, 3-mm multiple amplitude in X, Y and Z directions).		
Atmosphere	There should be no corrosive gases or excessive dusts.		
Structure	Portable electronic calculator type		
Cooling	Natural cooling		

Part III

Installation, Mounting, Wiring, and Preparation for Running

Chapter 12 How to Mount Programmable Controller

12.1 Installation

(1) Installation site and environment

Install the H-series in an environment which conforms to the general specification (see Section 1.1). Do not use the H-series in locations such as listed below.

a. Location where the ambient temperature is beyond the range from 0 to 55°C. (For the peripheral equipment, refer to the corresponding specification.)
b. Location where the relative humidity is beyond the range from 20 to 90% RH. (For the peripheral equipment, refer to the corresponding specification.)
c. Location where the temperature changes suddenly and dew is deposited
d. Location where corrosive gases, combustible gases, and coolant mist are generated
e. Location where dust, salt, and iron powder are generated
f. Location where vibration and shock are directly transmitted
g. Location where direct sunlight is exposed

(2) Installation of bases

(a) Precautions for installation of bases

[1] Install each base (basic and expansion bases) before mounting the module. Tighten the screws (M4, 12 mm or more in length) through the four fixing holes.

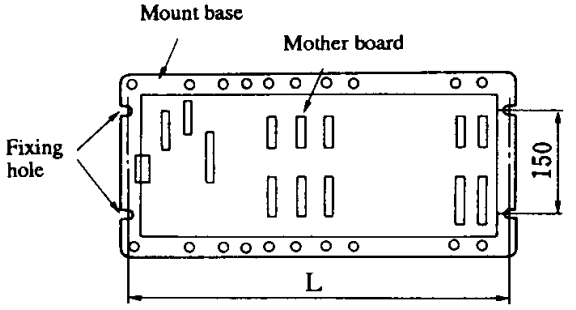
[2] To control the ambient temperature within the specified range:
(a) Reserve a sufficient ventilation space. (50 mm or more above and below each base and 10 mm or more left and right)
(b) Do not install the bases right above a device (heater, transformer, large capacity resistor, etc.) with a large calorific value.
(c) When the ambient temperature rises above 55°C, lower it below 55°C using a fan or cooler.

[3] Do not install the bases in the board where a high-voltage device is installed.

[4] Install the bases at a distance of more than 200 mm from the high voltage cables and power cables.

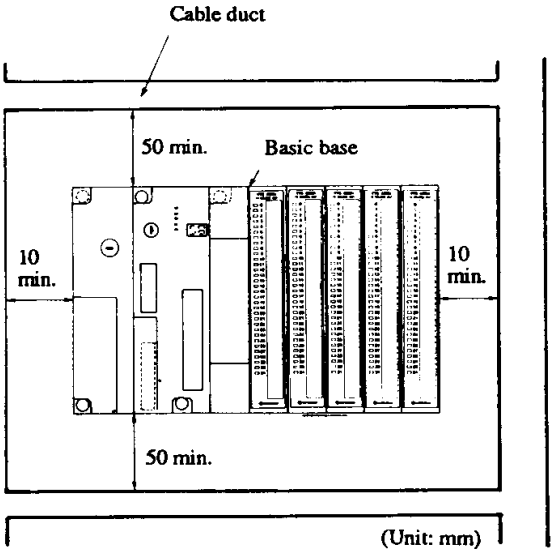
[5] Install the basic base at a height of 1000 mm to 1600 mm from the floor so as to increase the operability.

[6] Reserve a space of 50 mm or more above and below the module for ventilation and maintenance. Reserve a space of 10 mm or more left and right of the module for ventilation.



Base (basic base) before the module is mounted

Type	L dimension (mm)
BSU-02H/EXU-04H	211.5
BSU-05H/EXU-07H	318
BSU-09H/EXU-11H	460



Mounting location in the board

(b) Connecting of base terminals

In the case where an expansion base is provided, a base jumper wire is required between the basic base and the expansion base. Carry out its wiring in accordance with the following procedure.

(1) In the case where expansion bases are used, at first carry out base jumper wiring between the basic base and the first expansion base using a wire of 5.5 mm^2 and then between the first expansion base and the second expansion base using a wire of the same size. (See below.)

Lay these wires as spaced apart from other power lines and signal lines.

(2) Fix the bases. Mount modules as required and positively fix them by set screws. Then carry out wiring for the power supply module and input/output modules and then connect signal cables among the basic base and the extension bases.

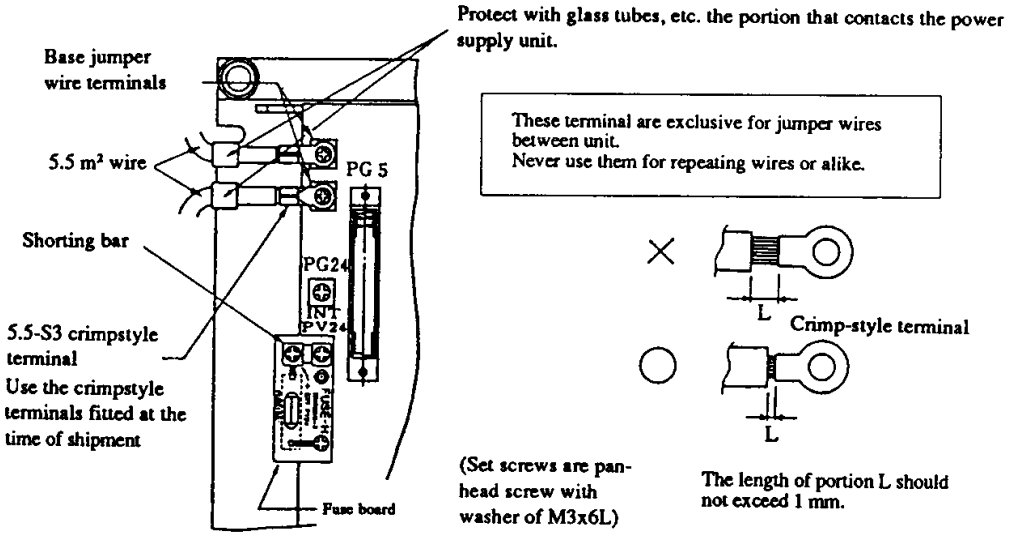


Figure 12.1 Details of Base Terminal Unit

(3) These bases may be run with power supplied from an external 24 VDC power supply unit installed outside of the H-series power supply module, if the capacity of the 24 V power supply unit is insufficient.

① When the capacity of 24 VDC power supply is sufficient with the H-series power supply module:

Keep the shorting bar as connected (as set at the time of shipment out of the works).

② When the capacity of 24 VDC power supply is insufficient with the H-series power supply module and additional supply from the exteriror is required.

a. Remove the shorting bar. (Be sure to remove it.)

b. Connect +24 V of the external power supply to terminal "⏍+", and connect 0 V to terminal PG 24. (Do not mix up the polarity.)

Never connect 24 V of the external terminal to terminal "INT PV24V" at this time.

c. Use wires of 2 mm^2 and lay them with care exercised not to pick up external noise.

See "Caution" in the following page for calculation of the 24 VDC capacity.

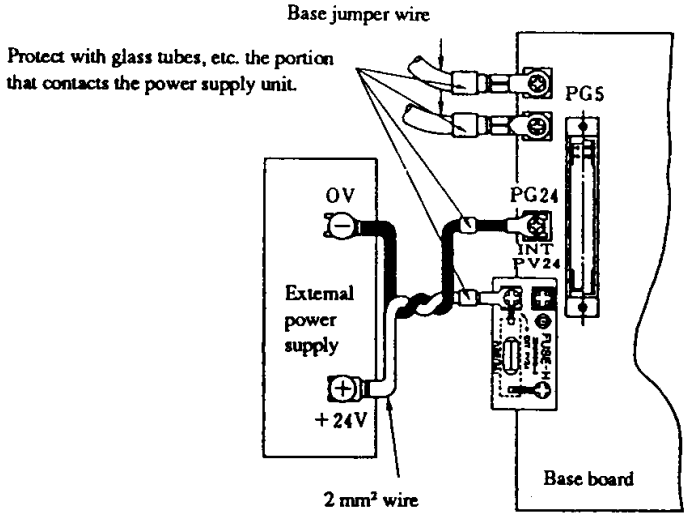


Figure 12.2 External Power Supply Connection Diagram

Replacement of fuses

Replacement fuses for each fuse board (model type: FUSE-H).

Fuses do not blow out under normal conditions. Therefore, always locate and repair the cause of a blown fuse before replacing it.

Fuse boards are optional. Please purchase one when needed.

Caution

Precautions in the case where 24 V is supplied from the exterior

(1) Make sure to remove the shoring bar.

(2) Exercise care not to make an error in the wiring connection.

External power supply's 0 V → Terminal "PG24"

External power supply's 24 V → Terminal "⏚"

Never connect 24 V of the external terminal to terminal "INT PV24V".

(3) The following modules will not operate if the shorting bar is removed and no 24 V is supplied from the exterior.

List of modules requiring 24 VDC

Module name	Type	24 VDC current consumption (A)
Relay output module	YRY20AH	0.13
	YRY20BH	0.27
Counter module	XCU001H	0.10
Analog input module	XAGV08H	0.07
	XAGC08H	0.07
	XAGV12H	0.17
	XAGC12H	0.17
Analog output module	YAGV08H	0.08
	YAGC08H	0.17
	YAGV12H	0.10
	YAGC12H	0.19

(4) Specifications of externally supplied 24 VDC power supply

Voltage ..... 24 VDC $^{+10\%}_{-\ 2\%}$ (including ripple and spike)

Protection..... With overcurrent protection

The current consumption of each module is shown in the above table. Calculate the required power supply capacity of the externally supplied 24 V as matched with the composition of used modules.

(5) The following two methods are available for checking the voltage of the externally supplied 24 V power supply.

① Dismount the power supply module and measure the voltage at terminals of the basic/expansion bases using a circuit tester.

② Measure the voltage at output terminals of the externally supplied 24 V power supply unit without dismounting the power supply module. (In this case, carry out wiring to the basic/expansion bases using thick wires (2 mm^2 or more) so as to minimize voltage drop.)

12.2 Mounting

(1) Mounting the power module

Mount the power module to the leftmost slot of the basic base or expansion base and fix it to the base with the upper and lower module fixing screws.

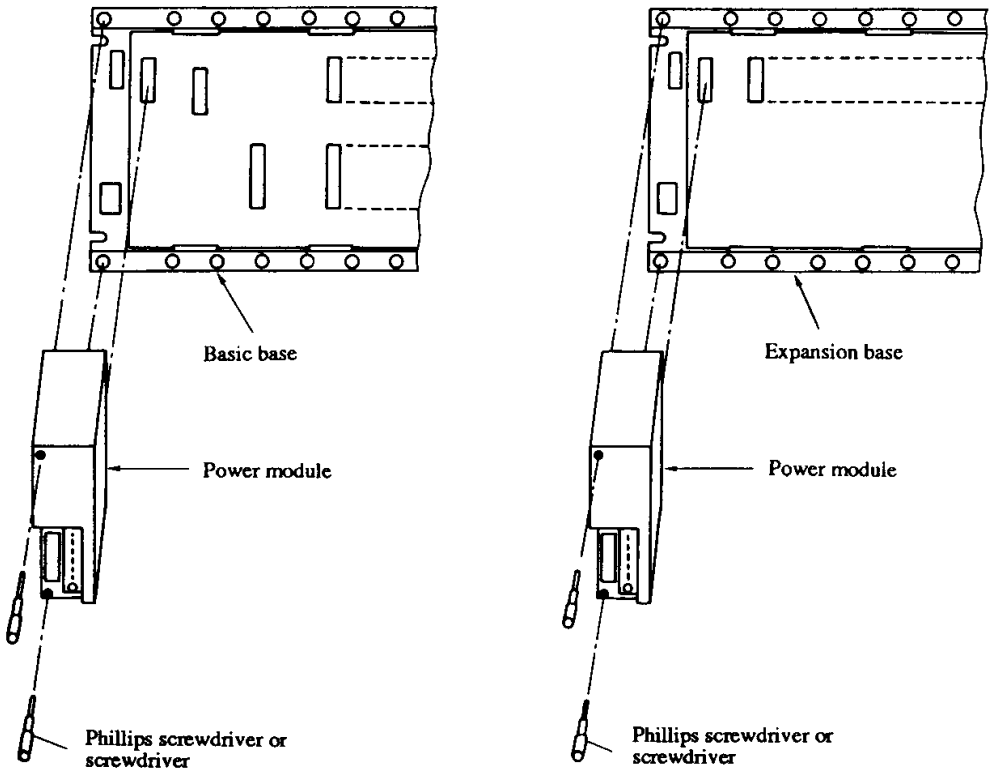


Figure 12.3 How to mount the Power Module

(2) Mounting the CPU module

Mount the CPU module on the right side of the power module mounted to the basic base and fix it to the base with the upper and lower module fixing screws at two locations each.

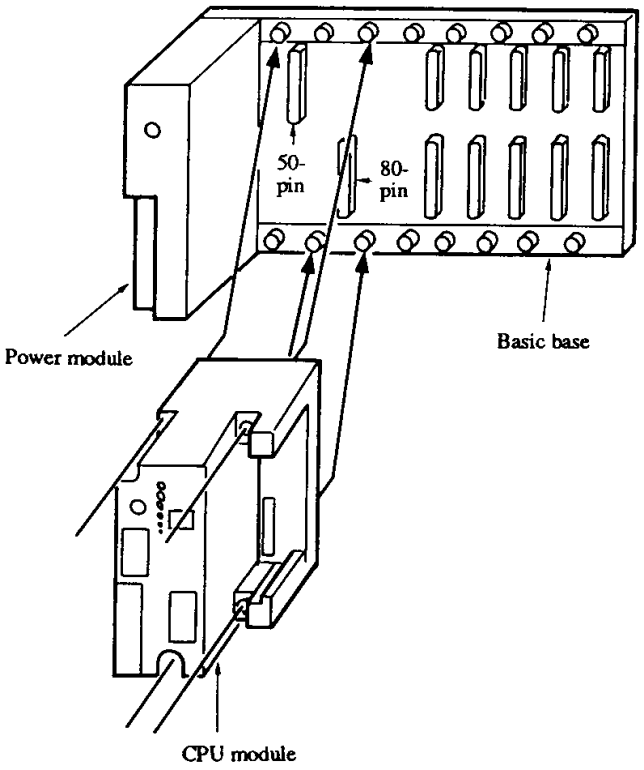


Figure 12.4 How to mount the CPU Module

The CPU module is connected to the basic base with a 80-pin and 50-pin precise connector. Take the following precautions for mounting.

[1] Firstly, set the connector of the CPU module to that of the base and press them lightly. If the pins are not fitted thoroughly, you may feel force of repulsion when pressing them. If this occurs, pressing them forcibly may cause bending of pins. Remove the module once to check whether any pins are bent.

[2] Press the entire front of the module and when you feel that the connectors are fitted with each other fully, fix the module to the base with the module fixing screws (at four locations).

(3) Method for mounting of memory cassette

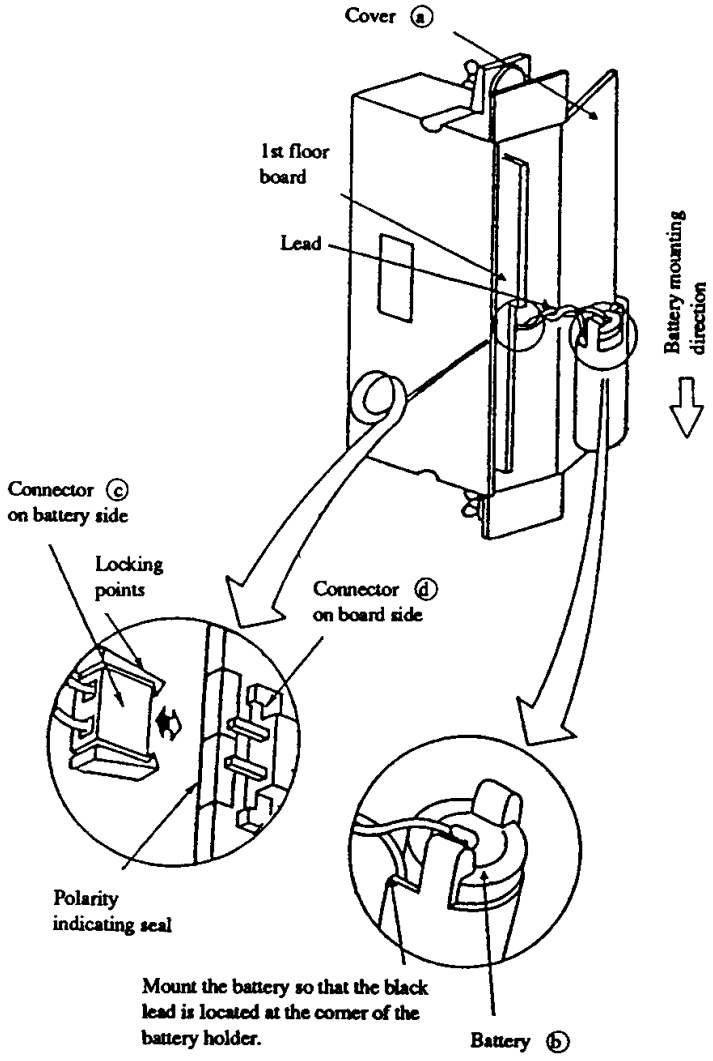
(a) Mounting and replacement of the battery

[1] Mounting the battery

(i) Open cover ⓐ of the memory cassette.

(ii) Correctly mounting battery ⓑ (in such a manner that black lead is located at the corner of the battery holder).

(iii) Insert connector ⓒ attached to battery ⓑ to connector ⓓ on the 1st floor board, with the polarity confirmed. (The lead wire color is indicated by a seal on the board for the polarity.)



[2] Replacing the battery

(i) Open cover ⓐ of the memory cassette

(ii) Disconnect connector ⓒ on battery side from connector ⓓ on board side. (Connector ⓒ is of lock type. Unlock it by pressing its both sides by fingers.)

(iii) Remove the existing battery to the upward side and mount a new battery ⓑ to the fitting position.

(iv) Correctly mount battery ⓑ (in such a manner that black lead is located at the corner of the battery holder).

(v) Insert connector ⓒ attached to battery ⓑ to connector ⓓ on the 1st floor board, with the polarity confirmed. (The lead wire color is indicated by a seal on the board for the polarity.)

- If a battery error has occurred, replace the battery within 50 hours.
- Replace the battery once every two years, even if its service life (the BTE lamp turned on) has not yet been matured.
- The battery should be replaced with the power to CPU turned on.
- It will be convenient if he scheduled date of the next replacement is written in the "DATE" column on the fron side on completion of replacement.

Disposal of used battery

Put each lithium battery cell in a vinyl bag to prevent short-circuiting), and ask a collector to collect it.

Never short-circuit the battery, put it into a fire, disassemble it, give external force to it, immerse it in water, electrically charge it, or cut its lead wire because the battery can take fire, explode, or burn.

(b) Mounting ROM (Only when an ROM cassette is used)

[1] ROM chip

There are three types of ROM cassettes available and they use different ROM chips. Two ROM chips are attached to each ROM cassette.

Type	ROM chip to be used		Remarks
ROM-16H	256k-bit ROM chip	ROMIC-01H	ROMC216H may be used.
ROM2-16H	256k bits (high speed type)	ROMC216H	
ROM2-48H	✱ 1M-bit ROM chip	ROMC248H	To store ROM data, an ROM writer is necessary

✱ To store ROM data, a 512k-bit ROM (MBM27C512-20 by FUJITSU or equivalent) is necessary

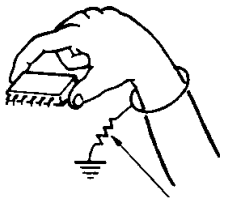
Each ROM chip is a precise electronic part. Take the following precautions.

(i) Do not touch the IC leads and do not apply excessive force to them.

(ii) Keep the leads away from hand fat and oils.

(iii) When storing each ROM chip, put it in the black mat which is used for delivery.

(iv) When holding each ROM chip by hand, ground the body to prevent electrostatic breakdown.



Resistor of about 1 MΩ

[2] Writing into ROM chip

To store ROM data in the user program, use the following method (a) or (b).

(a) Portable graphic programmer + Optional box

(b) Grpahic input device + ROM writer software + ROM writer (pecker 10 or 11 by AVAL, Ltd.)

When ROM2-48H is used, even if ROM data is to be stored by the method (a), and ROM writer (Pecker 11) is necessary.

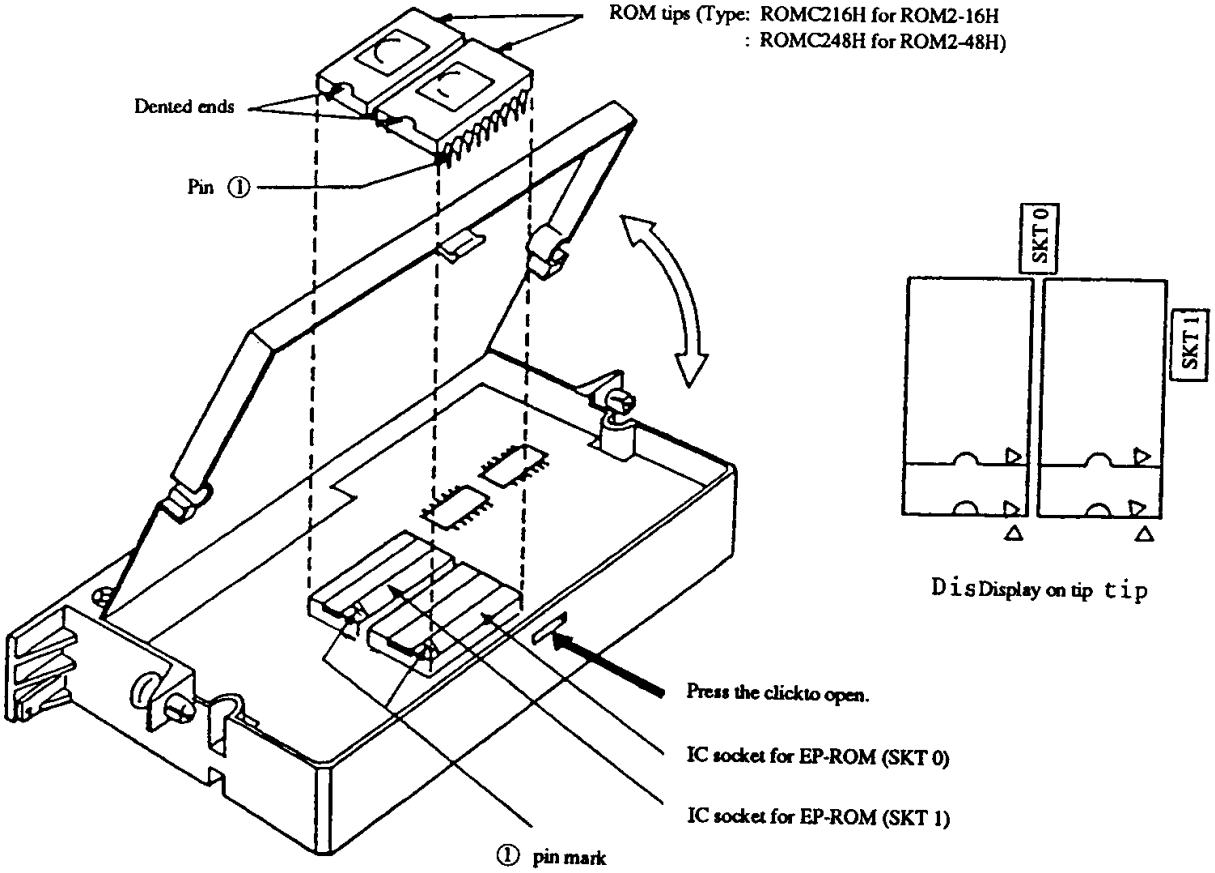
For further details of the operation method, refer to the instruction manuals for memory cassette, portable graphic programmer, ROM writer software, and ROM writer.

[3] Mounting ROMs (ROM2-16H, ROM2-48H) (See NOTE.)

Be careful when handling ROM tips becase they are electrically susceptible parts.

(i) When mounting a ROM tip, mate the " " mark on the IC socket, which is marked as SKT0 or SKT1, with the pin ① on the ROM tip.

Two ROM tips should be used regardless of the program capacity.



(ii) Check the following after installation of the ROM tips

- Are the ROM tips directed correctly?
- Are not their legs bent?
- Are correct ROM tips mounted on SKT0 and SKT1?

After above checking, turn on the power if they are found to be correctly mounted.

NOTE: Writing to ROM tips

For writing of a program to ROMs, see the following manuals:

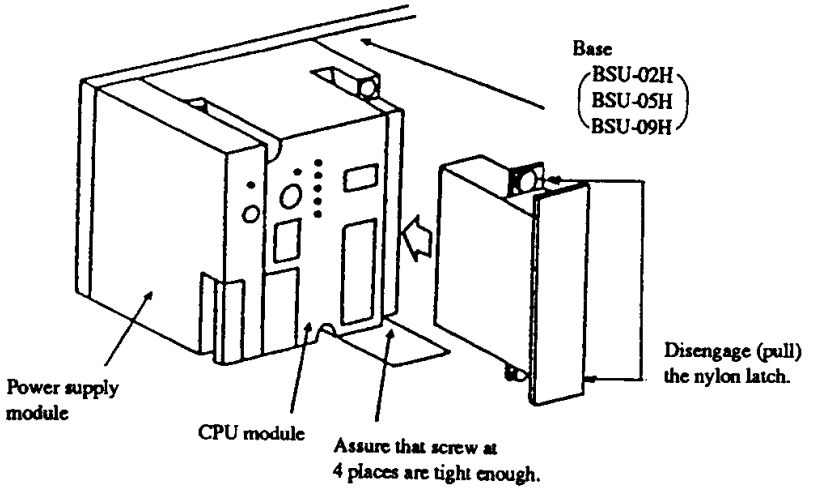
① PGM-GPH (Portable Graphic Programmer)

(c) Method for mounting

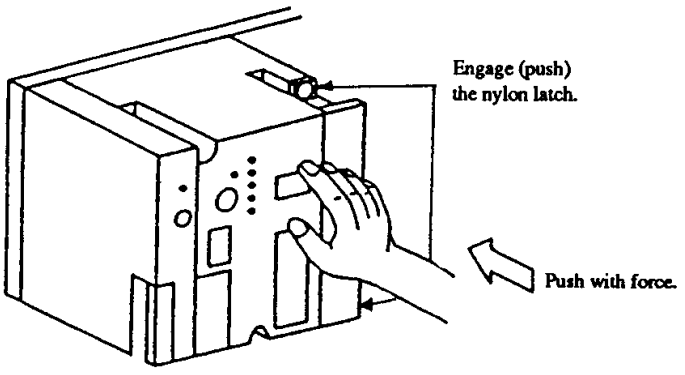
(I) Check if all of the mounting screws for the CPU to which the memory cassette is to be mounted are tight enough. (4 places)

(II) Assure that nylon latches for fixing the memory cassette are not in the locked state. (2 places)

(III) Assure that the CPU connector is free of abnormality and mount the memory cassette to the CPU by sliding it along the guides.



(IV) Positively mount the memory cassette to the CPU by the pushing the front face of the memory cassette with force.



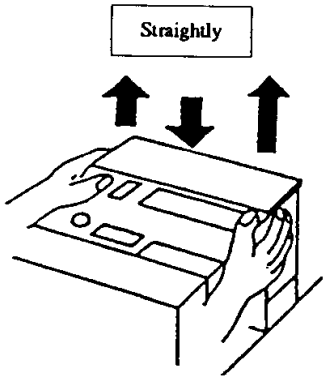
(V) Lock the memory cassette in place by pushing heads of memory cassette locking nylon latches. (2 places)

(VI) When using RAM**-**H and/or ROM2-**H for the first time, be sure to perform CPU initialize using the peripheral unit.

(d) Precautions for mounting the memory cassette

At the occasion of mounting of the memory cassette to a CPU module, pay particular attention to the following matters.

(I) At the occasion of mounting and dismounting of the memory cassette, straightly insert and remove it along the guides of the CPU as shown.

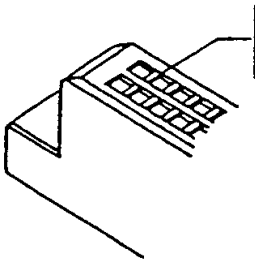


If the connector hardly fits, check for abnormality shown in paragraph (II), without forcing.

※ At the time of mounting of the memory cassette, at first straightly insert the memory cassette to the CPU module so that fitting of connectors becomes positive. Then lightly fit the memory cassette connector with the CPU module connector and push the memory cassette with force from the top of the case.

(II) Check the following two points before mounting and also after dismounting.

① Check the connector on the CPU module side for abnormality.



Assure that partitions are free of abnormality.

⇨ Correct the connector holes if abnormality was observed.

(4) Mounting the I/O controller

(a) Mounting

The I/O controller is used to connect an expansion base in the H-702 (or H-700) or any higher-grade system. Mount the I/O controller on the right side of the power module of the expansion base and fix it to the base with the upper and lower module fixing screws at two locations each.

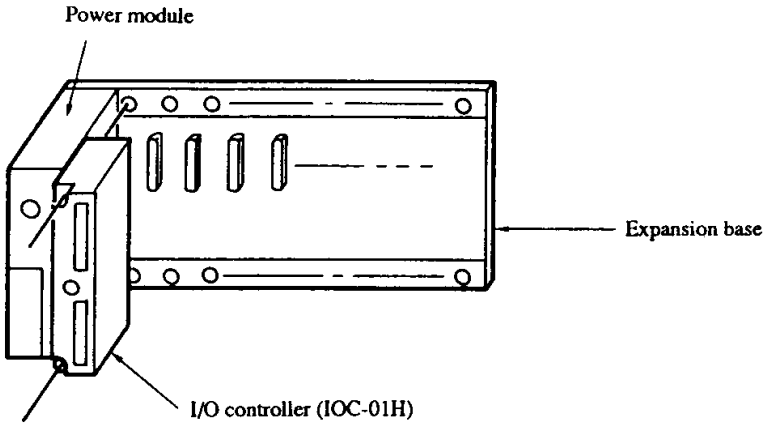


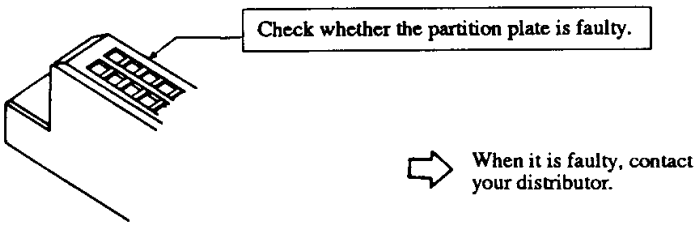
Figure 12.5 How to mount the I/O controller

Note: In the H-2002 or H-702 system, the revision of the I/O controller should be F or a subsequent release. When an I/O controller of Revision E or previous release is used, a "41" error, a "51" error, or an I/O data error may occur. For further details, see Section 5.2.

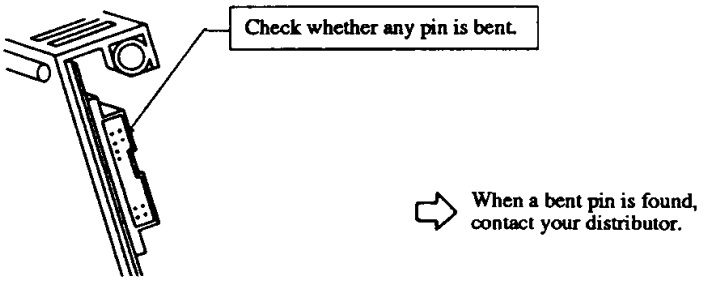
Items to be checked before mounting

Before or after mounting, check the following points for the I/O controller and all the modules.

(i) Is any connector between the modules on the basic and expansion bases faulty?



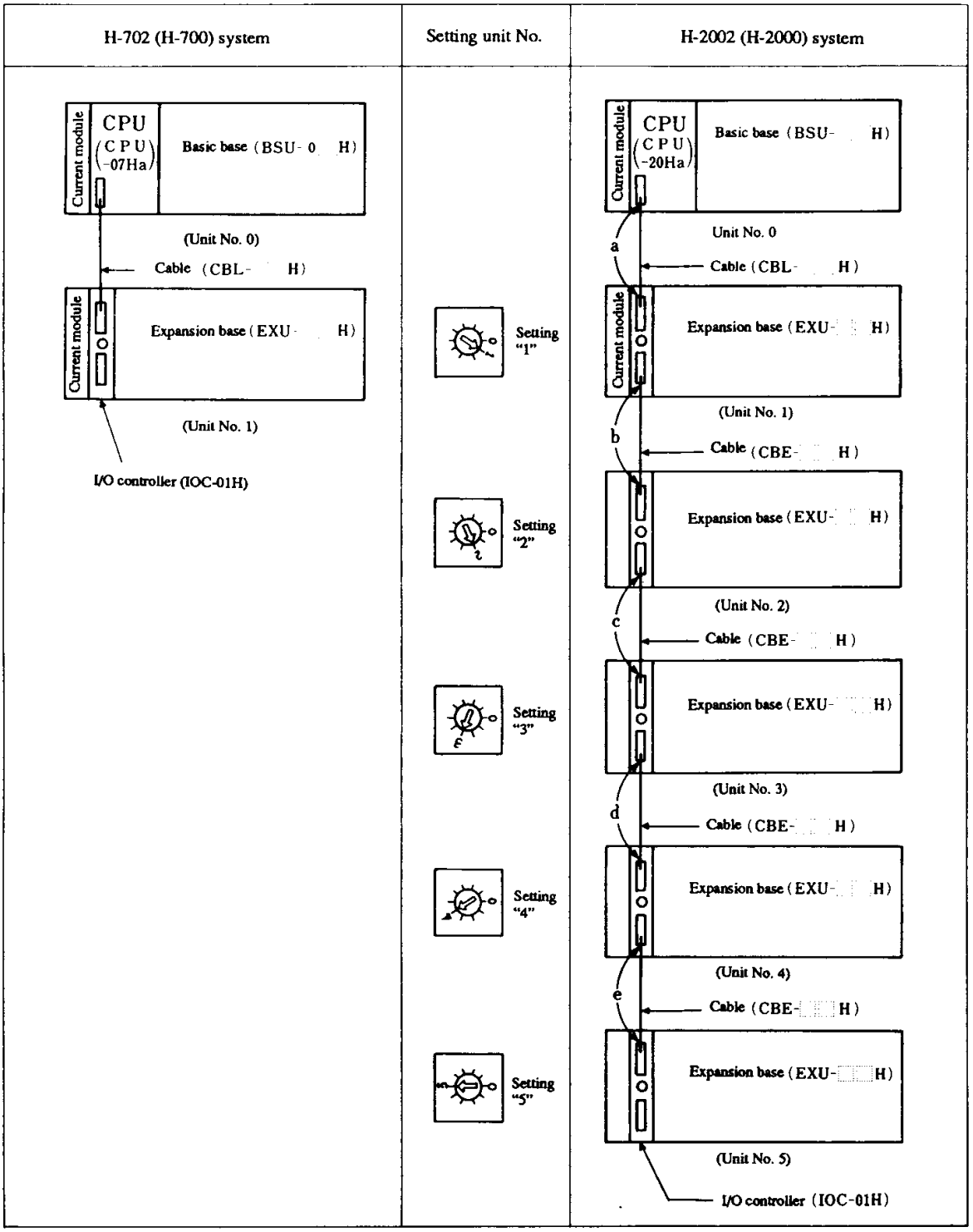
(ii) Is the connector of each module which is fitted with the base faulty?



(b) Setting unit No.

Set each unit number as shown below. Note that when any unit number is set incorrectly, a CPU error stop (error code 41, etc.) or a faulty operation may be caused.

Adjust the total cable length to 4 m or less. (a + b + c + d ≤ 4 m)



(5) Mounting a remote I/O local station

A remote I/O local station is used to construct an H-series remote I/O system. Mount the remote I/O local station on the right side of the power module of the expansion base and fix it to the base with the upper and lower module fixing screws at two locations each. The expansion base whereon the remote I/O local station is mounted requires no I/O controller (IOC-01H).

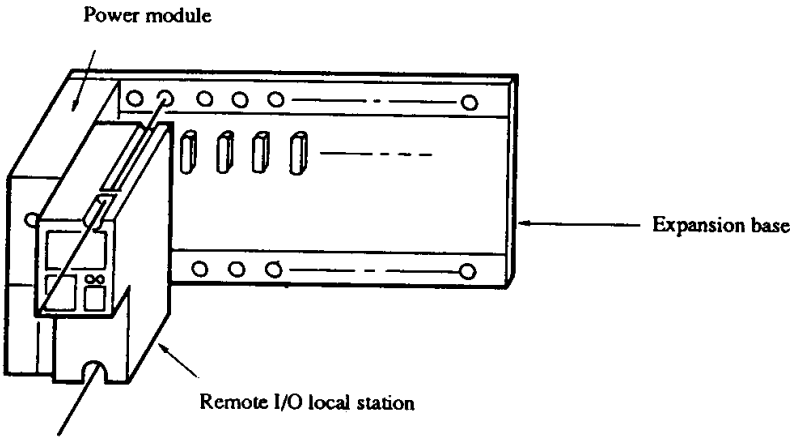


Figure 12.6 Mounting a Remote I/O Local Station

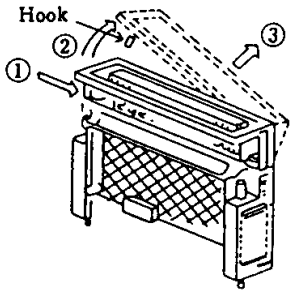
Note: When a remote I/O local station is mounted on the expansion base, the station occupies a mounting space of two slots. Therefore, the space for mounting the I/O module is reduced by one slot.

(6) Mounting the I/O module

Before mounting the I/O module, remove the module cover.

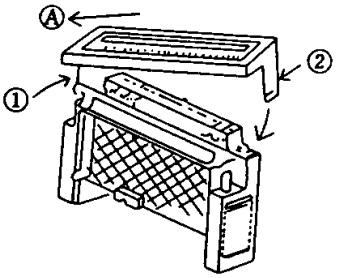
(1) Removal

Push portion ① of the module cover, pull up the cover in direction ②, and remove the cover in direction ③.



(2) Mounting

Insert the top of the module cover into portion ①, slightly push the cover in direction (A), and engage the connector. After the connector has been engaged, insert the buttom of LED cover (portion ② into position.



Module mounting procedure

Remove the module cover. (Only the I/O module)

↓

Mount the I/O module to the base.

↓

Tighten the screws for fixing the module with a screwdriver.

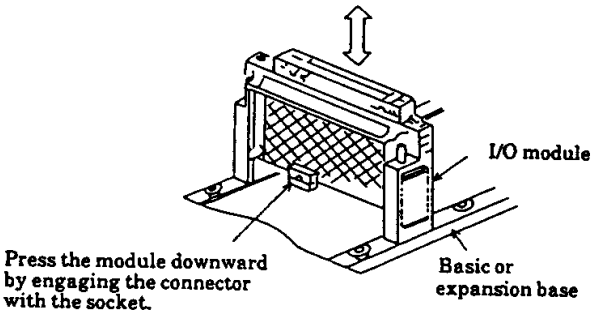
↓

Attach the module cover.

Remove the I/O module in the reverse order of assembly.

Points of mounting or removing the module

Mount or dismount an I/O module onto or from the basic or expansion base by sliding the module in vertical direction.



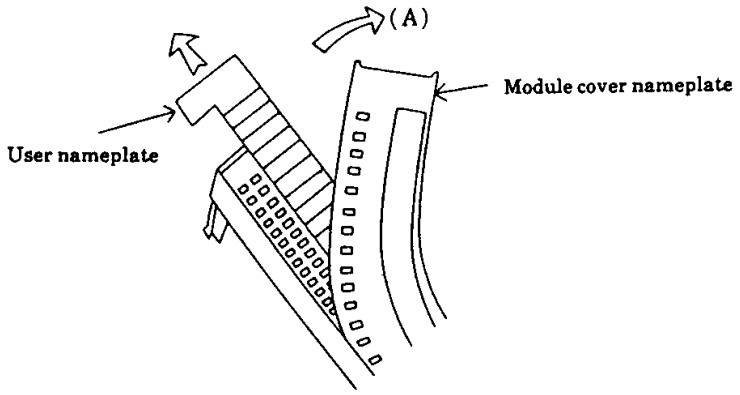
Screw tightening torque

Mounting position	Tightening torque (kg-cm)
I/O module terminal block (M3 screws)	5 to 8
I/O module terminal block (M4 screws)	8 to 14
Power module terminal block (M3 screws)	5 to 8

Removing the user nameplate

Pull out the end of module cover nameplate in direction (A) and remove the user nameplate.

The wire numbers and wiring information can be written on the user nameplate.



12.3 Power Supplies

(1) Type of power supplies

To operate the programmable controller, the H-series requires the following dedicated power supplies:

(1) 100VAC rated power supply (feed voltage of 85 to 132 VAC) or 200VAC rated power supply (feed voltage of 170 to 264 VAC) for power feeding to the programmable controller itself

(2) Input power supply

(3) Output load driving power supply

Select power supplies (2) and (3) according to the type of modules used and their specifications.

The cables of these power supplies must be separated from each other as shown below.

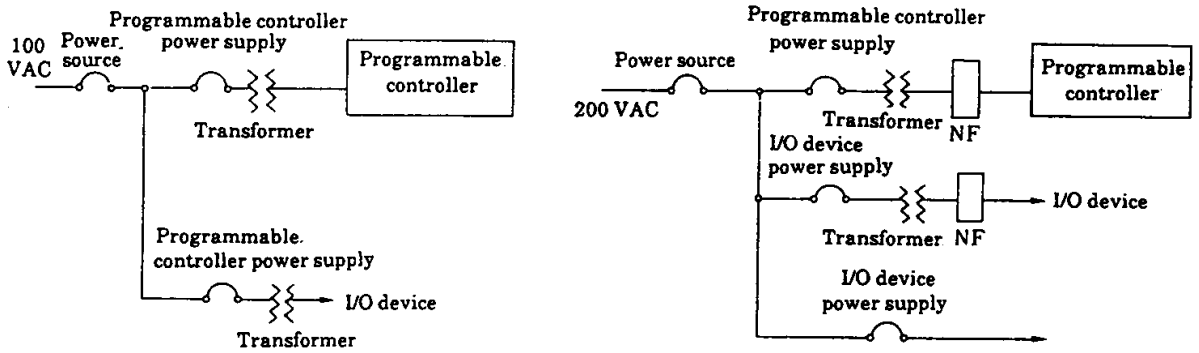


Figure 12.7 Example of Power Supply System Diagram

(2) Fail safe

[1] An interlock circuit is constructed outside the programmable controller (PC).

When the power switch of the PC is turned ON or OFF, the I/O may not operate normally temporarily due to the differences in the delay time and rise time between the PC body supply voltage and external supply voltage for PC I/O module signal (especially DC voltage). When an error occurs in the external power supply or PC body, a malfunction may be caused.

To prevent the entire system from being affected by such an error or from a viewpoint of fail safe, it is necessary to construct an emergency stop circuit, protection circuit, and interlock circuit for the parts of the system which may be damaged by the malfunction outside the PC.

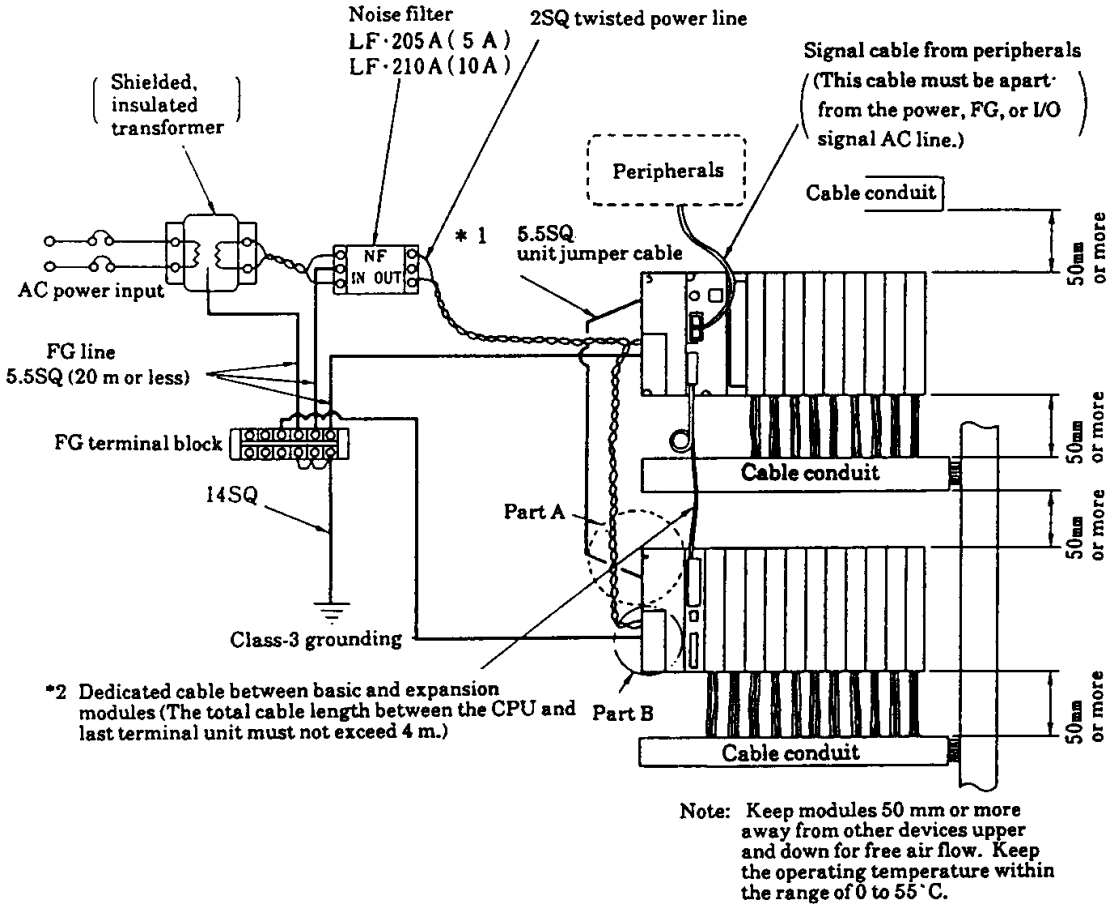
[2] An arrester is installed.

To prevent the system from damage by lightning, it is recommended to install an arrester in each power circuit of the PC.

(3) Example of H-700 system wiring diagram

(This example can also be used for the H-300 and H-2000 series systems.)

*1 The primary and secondary lines of the noise filter and insulated transformer should be separated from each other. These lines should not be passed in parallel.



Reference: When the grounding cable is more than 20 m in length or connected to a common grounding terminal

In either case, the grounding may produce a contrary result and the system may be affected by noise. If this occurs, grounding of high impedance (about 10 kΩ to 1 MΩ) may be effective. It is recommended to mount a surge killer to the noise generation source.

Figure 12.8 Wiring Example

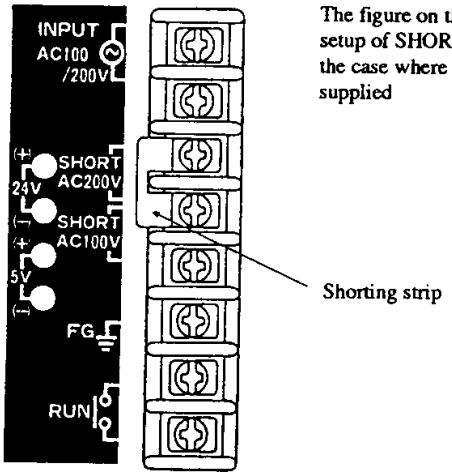
(4) Connection

(a) Connection

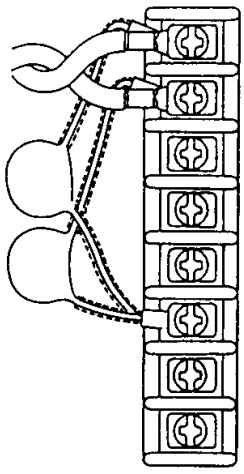
Carry out power supply wiring making use of the terminal block on the front face, after fixing the power supply module in the position. (Use wires of 1.25 to 2 mm^2 for wiring connection.)

Carry out wiring as shown in the power supply module terminal name plate.

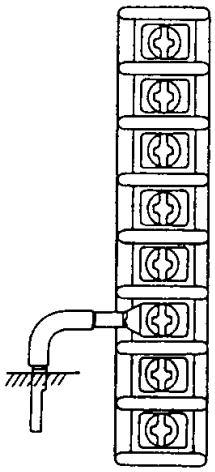
This power supply module is common for 100 VAC and 200 VAC, but when the power of 100 VAC is supplied short the 100 VAC SHORT terminals using the provided shorting strip, and if 200 VAC is supplied, short 200 VAC SHORT terminals using the provided shorting strip.



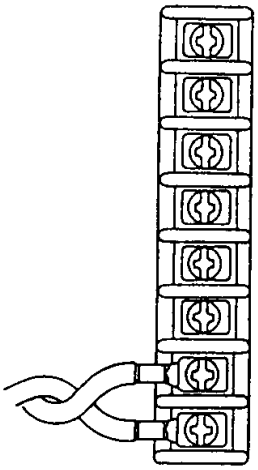
Power supply module terminal name plate



Feeder Wiring (1.25–2 mm²) and Connection of Accessories and Capacitors



Wiring of Groundding Wire (5.5 mm²)



Wiring of Run Contacct Output (1.25–2 mm²)

Note: Indication of the shorting strip is omitted. The shorting strip should be connected without fail as shown on the power supply module terminal name plate.

(b) Running

Carry out the following checks with the power supply module at the time of installation, before starting .

- Check once again if the voltage and frequency of the supplied power are matched with the product specification. In addition, check once again if the location of the shorting strip is correct.
- Check if the power supply module is firmly fixed to the specified position by the module lock screws. Retighten the screws if they were found loose.
- Check if the external wiring is connected to the correct position.
- Check if the external wiring is firmly fixed to the terminal block by terminal screws. Retighten the screws if they were found loose.

(5) Distribution of I/O signal cables

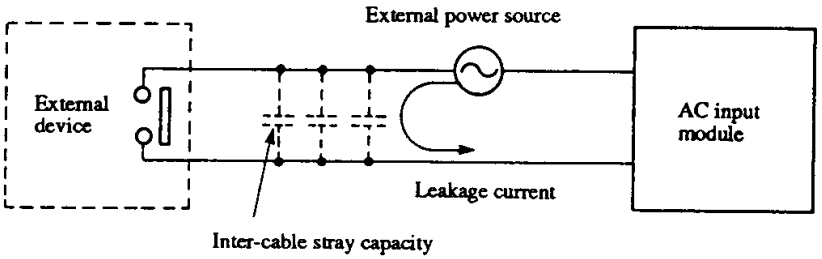
(a) Electrical wires and crimp terminals to be used for I/O signal cables

Input and output	Electrical wire	Crimp terminal
16-point I/O module	KIV 2.0 mm^2 max.	M3 round crimp terminal or
32-point I/O module	KIV 1.25 mm^2 max. ✱1	M3 Y type crimp terminal

✱1: When using a crimp terminal with an insulating sleeve, use wires of 0.75 mm^2 or less.

(b) Effect of electrostatic coupling

When an alternating current is used in the input circuit and the cable length is long, a phenomenon that a voltage is observed at the input terminal though no signal is supplied is generated.

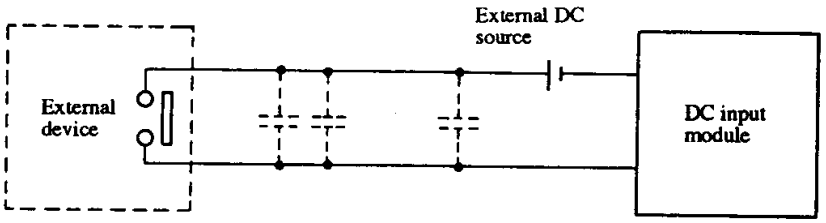


This phenomenon is that even if the contact of the external device is opened, a leakage current flows by the inter-cable stray capacity and a voltage is generated at the input terminal of the AC input module.

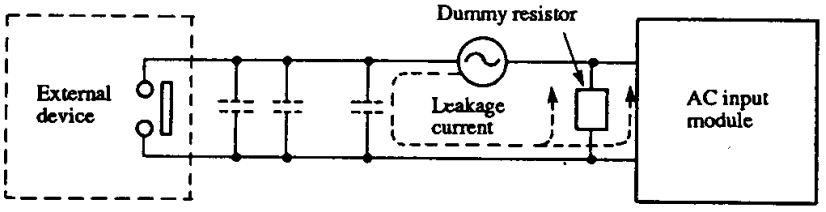
This phenomenon may cause malinput or reduction in noise resistance.

The following are countermeasures for it. Control the voltage at the input terminal which is generated by electrostatic coupling to 1/2 of the maximum OFF voltage of the input module or less.

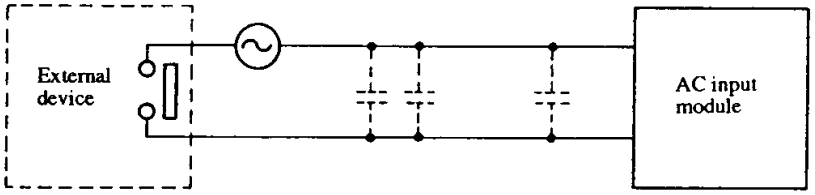
[1] Method that a direct current is used in the input circuit



[2] Method that a dummy resistor is connected in parallel with the input terminal so as to reduce the impedance of the input module



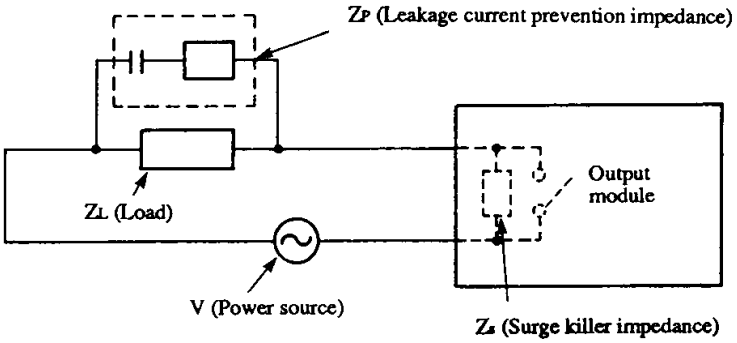
[3] Method that the external power source is connected to the external device



(c) Effect of leakage current

A surge killer is mounted in each of the modules YRY20AH, YDR20AH, YSR20AH, and YSR20BH. It causes a slight leakage current. Therefore, when a minute current load or a load with a small holding current is connected, the module may be turned ON by mistake or may not be turned OFF though an attempt is made to turn it OFF. In this case, connect a resistor or a capacitor and resistor which are connected in series to the load in parallel so as to prevent the leakage current from flowing through the load.

Reference: How to obtain leakage current prevention impedance ZP



How to obtain ZP (Select a value which is as close as possible to ZP using the following expression as a guideline.)

$$\frac{Z_L \cdot Z_S}{\frac{V}{I_L} - Z_L - Z_S} > Z_P > \frac{V \cdot Z_L}{Z_L \cdot I_O - V}$$

where, V: Supply voltage (V)

ZP: Leakage current prevention impedance (Ω)

ZL: Load impedance (Ω)

Zs: Surge killer impedance (Ω)

IL: Minimum holding current of load (A)

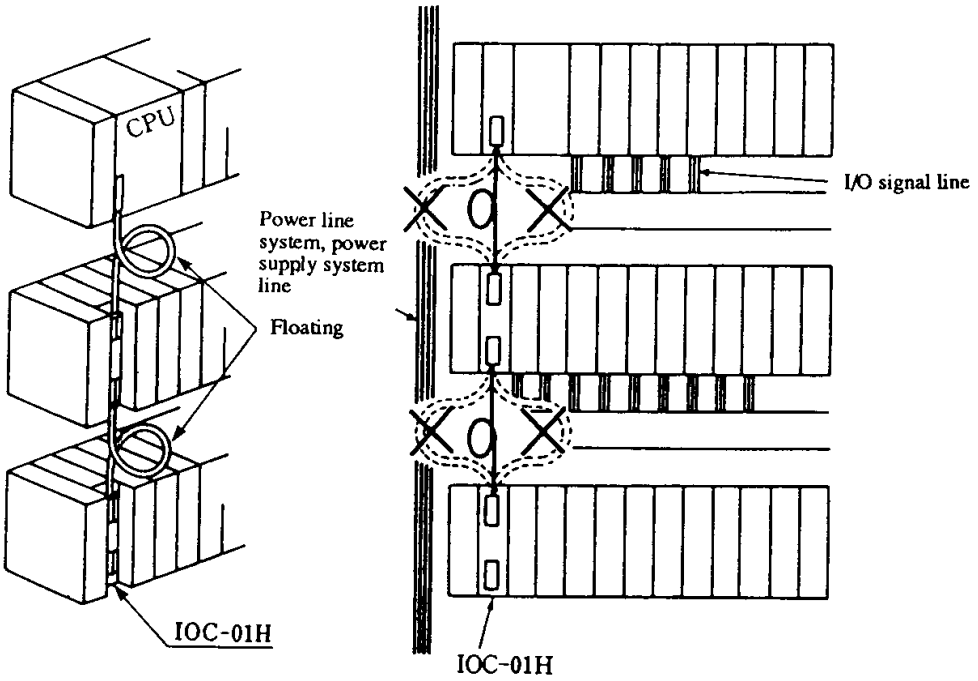
Io: Maximum load current of output module (A)

Surge killer impedance Zs

Module name	Electrostatic capacity (pF)	Impedance Zs (Ω)	
		50 (Hz)	60 (Hz)
YRY20AH/YDR20AH	4.680	6.8×10^5	5.6×10^5
YSR20AH	2.880	1.1×10^6	9.2×10^6
YSR20BH	2.880	1.1×10^6	9.2×10^6

The H-series uses a capacitive varister as a surge killer.

(6) Distribution of additional cables



Be sure to separate each additional cable (CBL-□□H, CBE-□□H) from the power line, I/O signal line, and power supply system line.

When the additional cable is forced to pass near any of the above lines, pass the cable at right angles to the line instead of in parallel with it.

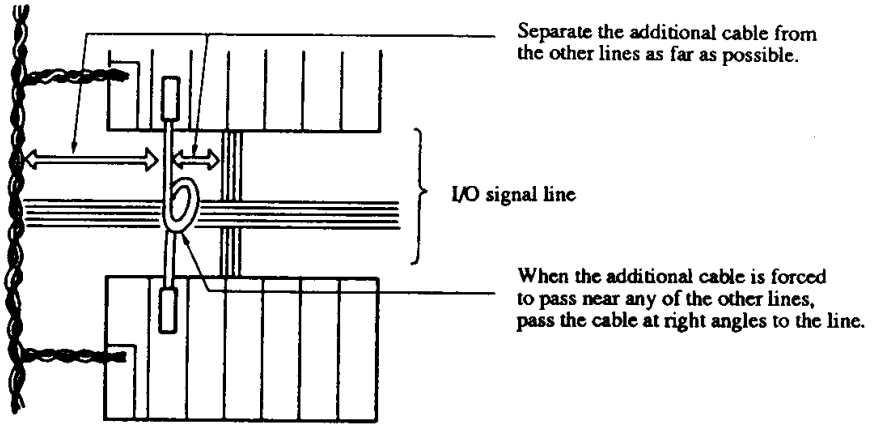


Figure 12.9 Distribution Example of an Additional Cable

(7) Distribution of communication and sophisticated function module cables

The cables connected to the communication and sophisticated function modules transmit or receive data by weak or high-speed signals. Be sure not to pass the cables through the cable duct of the other I/O signal and power lines. Keep the duct of the cables at a distance as far as possible from the other duct. When the cables are forced to pass through the same duct, pass them through an iron pipe for shielding.

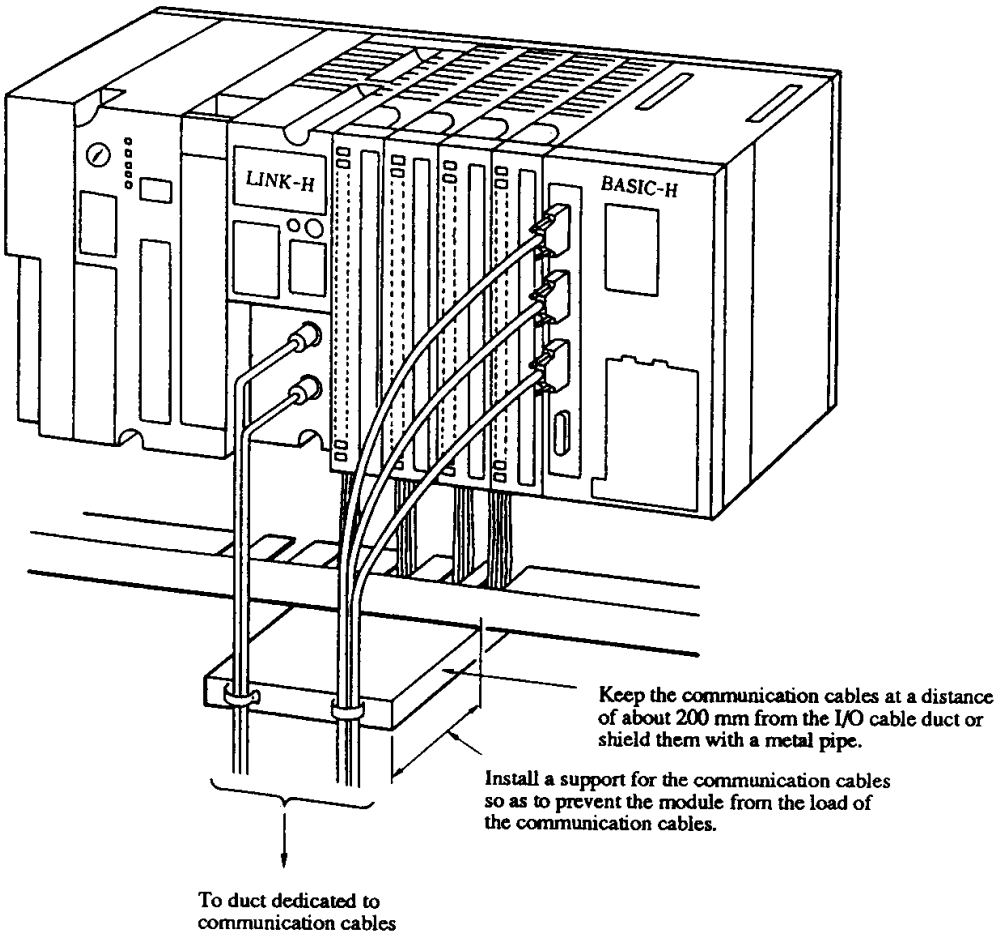


Figure 12.10 Communication Module Cable Distribution Example

(8) Wiring diagram example (H-702 remote I/O system)

(For the H-302 or H-2002 system or H-300, H-700, or H-2000 system, refer to this wiring diagram.)

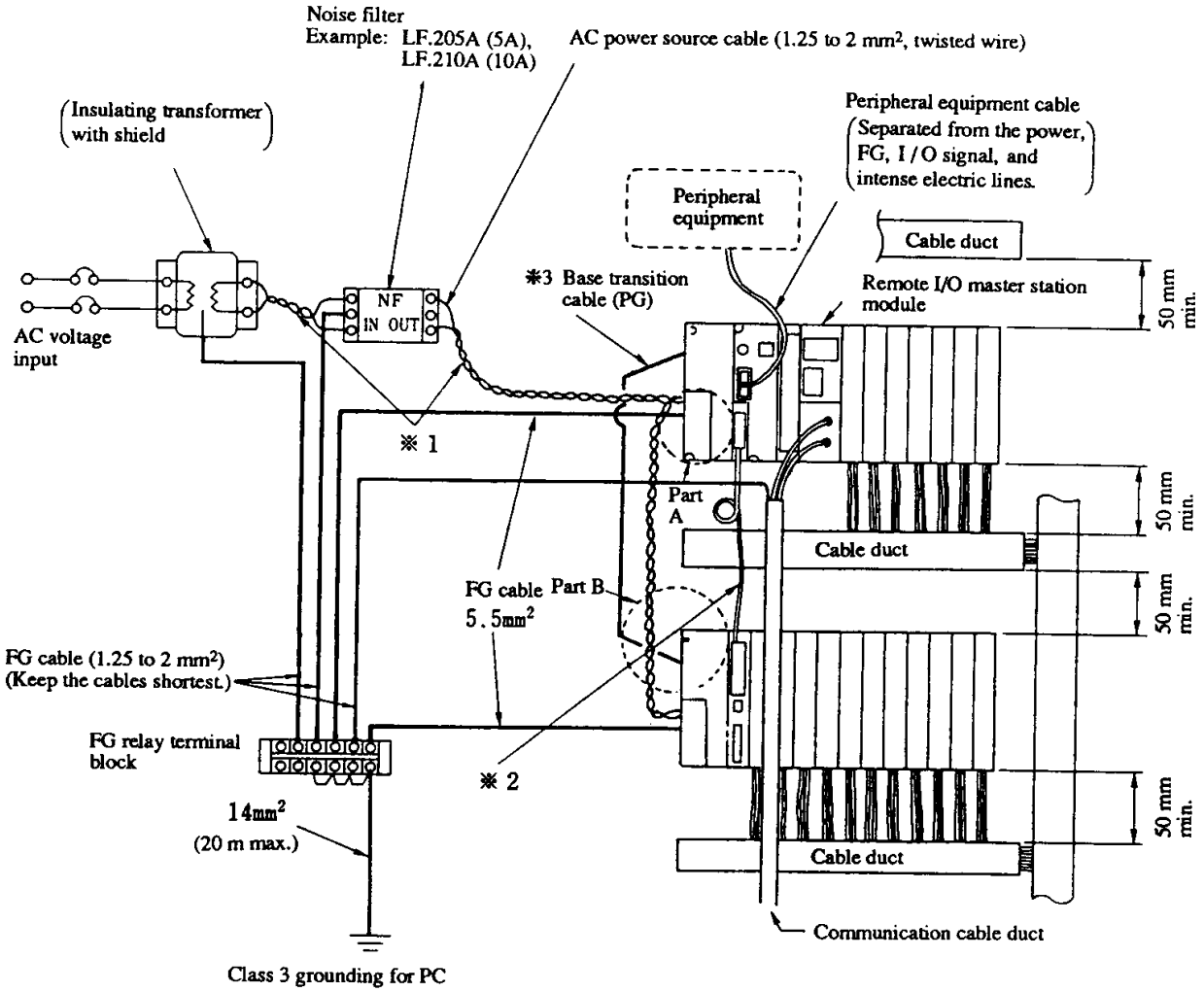
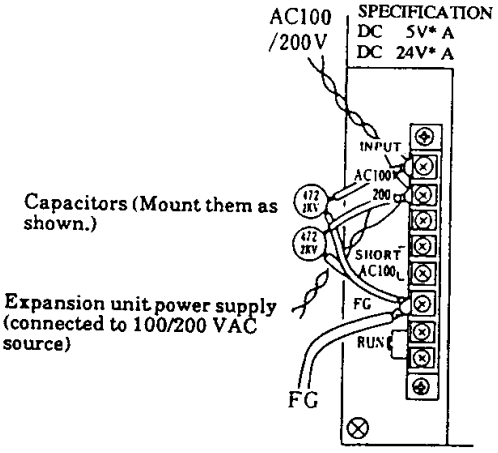


Figure 12.11 H-702 Remote I/O System Wiring Diagram Example

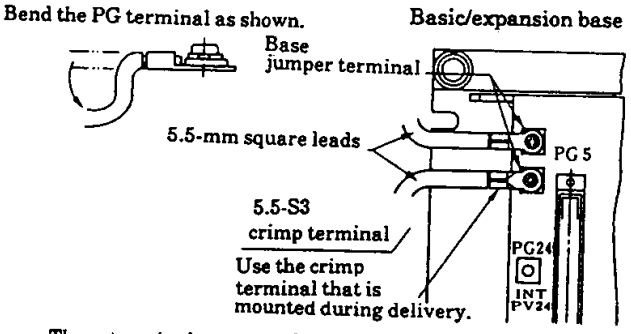
※1: Separate the primary side of the cables of the noise filter and insulating transformer from the secondary side so hat both sides are not made parallel with each other.

※2: Adjust the total cable length between the basic and expansion bases to 4 m max. from the CPU module to the end unit.

※3: Use a base transition cable (PG) with a section of 5.5 mm² (KIV cable: JIS C 3316).



Part A: Wiring details at power module terminal block



These terminals are used for base-to-base jumper lines only. Never use the terminals for signal transmission.

Note: Unit jumper cables
Place a jumper cable between the basic and expansion bases and between expansion bases to provide an equal potential. It should be wired before the power module is mounted.

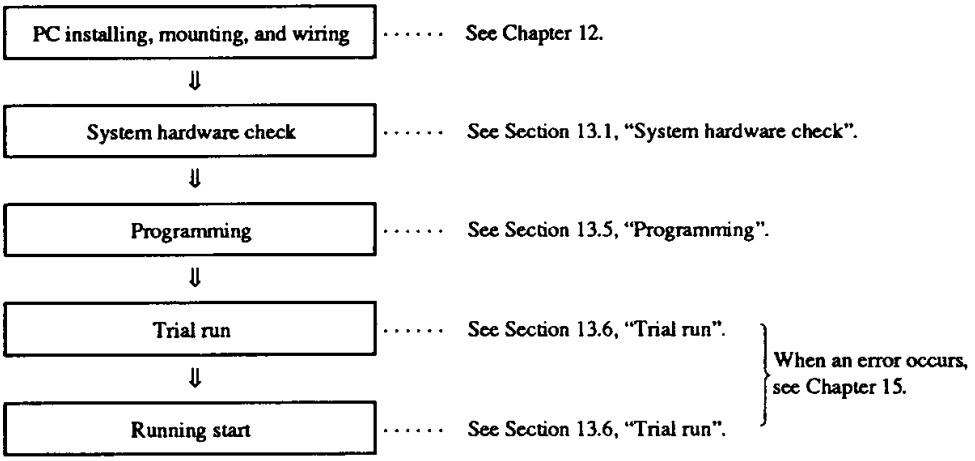
Part B: Mount base jumper details

Chapter 13 Preparation for Running

An example of the procedure from constructing the PC system to starting actual running will be shown below.

This chapter will be described under the assumption that the processing up to "1. Module mounting and input power wiring" shown below is finished.

Flow chart up to running start



13.1 Before Operation

(1) Check the following before turning the system power on:

(i) The correct type of system delivered
(ii) Complete set of accessories
(iii) No defects or shortage due to transportation

(2) Battery setup

Mount the battery of accessory kit in the memory cassette.

(3) Power cabling

Set the source voltage of power module (by placing a jumper for 100 or 200 VAC) and connect the power cable to the power source. (Make sure that the system components operate normally and turn on the power supply of each load.)

(4) Connect the peripheral devices (GPC, portable graphic programmer, and instruction language programmer) to the system.

(5) Turn on the power supply of all devices and make sure that they operate normally.

Caution: Keep the CPU operation switch in the STOP position.

(6) Clear the entire program memory through initialization.

(7) Initialize the CPU and assign the I/O addresses correctly. Incorrect I/O assignment causes erroneous signal I/O. (See the GPC Manual and Programmer Manual for details.)

(8) Create an application program. See the GPC Manual and Programmer Manual for the programming information.

13.2 Precautions before Starting

(1) Starting Time

Table 13.1 Starting Time of Each CPU Module

Unit: second (maximum value)

Power status		OFF → ON	ON status				ON status
Key switch position		STOP	STOP or REMOTE → RUN				RUN → STOP or REMOTE
Memory cassette		—	RAM-04H	RAM-08H	RAM-16H ROM-16H	RAM-48H ROM-48H	—
CPU	CPUP-03H CPU-03Ha	12	0.9	1.2	—	—	0.03
	CPUP-07H CPU-07Ha		0.9	1.2	2.0	—	
	CPUP-20H CPU-20Ha		1.8	2.0	2.4	4.0	
Memory cassette		—	RAM2-04H	RAM2-08H RAM3-08H	RAM2-16H RAM3-16H ROM2-16H	RAM2-48H RAM3-48H ROM2-48H	—
CPU	CPU2-03H	6.5	0.8	1.0	—	—	0.03
	CPU2-07H		0.8	1.0	1.7	—	
	CPU2-20H		0.7	0.9	1.6	3.5	
Remarks		From turning power ON to running start being ready*	When a program is prepared in full memory capacity				

* In this period, the 7-segment indicator of the CPU module indicates FF.

(2) Power ON or OFF procedure

Power ON procedure

Up to 16 seconds after power is turned on $\left(\begin{matrix}\text{power ON} \rightarrow \text{STOP} \rightarrow \text{RUN} \\ \quad\quad 12\text{ s} \quad\quad 4\text{ s}\end{matrix}\right)$, the H-series starts arithmetic. If the input power source is not started perfectly before arithmetic start, the CPU receives data, which is inputted as ON, as OFF and does arithmetic. Therefore, allow the I/O power source to start before arithmetic start.

When power is turned off

The CPU requires up to 350 ms to stop running actually after the AC power is turned off. If the input power is turned off in this period, a signal which is supplied to the input module is turned OFF. Therefore, the CPU performs arithmetic on the basis of this OFF data and may perform a malfunction.

To avoid it, it is necessary, for example, to change the input power source to a DC power source, to increase the holding time after the AC power is turned off to 350 ms or more, and to prevent the input signal to the input module from turning OFF by mistake. When running is changed to stop when the power is on, the CPU stops arithmetic about 30 ms later.

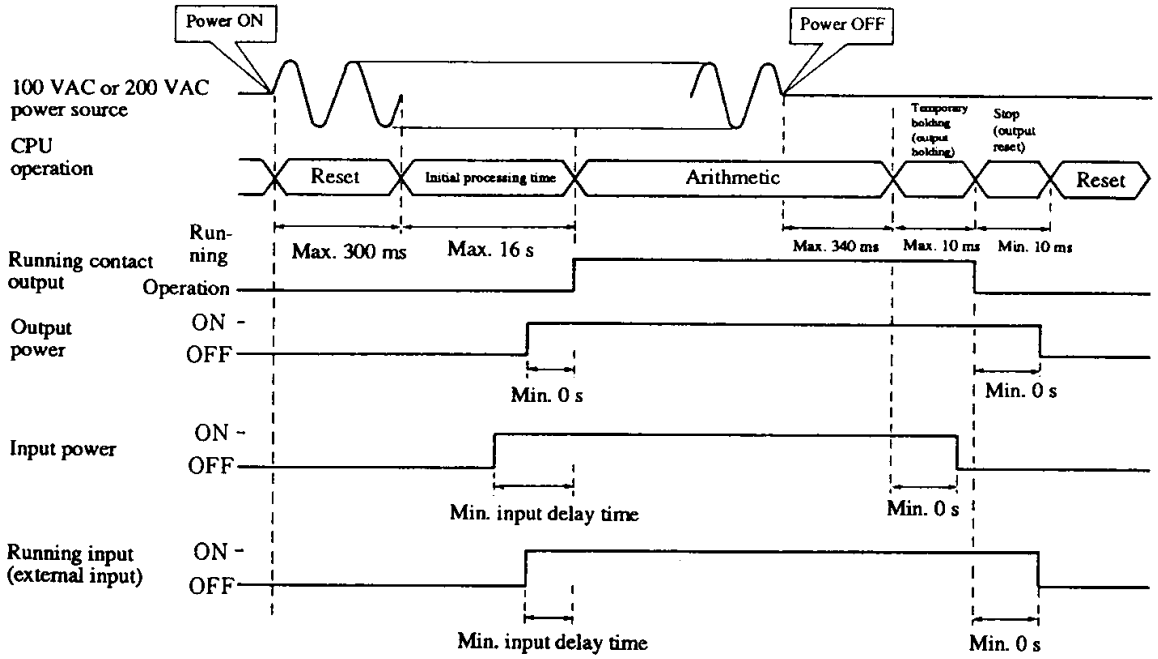


Figure 13.1 Operation when Power is turned ON or OFF

(3) Power turning ON or OFF procedure for a plurality of power modules

The power turning ON or OFF procedure when a plurality of power modules are used for a CPU (an independent system or remote system) is as follows:

a) In a system using basic or additional units, the CPU starts operation when all the power modules are started.

b) In a system using remote I/O modules, turn the remote I/O local station ON within 1 second after the CPU is started (when the indication of the 7-segment LED of the CPU is changed from FF). Otherwise, the CPU may cause a "43" error (remote error). If this occurs, turn the running switch to STOP and then to RUN. The error can be canceled.

c) When at least one power module fails, the CPU stops arithmetic. (A case that the setting of "running parameter" is specified as a running continuation mode when an error occurs is excluded.)

d) Note that when the CPU stops arithmetic due to power failure and then the power source is returned normally, the operation after return may vary with the mounting location of the power source.

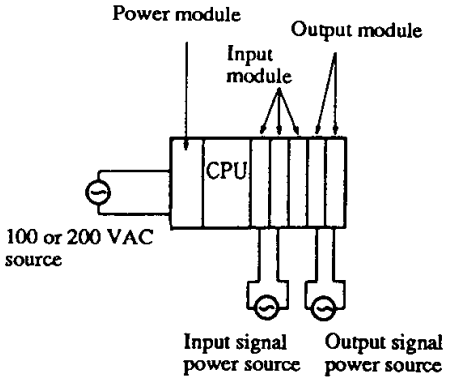
i) Power source for expansion unit: The CPU is reset and restarted. (Automatic start)

ii) Power source for remote local station: The CPU is kept in the error stop state. (Stop holding)

(Perform an error cancel operation and restart the CPU.)

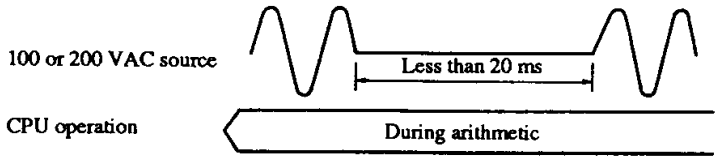
(4) Operation when an instantaneous power failure occurs

The operation when an instantaneous power failure occurs in the power source of each unit is shown below.



(a) Instantaneous power failure of less than 20 ms

The CPU continues arithmetic (running).



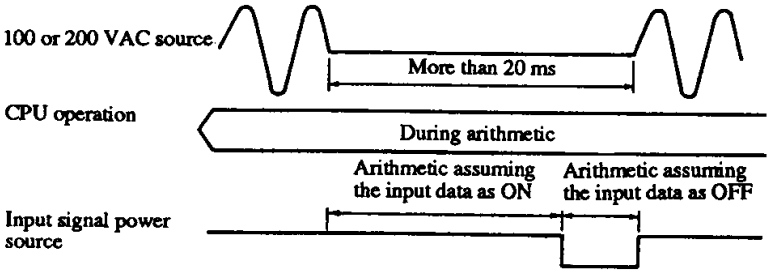
Note 1: Hold the input signal power source when the CPU performs the operation continuously. When it is not held, the CPU performs arithmetic assuming the input data as OFF. Note that when the CPU particularly performs arithmetic for changing the power failure storage content by an input signal, the CPU may change the power failure storage content by mistake due to instantaneous power failure.

Note 2: When the CPU running condition is specified for external input and the input power source holding time is short (350 ms or less), the running may be stopped once.

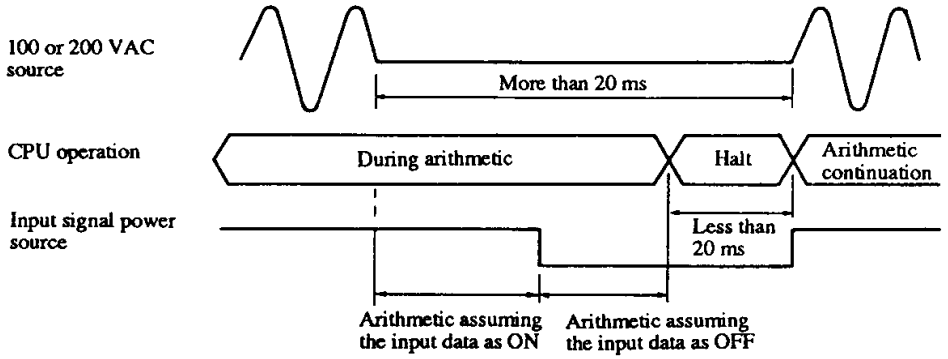
(b) Power failure of more than 20 ms

In the case of power failure of more than 20 ms, there are available cases such as continuation of running, halt and continuation of running, and stop and restart of running.

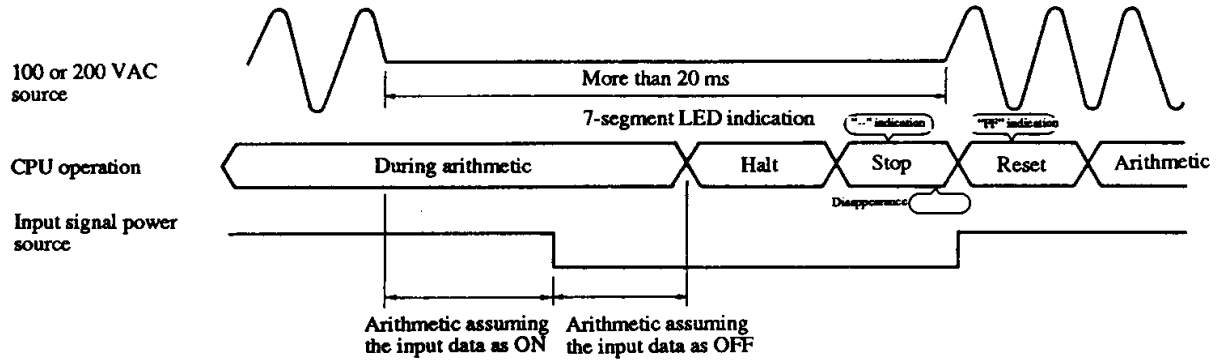
[1] Continuation of running



[2] Halt and continuation of running



[3] Stop and restart of running



A power failure of each power module of the H-series is detected by a voltage drop of the internal DC source. Therefore, the holding time varies with the number of mounted modules and arithmetic may be continued for 20 to 350 ms.

For an instantaneous power failure which exceeds this holding time, arithmetic is executed once again through reset and initial processing.

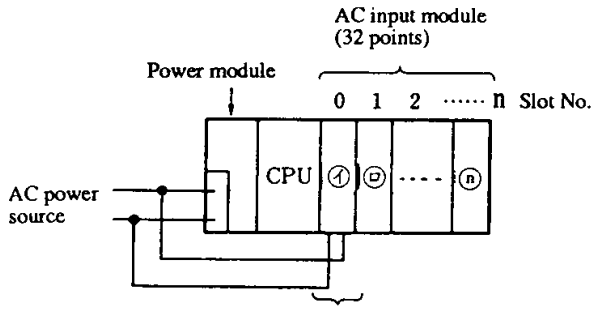
As the number of modules decreases, the power holding time increases (see the item of "Power failure of more than 20 ms" mentioned above), and the input is turned off first, and the CPU performs arithmetic using the input data.

When such a phenomenon is faulty:

1) Change the input power source of the input module to a DC source and set the holding time to 350 ms or more.

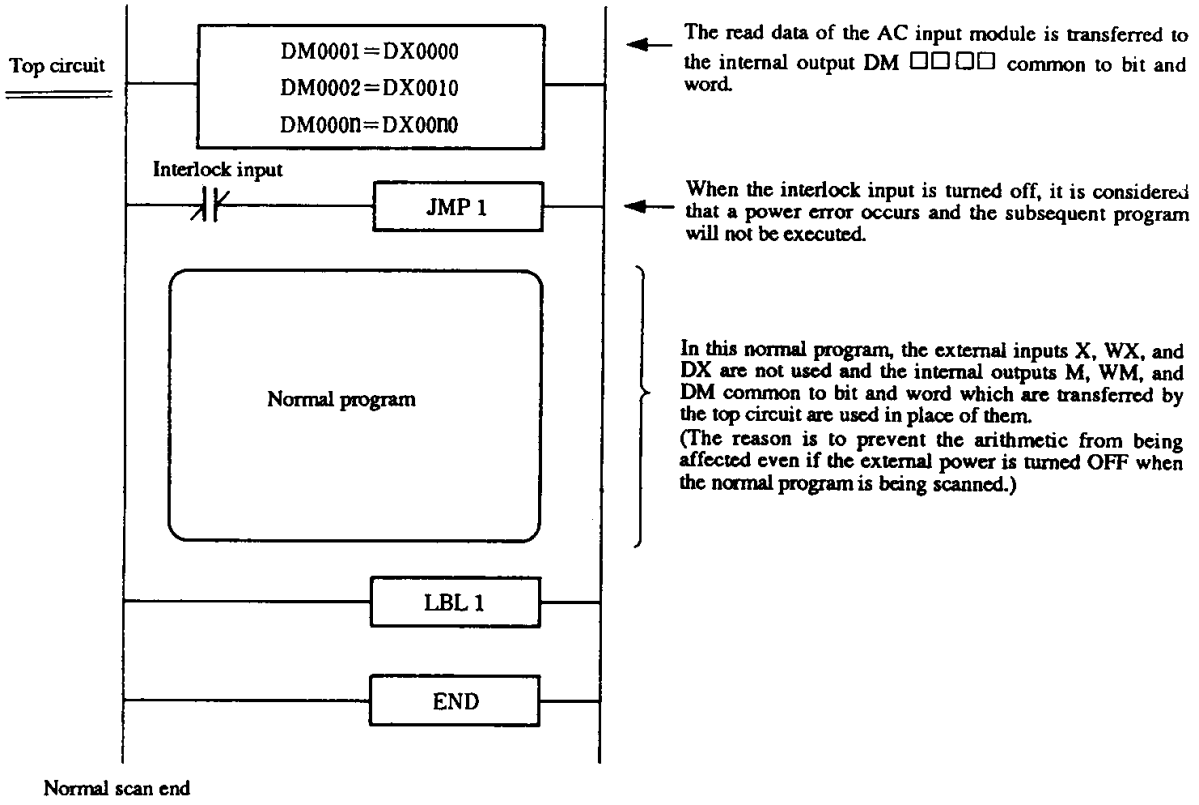
2) Supply the voltage of the power module to one of the points of the AC input module of the programmable controller and stop arithmetic forcibly by using it as an interlock. (An example is shown on the next page.)

Configuration



AVR: Power module
CPU: CPU module
[a]: DX0000
[b]: DX0010

Program



Arithmetic halt program example when power fails

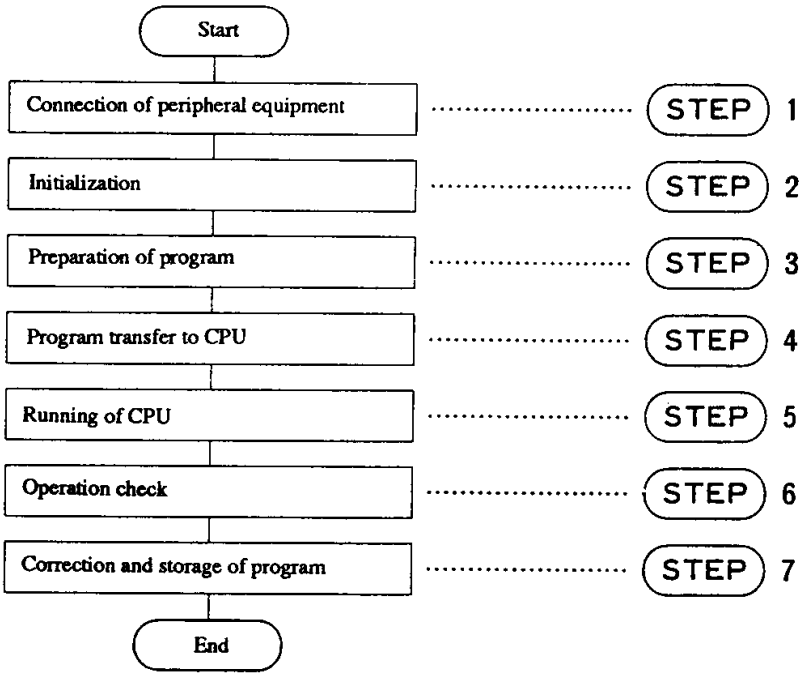
Note: In this program example, the interlock input is turned OFF and the timer is updated inside the sequencer even if the normal program is not executed.

13.3 Simple Operation Example

In this section, to allow the user to fully understand the basic operation of the H-series, minimum contents which are required to be executed among the processes from unpacking to operation check by a simple relay ladder program and concrete operation examples will be explained.

(1) Operation check procedure

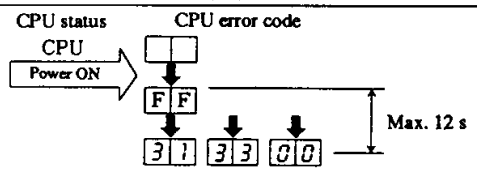
Check the operation as specified below.



An example using the graphic programming console and HILDRL as peripheral equipment will be described. For further details, refer to the manuals (instruction manuals) of graphic programming console, portable graphic programmer, and command programmer.

In this example, CPU2-07H is assumed as a CPU module and RAM2-08H as a memory cassette.

(2) Execution contents and operational points

Step	Item	Execution contents, operational points	Check
1	Connection of peripheral equipment (When the graphic programming console is used)	[1] Prepare a graphic programming console system floppy disk (MS-DOS) and HI-LADDER/HI-COMMAND system floppy disk (HILDRL). (Attached to the graphic programming console) [2] Turn the power switch of the graphic programming console on. [3] Insert the MS-DOS system floppy disk into the floppy disk driver on the left and press the [A] key. A> is displayed. ⇓ Remove the MS-DOS system floppy disk, insert the HILDRL system floppy disk in place of it, and press the "HILDRL" [RETURN] key. ⇓ The initial screen will be displayed within about 20 seconds.	
2	Initialization	 [1] Select ON LINE programming. [2] Initialize the CPU and GPC. [3] CPU setting: Set the CPU type to H-700. : Set the memory type to RAM-08H. [4] Allocate I/O.	
3	Preparation of program (Ladder circuit)	[1] "Programming mode" → Select EDIT. [2] Select WRITE NEXT. [3] Circuit element input → [ENT] — Prepare the circuit according to the procedure of [STA]. Circuit preparation (The circuit is registered in the memory of the graphic programming console by [STA].)	
4	Transfer of program to CPU (Unnecessary when the direct programming mode of the graphic programming console is used)	[1] Select Memory Transfer (GPC → CPU, program) and transfer the program. [2] Be sure to execute it when the circuit is corrected by the graphic programming console. [3] GPC = CPU (Program verify)	
5	Running of CPU	 Change the running switch to RUN.	
6	Operation check	[1] Check the I/O operation status by the indication of the I/O LED. [2] Check the operation of the program by the monitor function. [3] Check whether the external load operation is correct.	
7	Correction and storage of program	[1] EDIT → CHANGE function [2] Correct the program. [3] Transfer the program. [4] Save the program on a floppy disk.	

13.4 Checking I/O Cables

[1] Checking external programming console cables

[2] Checking external output device cables

(1) Checking external programming console cables

The checking procedure is as follows:

[1] Check that the CPU is stopped.

[2] Turn the power switch of the external programming console on.

[3] By manually turning the external input ON or OFF, check the cables of the external programming console.

Check the cables by confirming the ON or OFF status of the external I/O device by the following means.

Checking method		Description
Using the LED module of the I/O unit		Check the condition of each cable by confirming that the LED corresponding to input of the LED module lights.
Monitor by peripheral equipment	I/O monitor	Check the condition of each cable by specifying the input number by the monitor function of the programming device and reading the input status.
	List monitor (only graphic programming console)	This is a function which can monitor the input status of up to 64 points at one time and improves the check efficiency.

For details of the monitor function, refer to the following item of the instruction manual of each peripheral equipment.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Chapter 10, "Monitor", of the programming edition
Portable graphic programmer (PGM-GPH)	Chapter 5, "Monitor"
Command programmer (PGM-CHH)	Chapter 5, "Monitor (Manual)"

(2) Checking external output device cables

The checking procedure is as follows:

[1] Check that the CPU is stopped.

[2] Turn the power switch of the external programming console on.

[3] Check the interlock and security of the external output device.

[4] Check the cables of the external output device.

When checking the cables of the external output device, turn each of the output bits of the output module ON or OFF using the "Forced Output" function and check that the terminal device operate correctly.

Do not use the "Forced Set, Reset" function for this output cable check. Otherwise, data in the CPU which is preset is outputted simultaneously and an unexpected operation may be caused. Be sure to use the "Forced Output" function.

For details of the "Forced Output" function, refer to the following item of the instruction manual of each peripheral equipment.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Section 10.4, "Forced Output", of Chapter 10, "Monitor", of the programming edition
Portable graphic programmer (PGM-GPH)	Section 5.4, "Forced Output", of Chapter 5, "Monitor"
Command programmer (PGM-CHH)	Section 5.4, "Forced Output (Manual)", of Chapter 5, "Monitor"

13.5 Programming

A program is prepared by GPCL and written into the CPU by memory transfer or a program is prepared directly in the CPU by the portable graphic programmer or command programmer.

For starting the peripheral equipment, see Section 13.3.

For detailed language explanation necessary for programming, refer to the software edition.

When regenerating and using a program stored on a floppy disk or cassette tape, refer to the following item of the instruction manual of each peripheral equipment.

<table>
<tr><td>Programming method</td><td colspan="4">Peripheral equipment and operation method
Refer to the following data.</td></tr>
<tr><td rowspan="4">Newly programming by the peripheral equipment</td><td>Peripheral equipment</td><td colspan="3">Operation method</td></tr>
<tr><td>Graphic programming console (GPCL)</td><td colspan="3">Introduction of Software Edition of the graphic programming console (GPCL) instruction manual, etc.</td></tr>
<tr><td>Portable graphic programmer (PGM-GPH)</td><td colspan="3">Chapter 4, "Programming", of the portable graphic programmer instruction manual, etc.</td></tr>
<tr><td>Command programmer (PGM-CHH)</td><td colspan="3">Chapter 4, "Programming", of the command programmer manual, etc.</td></tr>
<tr><td rowspan="5">Loading a program recorded on a cassette or floppy disk into the CPU</td><td>Recording medium</td><td>Programming device</td><td colspan="2">Operation method</td></tr>
<tr><td rowspan="3">Audio cassette tape recorder (CMT)</td><td>Graphic programming console (GPCL)</td><td colspan="2">Section 7.2, "CMT", of Chapter 7 of the programming edition of the graphic programming console (GPCL) instruction manual</td></tr>
<tr><td>Portable graphic programmer (PGM-GPH)</td><td colspan="2">Section 6.6, "Cassette (CMT) Interface" of Chapter 6 of the portable graphic programmer instruction manual</td></tr>
<tr><td>Command programmer (PGM-CHH)</td><td colspan="2">Section 6.6, "Cassette (CMT) Interface" of Chapter 6 of the command programmer manual</td></tr>
<tr><td>3.5" floppy disk drive (FDD)</td><td>Graphic programming console (GPCL)</td><td colspan="2">Section 7.1, "FDD" of Chapter 7 of the programming edition of the graphic programming console (GPCL) instruction manual</td></tr>
<tr><td>Using a program recorded in the ROM</td><td colspan="4">See the item of ROM mounting in Section 12.2.(3).(b) of this manual. When the ROM is mounted, perform memory transfer from CPU to GPC.</td></tr>
</table>

13.6 Trial Run

The trial running procedure is as follows:

[1] Interlock check
[2] Running at no load
[2] Running at an actual load

(1) Interlock check

Check that the interlock function operates surely to prevent an emergency.

Install the emergency stop circuit, protection circuit, and interlock circuit outside the programmable controller.

(2) Running at no load

Before operating the system load actually, operate only the program mimically to check the operation of the program..

When there are possibilities that the remote machine may be damaged due to an expected operation caused by a program error or any other damage is caused, be sure to execute running at no load.

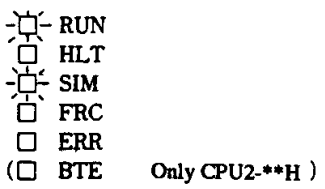
The H-series PC provides the following functions which are convenient for the above program debug.

Function	Use	Description	Peripheral equipment
① Simulation	The external output is not operated and only the output indicator lamp is operated according to the program.	This function is used to check the program operation by outputting no data to the outside and allowing only the LED module to blink.	Graphic programming console Portable graphic programmer Command programmer

For details of the simulation function, refer to the following item of the instruction manual of each peripheral equipment.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Chapter 13, "Simulation", of the programming edition
Portable graphic programmer (PGM-GPH)	Chapter 8, "Simulation"
Command programmer (PGM-CHH)	Chapter 8, "Simulation (Manual)"

When the simulation function is set, the SIM part of the status indication LED of the CPU unit lights.



Function		Use	Description	Peripheral equipment
② Debug function	Break point	• To check the quick programming timing	When the CPU is executed by the continuous execution function, the CPU is stopped at the contact (symbol) which is set in the program or the circuit.	Graphic programming console
	Scan run	• To stop and check the program operation when the programming condition is satisfied	The function is used to scan by the specified times (1 to 9999 times) from the top circuit of the program. The scan starts at the location where the CPU is stopped at present and stops at the scan end (final circuit) after scanning by the specified times.	
	Step run		The CPU executes in symbol or command units according to movement of the cursor from the current execution location.	
	Execution stop circuit display		The circuits on one screen starting with the circuit containing the location where the CPU is stopped in execution are displayed and monitored. The cursor is positioned at the execution stop part.	
	CPU halt specification		The execution of the CPU by the debug scan run function or continuous execution function is stopped at the scan end (final circuit).	
	Continuous execution		The CPU executes from the location where it is stopped in execution.	

For details of the debug function, refer to the following items of the instruction manual of the programming device shown below.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Section 10.5, "Debug Execution", of Chapter 10 of the programming edition
	Chapter 14, "Debug", of the programming edition.

Function	Use	Description	Peripheral equipment
③ Force	• To set input forcibly when actual input is disabled	The function is used to input mimically instead of actual input. The specified I/O status is held at the specified value regardless of input from the external cable.	Graphic programming console Portable graphic programmer Command programmer
	• To keep a part of output in a fixed status regardless of the program	The output status is held at the specified value regardless of the arithmetic content and result of the CPU.	
④ Forced set or reset	• To continue the control status forcibly or to change the internal or external output status forcibly	The internal or external output is forcibly set.	

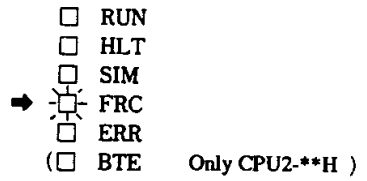
For details of the forced set and reset function, refer to the following item of the instruction manual of each programming device.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Section 10.3, "Forced Set, Reset", of Chapter 10 of the programming edition
Portable graphic programmer (PGM-GPH)	Section 5.3, "Forced Set, Reset", of Chapter 5
Command programmer (PGM-CHH)	Section 5.3, "Forced Set, Reset (Manual)", of Chapter 5

For details of the force function, refer to the following item of the instruction manual of each programming device.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Chapter 12, "Force", of the programming edition
Portable graphic programmer (PGM-GPH)	Section 5.6, "Force", of Chapter 5
Command programmer (PGM-CHH)	Section 5.6, "Force (Manual)", of Chapter 5

When the force function is set, the FRC part of the status indication LED of the CPU unit lights.



The monitor function is used for operation check.

The following monitor functions are available.

No.	Function	Description	Peripheral equipment
1	Circuit monitor	The function specifies the circuit number, I/O number, and tool number, searches and displays the circuit, and displays the ON or OFF status of the contact coil.	Graphic programming console Portable graphic programmer Command programmer
2	I/O monitor	The function displays the ON or OFF status of the specified I/O (internal output included) and word content on the message display unit independently of and simultaneously with the circuit monitor function.	Graphic programming console Portable graphic programmer Command programmer
3	List monitor	The function monitors points in units of 16 points (in units of 16 words) continuously from the specified I/O number. Up to 64 points (64 words) can be monitored on one screen.	Graphic programming console
4	Command monitor	The function displays the circuit ON or OFF status in a command word in circuit or command units.	Graphic programming console Portable graphic programmer Command programmer
5	A plurality of circuits monitor	The function specifies and monitors the circuit number, I/O number, and application command of each of up to 4 circuits.	Graphic programming console

For details of the monitor function, refer to the following item of the instruction manual of each programming device.

Peripheral equipment	Item to be referred to
Graphic programming console (GPCL)	Chapter 10, "Monitor", of the programming edition
Portable graphic programmer (PGM-GPH)	Chapter 5, "Monitor"
Command programmer (PGM-CHH)	Chapter 5, "Monitor"

(3) Running at an actual load

Turn the external signal power source ON and check the operation of external input and output.

The procedure is the same as that of Running at No Load in Item (2) except operation of the load. Refer to Item (2).

13.7 Control of Running and Stop

A method for control of running and stop of the H-series PC is as follows:

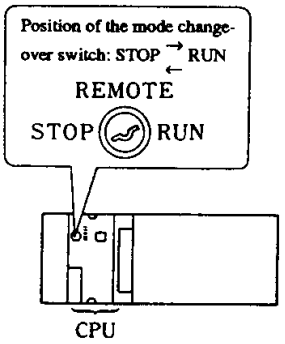
[1] Running and stop by the mode changeover switch of the CPU

[2] Debug running by the peripheral equipment

[3] Remote control by the host computer

(1) Running and stop by the mode changeover switch

There are the following two methods available depending on setting or non-setting of input definition of running control (set by the peripheral equipment beforehand).



[1] No input definition is set.

Changeover switch STOP: Stop

RUN: Running of the user program

[2] Input definition is set. (Running control at a special point)

Changeover switch STOP: Stop

RUN: Running or stop is selected by turning only one defined special bit I/O point ON or OFF.

Input definition is given in the system mode of the peripheral equipment (CPU setting → running parameter → running control).

Input definition of I/O

One of the I/O signals (X□□□□□, R□□□□□, L□□□□□, M□□□□□) defined beforehand. When the PC receives ON or OFF of the defined signal from the outside of the PC, it switches running or stop of the PC.

Running conditions

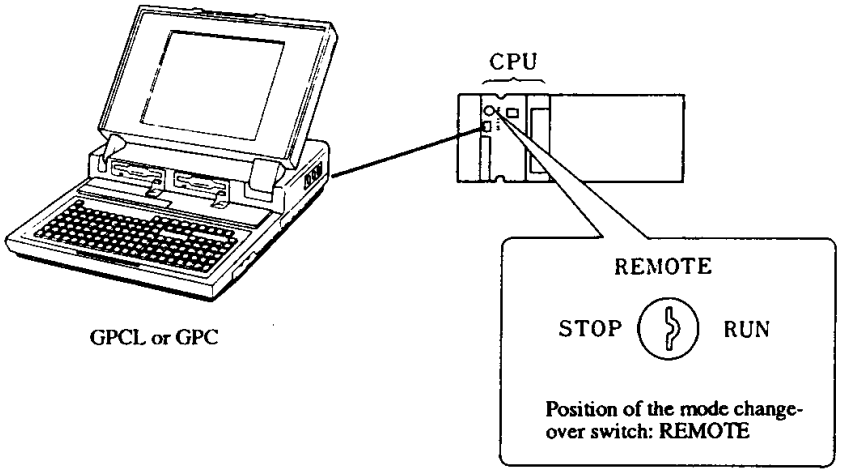
[1] When the running control input contact is specified by a parameter, the input contact should be ON.

[2] The CPU should be free of errors. (The ERR indicator LED should be off.)

[3] Writing and transfer of the user program from the peripheral equipment should be finished (when the user program is being transferred, the PC starts running after the transfer is finished).

[4] The special internal output RUN inhibition status (R7E9) should be OFF. The CPU checks the syntax of the program before starting running. If no error is found, running starts normally and the RUN LED lights.

(2) Debug running by the peripheral equipment



For debug running of the program, the graphic input device (GPCL) is used. Set the mode changeover switch of the CPU to REMOTE. The following two statuses of the CPU are available for debug.

1. Debug RUN: The user program is executed by an instruction from the peripheral equipment.
   - [1] Scan RUN
   - [2] Step RUN
   - [3] Continuous execution
2. Debug HALT: The user program is halted by an instruction from the peripheral equipment.

Running conditions

[1] The mode changeover switch of the CPU should be set at REMOTE.

[2] The special internal output debug permission status (R7C5) should be ON.

[3] When the running control input contact is specified by a parameter, the input contact should be ON.

[4] The user program should not be written and transferred from another peripheral equipment.

[5] The special internal output RUN inhibition status (R7E9) should be OFF.

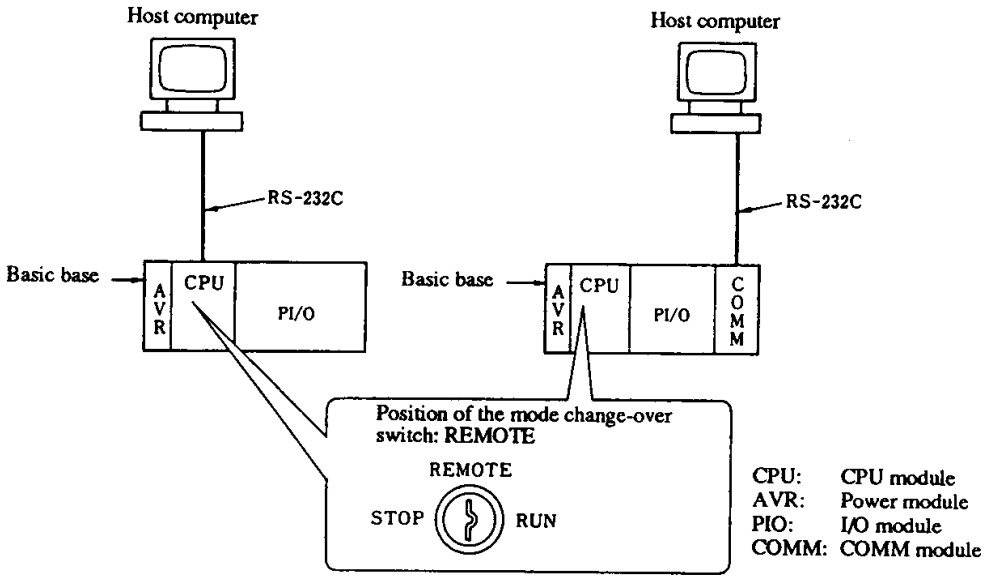
[6] The CPU should be free of errors. (The ERR indicator LED should be off.)

Note:

The debug function of the user program cannot be performed by the portable graphic programmer (PGM-GOH) and command programmer (PGM-CHH).

(3) Remote running control by the host computer

There are two methods available; one is a method using the CPU module and the other is a method using the COMM module.



When the host computer issues a task code (CPU control code) to the PC, the user program runs or stops.

The communication procedure dedicated to the H-series (high protocol) is used for communication between the host computer and PC. Therefore, when applying remote control, refer to Chapter 6 of the software edition or the software edition of the COMM module instruction manual.

Task code example:

CPU control: Reading of the CPU status (H10), running or stop of the CPU (H11)

I/O control: I/O No. specification monitor (H40), I/O forced set or reset (H42)

When one of the above task codes is used, the PC runs or stops, or I/O signals are monitored, or special internal output or I/O signals are set or reset forcibly.

Running conditions

[1] The mode changeover switch of the CPU should be set at REMOTE.

[2] When running the PC, the special internal output remote RUN permission status (R7C3) should be ON. When stopping the PC, the remote STOP permission status (R7C4) should be ON.

[3] When the running control input contact is specified by a parameter, the input contact should be ON.

[4] The CPU should be free of errors. (The ERR indicator LED should be off.)

[5] The user program should not be written and transferred from another peripheral equipment.

[6] The special internal output RUN inhibition status (R7E9) should be OFF.

When running starts normally, the RUN LED lights.

13.8 Running in Case of an Error

Running in case of an error is that the PC does not stop but continues running when a PC error occurs (only a minor fault).

Use this function temporarily for maintenance such as debugging of the CPU. If the normal running takes place when the running in case of an error mode is set, phenomena such that the scan time is delayed or the periodic interruption interval becomes irregular may be caused.

The running in case of an error mode can be specified only when one of the following error codes (E. CODE) is displayed.

Error code (E. CODE)	Error name	Description	Location where the running mode is set
41	I/O information check error	The actual modules do not conform to the I/O allocation table.	Set the running parameter "I/O allocation mismatch" to 1.
43	Remote error	An error in the remote I/O master station or remote I/O local station	Set the running parameter "Remote error" to 1 and "Remote calling station error" to 1.
44	Delay error (normal scan)	The normal scanning time is more than the specified one.	Set the special internal output R7C0 to 1.
45	Delay error (periodic scan)	The periodic scan does not end within the shortest periodic time.	Set the special internal output R7C1 to 1.
46	Delay error (interruption scan)	The same interruption is caused during interruption scanning.	Set the special internal output R7C2 to 1.
47	I/O allocation points over	The number of allocation I/O points is more than the maximum value of the CPU.	Set the running parameter "I/O allocation mismatch" to 1.
48	HI-FLOW assemble error	• The I/O allocation when the HI-FLOW program is prepared does not match with the current I/O allocation. • The same timer or counter is used doubly with the ladder program. • The HI-FLOW timer or counter is not defined.	Set the special internal output R7DF to 1.

The running mode is set by the peripheral equipment. Select the following system mode by the peripheral equipment and set the running mode.

	System mode to be selected
Running parameter:	CPU setting → running parameter
Special internal output set or reset:	Monitor → list monitor → I/O monitor → forced set or reset

Part IV

Maintenance, Inspection, Error Recovery

Chapter 14 Inspection and Maintenance

To use the H-series system functions correctly and provide the normal system operation, the routine or periodic system inspection is required.

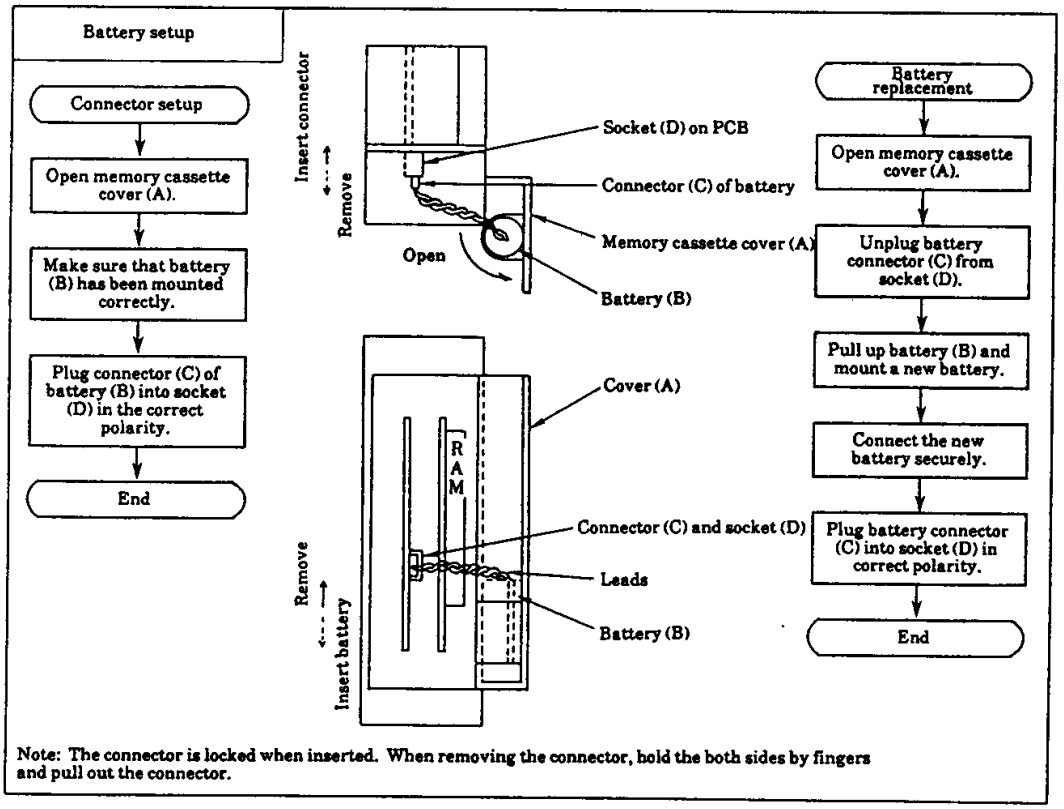
This chapter explains the H-series inspection items and error recovery procedure if an error occurs.

14.1 Routine Inspection

Table 14.1 Routine Inspection Items

Item	Lamp indication	Inspection	Normal operation	Abnormal operation	Possible errors
Power lamp check (power module)	POW	Visual	Lamp On	Lamp Off	Power failure or error in power system
Operation status check	RUN	Visual	Lamp On (Operation)	Lamp Off (Stop)	
Error occurrence (CPU module)	ERR	Visual	Lamp Off	Lamp On	Cycle time over error, syntax error, microcomputer overrun, or problem in power supply
Battery voltage check		Check R7D9 using the programmer.	Off	On	Dropped battery voltage or improper battery mounting *

* If the battery voltage drop indicator turns on and if the new battery is not mounted within 1 week, the memory contents may be destroyed. If the power supply is left off for a long time, this error cannot be detected.



Note: The connector is locked when inserted. When removing the connector, hold the both sides by fingers and pull out the connector.

14.2 Periodical Inspection

Table 14.2 Periodic Inspection Items

System Device	Inspection Item	Standard	Remarks
Between programmer and CPU	Programmer operation check	All key switches and indicators should operate normally.	
Power supply	Power voltage variation	Within 100/200 VAC +10%/-15%	Multimeter (or VOM)
		5.1 +0.1 VDC	Digital voltmeter (class 0.5)
PI/O module	Service life of output relay	Electrical: 100 thousand times Mechanical: 10 million times	See Table 7.3 for the switching requirements.
	LED	Should be switched normally.	
	External power voltage	Should meed the module specifications.	See the associated I/O module sections.
Battery	Check of voltage and service life	R7D9 should be off. Replace the battery within 2 years.	See the battery replacement section.
Mounting and connection	(1) Fixing of each unit (2) Fitting of each connector (3) Tighten screws (4) Signal and power cables	No problem should exist.	Retighten the unit screws. Plug in securely. Retighten the loosen screws. Visual inspection
Ambient conditions	(1) Temperature (2) Relative humidity (3) Others	0 to 55°C 20 to 90% (without condensation) No dust, foreign matter, or vibration exists.	Visual inspection
Spare parts	Shortage or defects	No problem should exist.	Visual inspection
Program	Check of program contents	Make sure that the program contents (saved on floppy disk, ROM or cassette tape) match the CPU contents.	

(2) Life of power modules

Many electrolytic capacitors are used in each power module. Each electrolytic capacitor has a life span and it is said that when the ambient temperature rises 10°C, the life span is halved.

The life span of each power module is about 5 years at an ambient temperature of 35°C. Fix the spares in consideration of the operational temperature requirements. Mount the power modules in consideration of the ventilation and ambient temperature to lengthen the life span.

To use the H-series system functions correctly and provide the normal system operation, the routine or periodic system inspection is required.

This chapter explains the H-series inspection items and error recovery procedure if an error occurs.

Chapter 15 Countermeasures for Faults and Errors

Parts to display errors which are detected by the CPU module or each device of the peripheral equipment in the H-series PC system are shown in Figure 15.1. Errors are displayed by error codes. Take action according to the error code list.

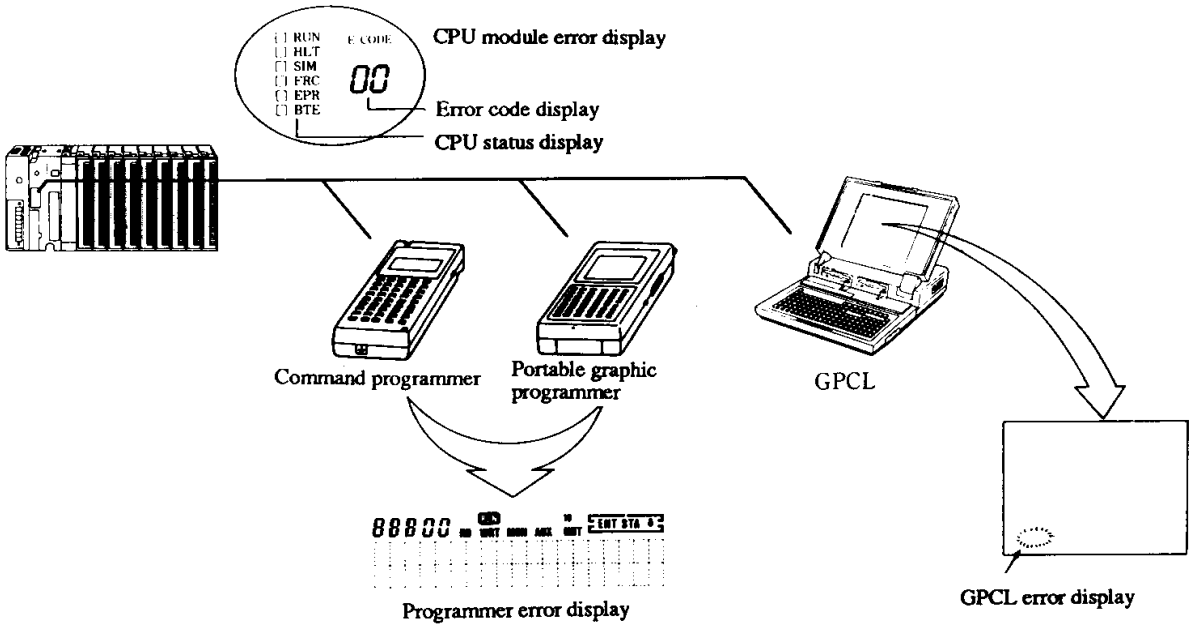


Figure 15.1 Error Display Part

In this section, an error displayed on the 7-segment (E. CODE) of the CPU module will be described. For error display of each peripheral device, communication function module, and advanced function module, refer to the corresponding instruction manual.

15.1 Error Recovery Method

(1) How to see error codes

The CPU module detects various errors by the self diagnosis function and displays the corresponding error codes. When an error occurs, refer to the 7-segment 2-digit numeral indicator (E. CODE) for error code display on the front of the CPU module and take an action corresponding to the displayed code.

Errors are classified into the following four groups depending on the significance level and an error recovery corresponding to each level is provided.

Table 15.1 Error Significance Level List

Significance level	Error code	Description	CPU running status
Major fault	Lamp off (blank) 10 - 88 FF ※1	Hardware error Peripheral equipment unconnectable	Running stop
Medium fault	20 - 30 -	Hardware error, program error Peripheral equipment connectable	Running stop
Minor fault	40 -	Program error, parameter setting error Peripheral equipment connectable	Running continuation or stop in case of an error can be selected. (Specified by the peripheral equipment)
Warning	50 - 60 - 70 -	The running of the PC is not affected. Peripheral equipment connectable	Continuous running

※1: When FF is displayed until the CPU is started up when power is turned on, it means normal operation.

The priority of 7-segment LED indications when a plurality of errors occur is as follows:

[1] When the error levels are different from each other

The display of a higher error level takes priority.

Example: If an error of a medium fault level (for example, 22: sequence processor error) occurs when an error of a warning level (for example, 71: battery error) is displayed, 22 is displayed.

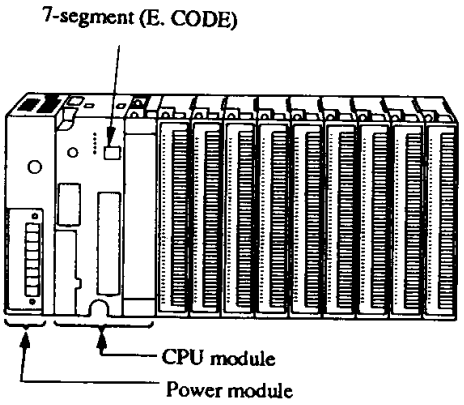
[2] When the error levels are the same

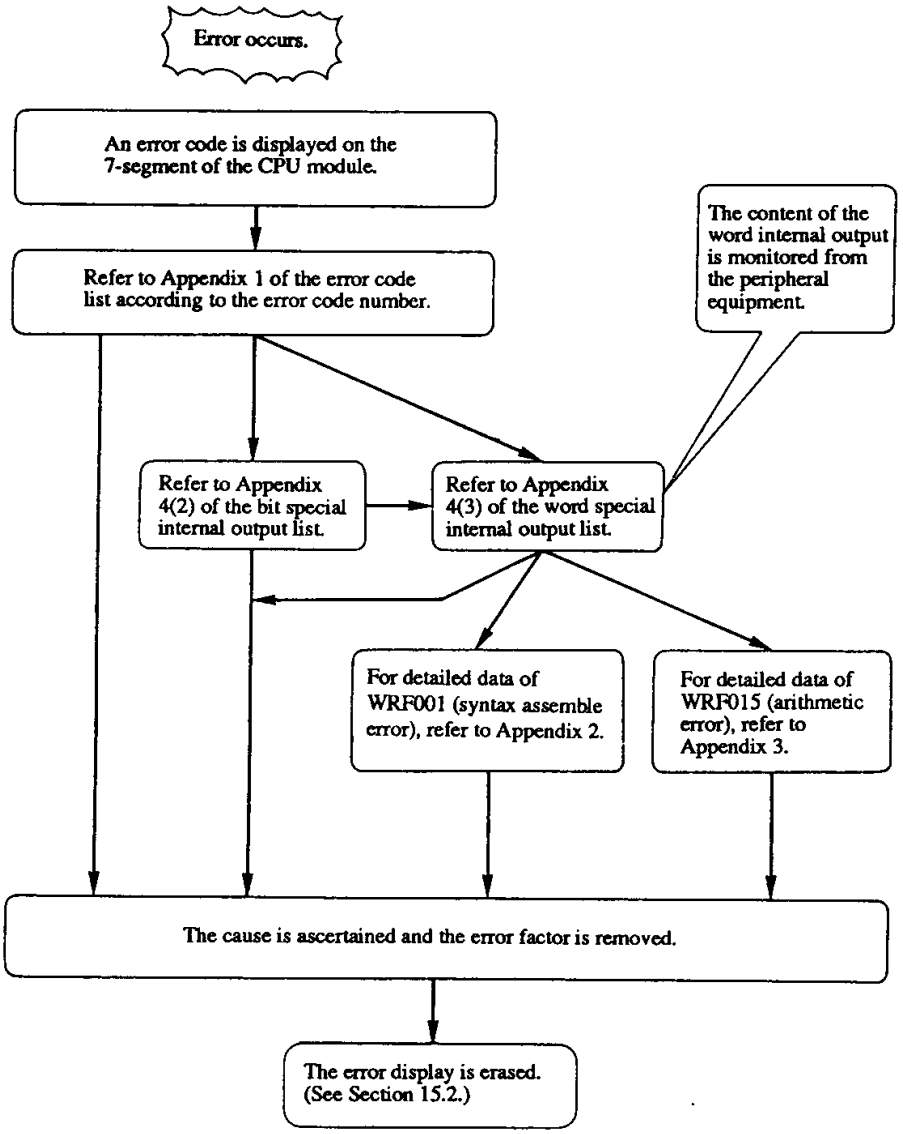
The display of an error which occurs last takes priority.

If "72: instantaneous power failure detection" occurs when "71: battery error" is displayed, 72 is displayed. (Both are errors of a warning level.)

When the error factor is removed and the internal output R7EB (or R7EC) is turned ON or the key switch of the CPU is changed (another mode is selected and then it is returned to the previous mode), the indication of the 7-segment LED is returned to 00. For further details, see Section 15.2.

(2) Error recovery procedure





15.2 How to erase the Error Display

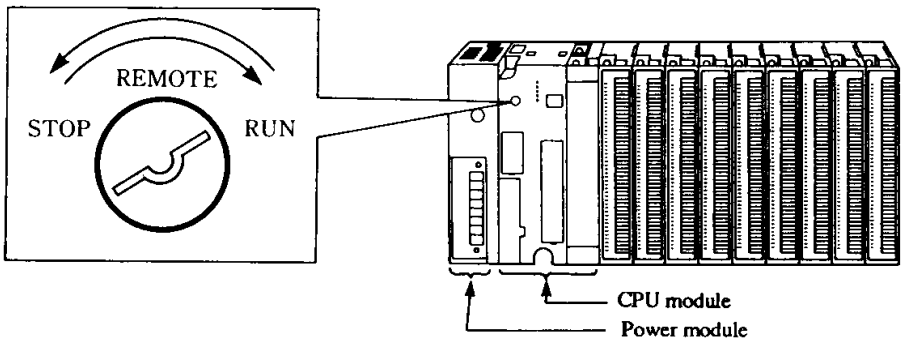
To save an error which occurs during running, the error indicator of the H-series CPU is kept on even after the error factor is removed.

To erase the error display forcibly, execute the following procedure.

(1) When the CPU is stopped

Turn the key switch of the CPU to STOP and then to RUN once again.

In this case, the 7-segment of the CPU displays 00. However, the error information is kept set in the error special internal output which records the CPU error type and details (an error analysis after recovery can be made). To reset the error information, execute the procedure described in (2) or turn the key switch to STOP and press the power failure storage reset switch (R.CL) on the front of the CPU module.



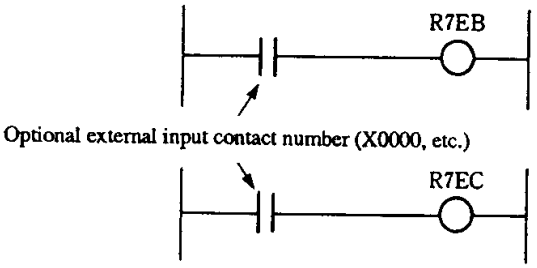
(2) When the CPU cannot be stopped because it is on-line (Reference)

(a) Clear only the 7-segment display.

Set 1 in the special internal output R7EB.

(b) Clear the 7-segment display and error special internal output.

Set 1 in the special internal output R7EC.



As a method for setting 1 in the special internal output, a method using a program as shown on the right or a method of forced set or reset by the peripheral equipment is available.

The range of special internal output which is cleared when 1 is set in R7EC is shown below.

Word special internal output

	No.
Self diagnosis error code	WRF000
Details of syntax assemble error	1
Details of I/O information mismatch	2
Details of communication function module mismatch	3
Communication function module error slot No.	4
I/O module error slot No.	5
Remote error slot No.	6
Link error slot No.	WRF007

Bit special internal output

	No.
Major fault error	R7C8
Sequence processor error	9
User memory error	A
P I/O bus error	B
User memory size over	C
I/O information check mismatch	D
Communication function module check mismatch	E
(Undefined)	R7CF
Remote error	R7D0
Delay error (normal scan)	1
Delay error (periodic scan)	2
Delay error (interruption scan)	3
Syntax assemble error	4
I/O module error	5
Allocation points over	6
Communication function module error	7
System bus error	8
Battery error	9
Instantaneous power failure detection	A
Self diagnosis error	B
(Undefined)	C
Communication function module allocation points over	D
Link module error	R7DE

Special internal output area which is cleared by the special internal output R7EC

When all of the special internal output data cannot be cleared due to execution of the program, clear only the corresponding error flag with reference to the error code list of Appendix 1.

Note: When the internal output R7DB (WRF000) of a self diagnosis error is used in the CPU run stop condition as a system error, R7DB is turned ON (WRF000 is H71) even if it is an error of warning or so (battery error [71]) and the CPU may be stopped. Do not use the internal output of a self diagnosis error as a CPU run stop condition.

Chapter 16 Troubleshooting

16.1 Checkpoints at Error Occurrence

If the H-series fails, check the following items:

(a) Power system

- The 100 or 200 VAC line should be set correctly (by the jumper pin).
- The source voltage should meet the voltage requirements. (The 100VAC line should be within the range of 85 to 132 VAC, and the 200VAC line should be within the range of 170 to 264 VAC.)
- There should be no distortion in the power waveforms.
- There should be no excessive noise in the power supply.
- The power fuse should not be blown out. All basic and expansion modules should be powered.
- The capacity of system power supply should be greater than the total capacity of modules.

(b) CPU and associated components

- The CPU should have been setup normally before startup.
- The switch (unit No.) of the IOC-01H I/O controller should be set correctly.
- No error code should be displayed.
- The mode selector switch should be set to the correct position.
- The memory cassette should be mounted correctly.
  - Correct RAM and ROM type
  - Appropriate memory size
  - Battery mounted

(c) Input modules

- The modules and their input power voltages should meet the specifications.
- The module input voltages should meet the specifications.
- No chattering should occur in the input signal. The input modules should be numbered correctly in the program.

- Cabling and wiring of input modules should be correct.

(d) **Output modules**

- The modules and their load voltages should meet the specifications.
- The loads and their power supplies should meet the specifications.
- The fuse should not be blown out.
- There should be no chattering in the output waveforms.
- The output modules should be numbered correctly in the program.
- Cabling and wiring of output modules should be correct.

(e) **Cabling and wiring**

- The power module should be grounded with the class-3 FG line.
- Cables between expansion modules should be separated from other cables.
- The power cables should be separated from signal I/O cables.
- The connector pins of all modules should not be bent.

(f) **Communication function modules**

- The T×D and R×D signal cables should have been connected correctly.
- The remote station, CPU link, and COMM setup switches should have been set correctly.
- Cables should not be disconnected or in poor contact.
- Signal cables should be separated from high-voltage power cables (except for optical fiber cables)
- The cables should not contain the resistance leads for the arrester.

- No error code should be displayed on the module.

The remote I/O modules should be connected as follows:

R×D of host station to T×D-R of substation-1
T×D of host station to R×D-R of substation-1
R×D-T of substation-1 to T×D-R of substation-2
T×D-T of substation-1 to R×D-R of substation-2

The R×D-T and T×D-T terminals of end substation should be jumpered.

16.2 Troubleshooting Notes

(a) Turn off the power supply and replace a module, if necessary.

(b) When returning a module for repair, attach as much fault information as possible.

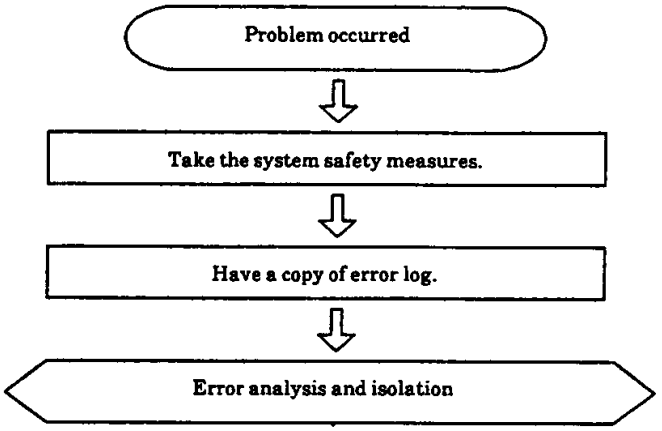
(c) If terminals are in poor contact, wipe the terminal contacts with a soft cloth dipped in the alcohol. There should remain any foreign matter on the contact surface.

(d) The following tools may be required for troubleshooting:

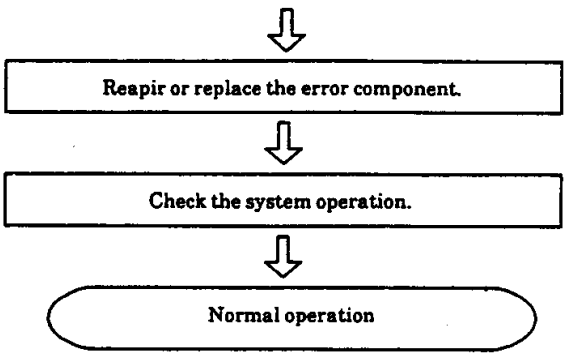
(i) Philips and flat-blade screwdrivers
(ii) Digital voltmeter or multimeter
(iii) Oscilloscope (special case)

16.3 Troubleshooting Procedure

The following shows the standard processing flowchart that should be used if a problem occurs.

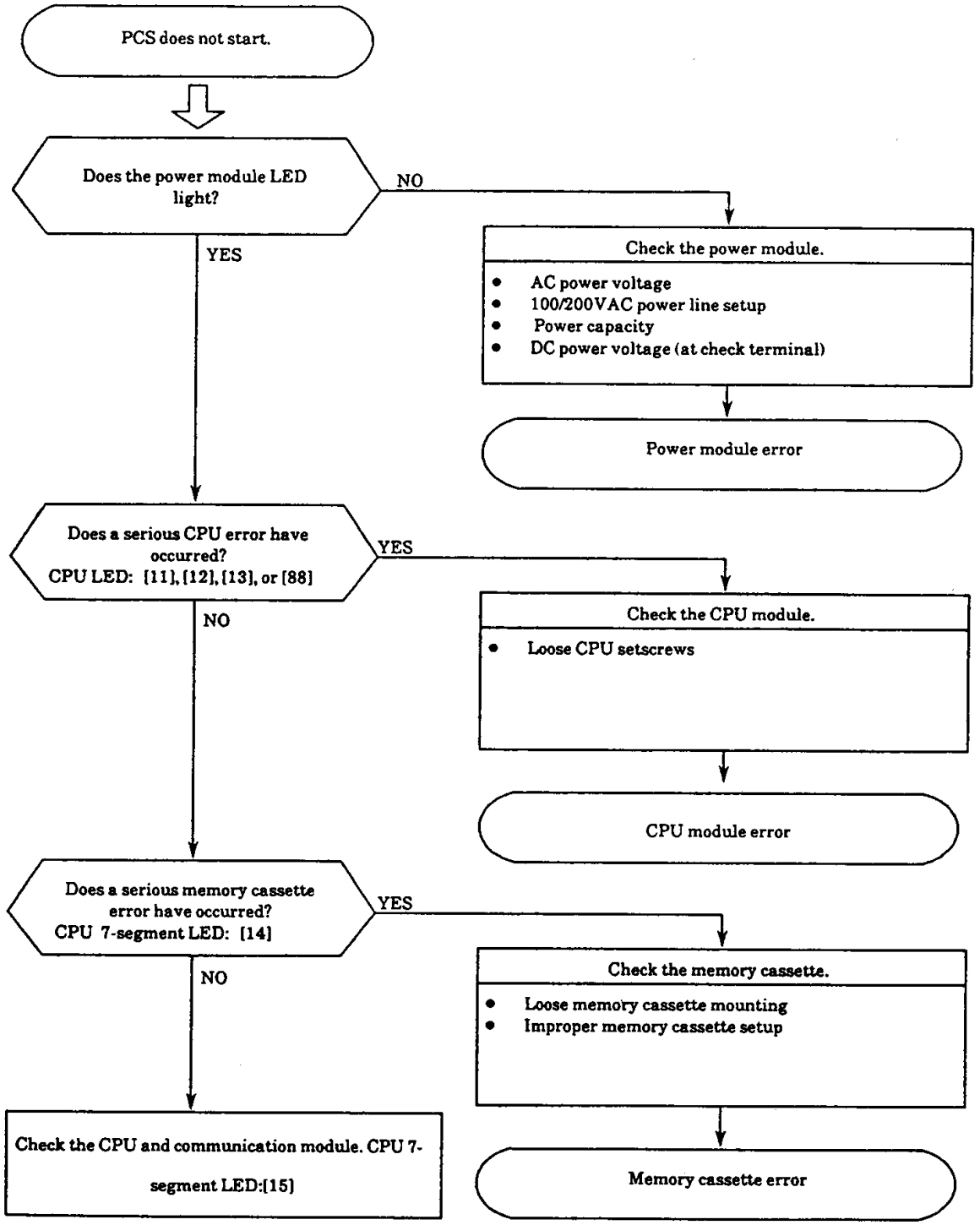


Problem	Checkpoints	Possible cause
PCS does not starts.	Power LED, and CPU error code and LED	Problem in power supply, power failure, insufficient power capacity, serious CPU error, or loose memory cassette
System does not start at all.	CPU error code and LED, and internal error output	I/O assignment error, incorrect parameter setup, program error, syntax error, or start conditions not satisfied
Operation stops.	Power LED, and CPU error code and LED	Problem in power supply, remote error, abnormal power supply of expansion module or its power failure, CPU error, memory error, communication module error, or base error
Incorrect input or no input to the input module	CPU LED, I/O LED, and monitor from peripherals	Force Control specified, user program timing error, problem in input power supply, I/OC assignment error, connection error, input module error, or I/O noise
Incorrect output or no output from the output module	CPU LED, I/O LED, and forced set/reset from peripherals	Force Control specified, simulation specified, user program error, setup error, connection error, output module error, or I/O induction noise
Communication error	CPU error code and LED, internal error output, and communication module error code	CPU error, communication module error, problem in communication module power supply, or communication cable error
Pheipherals cannot be connected	CPU error code or LED, and peripherals	Serious CPU error, loose memory cassette, or peripheral device error



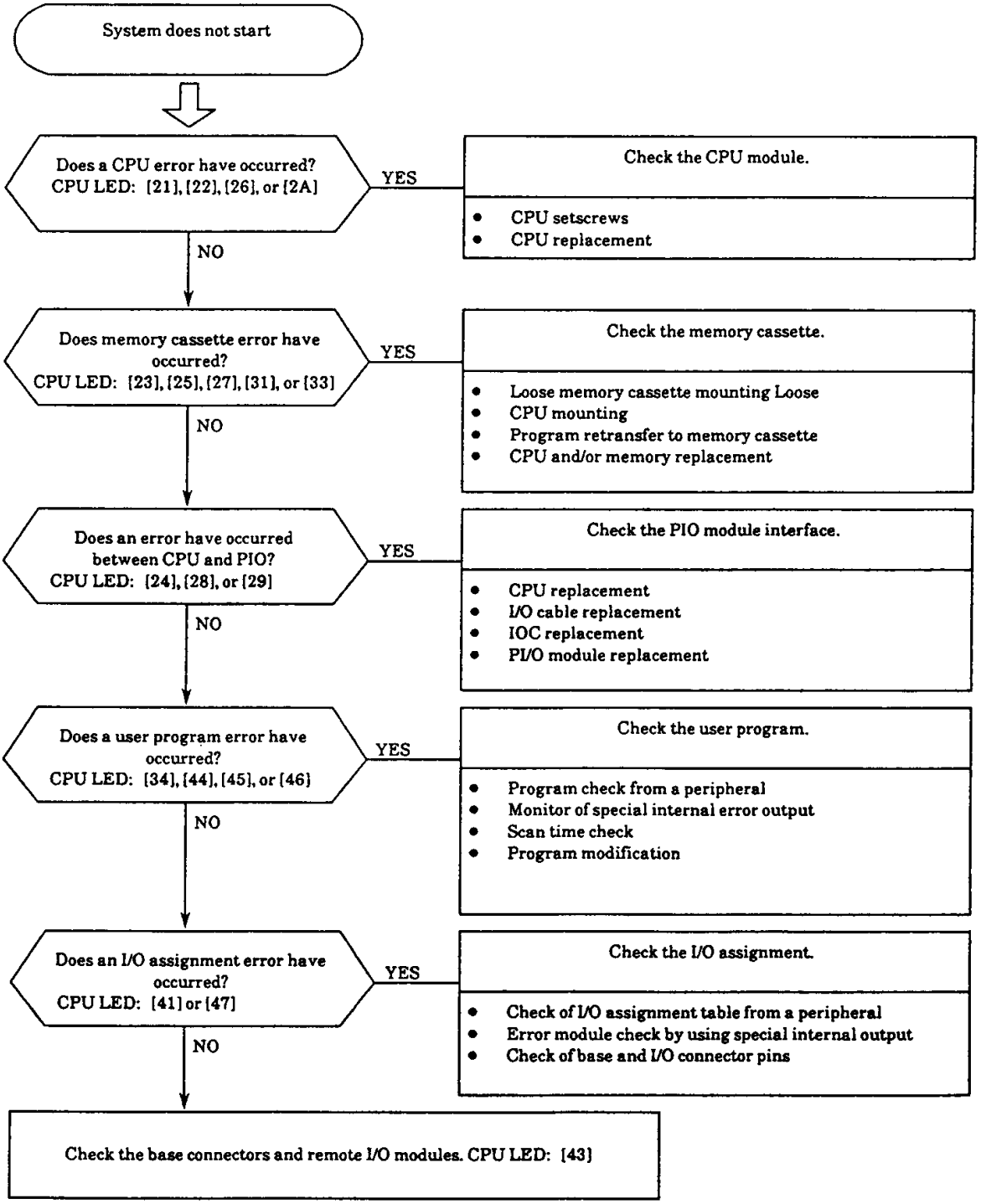
(1) PCS does not start.

Message "00" does not appear on the LED display of the CPU when the power supply is turned on. The peripherals are electrically not connected.



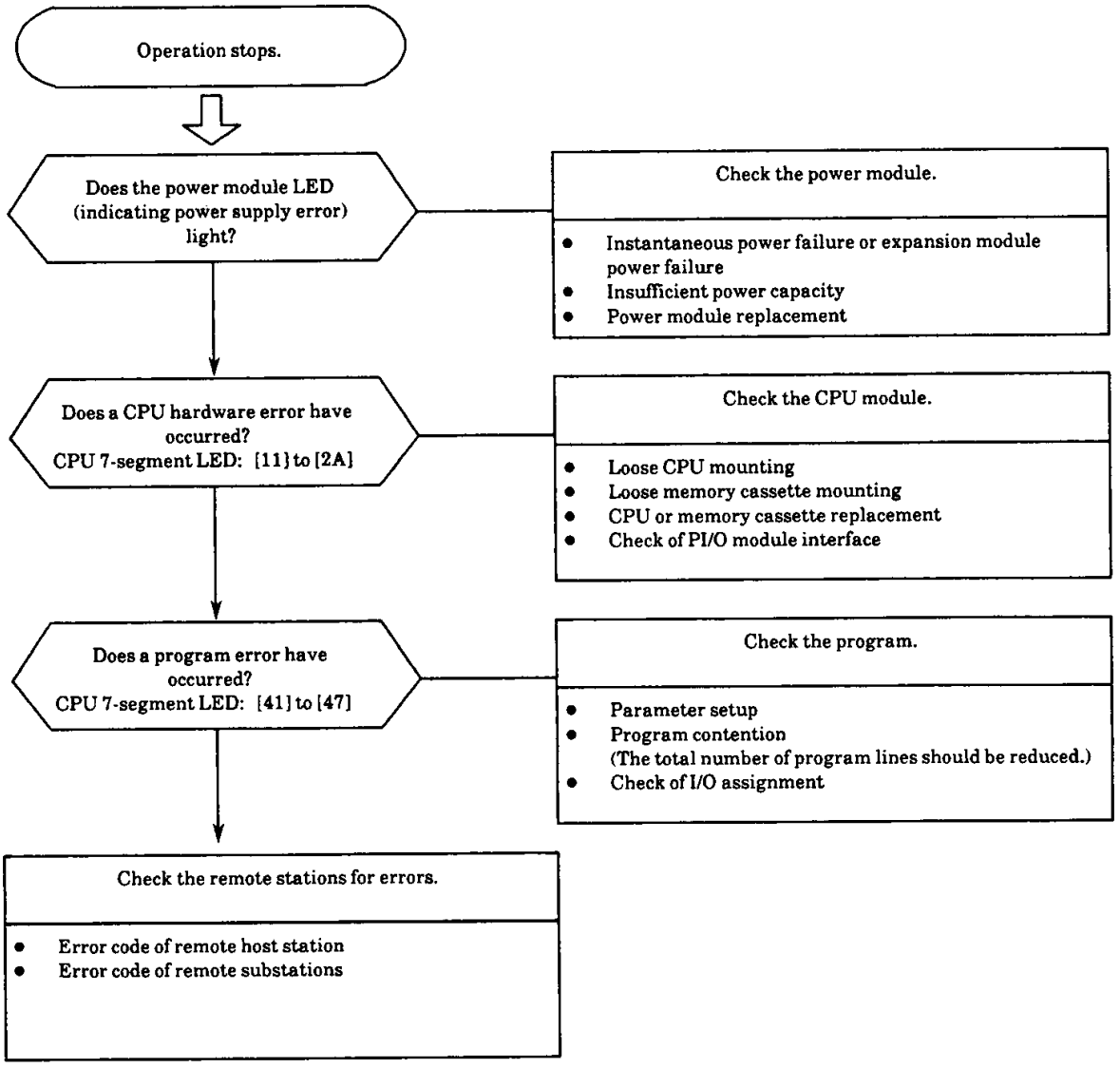
(2) System does not start at all.

The CPU does not start (that is, the RUN LED does not light) although the PCS start conditions are all satisfied. However, the peripheral devices can be connected.

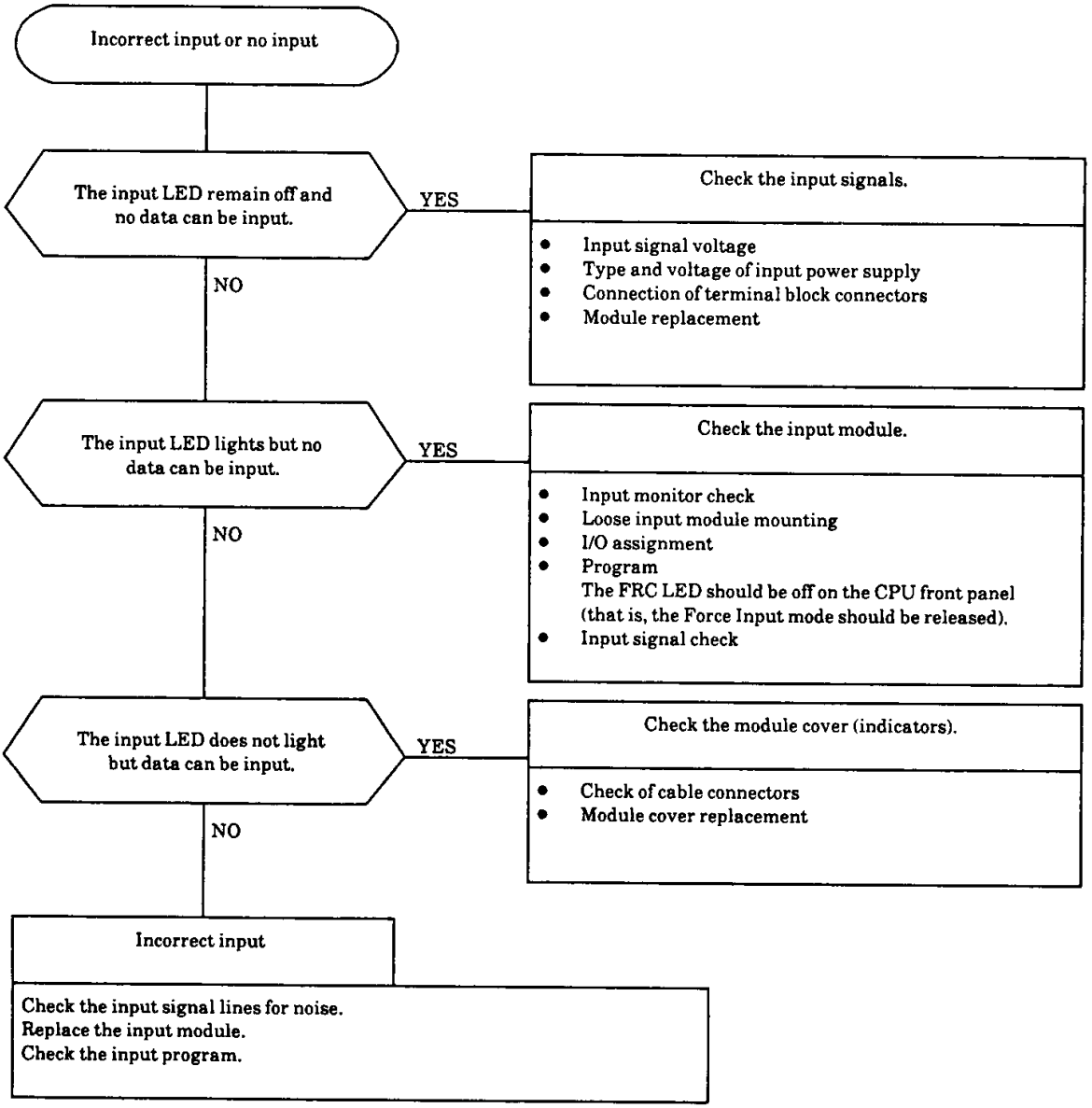


(3) Operation stops.

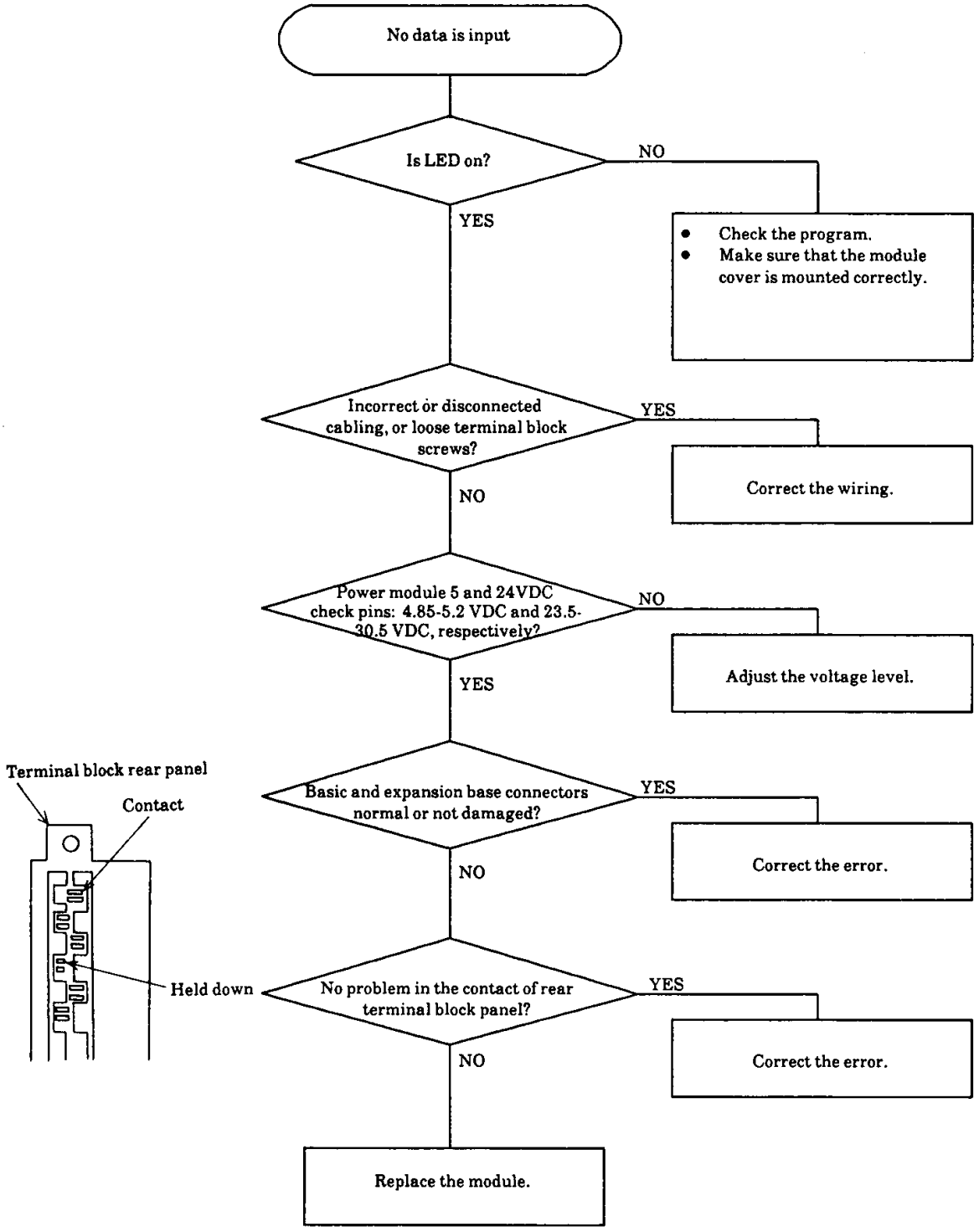
The CPU stops (and the RUN LED goes out) during normal operation.



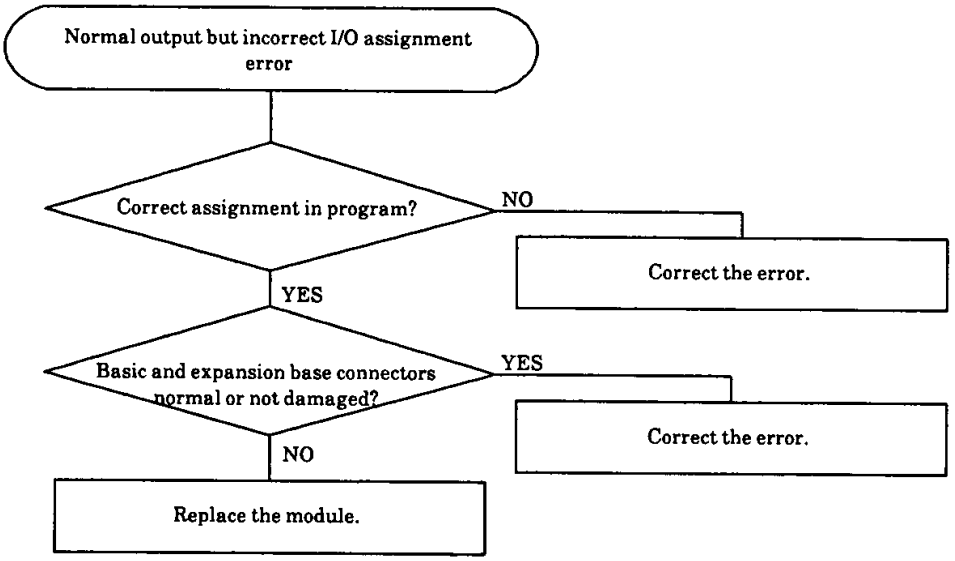
(4) Incorrect input or no input to the input module The CPU operates but correct data cannot be entered.



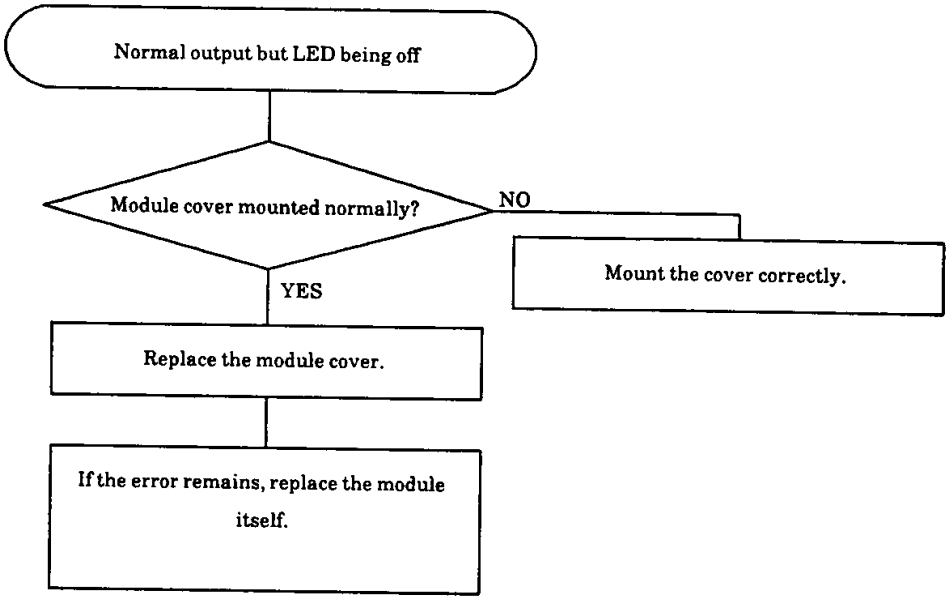
(a) If no data can be input



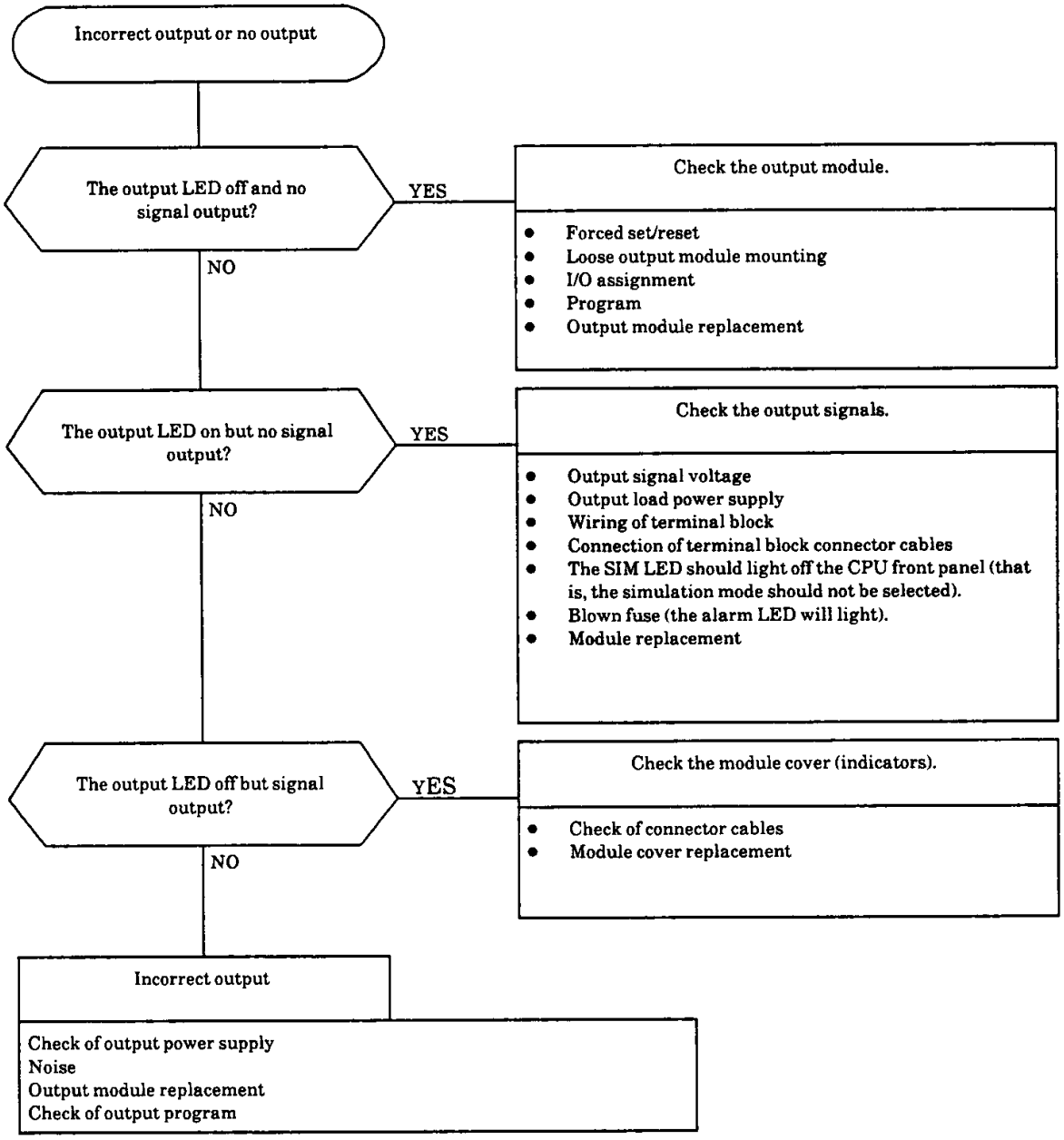
(b) Normal output but incorrect I/O assignment error



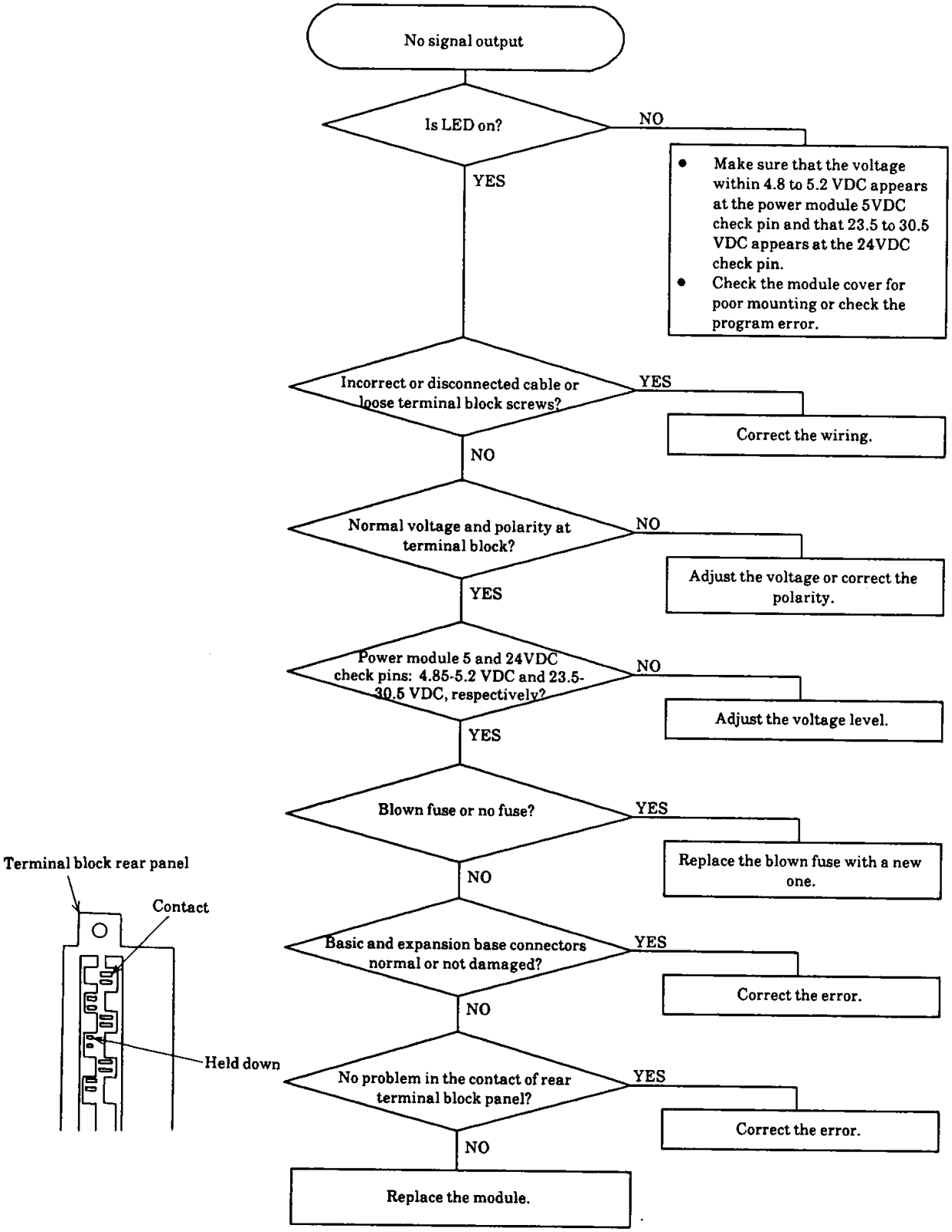
(c) Normal output but LED being off



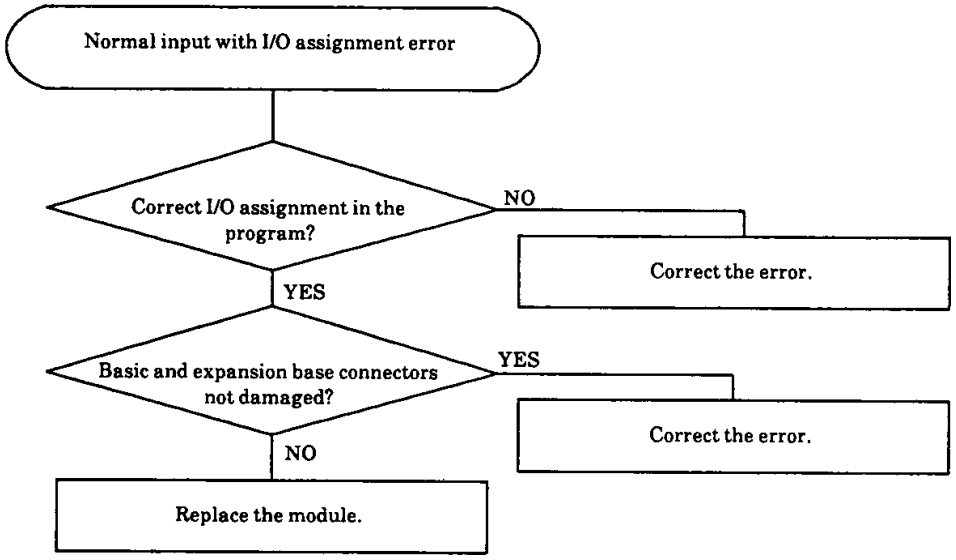
(5) Incorrect output or no output from the output module
The CPU operates normally but invalid signals are output.



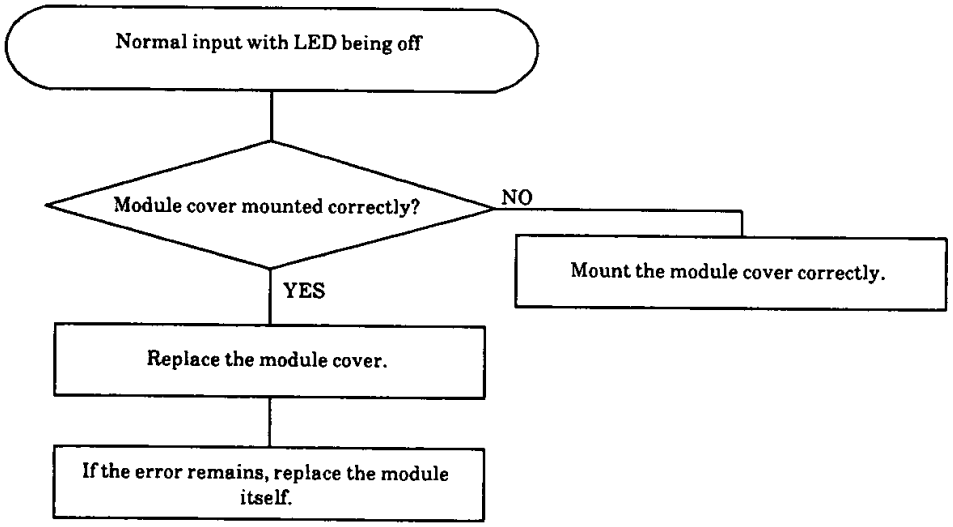
(a) Check during no signal output



(b) Check during normal signal input but I/O assignment error exists

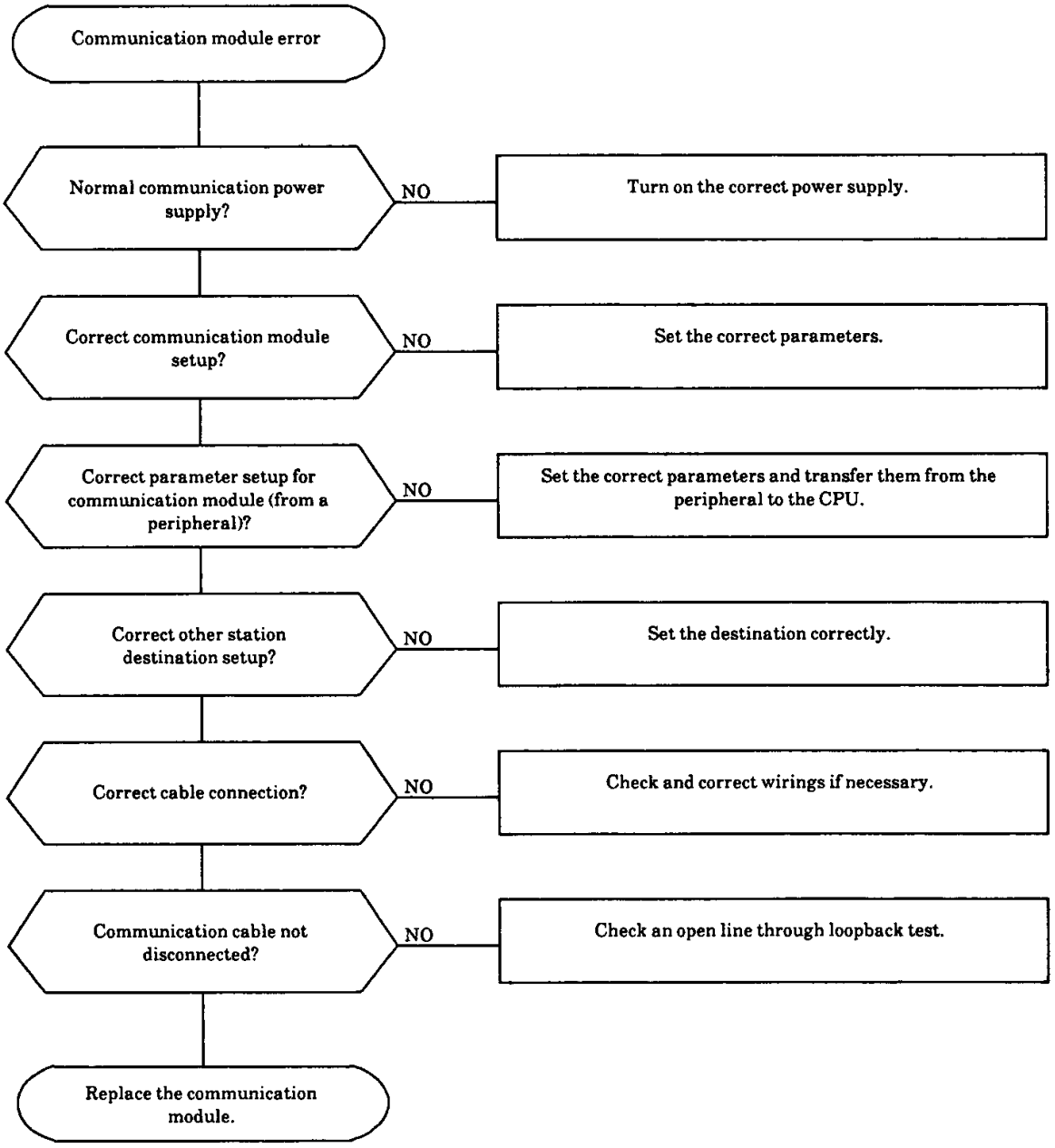


(c) Check during normal input with LED being off



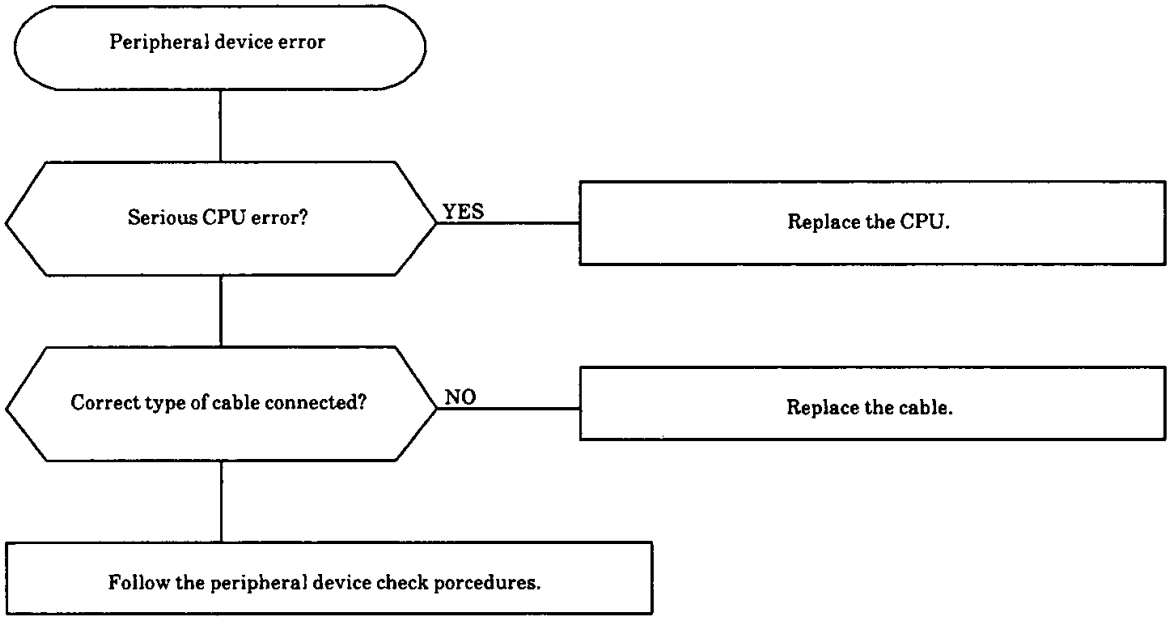
(6) Communication error

An error has occurred in a communication module (CPU link, remote host or substation, or COMM module).

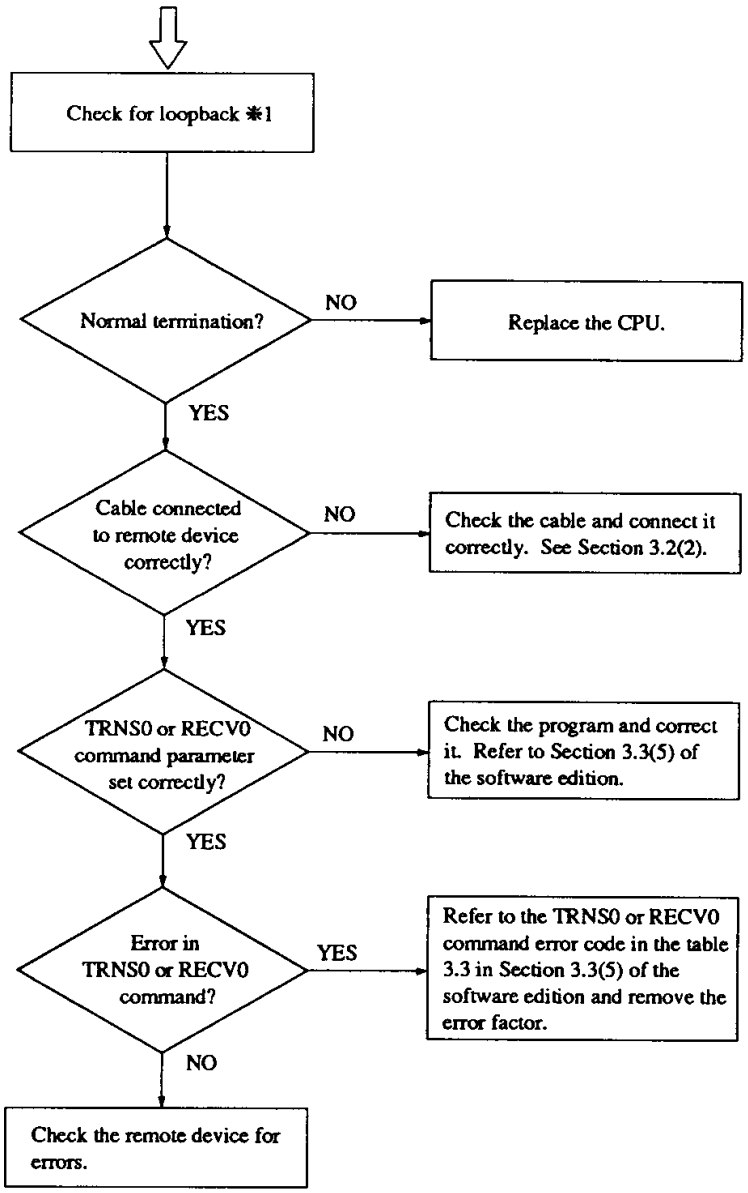


(7) Peripheral device error

The peripheral devices cannot be connected or an error has occurred in the peripheral device.



(8) Unconnectable to the general purpose port



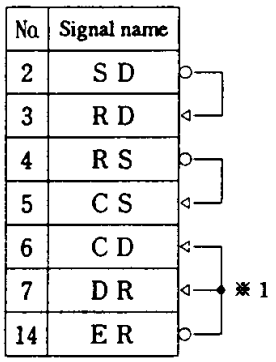
*1: The loopback check is a check for separating an error in the CPU module and an error in the cable or remote device from each other on a hardware basis. It does not check the TRNS0 and RECV0 commands (rationality of the user program). For the loopback check method, see the next and subsequent pages.

General purpose port loopback check (Only CPU2-**H)

The general purpose port has a loopback check for separating an error in the CPU and an error in the cable or device from each other.

Next. the loopback check procedure and display will be described.

[1] Preparation of a loopback check connector (By the user)



- Loopback check connector (15 pins):

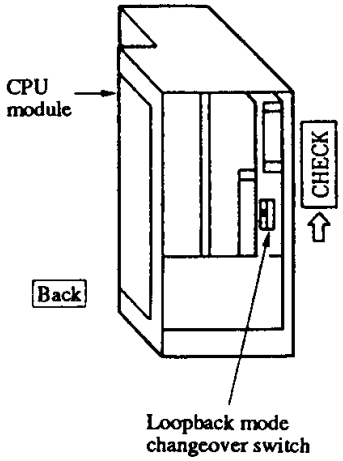
  HDAB-15P (connector, male), HDA-CTF1 (case) by Hirose Denki or equivalent

- Connect pins 2 and 3, pins 4 and 5, and pins 6, 7, and 14 as shown in the diagram on the left. After connection, execute the continuity test using a tester.

- This connector may be used as a loopback check connector for SIO-H (RS-232C port) or BASIC-H.

※1: The general purpose port does not use the signals CD, DR, and ER.

[2] Start of the loopback check



(a) Turn the power switch of the base of the CPU off.

(b) Remove the CPU module from the base.

(c) Turn the switch on the back of the module which is shown in the drawing on the left to the CHECK position.

Change the switch surely using a sharp pen with a sharp tip. Do not touch any part other than the switch.

(d) Mount the CPU module on the base once again.

(e) Connect the loopback check connector which is prepared in [1] to the CPU.

(f) Turn the power on. The loopback check will start.

[3] Description of loopback check

No.	Item	Description	Result
1	Checking between RS and CS	Check that when RS is set to 1, CS is set to 1.	
2		Check that when RS is set to 0, CS is set to 0.	Acceptable: To No. 3 Rejected: Stop
3	Checking between SD and RD	Check whether when H00 to HFF are sent, they match with the received data.	Acceptable: To No. 1 Rejected: Stop

[4] Display of 7-segment (E. CODE) and LED when the loopback check is performed

No.	Operation	Display		Remarks
		7-segment	LED	
1	Loopback check start		RUN○ HLT○ SIM○ FRC○ ERR○ BTE○	A loopback check message is displayed for about 1 second. → To No. 2
2	Checking between RS and CS (Data 1)		RUN● HLT○ SIM○ FRC○ ERR○ BTE○	The display on the left appears for about 1 second and the check is performed. Acceptable: To No. 3 Rejected: The display is left as it is and the check is stopped.
3	Checking between RS and CS (Data 0)		RUN○ HLT● SIM○ FRC○ ERR○ BTE○	The display on the left appears for about 1 second and the check is performed. Acceptable: To No. 4 Rejected: The display is left as it is and the check is stopped.
4	Checking between SD and RD		RUN○ HLT○ SIM● FRC○ ERR○ BTE○	The transmission data is displayed in hexadecimal. Acceptable: To No. 5 Rejected: The rejected data is displayed and the check is stopped.
5	Normal termination		RUN○ HLT○ SIM○ FRC○ ERR○ BTE○	After the display on the left appears for about 1 second → No. 1

● LED on ○ LED off

[5] End of the loopback check

Return the switch which is turned to the CHECK side in [2] to the opposite side. Before changing the setting, turn the power off.

Chapter 17 Appendix

Appendix 1 Error Codes and Special Internal Output

(1) List of error codes

Error numbers, description of errors, their causes and corrective measures are described below.

With the CPU module, using self-diagnostic function it is possible to detect and indicate various errors. On occurrence of an error, at first observe the error indicator LED (7 segment 2-digit numerical display) on the CPU module front face, and take corrective measures which correspond to the indicated error code.

The occurred errors are classified into the following four levels by their seriousness, and error processing that corresponds to each level is executed.

On occurrence of an error caused by multiple causes, the code for the factor of the higher error level (the figure of the first digit is smaller) is displayed.

If they are of the same level, the code for the cause that occurred later is displayed.

Error level	Error code	Description	CPU running status
Serious failure	Light off 10 - 88 FF	Hardware error Connection of a peripheral device is disables.	Run stop
Medium failure	20 - 30 -	Hardware error, program error Connection of a peripheral device is permitted.	Run stop
Minor failure	40 -	Program error Parameter setting error Connection of a peripheral device is permitted.	Continuation/stop of running on occurrence of an error may be selected (designated by a peripheral device).
Alarm	50 - 60 - 70 -	Running of PCS is not affected Connection of a peripheral device is permitted.	Running continued

The error codes and corrective measures are described below.

For troubleshooting, also refer to Chapter 7 of the application manual.

[1] Serious failure

Connection of a peripheral device is disabled. Replacement is required except for errors in the power supply module or communication module.

Error code	Error name	CPU status	Description and cause	Corrective measure	Set special internal output
11	System ROM error - 1 (checked at the time of power ON)	Halt	Sum check error of system ROM for microcomputer	Check fixing of modules to the basic/extension base in the CPU interior. Turn ON the power again. Replace the CPU.	-
12	System RAM error - 1 (checked at the time of power ON)	Halt	Sum check error of system ROM for microcomputer	Same as above	-
13	Microcomputer error (always checked)	Halt	Detection of undefined instruction of microcomputer	Same as above	R7C8
14	Memory cassette type error (checked at the time of power ON)	Halt	Error in memory cassette interior	Replace the memory cassette.	-
15	System bus time-out error (checked at the time of bus access)	Halt	No response from the communication module against request from CPU.	Refix the communication module and turn ON the power again. Replace the communication module manual. Replace the CPU.	R7D8
88	Microcomputer jam error (always checked)	Halt	Watch dog timer error	Review fixing in the CPU interior and fixing to the basic base. Turn ON the power again. Replace the CPU. Check for errors in the communication with modules such as interruption, CPU link, remote master, COMM, BASIC, etc. Replace modules.	-
--	AC power error status (always checked)	Halt	Extension power supply error during momentary power failure	Check for error in the power supply for the extension unit.	-
All lamps out	Power OFF, power supply error (always checked)	Halt	Power is OFF or the power supply module is abnormal. Reset status	Check for error in the power supply for the basic unit.	-
FF	CPU internal reset processing status (always checked)	Halt	In CPU initialize processing at the time of activation of power	Indication for about 10 seconds after the power is turned ON again (including activation from momentary power failure) is not an error.	

[2] Medium failure (hardware error)

Error code	Error name	CPU status	Description and cause	Corrective measure	Set special internal output
21	System ROM error - 2 (checked at the time of power ON)	Halt	Sum check error of system ROM for sequence processor (SP)	Review Fixing in the CPU interior and fixing to the basic base. Turn ON the power again. Replace the CPU.	-
22	Sequence error (always checked)	Halt	The result of SP's arithmetic operator check program is abnormal.	Same as above	R7C9
23	Undefined instruction (always checked)	Halt	Detection of undefined instruction issued by SP (after retry of 3 times)	Review fixing in the CPU and fixing of the memory cassette. Turn ON the power again.	R7C9
24	Sequence processor bus error (checked at the time of external I/O access)	Halt	No response from external PI/O module against a request from SP. Error between SP and PI/O.	Review fixing in the CPU interior. Turn ON the power again. Replace the CPU. Replace the IO/C, extension cable. Replace modules other than standard PI/O (16/32/64 point I/Os).	R7C9
25	Memory cassette error (always checked)	Halt	The memory cassette is not correctly mounted.	Review fixing of the memory cassette. Turn ON the power again.	-
26	High speed arithmetic operation memory error (checked at the time of power ON, at the time of STOP to RUN, and during RUN)	Halt	Error in internal compare between high speed arithmetic operation memory, memory cassette and system ROM for SP	Review fixing in the CPU interior and fixing of the memory cassette. Turn ON the power again. Replace the CPU and memory cassette.	R7C9
27	Data memory error at the time of power ON (when all clear is made from a peripheral device)	Halt	Error in data memory read/write check	Review fixing of the memory cassette. Turn ON the power again. Replace the memory cassette. Replace the CPU.	-
28	PI/O bus error (checked at the time of external I/O access)	Halt	No response from external PI/O module against a request from microcomputer. Error between microcomputer and PI/O.	Same as error code 24.	R7CB
29	Sequencer bus time-out error (always checked)	Halt	Microcomputer's SP bus access (program detection, write, monitor, etc.) does not terminate.	Review fixing in the CPU interior and fixing to the basic base. Turn ON the power again. Replace the CPU.	R7CB
2A	System RAM error - 2 (checked at the time of power ON)	Halt	Read/write check error of system RAM for SP	Same as above	-
2C	Sequence Processor fault	Halt	Watch dog timer error for sequence processor	Turn power off and on again. In case the same error comes back, replace the CPU module due to its hardware fault	R7C9

[3] Medium failure (program error)

Transfer a correct program to the CPU once again using a peripheral device and start running once again.

Error code	Error name	CPU status	Description and cause	Corrective measure	Set special internal output
31	User memory error (checked at the time of power ON, at the time of STOP to RUN, during RUN (RAM only), at the time of alteration to parameters and at the time of all clear)	Halt	(In the case of ROM memory) Correct program is not contained in the user memory. Or, the ROM is not correctly mounted. (Sum error) (In the case of RAM memory) The contents of the user memory are unfixed. Or, correct read/write cannot be made. (Sum error)	(In the case of ROM memory) Write a correct program in the ROM once again and mount it to the ROM memory cassette. Replace ROM < ROM memory cassette. Replace CPU. (In the case of RAM memory) Transfer a correct program to the CPU (memory cassette) once again using a peripheral device. Initialize the CPU. Replace the memory cassette. Replace CPU.	R7CA
33	User memory size error (checked at the time of STOP to RUN)	Halt	The parameter set user program volume is larger than the practical user memory.	Carry out parameter setup of the actual memory capacity using a peripheral device and transfer the parameters to the CPU. Take measures equal to those of error code 31.	R7CC
34	Syntax, assemble error (checked at the time of STOP to RUN)	Halt	There is a syntax error in the user program (ladder). Detailed contents of the error are set in special internal output WRF001.	Carry out a program check once again using a peripheral device. Correct the program error and transfer the program to the CPU.	R7D4 WR F001

[4] Minor failure (program error, parameter setting error)

The running stops usually on occurrence of an error, but it is possible to continue running even on occurrence of an error, if designation is made by a peripheral device in advance.

Error code	Error name	CPU status	Description and cause	Corrective measure	Set special internal output
41	I/O information compare error (always checked)	Halt (run)	Actually mounted I/O modules are not matched with contents f the I/O assignment list set by a peripheral device. (Excluding remote destination)	Correct the I/O assignment list as matched with the I/O modules (or match the I/O modules with the I/O assignment list). Abnormal I/Os are observed when word special internal output WRF002 is monitored. Review setting of the IOC unit number setting SW. Review fixing of each module and cable connection. Turn ON the power again.	R7CD WR F002
43	Remote error (always checked)	Halt (run)	Remote master module error Error in number·of remote substations Remote I/O assignment error Remote transfer error	Observe the instructions given in the remote module manual with reference made to the remote module error code. Alter remote I/O assignment and assignment of number of substations.	R7D0 WR F006
44	Jam error (checked during execution of usual scan END processing)	Halt (run)	One scan time exceeded the set time (usually 100 msec; may be set by the user).	Shorten the program length so that excess will not occur. Increase the set length.	R7D1
45	Jam error (checked on occurrence of periodic scan interruption)	Halt (run)	The execution time of periodic scan (10 sec, 20 sec, 40 sec) exceeded 10 msec, 20 msec, 40 msec respectively.	Shorten the program length so that excess will not occur.	R7D2
46	Jam error (checked on occurrence of interrupt scan interruption)	Halt (run)	Interruption of the same factor occurred during interrupt processing.	Increase the period of continuously entered interruption. Shorten the interruption processing program.	R7D3
47	Excess of number of points of I/O assignment (checked at the time of power ON, at the time of STOP to RUN, during RUN (RAM only), at the time of alteration to parameters and at the time of all clear)	Halt (run)	The total number of I/O points of the I/O assignment list set by a peripheral device exceeded 4096 points.	Delete surplus setting from the I/O assignment list and transfer the list to the CPU once again.	R7D6

[5] Alarm

Error code	Error name	CPU status	Description and cause	Corrective measure	Set special internal output
51	I/O module error (always checked)	Run	(Standard output module) Fuse blow was detected. (High function communication module) An error occurred in the module.	Identify the failed modules by monitoring word special internal output WRF005 and eliminate the cause for the error. (However, fuse blow at a remote destination is not indicated. Care should be exercised).	R7D5 WR F005
52	I/O transfer error High speed function PI/O transfer instruction (checked during execution of TRNS, RECV, QTRNS, QRECV)	Run	An error occurred during transfer with high function module.	Make recovery from the error by turning ON the power for the high function module once again.	-
53	PI/O unjust interruption (checked during RUN)	Run	Occurrence of interruption from a slot other than the slot to which the module with high function is assigned.	Check if mounting is matched with assignment of modules such as interruption input, CPU link, remote master, COMM, BASIC, and make correction as required. Separate I/O external wiring of I/O extension cables from power lines, FG lines, etc.	-
54	Communication function module error (always checked)	Run	Hardware failure of communication function module	Identify the failed communication function module by monitoring word special internal output WRF004, and execute error recovery processing in accordance with the error code on the communication function module.	R7D7 WR F004
55	Communication function module transfer error (checked at the time of connection of a peripheral device to remote destination and link destination)	Run	An error occurred during transfer with the communication function module.	Identify the failed module by monitoring word special internal output WRF004. Execute processing in accordance with the error code on the communication function module.	R7D7 WR F004
56	System bus error (always checked)	Run	The BASIC unit (module) failed.	Check the program of the BASIC unit (module). Replace the BASIC unit (module).	R7D8
57	Communication function module assignment over (always checked)	Run	The assignment of the parameter set communication function module exceeded the maximum.	Correct the assignment in accordance with the rules such as up to 2 links, up to 4 remote stations, one BASIC only.	R7DD
58	Communication function module information compare error (always checked)	Run	Actual I/Os are not matched with parameter set assignment.	Alter parameter setting. Alter I/Os. Identify the unmatched I/Os by monitoring word special internal output WRF003.	R7CE WR F003
59	Link module error (always checked)	Run	Hardware error of link module	Make recovery from the error in accordance with the error code of the ink module.	R7DE WR F007

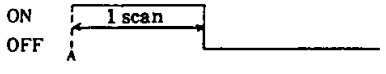
Error code	Error name	CPU status	Description and cause	Corrective measure	Set special internal output
61	Port transfer error (parity) (checked during transfer)	Run	Occurrence of a parity error during communication between CPU and a peripheral device (host computer)	Check connection of the communication cable (for loose or disconnected connector). Check laying of the communication cable (connector signal layout). Check data bit composition and transfer rate of the host computer.	-
62	Port transfer error (framing/overrun) (checked during transfer)	Run	Occurrence of a framing/ overrun error during communication between CPU and a peripheral device (host computer)	Same as above.	-
63	Port transfer error (time-out) (checked during transfer)	Run	Occurrence of a time-out error during communication with a peripheral device (host computer) 1) The connector cable is not correctly mounted. 2) The processing (protocol) on the host computer side is different from the specification for CPU.	Check connection of the communication cable (for loose or disconnected connector). Check laying of the communication cable (connector signal layout, etc.). Check processing on the host computer side.	-
64	Port transfer error (protocol error)(checked during transfer)	Run	Occurrence of a protocol error during communication with a peripheral device (host computer) 1) The connector cable is not correctly mounted. 2) The processing (protocol) on the host computer side is different from the specification for CPU.	Check connection of the communication cable (for loose or disconnected connector). Check laying of the communication cable (connector signal layout, etc.) Check processing on the host computer side.	-
65	Port transfer error (BCC error) (checked during transfer)	Run	Data cannot be correctly received in the communic-ation with a peripheral device (host computer) 1) The connector cable is not correctly mounted. 2) The BCC calculation on the host computer side is different from the specification for CPU.	Check connection of the communication cable. Check processing on the host computer side. Note: BCC: Block check character ... Character in which the check sum value of the character transfer text enters.	-
71	Battery error (checked during transfer)	Run	1) The battery voltage in the memory cassette dropped to a level that is lower than the specified level. 2) The battery's lead connector is not mounted.	Replace the battery in the state where the power is ON. Connect the battery lead wires.	R7D9
72	Detection of momentary failure (always checked)	Run	Momentary power failure for a short length occurred. (Execution of arithmetic operation is continued.)	Check the AC power supply input, if this trouble occurs frequently.	R7DA

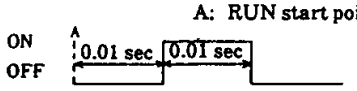
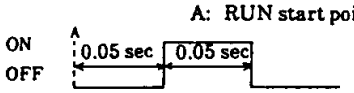
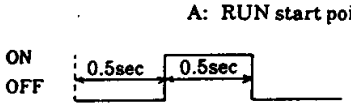
(2) Special internal output

The CPU status and the status on occurrence of an error can be learned by monitoring the word special internal output shown below.

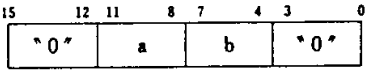
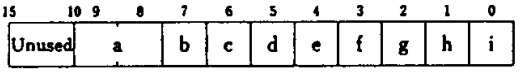
[1] List of bit special internal outputs

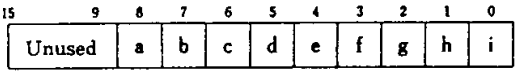
No.	Name	Description	Description in detail
R7C0	Continuation on occurrence of a jam error (usual scan)	0: Stop of RUN on occurrence of an error 1: Continuation of RUN on occurrence of an error	Stop or continuation of RUN on occurrence of a jam error of usual scan is designated.
R7C1	Continuation on occurrence of a jam error (periodic scan)	Same as above.	Stop or continuation of RUN on occurrence of a jam error of periodic scan is designated.
R7C2	Continuation on occurrence of a jam error (interrupt scan)	Same as above.	Stop or continuation of RUN on occurrence of a jam error of interrupt scan is designated.
R7C3	Remote RUN permit	0: Remote RUN inhibit 1: Remote RUN permit	If remote RUN (RUN command from a peripheral device) is permitted is designated.
R7C4	Remote STOP permit	0: Remote STOP inhibit 1: Remote STOP permit	If remote STOP (STOP command from a peripheral device) is permitted is designated.
R7C5	Debug permit	0: Debug inhibit 1: Debug permit	If debug RUN is permitted is designated.
R7C6	Simulation permit	0: Simulation inhibit 1: Simulation permit	If simulation mode is permitted is designated.
R7C7	Permit of alternation during RUN	0: Alternation during RUN inhibit 1: Alternation during RUN permit	If alternation during RUN of a user program is permitted is designated.
R7C8	Serious error	0: With serious error 1: Without serious error	If there is an error in the management microcomputer is indicated.
R7C9	Sequence error	0: Normal 1: Abnormal	If there is an error in the sequencer is indicated.
R7CA	Memory error	Same as above.	If there is an error in the user memory is indicated.
R7CB	PI/O bus error	Same as above.	If there is an error during PI/O bus access is indicated.
R7CC	Memory size over	Same as above.	If the user program memory size set by a parameter is exceeded is indicated.
R7CD	I/O information compare mismatch	0: Normal 1: Unmatched	If the actual mounting is same as the parameter set I/O information. (Mismatch information is output to WFR002.)
F7CE	Communication function module compare mismatch	0: Normal 1: Unmatched	If the actual mounting is same as the parameter set communication function module information. (Mismatch information is output to WFR003.
W7CF	(Undefined)		
R7D0	Remote error	Same as above.	If the remote module is normal.

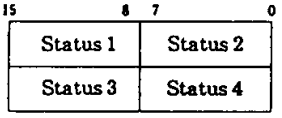
No.	Name	Description	Description in detail
R7D1	Jam error (usual scan)	Same as above.	If the usual scan execution time exceeds the designation of the parameter.
R7D2	Jam error (periodic scan)	Same as above.	If periodic scan terminated during the fixed period.
R7D3	Jam error (interruption scan)	Same as above.	If interruption of the same cause occurred during interruption scan.
R7D4	Syntax, assemble error	0: Normal 1: Abnormal	If there is a syntax error in the user program. (Detail information is output to WRF001.)
R7D5	I/O module error	Same as above.	If there is an error (fuse blow) in the I/O module. (The error slot No. is output to WRF005.)
R7D6	Number of assigned points over	0: Normal 1: Over	If parameter set I/O assignment exceeds the maximum value.
R7D7	Communication function module error	0: Normal 1: Abnormal	If there is an error in the Communication function module (The error slot No. is output to WRF004.)
R7D8	System bus error	Same as above.	If there is an error at the time of system bus access.
R7D9	Battery error	Same as above.	If the battery voltage in the memory cassette has dropped.
R7DA	Detection of momentary power failure	0: With momentary power failure 1: Without momentary power failure	If momentary power failure occurs in the power supply of CPU.
R7DB	Self-diagnosis error	0: Normal 1: Abnormal	If an error occurs in self diagnosis. (Information in detail is output to WRF000.)
R7DC	Simulation error	Same as above.	If the power supply for the extension unit is activated at the time of simulation.
R7DD	Excess of communication function module assigned number of points	0: Normal 1: Over	If parameter set communication function module assignment has exceeded the maximum number.
R7DE	Link module error	0: Normal 1: Abnormal	If there is an error in the link module.
R7DF	(Undefined)		
R7E0	Mode select key switch position (STOP)	0: Key switch other than STOP 1: Key switch STOP	Either one is ON.
R7E1	Mode select key switch position (REMOTE)	0: Key switch other than REMOTE 1: Key switch REMOTE	
R7E2	Mode select key switch position (RUN)	0: Key switch other than RUN 1: Key switch RUN	
R7E3	One scan ON after RUN	0: Two scans or subsequent after RUN 1: One scan ON after RUN	A: RUN start point 
R7E4	Always ON	0: No 0 status 1: Always	

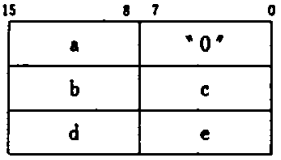
No.	Name	Description	Description in detail
R7E5	0.02 sec clock	0: 0.01 sec 1: 0.01 sec	A: RUN start point 
R7E6	0.1 sec clock	0: 0.05 sec 1: 0.05 sec	A: RUN start point 
R7E7	1.0 sec clock	0: 0.5 sec 1: 0.5 sec	A: RUN start point 
R7E8	Occupy declaration	0: Non-occupied state 1: Occupied state	Occupied state when CPU is making communication with a peripheral device or alike.
R7E9	RUN inhibited state	0: RUN permitted 1: RUN inhibited	If RUN inhibited state is produced.
R7EA	Start of alteration during RUN	0: Not alteration during RUN 1: Alteration during RUN	If RUN is temporarily stopped (output hold) in the alteration during RUN.
R7EB	Clear 7 segments	Clear by "1" (00 display)	Applicable to software with revision "F" and after
R7EC	Clear special internal error output	Clear by "1"	Ditto
R7ED to R7EF	(Undefined)		
R7F0	Carry	0: Carry OFF 1: Carry ON	Carry flag used in arithmetic instruction
R7F1	Overflow	0: Without overflow 1: With overflow	Overflow flag in arithmetic instruction
R7F2	Shift data	0: Shift data "0" 1: Shift data "1"	Shift data used in shift instruction or alike
R7F3	Operational error	0: Normal 1: Abnormal	If there is an instruction error during execution of an operational instruction. (Information in detail is output to WRF015.)
R7F4	Data error	Same as above.	If there is a data error detected during execution of an operational instruction.
R7F5 to R7FF	(Undefined)		

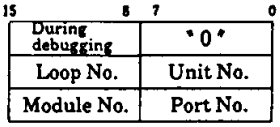
[2] List of word special internal outputs

No.	Name	Stored data	Description
WR F000	Self-diagnosis error code	Self-diagnosis error No.	The error No. detected by CPU is stored by a binary code.
WR F001	Syntax, assemble error detail	Syntax, assemble error No.	Syntax, assemble error in the user program is stored by a binary code. (See note)
WR F002	I/O information mismatch detail	Mismatched I/O slot No. (See note)	The I/O slot No. that is mismatched with parameters setting is stored.  a: Unit No. (0 - 5) b: Slot No. (0 - A)
WR F003	Communication function module error mismatch detail	Mismatched module slot No. (See note)	The module slot No. that is mismatched with parameters setting is stored. (0 - A)
WR F004	Communication function module error slot No.	Mismatched module slot No. (See note)	The slot No. of the communication function module involving an error is stored. (1 - 8)
WR F005	I/O module error slot No.	Same as above	The slot No. of the I/O module involving an error is stored. (Composition same as that of WRF002)
WR F006	Remote error slot No.	Same as above.	The slot No. of the remote module involving an error is stored. (Composition same as that of WRF002)
WR F007	Link error slot No.	Same as above.	The slot No. of the link module involving an error is stored. (Composition same as that of WRF002)
WR F008 to WR F00F	(Undefined)		
WR F0101	Cycle time (maximum)	Maximum execution time of a usual scan	10 msec units
WR F011	Cycle time (current)	Execution time of a usual scan	10 msec units
WR F012	Cycle time (minimum)	Minimum execution time of a usual scan	10 msec units
WR F013	CPU status	CPU operating status  a: CPU type - 01=H-2000, 10=H-700, 11=H-300 b: Battery error - 1=Occurred, 0=None c: Unused d: Debug - 1=During execution, 0=Not in execution e: Force - 1=During execution, 0=Not in execution f: Error - 1=Occurred, 0=None g: Simulation - 1=During execution, 0=Not in execution h: Halt - 1=During execution, 0=Not in execution i: Operation - 1= RUN, 0=STOP	
WR F014	Word internal output capacity	Word internal output number of words	One out of 0400, 4400, C400.

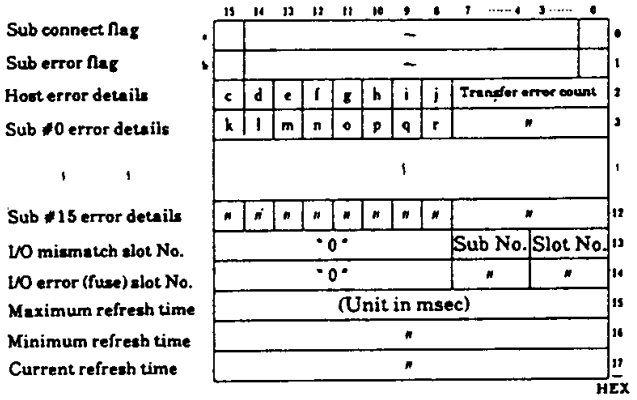
<table>
<tr><th>No.</th><th>Name</th><th>Stored data</th><th>Description</th></tr>
<tr><td>WR F015</td><td>Operational error code</td><td>Operational error No.</td><td>The error No. occurred during execution of an operational instruction is stored.</td></tr>
<tr><td>WR F016
F017</td><td>Extension register for operation</td><td>Surplus at the time of execution of an operational instruction</td><td>32 bits operation: More significant - F017, less significant - F016
16 bits operation: F016 is used</td></tr>
<tr><td>WR F018</td><td>Communication function module activation flag</td><td colspan="2">System bus status by slot of basic base
 

1=System bus activation completed
0=System bus activation not completed
a = Slot 8, b = Slot 7 ... i = Slot 0</td></tr>
<tr><td>WR F019</td><td colspan="3">(Undefined)</td></tr>
<tr><td>WR F020
WR F021</td><td>Communication function module slot 0 status</td><td>Status data (slot 0)</td><td rowspan="3"> 

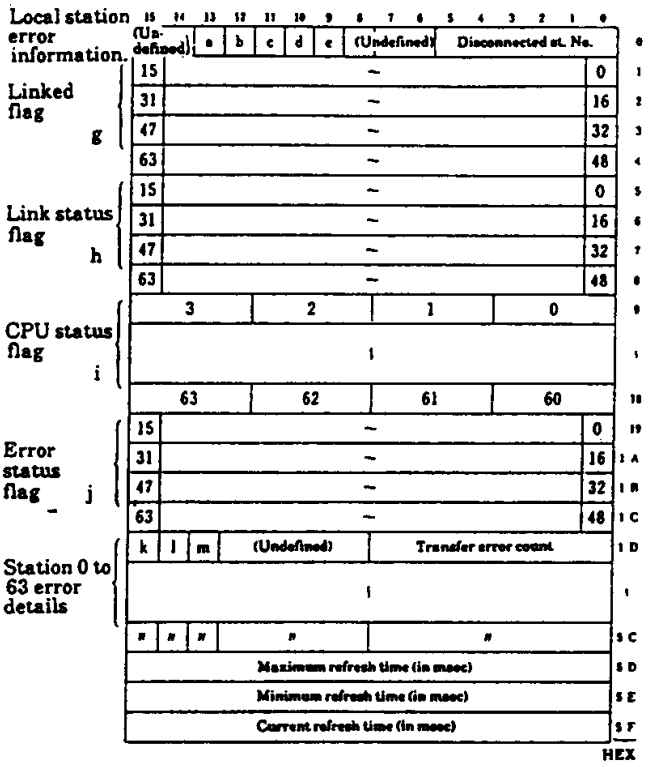
The contents of the slot where no communication function module is mounted are unfixed.
See the communication function module manual for details.</td></tr>
<tr><td>|</td><td>|</td><td>|</td></tr>
<tr><td>WR F030
WR F031</td><td>Communication function module slot 8 status</td><td>Status data (slot 8)</td></tr>
<tr><td>WR F032
WR F03F</td><td colspan="3">(Undefined)</td></tr>
<tr><td>WR F040
F041
F042</td><td>Member registration area 1</td><td>Port No. where CPU occupation is made</td><td rowspan="3"> 

a: 0=No occupation, 1=Read occupation, 2=Write occupation
b: Loop No.
c: Unit No.
d: Module No.
e: Port No.</td></tr>
<tr><td>|</td><td>|</td><td>|</td></tr>
<tr><td>WR F049
F04A
F04B</td><td>Member registration area 4</td><td>Port No. where CPU occupation is made.</td></tr>
<tr><td>WR F04C
F04D
F04E</td><td>Debug registration area</td><td>Port No. where debug is executed.</td><td> 
</td></tr>
<tr><td>WR F04F
to
WR F07F</td><td colspan="3">(Undefined)</td></tr>
<tr><td></td><td colspan="3"></td></tr>
</table>

No.	Name	Stored data	Description
WR F080 F097	Remote master 1 error flag		
WR F098 F0AF	Remote master 2 error flag		
WR F0B0 F0C7	Remote master 3 error flag		a: Bit No. corresponds to substation No. 1=Participation, 0=No participation b: Bit No. corresponds to substation No. 1=With error, 0=Without error c: Time-out error d: Frame error e: System bus error f: Substation I/O error g: Station No. overlap h: Substation connection mismatch
WR F0C8 F0DF	Remote master 4 error flag		i: I/O information mismatch j: Remote number of points error k: Same as c l: Same as d m: (Undefined) n: Same as f o: Same as g p: Same as h q: Same as i r: (Undefined)



No.	Name	Stored data	Description
WR F0E0 F13F	Link 1 error flag		



WR F140 F19F	Link 2 error flag	a: System bus error b: Area setup is outside of the range c: Station No. is outside of the range d: (Undefined) e: Area overlapped f: Channel open circuit 1 = With error 0 = Without error g: Figure in the table is station No., 1=Participation, 0=No participation h: Figure in the table is station No., 1=In link operation, 0=Link stop i: Figure in the table is station No., Contents of 4 bits are as follows: [a][b][c][d] (4 bits) A: 1=CPU error, 0=Normal B: 1=In simulation, 0=Not in simulation C: 1=HALT status, 0=Not in HALT status D: 1=RUN, 0=STOP j: Figure in the table is station No., 1=With error, 0=Without error k: Time-out error, 1=With error, 0=Without error l: Frame error, 1=With error, 0=Without error m: Error between CPU and link, 1=Error, 0=Normal

Note: The youngest slot No. which detected an error up to the present time including the past is stored. Turn OFF the corresponding bit special internal output once in order to check the slot where an error currently occurred.

[3] Timing of reset of special internal outputs

Set/reset of bit special internal output

No.	Set	Reset
R7C0 to 7C7	Should be set by the user.	Should be set by the user. Reset can also be made by the power failure storage area reset switch.
R7C8 to 7DE	Reset is made by the system.	
R7E0 to 7E3		Reset is made by the system
R7E4 to 7EA		Reset cannot be made because of being always ON.
R7F0 to 7F4		Reset is made by the system.

Data set/zero clear of bit special

No.	Set	Reset
WR F000 to F007	Reset is made by the system.	Should be zero cleared by the user.
WR F010 to F014		Managed by the system.
WR F015 to F018		Should be zero cleared by the user.
WR F020 to F04E		Managed by the system.
WR F080 to F0DF		
WR F0E0 to F19F		