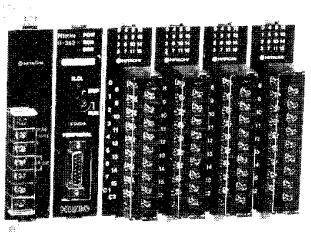
HITACHI

# APPLICATION MANUAL H-SERIES H-250/252B (HARDWARE EDITION)



NJI—167 (X)

## WARNING

To ensure that the equipment described by this manual. As well as all equipment connected to and used with it, operate satisfactorily and safety, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standard and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

INSTALL EMARGENCY POWER STOP SWITCH, WHICH OPERATES INDEPENDENTLY OF THE PROGRAMMABLE CONTROLLER TO PROTECT THE EQUIPMENT AND/OR PERSONNEL IN CASE OF THE CONTROLLER MALFUNCTION.

Personnel who are to install and operate the equipment should carefully study this manual and any other referred to by it prior to installation and/or operation of the equipment. Hitachi Industrial Equipment Systems Co., Ltd. constantly strives to improve its products, and the equipment and the manual(s) that describe it may be different from those already in your possession.

If you have any questions regarding the installation and operation of the equipment, or if more information is desired, contact your local Authorized Distributor or Hitachi Industrial Equipment Systems Co., Ltd.

## IMPORTANT

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. AS TEMPORARILY PERMITTED BY REGULATION, IT HAS NOT BEEN TESTED FOR COMPLIANCE WITH THE LIMITS FOR CLASS A COMPUTING DEVICES PURSUANT TO SUBPART J OF PART 15 OF FCC ROULES, WHICH ARE DESIGNED TO PROVIDE PEASONABLE PROTECTION AGAINST SUCH INTERFERENCE.

OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER, AT HIS OWN EXPENSE, WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

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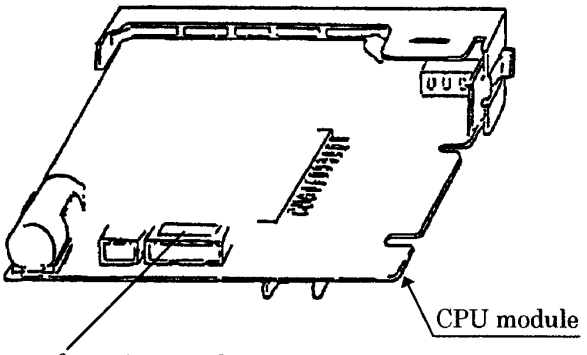
Notes when H-250/252B is used

Please take notice of a following points when you use HIDIC H-252B (CPU form CPU22-02HB) and H-250 (CPU form CPU21-02H). This case will adjust to of the H-250/252B application manual hardware edition (NJI-167(X)).

| No | Pertinent page | Item | Contents |
|---|---|---|---|
| 1 | Inserts the content in the final lines of NJI-167(X) P12-16 | Program transfer from memory pack | When the CPU module is used for the first time and the program is transferred from the memory pack without initializing the CPU with a peripheral equipment and is run, the CPU might malfunction.<br>(1)H-252B which the manufacturing number (MFG . No.) is on and after 96G21.<br>When the program is transferred from the memory pack without initializing the CPU, please memorize the power failure once (Press the R.CL switch with the CPU stops after turning on the power supply) before the run begins first after transferring the program.<br>(2) H-250, or H-252B which the manufacturing number (MFG . No.) are before 96G20<br>Please initialize the CPU before transferring the program from the memory pack<br><br>The view of the manufacturing number is as follows.<br>  <br><br>the manufacturing number<br>When producing on July 21, 1996<br>96 G 21<br>Day<br>Month<br>Jan. Feb. Mar. Apr. May. Jun. Jul. Aug. Sept. Oct. Nov. Dec.<br>A B C D E F G H I J K L<br>End two digits at anno Domini |

# CAUTION FOR SAFETY

Before installation, operation, maintenance and inspection, you have to read all this manual and other accessory documents carefully and use it correctly.

Use it after mastering all about knowledge of hardware, information of safety and precautions.

And this manual must be reached at hand of last responsible person for maintenance.

In this manual, the ranks of precaution for safety are divided as "DANGER" and "CAUTION".


: The case which dangerous situation may happen, fear of death or receiving a serious injury is assumed when user makes a mistake in handling.


: The case which dangerous situation may happen, fear of receiving a middling injury and a slight injury is assumed and occurrence of only material injury is assumed when user makes a mistake in handling.

Moreover, the matters described in 

also may be combined with serious result in some situation.

As both items state a important contents, please follow it certainly.

The explanations of picture display for inhibition and compulsion are described as follows.

: It displays inhibition ( a matter they must not do ).
For example in case of Fire Strictly Prohibited, it is  .

: It displays compulsion ( a matter they must do certainly ).
For example in case of Earth, it is  .

1. About installation

| ⚠ CAUTION |
| --- |
| ◦ Use it in the environment described in the catalog and manual.<br>If you use it in the environment which high temperature, high humidity, dust, corrosive gas, vibration, and shock exist, these may become a cause of electric shock, fire, and wrong movement.<br>◦ Install it according to manual. If installation is defective, it may become a cause of fall, breakdown and wrong movement.<br>◦ Don't enter an alien substance such as wiring fall.<br>It may become a cause of fire, breakdown, and wrong movement. |

2. About wiring

| COMPULSION |
| --- |
| ◦ Carry out earth certainly.<br>If earth is not carried out, a fear of electric shock and wrong movement exist. |

| CAUTION |
| --- |
| ◦ Connect a power supply matching to rate.<br>If a power supply mismatching to rate is connected, it may become a cause of fire.<br>◦ As for wiring work, specialist owning a qualification should carry out it.<br>If wiring is mistaken, a fear of fire, breakdown, and electric shock exist. |

3. Caution in using

| DANGER |
| --- |
| ◦ Exercise care not to touch the terminal during conduction.<br>A fear of electric shock exist.<br>◦ Construct emergency stop circuit, interlock circuit and so on outside of PC.<br>Because of a breakdown of PC, a fear of machine damage and accident exist. |

| CAUTION |
| --- |
| ◦ Operations such as program change in running, forced output, RUN, and STOP must be carried out in adequate confirmation of safety. Because of mistake in operation, a fear of machine damage and accident exist.<br>◦ Turn on according to a order of turning on power supply.<br>Because of wrong movement, a fear of machine damage and accident exist. |

4. About maintenance

| DANGER |
| --- |
| ◦ Exercise care not to connect a battery in reverse of +, −, charge it, decomposition it, heat it, throw it into fire, short it.<br>A fear of explosion and catching fire exist. |

| INHIBITION |
| --- |
| ◦ Exercise care not to break up and reconstruct PC.<br>It becomes a cause of fire, breakdown, and wrong movement. |

| CAUTION |
| --- |
| ◦ Mounting and dismounting module / unit must be carried out after turning off power.<br>It may become a cause of electric shock, wrong movement, and breakdown.<br>◦ As to fuse, exchange to appointed one.<br>It becomes a cause of fire and breakdown. |

# INTRODUCTION

We appreciate that you have selected the H-series H-250/252 of the Hitachi programmable controller (hereinafter abbreviated to PC). This manual outlines each module focusing to the H-series H-250/252 CPU modules 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 manual consists of the following two separate volumes.

**Hardware Edition**

Part I Outline of H-series H-250/252 P C: Concept on H-series H-250/252

Part II System Device Specification: Specification of each module of H-series H-250/252

Part III Installation, Mounting, Wiring, and Preparation for Running: From installation to trial run of H-series H-250/252

Part IV Maintenance, Inspection, and Error Recovery Processing: Maintenance, etc. of H-series H-250/252

Appendix List of special internal outputs

**Software Edition**

Chapter 1 Input/Output signal: Allocation of I/O signals of H-series H-250/252 and special internal output

Chapter 2 Processing Method and Concept on Scanning: Processing method of H-series H-250/252 and concepts on scanning

Chapter 3 Ladder/Command: H-series H-250/252 Ladder/Command programming language

Chapter 4 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-300/700/2000 and H-302/702/2002,H- 100M, H-200, or HB-700 of the H-series CPU module, refer to the dedicated manual.

Caution

In this manual, descriptions relating to H-252 are for the series name H-252B.

**Note:**

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

(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.

## 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 | Key switch | 2 | |
| 3 | Instruction manual<br>Hardware edition<br>Software edition | 1 copy<br>per<br>each | |

# CONTENTS

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

# Part IV Daily Inspection and Periodic Inspection

# Part I

## Outline of H-series H-250/252 PC

# Chapter 1 System Configuration



## 1.1 General Specification of H-250/252 series (PC body and modules)

**Table 1.1 General Specification of H-250/252 series**

| Item | Specification | | |
|---|---|---|---|
| Power supply | Supplied from the power module | | |
| Operating temperature | 0 to 55°C (Peripheral s excluded) | Storage temperature | -10°C to 75°C (Memory data can be guaranteed only in the operating temperature range) |
| Operating humidity | 20 to 90% RH without dew condensation (Peripheral s excluded) | Storage humidity | 10 to 90% RH without dew condensation |
| Vibration resistance | 16.7Hz, double amplitude 3 mm, 2 hours in each of X, Y, and Z directions | | |
| Noise resistance | • Noise voltage 1500 Vp-p, noise pulse width 100ns and 1μs (By using a noise simulator.)<br>• Based on NEMA ICS 3-304 (Input modules excluded)<br>• Electrostatic noise 3000 V applied to exposed metal | | |
| Insulation resistance | 20MΩ minimum between external AC terminal and frame ground (FG) terminal (Test method: Using a 500 VDC Megger) *1 | | |
| Withstand voltage | 1 minute at 1500 VAC between external AC terminal and frame ground (FG) terminal *1 | | |
| Grounding | 100Ω max. (exclusive grounding required) | | |
| Atomosphere | The equipment should be free of corrosive gasses such as ammonia, hydrogen sulfide and sulfer dioxide, oils, and excessive dust. | | |
| Structure | Open wall mounting type (one direction only) | | |
| Cooling | Natural cooling | | |

*1. Disconnect the internal connectors in the power module while these tests are being made, because the varistor is connected to the power terminal of the power module.

*2. For peripherals refer to the applicable operating manual.

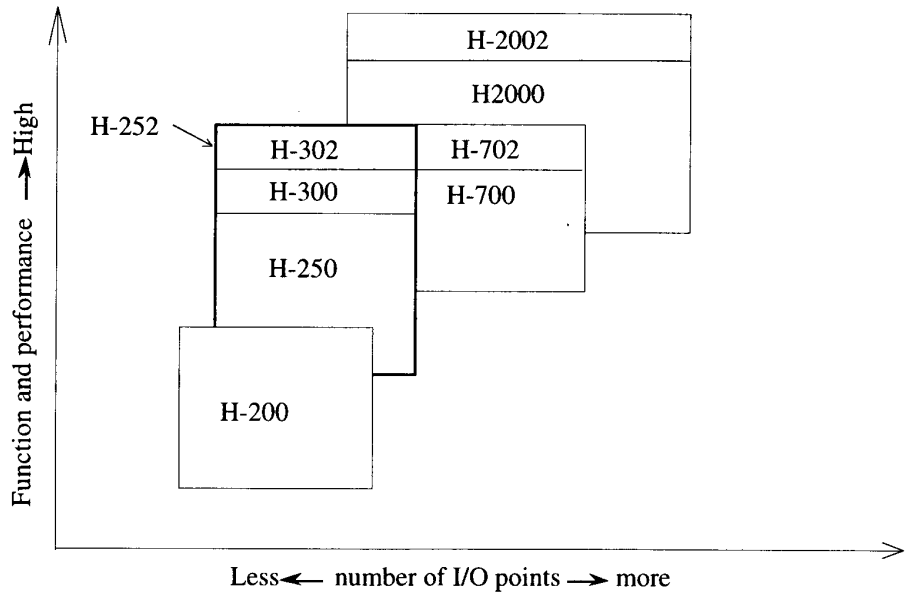
## 1.2 Positioning of H-series, H-250/252

H-series, H-250/252, is provided with various functions in addition to those of H-200, as shown in the following descriptions.

1. Features of H-250
   - Processing speed is shortened to 0.6μs from 1.5μs in the basic commands.
   - Performance is up-graded in some commands (signed computations, transfers, FOR~NEXT loop, etc.)
   - Capacity of the internal outputs is increased.
   - Performance is up-graded in the memory pack.
2. Features of H-252
   - Processing speed is shortened to 0.2μs in each basic command.
   - PID function is provided as a standard feature.
   - Performance is up-graded in some commands (data search, sophisticated function module commands, etc.)
   - Tracing function is added (time chart, command tracing, etc.).
   - The link area is expanded to 32,768 points/2 Kword.
   - Programming/monitoring is possible into a linking destination.

H-250/252 in H-series is positioned as shown on the following figure.

**Figure 1.2.1 Positioning of H-series**



## 1.3 Drawings for Modules and Peripheral Equipment



The H-250/252 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 modules.

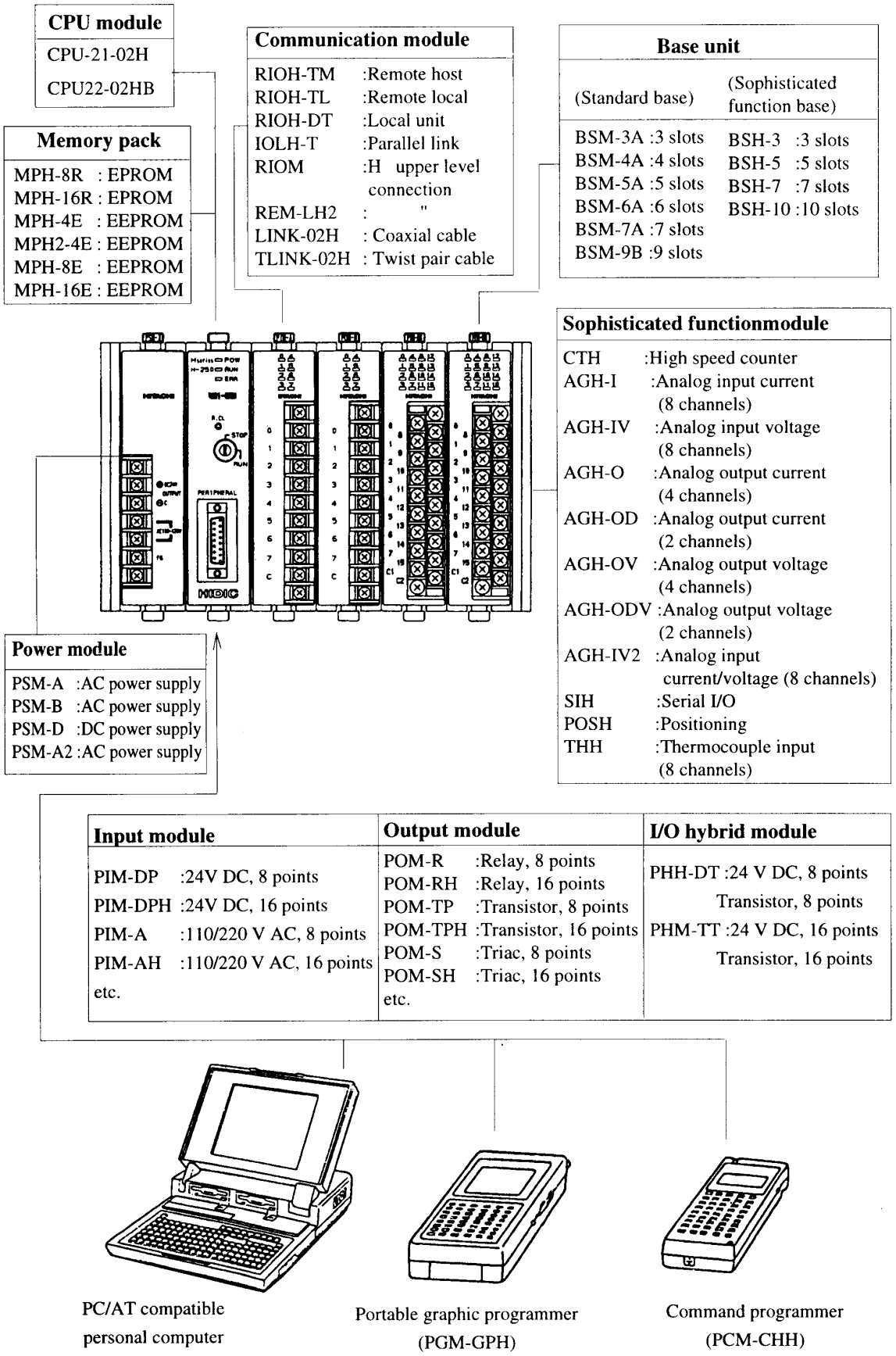



**Figure 1.3.1 Structure of H-250/252 components**

The peripheral equipment are the command programmer, the portable graphic programmer, and the graphic programming console. Each peripheral has functions that are different from those of the others, and also has different suitability to the connection with external devices (printers, auxiliary storage devices, etc.). Use appropriate peripherals and external devices depending upon the purpose.

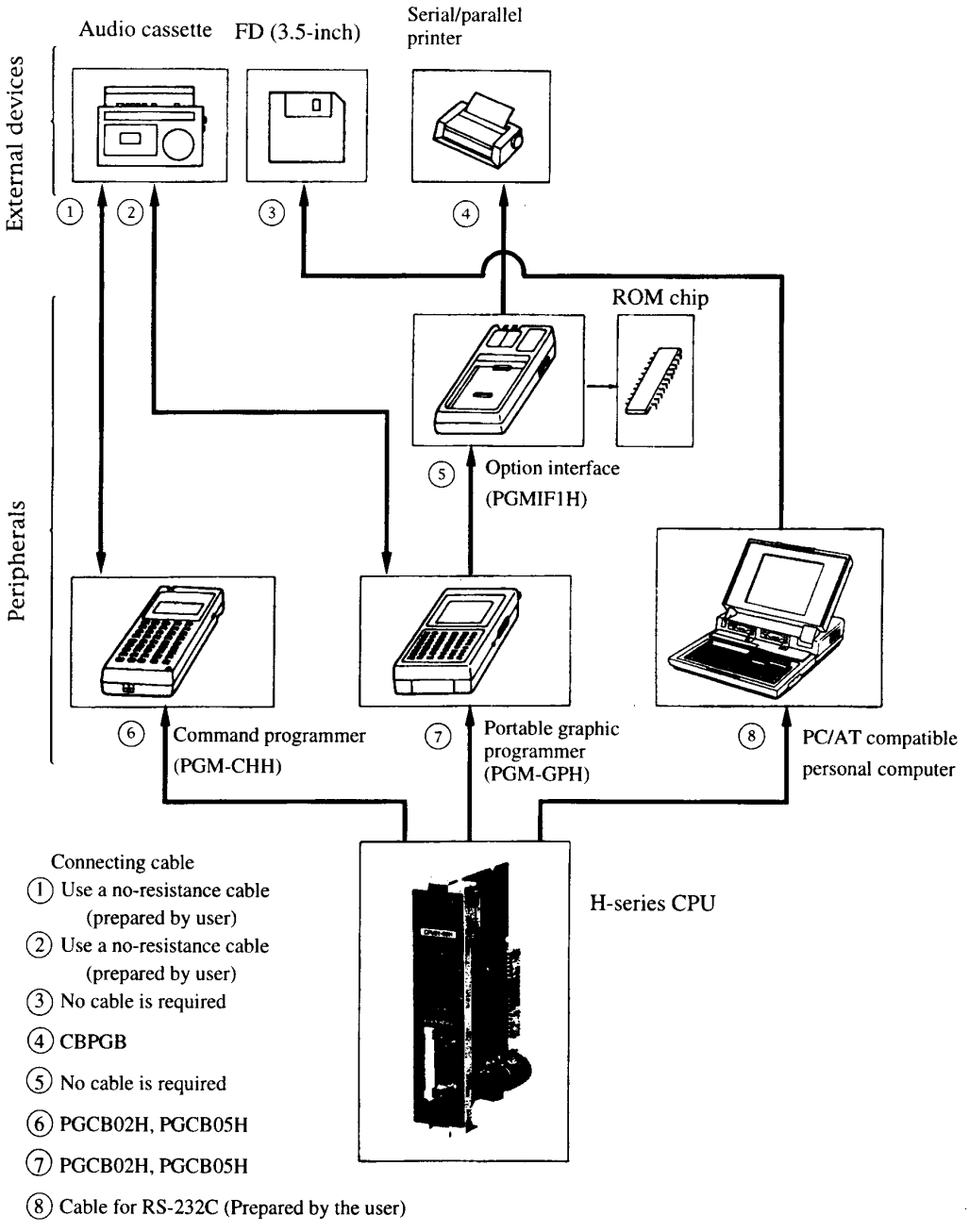


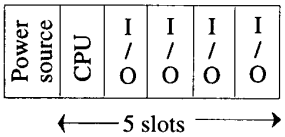

**Figure 1.3.2 Structure of Peripheral Equipment for H-250/252**

## 1.4 Component Lists

### (1) Basic components (1/2)

| Item | | Type | Specification | I/O Assignment | Remarks |
|---|---|---|---|---|---|
| CPU | H-250 | CPU21-02H | Max 256 points inputs/outputs with RAM memory 7.6k steps as standard | — | |
| | H-252 | CPU22-02HB | Max 464 points inputs/outputs with RAM memory 15.7k steps as standard | | |
| Memory pack | EPROM | * MPH-8R | Program capacity 7.6k steps | — | |
| | | # MPH-16R | Program capacity 15.7k steps | | |
| | EEPROM | * MPH-4E | Program capacity 3.5k steps | | |
| | | # MPH2-4E | Program capacity 3.5k steps(with copy function) | | |
| | | # MPH-8E | Program capacity 7.6k steps(with copy function) | | |
| | | # MPH2-16E | Program capacity 15.7k steps(with copy function) | | |
| Base (Standard) *3 | | BSM-3A | 3 slots | — | The basic base and the expansion base are in a common use. CPU link modules (LINK-02H, TLINK-02H) can not be used. |
| | | BSM-4A | 4 slots | | |
| | | BSM-5A | 5 slots | | |
| | | BSM-6A | 6 slots | | |
| | | BSM-7A | 7 slots | | |
| | | BSM-9B | 9 slots | | |
| Base (Sophisticated function) *3 | | # BSH-3 | 3 slots | | The basic base and the expansion base are in a common use. CPU for H-200 can not be used. |
| | | # BSH-5 | 5 slots | | |
| | | # BSH-7 | 7 slots | | |
| | | # BSH-10 | 10 slots | | |
| Power supply module | | PSM-A | Selectable between 85 to 132VAC and 170 to 264VAC | — | |
| | | PSM-A2 | With range 85 to 264VAC, CH2+CH3=0.7A | | |
| | | PSM-B | Selectable between 85 to 132VAC and 170 to 264VAC Capacity increasable | | |
| | | PSM-D | Power source voltage 24VDC | | |
| Input module | AC input module | PIM-A | 8 inputs of 85 to 264 VAC | X16 | |
| | | PIM-AH | 16 inputs of 85 to 264 VAC | X16 | |
| | | PIM-AW | 16 inputs of 85 to 264 VAC, removable terminal type | X16 | |
| | DC input module sink type (negative logic) | PIM-D | 8 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DH | 16 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DW | 16 inputs of 21.6 to 26 VDC, removable terminal type | X16 | |
| | | * PIH-DM | 32 inputs of 21.6 to 26 VDC, connector type | X32*2 (WX 8W) | |
| | DC input module source type (positive logic) | PIM-DP | 8 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DPH | 16 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DPW | 16 inputs of 21.6 to 26 VDC, removable terminal type | X16 | |
| Output module | Relay output module | POM-R | 8 outputs of 85 to 264 VAC and 21 to 27 VDC | Y16 | |
| | | POM-RC | Isolated relay output 8 points | Y16 | |
| | | POM-RH | 16 outputs of 85 to 264 VAC and 21 to 27 VDC | Y16 | |
| | | POM-RW | 16 outputs of 85 to 264 VAC and 21 to 27 VDC, removable terminal type | Y16 | |
| | Triac output module | POM-S | 8 outputs of 85 to 264 VAC | Y16 | |
| | | POM-SH | 16 outputs of 85 to 264 VAC | Y16 | |
| | | POM-SW | 16 outputs of 85 to 264 VAC, removable terminal type | Y16 | |

The combined use of the standard base and the Sophisticated function base is not acceptable in the basic base nor in the expansion base.
(Example)




*1. The base and modules marked with # are for exclusive use for H-250 and H-252. The moduls marked with * are for common use with H-200. The modules without any marks are for common use in EM and H-200.

*2 Though the assignment is possible also for WX8W, it can not be treated as bit data.

*3 The maximium numbers of assigned slots are shown below.

| | H-252 | H-250 |
|---|---|---|
| Standard base | 16 | 16 |
| Sophisticated function base | 29 | |

## Basic component (2/2)

| Item | | Type | Specification | I/O Assignment | remarks |
|---|---|---|---|---|---|
| Output module | Transistor output module sink type (negative logic) | POM-T | 8 outputs of 5 to 27 V DC | Y16 | |
| | | POM-TH | 16 outputs of 5 to 27 V DC | Y16 | |
| | | POM-TW | 16 outputs of 5 to 27 V DC, removable terminsal type | Y16 | |
| | | *POH-TM | 32 outputs of 5 to 27 V DC, connector type | Y32 *2 (WY8W) | |
| | Transistor output module source type (positive logic) | POM-TP | 8 outputs of 3 to 26 V DC | Y16 | |
| | | POM-TPH | 16 outputs of 3 to 26 V DC | Y16 | |
| | | POM-TPW | 16 outputs of 3 to 26 V DC, removable terminsal type | Y16 | |
| I/O mixed module | | PHH-DT | DC inputs 8 points sink (negative logic) transistor outputs 8 points sink (negative logic) | B 1/1 | |
| | | PHM-TT | TTL inputs 16 points TTL outputs 16 points | B 1/1 | |
| Communication module | Coaxial cable CPU linkage module | #LINK-02 | Up to 64 CPUs, up to 1024 words of link data | Link | Can be used only for H-252. |
| | Bypass relay | #BYP-02H | Bypass relay for LINK-02H | DUM16 | |
| | Twisted pair cable CPU linkage module 1 | #TLINK-02H | Up to 32 CPUs, up to 1024 words of link data | Link | |
| | Twisted pair cable CPU linkage module 2 | * IOLH-T | Up to 8 CPUs, up to 8 words of link data | Link | |
| | Remote I/O mini linkage module | * REM-LH2 | Connection with H-300 to H-2002 through remote master (REM-MMH), twisted pair cable | Link | |
| | Link for S10α | * IOLH-TA | Connection with S10α(the port 2 of CPU), twisted pair cable | Link | |
| | Coaxial cable remote I/O linkage module | * RIOM | Connection with H-300 to H-2002 through remote master (REM-MAH), coaxial cable | B 1/1 | Can not ne used for sophisticated function base |
| | Remote I/O module | * RIOH-TM | Master station for remote I/O (twisted pair cable) | Remote | |
| | | *RIOH-TL | Local station for remote I/O (twisted pair cable) | Setting not required | Can not ne used for sophisticated function base |
| | | *RIOH-DT | Local station for remote I/O (twisted pair cable), I/O solid unit, with power source | B 1/1 | |
| Fast counter module | | *CTH | 2 phase pulse, 10kHz, 16 bit counter | FU N3 | |
| Positioning module | | * POSH | 2 axis positioning, pulse module | 4/4W DUM16 | |
| Serial I/O module | | * SIH | ~~RS-232C × 1 channel~~ | 4/4W | |
| Analog module | Analogue input module | * AGH-I | 8 channels, 4 to 20mA, 8-bit current input | WX 8W | |
| | | * AGH-IV | 8 channels, 0 to 10V, 8-bit voltage input | | |
| | | * AGH-IV2 | 8 channels, 4 to 20mA, 0 to 10V, 12-bit for change-over of current/voltage | | |
| | Analogue output module | * AGH-O | 4 channels, 4 to 20mA, 8-bit current output | WY 8W | |
| | | * AGH-OD | 2 channels, 4 to 20mA, 8-bit current output | | |
| | | * AGH-OV | 4 channels, 0 to 10V, 8-bit voltage output | | |
| | | * AGH-ODV | 2 channels, 0 to 10V, 8-bit voltage output | | |
| Thermocouple module | | * THH | 8 channels, -100 to 500°C·····J type, -100 to 1000°C·····K type | WX 8W | Will be discontinued. Please avoid extension |

*1. The base and modules marked with # are for exclusive use for H-250 and H-252. The modules marked with * are for common use with H-200. The modules without any mark are for common use in EM and H-200.

*2 Though the assignment is possible also for WY8W, it can not be treated as bit data.

### (2) Peripherals

| Item | | Model | Specification | Remarks |
|---|---|---|---|---|
| Portable graphic programmer | Programmer mainframe | PGM-GPH | With EL backlight<br>Audio CMT I/F function | |
| | Option I/F | PGMIF1H | ROM writer function<br>Printer I/F function | |
| | Option I/F | PGMPK2H | ROM pack for PGM-GPH<br>Change of program during RUN available | |
| Command programmer | | PGM-CHH | Display with LED back light<br>Audio CMT I/F function | |
| Programming software | | HL-AT3E | LADDER EDITOR for PC/AT compatible personal computer | |

### (3) Connecting cable

Table 1-2-3 lists the connecting cables.

**Table 1-2-3 Connecting cables**

| Use | Type | Specification | Remarks |
|---|---|---|---|
| Expansion signal cables (between basic base and expansion base) | CNM-10 | Round cable, 1.0m long | Commonly usable for EM/H200. |
| | CNEB-06 | Round cable, 0.6m long | |
| | CNM-06 | Flat cable, 0.6m long | |
| | CNM-01 | Flat cable, 0.1m long | |
| Cables for portable graphic programmer and command programmer | PGCB02H | 2m long between CPU and a programmer | Commonly usable for H-200/300/700/2000. |
| | PGCB05H | 5m long between CPU and a programmer | |
| Cable for external connection | CBM-02 | 2m long for 32-point module | Commonly usable for EM/H-200. (PIH-DM, POH-TM). |
| | CBM-05 | 5m long for 32-point module | |
| | CBM-10 | 10m long for 32-point module | |

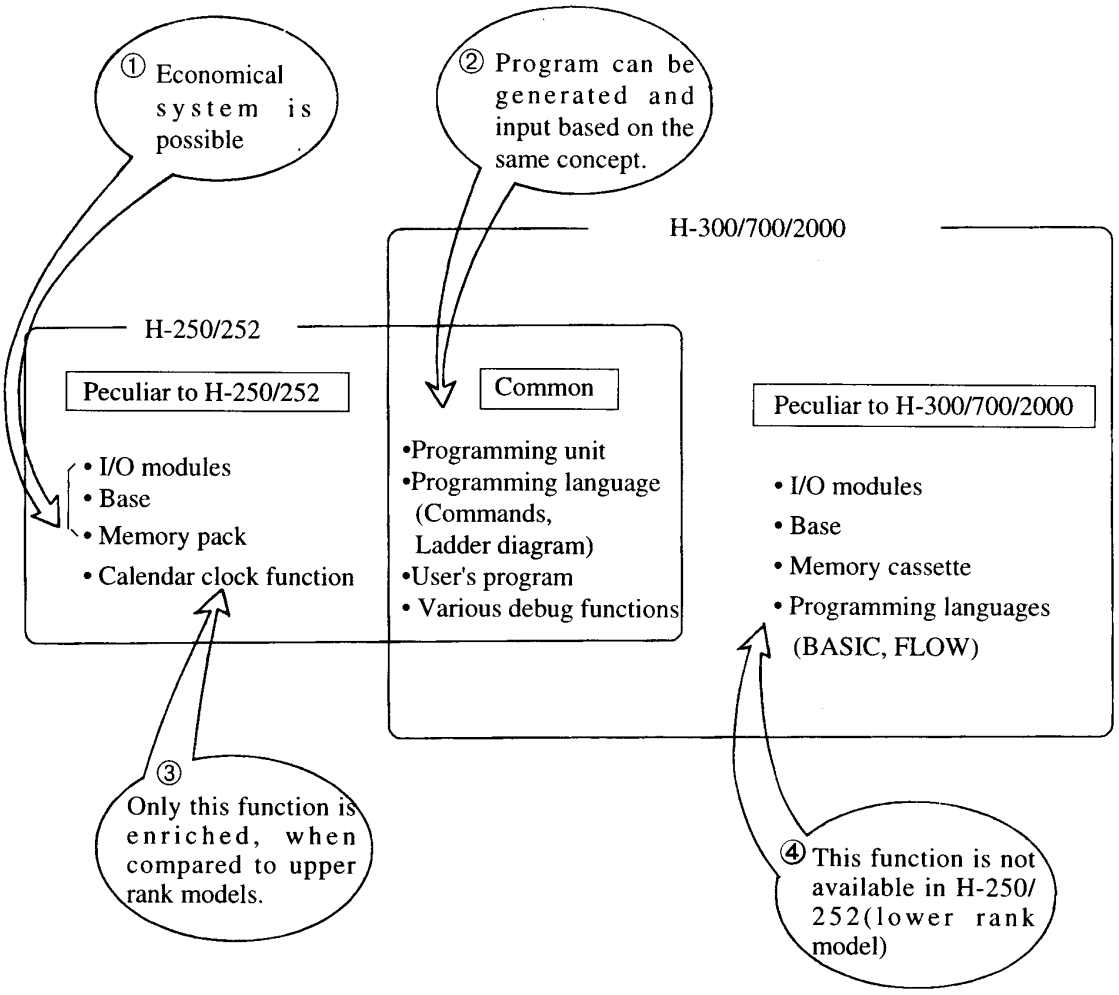
### (4) Other

| Type | Use | Remarks |
|---|---|---|
| LIBAT-H | Lithium battery | Commonly usable for H-200/300/700/2000 |
| ROMIC01H | ROM for the memory pack (MPH-8R) | Commonly usable for H-200/300/700/2000 |
| CVM | Cover for dummy slots | Commonly usable for H-200 |

## 1.5 Compatibility

### (1) Compatibility between H-250/252 and H-series of upper rank models

Fig 1.5.1 illustrates the comparison between H-250/252 and H-300/700/2000.




* Calendar clock function is added also to H-302/702/2002.

**Figure 1.5.1 Comparison between H-250/252 and the upper rank models (H-300/700/200)**

### (2) Compatibility of softwares

H-250/252 programs are upward-compatible to H-200 programs. The programs for H-200 is executable in H-250/252 with the following precautions.

**The dynamic timing (the portions that are adjusted by computation) should be changed by the value as is required by the increased processing speed. Special cautions should be made in this respect in a case a timing is made without using any timer function in sophisticated function modules or communication modules.**

### (3) Unusable Functions

H-250/252 is incapable of using the I/O categories and instructions listed in the table below unlike the upper rank models. Therefore, take "Substitutive measure" in the table. If the measure cannot be taken, then the upper rank model should be used.

Table 1.5.1 List of Unusable Functions

| No. | Unusable item | Name | Description | Substitutive measure (for reference) |
|---|---|---|---|---|
| 1 | I/O categories | Array variable | When I/O of Array variable is an external input (X, WX, DX, Y, WY, DY) | Make I/O of Array variable as an internal output (WR, WM) by means of assignment statements. |
| 2 | Command | Control commands for BASIC application | RSRV, START | Disregard because BASIC is not usable in H-250/252 |
| 3 | Programming language | BASIC language | HI-BASIC | Connect a personal computer and make processing with it. |
| | | FLOW language | HI-FLOW | Program using Ladder diagram |
| 4 | Function | Debug function | Simulation | Operate H-250/252, turning off the power supply to load (machine) or disconnecting power cable(common) to the load. |
| | | | Forced debug | Debug without this feature |
| | | Programmer connection at link end | Change of monitor/ program from link end | Connect the programmer to CPU. * 1 |
| | | Programmer connection at a remote end | Change of monitor/ program from remote end | Connect the programmer to CPU. |
| | | Installation of sophisticated function module at a remote end | Installation of analogue/counter module at a remote substation | Install CPU at a remote end, load a program and communicate with CPU link module |
| | | I/O assignment copy | Automatic generation of I/O assignment table | Generate I/O assignment table by key entry. |

*1) Connection is possible in H-252.

### (4) Difference in the command function

• Nesting of the master control

| H-250 | H-200/252B/300/700/2000 |
|---|---|
| Up to 7 layers | Up to 8 layers |

### (5) Other different points

**Remote mode setting**

**Table 1.5.2 List of the remote mode setting**

| CPU mode | CPU operation | H-250/252 | | H-300/700/2000 |
|---|---|---|---|---|
| | | Key switch | Dip switch-4 | |
| RUN | Running (will not accept RUN/STOP command from a personal computer) | RUN | OFF | Set the key switch at RUN |
| Remote RUN | Running (will accept STOP command from a personal computer) | RUN | ON (Remote) | Set the key switch at REMOTE after CPU is put into operation by setting the key switch at RUN. |
| Remote STOP | Stopped (will accept RUN command from a personal computer) | STOP | ON (Remote) | Set the key switch at REMOTE after CPU is stopped by setting the key switch at STOP. |
| STOP | Stopped (will not accept RUN/STOP command from a personal computer) | STOP | OFF | Set the key switch at STOP |

**I/O processing system**

① Even when the direct mode is selected by the dip switch setting, the I/O processing for the word modules (32-point I/O, analog, counter, link, remote, positioning, serial I/O, thermocouple) will become the refresh mode.

② Only H-250, the case reading from 8/16 points modules as word data, select refresh mode.

③ H-250/252 protocol

H-250/252 protocol is the same as in the upper rank models except the limitations for the tasks listed bellow. For their details refer to Chapter 4 Communication with a host computer in the software edition manual.

**Table 1.5.3 Limitations for H-250/252 protocol**

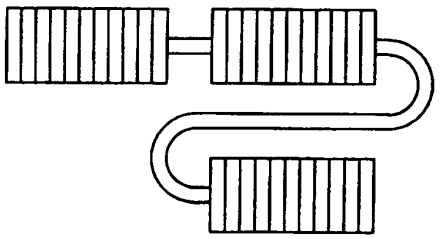
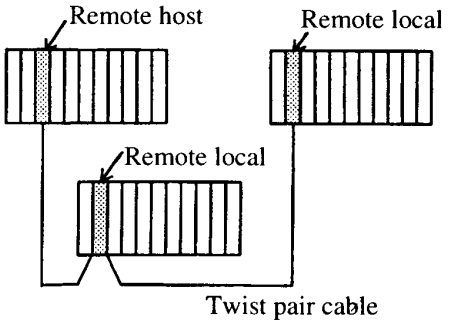
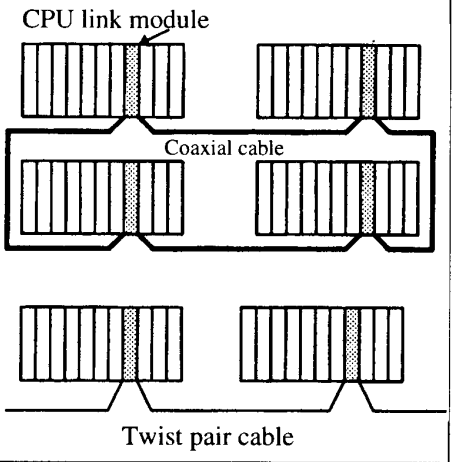
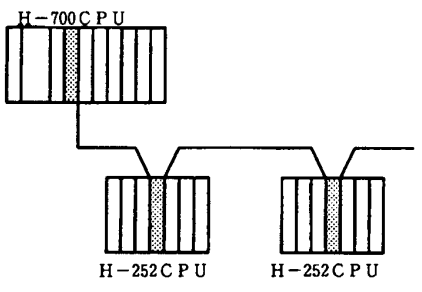
| Classification | task code No | Description | Limitation |
|---|---|---|---|
| I/O control | 40/A0 | P I/O No. assigning monitor (continuous N points) | All I/O outside the range of H-250/252 will be returned as "zero" |
| | 42/A2 | P I/O No. assigning forced Set/Reset (continuous N points) | Will be normally executed even outside the range of H-250/252 |
| | 44/A4 | P I/O No. assigning monitor (random N points) | All I/O outside the range of H-250/252 will be returned as "zero" |
| | 45/A5 | P I/O No. assigning forced Set/Reset (random N points) | Will be normally executed even outside the range of H-250/252 |

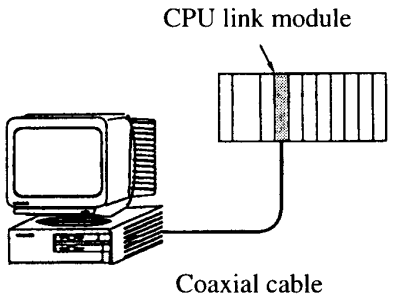
# Chapter 2 Concept on Structuring Various Systems



## 2.1 Outline of System Configurations

The following systems are for H-250/252.

| 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. |  |
| Remote I/O system | This is a system which is used to set an I/O module farther away (more than 4 meters) 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. |  |
| CPU link system | This is a system in which a plurality of basic base are connected in a loop form or in a bus form. They are connected via CPU link modules each other with coaxial cables or twist pair cables. |  |
| Remote I/O MINI system | A plurality of basic base are connected with the PC of upper layer, which will form an upper layer link system through I/O control. The connection can be possible with products by other manufacturers. |  |

| System name | Explanation of system | Configuration example |
|---|---|---|
| Upper layer link system by PCLINK-H | A PC/AT compatible personal computer is connected with one or more units of H-series CPU, which are to be served to monitor and manage data. The coaxial link module and a PC/AT compatible personal computer equipped with a built-in PCLINK-H board (now under development) are to be used. |  |
| Compound system | A system comprising the remote I/O, the CPU link and the upper layer link system. | |

## 2.2 Independent system

**[Outline]**

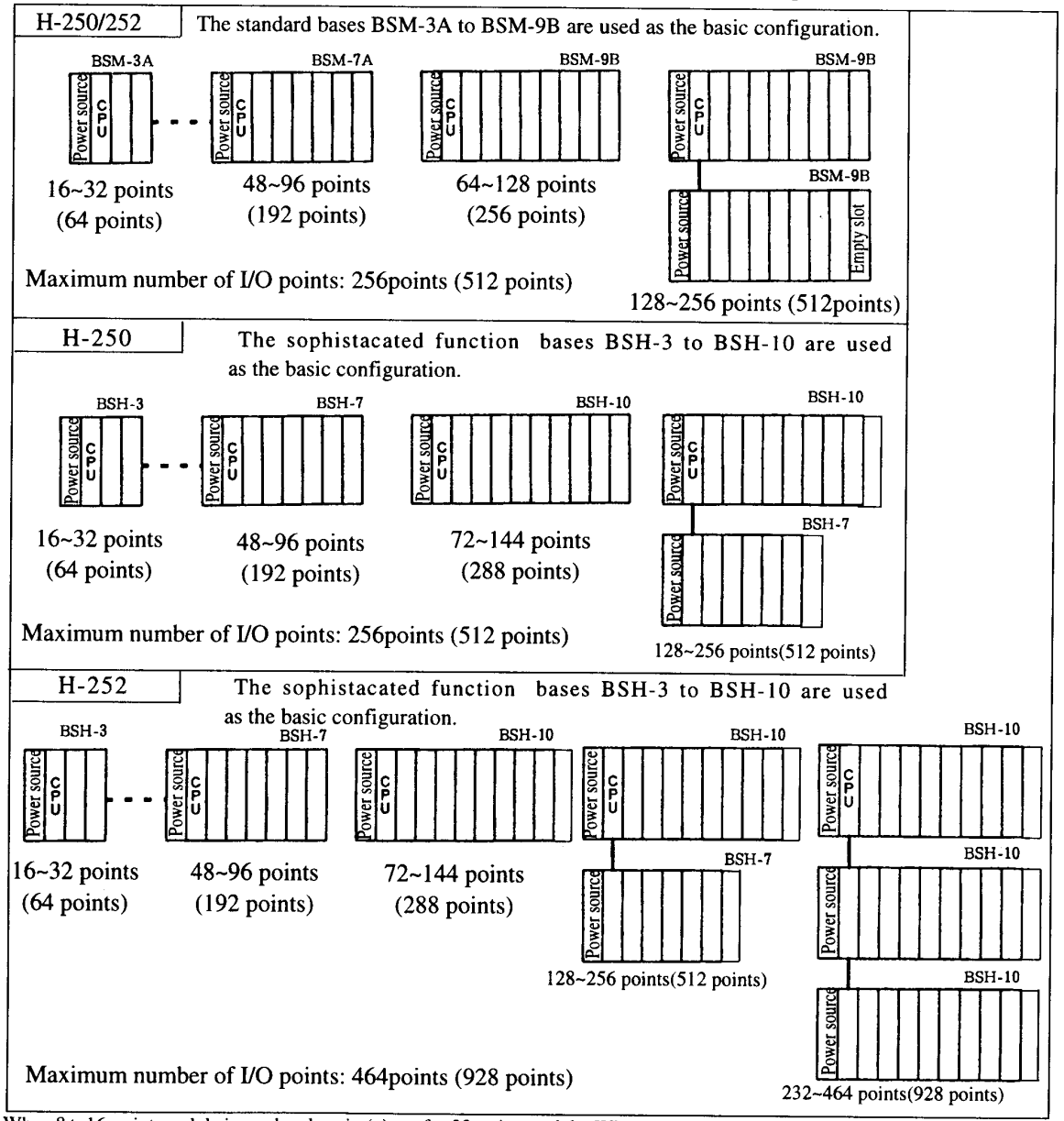
I/O control is performed by one unit of CPU.

When rather small number of I/O points are use, one unit of the basic base is enough to form a system. The standard bases (the sophisticated function modules) are prepared in 6 types classified by the number of mounted I/O modules ranging from 3 to 9 (for the sophisticated function modules, 4 types with 3, 5, 7, 10 modules each). Select suitable types depending upon the number of items to be controlled. (Refer to Chapter 6 Base).



**[Configuration example]**

- Maximum capacity of external I/O is 16 slots for H-250, and 29 slots for H-252 (16 slots in the standard base). Maximum number of I/O points are 464 points which can be used by every 8 points as a unit for structuring desired system.
- A lineup of the components is formed by the group of unity slots for every one of the power module, the CPU module or the basic base, which will minimize the installation space.



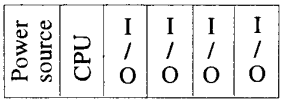

When 8 to16-point module is used, values in ( ) are for 32-point module. When coaxial cable CPU linkage module is used (in the case of 2 slots), note that the number of points will different from the above values. Note that the standard base and the sophisticated function base can not be used mixed in the basic base and in the expansion base.

## [Component Lists for Independent System]

### (1) Basic components (1/2)

| Item | | Type | Specification | I/O Assignment | Remarks |
|---|---|---|---|---|---|
| CPU | H-250 | CPU21-02H | Max 256 points inputs/outputs with RAM memory 7.6k steps as standard | — | |
| | H-252 | CPU22-02HB | Max 464 points inputs/outputs with RAM memory 15.7k steps as standard | | |
| Memory pack | EPROM | * MPH-8R | Program capacity 7.6k steps | — | |
| | | # MPH-16R | Program capacity 15.7k steps | | |
| | EEPROM | * MPH-4E | Program capacity 3.5k steps | | |
| | | # MPH2-4E | Program capacity 3.5k steps(with copy function) | | |
| | | # MPH-8E | Program capacity 7.6k steps(with copy function) | | |
| | | # MPH2-16E | Program capacity 15.7k steps(with copy function) | | |
| Base (Standard) *3 | | BSM-3A | 3 slots | — | The basic base and the expansion base are in a common use. CPU link modules (LINK-02H, TLINK-02H) can not be used. |
| | | BSM-4A | 4 slots | | |
| | | BSM-5A | 5 slots | | |
| | | BSM-6A | 6 slots | | |
| | | BSM-7A | 7 slots | | |
| | | BSM-9B | 9 slots | | |
| Base (Sophisticated function) *3 | | # BSH-3 | 3 slots | | The basic base and the expansion base are in a common use. CPU for H-200 can not be used. |
| | | # BSH-5 | 5 slots | | |
| | | # BSH-7 | 7 slots | | |
| | | # BSH-10 | 10 slots | | |
| Power supply module | | PSM-A | Selectable between 85 to 132VAC and 170 to 264VAC | — | |
| | | PSM-A2 | With range 85 to 264VAC, CH2+CH3=0.7A | | |
| | | PSM-B | Selectable between 85 to 132VAC and 170 to 264VAC Capacity increasable | | |
| | | PSM-D | Power source voltage 24VDC | | |
| Input module | AC input module | PIM-A | 8 inputs of 85 to 264 VAC | X16 | |
| | | PIM-AH | 16 inputs of 85 to 264 VAC | X16 | |
| | | PIM-AW | 16 inputs of 85 to 264 VAC, removable terminal type | X16 | |
| | DC input module sink type (negative logic) | PIM-D | 8 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DH | 16 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DW | 16 inputs of 21.6 to 26 VDC, removable terminal type | X16 | |
| | | * PIH-DM | 32 inputs of 21.6 to 26 VDC, connector type | X32*2 (WX 8W) | |
| | DC input module source type (positive logic) | PIM-DP | 8 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DPH | 16 inputs of 21.6 to 26 VDC | X16 | |
| | | PIM-DPW | 16 inputs of 21.6 to 26 VDC, removable terminal type | X16 | |
| Output module | Relay output module | POM-R | 8 outputs of 85 to 264 VAC and 21 to 27 VDC | Y16 | |
| | | POM-RC | Isolated relay output 8 points | Y16 | |
| | | POM-RH | 16 outputs of 85 to 264 VAC and 21 to 27 VDC | Y16 | |
| | | POM-RW | 16 outputs of 85 to 264 VAC and 21 to 27 VDC, removable terminal type | Y16 | |
| | Triac output module | POM-S | 8 outputs of 85 to 264 VAC | Y16 | |
| | | POM-SH | 16 outputs of 85 to 264 VAC | Y16 | |
| | | POM-SW | 16 outputs of 85 to 264 VAC, removable terminal type | Y16 | |

The combined use of the standard base and the Sophisticated function base is not acceptable in the basic base nor in the expansion base.
(Example)




*1. The base and modules marked with # are for exclusive use for H-250 and H-252. The moduls marked with * are for common use with H-200. The modules without any marks are for common use in EM and H-200.

*2 Though the assignment is possible also for WX8W, it can not be treated as bit data.

*3 The maximium numbers of assigned slots are shown below.

| | H-252 | H-250 |
|---|---|---|
| Standard base | 16 | 16 |
| Sophisticated function base | 29 | |

## Basic component (2/2)

| Item | | Type | Specification | I/O Assignment | remarks |
|---|---|---|---|---|---|
| Output module | Transistor output module sink type (negative logic) | POM-T | 8 outputs of 5 to 27 V DC | Y16 | |
| | | POM-TH | 16 outputs of 5 to 27 V DC | Y16 | |
| | | POM-TW | 16 outputs of 5 to 27 V DC, removable terminsal type | Y16 | |
| | | *POH-TM | 32 outputs of 5 to 27 V DC, connector type | Y32 *2 (WY8W) | |
| | Transistor output module source type (positive logic) | POM-TP | 8 outputs of 3 to 26 V DC | Y16 | |
| | | POM-TPH | 16 outputs of 3 to 26 V DC | Y16 | |
| | | POM-TPW | 16 outputs of 3 to 26 V DC, removable terminsal type | Y16 | |
| I/O mixed module | | PHH-DT | DC inputs 8 points sink (negative logic) transistor outputs 8 points sink (negative logic) | B 1/1 | |
| | | PHM-TT | TTL inputs 16 points TTL outputs 16 points | B 1/1 | |
| Communication module | Coaxial cable CPU linkage module | #LINK-02 | Up to 64 CPUs, up to 1024 words of link data | Link | Can be used only for H-252. |
| | Bypass relay | #BYP-02H | Bypass relay for LINK-02H | DUM16 | |
| | Twisted pair cable CPU linkage module 1 | #TLINK-02H | Up to 32 CPUs, up to 1024 words of link data | Link | |
| | Twisted pair cable CPU linkage module 2 | * IOLH-T | Up to 8 CPUs, up to 8 words of link data | Link | |
| | Remote I/O mini linkage module | * REM-LH2 | Connection with H-300 to H-2002 through remote master (REM-MMH), twisted pair cable | Link | |
| | Link for S10α | * IOLH-TA | Connection with S10α(the port 2 of CPU), twisted pair cable | Link | |
| | Coaxial cable remote I/O linkage module | * RIOM | Connection with H-300 to H-2002 through remote master (REM-MAH), coaxial cable | B 1/1 | Can not ne used for sophisticated function base |
| | Remote I/O module | * RIOH-TM | Master station for remote I/O (twisted pair cable) | Remote | |
| | | *RIOH-TL | Local station for remote I/O (twisted pair cable) | Setting not required | Can not ne used for sophisticated function base |
| | | *RIOH-DT | Local station for remote I/O (twisted pair cable), I/O solid unit, with power source | B 1/1 | |
| Fast counter module | | *CTH | 2 phase pulse, 10kHz, 16 bit counter | FU N3 | |
| Positioning module | | * POSH | 2 axis positioning, pulse module | 4/4W DUM16 | |
| Serial I/O module | | * SIH | RS-232C × 1 channel | 4/4W | |
| Analog module | Analogue input module | * AGH-I | 8 channels, 4 to 20mA, 8-bit current input | WX 8W | |
| | | * AGH-IV | 8 channels, 0 to 10V, 8-bit voltage input | | |
| | | * AGH-IV2 | 8 channels, 4 to 20mA, 0 to 10V, 12-bit for change-over of current/voltage | | |
| | Analogue output module | * AGH-O | 4 channels, 4 to 20mA, 8-bit current output | WY 8W | |
| | | * AGH-OD | 2 channels, 4 to 20mA, 8-bit current output | | |
| | | * AGH-OV | 4 channels, 0 to 10V, 8-bit voltage output | | |
| | | * AGH-ODV | 2 channels, 0 to 10V, 8-bit voltage output | | |
| Thermocouple module | | * THH | 8 channels, -100 to 500°C·····J type, -100 to 1000°C·····K type | WX 8W | Will be discontinued. Please avoid extension |

*1. The base and modules marked with # are for exclusive use for H-250 and H-252. The modules marked with * are for common use with H-200. The modules without any mark are for common use in EM and H-200.

*2 Though the assignment is possible also for WY8W, it can not be treated as bit data.

## 2.3 Remote I/O system

### (1) System configuration

The system configuration of the remote I/O system is shown on Figure 2.3.1.

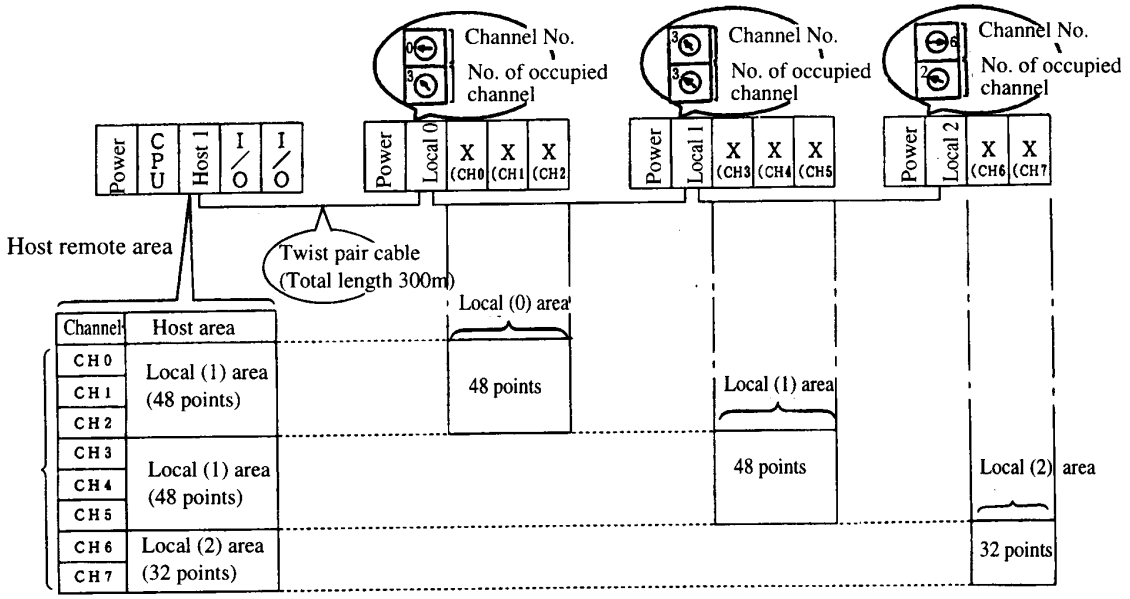


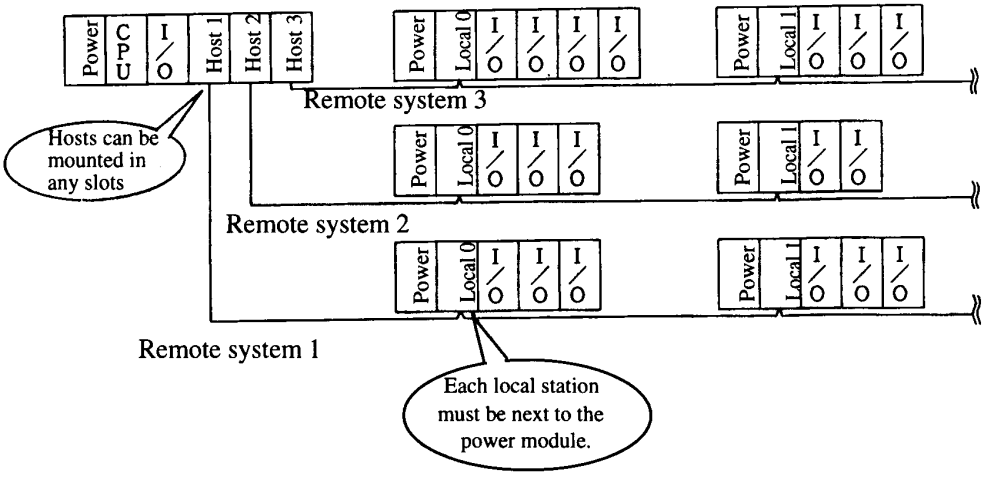

**Figure 2.3.1 Configuration of Remote I/O System**

① The remote I/O system is configurated with the remote host station (RIOH-TM) and the local stations (RIOH-TL), being interconnected by twist pair cables. When the operating switches, indicating lamps or the main control panel are located apart each other, the twist pair cables will transmit data, contributing to elimination of individual wirings.

② The host station is provided with 8 channels (CH0~CH7) of remote I/O area, which have correspondence with each of the local stations starting from the top local station.

③ Each channel of the host station is of 16-bit, which can transmit total of 128 points of I/O (16 points × 8 channels) to the remote end stations.

④ As the maximum of 4 host stations can be mounted in the slots other than those for the CPU modules or power modules, four remote systems can be constructed. Identification will be made starting from the nearest station to CPU as the host 1, the host 2, , etc.

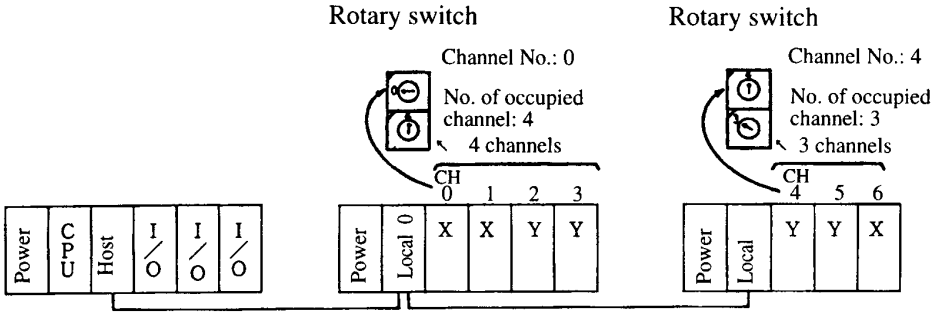


⑤ Each local station should be mounted next to the right of the power module. Maximum of the 8 local stations can be connected with each host station.

⑥ In each local station must accommodate only bit I/O modules, but no word I/O modules (Analogue modules, Counter modules).

⑦ Each local station is provided with a set of rotary switches which will select the channel No. and number of channels occupied in the station.






⑧ The permissible distance of data transmission differs depending upon the thickness of cable.

0.3mm$^2$ twist pair cable.....150 meters in total.

0.75mm$^2$ twist pair cable.....300meters in total (150 Ω terminator resistor is required).

**(2) I/O assignment and I/O number**

① I/O assignment should be made for the remote host and the remote local as shown in Table 2.3.1.

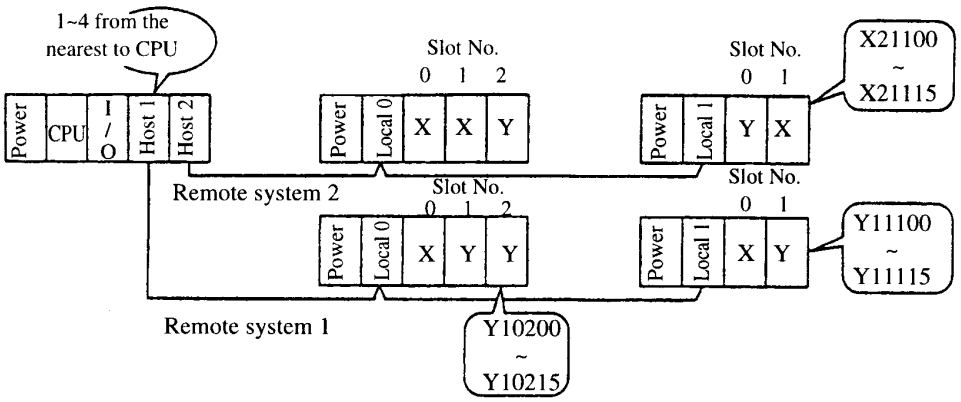
**Table 2.3.1 I/O assignment designation**

| Module classification | Type | I/O assignment designation |
|---|---|---|
| Remote host | RIOH-TM | Remote |
| Remote local | RIOH-TL | Settig required in Remote end |

② Table 2.3.2 shows how to assign I/O identification numbers.

**Table 2.3.2 How to assign I/O identification numbers**

| Category | Medium group | Individual | Designation | Usable range |
|---|---|---|---|---|
| Remote I/O | External input | Bit | X [r] [St] [S] [b] [b] | r : Remote host No. (1~4)<br>St : Remote local No. (0~7)<br>S : Slot No. (0~7)<br>bb : Bit No. (00~15) Decimal<br>W1 : Word No. (0~1) |
| | | Word | W X [r] [St] [S] [W1] | |
| | External output | Bit | Y [r] [St] [S] [b] [b] | |
| | | Word | W X [r] [St] [S] [W1] | |



## 2.4 CPU Link System

**[Out line]**

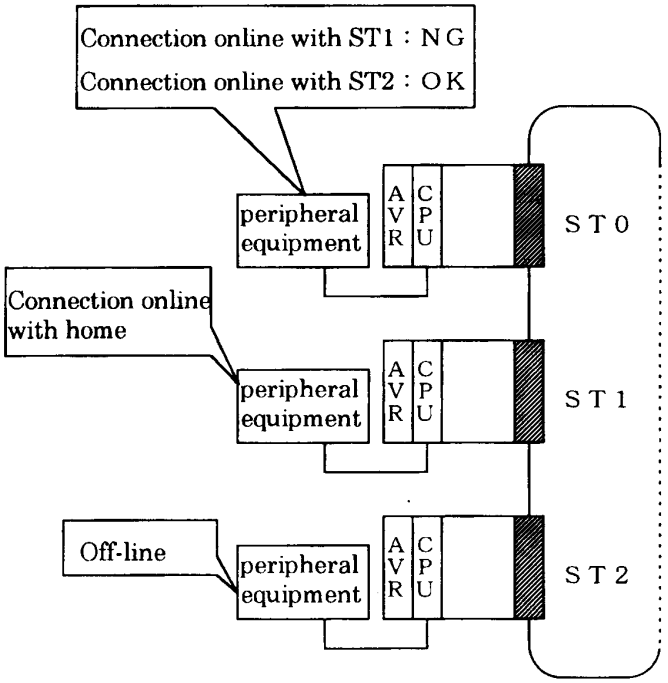
Two or more (64 maximum or 32 maximum) CPUs are connected each other in a loop form or path form together with CPU link modules LINK-02H (coaxial cable) or TLINK-02H (twist pair cable), which will enable operations co-related with these CPU by means of transmission of data (1,024 words maximum) between them.

Two CPU link modules can be connected to one unit of CPU, forming two loops. The special CPU link module (IOLH-T) is available for a system comprising of maximum of 8 units of CPU (8 words maximum) when the twist pair cable is used.

Transmission of data will be executed through the CPU link area (WL0~3FF, WL1000~13FF). This area, when being used for no CPU, can also be used for both internal bit outputs and external word outputs.

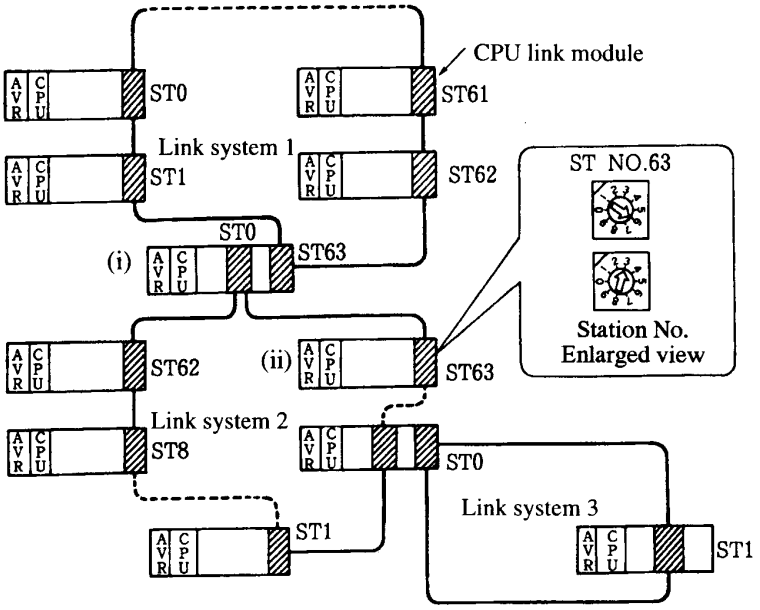
CPU of any one of the station in the system can access CPU of any other station in the system for programming, monitoring, etc..(The CPU link system by IOLH-T cannot do the monitor/the programming at link end).

However, please do not connect online from two or more stations with one CPU of H-252 at the same time by the peripheral equipment or the personal computer in the CPU link system. It is likely to become a communication error. The number of the peripheral equipment which connects online with the CPU of H-252B at the same time must become one.



As the coaxial CPU link module can be used mixed in a loop because it is compatible with the CPU link module of the upper grade H-series (H-300 or upper) CPU link modules.

**[Configuration example]**




**[Points of Configuration]**

① Up to two CPU link modules can be mounted on the basic base containing any type of CPU. They can be mounted on any input slot.

② Maximum of 64 unit (or 32 unit) of CPU module can be linked in one link system.

③ Give identification number on each CPU link component station by 0~63 (or 31) in a link system, avoiding double numbering. The station number "0" (for the host) is indispensable in any case. The numbering shall be set by the rotary switch provided on the CPU link module.

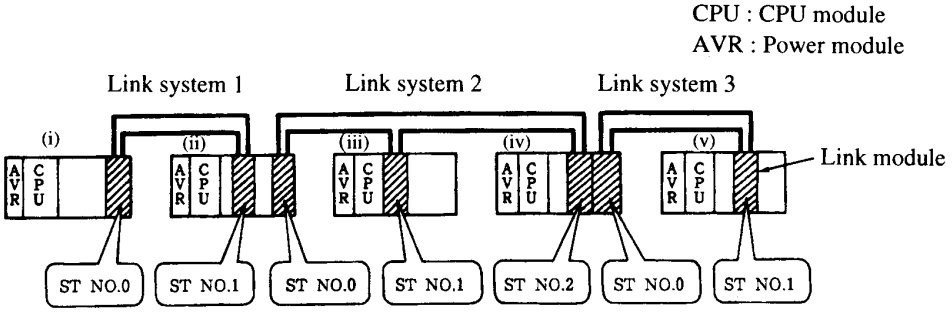
④ Total length of cables: 1 km (maximum 500 m between two stations)

⑤ CPU module (i) can be used for programming, monitoring, etc., by CPU in any of the stations of the link system 1 or 2. CPU module (ii) can be used for programming, monitoring, etc., by CPU in any of the stations of the link system 2 or 3. (not for H-250).

**[Conception of Link Area]**

The CPU link area is assumed to be assigned as bellow. (The area assignment shall be made through peripherals. For details, refer to the operation manuals for corresponding peripherals).

| | 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 |
| Number of assignments | H 100 words | H 1FF words | H 110 words | H 80 words | H 150 words | H 70 words | H 200 words |

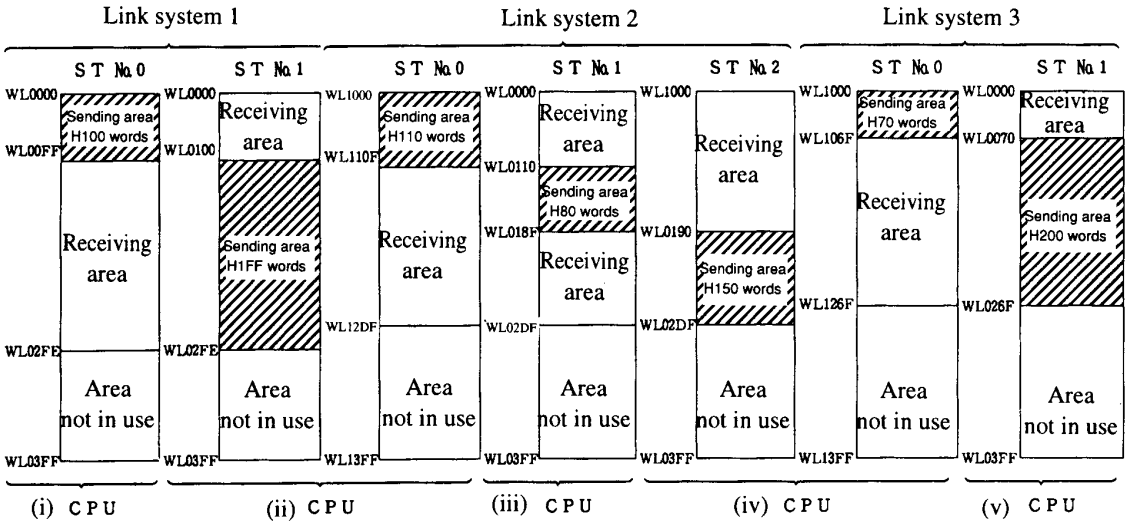



Each CPU link area is divided into the sending area and receiving area. In the sending area, data on the own station will be set. These data will be sent in turn to each link area belonging to the same link system. This status implies that all the CPU in the link system are charged with identical data.

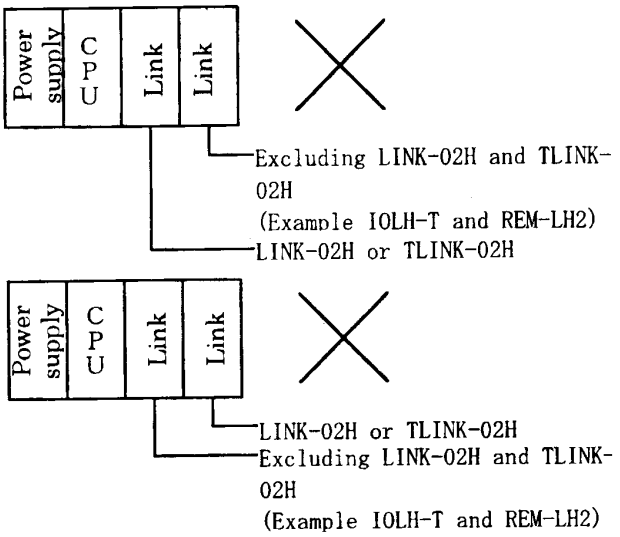
On the other hand, a system will be as shown bellow when 2 link modules are mounted in 1 CPU.

In this method, both of the two areas (WL0000~WL03FF, WL1000~WL13FF) in the CPU shall be utilized to make correspondence with each link. The CPU, having interconnection with 2 links, will assign and manage data in each link area.

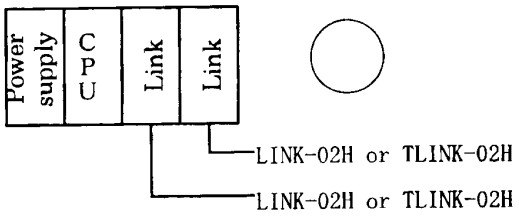
Note: The following numerical numbers are in hexadecimal.



LINK-02H, TLINK-02H, and other link modules (example IOLH-T) cannot exist together on the same base (basic base). When LINK-02H and TLINK-02H exist together to other link modules by mistake, the link data and the flag become irregular.



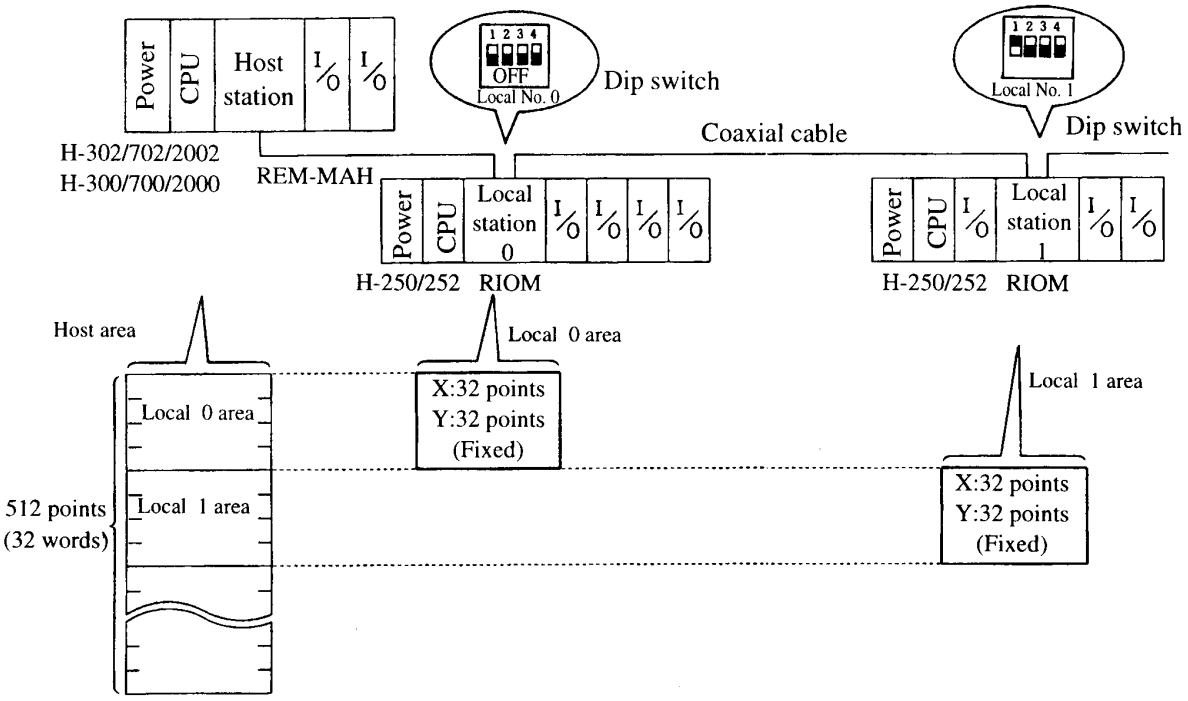

Coexistence on the same base of LINK-02H and TLINK-02H is possible.




Please refer to the owner guide of LINK-02H and TLINK-02H for details.

## 2.5 I/O link System (coaxial cable) with Upper Grade Machines (H-302/702/2002, H-300/700/2000)

The I/O link system with H-series upper grade machines (H-302/702/2002, H-300/700/2000) can be configurated by installing the upper grade link module (RIOM) onto H-250/252. (Sophisticated function modules can not be used for this purpose).




(1) The remote host [REM-MAH] is installed on the upper grade machine, and the upper grade link module [RIOM] is installed on the H-250/252. The I/O link system is configurated by connecting these units. RIOM forms the local station.

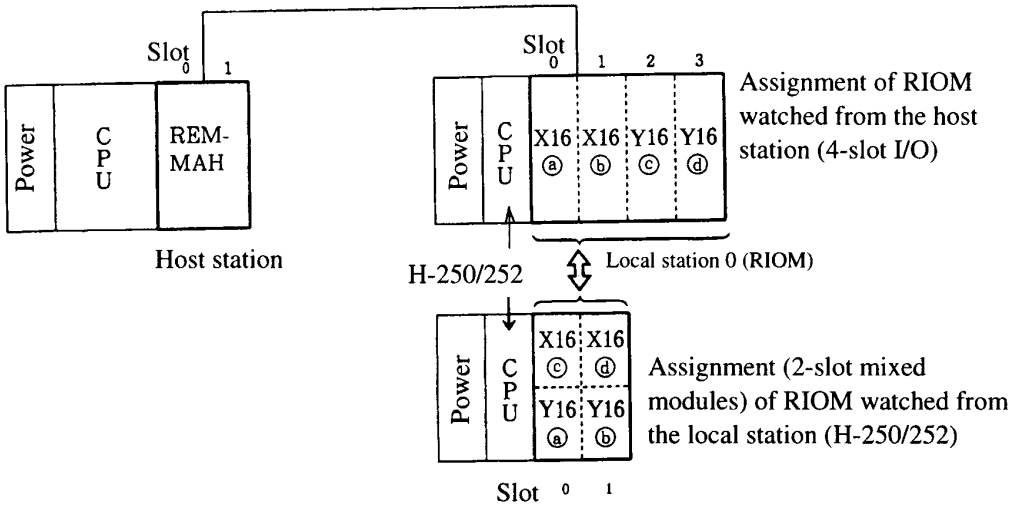
(2) The host station is provided with the remote I/O area with 512 points. Each RIOM is provided with 32 input points and 32 output points. (Number of occupied points is fixed). Therefore, maximum of 8 RIOM units can be connected to one host station.

(3) The host station can be installed on any slots excluding CPU slots and power slots. The local station can also be installed on any slots excluding CPU slots and power slots.

(4) Each local station is provided with the dip switch which will set the station No. The numbering shall be made from 0 to 7 starting at the nearest to the host.

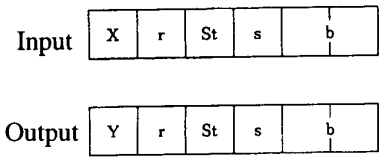
(5) RIOM can be used with the upper grade remote local station [REM-LOM] mixed in the link.

**[Concept of I/O Link]**




When RIOM is connected with the host [REM-MAH], the host will recognize the RIOM as an I/O (X16, X16, Y16, Y16 in a fixed order) with 4 slots. The local station CPU (H-250/252) will recognize RIOM as a mixed module (slot 0: X16, Y16, slot 1: X16, Y16). These areas linked each other. Input (X) of the link area of the host will be received as the local station output (output (Y )when looked from the local CPU), and the output (Y) from the host will become an input to the local station (input (X) when looked from the local CPU). Therefore the link areas will be as shown by ⓐ, ⓑ, ⓒ, ⓓ.

The I/O numbers will be assigned to this RIOM in the host station.

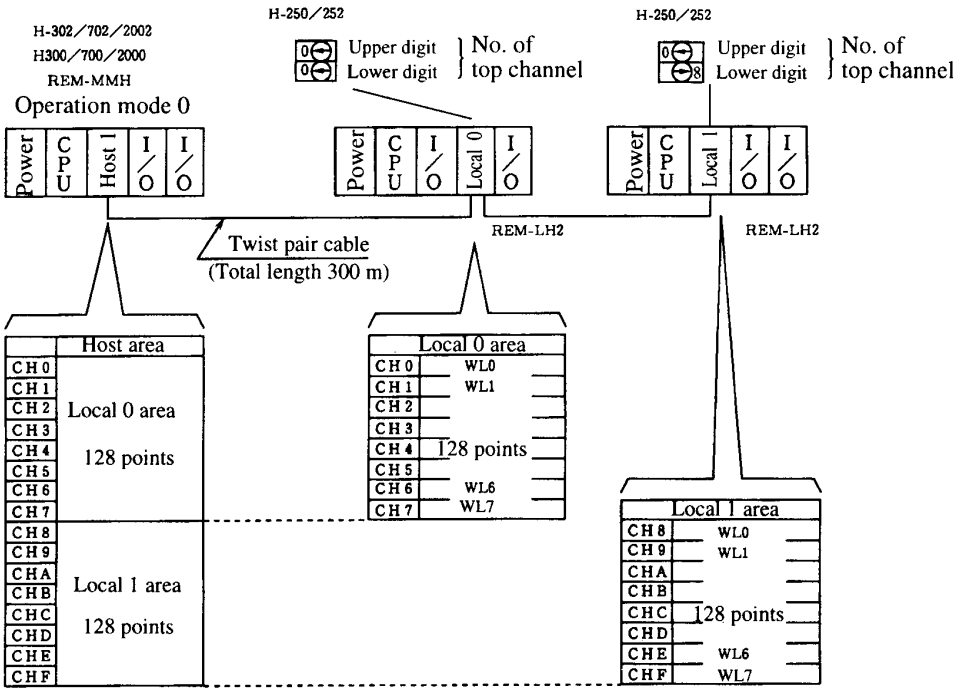



r : Remote host station No. (1~4)
St: Remote local station No. (0~7)
S : Slot No. in the local station ( 0~3 in this illustration)
b : Bit No. in the module (00~15)

RIOM numbers in this system are as shown in the following table.

| Area | RIOM No. when watched from the host station | RIOM No. when watched from the local station |
|---|---|---|
| ⓐ | X10000~X10015 | Y016~Y031 (WY01) |
| ⓑ | X10100~X10115 | Y116~Y131 (WY11) |
| ⓒ | X10200~X10215 | X000~X015 (WX00) |
| ⓓ | X10300~X10315 | X100~X115 (WX10) |

## 2.6 I/O link System (twist pair cable) with Upper Grade Machines(H-302/702/2002, H-300/700/2000)




(1) The upper link system is formed by connecting the remote I/O module (host REM-MMH) of upper grade PC with the upper link module (REM-LH2) by twist pair cables.

Maximum of 8 local stations (REM-LH2) can be connected to one host station.(REM-MMH)

(2) REM-LH2 is provided with a set of rotary switches which is used to set number of the top channel. 8 occupied channels are provided.

(3) The CPU link area (common area for bits/words : L/WL) is used for data communication. (Set the "link" and assign I/O).

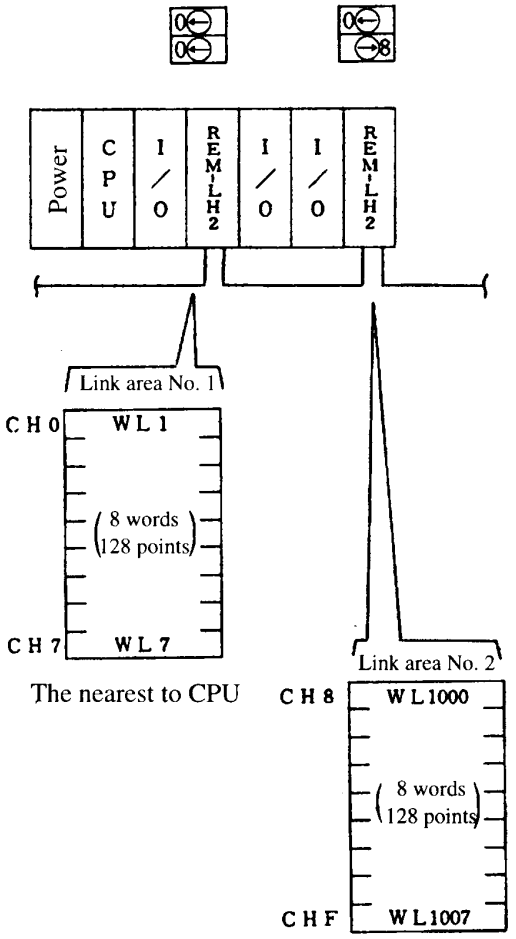
The CPU link area is provided with 2 areas, each of which comprises 128 points of 8-word.

(4) Assign the channel numbers 00~63 on each upper grade link module in 1 link avoiding double numbering.

(5) The upper link area is divided into the sending area and the receiving area. Data of own station will be set in the sending area and then transmitted to the host station (REM-MMH). Therefore other local station can receive these data relayed through the host station.

(6) When the CPU link area is not used in this way, the area will become available for the common bit/ word internal outputs.

(7) Maximum of 2 upper link modules can be mounted to be connected with H-250/252.

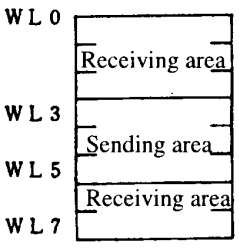



This example shows 2 units mounted on 1 base in 1 link system. The upper links with 256 points (16 words)/CPU are necessary in this case.

(8) Assignment of the own station

The sending area shall be assigned as the own station area.

Following example shows WL3~WL5 as the own area.




This assignment shall be made by means of the setting function of CPU link parameters through a programming device.

## 2.7 Upper Link System

**[Outline]**

A personal computer or an upper grade computer (hereinafter defined as the host computer) is connected with a CPU module or a communication module for the purpose of communication of data between them. The CPU link I/F board (PCLINK-H) is prepared to be installed in a PC/AT compatible personal computer for use in the communication with the CPU link module.

The features of each component are:

- The CPU module is provided with peripheral ports which will serve to execute the communication.
- The CPU link I/F board PCLINK-H shall be installed in a PC/AT compatible personal computer to be connected with the CPU link module for communication use. High speed will be realized through the CPU link area.

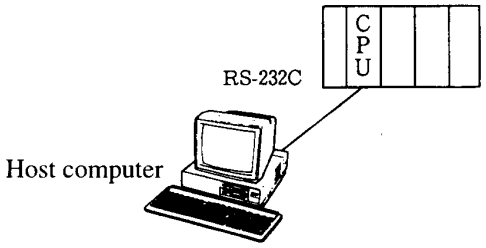


### (1) System using CPU module

**[Outline]**

The CPU module of H-250/252 is provided with Peripheral ports (ports for connection of peripherals). These ports are base upon RS-232C serial interface standard. The communication will be made through these ports with the host computer.

**[Example of Configuration]**




**[Points of Configuration]**

① RS-232C shall be applied for connecting the personal computer with the peripherals.

② Note that the peripherals can not be connected to the CPU module when the peripheral ports are occupied for the communication.

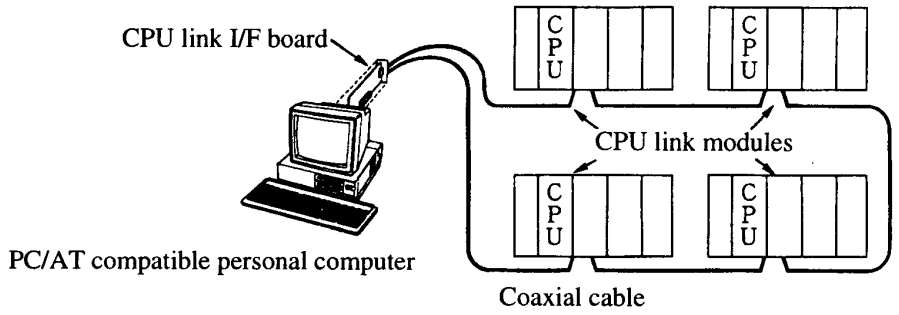
③ Communication speeds are 2400, 4800, 9600, 19200 bps. (selectable through a dip switch).

**(2) PCLINK-H system**

**[Outline]**

The CPU link I/F board PCLINK-H shall be installed in a PC/AT compatible personal computer to be connected with the H-250/252 CPU link for the purpose of communicating between CPU in high speed. (now under development).

Two units (corresponding to two loops) of CPU link I/F can be installed in a personal computer. Expansion is easy in this feature.




**[Example of Configuration]**

**[Points of Configuration]**

① The link system will not be disconnected even when the power is off in the PC/AT compatible personal computer.

(PCLINK-H set consists of a CPU link I/F board and a control software).

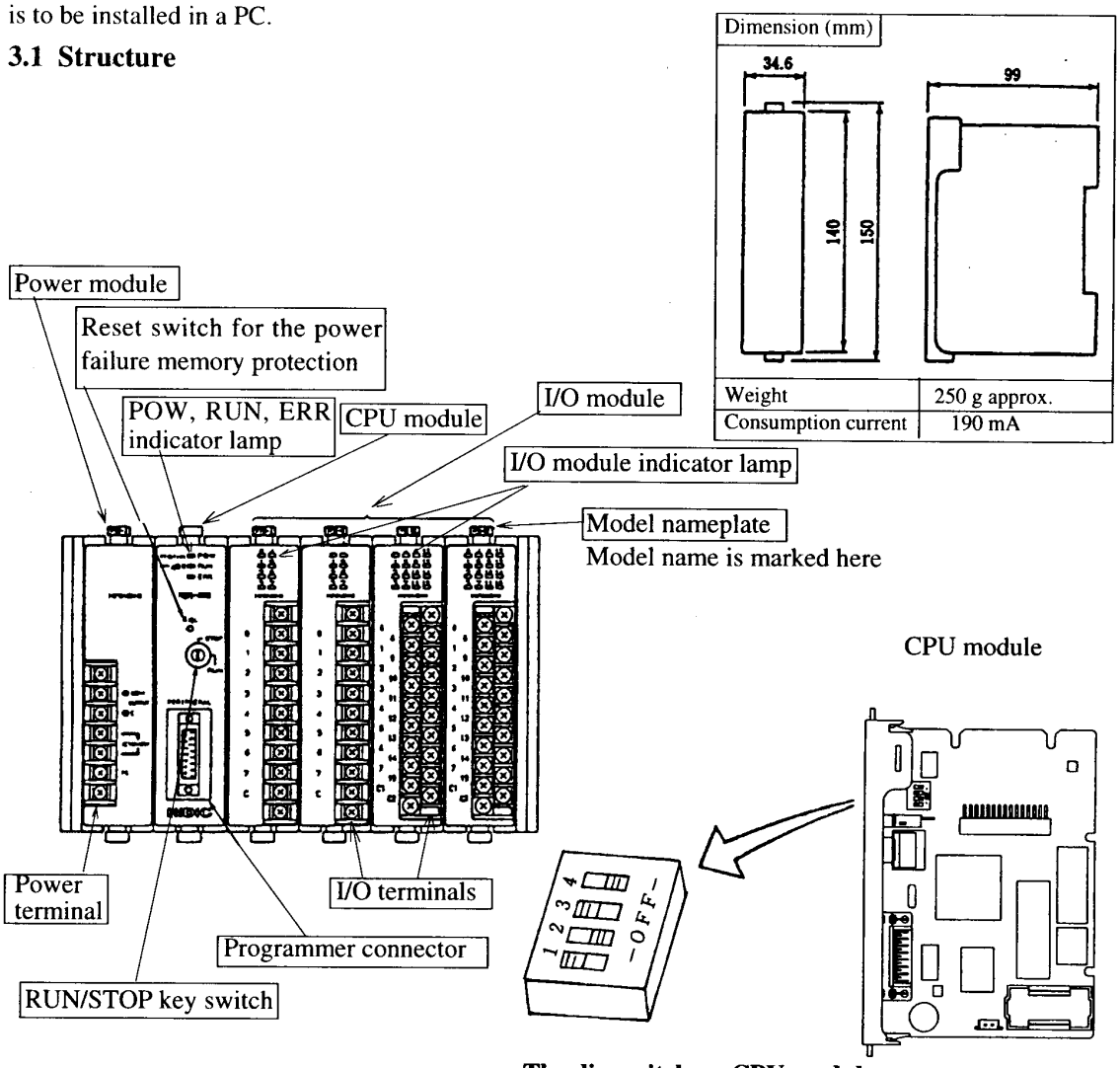
# Part II

## Specification of Component

# Chapter 3 CPU Module

CPU module performs I/O processing, computation and storage of control data. Therefore a CPU module is to be installed in a PC.

## 3.1 Structure




**The dip-switch on CPU module**

Setting of the dip switch on CPU module is shown on Table 3.1.1

**Table 3.1.1 Setting of the dip switch**

| No. | Function | Setting | | | |
|---|---|---|---|---|---|
| | | 2400bps | 4800bps | 9600bps | 19200bps |
| 1 | Baud rate setting in a personal computer connection | ON | ON | OFF | OFF |
| 2 | | ON | OFF | ON | OFF |
| 3 | I/O processing system | Refresh mode : ON | | Direct mode : OFF | |
| 4 | Remote setting | Remote : ON | | Normal : OFF | |

Factory setting: No.1 ON, No.2 OFF, No.3 ON, No.4 OFF

## 3.2 Specification of RS-232C port

### (1) Specification of the port for peripherals (special communication procedure)

**[Outline]**

The port for peripherals is prepared for connecting the CPU with H-series peripherals, and for communicating various data with the CPU module using the special protocol (HI-PROTOCOL) for exclusive use for H-series.

For the special protocol for H-series, refer to Chapter 4 Communication with Host Computer in the Manual-Software Edition.

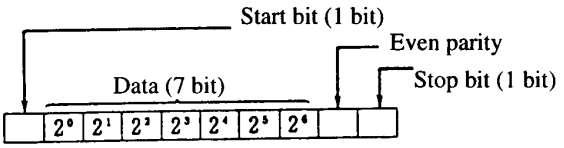
| Item | Specification |
|---|---|
| Communication speed | 2,400bps, 4,800bps, 9,600bps, (Selectable by a switch while PHL signal is in LOW level).<br>19,200bps (Fixed to 19,200bps while PHL signal is in HIGH level). |
| Communication procedure | Half duplex |
| Synchronizing method | Start-Stop synchronizing |
| Starting method | Single side starting by a host's command |
| Transmission method | Serial transmission (Bit serial transmission) |
| Transmission code | ASCII |
| Transmission code structure (Fixed) |  |
| Transmission code dispatching order | From the lowest digit bit ($2^0$) by every character |
| Error control | Vertical parity check (Even)<br>Sum check, framing check,<br>Framing error check |
| Transmission unit | Every message unit (variable length) |
| Maximum message | 503 bytes/message (including the transmission control characters) |
| Interface | Based on RS-232C (Maximum cable length 15 meters, for the 15-pin connector.) |
| Communication mode | Non-transparent mode/Transparent mode |
| Communication protocol | The protocol (HI-PROTOCOL) special to H-series |
| Connectors and cables | • Connector at CPU : RDAD-15SE-LN (05) by HIROSE DENKI<br>• Connector at cable end : HDAB-15P (Case : HDA-CTF1) by HIROSE DENKI<br>• Use 7-pair to 12-pair twist cables (with over all shielding). |

**Table 3.2.1 List of the connector signals in the port for peripherals**

| Pin No. | Signal expression | Direction | | Interpretation | Connection |
|---|---|---|---|---|---|
| | | CPU | Host | | |
| 1 | NC | - | - | Not in use | Do not connect |
| 2 | SD | → | | Sending data from the CPU | Connect to RD of the host computer |
| 3 | RD | ← | | Sending data from the CPU | Connect to SD of the host computer |
| 4 | RS * | → | | Will become High level when the CPU is ready to receive. | Connect to CS of the host computer |
| 5 | CS * | ← | | Must be High level while the CPU is sending data. | Connect to RS of the host computer, or fix at High level |
| 6 | RV1 | - | - | Not in use | Do not connect |
| 7 | DR | ← | | Must be High level while the host computer is ready to communicate. | Connect to ER of the host computer |
| 8 | PHL | ← | | Chage over communication speed<br>Low level : by a dipswitch<br>High level : 19,200 bps | Set at Low level or High level depending upon the executing communication speed. |
| 9 • 10 | SG | | | Signal ground | Connect to SG of the host computer |
| 11 • 12 | RV5 | - | - | 5 V output | Do not connect |
| 13 | NV12 | - | - | -12 V output | Do not connect |
| 14 | PV12 | - | - | +12 V output | Do not connect |
| 15 | NC | - | - | Not in use | Do not connect |

RS-232C interface circuit of the port on the CPU for peripherals is shown bellow.

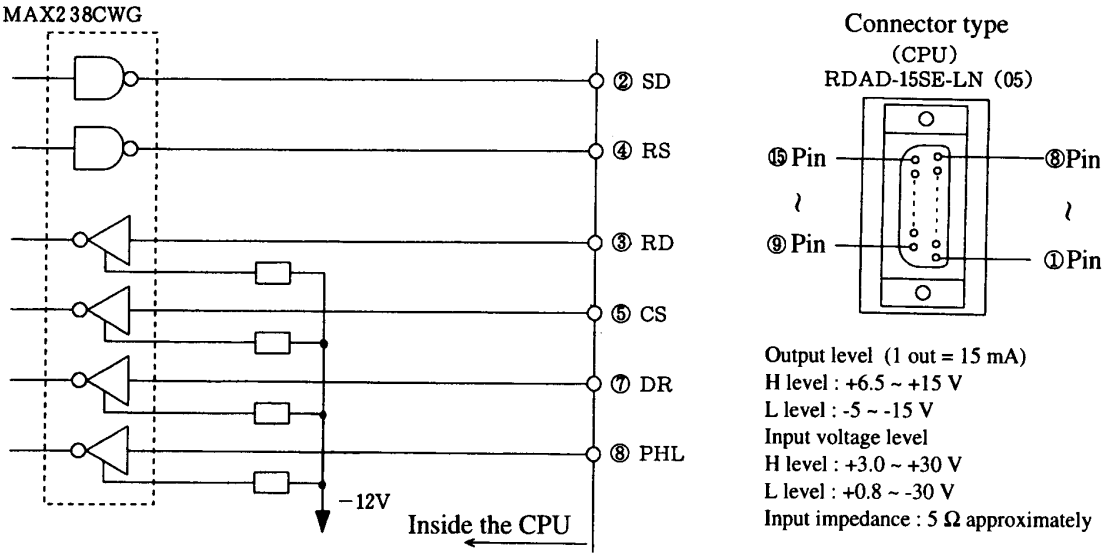



**Figure 3.2.1 RS-232C interface circuit of the port on the CPU for peripherals**

* Note that the signals RS and CS are different from the standard RS-232C in the following features.

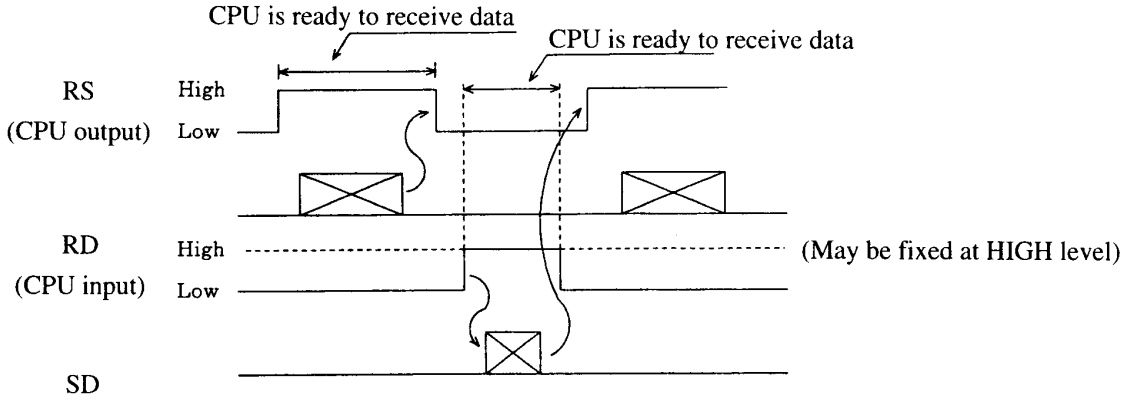



**Figure 3.2.2 Interpretation of RS and CS signals**

## 3.3 Performance List

### ■ Basic specification

| Item | | | | H-252 | H-250 | H-200 (for reference) |
|---|---|---|---|---|---|---|
| Control specification | Maximum number of usable slots | | | 29 | 16 | |
| | Number of I/O | 8-point I/O module | | Maximum 232 points | Maximum 128 points | |
| | | 16-point I/O module | | Maximum 464 points | Maximum 256 points | |
| | | 32-point I/O module | | Maximum 928 points | Maximum 512 points | |
| | | 32-point I/O module + Remote I/O | | Maximum 1,312 points | Maximum 896 points | |
| | Command • Ladder diagram | Processing system | | Stored program • Cyclic System | | |
| | | Processing speed | Sequence command | 0.2μs/command | 0.6μs/command | 1.5μs/command |
| | | | Arithmetic•Application command | several μs to several thousands μs/command | | |
| | | User's program memory | | 15.7K steps (RAM, EPROM, EEPROM)<br>7.6K steps (EPROM, EEPROM)<br>3.5K steps (EEPROM)<br>(15.7K-steps RAM is built in CPU) | 7.6K steps (RAM, EPROM, EEPROM)<br>3.5K steps ( EEPROM)<br>(7.6K-steps RAM is built in CPU) | |
| | | Command | Sequence command | 39 (Double word processing is possible) | | 31 (Double word processing is impossible) |
| | | | Arithmetic•Application command | 114 | 70 | 51 |
| | | LADDER chart | Sequence command | 39 (Double word processing is possible) | | 31 (Double word processing is impossible) |
| | | | Arithmetic•Application command | 114 | 70 | 51 |
| I/O processing specification | I/O processing system | | | Direct processing/Refresh processing | | |
| | Internal output | Bit | | 1,984 points (R0 to R7BF) | | |
| | | Word | | 17K Words (WR0~WR43FF) | 1K Word (WR0~WR3FF) | |
| | | Special | Bit | 64 points (R7C0 to R7FF) | | |
| | | | Word | 512 Words (WRF000~WRF1FF) | | 64 Words (WRF000~WRF03F) |
| | | CPU link | | 16,384 points 1,024 Words × 2 loops<br>L0 to L3FF,L10000 to L13FFF<br>/ WL0 to WL3FF, WL1000 to WL13FF | 128 points / 8 words × 2 loops | |
| | | Remote I/O | | 128 points × 4 ports | | |
| | | For both bits and words | | 16,384 points/1K Words | | 4,096 points/256 Words |
| | Timer/ Counter | Number of points | | 512 points (TD+CU) (0~255 points for Timer, 64 points for 10ms Timer) | | |
| | | Timer setting | | 0 to 65,535 s Time base 0.01s, 0.1s, 1s | | |
| | | Counter setting | | 1~65,535 | | |
| | Edge detection | | | Leading edge 512, Trailing edge 512 | | Leading edge 128, Trailing edge 128 |
| | Calendar clock | | | Year • Month • Day • Day of the week • Hour • Minute • Second | | |
| Peripherals | Programming system | | | Command • LADDER chart | | |
| | Peripherals | | | Portable graphic programmer (PGM-GPH), Command programmer (PCM-CHH), PC/AT compatible personal computer. | | |

* Note : These are divided into the two discontinuous areas WR0 to 3FF anf WR400 to 43FF.

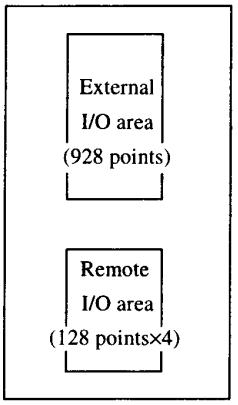
| Memory Pack |
|---|
| MPH-8R (EPROM 7.6 k steps) |
| MPH-4E (EEPROM 3.5 k steps) |
| MPH-16R (EPROM 15.7 k steps) |
| MPH-16E (EEPROM 15.7 k steps, with copy function) |
| MPH-8E (EEPROM 7.6 k steps, with copy function) |
| MPH2-4E (EEPROM 3.5 k steps, with copy function) |

**[Conception of I/O points]**

Number of I/O points shall be determined depending upon the following conditions.

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

Each CPU is provided with the external I/O area (928 points) and the remote area (512 points).

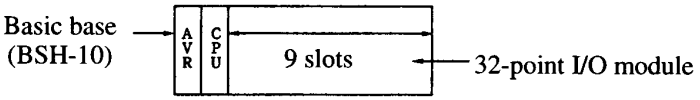



**(1) In case only the external I/O area is to be used (Conception of single system)**

<Example 1> In case only the 32-point I/O module is to be used in the basic base.

32 points × 9 (maximum number of slots) = 288 points

Maximum number of I/O points becomes 288 points.

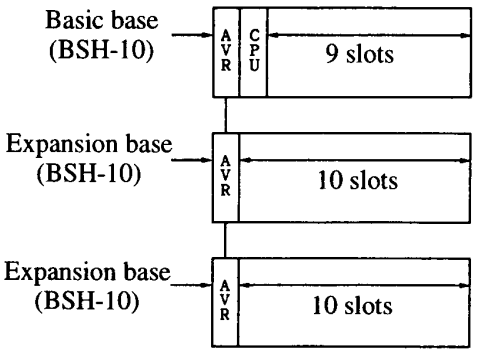



CPU : CPU module

AVR : Power module

<Example 2> In case only the 32-point I/O module is to be used in the basic base + the two ( maximum number for H-252) expansion bases.

32 points × 29 (maximum number of slots in H-252) = 928 points



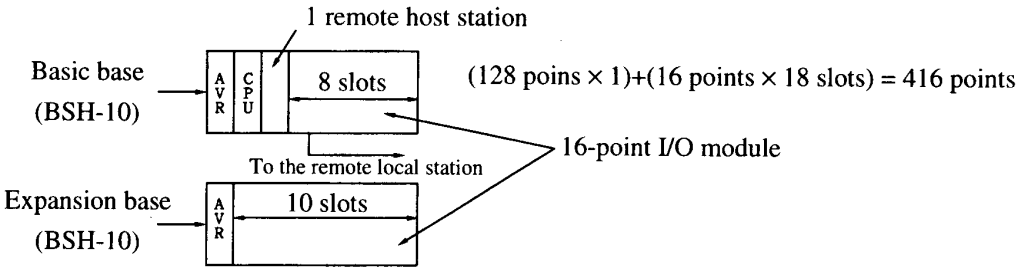
**(2) In case both the external I/O area and the remote area are to be used (Conception of the remote I/O)**

Number of I/O points

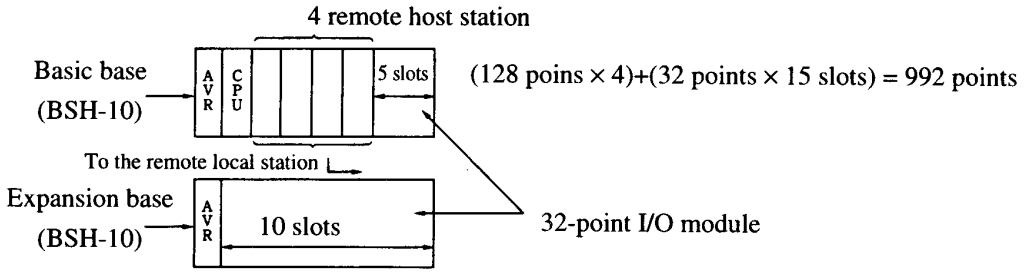
= (128 points × (number of the remote host stations))

+ ((I/O points per 1 slot) × (number of slots to be used))

<Example 1> In case 1 remote I/O module and 18 16-point I/O modules are to be used.




<Example 2> In case 4 remote I/O modules and 15 32-point I/O modules are to be used.



## 3.4 List of Functions

| Item No. | Details (1/6) |
|---|---|
| 1 | Remote operation • control function |
| | Explanation \| 1. Purpose : To perform various functions of the CPU from the host computer, such as control, operation, monitoring, etc.<br>2. Description :<br>• The host computer sends (communicates) task codes to the H-series PC.<br>• The communication between the host and PC will be made through the ports for peripherals on the CPU module. |
| | Operating conditions \| 1. The dip SW-4 ON, the key SW position must be in "RUN".<br>2. R7C3 (remote RUN able) and R7C4 (remote STOP able) in the special internal output must be "ON".<br>3. R7E9 (RUN disable) in the special internal output must be "OFF".<br>4. CPU error (a minor failure or heavier) must not be occurred.<br>5. When the operation control input is specified by an operation parameter, such input must be "ON".<br>6. No transmission or writing are being performed from other peripherals. |
| | Others \| 1. "RUN" LED will be illuminated when the PC is put into operation.<br>2. Communication between the host and the PC shall be made by the protocol special to H-series.<br>3. For details, refer to Chapter 4 Communication with the Host Computer in the Manual- Software Edition. |
| 2 | Operation / control function through particular contacts |
| | Explanation \| 1. Purpose : Operation and control of PC will be made by the external input or internal bit output that is particularly specified through a peripheral.<br>2. Description:<br>• The operational control parameter must be set at "Input definition exists" in the CPU through a peripheral.<br>• An I/O No. must be set out of X, R, L, or M. |
| | Operating conditions \|<br>1. The key SW of CPU module must be in "RUN".<br>2. R7E9 (RUN prohibited) in the special internal output must be "OFF". |
| | Others \| 1. "RUN" LED will be illuminated when the PC is put into operation.<br>2. For details, refer to "CPU setting • operation parameters" in Manual for the peripherals. |
| 3 | Operation keeping function |
| | Explanation \| 1. Purpose: PC will be kept in operation even when an I/O assignment failure, a remote failure, or a delay error occurs.<br>• The parameter must be set in the CPU module through a peripheral. |
| | Operating condition \| 1. I/O assignment mismatching for the abnormal operation mode must be set at "OK" in the CPU.<br>2. Remote error for the abnormal operation mode must be set at "OK" in the CPU.<br>3. Delay error check time must be set in the CPU. (When no setting is made, the check timing will be 100 ms) |
| | Others \| 1. PC will be shut down on the occurrence of the above error if no setting is made.<br>2. Maximum setting time for the delay check is 2 seconds (10 ms × 200).<br>3. For details, refer to "CPU setting • operation parameters" in Manual for the peripherals. |

| Item No. | Details (2/6) |
|---|---|
| 4 | In-RUN service program change function |

**Explanation**

1. Purpose : To perform a change in a user's program while the PC is in RUN operation.
2. Description :

- The change must be made through a peripheral. When this function is executed the CPU will stop temporarily (HALT) and hold the output value of the execution of the user's program at the end of the subject scan. After the user's program is changed the user's program will start again at the top of the scan.
- Setting values can be changed in the TIMER•COUNTER irrespective of "HALT".

**Operating conditions**

1. Other peripheral must not be executing an In-RUN service program change nor a debugging. (will cause an occupation error).
2. While the debugging function is used, the CPU must be in "debug HALT".
3. While the settings are to be changed in the TIMER•COUNTER, no other peripheral should monitor the CPU. (will cause an occupation error).
4. The memory pack must not be mounted. (In-RUN service program change can not be made when the memory pack is mounted)

**Others**

1. Approximate time of "HALT" will be as shown in the following table.

Approximate time of "HALT" will be as shown in the following table.

(Not maximum value Unit : second)

| Capacity of program | LADDER EDITOR ※1 | Portable graphic programmer ※1 | Command programmer ※2 |
|---|---|---|---|
| 4 k steps | 2.1 | 3.3 | 3.1 |
| 8 k steps | 4.0 | 5.1 | 4.5 |
| 16 k steps | 7.9 | 8.8 | 7.2 |

※1 For LADDER EDITOR and the portable graphic programmer, the values are for the case the circuit with 10 steps are inserted in the top of circuit.

※2 For the command programmer, the values are for 1 step change.

Approximate time of changing set value of Timer will be as shown in the following table.

(Not maximum value Unit : second)

| Capacity of program | LADDER EDITOR | Portable graphic programmer | Command programmer |
|---|---|---|---|
| 4 k steps | 0.1 | 2.8 | 3.0 |
| 8 k steps | 0.1 | 4.2 | 4.3 |
| 16 k steps | 0.1 | 6.9 | 7.1 |

2. Note that even if the I/O No. which is used for external output is changed in-RUN service and the output coil command is deleted during execution of the program, the output status before changing will be kept as it is.
3. If the program or TIMER•COUNTER is 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 will be executed from the beginning.
4. For details, refer to the Manuals for the peripherals.

| Item No. | Details (3/6) |
|---|---|
| 5 | Debugging function |
| | Explanation 1. Purpose : To check a user's program execution.<br>2. Description :<br>(1) Break point setting : One break point, where the program will be proceeded to and the debugging will be halted (DEBUG HALT), can be set in the program.<br>(2) RUN continuation after STOP : The program will returned to DEBUG RUN from DEBUG HALT, in continuation of the program execution.<br>(3) HALT of an execution : At the end of the scanning the program execution will be stopped and be in HALT status.<br>(4) Scanning RUN : The program will scan the predetermined number of scan cycles after DEBUG HALT status and then return to DEBUG HALT status again.<br>(5) Step RUN : The program will execute 1 symbol or 1 command after DEBUG HALT status and then return to DEBUG HALT status again.<br>• Debug RUN.....The program is executed through the graphic programming device.<br>• Debug HALT.....The program is stopped through the graphic programming device. |
| | Operating conditions 1. The dip SW4 on the CPU must be in ON, and the key SW must be in "RUN".<br>2. R7C5 (debug enable) in the special internal output must be "ON".<br>3. R7E9 (RUN disable) in the special internal output must be "OFF".<br>4. No CPU error (minor error or the heavier) must be occurred.<br>5. When an operational control input is set in the operation parameters, such input must be "ON".<br>6. No other peripheral must try write or transmit a program into the CPU. |
| | Others 1. The debugging function can only be executed through the graphic programming console.<br>2. Timer resetting will not be made during the DEBUG HALT. The special internal output R7E5~R7E7 (0.1~1-second clock) will also not be processed. No processing will be made for the timer or the special internal outputs also during the step RUN.<br>3. Though the timer and the special internal outputs will be processed during the scan RUN, correct clock values will not be assured when RUN-HALT operations are repeated.<br>4. For details, refer to the manual for the graphic programming console. |
| 6 | Power failure storage clear function (Function given by Hardware) |
| | Explanation 1. Purpose : To clear to "0" the assigned area for the power failure storage.<br>2. Description :<br>Must be pressed the switch "R.CL" on the CPU module surface during the PC is in STOP. |
| | Operating conditions 1. This function is effective during the PC is under STOP status. The clearing will become effective at the subsequent start of RUN.<br>2. The special internal area (continuous storage in the power failure) will also be initialized. |
| | Others 1. During the PC is in running, pressing the switch "R.CL" will be ignored<br>2. Same function is provided in the special internal bits. |

| Item No. | Details (4/6) |
|---|---|
| 7 | Interruption processing function |
| | Explanation 1. Purpose : To run an interruption program.<br>2. Description :<br>• The periodic interruption program with 10ms, 20ms or 40ms will be executed. |
| | Operating conditions<br>1. Must be defined the periodic interruption program with INT0~2 (10ms, 20ms, 40ms). |
| | Others 1. Note that a delay error may be occurred caused by possible prolonged execution time of the normal scan program when the interruption program is started. |
| 8 | PID operation function (only for H-252) |
| | Explanation 1. Purpose : To perform control operation of plant process production volume or the like.<br>2. Description :<br>• The process control by means of a combination of the proportional (P), integrating (I), differentiating (D) function. |
| | Operating conditions 1. In order to secure PID operation, WR area with the continuous (5+ (number of loops) × 47) words and R area with ((number of loops) × 16) bits are necessary. Secure these area in the system design.<br>2. Do not use INT0 (10ms periodic scan)<br>3. INT1 (20ms periodic scan) must be programmed only in PID command or its starting condition. In case a processing other than the PID operation is unavoidable, set the sampling time of the PID operation as long as possible so that the total sum of processing time of INT 1, INT 2 and PID shall be less than 7ms. |
| | Others 1. Sampling time of PID operation is more than 20ms or 40ms (at the remote end).<br>2. When the CPU computation is stopped by an error or similar reasons, the output value (MV) will be OFF. Therefore, when the output is required to be hold, the provision must be made outside of the PC for such holding.<br>3. As the output value (MV) will be hold during the In-RUN service program change execution, the change operation must be made while the PID control system is under a stable status.<br>4. For details of computation procedure, refer to the supplementary notes or the Manual-Software Edition. |

Item No. 9

Details (5/6)

Clock function

Explanation 1. Purpose : To control or manage the CPU data by time or day.

2. Description :

- Clock data will be set in the special internal word outputs WRF00B~WRF00F in a BCD code and updated every second. (Since the CPU module will update data regardless of the timing of the user's program, there will be no data simultaneity between words).
- When "1" is set in the special internal bit output R7F8, clock read data will be set in the special internal word outputs WRF01B~WRF01F in a BCD code. The data will be retained until "1" is set in R7F8 again.
- When "1" is set in the special internal bit output R7F9, the data which is set in the special internal word outputs WRF01B~WRF01F in a BCD code will be set in the clock.
- When "1" is set in the special internal bit output R7FA, the clock data will be subject to 30-second adjustment. (00~29 seconds will be adjusted to 00, and 30~59 seconds will be carried to 1 minute +00)

Others 1. When data is set in a way other than a BCD code, a data error will be occurred, and "1" will be set in the special internal bit output R7FB, and no clock data will be set. When correct data is set, R7FB will be set to "0".

2. The clock accuracy will be affected by the ambient temperature. While the CPU is energized, the monthly accuracy is -175~+70s at 0~55°C, -110~+70s at 5~45°C, -55~+70s at 20~30°C. When the CPU is not energized (with the battery backup), a delay time of about 20 seconds must be added to these values. Adjust the clock and ambient temperature in due frequency depending upon particular requirements of the subject system.

3. The special internal outputs and their interpretations for the clock function.

| | I/O No. | Special internal bit output |
|---|---|---|
| * | R7F8 | Data reading |
| * | R7F9 | Data writing |
| * | R7FA | Clock adjustment |
| | R7FB | Data error |

| I/O No. | Special internal word output b15 b0 | | (Example) | |
|---|---|---|---|---|
| WRF00B | Gregorian calendar (4 digits) | | 19 | 91 |
| WRF00C | Month | Day | 09 | 21 |
| WRF00D | 0 0 0 | The day of week | 0 0 0 | 6 |
| WRF00E | Hour | Minute | 08 | 05 |
| WRF00F | 0 0 | Second | 00 | 00 |

| I/O No. | Special internal word output b15 b0 | | (Example) | |
|---|---|---|---|---|
| WRF01B | Gregorian calendar (4 digits) | | 19 | 91 |
| WRF01C | Month | Day | 09 | 21 |
| WRF01D | 0 0 0 | The day of week | 0 0 0 | 6 |
| WRF01E | Hour | Minute | 08 | 05 |
| WRF01F | 0 0 | Second | 00 | 00 |

*1 After "1" is set, the system software will realize the reset.

- Gregorian calendar : 4-digit BCD, month and day : 2-digit BCD, the day of week : 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., September 21 (Saturday), 1991.

4. As the battery in the CPU is used also for the clock data holding, note that the clock data will not be secured when the battery failure occurs.

| Item No. | Details (6/6) |
|---|---|
| 10 | Trace monitor function (only for H-252)<br>Explanation 1. Purpose : To use for debugging or various monitoring of a user's program .<br>2. Description :<br>• The function will be performed through a peripheral. The trace monitor function is provided with the following subfunctions.<br>(1) Continuous time chart (2) Trigger time chart (3) Continuous trace (4) Trigger trace<br>(5) CPU command trace (6) Trigger circuit monitor<br>Operating conditions 1. This function is effective when Ladder/Command programming soft LADDER EDITOR is employed.<br>Others 1. For details, refer to the supplementary notes or the manual for LADDER EDITOR. |
| 11 | Data transfer command for the sophisticated function module (only for H-252)<br>Explanation 1. Purpose : To simplify the data transmission between the sophisticated function module and the CPU module.<br>2. Description : TRNS commands.<br>Operating conditions<br>Others 1. For details of the commands, refer to the Manual-Software Edition. |
| 12 | Addition of FUN commands (only for H-252)<br>Explanation 1. Purpose : To support the special function commands.<br>2. Description : Trigonometric functions, data retrieval, data conversion, special shift commands.<br>Operating conditions<br>Others 1. For details of the commands, refer to the Manual-Software Edition. |

**[Supplementary notes]**

**1. In-RUN service program change function**

**(1) Features**

The ladder diagram/command program can be edited as shown below through the HI-LADDER/HI-COMMAND system V2.** or the LADDER EDITOR while the PC is in RUN.

① WRITE NEXT (Circuit insertion)

② WRITE FIRST (First circuit insertion)

③ CHANGE (Circuit change)

④ DELETE (Circuit deletion)

* The commands subject to the check.

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

When the password is inputted, the above commands (excluding MCS, MCR) can be can be changed even in RUN operation. Special care should be taken in executing such change because an error caused by such change will stop the CPU.

**(2) Precautions**

Changing the program when the CPU is in RUN is to change the program content when the system is in RUN, which naturally will constitute a very risky practice. Therefore, in trying to perform such change, study well the scope and effect of the change beforehand, taking the following items into considerations.

① When the program is changed, the CPU will be halted (HALT: RUN halted with the output held). Take caution in timing of the change.

② When the program is added or the program is changed for a system in which the user's program is executed just at the end of the delay check time, the program scan time after the change is increased. In such case, the CPU may be stopped due to possible scan delay error.

Therefore, turn the special internal output R7C0 (continuation in a delay error) ON by means of the forced output means, or investigate adequately whether the delay check time is suitable with reference to the actual cycle time (special internal output: WRF010~WRF012).

## 2. PID function (only for H-252)

### (1) PID control

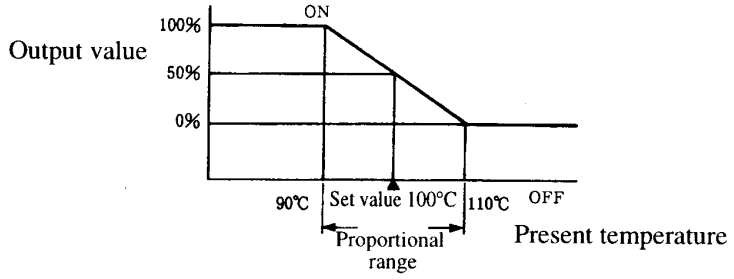
PID control is widely known as a method to control temperature, pressure, fluid level, etc. in the field of process control system or the like. Out of PID, the P, I and D means Proportional, Integral and Differential operation respectively. Each operation is explained below.

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, when the present measured value is lower than the proportional range, operation value will be 100%. When the measured value becomes into the proportional range, the operation value will be decreased in proportion to the deviation and then finally will approach 50% when the set value meets (no deviation) the actual value (measured value). This feature will assure smoother control without excessive oscillatory change as would often be encountered in a ON-OFF simple control.



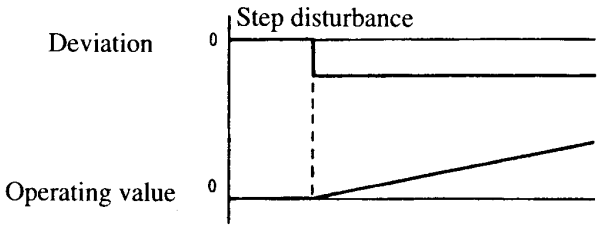



**Proportional operation**

(Example) In a temperature controller with the range of 0~400°C, when the proportional range is set as 5%, the width of proportional range is converted as 20°C. In this case, when the target value is set at 100°C, the output will be continuously ON until the actual value reaches 90°C, and will be in OFFs and ONs in various duration after the actual value exceeds 90°C , then the output will be in ONs and OFFs in same accumulative time durations (50%) when the actual value reaches 100°C.

② Integrating operation (I)

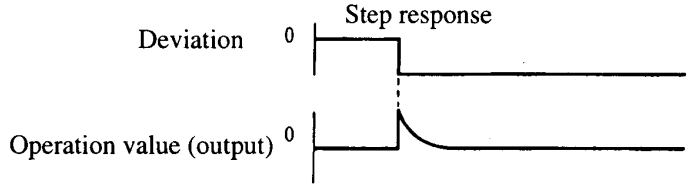
Some offset value may exist in the output in the proportional operation. When the integrating operation is combined with the proportional operation, the offset will be decreased to zero with an elapse of integrating time, causing the controlled temperature to meet the set value more precisely.




**Integrating operation**

③ Differential operation (D)

The proportional operation or the integrating operation provides a corrective operation to a resultant control value, which will naturally cause a drawback as the delayed response. The differential operation is to provide a corrective operation giving the magnitude of operating value (output) that is proportional to the inclination (changing speed) of the deviation for the purpose of compensating such drawback. That is to give the large operating value (output) against a quick external disturbance on the system in order to effectuate a quick restore of the stable operation.

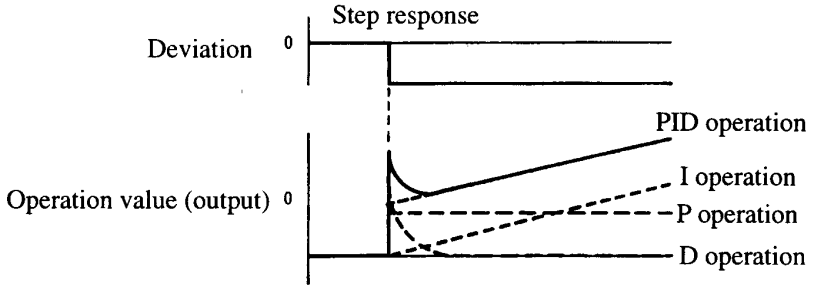



**Differential operation**

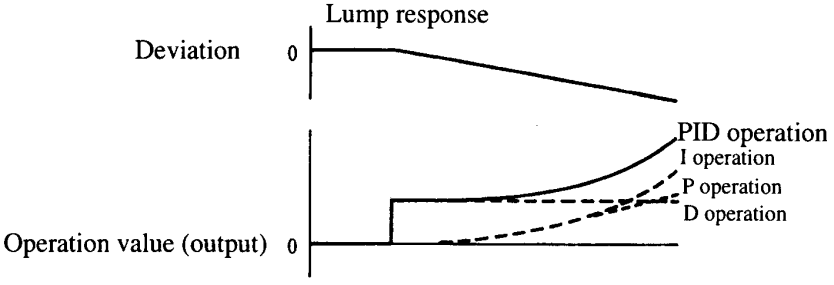
④ PID operation

PID operation is the combined operations composed of the proportional, the integrating operation and the differential operation, and will be highly effective in a system with a larger time lagging constant because the PID operation will effectuate the smoother control without hunting through the proportional control element, will correct automatically the offset through the integrating element, and then will accelerate the response to the external disturbance through the differential element.

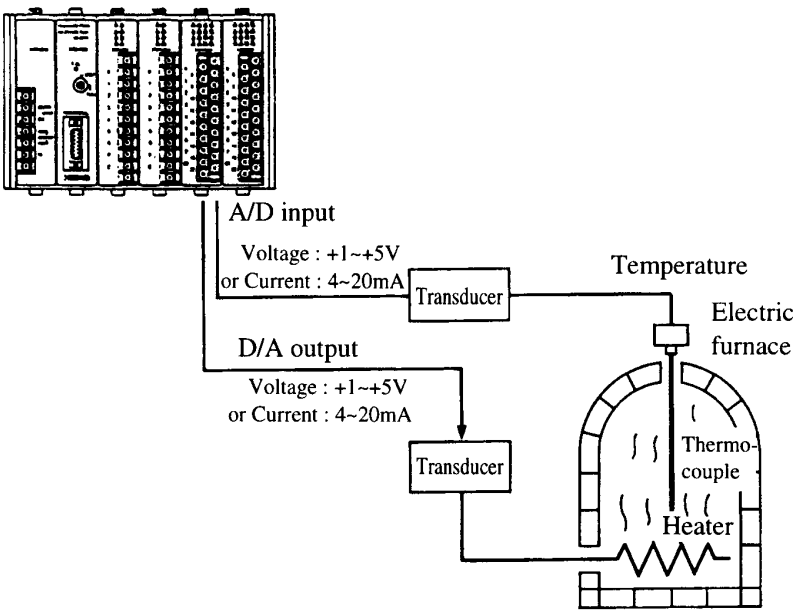
The illustrations below show the operating values (output) in PID operations acting to a step deviation disturbance and to a lump deviation disturbance.




**PID operation output response/Step disturbance**

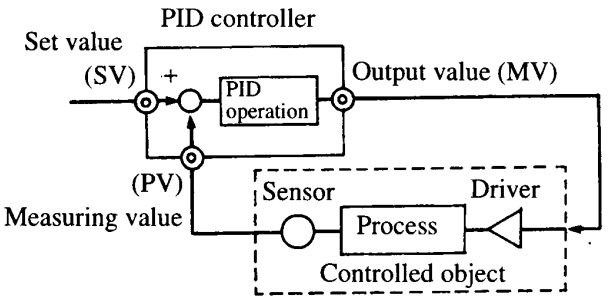



**PID operation output response/Lump disturbance**




**Example: Electric furnace temperature control**

A basic block diagram of PID control system is shown below.




**PID control system**

In the illustration shown right, the sensors for the controlled object will detect temperature, pressure, flow, etc. out of the process and will input these data into the PID controller generally in analogue signals such as 4~20mA.

The PID controller will perform the PID computation suitable for the controlled object in accordance with the difference between the detected sensor value and a preset value (deviation). The result of such computation will also generally be outputted in analogue signals such as 4~20mA.

**(2) PID operation**

The output value MV, to be computed in the PID controller as shown in the PID system diagram, is expressed by the following formula.

$$MV(t) = Kp\{ (SV-PV) + \frac{1}{T_I}\int (SV-PV)\,dt + T_D\frac{d}{dt}(SV-PV) \} \quad \text{..... (Formula 1)}$$

or (Formula 1) is expressed as follows by the conversion form using Laplace operator S.

$$\frac{MV(S)}{E(S)} = Kp\left( 1 + \frac{1}{T_I \cdot S} + T_D \cdot S \right) \quad \text{.....(Formula 2)}$$

*1 *2 *3

*1: Proportional term
*2: Integrating term
*3: Differentiaing term

Where $E(S)=[f(SV-PV)]\cdot S$

MV(t), MV(S) : Output

(SV-PV), E(S) : Deviation

Kp : Proportional gain ($Kp = \frac{100\,(\%)}{PB(\%)}$ PB : Proportional range)

Ti : Integrating time

$T_D$ : Differentiating time

{ SV : Set value

PV : Measuring value

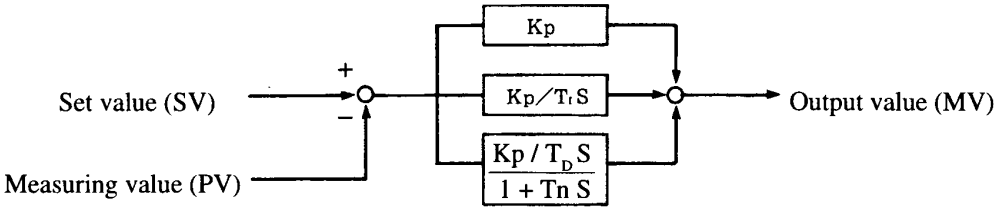
The theoretical differential output as expressed by $T_D\frac{d}{dt}$ or $T_D \cdot S$ is a stepwise output which will naturally not be well responsive to a controlled object with heavier mass inertia, such as a control valve. Therefore, In an actual PID controller, "Constant - (Time lag of 1st order)" is used as the practical proximate differential output. Accordingly, when the differential element $Tp \cdot S$ in (Formula 2) is replaced by $\frac{T_D \cdot S}{1 + \frac{T_D}{n} \cdot S}$, (Formula 1) and (Formula 2) are expressed as follows.

$$\frac{MV(S)}{E(S)} = Kp\left\{ 1 + \frac{1}{T_I \cdot S} + \frac{T_D \cdot S}{1 + \frac{T_D}{n} \cdot S} \right\} \quad \text{.....(Formula 3)}$$

Where n is defined as the differentiating gain and generally has the value of about10. Then the following formula is given by making $\frac{T_D}{n} = Tn$. Tn is defined as "Differentiating time lag".

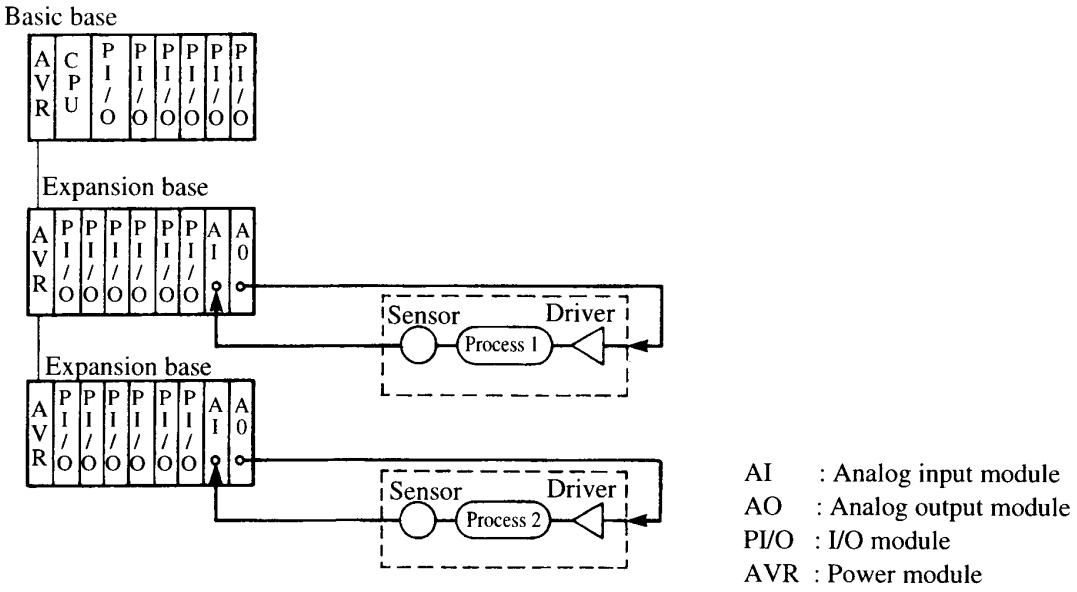
$$\frac{MV(S)}{E(S)} = Kp\left\{ 1 + \frac{1}{T_I \cdot S} + \frac{T_D \cdot S}{1 + Tn \cdot S} \right\} \quad \text{.....(Formula 4)}$$

This formula is expressed as a block diagram as shown below.



### (3) System configuration

The following illustration shows an example of a configuration consisting of PID control loops.




**Example of a system configuration**

By means of such configuration, data can directly be read from or written on the analog I/O modules mounted on the basic base or the expansion bases. Therefore, the various sensor signals, to be converted to the set value (SV) and the measuring value (PV), can be taken into the analogue I/O input modules in appropriate H-series. The output value (MV) in the PID operation can be outputted from the analogue I/O output module suitable for the driver specification. Thus the PID control loop will be configurated.

Then the control timing between the loops will be managed by the PID execution managing commands provided with the CPU. The operation of only 1 loop will be executed without fail in 20ms periodic scan. Each loop will be controlled by the PID operation to be executed by the timing of once every (20ms × (No. of loop)) scans. (When the shortest sampling time is specified).

### (4) Specifications of PID control function

Specifications of PID control function are shown below.

**Specifications of PID control function**

| Item | Specification | Description |
|---|---|---|
| Number of loops | 1~ 64 | The PID control command requires a parameter area, a WR area (5 words + (number of loops) × 49 words), and an R area (16 bits × (number of loops)) for the execution. |
| Sampling time TZ | 1 ~ 200 ( × 20ms)<br>(When AI/AO is mounted on the basic base or the expansion base.) | • The minimum sampling time of each loop is n × 20ms (n : number of loops).<br>• Loops can have different sampling times if the sampling times are multiple of the minimum sampling time (the number of loops).<br><br>(Example) Setting of sampling times (TZ) of 4 loops<br><br>Loop 1: 4 / 4 / 8 / 4 / 3*<br>Loop 2: 4 / 4 / 24 / 4 / 12<br>Loop 3: 4 / 8 / 16 / 4 / 48<br>Loop 4: 4 / 8 / 40 / 10* / 24<br>Ex. 1 Ex. 2 Ex. 3 Ex. 4 Ex. 5<br><br>Ex. 1 to EX. 3 : Valid<br>Ex. 4 to EX. 5 : Invalid |
| PID constants<br>Kp<br>Ti / TZ<br><br>TD / TZ<br><br>Tn / TZ | <br>-1000 ~ +1000 (%)<br>1 ~ 32767<br><br>1 ~ 32767<br><br>1 ~ 32767 | <br>Proportional gain (%)<br>Ratio of integration time (Ti) to sampling time (TZ)<br>Ratio of differentiating time ($T_D$) to sampling time (TZ)<br>Ratio of differentiating lag time ($T_n$) to sampling time (TZ) |
| Set value SV<br>Measuring value PV<br>Output MV | -32767 ~ +32767<br>-32767 ~ +32767<br>-32767 ~ +32767 | Analog input bit pattern (after conversion)<br>Analog input bit pattern (after conversion)<br>Analog output bit pattern (before conversion) |
| Upper limit output UL<br>Lower limit output LL | -32767 ~ +32767<br><br>-32767 ~ +32767 | Upper limit of output value<br><br>Lower limit of output value |
| Initial value INIT | -32767 ~ +32767 | Initial output value |

## 3. Trace monitor function (only for H-252)

### (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 is combined with LADDER EDITOR.

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

The list of which can be used by the trace monitor is shown below.

| | | |
|---|---|---|
| Usable I/O | Bit | X, Y, R, L, M, Timer•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

Each function of the trace monitor is explained below.

(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 command trace

When the trace command (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

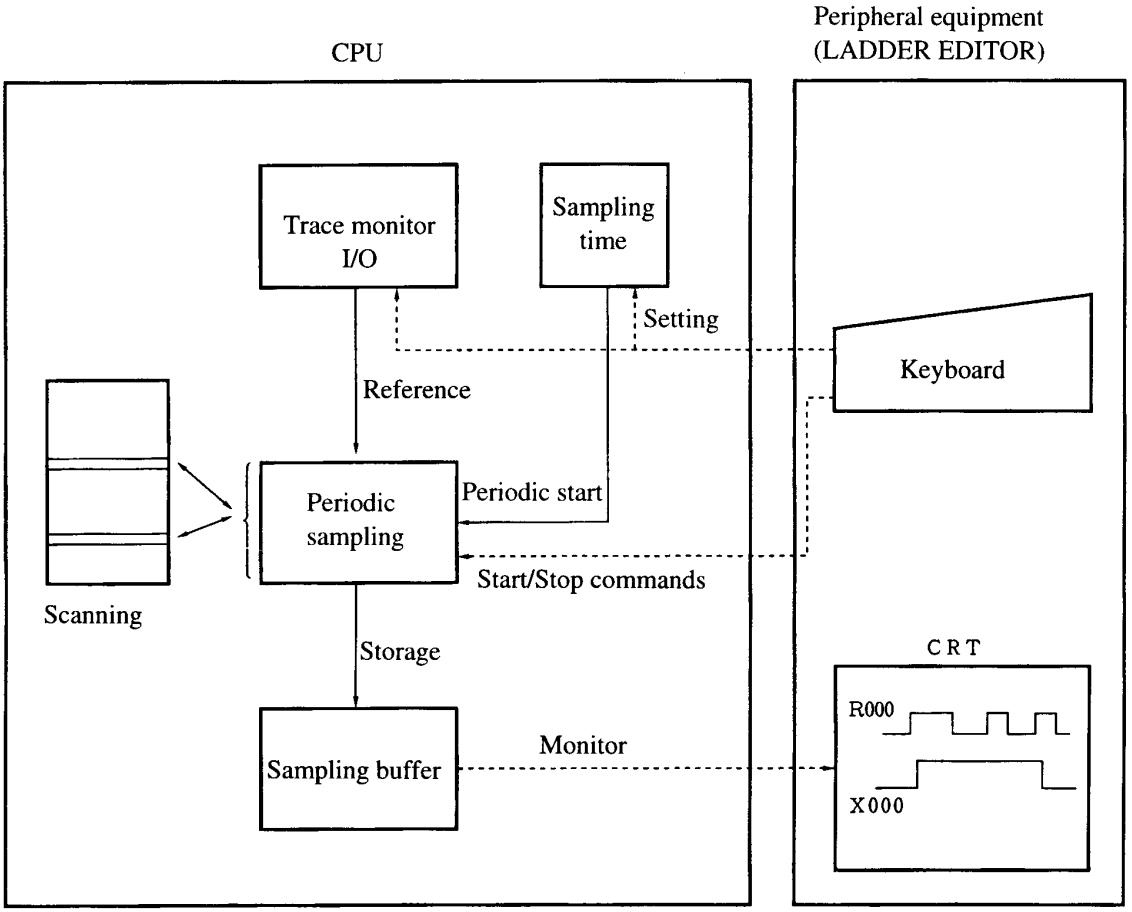
When the trigger-specified I/O satisfies the specified condition (set value), the function stores the status of the circuit which is separately specified and monitors the circuit.

### (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 form).

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

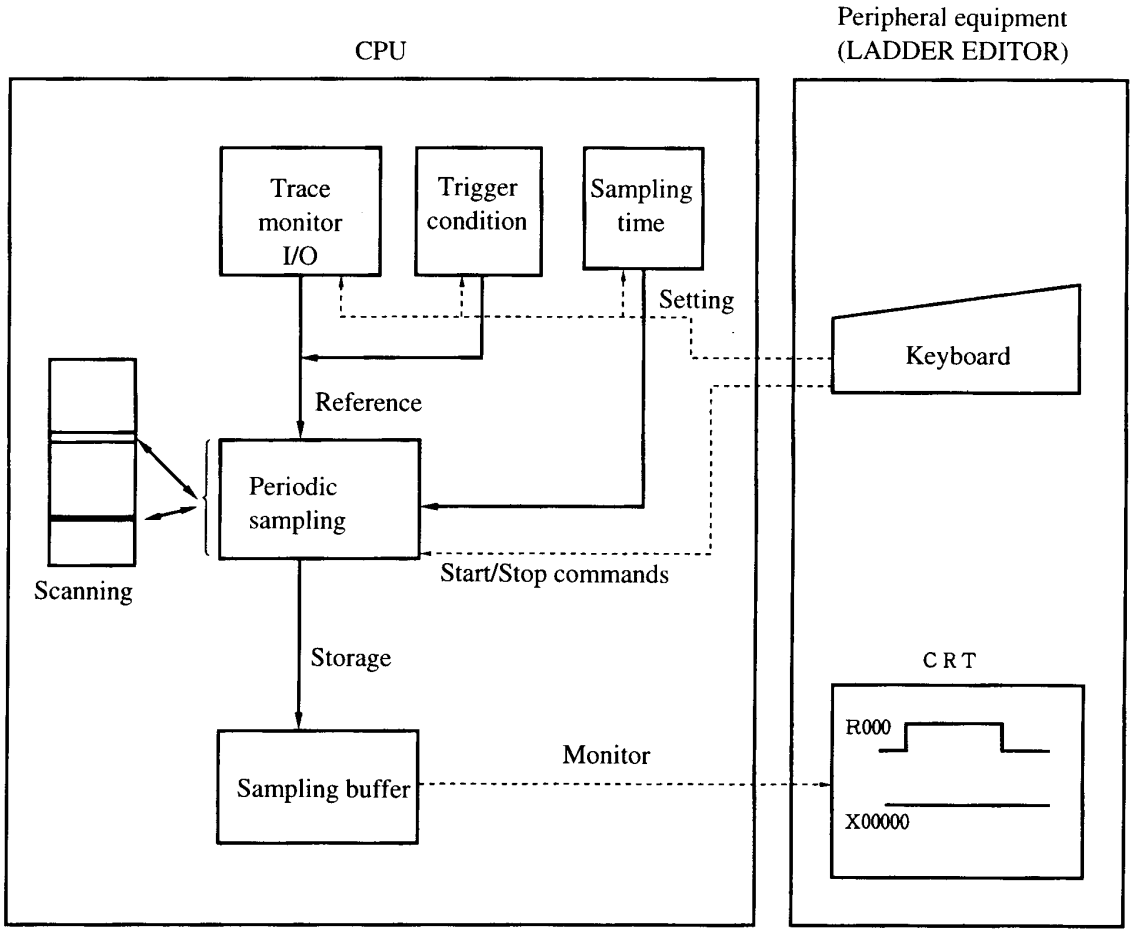



Note When data is being monitored by the continuous time chart function or continuous trace function, the trace status may be changed to the STOP mode. The reason is that the data amount becomes larger than the data amount which is stored in the sampling buffer by the CPU within a specified time and 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.

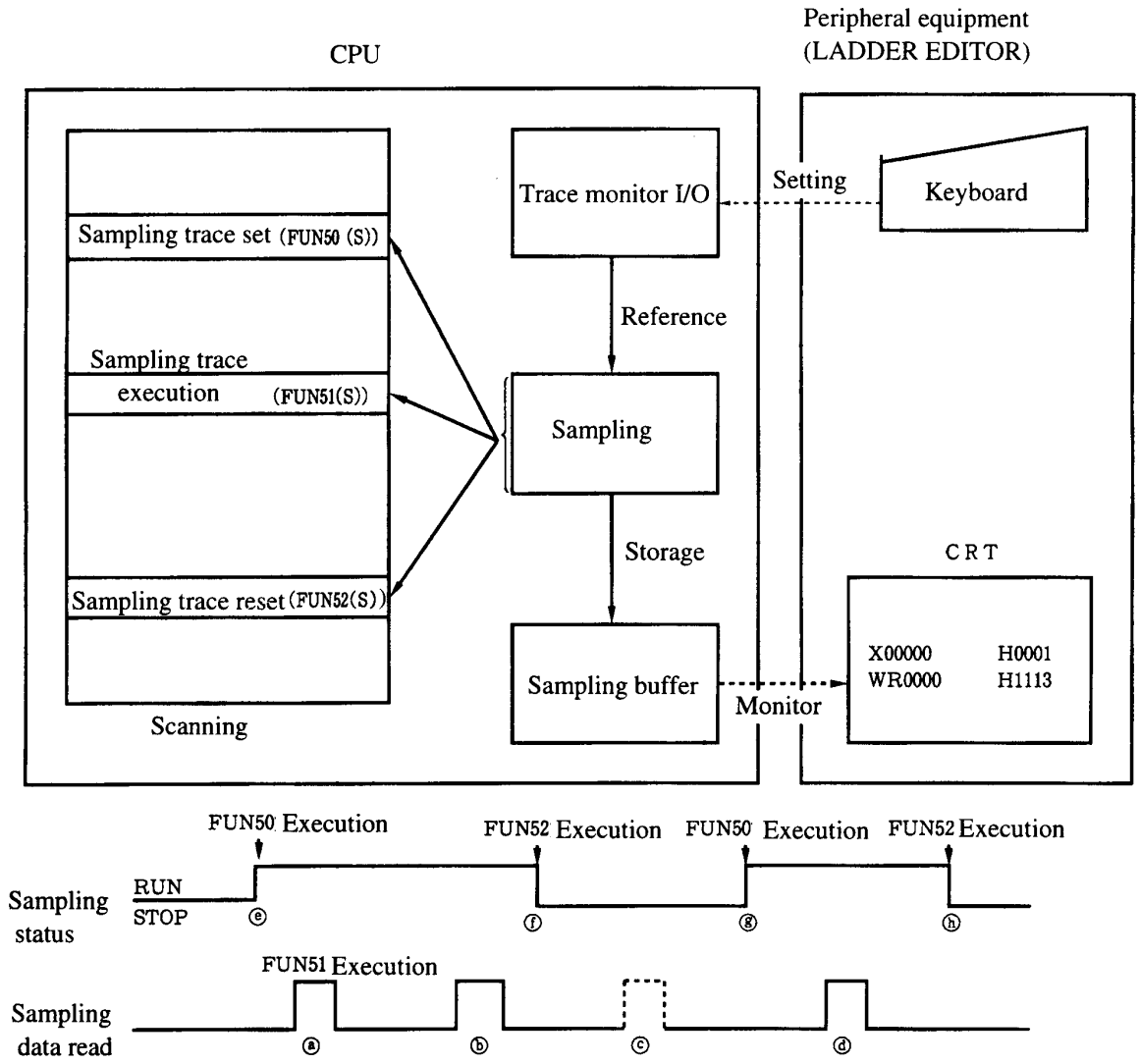
② (II) Trigger time chart, (IV) Trigger trace

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 command is stopped.



③ (V) CPU command trace

The CPU command trace monitor function reads the content of the specified I/O (trace monitor I/O) whenever the FUN51(S) command 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).



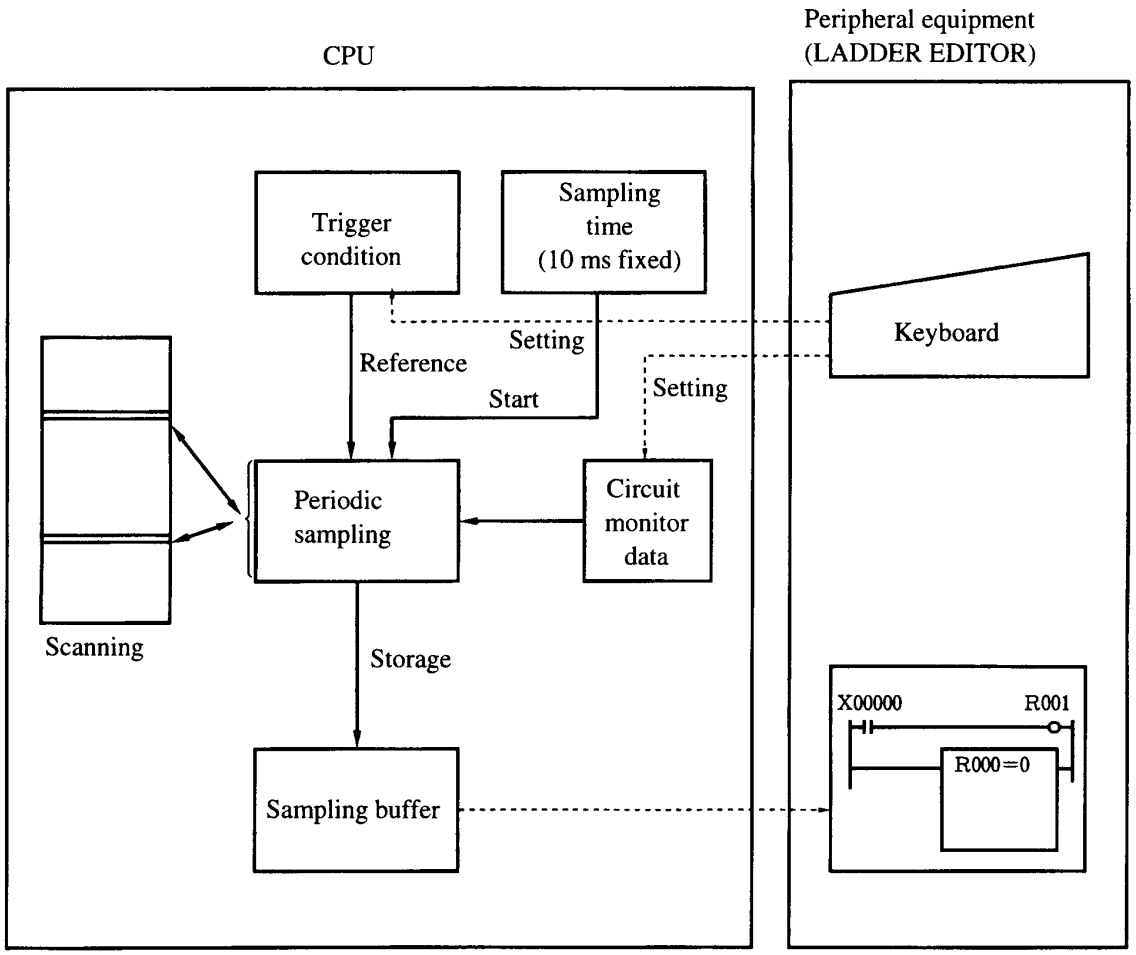

In the CPU command trace function, as shown in the CPU command trace outline operation time chart indicated above, by executing the sampling trace setting command FUN50(S), the sampling status (R7FD) becomes RUN (between ⓔ and ⓕ and between ⓖ and ⓗ and sampling by the sampling trace command FUN51(S)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

④ (VI) 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/Opoints 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 is maximum 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

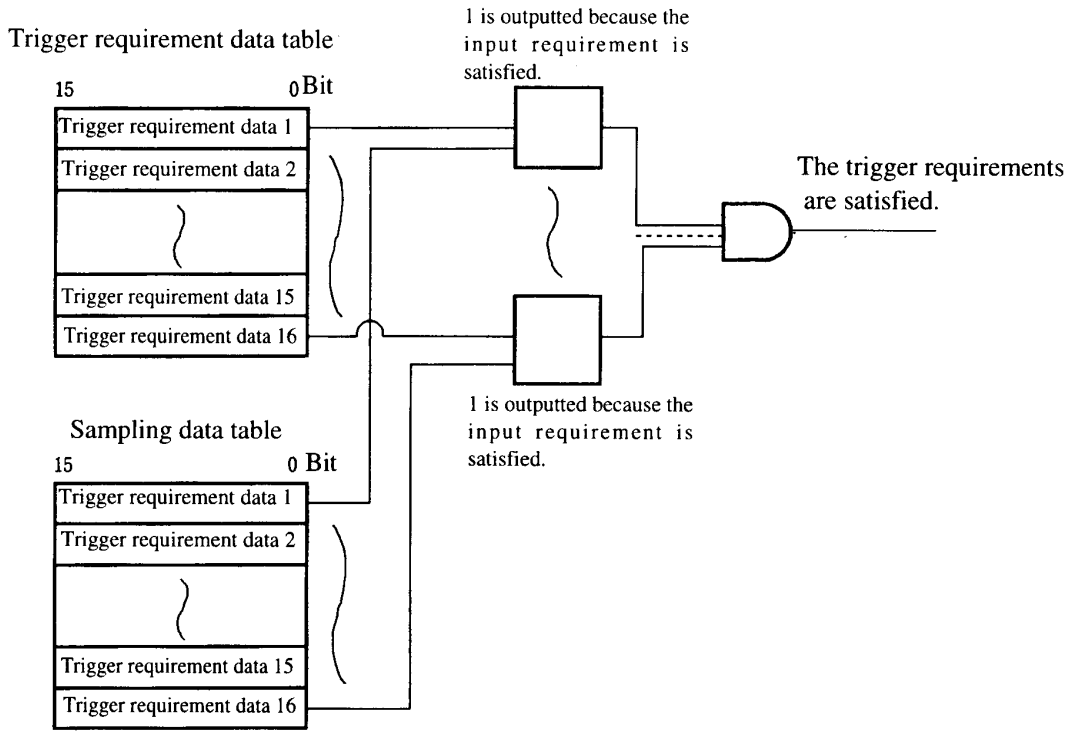
The number of data points to be set for triggering is up to 16. Double words, and bits can be set for I/O.

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

| | Trigger time chart | Trigger circuit monitor<br>Trigger trace |
|---|---|---|
| I/O type which can be set | Bit I/O | Bit I/O<br>Word I/O |

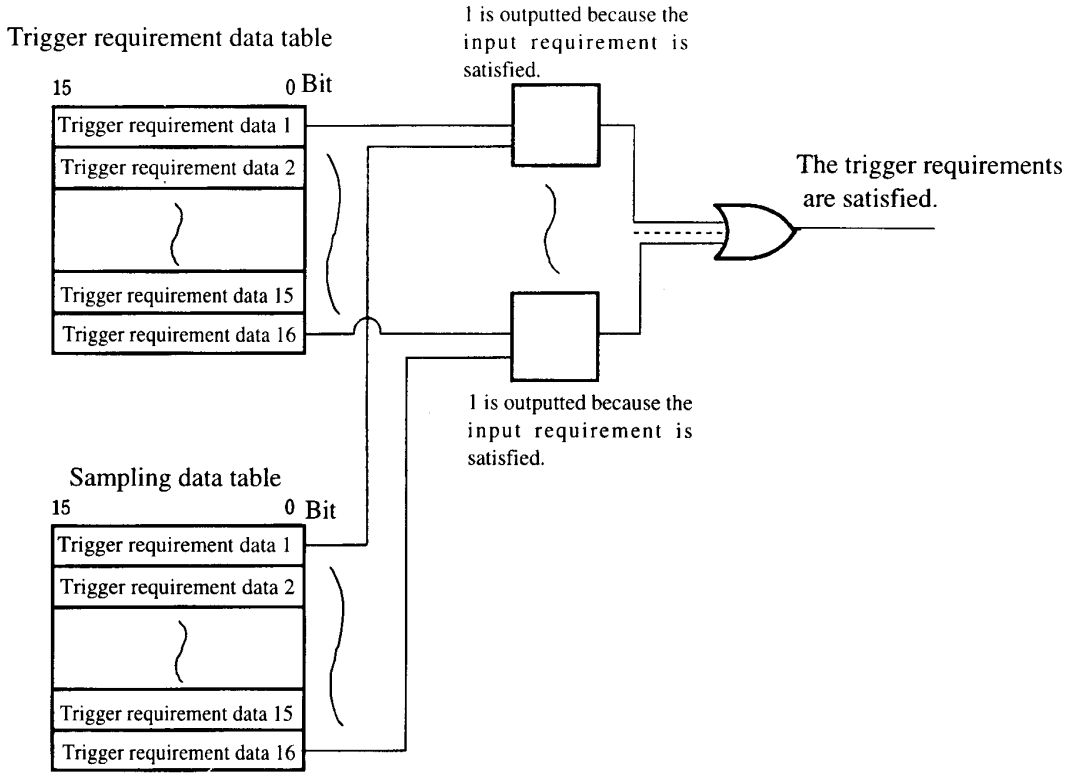
③ AND/OR requirements of the trigger.

• 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 where 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

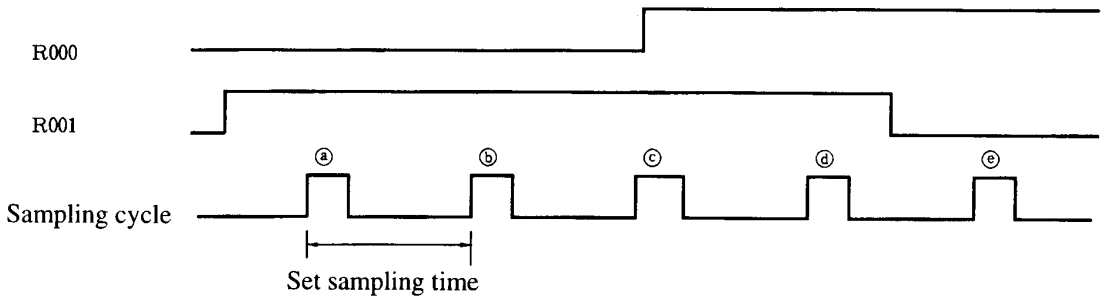
Parameters which are required to be set by the peripheral equipment (system software: Ladder Editor) before the trace monitor executes are as follows:

| Parameter to be set / Trace monitor function | Sampling time | Trace monitor I/O No. | Trigger requirement AND/OR | Trigger requirement data |
|---|---|---|---|---|
| Continuous time chart | ○ | ○ | × | × |
| Trigger time chart | ○ | ○ | ○ | ○ |
| Continuous trace | ○ | ○ | × | × |
| Trigger trace | ○ | ○ | ○ | ○ |
| CPU command trace | × | ○ | × | × |
| Trigger circuit monitor | × | × | ○ | ○ |

### (7) Trace monitor operation time chart

① Continuous time chart

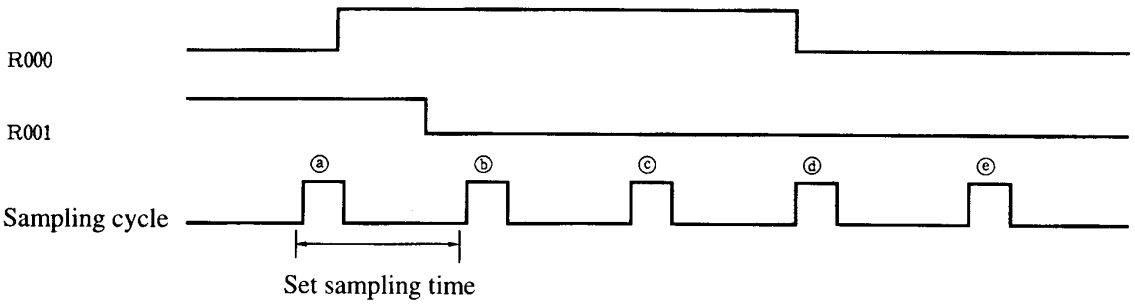
An operation time chart of the continuous time chart function for the bit I/O R000 and R001 is shown below.




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

③ Continuous trace

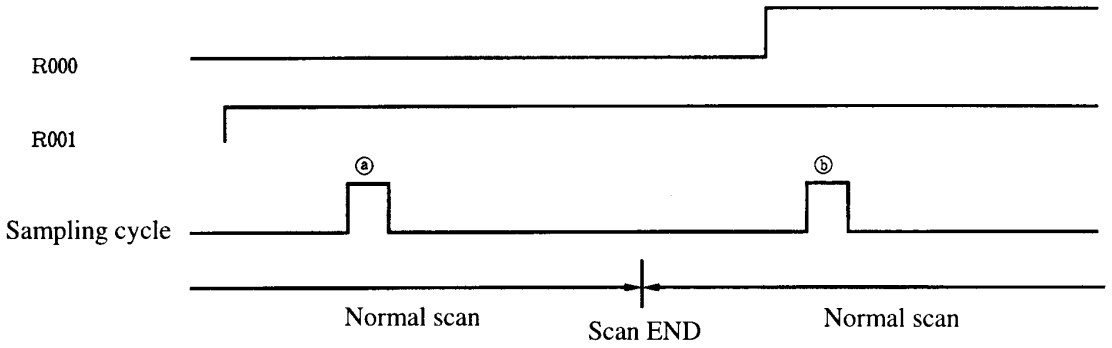
The operation time chart of the continuous trace function is basically the same as that of the continuous time chart function. The difference between both functions is that the continuous time chart function samples only bit I/O, though the continuous trace function can sample bit I/O, word I/O, and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

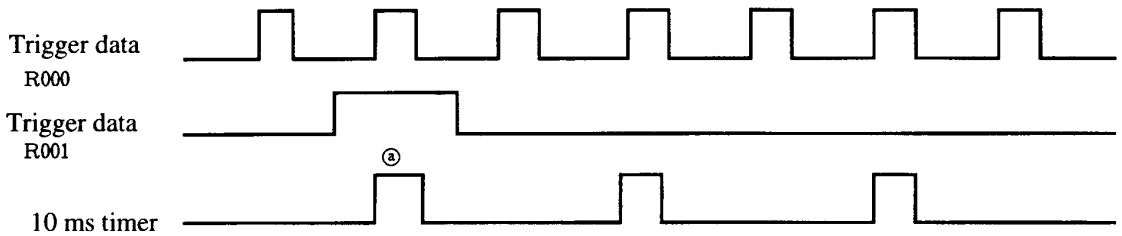
Changes of the bit I/O R000 and R001 and an operation time chart of the CPU command trace function are shown below.




When the sampling trace command provided in the ladder program is executed at ⓐ or ⓑ, the CPU command 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 ⓐ, the function samples the I/O data which is used in the set circuit.

### (8) List of sampling operation in each CPU status

| No. | CPU status | CPU operation mode | CPU operation | LED of I/O | 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 the range | Indication | Output | * Partially enabled |
| 6 | D. HLT | Debug halt | Stop | Indication | Output | Disabled |



* Sampling in the D.RUN status.

① In the case of n scan RUN or 1 scan RUN, the time chart and I/O sampling function 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 command sampling function is in execution and the command to be executed is sampling trace FUN51(S), data is sampled.

Note: All the trace monitor functions are stopped during the halt time in the In-RUN service change mode.

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

| No. | Function name | Measuring condition | H-252 (μs) | Remarks |
|---|---|---|---|---|
| 1 | Continuous time chart Continuous trace | • Trace monitor I/O : 1 point<br>• sampling time : 10 ms | 131 | Upper value continuous time chart lower value: continuous trace |
| | | | 139 | |
| | | • Trace monitor I/O : 16 points<br>• sampling time : 10 ms | 580 | |
| | | | 605 | |
| 2 | Trigger time chart<br><br>Trigger trace (When Trigger condition is AND) | • Trace monitor I/O : 1 point<br>• sampling time : 10 ms<br>• Trigger requirement : 1 point | 213 | Upper value trigger time chart lower value: trigger trace |
| | | | 225 | |
| | | • Trace monitor I/O : 16 points<br>• sampling time : 10 ms<br>• Trigger requirement : 16 points | 612 | |
| | | | 650 | |
| 3 | Trigger circuit monitor (When Trigger condition is AND) | • Sampling point : 1 point<br>• Trigger requirement : 1 point | 188 | |
| | | • Sampling point : 50 points<br>• Trigger requirement : 16 points | 2333 | |

• 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 command trace samples data by the ladder command, the scan time is increased by the execution time of the sampling command. (The 10-ms periodic system processing time will not be increased.)

Therefore, when using one of the functions, take that timing into considerations in designing a system.

**(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 command 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 watched through 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 Pack

## 4.1 EEPROM Memory Pack (MPH-4E, MPH2-4E, MPH-8E/16E)

### (1) Outline

As MPH-4E, MPH2-4E, and MPH-8E/16E are provided with EEPROM, when installed in the CPU, they can store a ROM program by writing or transferring the program through peripherals (PGM-CHH, GPCL(HI-LADDER), PC98(LADDER EDITOR, etc.)). In addition, the ROM program will be protected even when a battery failure occurs because the memory needs not be backed up.

(note) In-RUN service program change can not be made when the memory pack is mounted.

**Table 4.1.1 Specifications of EEPROM Memory pack for H-250/252**

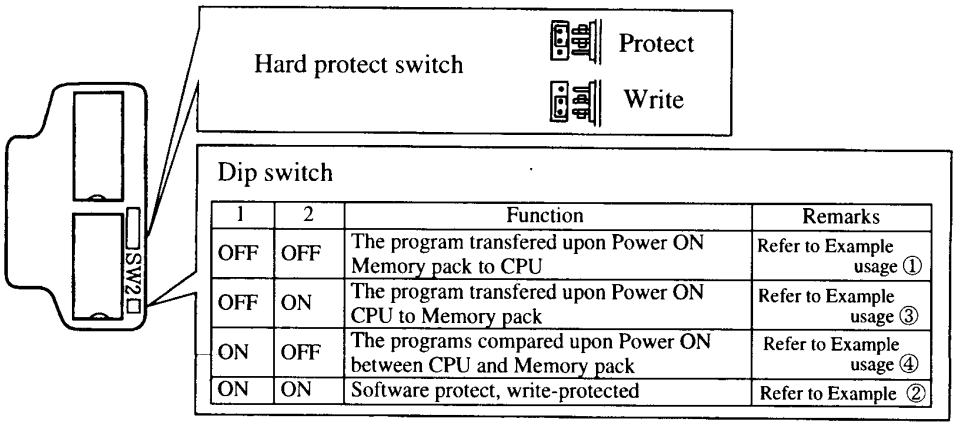
| Type | | MPH-4E | MPH2-4E | MPH-8E | MPH-16E |
|---|---|---|---|---|---|
| Memory capacity [Step] | | 3.5 k | 3.5 k | 7.6 k | 15.7 k |
| Memory type | | EEPROM | EEPROM | EEPROM | EEPROM |
| Dip switch, Hard protect switch : Yes/No | | No | Yes | Yes | Yes |
| Program transfer function | Pack⇒ CPU | ○ | ○ | ○ | ○ |
| | CPU⇒ Pack | — | ○ | ○ | ○ |
| | CPU = Pack | — | ○ | ○ | ○ |
| | Protect | — | ○ | ○ | ○ |

○ : abled

### (2) Copy and write protect function of the memory pack

MPH2-4E and MPH-8E/16E are able to copy or compare programs between the CPU and the memory pack, or to protect the program, by simply setting the dip switch and the hard protect switch , and energizing the power even without using a programming device.

Set the switch and use various functions in reference to the following examples of usage ① ~ ④.




| 1 | 2 | Function | Remarks |
|---|---|---|---|
| OFF | OFF | The program transfered upon Power ON Memory pack to CPU | Refer to Example usage ① |
| OFF | ON | The program transfered upon Power ON CPU to Memory pack | Refer to Example usage ③ |
| ON | OFF | The programs compared upon Power ON between CPU and Memory pack | Refer to Example usage ④ |
| ON | ON | Software protect, write-protected | Refer to Example ② |

**Caution**

- Never fail to relocate the connector switch of the hard protect switch to the upper or lower position. If the connector is removed, the writing will be disabled and the program can not be copied to the memory pack from the CPU. The examples 1 or 4 will enable the copy accordingly.

Example usage ① In case a memory pack in the status of "writing enabled".....

MPH-4E ,
or MPH2-4E or MPH-8E/16E with the following setting.
Hard protect switch..... Write
Dip switch..... 1 : OFF, 2 : OFF

When a memory pack is mounted with "writing enabled" status and then a program is written on or transferred to during the CPU STOP, the program will be written both on the EEPROM memory pack and on the built-in RAM of the CPU. Therefore, when the memory pack is mounted on the CPU module before programming, the program will always be stored in the EEPROM, being possible special purpose Program ROM to be eliminated.

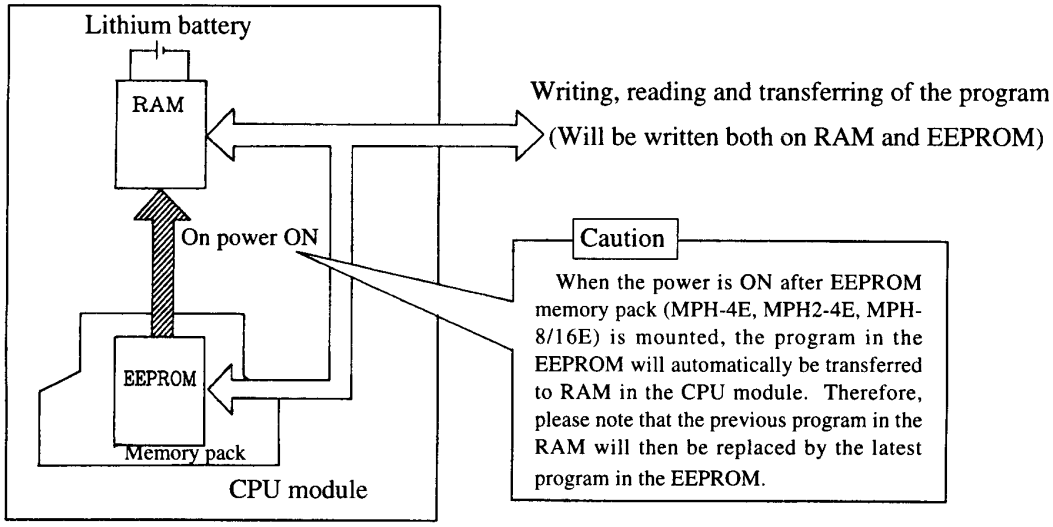



**Figure 4.1.1 Relationship between Program and Memory**

Cautions

- The memory transfer can not be executed while the CPU is in operation. Therefore, when performing the memory transfer through a peripheral, select the "memory transfer" making the transfer selection display appear after the CPU is in STOP.
- Mounting the memory pack

  Mount the EEPROM memory pack (MPH-4E, MPH2-4E, MPH-8E/16E) as shown on the following illustration.

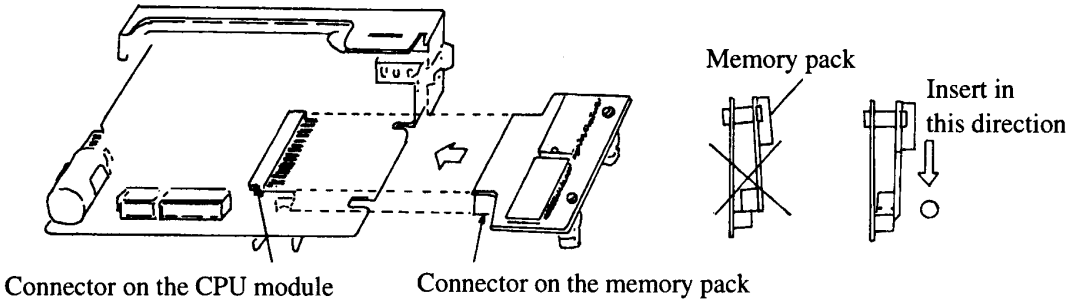



**Figure 4.1.2 Mounting EEPROM Memory Pack**

Example usage ② In case a memory pack in the status of "writing disabled".....

Hard protect switch..... Protect
Dip switch..... 1 : ON, 2 : ON

Protects of two types will be given to programs of two types, through setting of switches in the memory pack.

- Software protect.....Protecting against a misoperation.
- Hardware protect.....Protecting against excessive noise.

In the case of "writing enabled" in the example ① and in this function, on bringing the CPU power into ON, the program can be automatically transferred to the CPU RAM from EEPROM which needs not to be backed up by a battery, thereby a possible loss of the program due to a battery failure will be prevented.



**Caution**

When the power is ON after EEPROM memory pack (MPH2-4E, MPH-8/16E) is mounted, the program in the EEPROM will automatically be transferred to RAM in the CPU module. Therefore, please note that the previous program in the RAM will then be replaced by the latest program in the EEPROM.

- When the CPU is initialized with the setting in "hardware protect", the communication error will be occurred as the user's memory failure (Error code : 31H).

Example usage ③ In case A program is to be copied to the memory pack from CPU.

Setting of the memory pack switches ..... Hard protect switch : Write
Dip switch. 1 : OFF, 2 : ON

▽

Mounting the memory pack

▽

Power ON .....RUN LED flickering, ERR LED extinguished (will be continued for several 10s seconds)

▽

Copy completed .....RUN LED, ERR LED extinguished

**Caution**

- In copy functioning, when the program size exceeds the capacity of EEPROM memory pack (MPH2-4E, MPH-8E/16E), the program will not be copied due to the memory size error and the self diagnostic error code 33 will be set.

  When the two memory capacities are not the same, the program in the CPU will be copied if the program size is within the memory pack size. In such case, the self diagnostic error code 36 will be set due to the mismatching in memory assignment.

Example usage ④ In the case of comparing the contents between the CPU and the memory pack.

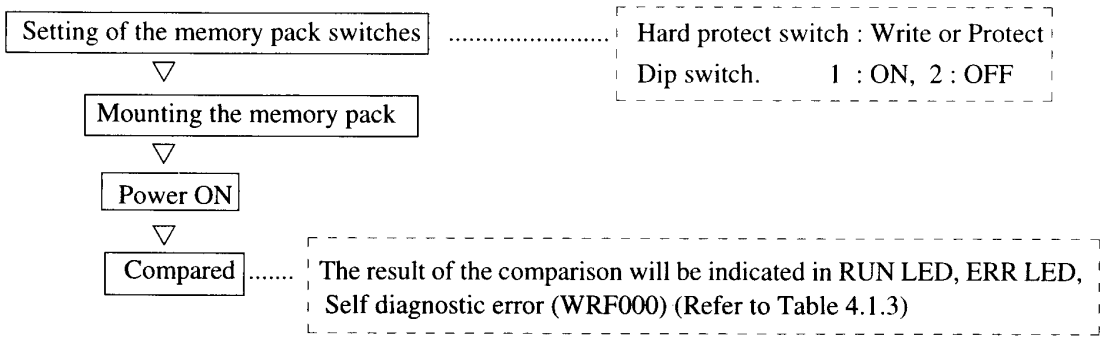



**Table 4.1.3 Classification and Indications of the Comparing**

| Compaired result | Error code | Indication and Operation of CPU module | | |
|---|---|---|---|---|
| | | RUN LED | ERR LED | RUN Able•Disable |
| Sum error in Memory pack | 31 | Off | On | Disable |
| Sum error in CPU memory | 31 | Flickering | On | Disable |
| Mismatching in Ladder program area or in Parameter area (excluding memory assignment) | 35 | Off | Fast flickering | Disable |
| Mismatching in Memory assignment area | 36 | Fast flickering | Off | Disable |
| Complete matching between CPU and Memory pack | 00 (No error) | Off | Off | Able |

## 4.2 EPROM Memory Pack (MPH-8R/16R)

### (1) Outline

As MPH-8R/16R is provided with EPROM, the backup of the memory by a battery is not necessary. Therefore, when a program is written in the ROM and mounted in the CPU, the program will be protected from a possible loss due to a battery failure.

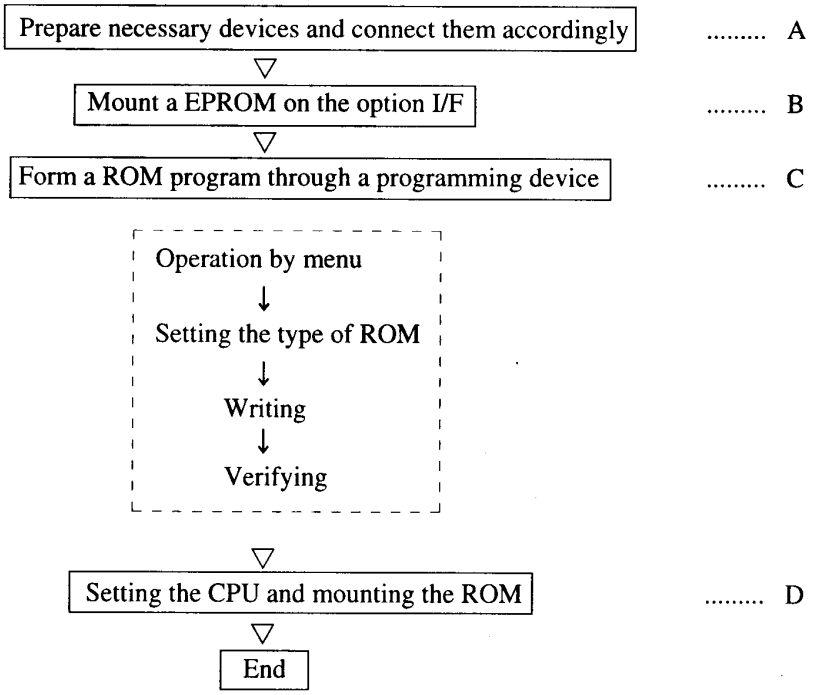
**Table 4.2.1 Specifications of the EPROM memory packs for H-250/252**

| Type | | MPH-8R | MPH-16R |
|---|---|---|---|
| Memory capacity [steps] | | 7.5k | 15.7k |
| Memory type | | EPROM | EPROM |
| Equipped:<br>Dip switch, Hard protect switch : Yes/No | | No | No |
| Program transfer function | Pack⇒CPU | | |
| | CPU⇒Pack | - | - |
| | CPU = Pack | - | - |
| | Protect | - | - |



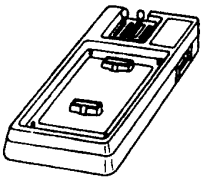
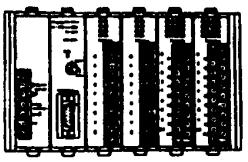
### (2) Forming a ROM program

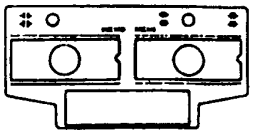
To form a ROM program from the program written in the built-in RAM of the CPU module of H-250/252, follow the steps shown below.



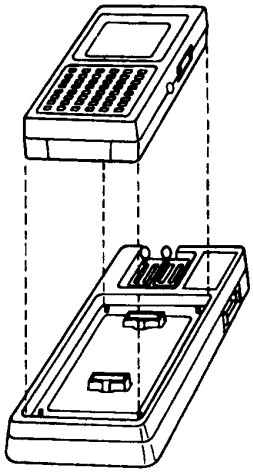
(A) Preparing necessary devices and connect them accordingly

The devices necessary to form a program ROM are shown below.

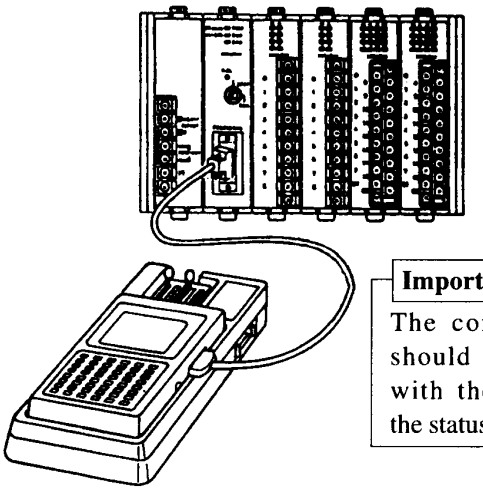
| Portable graphic programmer | Option I/F for Portable graphic programmer | Basic unit H-250/252 |
|---|---|---|
|  |  |  |
| PGM-GPH | PGMIF1H | |

| Memory pack | Connecting cable: PGM-GPH ~ CPU |
|---|---|
|  |  |
| MPH-8R/16R | PGCB-02H |

① Mount the option I/F onto the portable graphic programmer (PGM-GPH)



② Connect the portable graphic programmer (PGM-GPH) with the CPU.



**Important**

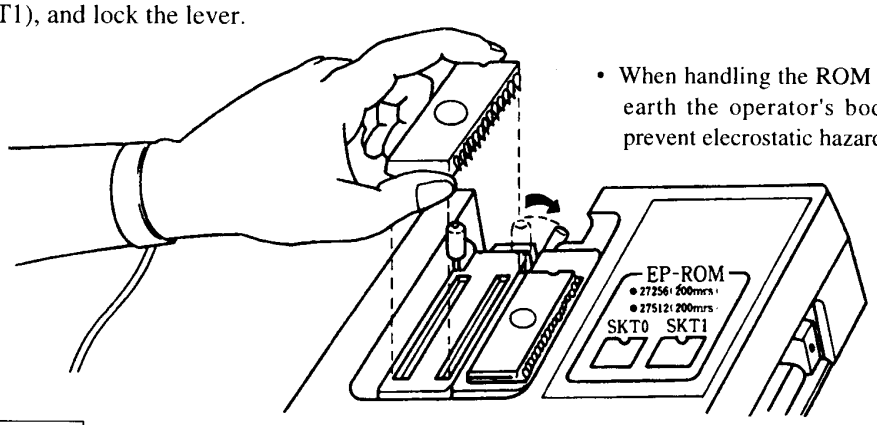
The connection should be made with the CPUin the status of STOP

For details of the connection of the option I/F, refer to the manual for the portable graphic programmer, or the following parts of the operation manual.

| Programming device | The parts to be referred |
|---|---|
| Portable programming programmer (PGM-GPH) | Chapter 2: 2. 4. 3 Connection of the option I/F |

(B) Mounting the EPROM on the option I/F.

The EPROM (ROMIC-01H) is supplied as a part of the EPROM memory pack (MPH-8R/16R). Mount the EPROM on the option I/F PGMIF1H) matching the direction of pins 1. into IC socket (SKT0, SKT1), and lock the lever.




• When handling the ROM chip, earth the operator's body to prevent elecrostatic hazards.



**Cautions**

1. EPROM may be destroyed if the EPROM is removed and mounted during operation of the ROM writer.
2. Since EPROM is generally vurnerable to electrostatic shock, discharge static electricity from the operating person by touching the earth before the operation.
3. Do not touch the leads (terminals) of the EPROM. Do not apply undue forces on the leads.
4. For writing on the EPROM, use the one with the status completely erased off. Cover it with a light shielding label after writing is over.
5. While the EPROM is stored for a considerable long time of period, store it in a protective case wrapped with a sheet of aluminum foil to prevent a damage to be induced by static electricity.

(C) Forming a program ROM through the portable graphic programmer.

Operation by menu
Select the option box function

▽

Setting ROM type
Set 27256 as the ROM type

▽

Writing
Write the content of RAM memory on the ROM memory.

▽

Verifying
Verify that the content of the RAM memory has been written correctly on the ROM memory.

For details, refer to the portable graphic programmer manual, or the following parts of the operation manual.

| Programming device | Parts to be referred to |
|---|---|
| Portable graphic programmer (PGM-GPH) | Chapter 6 : 6. 8. 2 ROM Writer |

(D) Mounting the ROM

① Mount the EPROM that has been written at SKT0 into the IC socket (SKT0) , and mount the EPROM that has been written at SKT1 into the IC socket (SKT1), on the memory pack.

**Caution**

To prevent the ROM from electrostatic hazards in the operation, discharge static electricity out of the operator's body by touching the earth prior to the operation. Take a body earth as practicably as possible.

**Caution**

When mounting the ROM:

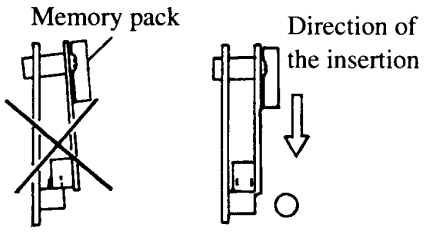
The following items should be well verified

1. The ROM is in the correct direction. (Match the notches).
2. No distortion should be found on the leads of the ROM.

② Mount the memory pack on the CPU module.

**Cautions**

- Note that the program stored in the CPU module will be lost, when the power is turned ON with the memory pack mounted on the CPU.
- The insertion of the memory pack should be in correct line with the receptacles as shown below.



## 4.3 Indication method and error codes for the CPU

The CPU indications and the self diagnostic error codes (WRF000) to be set in execution of various functions.

**Table 4.3.1 Indication method and error codes for the CPU**

| Error to be indicated in the execution | Error code | LED indication of CPU | | Mode to be occurred | | | |
|---|---|---|---|---|---|---|---|
| | | RUN | ERR | Pack⇒ CPU | CPU ⇒ Pack | CPU = Pack | Soft protect |
| Sum error in the memory pack | 31 | Off | On | ○ | - | ○ | ○ |
| Sum error in CPU memory | 31 | Flickering | On | - | ○ | ○ | - |
| Memory size error | 33 | Flickering by turns | | - | ○ | - | - |
| Mismatching in the comparison | 35 | Off | Fast flickering | - | - | ○ | - |
| Mismatching in the memory assignment *1 | 36 | Fast flickering | Off | - | ○ | ○ | - |
| Writing on EEPROM | - | flickering | Off | - | ○ | - | - |

*1 Will be occurred when the CPU memory assignment does not match the memory pack capacity.

*2 Verify the error codes after the memory pack from the CPU

Cautions

In H-250, cautions should be taken to the following points when MPH-16E or MPH-16R is used with the memory assignment of 16 ksteps.

1. When MPH-16E is mounted with the transfer mode (Dipsw 1 : OFF, 2 : OFF) the program will not be transferred caused by the error code 33.
2. When MPH-16R, or MPH-16E with the soft protect mode (Dipsw 1 : ON, 2 : ON), is mounted,
   (1) When the program capacity of the memory pack is less than 8 kstep, the program will be transferred to CPU, but the error code 5A will be set.
   (2) When the program capacity of the memory pack is more than 8 kstep, the program will not be transferred to CPU, caused by the error code 33.
3. When MPH-16E is mounted with the verify mode (Dipsw 1 : ON, 2 : OFF) and the program capacity of the memory pack is more than 8 kstep, the verifying operation will be executed, but error code 35 will be set.

# Chapter 5 Power Module

The following two power source are necessary for operation of H-250/252 PC.

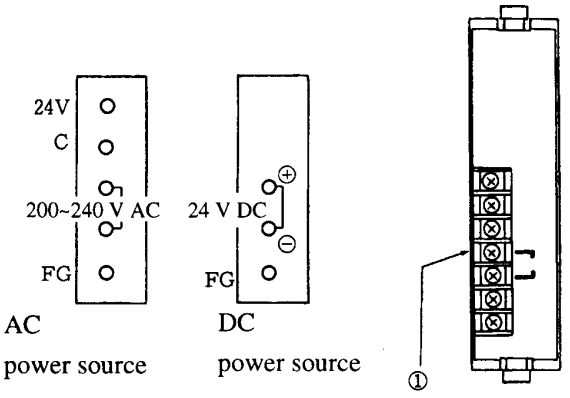
1. For H-250/252 PC main unit : The source to supply power to operate H-250/252 PC. Each PC base requires one unit of the power source which shall supply 5 VDC and 24 VDC.
2. For I/O signals : The source to supply power to the I/O module.

When, in the above case 1, the capacity of 24 VDC becomes insufficient, an additional external power source to supply 24 VDC shall be prepared.

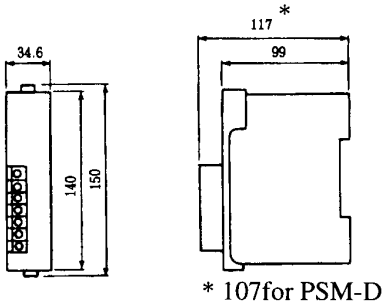
For the item 2 above, separate power sources must be prepared by the user depending upon specifications of loads.

## 5.1 Construction

Name and function of each part

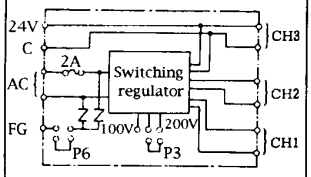
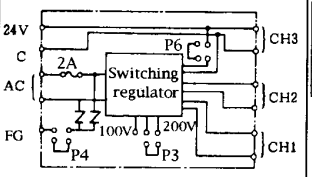
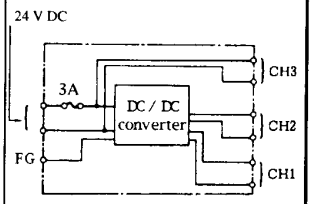
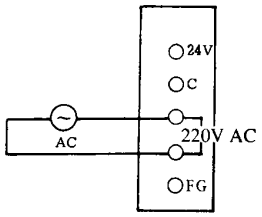
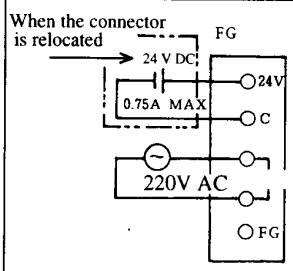
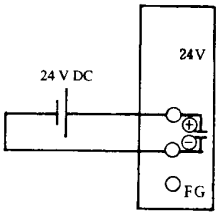



| Type | | Name |
|---|---|---|
| AC | PSM-A | Power module (100 V/200 VAC selectable) |
| | PSM-A2 | Power module (100 V/200 VAC continuous) |
| | PSM-B | Power module (100 V/200 VAC selectable) (Increased capacity type) |
| DC | PSM-D | Power module 24 VDC |
| Weight(g) | | 250 approx.(210 for PSM-D) |
| Dimensions (mm) | | |

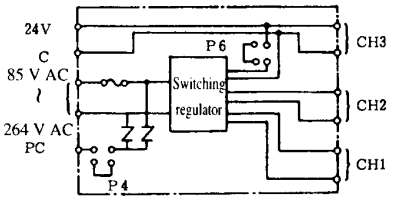



| Number | Name | Function |
|---|---|---|
| ① | Terminal plate | Connect power source cables |

## 5.2 Specifications

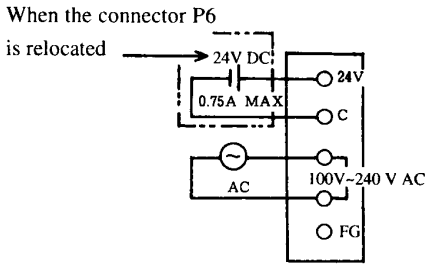
| Item \ Type | | PSM-A | PSM-B | PSM-D |
|---|---|---|---|---|
| Source voltage | Rated voltage | 100V/110V/120V AC, 200V/220V/240V AC (100V AC and 200V AC selectable by the connector) | | 24V DC |
| | Permissible range | 35V to 132V AC, 170V to 264V AC | | 19.2V to 30V DC |
| Frequency | Rated frequency | 50/60 Hz | | ——— |
| | Permissible range | 47 to 63 Hz | | ——— |
| Input current | | 0.6 A or less | | 1.6 A or less |
| Output current | CH1 (5V) | 1A (for CPU, Programmer) | 1.7A (for CPU, Programmer) | 1A (for CPU, Programmer) |
| | CH2 (24V) | 0.3A (for Output module) | 0.5A (for Output module) | 0.3A (for Output module) |
| | CH3 (24V) | 0.45A (for Input module) | 0.25A (for Input module) | 1A (for Input module) |
| Dimensions(mm) | | 34.6 (W) × 150 (H) × 117 (D) | | 34.6 (W) × 150 (H) × 107 (D) |
| Weight (g) | | 250 | 250 | 210 |
| Circuit diagram | |  |  |  |
| External wiring | |  |  |  |

| Item \ Type | | | PSM-A2 | |
|---|---|---|---|---|
| Power source voltage | Rated voltage | | 100V/110V/120V AC<br>200V/220V/240V AC | Circuit diagram |
| | Permissible range | | 85 to 264V AC | |
| Frequency | Rated frequency | | 50/60Hz | |
| | Permissible range | | 45 ~ 63Hz | |
| Input current | | Rush | 40A or less | External connection |
| | | Rated | 0.6A or less | |
| Output current | CH1 (5V) | | 5V, 1A | |
| | CH2 (24V) | | 24V, 0.7A total | |
| | CH3 (24V) | | | |
| Dimension (mm) | | | 34.6(W) × 150(H) × 117(D) | |
| Weight (g) | | | 250 | |




• Power can also be supplied through CH3 when the connector P6 is disconnected.

• Disconnect the connector P4 while a dielectric strength test is being made.




(1) Power module receives AC or DC power and supplies the power to the CPU, programmer and I/O modules. Output is composed of 3 channels CH1 (5V) for CPU and programmer, CH2 (24V) for output module, and CH3 (24V) for input module.

The maximum output current in each channel is specified in the table . The current consumption of each module is marked in the specifications. So configure a system so that total current consumption in each channel does not exceed the maximum current output.

(2) Since they have been factory-set at 220V AC, the connection need be changed over to 110 V when necessary, and then attach the furnished voltage nameplate.

(3) The PSM-A, PSM-B and PSM-A2 incorporate a varistor for suppressing lightning surge. Therefore, the connector (PSM-A:P6, PSM-B:P4, PSM-A2:P4) must be disconnected while testing dielectrlc strength or insulation resistance.

Otherwise, the varistor might be damaged.

(4) CH3 is also used by a sensor. Confirm that total current consumption does not exceed 0.45A with the PSM-A, and 0.25A with the PSM-B.

Point

The PSM-B allows power supply from an external power unit to CH3 through relocation of the connector. Utilize this feature in case CH3 current is inadequate because of too many input modules to be connected.

(5) Current consumptions of the programmers are as follows.

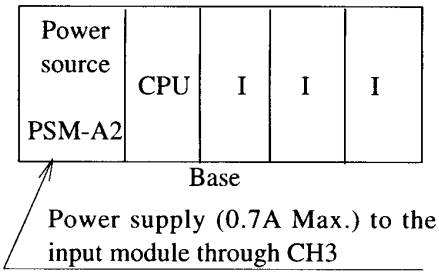
(Unit : mA)

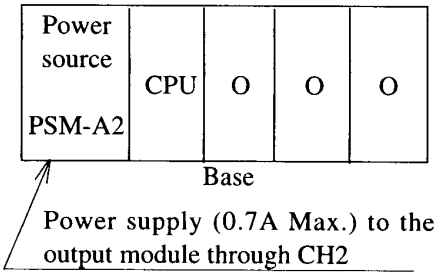
| Item | Type | CH1 (5V) | CH2 (24V) | CH3 (24V) |
|---|---|---|---|---|
| Portable graphic programmer | PGM-GPH | 400 | 0 | 0 |
| Option I/O | PGMIF1H | 700 | 0 | 0 |
| Command programmer | PGM-CHH | 450 | 0 | 0 |

(6) Features of PSM-A2

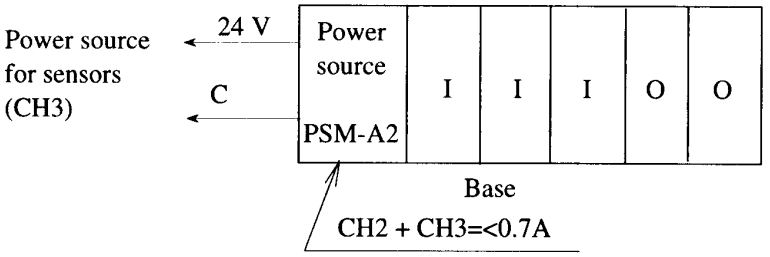
PSM-A2 can be connected either to 100 V AC or 200 V AC source, because the permissible operating range is as wide as 85 ~ 264V AC. It would be used in wider market where there is many kind of utility power voltages.

① CH2 and CH3 are designed for the free channel system, and can be supplied with a total of 0.7A. Therefore, this feature will be most advantageous for the case only output modules or input modules are installed.

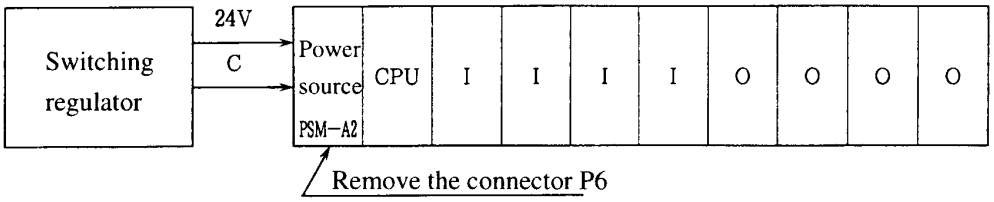



② This feature naturally does not reject an application with both input modules and output modules are installed mixed. The 24 V terminal and C terminal of the power module can be used for sensors. These power source for sensors have same capacity as in CH3. Total current of CH2 and CH3 should be not more than 0.7A.



③ When the power capacity of 0.7 A is insufficient for CH2+CH3, the maximum of 0.75 A can be supplied to CH3 from the switching regulator to be prepared externally with the connector P6 to be removed from the power module.




In such case, CH2 and CH3 are capable of the following capacity.

{ CH2 (for the output module)..... 0.7 A MAX.
CH3 (for the input module)..... 0.75 A MAX. (to be supplied from an external switching regulator)

## 5.3 Selection of the power module

The power modules are prepared in four types [PSM-A], [PSM-A2], [PSM-B], [PSM-D], for H-250/252. Specifications are shown in Table 5.3.1 for each type. Select depending upon user's system specifications.

**List of Specifications of Power Modules**

| Item | | | PSM-A | PSM-A2 | PSM-B | PSM-D |
|---|---|---|---|---|---|---|
| Input power source voltage | | | 85 ~ 132 VAC or 170 ~ 264 VAC (Selectable 100V or 200V by the connector) | 85 ~264 AC (Wide range) | 85 ~ 132 VAC or 170 ~ 264 VAC (Selectable 100V or 200V by the connector) | 19.2 ~ 30 VDC |
| Output current | Built-in | CH1 (5V) | 1 A | 1 A | 1.7 A | 1 A |
| | | CH2 (24V) | 0.3 A | } 0.7A total | 0.5 A | 0.3 A |
| | | CH3 (24V) | 0.45 A | | 0.25 A | 1 A |
| | Supplied externally | CH3 (24V) | Can not accept the external power supply | 0.75A (The built-in CH3 can not be used) | 0.75A (The built-in CH3(0.25A) can not be used) | Can not accept the external power supply |
| Use | | | When the number of I/O modules are small (5 modules or less) | When the number of I/O modules are large | Necessary when H-series portable graphic programmer is used (Current capacity increased in 5V) | For DC power source |

## 5.4 Cautions in using the power sources

### (1) Life of power modules

Many electrolytic capacitors are used in each power module. Capacitors of this type generally have rather limited service life depending upon service condition. The life span would be halved when the ambient temperature rises by 10°C.

Assume the service life of a power module as approximately three years under the rated ambient temperature, when controlling the inventory of spare parts. Adequate ventilation and improvement on the ambient temperature are recommended for the purpose of elongating the service life.

### (2) Shutting off the power when a module is being replaced.

While performing a replacement of a module or an alteration in the device layout, never fail to shut off the power to the PC main units and also the power to I/O modules.

If a module is extracted and reinstalled with the power being supplied (hot-line job), electronic parts may be destroyed or workers may be suffered from electric shock. Extra care should be taken to perform the work with the power source completely disconnected.

# Chapter 6 Base

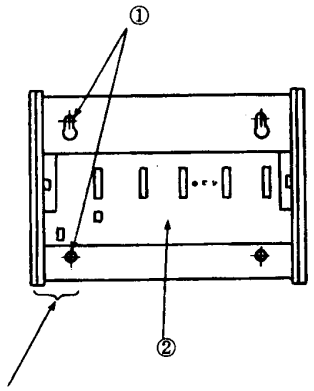
Base functions to fix the various modules and to provide communication routes between the modules.

The bases are designed in two types, the basic base (BSM-**) and the sophisticated function base (BSH-*).

The standard base is divided into six subtypes and the sophisticated function base is into four subtypes so that an optimum base selection can be made depending upon the number of the modules to be actually mounted.

## 6.1 Construction of the standard base

Name and function of each part



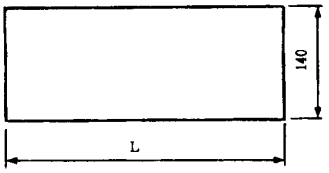

Slot for the exclusive use of the power module

| Number | Name | Function |
|---|---|---|
| ① | Fixing screw hole | Fixing the base |
| ② | Mother board | The circuit board to relay the I/O buses and the system buses between the CPU module and various modules. |

Type

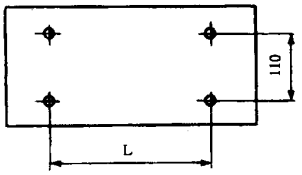
| Type | Number of slots |
|---|---|
| BSM-3A | 3 slots |
| BSM-4A | 4 slots |
| BSM-5A | 5 slots |
| BSM-6A | 6 slots |
| BSM-7A | 7 slots |
| BSM-9B | 9 slots |

Dimensions (mm)




| Type | Dimension "L" |
|---|---|
| BSM-3A | 160 |
| BSM-4A | 195 |
| BSM-5A | 230 |
| BSM-6A | 265 |
| BSM-7A | 300 |
| BSM-9B | 370 |

Mounting dimensions (mm)

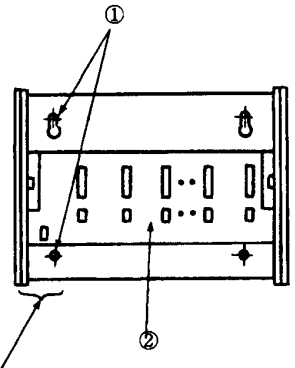



| Type | Dimension "L" |
|---|---|
| BSM-3A | 80 |
| BSM-4A | 120 |
| BSM-5A | 160 |
| BSM-6A | 200 |
| BSM-7A | 240 |
| BSM-9B | 310 |

(Note) Since some modules can not be used in the standard base, confirm the suitability referring to the list of the structure component in Section 1.4.

## 6.2 Construction of the sophisticated function base

Name and function of each part



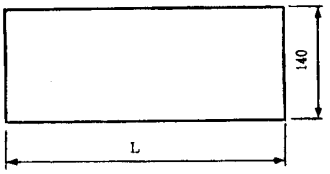

Slot for the exclusive use of the power module

| Number | Name | Function |
|---|---|---|
| ① | Fixing screw hole | Fixing the base |
| ② | Mother board | The circuit board to relay the I/O buses and the system buses between the CPU module and various modules. |

Type

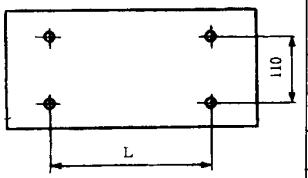
| Type | Number of slots |
|---|---|
| BSH-3 | 3 slots |
| BSH-5 | 5 slots |
| BSH-7 | 7 slots |
| BSH-10 | 10 slots |

Dimensions (mm)




| Type | Dimension "L" |
|---|---|
| BSH-3 | 160 |
| BSH-5 | 230 |
| BSH-7 | 300 |
| BSH-10 | 405 |

Mounting dimensions (mm)




| Type | Dimension "L" |
|---|---|
| BSH-3 | 80 |
| BSH-5 | 160 |
| BSH-7 | 240 |
| BSH-10 | 345 |

(Note) Since some modules can not be used in the sophisticated function base, confirm the suitability referring to the list of the structure component in Section 1.4.

# Chapter 7 I/O Module

## 7.1 Outline

The I/O modules are prepared in various types depending upon types of power source (24 VDC, 100 VAC, 200 VAC, etc.) and number of points (8, 16, 32 points).

Wiring work of signal wires must be made with the external terminal cover removed. (Note that some module is provided with no cover).

To use an input I/O module or an output module, separate power source must be prepared for each module type. One for operation of the module main unit and the other for the input signal•output load. Each module will be supplied with automatically 5 V and 24 V from the power module for operating the module main unit when installed on the base. Select a suitable power module taking the consumption current of the module to be used into consideration. When the capacity of the 24 VDC source becomes insufficient, use an external additional power source.

The power source must be prepared separately for the input signal and output loads in accordance with the specifications of the particular module to be used.

## 7.2 List of I/O Modules

List of I/O modules are shown in the following table.

**[Input module]**

| Name | | Type | Specification | I/O assignment | Remarks |
|---|---|---|---|---|---|
| Input module | AC input module | PIM-A | 8 points, 100V/200V AC input | X16 | |
| | | PIM-AH | 16 points, 100V/200V AC input | X16 | |
| | | PIM-AW | 16 points, 100V/200V AC input (detachable terminal board) | X16 | |
| | DC input module (sink) | PIM-D | 8 points, 24V DC input | X16 | |
| | | PIM-DH | 16 points, 24V DC input | X16 | |
| | | PIM-DW | 16 points, 24V DC input (detachable terminal board) | X16 | |
| | | PIH-DM | 32 points, 24V DC input (connector) | X32(WX8W) *1 | |
| | DC input module (source) | PIM-DP | 8 points, 24V DC input, source type | X16 | |
| | | PIM-DPH | 16 points, 24V DC input, source type | X16 | |
| | | PIM-DPW | 16 points, 24V DC input, source type (detachable terminal board) | X16 | |

*1 Though assignment is possible also for WX8W, it can not be treated as bit data.

**[Output module]**

| Name | | Type | Specification | I/O assignment | Remarks |
|---|---|---|---|---|---|
| Output module | Relay output module | POM-R | 8 points, relay output | Y16 | |
| | | POM-RC | 8 points, relay output, independent contacts | Y16 | |
| | | POM-RH | 16 points, relay output | Y16 | |
| | | POM-RW | 16 points, relay output (detachable terminal board) | Y16 | |
| | Triac output module | POM-S | 8 points, triac output | Y16 | |
| | | POM-SH | 16 points, triac output | Y16 | |
| | | POM-SW | 16 points, triac output (detachable terminal board) | Y16 | |
| | Transistor output module (sink) | POM-T | 8 points, transistor output | Y16 | |
| | | POM-TH | 16 points, transistor output | Y16 | |
| | | POM-TW | 16 points, transistor output (detachable terminal board) | Y16 | |
| | | POH-TM | 32 points, transistor output (connector) | Y32(WY8W) *1 | |
| | Transistor output module (source) | POM-TP | 8 points, transistor output, source type | Y16 | |
| | | POM-TPH | 16 points, transistor output, source type | Y16 | |
| | | POM-TPW | 16 points, transistor output, source type (detachable terminal board) | Y16 | |
| I/O mixed module | | PHH-DT | 8 points DC, 8 points transistor output | B1/1 | |
| | | PHM-TT | 16 points TTL input, 16 points TTL output | B1/1 | |

*1 Though assignment is possible also for WY8W, it can not be treated as bit data.

**[Analog input module]**

| Name | | Type | Specification | I/O assignment | Remarks |
|---|---|---|---|---|---|
| Analog module | Analog input module | AGH-I | 8 quantities, 4~20mA, 8-bit current input | WX8W | |
| | | AGH-IV | 8 quantities, 0~10V, 8-bit voltage input | | |
| | | AGH-IV2 | 8 quantities, 4~20mA, 0~10V, 12-bit current/voltage selective type | | |
| | Analog output module | AGH-O | 4 quantities, 4~20mA, 8-bit current output | WY8W | |
| | | AGH-OD | 2 quantities, 4~20mA, 8-bit current output | | |
| | | AGH-OV | 4 quantities, 0~10V, 8-bit voltage output | | |
| | | AGH-ODV | 2 quantities, 0~10V, 8-bit voltage output | | |

**[Temperature measuring resistor input]**

| Name | Type | Specification | I/O assignment | Remarks |
|---|---|---|---|---|
| Thermo-couple module | THH | 8 quantities, -100~500°C·····J type<br>-100~1000°C·····K type | WX8W | |

## 7.3 Cautions in using I/O modules

**(1) When used for a L load.**

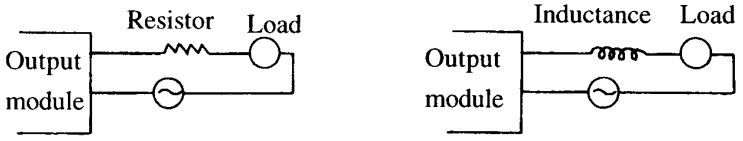
① When an output module is to be used for the frequent ON/OFF AC load or for the L load with large current or low power factor such as a solenoid coil, the triac type output module is recommended. (In the case of the relay output, service life of the contacts will be shortened caused by accelerated wears on the contact elements.)

② Recommended maximum frequency of ON/OFF for the L load consists of 1 second ON and 1 second OFF.

③ For a relay output module, connect a surge killer (for example, 0.1μF capacitor+100Ω resistor) to the inductive load (for example, a Hitachi magnetic contactor H20 or larger) with a coil capacity exceeding 10VA after contact is closed. When the load is DC, connect a flywheel diode.

**(2) When used for a load with large amount of changes.**

When a timer/counter utilizing DC/DC converter is used as a load, repeated periodic rush currents will be applied at the instant of ON or during the operation. Therefore, if the module is selected for the average current, troubles may be caused. When using such loads, connect a resistor or an inductance in series with the load, or select a module with larger current capacity in order to decrease the undesirable rush effect.




**(3) When used for a bulb**

A bulb load will have a rush current in 10 times the rated current. Take extra caution to the module current rating.

**(4) Relationship between the power module**

Limit the total consumption current of the modules mounted on one base at equal to or less than the rated capacity of the power module for that base.

**(5) Insulating solderless terminals**

Provide insulating tubes on the solderless terminals to be connected with the terminal board of the input module in order to prevent a short circuit.

**(6) Fuse**

① In each of the modules shown below, a fuse is provided in each common terminal set for the purpose of the prevention of the burning damage in external wirings. This provision is not intended for the protection for SSR elements and transistor elements used as switching devices in the subject circuits. Therefore, these elements will be broken when an output load is shotcircuited, never fail to have these devices repair.

Output module with fuses

| | | | |
|---|---|---|---|
| Triac output | POM-S | Transistor output | POM-T |
| | POM-SH, SW | | POM-TH, TW |
| Relay output | POM-R | | |
| | POM-RH, RW | | |

(Note) Avoid replacement of a fuse and subsequent energizing without removing the cause of the fusing, because such careless practice may cause increase damages further or burning out in the circuit elements.

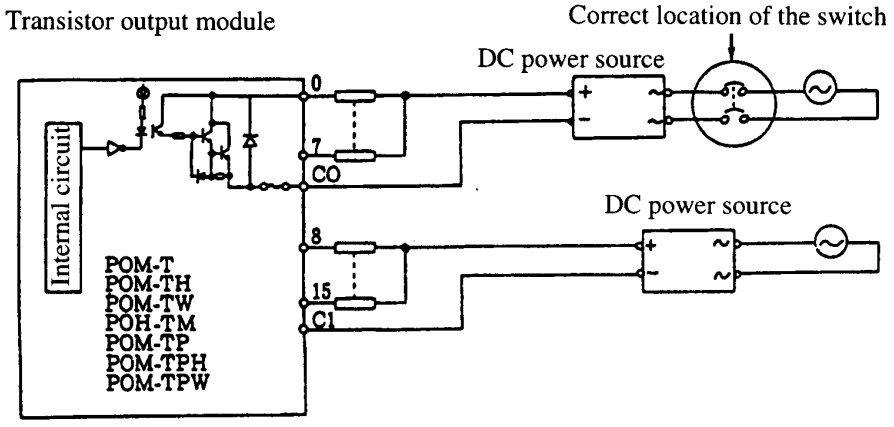
A replacement of a fuse by the user accompanied by a subsequent starting will be acceptable only in the case that number of ON points increase, but with the current in each bit kept under the rated, causing the common terminals to exceed the maximum permissible rated load current.

② In the output module with the specification of attached fuse as shown in ①. , if the fuse is not attached, no output will be made even though LED is lighting.

**(7) Transistor output module**

In the external power source wiring of the transistor output module, never fail to provide a switch in AC side of the DC power source when a switch is required in the power source circuit. Turn ON the external power source first and then ON the CPU power source next.

As shown in the illustration below, when the switch is provided between the external power source and the transistor output module, the output transistor will be ON for a very short instance of time (0.1ms or less) during a short transient of ON to OFF, causing a malfunction of the devices.

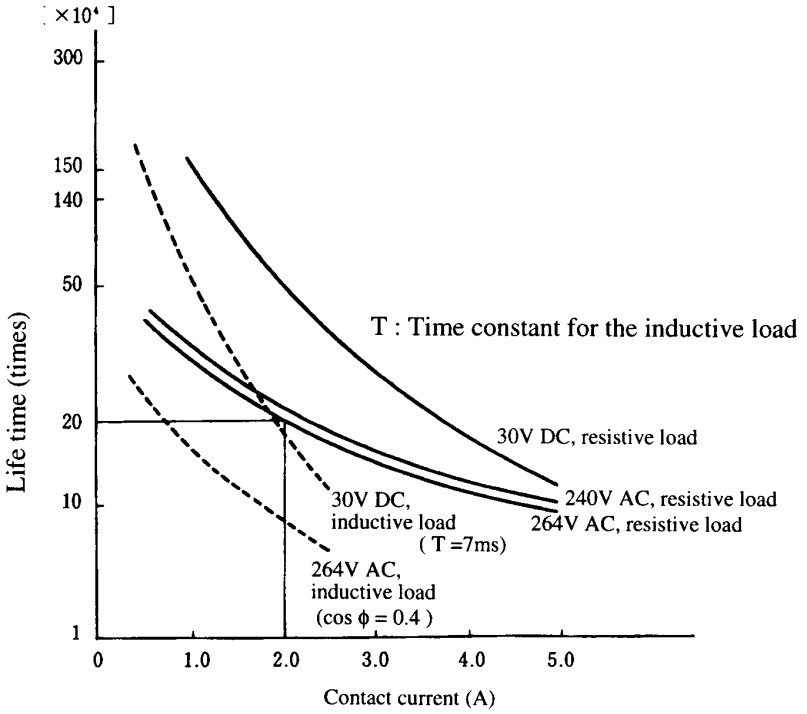



**(8) About the input switch for 100/200 VAC**

When using a thyristor or a triac as an input switching purpose for 100/200 VAC (PIM-A, PIM-AH,PIM-AW), use the devices with the withstand voltage of 2.8 times the voltage of the power source or more.

**(9) Electric service life curve of the H-series output relay(for reference)**

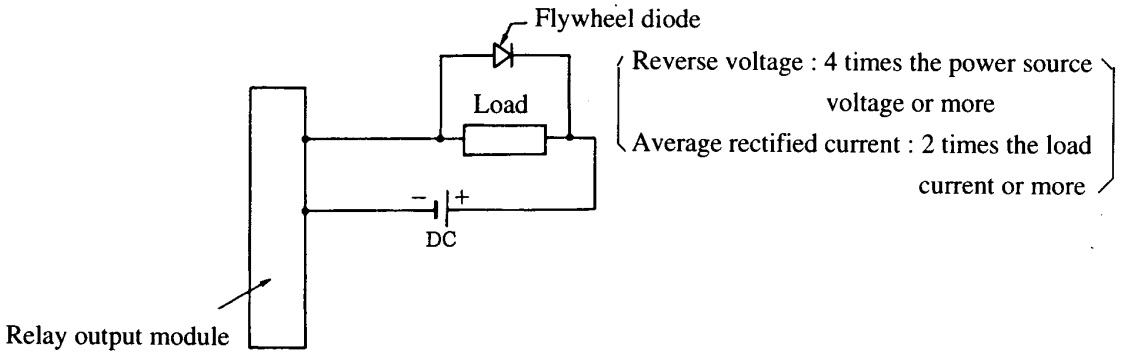
Contacts of the output relay have the electric service life of about 200 thousand operation cycles when used under the rated load (240V, 2A, 24V DC, 0.5A), and the mechanical life of 10 million operations.




Applied for the modules

- Relay output module (POM-R, POM-RH, POM-RW)
- Independent contact putput (POM-RC)

When used for DC power source, the contact life may be shortened caused by locking or similar actions depending on the mechanical operational frequency. To prevent such trouble, provide the flywheel diode or the like across the both ends of the external load.



**(10) Analog I/O module**

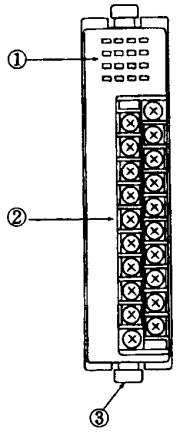
① In the analog modules (AGH-I, AGH-IV, AGH-IV2) the input terminals not in use must be connected with the common terminals.

② Before disconnecting the power source (at PC side) of the analog output modules (AGH-O, AGH-OD, AGH-OV, AGH-ODV), never fail to disconnect the power sources in the connected devices first in order to prevent outputting a possible false output.

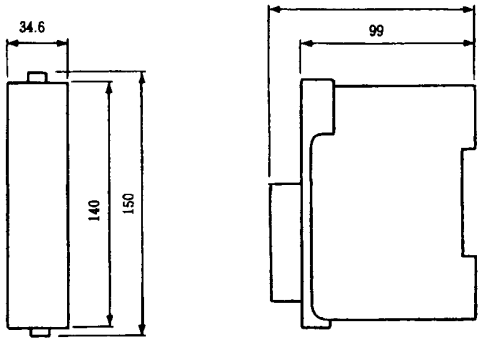
③ Limit the resistive load of the analog current input module (AGH-O, AGH- OD) equal to or less than 500Ω (including allowances). (When it exceeds 510Ω, the output current may be less than 20mA). In the channels not in use the outputs must be short-circuited.

## 7.4 Construction of I/O Module

Name and function of each part




Dimensions (mm)




| Module | L (mm) |
|---|---|
| 8-point I/O module | 117 |
| 16-point I/O module | 127 |
| 16-point I/O module (removable terminal) | 133 |
| PHM-TT, PIH-DM, POH-TM | 99 *1 |
| Analog module | 117 *2 |

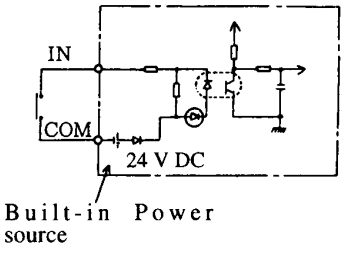
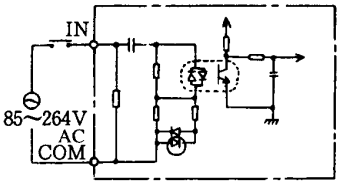
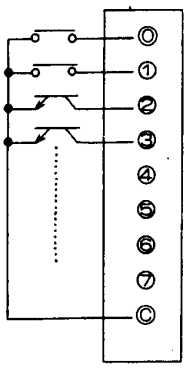
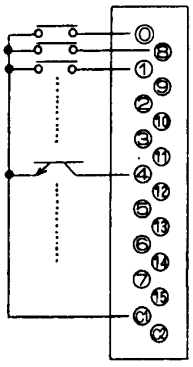
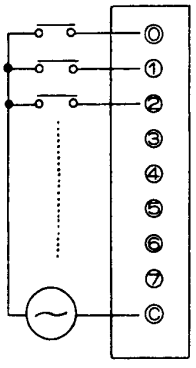
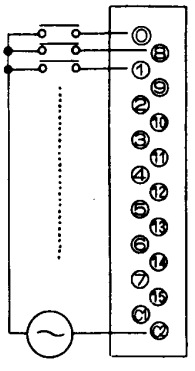
*1 Without the connector

*2 127 for AGH-IV2

| No. | Name | Function |
|---|---|---|
| ① | I/O display LED | The light emitting diode to indicate ON/OFF of I/O<br>To be illuminated during ON |
| ② | Terminal board | To be used for wirung<br>Connectors, in PIM-DM, POH-TM and PHM-TT |
| ③ | SNAP-INPLUG<br>to remove a module | Remove the module by means of this PLUG<br>(No screw is used for fixing the module)) |

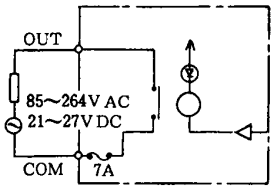
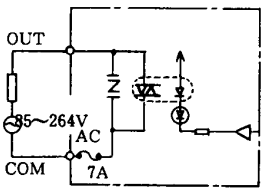
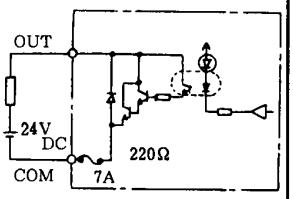
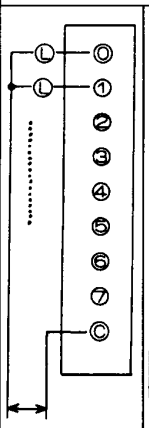
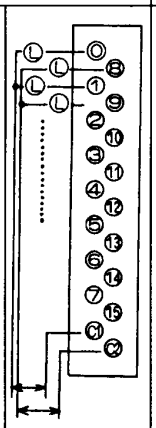
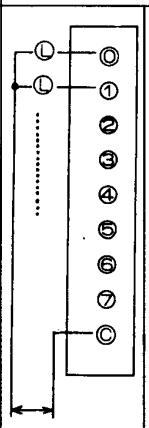
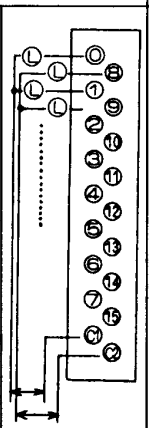
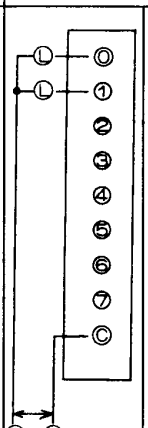
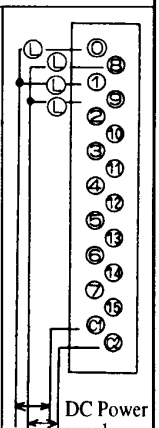
## 7.5 Specifications of I/O modules

### (1) Input module specifications

| Item \ Type | | PIM-D | PIM-DH, DW | PIM-A | PIM-AH, AW |
|---|---|---|---|---|---|
| Input specification | | DC input | | AC input | |
| Nominal voltage | | 24 V DC | | 110 / 220 V AC | |
| Input voltage | | 21.6 ~ 26 V DC | | 85 ~ 264 V AC, 50/60 Hz | |
| Input current | | 9mA (when input and common are short-circuited) | | 7 mA (110V AC, 50Hz) | |
| Operational specification | ON | 19V or more (resistance 300 Ω or less) | | 85 V AC or more | |
| | OFF | 7 V or more (resistance 200 kΩ or more) | | 30 V AC or less | |
| Input delay time | ON→OFF | 4 ms or less | | 16 ms or less | |
| | OFF→ON | 4 ms or less | | 16 ms or less | |
| No. of input points | | 8 points/module | 16 points/module | 8 points/module | 16 points/module |
| Common input | | 8 points/common terminal | | 8 points/common terminal | |
| Polarity | | Common terminal (-) | | — | |
| Insulation method | | Photocoupler | | Photocoupler | |
| Current consumption (Average) *1 | CH1 | 0.5mA + (No.of input ON points) ×0.5mA | | 1 mA | |
| | CH2 | 0 mA | | 0 mA | |
| | CH3 | (No.of input ON points) × 9mA | | 0 mA | |
| Dimensions (mm) | | 34.6 W × 150 H × 117 D | DH : 34.6W×150H×127D<br>DW : 34.6W×150H×133D | 34.6 W × 150 H × 117 D | AH : 34.6W×150H×127D<br>AW : 34.6W×150H×133D |
| Weight (g) | | 130 | DH : 170<br>DW : 180 | 160 | AH :230<br>AW : 240 |
| Circuit diagram | |  | |  | |
| External wiring | |  |  |  |  |

*1. Means consumption in each module. The total current consumption of each channel must not exceed the maximum output current of the power module. For output current capacity of the power module, refer to Chapter 5.2 Specification of Power Module.

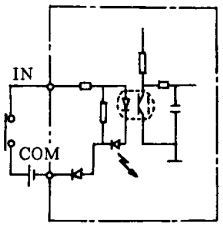
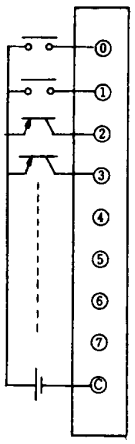
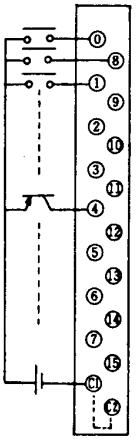
## (2) Specifications of Output Modules

| Item \ Type | | POM-R | POM-RH, RW | POM-S | POM-SH, SW | POM-T | POM-TH, TW |
|---|---|---|---|---|---|---|---|
| Output specification | | Relay output | | Triac output | | Transistor output | |
| Nominal voltage | | 110V/220V AC | | 110V/220V AC | | 24 V DC | |
| Output voltage | | 85 ~264 V AC, 21~27VDC | | 85 ~264 V AC | | 5 ~ 27 V DC | |
| Max load current | 1 circuit | 2 A | | 1 A | | 0.5 A | |
| | 8-circuit | 4 A | | 4 A | | 2.5 A *1 | |
| Min load current | | 10mA (5V DC) | | 50mA | | 10mA (24 V DC) | |
| Max leakage current | | —— | | 3mA (200V AC) | | 0.1mA (24 V DC) | |
| Max rush current | | 6A (100ms) | | 20A (20ms) | | 3A (20ms) | |
| Max output delay time | ON→ OFF | 10ms | | 11ms | | 1ms | |
| | OFF→ON | 10ms | | 11ms | | 1ms | |
| No. of output points | | 8 points | 16 points | 8 points | 16 points | 8 points | 16 points |
| Common output | | 8 points/common | | 8 points/common | | 8 points/common | |
| Polarity | | —— | | —— | | Common terminal (-) | |
| Insulation method | | Relay | | Photocoupler | | Photocoupler | |
| Current consumption (Average) *1 | CH1 | 0.2mA + (No.of output ON points)× 0.2mA | | 0.3mA + (No.of output ON points)× 0.2mA | | 0.2mA + (No.of output ON points)× 0.2mA | |
| | CH2 | (No.of output ON points) × 10mA | | (No.of output ON points) × 9mA | | (No.of output ON points) × 8 mA | |
| | CH3 | 0 mA | | 0 mA | | 0 mA | |
| Dimensions (mm) | | 34.6 W×150 H ×117 D | RH:34.6W×150H ×127D RW:34.6W×150H ×133D | 34.6 W×150 H ×117 D | SH:34.6W×150H ×127D SW:34.6W×150H ×133D | 34.6 W ×150 H ×117 D | TH:34.6W×150H ×127D TW:34.6W×150H ×133D |
| Weight (g) | | 160 | RH : 230 RW : 240 | 170 | SH : 250 SW : 260 | 150 | TH :220 TW : 230 |
| Circuit diagram | |   | |   | |   | |
| External wiring | |  Power supply |  Power supply |  AC Power supply |  AC Power supply |  DC Power supply |  DC Power supply |

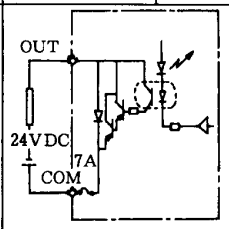
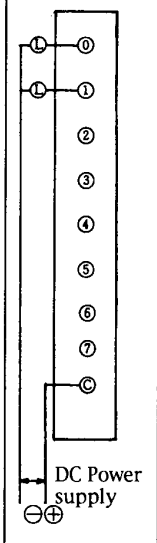
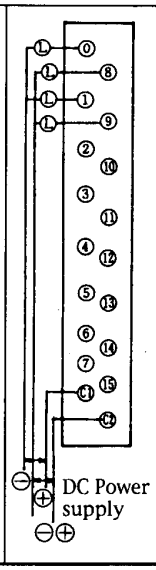
*1. As four-element transistor devices are used, maximum load current is limited in each of terminals No, 0 to 3, 4 to 7, 8 to 11, and 12 to 15. Transistor output must be 1.25 A/4circuits at maximum.

## (3) Specifications of Positive Logic (source type) I/O modules

### Positive logic input module (source type)

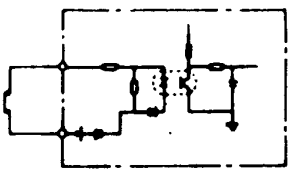
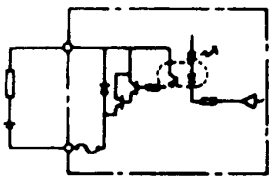
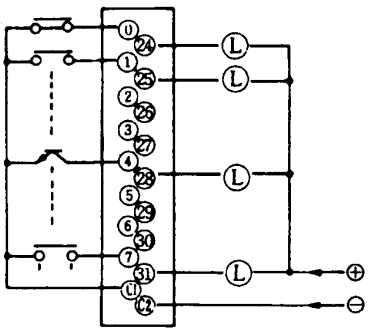
| Item \ Type | | PIM-DP | PIM-DPH, DPW |
|---|---|---|---|
| Input specification | | DC input | |
| Nominal voltage | | 24 V DC | |
| Input voltage | | 21.6 ~ 26 V DC | |
| Input current | | 9mA approx./24V AC (impedance 2.7k Ω approx.) | |
| Operating voltage | ON | 19V or more (resistance 300 Ω or less) | |
| | OFF | 7V or less (resistance 200kΩ or more) | |
| Max input delay time | ON→ OFF | 4 msec | |
| | OFF→ ON | 4 msec | |
| No. of input points | | 8 points | 16 points |
| Common input | | 8 points/Common | |
| Polarity | | Common terminal (-) | |
| Insulation method | | Photocoupler | |
| Current consumption (Average) *1 | CH1 | 0.5mA + (No.of input ON points)×0.5mA | |
| | CH2 | 0 mA | |
| | CH3 | 0 mA | |
| Dimensions (mm) | | 34.6 W × 150 H × 117 D | DPH:34.6W × 150H × 127D DPW:34.6W × 150H × 133D |
| Weight (g) | | 130 | DPH : 170 DPW : 180 |
| Circuit diagram | |   | |
| External wiring | |  |  • C1 and C2 are internally connected |

### Positive logic output module (source type)

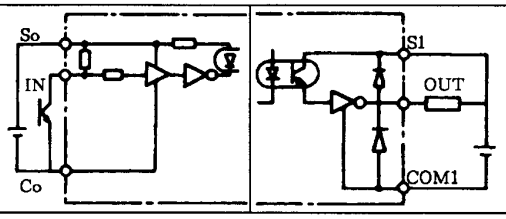
| Item \ Type | | POM-TP | POM-TPH, TPW |
|---|---|---|---|
| Output specification | | Transistor output | |
| Rated voltage | | 24V DC | |
| Output voltage | | 3 ~26 V DC | |
| Max load current | 1 circuit | 0.5 A | |
| | 4 circuit | 1.25 A | |
| | 8 circuit | —— | |
| Min load current | | 10mA (24V DC) | |
| Max leakage current | | 0.1mA (24V DC) | |
| Max rush current | | 3A (20ms) | |
| Max output delay time | ON→OFF | 1ms | |
| | OFF→ON | 1ms | |
| No. of output points | | 8 points | 16 points |
| Common output | | 8 points/common | |
| Polarity | | Common terminal (+) | |
| Insulation method | | Photocoupler | |
| Current consumption (Average) | CH1 | 0.2mA + (No.of output ON points)×0.2mA | |
| | CH2 | (No.of output ON points) × 8 mA | |
| | CH3 | 0 mA | |
| Dimensions (mm) | | 34.6 W × 150 H × 117 D | TPH:34.6W × 150H × 127D TPW:34.6W × 150H × 133D |
| Weight (g) | | 150 | TPH : 230 TPW : 240 |
| Circuit diagram | |   | |
| External wiring | |   |   |

### (4) Specifications of hybrid modules

#### I/O mixed module

| Item \ Type | | PHH-DT | |
|---|---|---|---|
| I/O specification | | DC input | Transistor output |
| Nominal voltage | | 24 V DC | 24 V DC |
| Input voltage | | 21.6 ~ 26 V DC | 5 ~ 27 V DC |
| Input current | | 9mA | — |
| Operating specification | ON | ON resistance 300 Ω or less | — |
| | OFF | OFF resistance 200 k Ω or more | — |
| Maximum load current | 1 circuit | — | 0.5A |
| | 4 circuit | — | 1.25A |
| | 8 circuit | — | 2.5A |
| Maximum leakage current | | — | 0.1mA (24V DC) |
| Maximum rush current | | — | 3A (20ms) |
| Max delay time | ON→ OFF | 4 msec | 1 msec |
| | OFF→ ON | 4 msec | 1 msec |
| No. of I/O points | | 8 points (0 ~ 7) | 8 points (24 ~ 31) |
| Common | | 8 points/Common | 8 points/Common |
| Polarity | | Common terminal (-) | Common terminal (-) |
| Insulation method | | Photocoupler | Photocoupler |
| Current consumption (Average) | CH1 | 10mA + (No.of input ON points) × 9mA + (No.of output ON points) × 8mA | |
| | CH2 | 0 mA | 0 mA |
| | CH3 | (No.of input ON points) × 9mA | 0 mA |
| Dimensions (mm) | | 34.6 W × 150 H × 127 D | |
| Weight (g) | | 200 | |
| Circuit diagram | |  |  |
| External wiring | |  | |

**TTL mixed I/O module**

| Item \ Type | | PHM-TT | |
|---|---|---|---|
| I/O specification | | TTL input | TTL input (open collector) |
| I/O voltage | | 4 ~ 27 V DC | 4 ~ 27 V DC |
| Input current | | 6mA (5V DC) | —— |
| Input voltage | ON | 1.5V or less (5V DC) | |
| | OFF | 3.5V or more (5V DC) | —— |
| Maximum load current | | —— | 20mA/point |
| Maximum leakage current | | —— | 50 μA |
| Maximum delay time | ON → OFF | 1 ms | 1 ms |
| | OFF → ON | 1 ms | 1 ms |
| No. of I/O points | | 16 points/module | 16 points/module |
| Common | | 16 points/Common | 8 points/Common |
| Polarity | | Common terminal (-) | Common terminal (-) |
| Insulation method | | Photocoupler | Photocoupler |
| I/O indication | | None | None |
| Current consumption (Average) | CH1 | (No.of output ONpoints) × 5mA + 30mA | |
| | CH2 | 0 mA | |
| | CH3 | 0 mA | |
| Dimensions (mm) | | 34.6 W × 150 H × 99 D (excluding the connector) | |
| Weight (g) | | 120 | |
| Circuit diagram | |  | |
| External wiring | | 40-pin flat cable connector pin arrangement | |

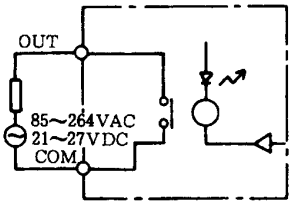
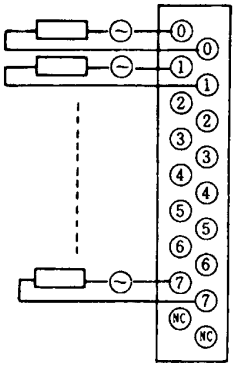
| Pin No. | Signal | Pin No. | Signal | Pin No. | Signal | Pin No. | Signal |
|---|---|---|---|---|---|---|---|
| 1 | COM0 | 21 | NC | 2 | COM1 | 22 | COM2 |
| 3 | S0 | 23 | NC | 4 | S1 | 24 | S2 |
| 5 | IN0 | 25 | IN8 | 6 | OUT16 | 26 | OUT24 |
| 7 | 1 | 27 | 9 | 8 | 17 | 28 | 25 |
| 9 | 2 | 29 | 10 | 10 | 18 | 30 | 26 |
| 11 | 3 | 31 | 11 | 12 | 19 | 32 | 27 |
| 13 | 4 | 33 | 12 | 14 | 20 | 34 | 28 |
| 15 | 5 | 35 | 13 | 16 | 21 | 36 | 29 |
| 17 | 6 | 37 | 14 | 18 | 22 | 38 | 30 |
| 19 | 7 | 39 | 15 | 20 | 23 | 40 | 31 |

External wiring connector

| Connection | Flat cable connection | Single wires connection | |
|---|---|---|---|
| Socket | HIF3BA-40DA-254R(Attached) | HIF3C-40D-254C | |
| Manufacturer | HIROSE DENKI Co. | | |
| Cable | Flat cable 40P, AWG 28, P = 1.27mm | Socket pin | Cable |
| | | HIF3-2226SC | AWG22 ~ 26 |
| | | HIF3-2428SC | AWG24 ~ 28 |

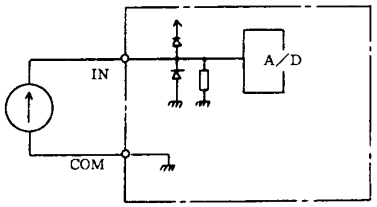
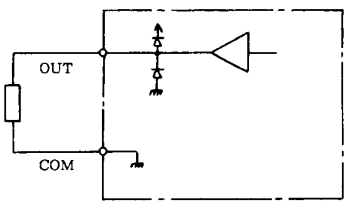
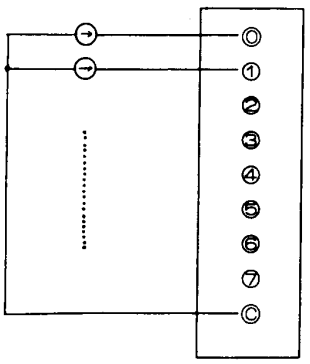
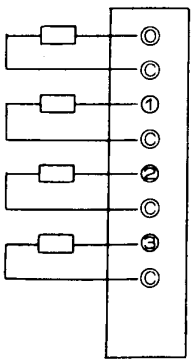
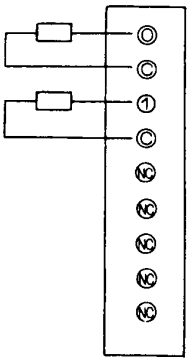
## (5) Specifications of Independent Contact Relay Output Module

**Independent contact relay output module**

| Item \ Type | | POM-RC |
|---|---|---|
| Output specification | | Relay output |
| Nominal voltage | | 110V/220V AC |
| Onput voltage | | 85 to 264 AC, 21 to 27 V DC |
| Maximum load current | 1 circuit | 2 A |
| Minimum load current | | 10mA (5V DC) |
| Maximum rush current | | 6A (100ms) |
| Max output delay time | ON → OFF | 4 ms |
| | OFF → ON | 5 ms |
| No. output points | | 8 points |
| Common | | 1 point/Common |
| Insulation method | | Relay |
| Current consumption (Average) | CH1 | 0.2mA + (No.of output ON points) x 0.2mA |
| | CH2 | (No.of output ON points) x 10mA |
| | CH3 | 0 mA |
| Dimensions (mm) | | 34.6 W x 150 H x 127 D |
| Weight (g) | | 200 |
| Circuit diagram | |   |
| External wiring | |   |

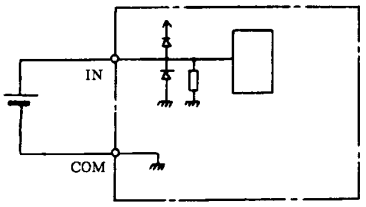
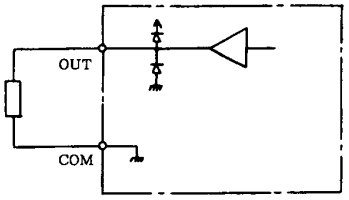
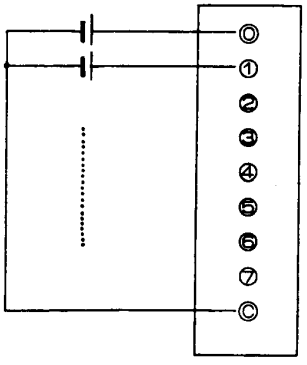
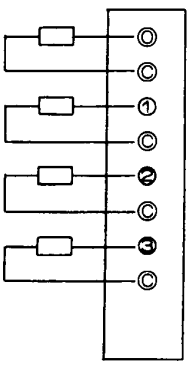
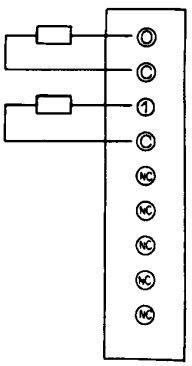
## (6) Specifications of Analog Current Modules

### Analog Current Modules

| Item \ Type | | AGH-I | AGH-O | AGH-OD |
|---|---|---|---|---|
| I/O specification | | Analog current input | Analog current output | |
| Range of current | | 4 to 20mA | 4 to 20mA | |
| Input impedance | | 220 Ω | — | |
| Load impedance | | — | 0 to 500 Ω | |
| Resolution | | 8 bits | 8 bits | |
| Conversion time | | 1ms | 1ms | |
| Overall accuracy | | ±(1% + 1 bit) | ±1 % | |
| No. of points | | 8 points | 4 points | 2 points |
| Insulation method | | Photocoupler (not insulated from DC inputs) | Photocoupler (not insulated from DC inputs) | |
| Insulation between inputs | | Not insulated | Not insulated | |
| Current consumption (Average) | CH1 | 25mA | 50 mA | 50 mA |
| | CH2 | 0 mA | 0 mA | 0 mA |
| | CH3 | 60mA | 250 mA | 140 mA |
| Dimensions (mm) | | 34.6 W × 150 H × 117 D | 34.6 W × 150 H × 117 D | 34.6 W × 150 H × 117 D |
| Weight (g) | | 150 | 240 | 190 |
| Circuit diagram | |   |   | |
| External wiring | |   |   |   |

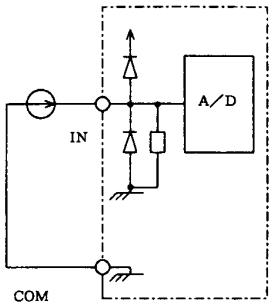
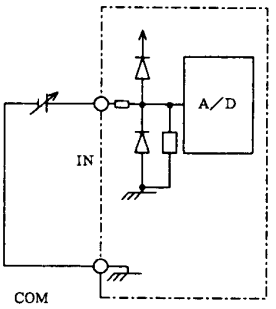
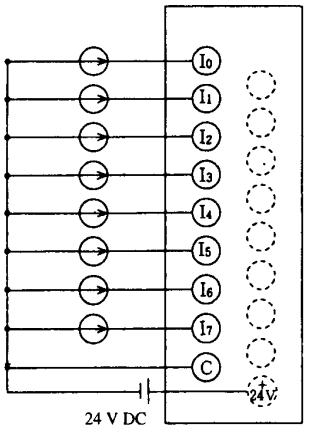
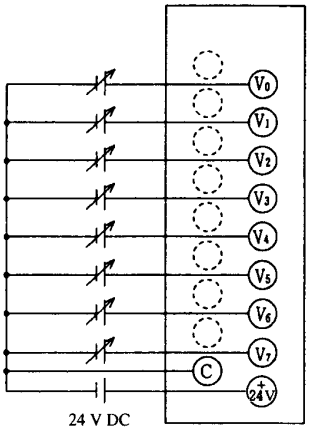
## (7) Specifications of Analog Voltage Modules

### Analog Voltage Modules

| Item \ Type | | AGH-IV | AGH-OV | AGH-ODV |
|---|---|---|---|---|
| I/O specification | | Analog voltage input | Analog voltage output | |
| Range of voltage | | 0 to 10 V DC | 0 to 10 V DC | |
| Input impedance | | 100k Ω | — | |
| Load impedance | | — | 10k Ω or more | |
| Resolution | | 8 bits | 8 bits | |
| Conversion time | | 1ms | 1ms | |
| Overall accuracy | | ±(1% + 1 bit) | ±1 % | |
| No. of points | | 8 points | 4 points | 2 points |
| Insulation method | | Photocoupler (Not insulated from DC inputs) | Photocoupler (Not insulated from DC inputs) | |
| Insulation between inputs | | Not insulated | Not insulated | |
| Current consumption (Average) | CH1 | 25mA | 50 mA | 30 mA |
| | CH2 | 0 mA | 0 mA | 0 mA |
| | CH3 | 60mA | 140 mA | 70 mA |
| Dimensions (mm) | | 34.6 W × 150 H × 117 D | 34.6 W × 150 H × 117 D | 34.6 W × 150 H × 117 D |
| Weight (g) | | 150 | 240 | 190 |
| Circuit diagram | |   |   | |
| External wiring | |   |   |   |

## (8) Specifications of 12-Bit Analog Module

### 12-Bit analog input

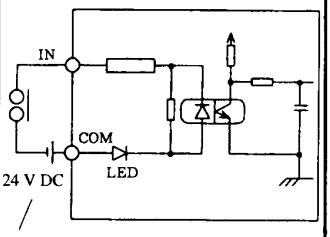
| Item \ Type | | AGH-IV2 | |
|---|---|---|---|
| I/O specification | | Analog currente input | Analog voltage input |
| Range of current | | 4 to 20mA | 0 to 10V |
| Input impedance | | 100 Ω approx.. | 100 k Ω approx.. |
| Resolution | | 12 bits | |
| Conversion time | | 5ms | |
| Overall accuracy | | ± 0.5 % (to the full scale value) | |
| No. of points | | 8 points | |
| Insulation | Between channel and internal circuit | Photocoupler | |
| | Between channels | Not insulated | |
| Current consumption (Average) | CH1 | 80mA | |
| | CH2 | 0 mA | |
| | CH3 | 0mA | |
| External wiring | | Two-core sealed cable (Max. 20 m) | |
| Dimensions (mm) | | 34.6 W × 150 H × 127 D | |
| Weight (g) | | 240 | |
| Circuit diagram | |  |  |
| External wiring | |  |  |

*1. Current input terminals ($I_0$ ~ $I_7$) and voltage input terminals ($V_0$ ~ $V_7$) are provided. They can also be used both for current input and voltage input, whereas they cannot be used for mixed current inputs and voltage inputs.

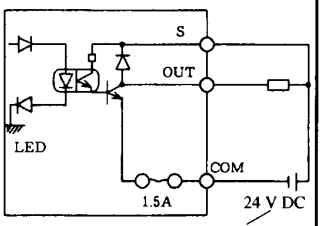
*2. Unused terminals must be short circuited with the common C.

### (9) Specifications of 32-Point I/O Module

**32-Point input module**

| Item \ Type | | PIH-DM |
|---|---|---|
| Input specification | | DC input |
| Nominal voltage | | 24 V DC |
| Input voltage | | 21.6 to 26 V DC |
| Current | | 5mA DC (At 24V DC) |
| Operating Specifi-cation | ON | 19V or more |
| | OFF | 7V or less |
| Max input delay time | ON ↓ OFF | 4 ms or less |
| | OFF ↓ ON | 4 ms or less |
| No. of input points | | 32 points/module |
| Common input | | 8 points/Common (note) |
| Polarity | | Common terminal (+) |
| Insulation method | | Photocoupler |
| Current consump-tion (Average) | CH1 | 20 mA |
| | CH2 | 0 mA |
| | CH3 | 0 mA |
| Dimensions (mm) | | 34.6 W × 150 H × 99 D (excluding the connector) |
| Weight (g) | | 155 |
| Circuit diagram | |   External power source |

**32-Point output module**

| Item \ Type | | POH-TM |
|---|---|---|
| Output specification | | Transistor output |
| Nominal voltage | | 24V DC |
| Permissible voltage | | 5 to 27 V DC |
| Max load current | 1 circuit | 100 m A |
| | 8 circuit | 0.8 A |
| Min load current | | 1 mA or more |
| Max. rush current | | 1 A (10ms or less) |
| Max. output saturation current | | 1 V or less |
| Max. leakage current | | 50 μA or less |
| Max output delay time | ON ↓ OFF | 1ms |
| | OFF ↓ ON | 1ms |
| No. of output points | | 32 points/module |
| Common output | | 8 points/common |
| Polarity | | Common terminal (-) |
| Insulation method | | Photocoupler |
| Current consump-tion (Average) | CH1 | 70 mA |
| | CH2 | 0 mA |
| | CH3 | 0 mA |
| Dimensions (mm) | | 34.6 W × 150 H × 99 D (excluding the connector) |
| Weight (g) | | 150 |
| Circuit diagram | |   External power source |

(Note) The common terminal of the 32-point module is connected internally in the module.

## Specification for 32-point I/O Module
## External wiring for 32-point module

### PIH-DM

32-POINT INPUT MODULE

| Hitachi Pin No. | Hirose Pin No. | Signal name | | Hitachi Pin No. | Hirose Pin No. | Signal name | |
|---|---|---|---|---|---|---|---|
| 26 | 50 | C2 | CH1 (WX1) | 1 | 25 | C0 | CH0 (WX0) |
| 27 | 49 | N.C. | | 2 | 24 | N.C. | |
| 28 | 48 | X10 | | 3 | 23 | X0 | |
| 29 | 47 | X11 | | 4 | 22 | X1 | |
| 30 | 46 | X12 | | 5 | 21 | X2 | |
| 31 | 45 | X13 | | 6 | 20 | X3 | |
| 32 | 44 | X14 | | 7 | 19 | X4 | |
| 33 | 43 | X15 | | 8 | 18 | X5 | |
| 34 | 42 | X16 | | 9 | 17 | X6 | |
| 35 | 41 | X17 | | 10 | 16 | X7 | |
| 36 | 40 | N.C. | | 11 | 15 | N.C. | |
| 37 | 39 | C3 | | 12 | 14 | C1 | |
| 38 | 38 | N.C. | | 13 | 13 | N.C. | |
| 39 | 37 | X18 | | 14 | 12 | X8 | |
| 40 | 36 | X19 | | 15 | 11 | X9 | |
| 41 | 35 | X1A | | 16 | 10 | XA | |
| 42 | 34 | X1B | | 17 | 9 | XB | |
| 43 | 33 | X1C | | 18 | 8 | XC | |
| 44 | 32 | X1D | | 19 | 7 | XD | |
| 45 | 31 | X1E | | 20 | 6 | XE | |
| 46 | 30 | X1F | | 21 | 5 | XF | |
| 47 | 29 | N.C. | | 22 | 4 | N.C. | |
| 48 | 28 | N.C. | | 23 | 3 | N.C. | |
| 49 | 27 | N.C. | | 24 | 2 | N.C. | |
| 50 | 26 | N.C. | | 25 | 1 | N.C. | |

Common C0, C1, C2, C3 are connected internally

N.C.: No Connection (Not in use)

### POH-TM

32-POINT OUTPUT MODULE

| Hitachi Pin No. | Hirose Pin No. | Signal name | | Hitachi Pin No. | Hirose Pin No. | Signal name | |
|---|---|---|---|---|---|---|---|
| 26 | 50 | C2 | CH1 (WY1) | 1 | 25 | C0 | CH0 (WY0) |
| 27 | 49 | S2 | | 2 | 24 | S0 | |
| 28 | 48 | Y10 | | 3 | 23 | Y0 | |
| 29 | 47 | Y11 | | 4 | 22 | Y1 | |
| 30 | 46 | Y12 | | 5 | 21 | Y2 | |
| 31 | 45 | Y13 | | 6 | 20 | Y3 | |
| 32 | 44 | Y14 | | 7 | 19 | Y4 | |
| 33 | 43 | Y15 | | 8 | 18 | Y5 | |
| 34 | 42 | Y16 | | 9 | 17 | Y6 | |
| 35 | 41 | Y17 | | 10 | 16 | Y7 | |
| 36 | 40 | N.C. | | 11 | 15 | N.C. | |
| 37 | 39 | C3 | | 12 | 14 | C1 | |
| 38 | 38 | S3 | | 13 | 13 | S1 | |
| 39 | 37 | Y18 | | 14 | 12 | Y8 | |
| 40 | 36 | Y19 | | 15 | 11 | Y9 | |
| 41 | 35 | Y1A | | 16 | 10 | YA | |
| 42 | 34 | Y1B | | 17 | 9 | YB | |
| 43 | 33 | Y1C | | 18 | 8 | YC | |
| 44 | 32 | Y1D | | 19 | 7 | YD | |
| 45 | 31 | Y1E | | 20 | 6 | YE | |
| 46 | 30 | Y1F | | 21 | 5 | YF | |
| 47 | 29 | N.C. | | 22 | 4 | N.C. | |
| 48 | 28 | N.C. | | 23 | 3 | N.C. | |
| 49 | 27 | N.C. | | 24 | 2 | N.C. | |
| 50 | 26 | N.C. | | 25 | 1 | N.C. | |

Common C0, C1, C2, C3 are connected independently.
Each common is provided with a fuse (1.5A).

### External wiring

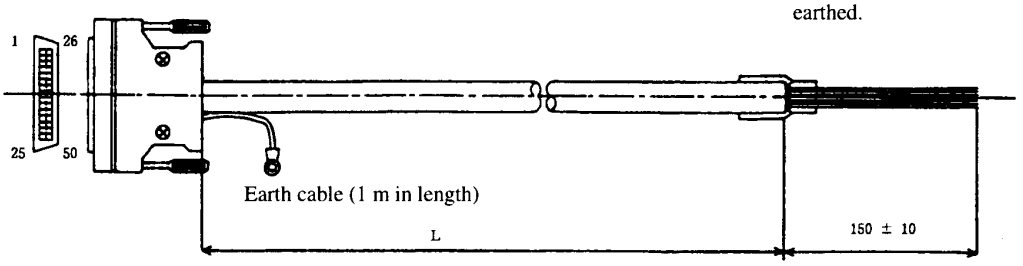
### Connector for external wiring

| Item | Product No. | Wiring method | Suitable cable |
|---|---|---|---|
| Plug connector | DX30-50P | Solderless single wire | AWG#30 |
| | DX30A-50P | " | AWG#28 |
| | DX31-50P | Solderless combined wires | AWG#30 |
| | DX31A-50P | " | AWG#28 |
| | DX40-50P | Soldered | - |
| Diecast cover | DX-50-CV1 | - | - |
| Manufacturer | HIROSE DENKI Co. | | |

Cable for 32-point module

| Type | Specification |
|---|---|
| CBM-02 | L = 2m • with single connector end • AWG#28 |
| CBM-05 | L = 5m • with single connector end • AWG#28 |
| CBM-10 | L = 10m • with single connector end • AWG#28 |

Caution : The earth cable of the connector should be earthed.



# Chapter 8 Communication module

## 8.1 Outline

The communication module is used to transmit control data between PCs.

To construct various systems such as an upper layer link system, a CPU link system, a remote I/O system, use the communication module (LINK-02H, TLINK-02H, RIOM, RIOM-TM, etc.) that is suitable for the system type. The link (IOLH-TA) is also prepared for S10 $\alpha$ to connect with the port 2 of S10 $\alpha$ CPU.

As described above, various systems are prepared to support communication function of the communication modules for H-250/252 PC.

## 8.2 List of the Communication modules

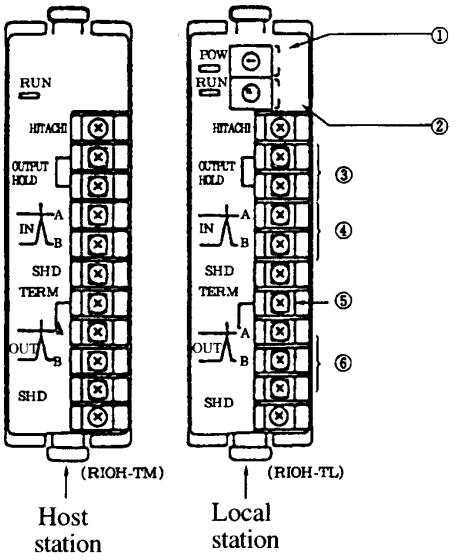
| Product name | | Type | Specification | I/O assignment | Remarks |
|---|---|---|---|---|---|
| Communication module | CPU link | LINK-02H | CPU link (coaxial cable) 1024 words | Link | Usable only for H-252 and on the sophistacated function base |
| | | BYP-02H | Bypass relay for LINK-02H | DUM16 | |
| | | TLINK-02H | CPU link (twist pair cable) 1024 words | Link | |
| | | IOLH-T | CPU link (twist pair cable) 8 words | Link | |
| | Remote I/O MINI link | REM-LH2 | Connected with (twist pair cable) the remote mini-host (REM-MMH) of H-302/702/2002 | Link | |
| | Link for S10α | IOLH-TA | Connected with (wist pair cable) the port 2 of S10 α CPU | Link | |
| | Coaxial remote I/O link | RIOM | Connected with (coaxial cable) the remote mini-host (REM-MAH) of H-302/702/2002 | B1/1 | Not usable for the sophisticated function base |
| | Remote I/O | RIOH-TM | Remote host station (twist pair cable) | Remote | |
| | | RIOH-TL | Remote local station (twist pair cable) | No setting required | Not usable for the sophisticated function base |
| | | RIOH-DT | Remote local station (twist pair cable), integral with I/O, with the power unit | B1/1 | |

For details of each communication module, refer to the manual for each module.

## 8.3 Construction and Specification of the Communication Modules

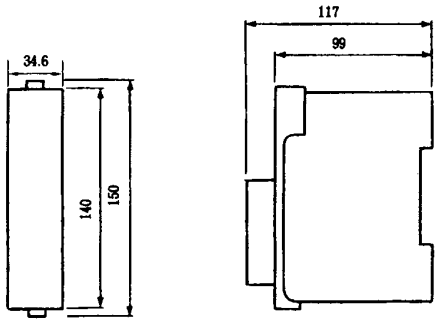
### (1) Remte I/O link module

Name and function of each part




| Type | RIOH-TM | RIOH-TL |
|---|---|---|
| Weight | 200g approx. | 200g approx. |

Dimensions (mm)




* ① and ② are not furnished for the host station.

| No. | Name | Function |
|---|---|---|
| ① | Station No. setting switch | To set a channel identification number where thetop I/O module of the subject local station corresponds to in the host remote area. |
| ② | Slot No. setting switch | To set number of I/O modules to be used in the subject local station |
| ③ | Output holding terminal | **Host station (RIOH-TM)**<br>When the remote system is in abnormal status, data transmission will be controlled from the remote module host to CPU module.<br>• OUT HOLD terminal short circuit.....The remote data will be held at the value prior to the abnormal status occurred.<br>• OUT HOLD terminal opened.....All remote data will be OFF (all "0").<br><br>**Local station (RIOH-TL)**<br>When the remote system is in abnormal status, output data will be controlled in the output module of the local module.<br>• OUT HOLD terminal short circuit.....The output data will be held at the value prior to the abnormal status occurred.<br>• OUT HOLD terminal opened.....All output data will be OFF. |
| ④ | Receiving terminal | Wiring terminals for receiving |
| ⑤ | Final terminal | Only for the top module and the end module, to be short-circuited to the sending terminal A |
| ⑥ | Sending terminal | Wiring terminals for sending |

| Item | | | Host station (RIOH-TM) | Local station (RIOH-TL) |
|---|---|---|---|---|
| General specification | Ambient temperature | | 0 ~ 50°C | |
| | Storage temperature | | -20 ~ 70°C | |
| | Ambient humidity | | 30 ~ 90% RH (no dew condensation) | |
| | Consumption current | CH1 (5V) | 130mA | 150mA |
| | | CH2 (24V) | 20mA | 20mA |
| | | CH3 (24V) | 5mA | 5mA |
| | Dimensions (mm) | | 34.6 (W) × 150 (H) × 117 (D) | |
| | Weight (g) | | 200 | |
| Functional specification | No. of connection | | (8 local stations/Host) × 4 systems | |
| | No. of remote points | | 128 poins × 4 systems | |
| | Communication speed | | 768 kbps | |
| | Refresh time | | 5ms approx. | |
| | Error check | | Inverted dual transmission | |

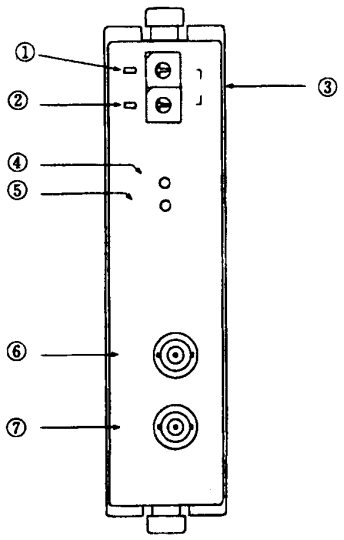
| Communiction route | Recommended cable | | | Cable length | | Terminator resistor |
|---|---|---|---|---|---|---|
| | Type | Manufacturer | External diameter | Between stations | Total length | |
| | CO-SPEV-SB(A)-1P-0.3mm$^2$ | Hitachi Densen | ϕ 5.5 approx. | 150m Max. | 150m Max. | Built in the module (100Ω) |
| | CO-EV-SX-1P-0.75mm$^2$ | | ϕ 16 approx. | 300m Max. | 300m Max. | To be connected externally(150Ω) |

For wiring method, program example, trouble shooting, etc., refer to the manual for each module.

### (2) CPU link module

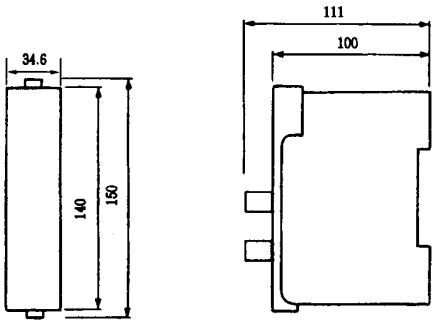
(a) Coaxial CPU link module (usable only for H-252)

Name and function of each part




| Type | LINK-02H |
|---|---|
| Weight | 240g approx. |

Dimensions (mm)



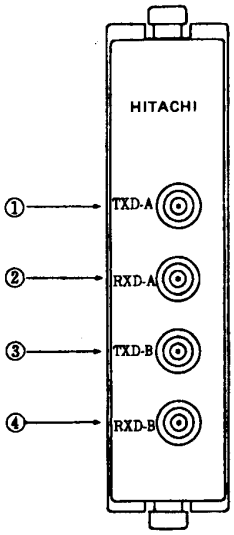

• This module must be used as a pair with BYP-02H.

| No. | Name | Function |
|---|---|---|
| ① | RUN LED | To indicate the status of participation to link systems (Illuminated during the link operation) |
| ② | ERR LED | To indicate a link operation error. Normal : Extinguished Abnormal : Illuminated or Flickering |
| ③ | Station No. code switch (in 2 digits) | To determine the station No. Setting range : 00 ~ 63 (Setting at 64 or more will cause the error "Station No. out of the range") |
| ④ | Error display clearing switch | To clear display content of ERR LED. Note the error that remains unrecovered will be indicated again. |
| ⑤ | Reset switch | To effect the hard reset on the module. |
| ⑥ | Coaxial connector (RXD) for receiving | To be connected with TXD of the previous station or TXD-B of the bypass module. |
| ⑦ | Coaxial connector (TXD) for sending | To be connected with RXD of the next station or RXD-B of the bypass module. |

* Please use PSM-B when you use LINKJ-02H because the power supply capacity of CH1(5V) is insufficient by the power supply modules other than PSM-B when you use LINK-02H.

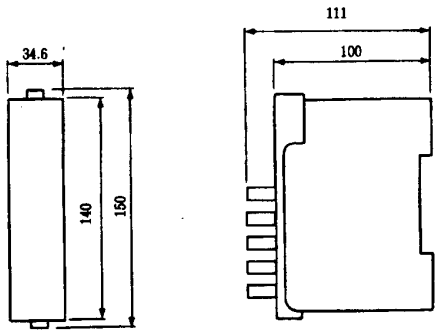
(b) Module for the bypass relay(For LINK-02H)

Name and function of each part




| Type | BYP-02H |
|---|---|
| Weight | 120g approx. |

Dimensions (mm)




- This module is the bypass module to be used as forming a pair with LINK-02H.

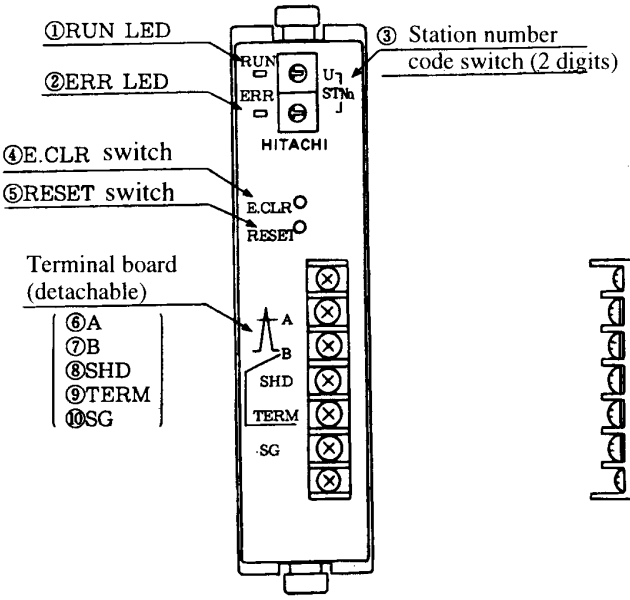
| No. | Name | Function |
|---|---|---|
| ① | Coaxial connector for sending (A) | To be connected with the next station's RXD-A |
| ② | Coaxial connector for receiving (A) | To be connected with the previous station's TXD-A |
| ③ | Coaxial connector for sending (B) | To be connected with RXD of the same station's link module |
| ④ | Coaxial connector for receiving (B) | To be connected with TXD of the same station's link module |

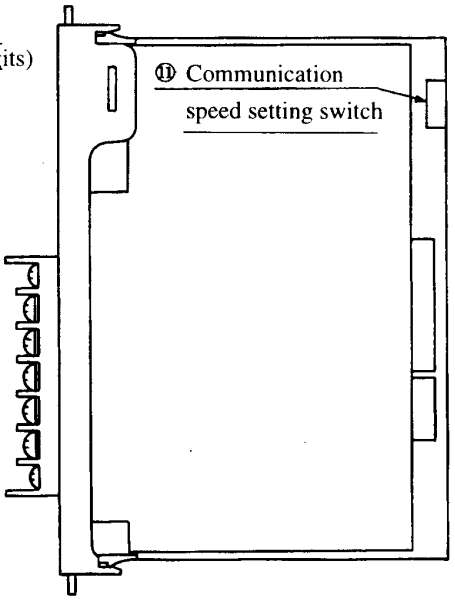
## Specifications for CPU Link Module (LINK-02H)

| Item | | | Specification |
|---|---|---|---|
| General specification | Operating temperature | | 0 ~ 55°C |
| | Storage temperature | | -10 ~ 75°C |
| | Operating humidity | | 20 ~ 90%RH, without dew condensation |
| | Storage humidity | | 20 ~ 90%RH, without dew condensation |
| | Operating environment | | No corrosive gases (ammonia, hydrogen sulfate, sulpha oxide, etc.), nor excessive dusts |
| | Vibration resistance | | 16.7Hz full amplitude 3mm X, Y, Z directions each in 2 hours |
| | Consumption current | | 5 VDC approx. 500mA |
| | Dimensions | | 34.6 (W) × 150 (H) × 111 (D) (mm) |
| | Weight | | 250 g. approx. |
| Functional specification | No. of connection of the link modules | | Max. 64 units/link system |
| | No. of mountings | | Max. 2 units/CPU (2 link systems/CPU) |
| | No. of link points | | 1024 words/link system (2048 words/2 link systems) (Memory storage disabled in power outage) |
| | Data transmission method | | Common data area method |
| | Send/Receive distinguishing in the data area assignment | | Parameters to be set through the peripherals |
| | Station No. identification | | 0 ~ 63 to be set by the rotary switch |
| | Communication speed | | 1 Mbps |
| | Communication method | | Half duplex serial transmission, frame synchronizing |
| | Communication type | | Token passing |
| | Modulation method | | Base band |
| | Refresh time | | 64 stations connected, 1024 words transmission.....390msec approx. (at 1 Mbps) (assumed, CPU scan time is 10ms) |
| | Error check | | CRC, over run check, time out, broken wire, parameter error (double numbering on a station, overlap in link area, etc.) |
| | Self diagnostic operation | | System ROM/RAM check, watch dog timer check, transmission loop back check |
| Transmission route specification | Transmission route type | | Loop type |
| | Cable length | Between stations | Max. 500m |
| | | Total length | Max. 1 km |
| | Abnormal station treatment | | Bypassing |
| | Recommended cable | | 5D2VTxE with shielding (Fujikura Densen Co.) |
| Type of CPU base applicable | CPU module | | CPU22-02HB |
| | Base (Basic base) | | BSH-3, BSH-5, BSH-7, BSH-10 |

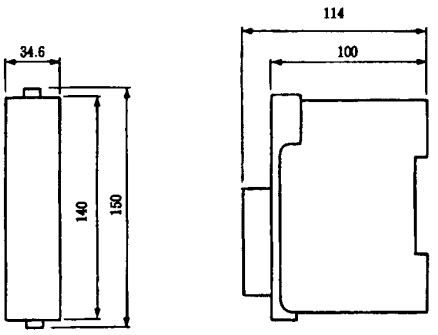
(c) Twist pair cable CPU link module

| Name and function of each part | Type | TLINK-02H |
|---|---|---|




| Weight | 230g approx. |
|---|---|
| Dimensions (mm) | |



| No. | Name | Function |
|---|---|---|
| ① | RUN LED | To indicate the participation to the link system. (Illuminated during link operation) |
| ② | ERR LED | To indicate a link operation error.<br>Normal : Extinguished Abnormal : Illuminated or Flickering |
| ③ | Station No. code switch (in 2 digits) | To determine the station No.<br>Setting range : 00 ~ 31 (Setting at 32 or more will cause the error "Station No. out of the range") *1 |
| ④ | Error display clearing switch | To clear display content of ERR LED. Note the error that remains unrecovered will be indicated again. |
| ⑤ | Reset switch | To effect the hard reset on the module. *2 |
| ⑥ | Communication data (+) connection terminal (A) | |
| ⑦ | Communication data (-) connection terminal (B) | |
| ⑧ | Cable shield connecting terminal (SHD) | |
| ⑨ | Terminator terminal (TERM) | Short circuit between B and TERM : Enable the internal terminator resister.<br>Open circuit between B and TERM : Disable the internal terminator resister. *3 |
| ⑩ | Base connecting terminal (SG) | |
| ⑪ | Communication speed setting switch | |

| No.1 | No.2 | Communication speed |
|---|---|---|
| OFF | OFF | 125 kbps |
| ON | OFF | 250 kbps |
| OFF | ON | 500 kbps |
| ON | ON | 1 Mbps |



*1) Identification No. 0 should be assigned on one Host station in every link system. Avoid double numbering on the stations in the same link system. If incorrect numbering is made, the link operation will not be performed correctly.

*2) While the CPU is under operation, never press RESET switch, because such unexpected operation may cause damages on the machine components in the system or injuries to operating personnel.

*3) In the terminal stations at both ends of the link transmission system, connect a terminator resistor across the terminals A and B (in case the terminator resistor is other than 100Ω), or short-circuit the terminals B and TERM to enable the internal terminator. (in case the terminator is 100Ω).

* Please use PSM-B when you use TLINK-02H because the power supply capacity of CH1(5V) is insufficient by the power supply modules other than PSM-B when you use TLINK-02H.

## Specifications of CPU link module (TLINK-02H)

| Item | | | Specification |
|---|---|---|---|
| General specification | Operating temperature | | 0 ~ 55°C |
| | Storage temperature | | -10 ~ 75°C |
| | Operating humidity | | 20 ~ 90%RH, without dew condensation |
| | Storage humidity | | 10 ~ 90%RH, without dew condensation |
| | Operating environment | | No corrosive gases (ammonia, hydrogen sulfate, sulpha oxide, etc.), nor excessive dusts |
| | Vibration resistance | | 16.7Hz full amplitude 3mm X, Y, Z directions each in 2 hours |
| | Consumption current | | 5 VDC approx. 300mA |
| | Dimensions | | 34.6 (W) × 150 (H) × 114 (D) (mm) |
| | Weight | | 250 g. approx. |
| Functional specification | No. of connection of the link modules | | Max. 32 units/link system |
| | No. of mountings | | Max. 2 units/CPU (2 link systems/CPU) |
| | No. of link points | | 1024 words/link system (2048 words/2 link systems) (Memory storage disabled in power outage) |
| | Data transmission method | | Common data area method |
| | Send/Receive distinguishing in the data area assignment | | Parameters to be set through the peripherals |
| | Station No. identification | | 0 ~ 31 to be set by the rotary switch |
| | Communication speed | | 125 k/250k/500k/1 Mbps |
| | Communication method | | Half duplex serial transmission, frame synchronizing |
| | Communication type | | Token passing |
| | Modulation method | | Base band |
| | Refresh time | | 32 stations connected, 1024 words transmission.....200msec approx. (at 1 Mbps) (assumed, each CPU scan time is 10ms) |
| | Error check | | CRC, over run check, time out, broken wire, parameter error (double numbering on a station, overlap in link area, etc.) |
| | Self diagnostic operation | | System ROM/RAM check, watch dog timer check, transmission loop back check |
| Transmission route specification | Transmission route type | | Multi-drop (bus) type |
| | Cable length | Between stations | Max. 1 km/800/400/240m |
| | | Total length | Max. 1 km/800/400/240m |
| | Abnormal station treatment | | Access to the bus |
| | Recommended cable | | CO-SPEV-SB(A)-1P-0.3mm$^2$ (Hitachi Densen Co.) |
| Type of CPU base applicable | CPU module | | CPU22-02HB |
| | Base (Basic base) | | BSH-3, BSH-5, BSH-7, BSH-10 |

Maximum permissible length of the cable differs depending upon the communication speed.

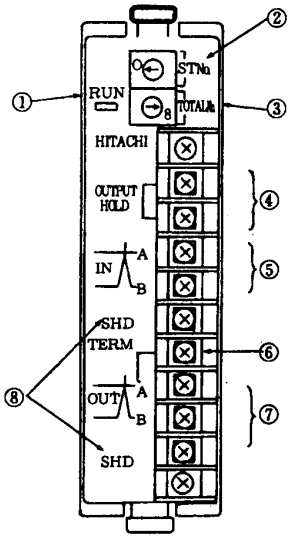
For wiring method, program example, trouble shooting, etc., refer to the manual for each module.

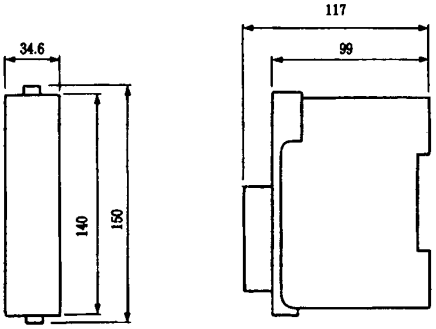
(d) Twist pair CPU link module

Name and function of each part

| Type | IOLH-T |
|---|---|
| Weight | 200g approx. |

Dimensions (mm)




| No. | Name | Function |
|---|---|---|
| ① | RUN LED | To indicate the participation to the link system. (Illuminated during link operation) |
| ② | Station No. setting switch | To give the serial identification No. on each link module starting from 0. (The modules are not necessarily be located in series order) |
| ③ | Total number setting switch | To set the number of modules used in the same link system. (This value must be set on the station No. 0. No setting is required on No.1 to 7.) |
| ④ | OUTPUT HOLD terminal | When the link system is in abnormal status, data transmission will be controlled from the link module to CPU module.<br>• OUTPUT HOLD terminal short circuit.....The link data will be held at the value prior to the abnormal status occurred.<br>• OUTPUT HOLD terminal opened.....All remote data will be OFF (all "0"). |
| ⑤ | Receiving terminal | Wiring terminal for the receiving side |
| ⑥ | Terminator terminal | To be connected to the sending terminal A only in both the top module and the end module. (only in case 0.3mm$^2$ cable is used). In case 0.75mm$^2$ cable is used, connect 150 Ω resistor across the sending terminals A and B. |
| ⑦ | Sending terminal | Wiring terminal for the sending side |
| ⑧ | Shield terminal | The terminal for the communication cable shield. |

| Item | | | Specification |
|---|---|---|---|
| General specification | Ambient temperature | | 0 ~ 55°C |
| | Storage temperature | | -20 ~ 70°C |
| | Ambient humidity | | 30 ~ 90% RH (no dew condensation) |
| | Consumption current | CH1 (5V) | 150mA |
| | | CH2 (24V) | 20mA |
| | | CH3 (24V) | 5mA |
| | Dimensions (mm) | | 34.6 (W) × 150 (H) × 117 (D) |
| | Weight (g) | | 200 |
| Functional specification | No. of connection | | (Max. 8 units / system) × 2 systems |
| | No. of remote points | | (128 poins / 8 words) × 2 areas |
| | Communication speed | | 768 kbps |
| | Refresh time | | 10ms × No. of station |
| | Error check | | Inverted dual transmission |

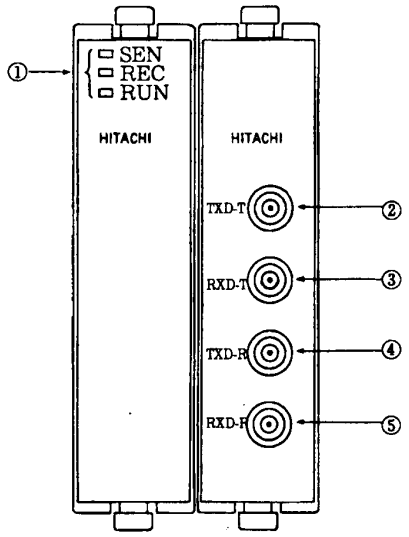
| Communiction route | Recommended cable | | | Cable length | | Terminator resistor |
|---|---|---|---|---|---|---|
| | Type | Manufacturer | External diameter | Between stations | Total length | |
| | CO-SPEV-SB(A)-1P-0.3mm$^2$ | Hitachi Densen | ϕ 5.5 approx. | 150m Max. | 150m Max. | Built in the module (100Ω) |
| | CO-EV-SX-1P-0.75mm$^2$ | | ϕ 16 approx. | 300m Max. | 300m Max. | To be connected externally(150Ω) |

For wiring method, program example, trouble shooting, etc., refer to the manual for each module.

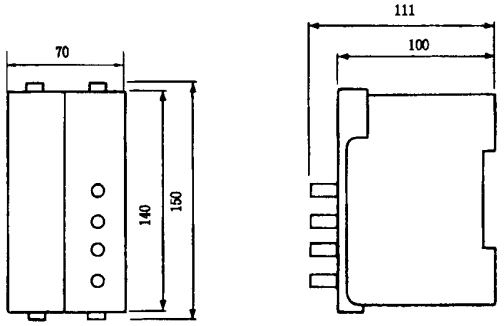
### (3) Link module for the upper layer machine

(a) Coaxial remote I/O link module

Name and function of each part




| Type | RIOM |
|---|---|
| Weight | 400g approx. |
| Dimensions (mm) | |




| No. | Name | Function |
|---|---|---|
| ① | Status indicator LED | SEN : Flickering when sending to the transmission line.<br>REC : Flickering when receiving to the transmission line.<br>RUN : Lighting during link operation. |
| ② | Sending connector (TXD-T) | To be connected with RXD-R of the next local station (The final local station must be connected with RXD-T). |
| ③ | Receiving connector (RXD-T) | To be connected with TXD-R of the next local station (The final local station must be connected with TXD-T). |
| ④ | Sending connector (TXD-R) | To be connected with RXD-T of the previous local station (or with RXD of the host station). |
| ⑤ | Receiving connector (RXD-R) | To be connected with TXD-T of the previous local station (or with TXD of the host station). |

Specifications of the coaxial remote I/O link module (RIOM)

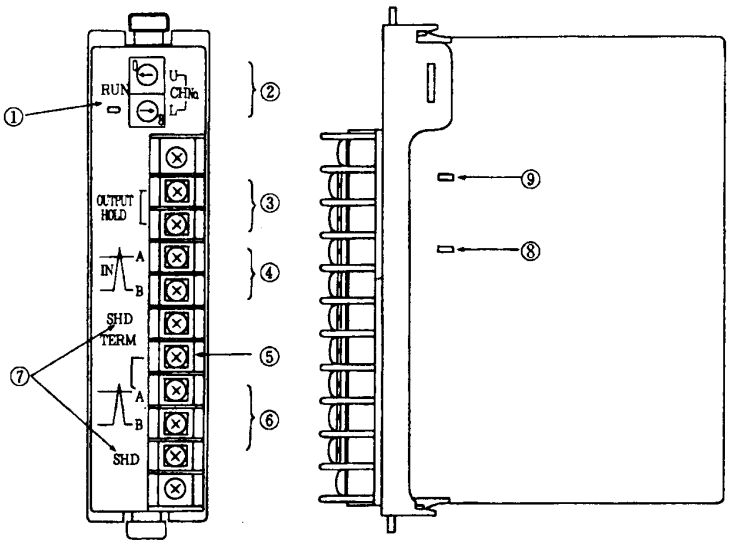
| Item | | Specification | |
|---|---|---|---|
| General specification | Ambient temperature | 0 ~ 55°C | |
| | Storage temperature | -10 ~ 75°C | |
| | Ambient humidity | 30 ~ 90% RH (no dew condensation) | |
| | Consumption current | CH1 (5V) | 500mA |
| | | CH2 (24V) | 30mA |
| | | CH3 (24V) | 0mA |
| | Dimensions (mm) | 70mm (W) × 150mm (H) × 111mm (D) | |
| | Weight | 400g approx. | |
| Functional specification | No. of connection | 8 RIOMs/Host station | |
| | No. of link points | Input: 32 points Output: 32 points/RIOM (fixed) | |
| | Communication speed | 1.5 Mbps | |
| | Transmission method | Half duplex serial transmission, frame synchronizing | |
| | Moduration method | Base band | |
| | Refresh time | Approx. max. 15ms/512 points (in the case of 8 local stations). | |
| | Error check | CRC, Sum check | |
| | Self diagnostic operation | System ROM/RAM check • Watch dog timer check, Transmission loop back check | |
| Communiction route | Cable length | Between stations | 500m |
| | | Total length | 500m |
| | Abnormal station treating | Baypassing | |
| | Cable and Connector to be used | Coaxial cable | 5D-2V or the equivalent (with shielding) |
| | | Connector at the cable end | Recommended, BNC-P-5DV (Hirase Denki Co.) or the equivalent |

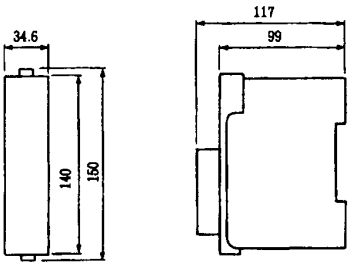
For wiring method, program example, trouble shooting, etc., refer to the manual for each module.

(b) Twist pair remote I/O mini link module

Name and function of each part

| Type | REM-LH2 |
|---|---|
| Weight | 200g Approx. |
| Dimensions (mm) | |




| No. | Name | Function |
|---|---|---|
| ① | RUN LED | Illuminated during the transmission |
| ② | Channel No. setting switch | To give the identification No. of the top channel occupied by the subject module. (8 channels starting from the top channel No. will be occupied.) |
| ③ | OUTPUT HOLD terminal | When the link system is in abnormal status, data transmission will be controlled from the link module to CPU module.<br>• OUTPUT HOLD terminal short circuit.....The link data will be held at the value prior to the abnormal status occurred.<br>• OUTPUT HOLD terminal opened.....All remote data will be OFF (all "0"). |
| ④ | Receiving terminal | Wiring terminal for the receiving side |
| ⑤ | Terminator terminal | In the case of the final module, to be short-circuited with the sending terminal A (only for the cable 0.3mm$^2$). In the case of the cable 0.75mm$^2$, connect a 150 Ω resistor across the sending terminal A and B. |
| ⑥ | Sending terminal | Wiring terminal for the sending side |
| ⑦ | Shield terminal | The terminal for the communication cable shield. |
| ⑧ | Operation mode changing connector (CON2) | To be changed over between the mode 2 or not in the host station (REM-MMH) *1 |
| ⑨ | Change over connector (CON3) | Change-over not required. *2 |

*1) For the method of the selection, refer to the manual for the module (REM-LH2).

*2) Though the change-over is not required, make sure of that referring to the manual for the module (REM-LH2).

Specifictions of the twist pair remote I/O link module(REM-LH2)

| | Item | | Specification | | | | |
|---|---|---|---|---|---|---|---|
| General specification | Ambient temperature | | 0 ~ 55°C | | | | |
| | Storage temperature | | -20 ~ 70°C | | | | |
| | Ambient humidity | | 30 ~ 90% RH (no dew condensation) | | | | |
| | Consumption current | CH1 (5V) | 150mA | | | | |
| | | CH2 (24V) | 20mA | | | | |
| | | CH3 (24V) | 0mA | | | | |
| | Dimensions (mm) | | 34.6 (W) × 150 (H) × 117 (D) | | | | |
| | Weight | | 200g | | | | |
| Functional specification | No. of connection | | (Max. 8 units / Host) × 2 link systems | | | | |
| | No. of remote points | | 8 words(128 poins ) × 2 link systems | | | | |
| | Communication speed | | 768 kbps | | | | |
| | Refresh time | | Will be changed depending upon the number of sub-local stations, 2 ~45ms approx. | | | | |
| | Error check | | Inverted dual transmission | | | | |
| Communiction route | Recommended cable | | | | Cable length | | Terminator resistor |
| | Type | | Manufacturer | External diameter | Between stations | Total length | |
| | CO-SPEV-SB(A)-1P-0.3mm² | | Hitachi Densen | ϕ 5.5 approx. | 150m Max. | 150m Max. | Built in the module (100Ω) |
| | CO-EV-SX-1P-0.75mm² | | | ϕ 16 approx. | 300m Max. | 300m Max. | To be connected externally(150Ω) |

For wiring method, program example, trouble shooting, etc., refer to the manual for each module.

# Chapter 9 Sophisticated Function Module

## 9.1 Outline

The sophisticated function modules are prepared in the following types.

**(1) Counter module**

This module picks up and counts high speed pulses that could not be processed by an ordinary type module and program. A conditional output can be obtained by inputting setting values through a sequence program. The counter module is prepared in the following type.

(a) 16 bits × 1 quantity counter module (Type : CTH)

**(2) Positioning module**

The highly accurate positioning control of a pulse motor or a servomotor will be made through a sequence program. The positioning module is prepared in the following type.

(a) The positioning module with two-axis pulse output (Type : POSH)

**(3) Serial I/O module (Type : SIH)**

Controls will be made through various external equipment to be connected with the non-procedural communication port (RS-232C).

## 9.2 List of the sophisticated function modules.

| Product name | Type | Specification | I/O assignment | Remarks |
|---|---|---|---|---|
| Counter module | CTH | 16-bit 1 quantity counter input 10kHz | FUN-3 | |
| Positioning module | POSH | two-axis pulse series output | 4/4W,DUM16 | |
| Positioning module | SIH | RS-232C, 1 port. Non-procedural. | 4/4W | |

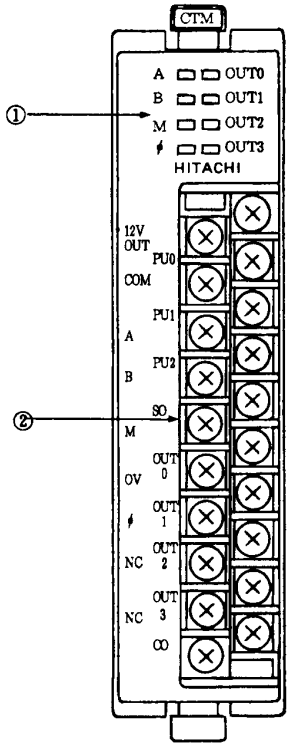
For details of each module, refer to the manual for the subject module.

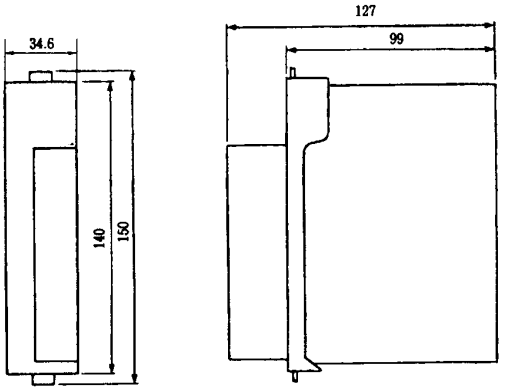
## 9.3 Construction and Specification of the Sophisticated Function Module

### (1) Counter module

(a) Construction of the counter module

| Name and function of each part | Type | CTH |
|---|---|---|
| | Weight | 200g approx. |
| | Dimensions (mm) | |




| No. | Name | Function |
|---|---|---|
| ① | Operation indicator LED | To indicate ON/OFF status of input signals. |
| ② | Terminal board | To input and output various signals such as pulse inputs or counter outputs. |

Counter module (CTH) does not operate correctly when the scan time of the program is 2.5mS or less when counter module (CTH) is used occasionally. Please input the program (dummy circuit etc.) so that the scan time may become 2.5mS or more. (However, being possible to monitor the scan time by special internal output WRF010 - WRF012 is min. 10mS. Please confirm the scan time of the program by calculating scan time of 2.2(8) of software edition.)

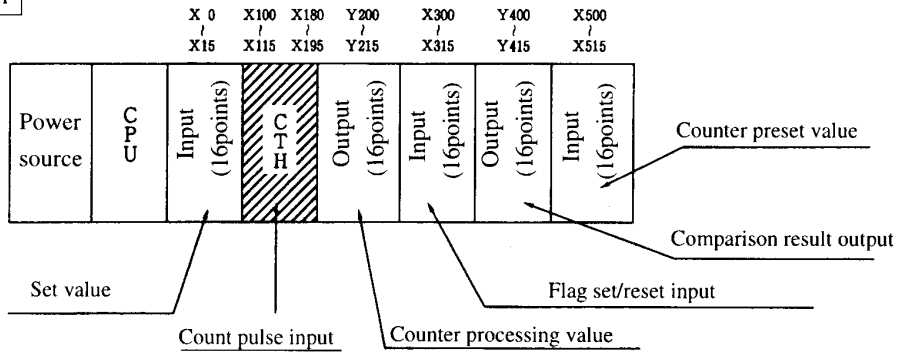
## (b) Specifications of Counter Module

| | Item \ Type | | CTH |
|---|---|---|---|
| Input specifications | Pulse count frequency | | 10kHz maximum |
| | Input pulse voltage | ON | 0 ~ 2 V |
| | | OFF | 5 ~ 12 V |
| | Counting pulse width | | 20 μs minimum |
| | Marker pulse width | | 20 μs minimum |
| | Input impedance | | 10k Ω approx. |
| | Insulation method | | Photocoupler |
| | No. of pulse input points | | 3 points (A, B, M) |
| | Polarity | | Common.... (-) |
| | Two-phase input pulse | Count up (in Addition) | A ON / B OFF — 90 ° — "B" is lagging by 90 ° to "A" |
| | | Count down (in Subtraction) | A / B — 90 ° — "A" is lagging by 90 ° to "B" |
| | Power for external input devices | | 12 V DC + 10%, 50mA (can be supplied to externals) |
| Output specifications | Output voltage | | 10 ~ 27 V DC |
| | Load voltage | | 0.5 A maximum/circuit, 1.25 A maximum/4 circuits |
| | Output system | | Transistor (open collector) |
| | Minimum load current | | 1 mA |
| | Output delay time | ON → OFF | 1 ms maximum |
| | | OFF → ON | 1 ms maximum |
| | Voltage drop at ON | | 1.5 V maximum (0.5 A) |
| | Insulation method | | Photocoupler |
| | No.of output points | | 4 points (OUT0, OUT1, OUT2, OUT3) |
| | Leakage current | | 0.1 mA maximum |
| | Polarity | | Common.....(-) |
| | Power source input for outputs | | 10 ~27 V DC, 50 mA (Supplied from outside to the module) |
| Count range | | | 0~ 9999/0 ~ 65535 |
| Count method | | | • Two-phase pulse counting (Up, Down)<br>• Single-phase pulse counting, reverse pulse counting<br>Selectable to Two-phase or Single-phase |
| Output | | | • Single point/single setting (open collector)<br>• When the setting = the count value, output will be held<br>• When the setting < the count value, outputted — Selectable |
| Marker | | | 1 point (Count value will be reset directly) |
| Operating indicator | | | Output, Pulse input |
| Register | | | • Count register<br>• Set value register for CU0, CU1, CU2, CU3<br>• Register for Status/Control |
| Function | | | • Pre-set of a count value<br>• Reading a count value<br>• Writing a set value<br>• Reading a set value<br>• Reading status<br>Phase "A" pulse ON/OFF<br>Phase "B" pulse ON/OFF<br>Marker ON/OFF<br>Set value = count value (ratch)<br>Set value < count value<br>Overflow flag<br>Underflow flag |
| Consumption current | | CH1 | 200 mA maximum |
| | | CH2 | 0 mA |
| | | CH3 | 160 mA maximum :at 50 mA supply to External input device (sensor)<br>110 mA maximum : at no supply to External input device |

(c) Example program of the counter module

[Example 1]

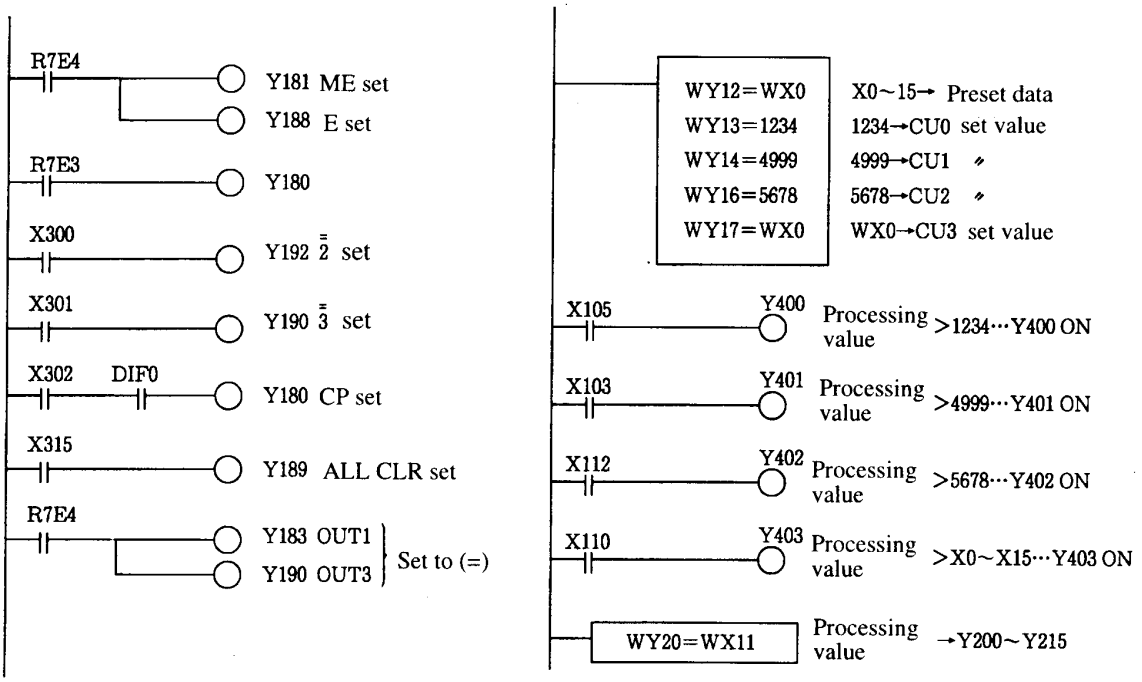
Configuration




Operation

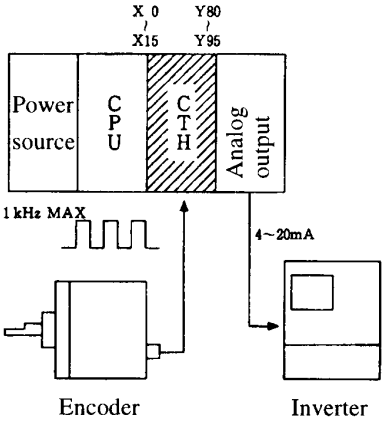
1. At the counter processing value > 1234, OUT0 will be ON in CTH. Y400 will be ON.
2. At the counter processing value > 4999, Y401 will be ON.
   At the counter processing value = 4999, OUT1 will be ON in CTH.
3. At the counter processing value = 5678, Y402 will be ON. (reset when X300 is ON).
   At the counter processing value > 5678, OUT2 will be ON in CTH.
4. At the counter processing value = X0~X15, OUT3 will be ON in CTH. Y403 will be ON. (reset when X301 is ON).
5. The counter processing value will be outputted to Y200~Y215.
6. When X302 is turned from OFF to ON, the preset value (X0~X15) → Counter processing value
7. When X315 is ON, OUT1 and OUT3 will be OFF in CTH. Y402 and Y403 will be OFF. (=flag reset).

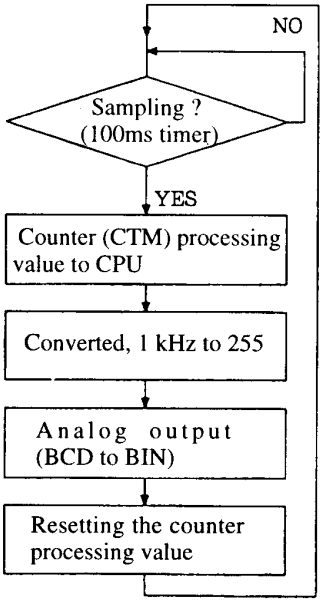
Programming



[Example 2]

Operation

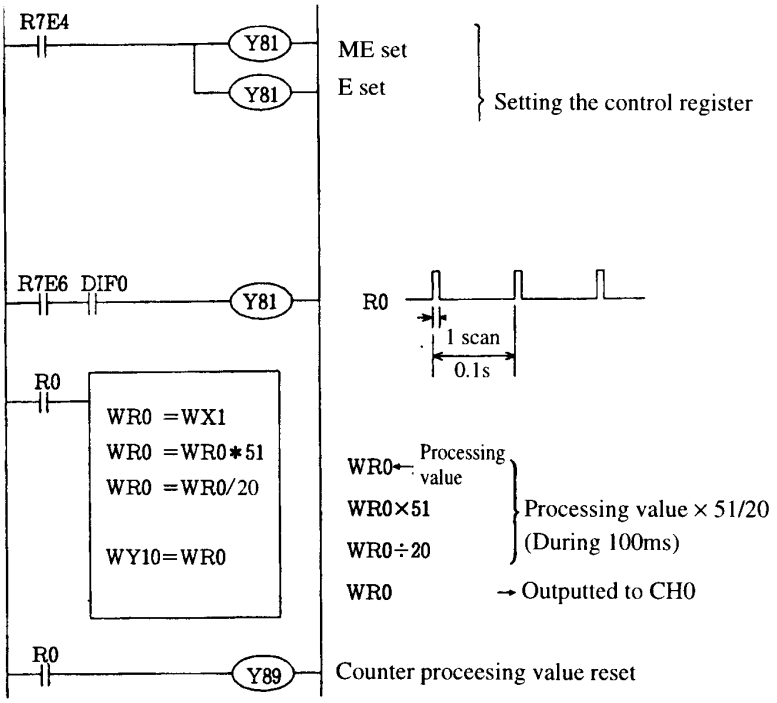



1. The counter module will count the pulse (1 kHz Max.) from the encoder for a period of 100ms.
2. The 1 kHz pulse (100 pulses/ 100ms) will be converted to 255.
   $100 \times (51/20) \times 255$
   ↑ Conversion coefficient
3. The analog module will give the speed information to the inverter.

As shown above, the speed control of the inverter will be made in accordance with the rotating speed of the encoder.

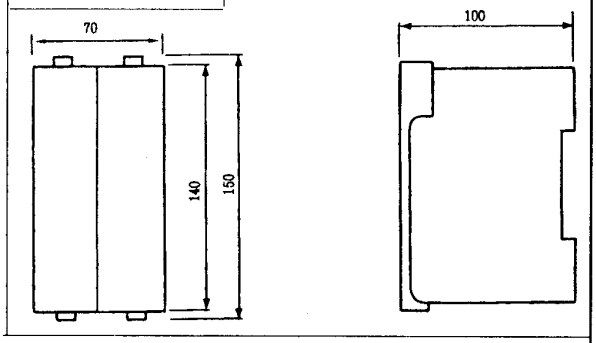
Programming



### (2) Two-axis positionong module

(a) Construction of the wo-axis positionong module

| Name and function of each part | Type | POSH |
|---|---|---|
| | Weight | 350g approx. |
| | Dimensions (mm) | |




**Watch dog timer error indicator**
Lighting in a micro computer failure

**Battery failure indicator**
No battery or
low energy battery

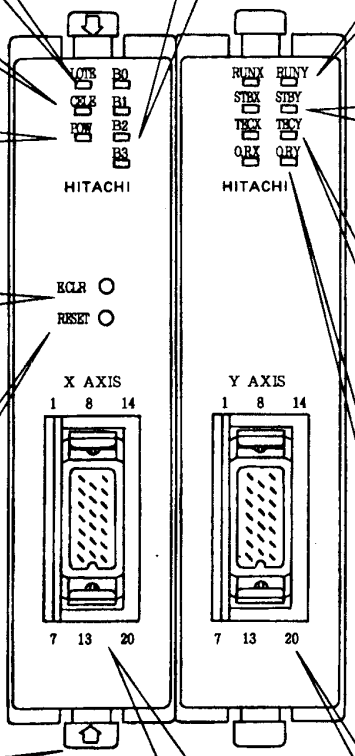
**Power source indicator**
Lighting when the power ON and no failure in the module.

**Error clear switch**
Clears data error, command error, communication error, max position error, max speed error.

**Reset switch**
Reset switch for the module itself.
Note that the common parameters and the automatic operation data are not cleared.

**Lock lever**
Module is detachable by means of the two lock levers to be operated to arrow marks at the upper and the lower position at the right of the module.

**Step No. indicator in teaching**
Step No. to be teached in will be indicatedin lower 4 bits.
Upper 3 bits in B3.




**RUN indicator**
RUNX :Lighting when X- axis is outputting.
RUNY : Lighting when Y-axis is outputting.

**Standby indicator**
STBX : Lighting when X- axis is in standby.
STBY : Lighting when Y- axis is in standby.

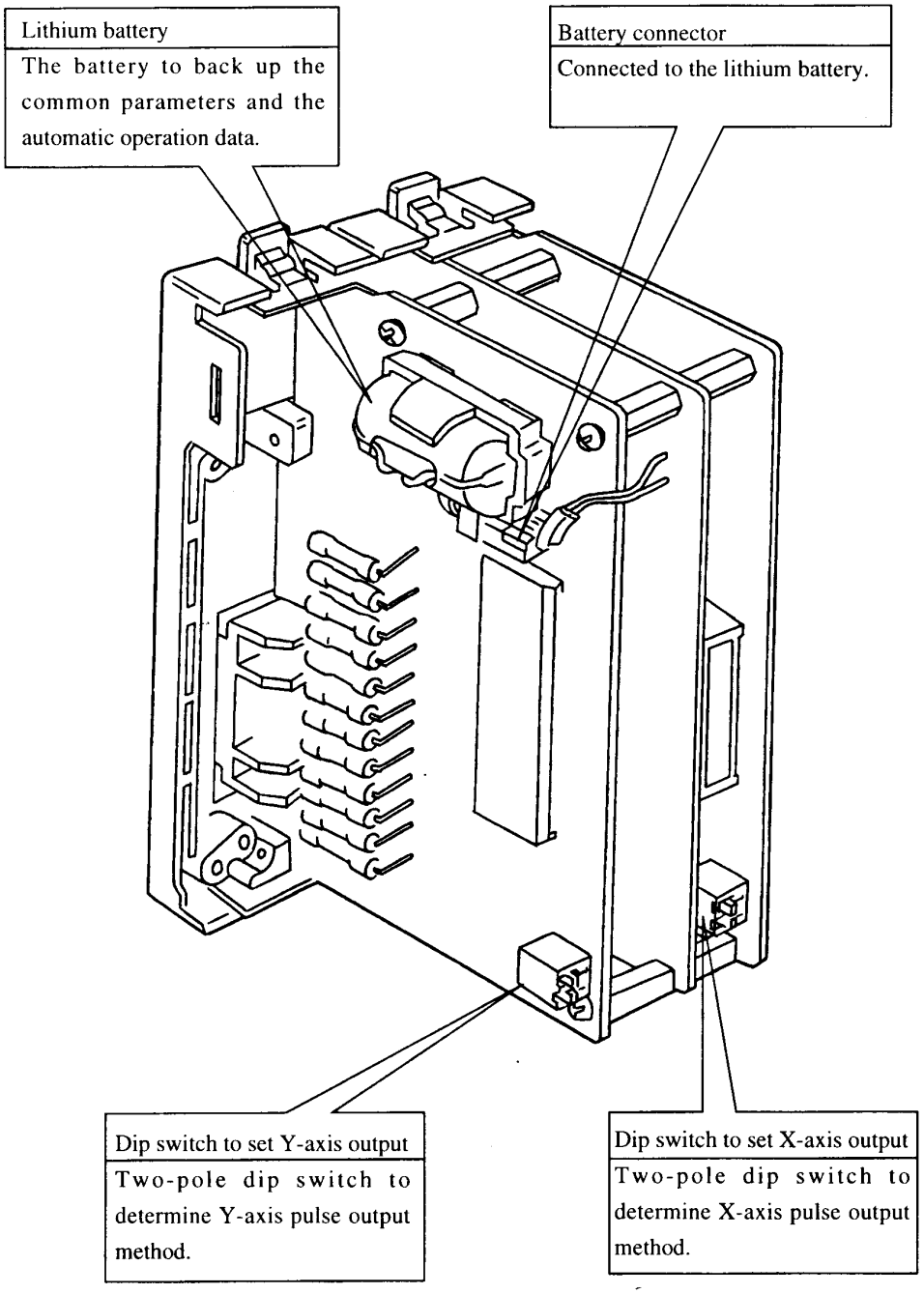
**Teaching indicator**
TECX : Lighting when X- axis is in teaching mode.
TECY : Lighting when Y- axis is in teaching mode.

**Over run indicator**
O. RX : Lighting when X- axis is in over run.
O. RY : Lighting when Y- axis is in over run.

**X-axis I/O connector**
20-pin connector for X-axis pulse series output signal and control input signal

**Y-axis I/Ot connector**
20-pin connector for Y-axis pulse series output signal and control input signal

Name and function of each part (Back side)




For the explanation of operation, mounting method, I/O assignment, etc., the manual for the positioning module.

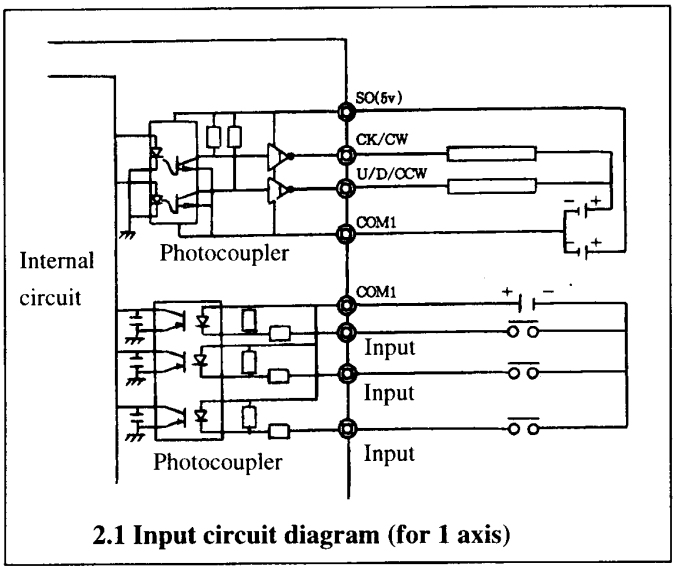
(b) Specification of wo-axis pulse positioning module

| | Item | | Specification |
|---|---|---|---|
| General specification | Power source | | 5 VDC 350mA (Supplied from the program controller) |
| | Operating temperature | | 0 ~ 55°C |
| | Storage temperature | | -10 ~ 75°C (Not guranteed for data in the memory) |
| | Operating humidity | | 20 ~ 90%RH (without dew condensation) |
| | Storage temperature | | 10 ~ 90%RH (without dew condensation) |
| | Environment | | No corrosive gases (ammonia, hydrogen sulphate, sulpha oxide, etc.) nor excessive dust. |
| | Vibration resistance | | Based on JIS-C0911 (16.7Hz dual amplitude 3mm X, Y, Z each direction) |
| | Noise resistance | | Noise simulstor : Pulse width 100ns, 1 μs 1500Vp-p<br>NEMA noise : NEMAICS2-230-42~45. |
| | Insulation | | I/O bus ~ the external terminal, 20M Ω and more (500VDC Megger) |
| | Withstand voltage | | I/O bus ~ the external terminal, 250VAC 1 minute |
| | Construction | | Open type module case (for 2 slots of Standard I/O ) |
| | Cooling method | | Natural air cooling |
| | External power source | | 5VDC ± 5% 10mA (for the pulse series output driver) |
| | Dimensions | | 70 (W) × 150 (H) × 100 (D) mm |
| Functional specification | No. of occupation points/No. of slots | | 128 points/2 slots |
| | No. of control axes | | Two axes (Simultaneous 2 axes, Independent 2 axes) |
| | No. of interpolating axes | | provided with the linear interpolatinfunction (Simultaneous 2 axes) |
| | Positioning data | Capacity | 256 data for each axis |
| | | Settin method | Sequence program |
| | Positoning | Method | Absolute method<br>Absolute method + increment method Selectable for every axis<br>Increment method |
| | | Position data | ± 7,999,999 pulses |
| | | Speed data | 6.25 pulse/S~25k pulse/S<br>12.5 pulse/S~50k pulse/S<br>25 pulse/S~100k pulse/S<br>50 pulse/S~200k pulse/S<br>} Selectable by common parameter. |
| | | Acceleration/ deceleration | Trapezoidal acceleration/deceleration (Can be set independently in both acceleration and deceleration in automatic operation) |
| | | Rate of acceleration/ deceleration | 19.53 pulse/S~320k pulse/S<br>39.06 pulse/S~640k pulse/S<br>78.13 pulse/S~1280k pulse/S<br>156.3 pulse/S~2560k pulse/S<br>} Selectable by common parameter. |
| | | Initial speed | Same as the speed data |
| | | Back lash compensation | 0~255 pulses |
| | | Setting upper/ lower limit | ± 7,999,999 pulses |
| | | Pulse output method | Pulse series, clock+didection signal (photocoupler-insulated)<br>Selectable by the dip switch |
| | Function of returh to the origin | | Arbitrary origin, low speed restoration, high speed restoration 1, high speed restoration 2 |
| | Manual (JOG) operation | | Pulses will be outputted by the manual input signals. |
| | Memory backup | | Backup by the lithium battry (15 minutes at the battery replacement) |
| | Mode in CPU STOP | | Operation abled (Data should be set in the memory in the module) |

(c) Specification of the I/O interface

| Item | | | Specification |
|---|---|---|---|
| Output | * CK/CW U/D/CCW pulse output | | Open collector output photocoupler-insulated (Max. 30V 30mA, resistive load) |
| | | | Pulse output method is selectable by the dip switch in the module. |
| | Maximum leakage current | | 100 μ A or less |
| | Maximum voltage drop at ON | | 0.8 V (at an output current 30mA) |
| Input | Input voltage | | DC10.8~30V |
| | Input impedance | | 2.2 k Ω |
| | Input current | | 5mA (12 V DC), 10mA (24 V DC) |
| | Operating voltage | Minimum ON voltage | 9 V |
| | | Maximum OFF voltage | 3.6 V |
| | Input delay | ON to OFF | 1 ms or less |
| | | OFF to ON | 1 ms or less |
| | Polarity | | Inside the unit (+), common |
| | Insulation method | | Photocoupler |

* CK : Clock pulse, U/D : Directioal pulse



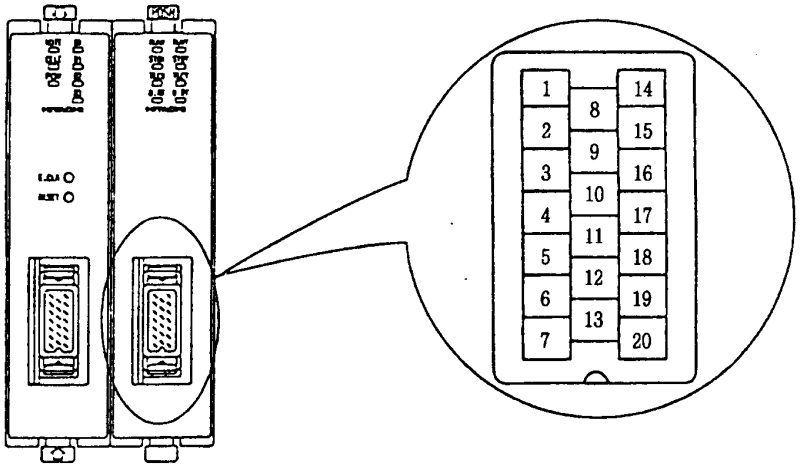

**2.1 Input circuit diagram (for 1 axis)**

(Note) For I/O external cable, use the twist pair cable with the overall shielding.

(d) Signal name and Pin arrangement

| Pin No. | I/O | Signal name | Description |
|---|---|---|---|
| 19<br>20 | Input | COM1 | Common power source for I/O signals (12/24 VDC) |
| 6 | | +○. RUN | CCW direction over run (Normal during ON) |
| 5 | | -○. RUN | CW direction over run (Normal during ON) |
| 4 | | Positioning completed | Input signal for motor driver positioning completed (Set normally ON in the case of no signal in the driver side) |
| 3 | | Change-over of the control mode | In the case of speed + positioning control mode, the mode will be changed to the positioning mode at ON to OFF. Bring it to ON at the starting. (In the case of positioning control or speed control mode, bring it to OFF.) |
| 2 | | Manual CW | CW direction operation input in the manual operation |
| 1 | | Manual CCW | CCW direction operation input in the manual operation |
| 10 | | Initial point LS | Initial point limit switch (Contact "a") |
| 9 | | Marker (Z phase) | Marker input (Z phase) in the case of the high speed return to origin. (Set OFF in other mode of return to origin) |
| 8 | | Teaching setting | Data setting signals in teaching |
| 7 | | +STEP | Step No. setting input in teaching (+1 step for every ON) |
| 11 | | -STEP | Step No. setting input in teaching (-1 step for every ON) |
| 12 | | Operation ready | "Operation ready" input (Operation ready at ON) |
| 15 | Output | S0 | Power source for pulse series output driver 5VDC ± 5% 100mA |
| 17 | | CK/CW | Clock or CW pulse output (Open collector Max. 30V 30mA) |
| 16 | | U/D/CCW | Directional signal or CCW pulse output (Open collector Max. 30V 30mA) |
| 14 | | COM0 (Note) | GND for pulse series output driver (0 V) |
| 13 | Not in use | NC | - |
| 18 | | NC | - |

(Note) Use COM0 common to X-axis and Y-axis.



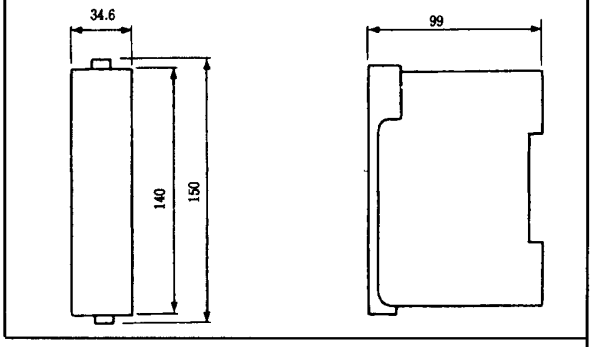

**External connector pin No.**

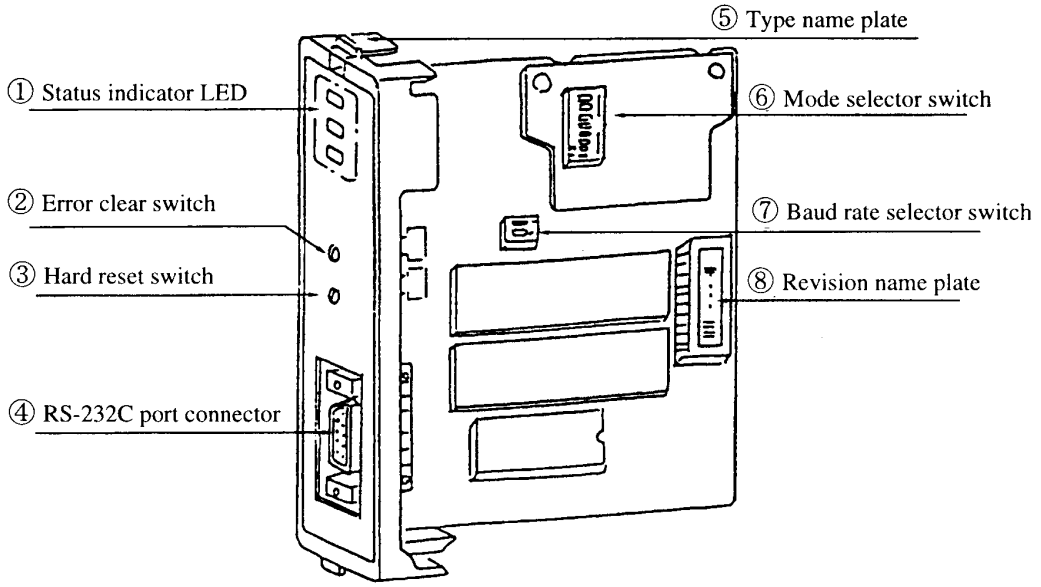
### (3) Serial I/O module

(a) Construction of the serial I/O module

Name and function of each part

| Type | SIH |
|---|---|
| Weight | 170g approx. |
| Dimensions (mm) | |



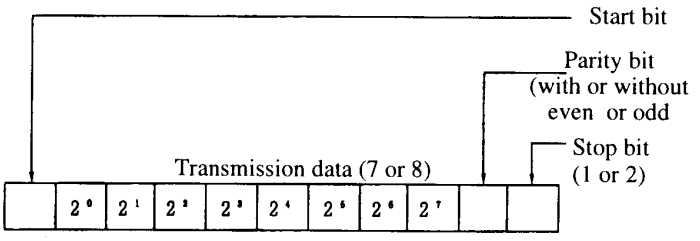
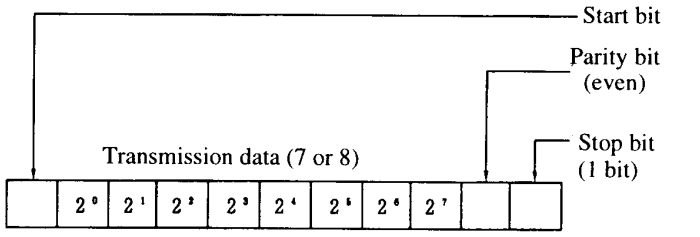




| No. | Name | Function |
|---|---|---|
| ① | Status indicator LED | To announce the error status of SIH |
| ② | Error clear switch | To extinguish the error indicating LED |
| ③ | Hard reset switch | Hard reset of SIH (Do not press during the operation) |
| ④ | RS-232C port connector | To connect the cable in RS-232C interface specification |
| ⑤ | Type name plate | SIH |
| ⑥ | Mode selector switch | To select communication modes, transmission mode with the externals, etc. (7 points). |
| ⑦ | Baud rate selector switch | To select the baud rate. |
| ⑧ | Revision name plate | To record the device manageing numbers in the specification name plate. |

For the explanation of operation, mounting method, I/O assignment, etc., refer to the manual for the serial I/O module.

(b) Specification of the serial I/O module

| | Item | Specification |
|---|---|---|
| General specification | Operating temperature | 0 ~ 55°C |
| | Storage temperature | -10 ~75°C |
| | Operating humidity | 20 ~90%RH without dew condensation |
| | Storage humidity | 10 ~90%RH without dew condensation |
| | Current consumption | 100mA (5 VDC) |
| | Dimensions | 34.6 (W) × 140 (H) × 99 (D) mm |
| | Weight | 170 g approx. |
| | Mounted location | Basic base, expansion base (not on the remote end) |
| | Number of mounting | Max 16 units |
| | Occupied I/O points | 128 points<br>(LADDER EDITOR setting = 4/4W, PGM-CHH, -GPH setting = WXY4/4 |
| | Failure detection | Watch dog timer, undefined command check, sum check, incorrect data check, loop back check (in the case of the self check mode) |

| | | | Item | Specification |
|---|---|---|---|---|
| Communication specification | | | Interface | Based on RS-232C 1 port |
| | | | Communication speed | 2400, 4800, 9600, 19200 bps, selectable |
| | | | Communication method | Bit serial communication (will be sent starting from the lowest bit of the transmitted character) |
| | | | Synchronizing method | Start-Stop synchronizing |
| | Non-procedural mode | | Transmitted character structure |  |
| | | | Input buffer | 1024 bytes |
| | | | Output buffer | 1024 bytes |
| | | | Error control | Over run error, framing error, parity error, message error, input buffer full, time out error |
| | Personal computer mode | | Transmitted character structure |  |
| | | | Transmission unit | Message |
| | | | Max, message length | 250 bytes/message (including transmission control characters) |
| | | | Error control | Over run error, framing error, parity error, character error, sum error, message length error |
| | RS-232C port | | Connection type | 1 : 1 |
| | | | Connector on the main unit | D sub 9-pin [Type : RDED-9S-LN (by Hirose Denki Co.) or the equivalent. |
| | | | Cable | Cable : Twist pair cable with overall shielding (Max. 15 m)<br>Connector : HDEB-9P (by Hirose Denki Co.) or the equivalent. |

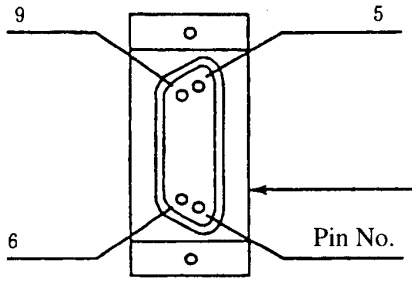
(c) Connecting specification of the communication report of the serial I/O module

RS-232C communication port is provided with SIH.

Connecting specification of the port is shown below.

Use the twist pair cable with overall shielding.

① Configuration of the connector on SIH. (RS-232C).




Recommended connector type (or the equivalent)

| | |
|---|---|
| Name | D sub-connector 9-pin, female. |
| Type | RDED-9S-LN |
| Manufacturer | Hirose Denki Co. |

② Signal name and the pin arrangement (RS-232C) on SIH.

| Pin No. | Signal name | Signal symbol | I/O direction | | Signal specification |
|---|---|---|---|---|---|
| | | | SIH | External equipment | |
| 1 | - | NC | - | - | Not in use |
| 2 | Receiving data | RD | ← | | Data received from the externals *2 |
| 3 | Sending data | SD | → | | Data sent from SIH *2 |
| 4 | Data terminal ready | ER | → | | To indicate SIH is ready<br>Constantly ON (high level) |
| 5 | Signal ground | SG | ← | → | Ground for the signal |
| 6 | - | NC | - | - | Not in use |
| 7 | Request to send | RS | → | | SIH requests to send to the externals.<br>•In the non-procedural mode.<br>ON (high level)/OFF (Low level) is controlled from CPU.<br>ON when SIH is ready to receive. * 1<br>OFF immediately after a reset of SIH.<br>•In the personal computer mode.<br>Constantly ON |
| 8 | Ready to send | CS | ← | | To indicate the externals are ready to receive.<br>When OFF, SIH will not send data. |
| 9 | Vcc | Vcc | → | | + 5V power source |

* 1 In the non-procedural mode, RS signal will be set by controlling "operation mode setting" command and "Control register" of the output register, through an application program in CPU.



| Modem control wire setting for setting the operation mode | RS setting for the control register | RS output status |
|---|---|---|
| Disable (Set to "0") | - | ON (High level) |
| Enable (Set to "1") | When set to "1" | ON (High level) |
| | When set to "0" | OFF (Low level) |

* 2 Each SD and RD wire must be twisted together with SG wire as practically as possible.

# Chapter 10 The Peripheral Equipment

## 10.1 Outline

(a) The peripherals

The following four peripherals are prepared for H-series H-250/252 PC.

**Table 10.1.1 List of the peripherals**

| No. | Name of the peripheral | Type | Specification |
|---|---|---|---|
| ① | (i) Portable programming programmer | PGM-GPH | Programming by the Command•Ladder diagram |
| | (ii) Option interface for the Portable programming programmer | PGMIF-H | Tool for forming a ROM program and printing the program. Must be used together with PGM-GPH. |
| | (iii) ROM pack for the Portable programming programmer | PGMPK2H | Expanded specification for the In-RUN service program change. |
| ② | Command programmer | PGM-CHH | Programming exclusively for the Commads |
| ③ | H-series Ladder diagram/ Command software LADDER EDITOR | HL-AT3E | Thge personal computer programming software. For detais, refer to the manual for LADDER EDITOR. |

① Portable graphic programmer

The programmer can program by the Ladder diagram (HI-LADDER) or the commands (HI-COMMAND).

The combination of (i) and (ii) is used for forming a ROM program or printing the program.

The combination of (i) and (iii) is used for expanding (circuit change, etc.) the function of In-RUN service program change.

② Command programmer

The command programmer is a programming device prepared exclusively for the command language (HI-COMMAND). The connection with PC is made directly or through the cable of special design.

③ H-series Ladder diagram / Command language software

Programming can be made by Ladder diagram / Command language by means of a PC/AT compatible personal computer.

(b) Comparison of the functions

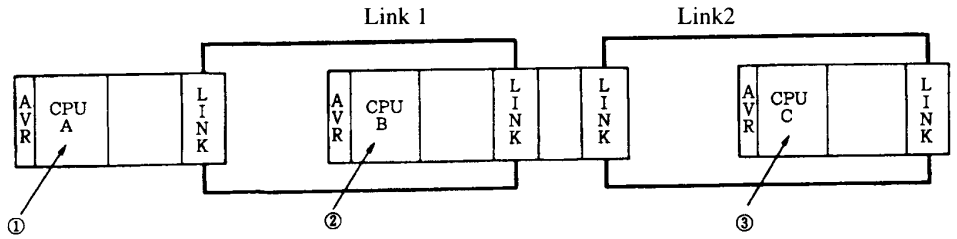
**Table : Comparison of functions of the peripherals**

| Function / Periphral name | Programming of the CPU module | | On-line programming | Printer connection | Program record | | Power outage memory protection | Supplemental programming function | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ladder diagram | Command | | Serial | 3.5-inch FD | Audio cassette | | In-RUN program change | Debug | Monitor |
| LADDER EDITOR | ○ | ○ | ○ | ○ | ○ | × | ○ | ○ | ○ | ○ |
| Portable graphic programmer PGM-GPH | ○ | ○ | × | *1 ○ | × | ○ | × | ○ | × | ○ |
| Command programmer PGM-CHH | × | ○ | × | × | × | ○ | × | ○ | × | ○ |

(c) Connecting position of the peripherals

In the following illustration, the positions that are suitable for the connection of the peripherals are ① ~ ③.

**Table 10.1.2 The locations suitable for the connection of the peripherals and CPU type for programming**



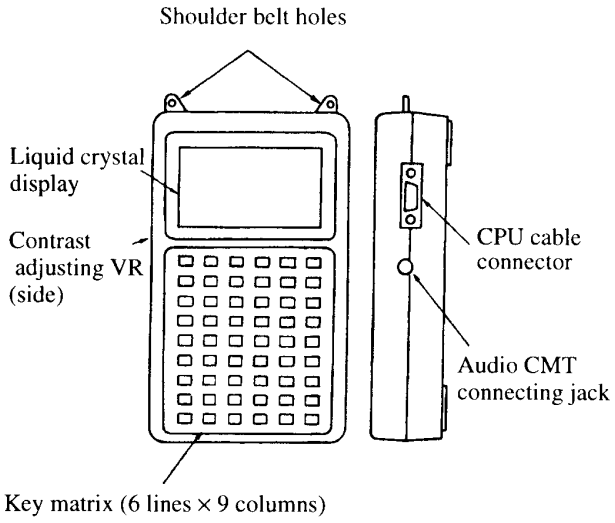

| Connecting position / CPU | | | Programming into CPU A | Programming into CPU B | Programming into CPU C | Remarks |
|---|---|---|---|---|---|---|
| Direct connection with CPU | H-252 | ① | ○ | ○ | × | Effective for link 1 CPU |
| | | ② | ○ | ○ | ○ | Effective for link 1 CPU and link 2 CPU |
| | | ③ | × | ○ | ○ | Effective for link 2 CPU |
| | H-250 | ① | ○ | × | × | Effective for CPU on the same base |
| | | ② | × | ○ | × | |
| | | ③ | × | × | ○ | |

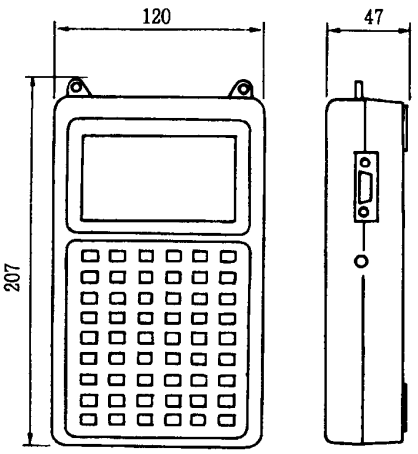
## 10.2 Construction and Specification of the peripheral equipment

### (1) Portable Graphic Programer

Name of each part

| Type | PGM-GPH |
|---|---|
| Weight | 660 g approx. |
| Dimensions (mm) | |




Accessaries : A connecting cable, a shoulder belt.

Function

- Inputting, editing, monitoring, syntax checking, etc. of the Ladder or command program.
- Provided with EL back light in the liquid crystal display.
- Key input is of a click touch and provided with confirmation method by buzzer sounds.
- With the audio CMT I/F.
- Printer I/F, ROM writer I/F (Option. Usable when connected directly with CPU. Type : PGMIF1H)
- Function upgrading is possible by replacing the ROM pack. (PGMPK2H: For In-RUN program change)

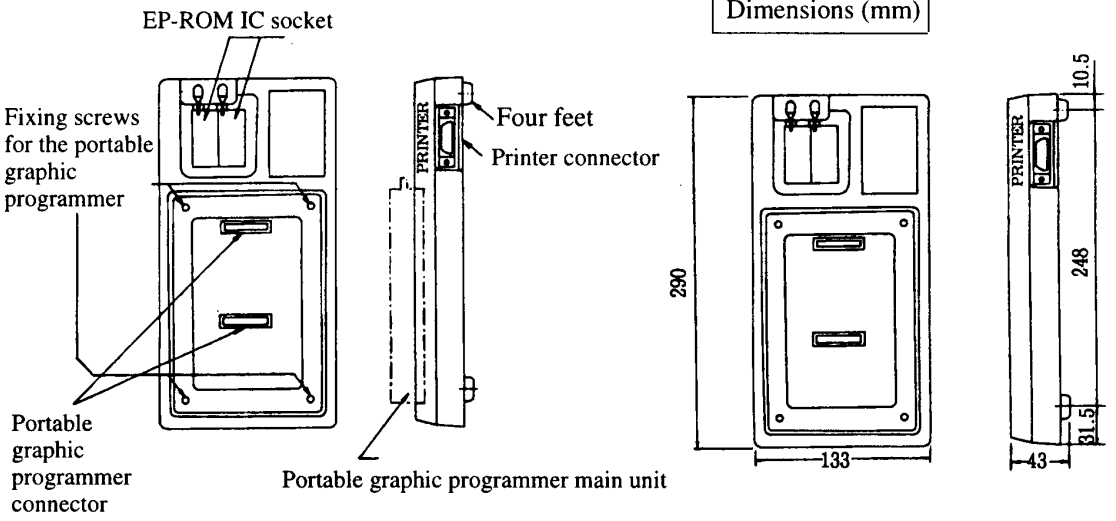
General specification

| Item | Specification | | |
|---|---|---|---|
| Source voltage | From the CPU to be connected with | | |
| Operating ambient temperature | 0 ~ 45°C | Storage ambient temperature | -10 ~ 60°C |
| Operating ambient humidity | 20 ~ 90%RH without rew condensation | Storage ambient humidity | 10 ~ 90%RH without rew condensation |
| Vibration resistance | Based on JIS C0911 (16.7Hz, Full amplitude 3mm, X, Y, Z, 2 hours in each direction) | | |
| Environment | No corrosive gases nor excessive dusts. | | |
| Construction | Handy pocket calculator type | | |
| Cooling | Natural cooling | | |

### (3) Option I/F for Portable Graphic Programmer

Name of each part

| | |
|---|---|
| Type | PGMIF1H |
| Weight | 660 g approx. |
| Dimensions (mm) | |




Function

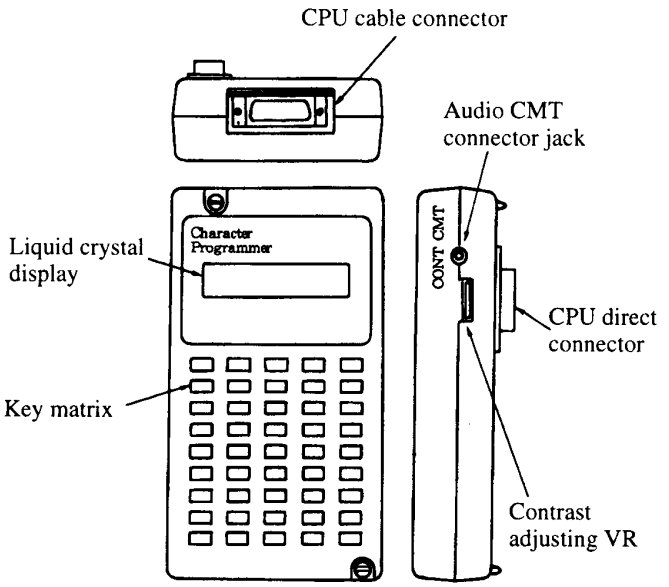
- Program printing (in Ladder diagram, command language)
- Cross references printing
- Parameter printing
- List printing of the Timer and Counter operation status
- Printing internal output data
- Writing, verifying, reading ROM
- PGMIF1H is operable only when CPU is connected with PGM-GPH

Interface specification

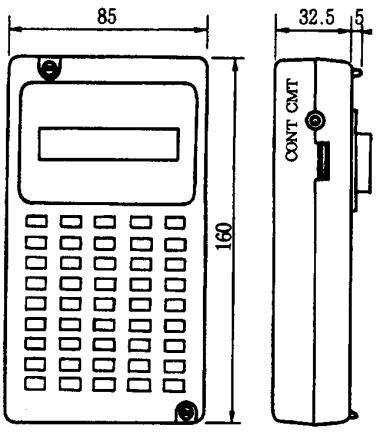
| Item | | Specification |
|---|---|---|
| Printer interface | Communication speed | 4800 bps |
| | Transmission code | 1start bit, 8 data bits, 1 stop bit |
| ROM writer interface | Applicable memory | MPH-8R, MPH-16R |
| | Applicable ROM | ROMIC-01H (provided with MPH-8R/16R) |

### (4) Command Programmer

Name of each part




| Type | PGM-CHH |
|---|---|
| Weight | 400 g approx. |
| Dimensions (mm) | |




Function

- Inputting, editing, monitoring, syntax checking, etc. of the command program.
- Provided with back light in the liquid crystal display.
- Key input is of a click touch and provided with confirmation method by buzzer sounds.
- With the audio CMT I/F

General specification

| Item | Specification |
|---|---|
| Operating ambient temperature | 0~45°C |
| Operating ambient humidity | 20~90%RH (without dew condensation) |
| Storage ambient temperature | -10~60°C |
| Storage ambient humidity | 10~90%RH (without dew condensation) |
| Vibration resistance | JIS C 0911 (16.7Hz, full amplitude 2mm, XYZ 2 hours in each direction |
| Environment | No corrosive rases nor excessive dusts |
| Construction | Handy pocket calculator type |
| Power source | Sipplied from the CPU connected with |
| Cooling | Natural cooling |
| Dimensions | 85 W × 160 H × 32.5D (mm) (excluding the CPU add-on connector) |
| Weight | 400 g approx. |

# Part III

## Installation, Mounting, Wiring, and Preparation for Running

# Chapter11 Installing the PC

## 11.1 Installing on the service location

### (1) Location and environment for the installation

H-series must be installed so that the PC is operated under the conditions stipulated in the general specifications (refer to Section 1.4). Avoid the uses under the conditions as described bellow.

a. In the location under the ambient temperature below 0°C or above 55°C (for peripherals, refer to corresponding specifications accordingly).

b. In the location under the relative humidity below 20 or above 90%RH (for peripherals, refer to corresponding specifications accordingly).

c. In the location where humidity would change quickly causing dew condensation.

d. In the location where the environment would be contaminated by corrosive gases, inflammable gases, solvents, or abrasives.

e. In the location where the environment would be contaminated by dust, salty materials, or ferrous particles.

f. In the location where vibrations or shocks would be directly applied to the PC.

g. In the location where the PC would be opened to direct sun shine.

### (2) Installing the bases

(a) Cautions in installing the bases

① Install the bases (Basic base, Expansion base) before modules are mounted into them. Fix securely each base with the four screws (M4, 12mm in length or more) through the four screw holes on the base.

②In order to use the PC under the allowable ambient temperature;

(i) Provide adequate ventilation spacing from the base. (50mm or more at the upper and the lower surface, 10mm and more at left and right side).

(ii) Avoid installing the base right above equipment radiating extensive heat (such as heaters, transformers, or big capacity resisters, etc.)

(iii) When the ambient temperature would rise above 55°C, adjust it below 55°C by means of fans or air conditioners.

③Avoid installing the base on a panel where a high voltage devices is located.

④Install the base apart 200 mm from high tension cables and power cables.

⑤Operability will be improved when the base is installed at the level 1,000mm to 1,600mm from the floor surface.

⑥Provide the space 10mm and more at the left and right side.

Figure 11.1.1. shows overall dimensions of H-250/252. Figure 11.1.2 shows the fixing screw holes.

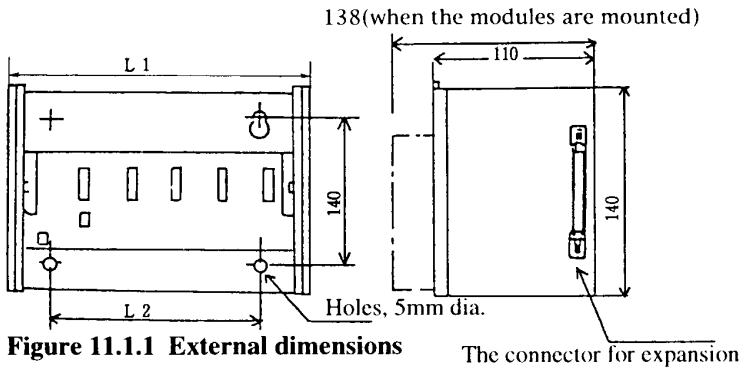
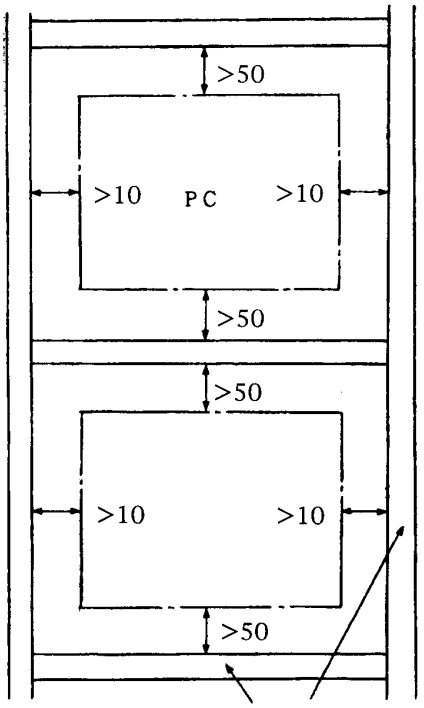



**Figure 11.1.1 External dimensions**

**Dimension table**

| Base | L1 (Fixing dimensions) | L2 (Fixing dimensions) |
|---|---|---|
| 3 slots | 160 | 80 |
| 4 slots | 195 | 120 |
| 5 slots | 230 | 160 |
| 6 slots | 265 | 200 |
| 7 slots | 300 | 240 |
| 9 slots | 370 | 310 |
| 10 slots | 405 | 345 |



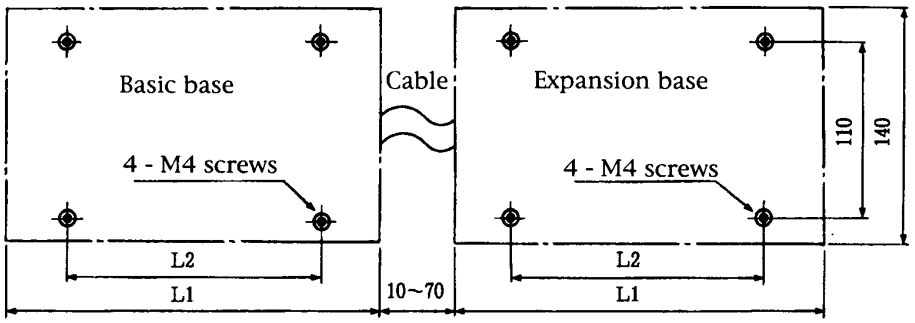
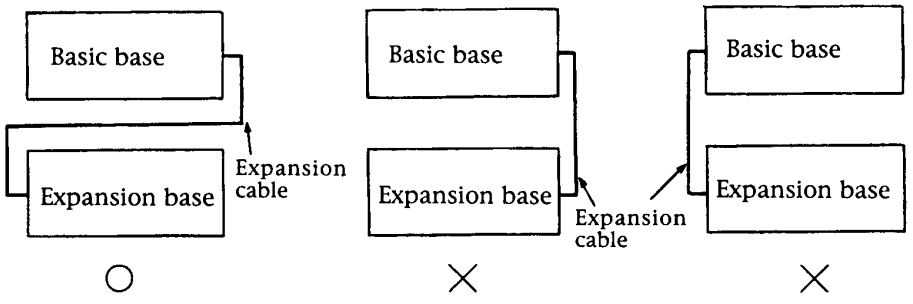



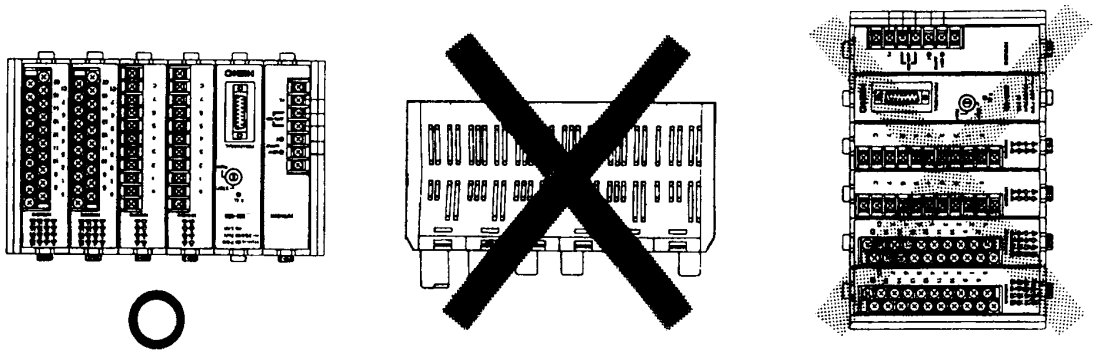

**Figure 11.1.2 Fixing screw holes and installation spacing**

⑦ As a standard practice, the expansion base must be located on the right side of the basic base. The spacing between them must be 10 to 70mm in case the expansion cable with 10cm length (CNM-01).

⑧ When the expansion base is installed above or under the basic base by using the 60cm expansion cable (CNEB-06) or the 100cm expansion cable (CNM-10), an extra care must be taken in the positions of the cable connection. If an improper connection is made, they will not function properly. In some cases modules might be damaged.



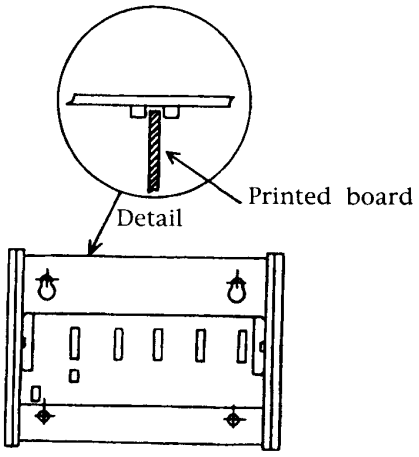
⑨ The upside-down position is acceptable. Avoid a horizontal or a vertical position.



## 11.2 Mounting components

### (1) Mounting the modules

At the top and bottom, each base has grooves as shown in the figure shown below. Push in the printed board of each module, matching it with the top and bottom grooves.




Base structure



① The power module must be mounted to the slots at the extreme left of the basic base or the expansion base.

② The CPU module must be mounted to the right of the power module of the basic base .

### (2) Mounting the memory pack

Refer to **Chapter 4 Memory Pack.**

## 11.3 Wiring

### (1) Separating the power source system

Following kinds of the power sources are prepared.

(i) The power source for H-series PC main unit.

(ii) The power source for I/O signals.

(iii) The power source for other general devices.

The above power sources must be wired and located as far as practicable from other systems.

When the above power sources are fed from a single utility source, each of them must be separated each other by means of transformers or other appropriate means.

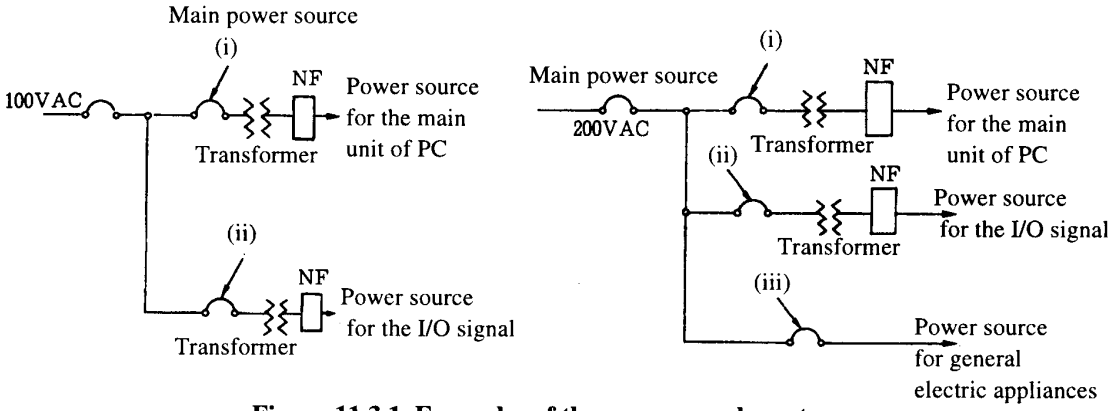



**Figure 11.3.1 Examples of the power supply system**

### (2) Fail safe

① The interlock circuit must be structured outside the PC.

At ON-OFF of the power source for the PC, I/O would possibly become unstable caused by differences in time laggings between the PC power source and the external power source for I/O module (especially the DC source), or also by differences in time laggings between leading edges. Unstable operation would be caused also by a trouble in a power source or PC.

In order to prevent damges and accidents of the controlled machines or systems resulted from such unstable operation, emergency shutdown circuits, protective circuits, interlock circuits, etc. that are to be prepared for direct prevention of such troubles must be constructed outside the PC, in view of the fail safe policy.

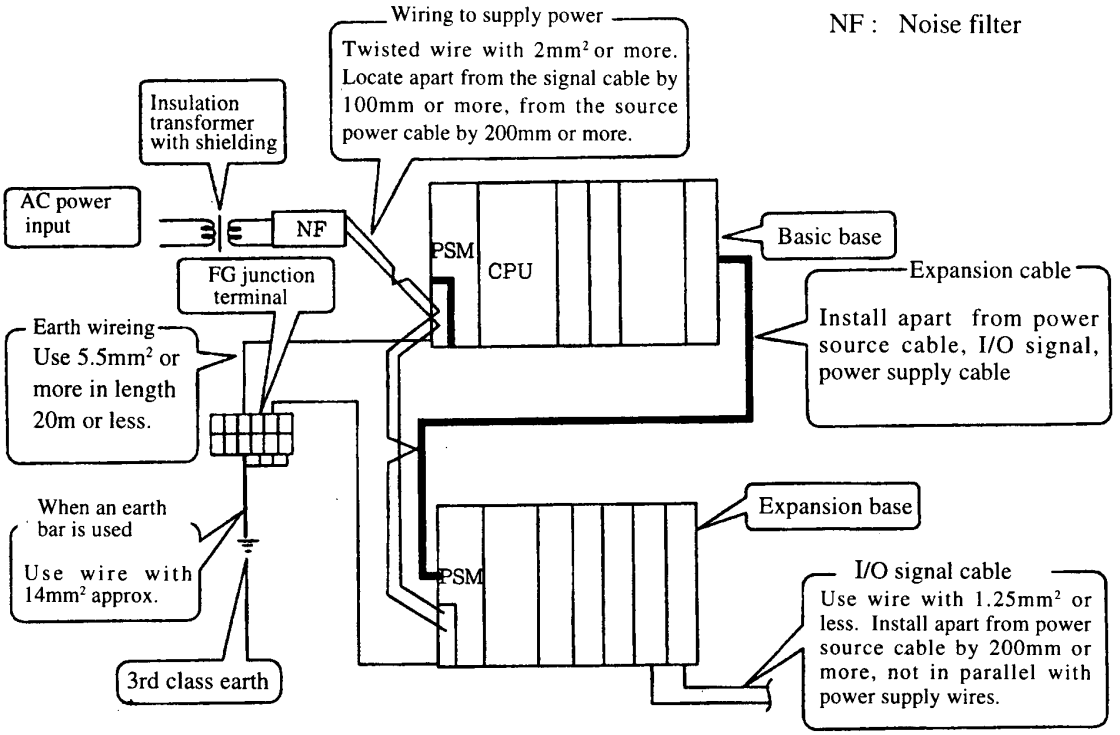
② Install the lightening arrester.

In order to prevent damages on the equipment, installation of the lightening arrester is recommended in the power source circuit of each PC.

A failure of power source in H-250/252 will be detected by the voltage drop in 5V DC source. In a case where loads in the 5V DC are lower because of operations by the basic unit only without any programmer, the 5V would be maintained longer resulting in the continuation of computation 100ms or more. Therefore, the OFF delay timer is necessary for securing coordination with Vcc, because AC signal will OFF earlier than the 5V when AC input module is used.

### (3) Wiring to the module terminals

PSM : Power module
CPU : CPU mofdule
NF : Noise filter




[Reference] When the earth wire is 20m or more, or the earth is set common with other equipment. In these cases, the earth may cause noise influence. In such case, the earth with a high impedance (10kΩ~1 MΩ approx.) may be a remedy. For noise source, provide a surge killer.

**Figure 11.3.2 Wiring example**

**(4) Wiring to the power module**

An example of wiring to H-250/252 is shown on Figure 11.3.3

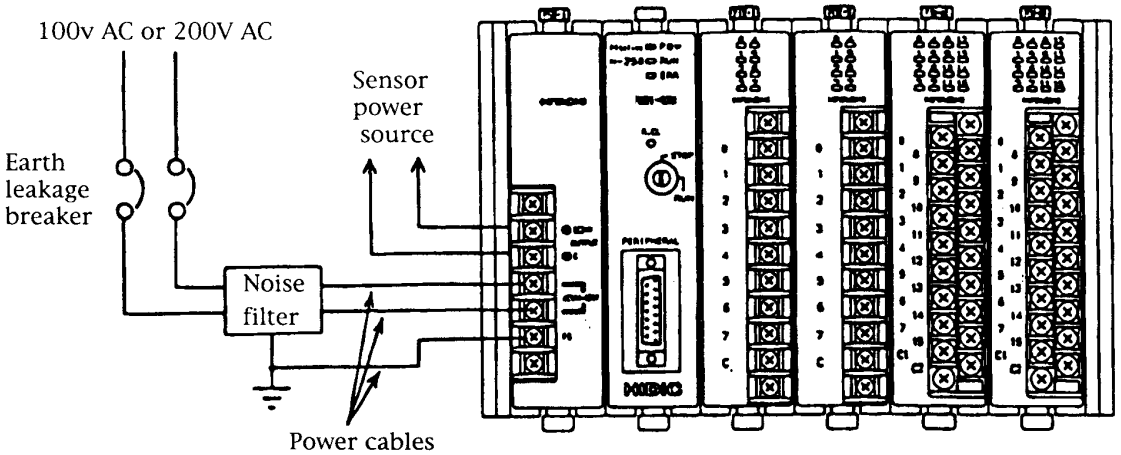
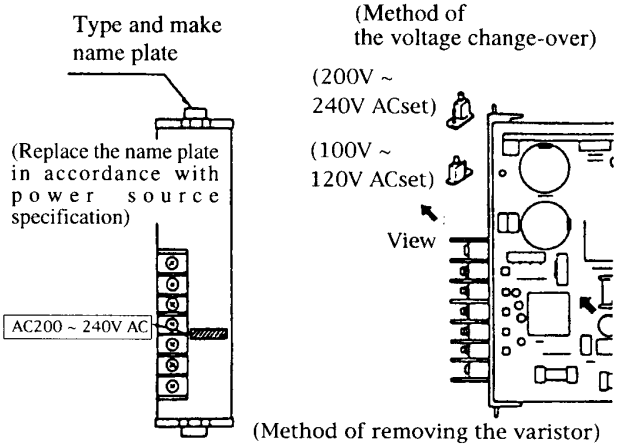



**Figure 11.3.3 Power source wiring**

(1) Power source voltage

The instrument can operate on either 110V AC or 220V AC system. Although the instrument has been set for 220V AC as a standard (factory setting), setting can be changed as shown in the figure at right when 110V AC power supply is required.




(2) The power cables with 2mm² or more must be used to prevent voltage drop.

(3) Earth

The earth terminals (FG terminals) must be ground by the cable with 2mm² or more (100 Ω or less).

The length of the earth wire should preferably be shorter than 20 meters.

① The instrument panel and the relay panel can use a common earth cable.

② Avoid a common earth cable with devices that would generate noises, such as a high frequency furnace, a large capacity power panel ( over a several kW in capacity), a thyristor converter, an electric welding machine.

③ Noise filter is recommended under bad electric environment.

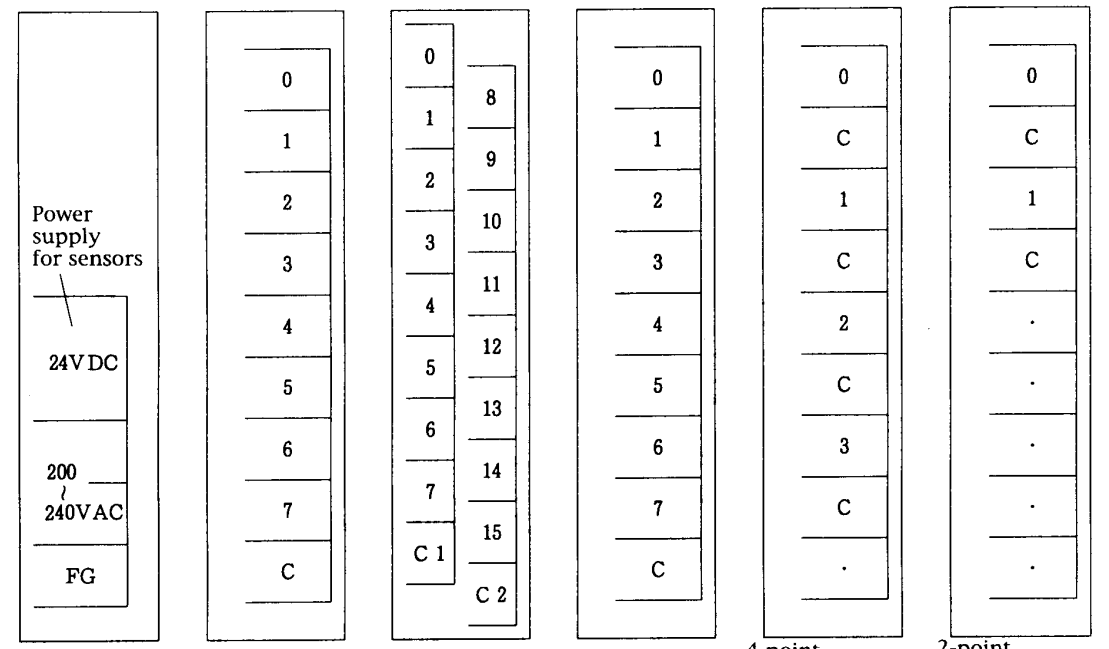
(4) Insulation resistance test, dielectric strength test

A varistor (470V class) is built in the power module for the purpose of the lightening surge protection. Therefore, never fail to disconnect the connector while an insulation resistance test or a dielectric strength test is conducted.

(5) Use PSM-D when the power source voltage is 24V DC.

(5) Cabling I/O signals

(a) Terminal layout of the power module and I/O modules

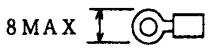


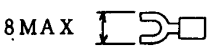

* DC power supply for sensors is also used for external inputs (9 mA/point) and has a capacity of 450 mA in case of PSM-A. 250 mA in case of PSM-B.

**Figure 11.3.4 Terminal layout of Power module, I/O modules**

Each terminal screw is of M3.5. When using a solderless terminal, its outside diameter must not exceed 8 mm.

Up to 2 solderless terminals are allowed for the same terminal screw. Do not fasten three or more terminals simultaneously at a terminal.



(b) External wiring of DC input and AC input

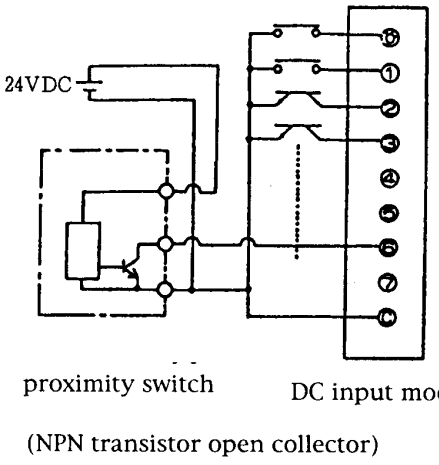
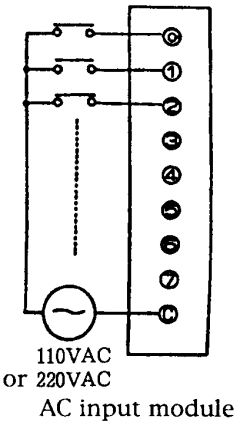
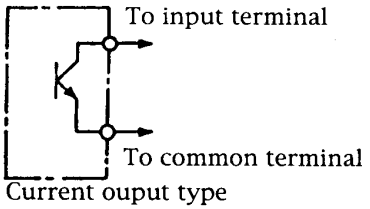
| Item | DC input (PIM-D, DH,ftc.) | AC input (PIM-A, AH, etc.) |
|---|---|---|
| External wiring |  |  |

**Figure 11.3.5 Input wiring**

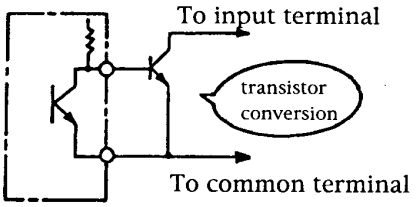
(c) DC input module wiring

① Power supply source (24V DC) is built in H-250/252. When each input terminal (XO, X1, .....) is short-circuited with the common terminal (C), the input will become ON, causing current of 10mA to be sent to external input contacts from the PC.




Current ouput type

○ (Good for direct connection)




Voltage ouput type

× (Required, transistor conversion)

② Sensors such as a proximity switch or photoelectric switch are directly connectable when they are of current output type (NPN transistor open collector output). Sensors of voltage output type must be connected to the input terminal via a transistor.

③ Although the current sensitivity is 4 ~ 6mA, secure 7mA or more for reliable ON operation and 1mA or less for reliable OFF operation.

(Caution) When connecting a 2-wire type proximity switch or an LED display-equipped limit switch, check the input impedance and select one in accordance with the above current specifications.

④ The 24V DC of the power module (PSM-A) can be used for a sensor power supply. Available value of the current ( I ) is given by:

I = Capacity (450mA) of CH3 in (PSM-A) - CH3 current to be consumed in I/O modules

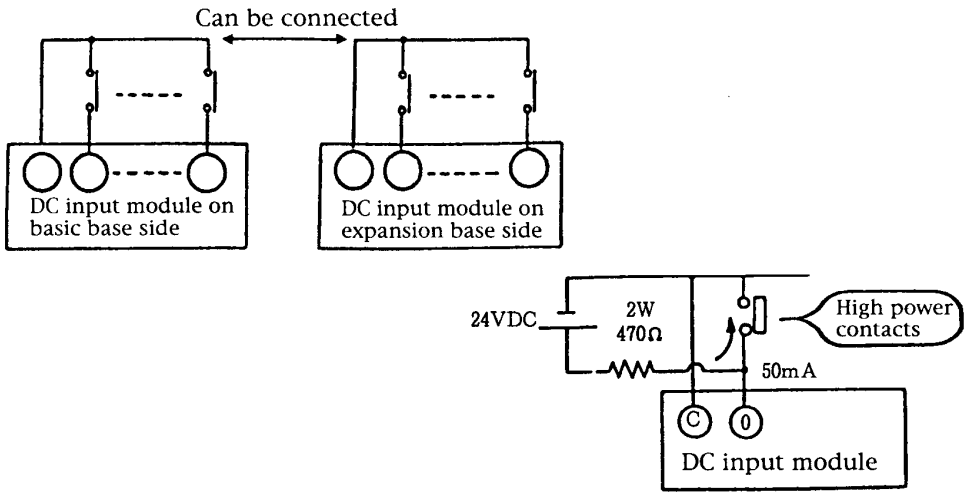
⑤ When installing a 24V DC switching regulator as a sensor power supply, connect the negative pole of power supply and the common terminal of DC input module. (Refer to the above Illustration of wiring).

⑥Connection of common terminal between DC input modules

The common terminals need not be connected between DC input modules in the same base.

(They are connected each other in the mother board of the base)

It is recommended to separate the common terminals of DC input between the basic base and the expansion base, to put things to order. However, connecting the common terminals each other will not cause a technical problem.




⑦Preventing inadequate contact in high power contacts if used

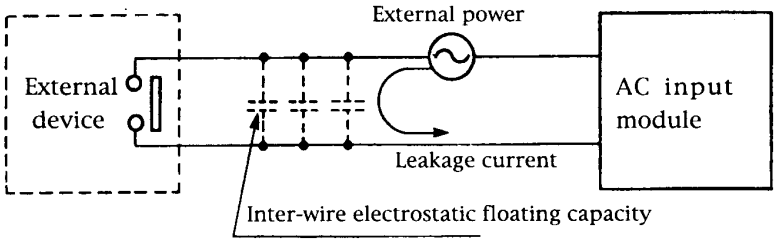
Approximately 9mA will be supplied through the closed external contacts. Use contacts that will not cause inadequate contacting at this current level. When, from some reason, a high power type contact is to be used, supply adequate current to the power contact through a resister as shown above right in order to prevent the possible inadequate contact.

⑧Length of input wiring

Input wiring length must be smaller than 30 meters. When the length exceeding 30 meters caused by layout or other inevitable reasons, separate adequately input wiring and output wiring each other. In no case it shall exceed 100 meters.

(d) AC input module wiring

When AC is used for input circuit, a lengthy wiring would possibly cause a false detection that the input terminal is judged excited though there is no actual signal in the system.

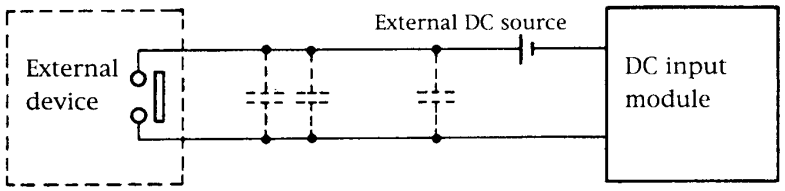



Such phenomenon is caused by leakage current induced by the inter-wire electrostatic floating capacity which will cause a false signal voltage on the input terminal of the AC input module contrary to the opened contact in the external device.

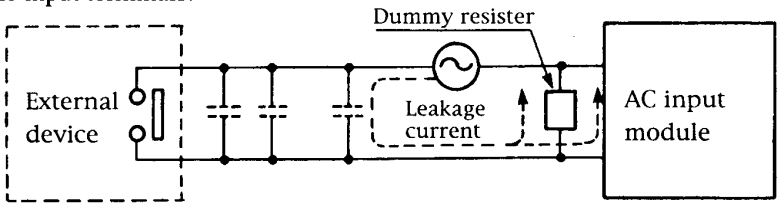
Such problem would cause a false input or impaired resistivity to noises.

To prevent such problem, the following precautions are recommended. Reduce the terminal voltage due to capacitance to 1/2 or less of maximum OFF voltage, using these methods.

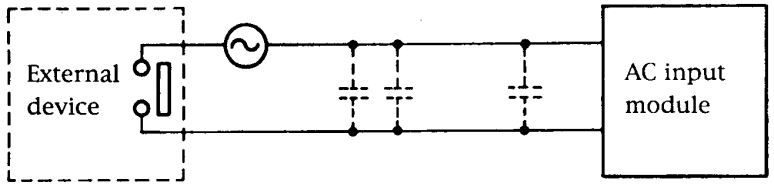
① Direct current is used for the input circuit.




② To decrease the impedance of the input module by the parallel connection of a dummy resister to the input terminals.




③ Connecting the external power source to the external device.




(e) Examples of output wiring for the relay output, transistor output, triac output

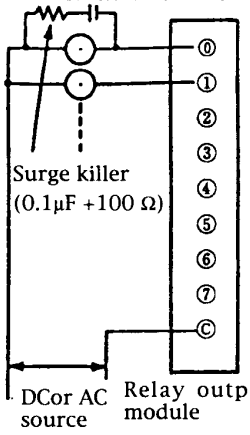
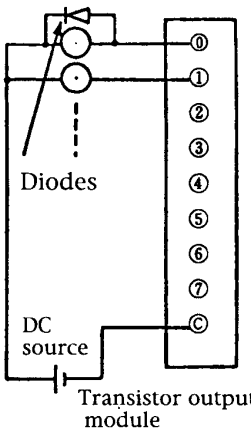
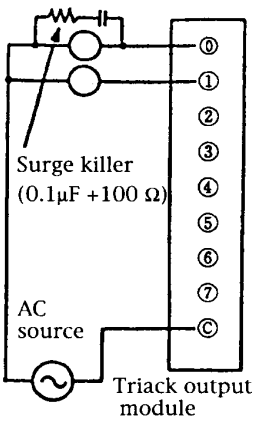
| Item | Relay output (POM-R, RH, etc.) | Transistor output (POM-T, TH, etc.) | Triac output (POM-S, SH, etc.) |
|---|---|---|---|
| External wiring |  |  |  |



**Figure 11.3.6 Output wiring**

(f) Relay output module wiring

① Service life of relay contacts

- Relay contact has a service life of more than 0.2 million times operation under 120V AC and 2A resistive load, and 1 million or more operation when load is applied from an electromagnetic contactor (Hitachi H10C:45VA at ON operation and inductive load 9 VA after ON operation).
- The service life is inversely proportional to the square of current (life quadruples when current is reduced to half). So attention must be paid since the life is significantly shortened when breaking a rush overcurrent or directly driving a capacitor load. In case the circuit need be opened/closed frequency, use of a transistor module or triac output module is recommended.

In case the contactor opens and closes frequently, use the transistor output module or the triac output module .

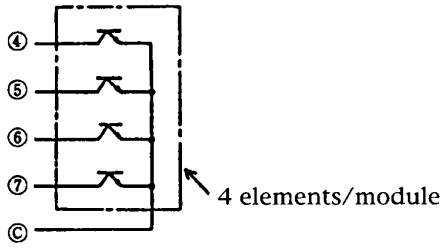
② Surge killer

For an inductive load beyond a coil capacity of 10VA, connect a surge killer (0.1μF capacitor + 100 Ω resister) in parallel with load. Connect a flywheel diode to DC load.

(g) Transistor output module wiring

① To be used for controlling DC load. Although a protection circuit is built in the module against surge which would be induced by an inductive load, it is recommended to suppress occurrence of surge by connecting a flywheel diode (with current 1 A and peak inverse voltage 250V as a standard) in parallel with inductive load as shown in Figure 11.3.6.

② The transistor is of a compound type composed of 4-elememt unit. Therefore, the current must be limited to 1.25A for 4 circuits across terminals 0 to 3, 4 to 7, 8 to 11, and 12 to 15. Assign the loads so that the operating current is within the limit.



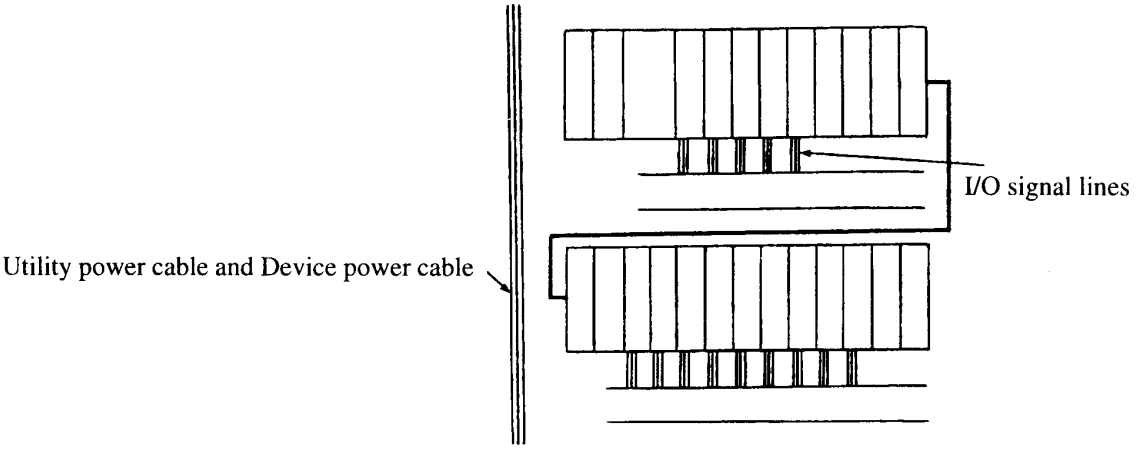

(h) Triac output module wiring

① To be used for controlling AC load

② Since a snubber circuit is built in the module for protecting the triac, a leakage current flows (3 mA with 220V AC and 1.5 mA with 110 V AC).

When an extremely small current load or lamp load is connected, the module might turn ON in error or might not be able to turn OFF. Such a phenomenon due to leakage current can be prevented by connecting a dummy load (aforementioned 0.1μF capacitor + 100 Ω resistor) in parallel with load.

**(6) Placing cables for expansion of devices**




Install the expansion cables (CNEB-06, CNM-10) separately from the power source cables, I/O signal wires, power supplying systems.

A cable, if unavoidable to be installed close to such wires or cables from some reason, must be placed perpendicular as practically as possible to such cables or wires.

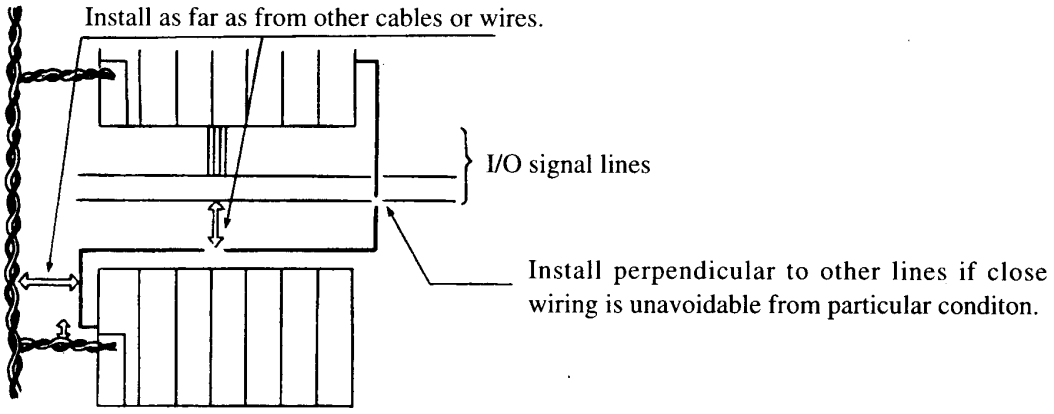



**Figure 11.3.7 Example of installation of the expansion cables**

### (7) Installation of the cables for the communication modules and the sophisticated modules

The cables for the communication modules and the sophisticated modules will carry very low level or high speed signals. Therefore, never install such cables into cable ducts where cables or wires of other types are already accommodated. In addition, the ducts accommodating such cables should be installed as far as practicable from the ducts of other types. If an installation is unavoidable in the same duct together with cables of other type due to particular circumstances, such cables should be covered by steel pipes or the like for shielding purposes.

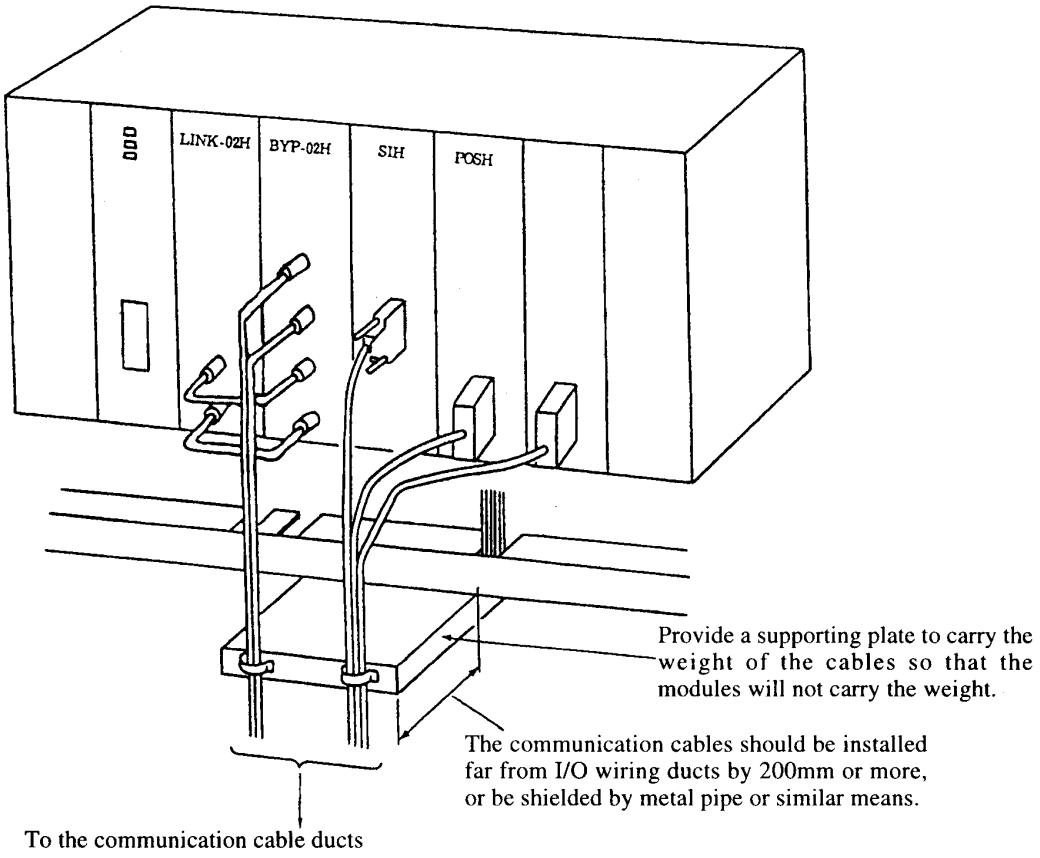



**Figure 11.3.8 Example of cables for the communication modules**

### (8) Wiring example (H-250/252 RemteI/O system)

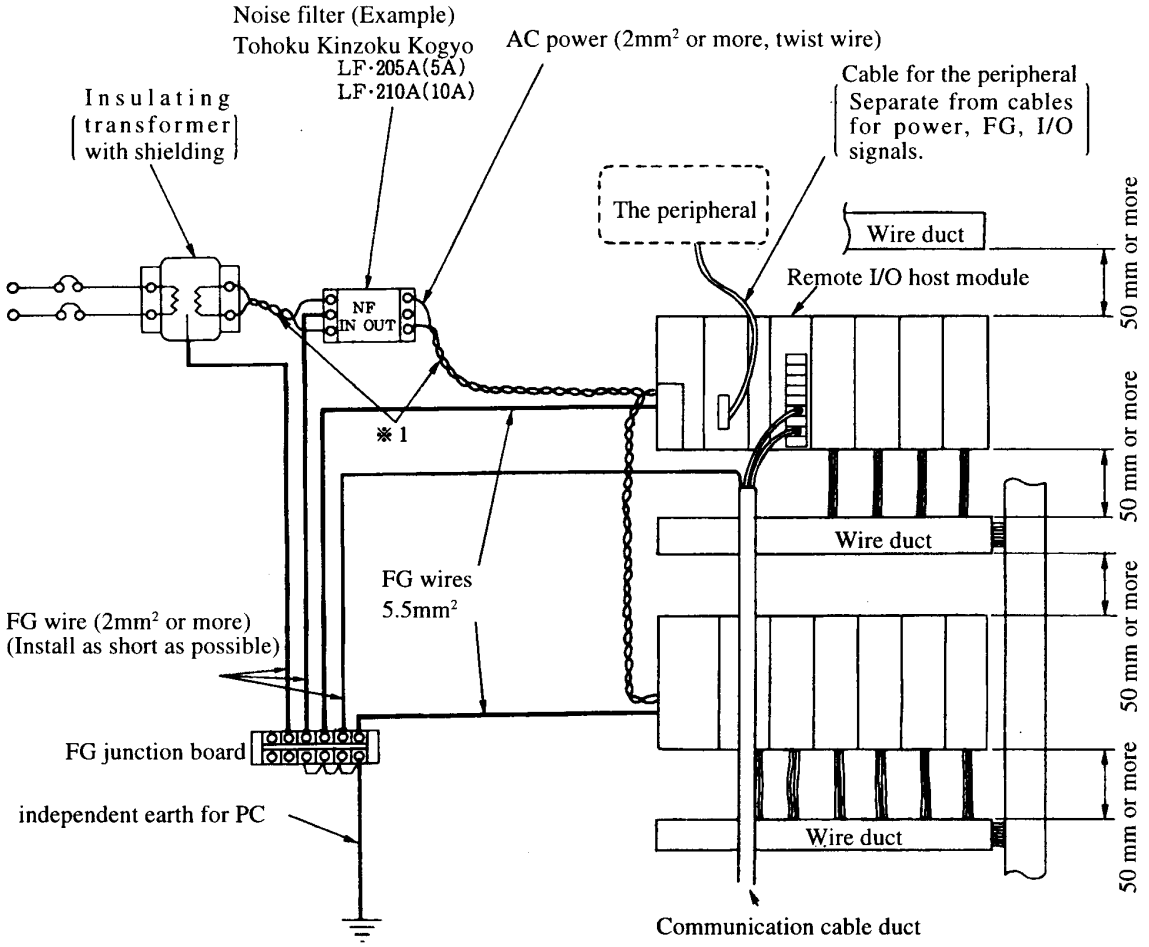



**Figure 11.3.9 Wiring example (H-250/252 RemteI/O system)**

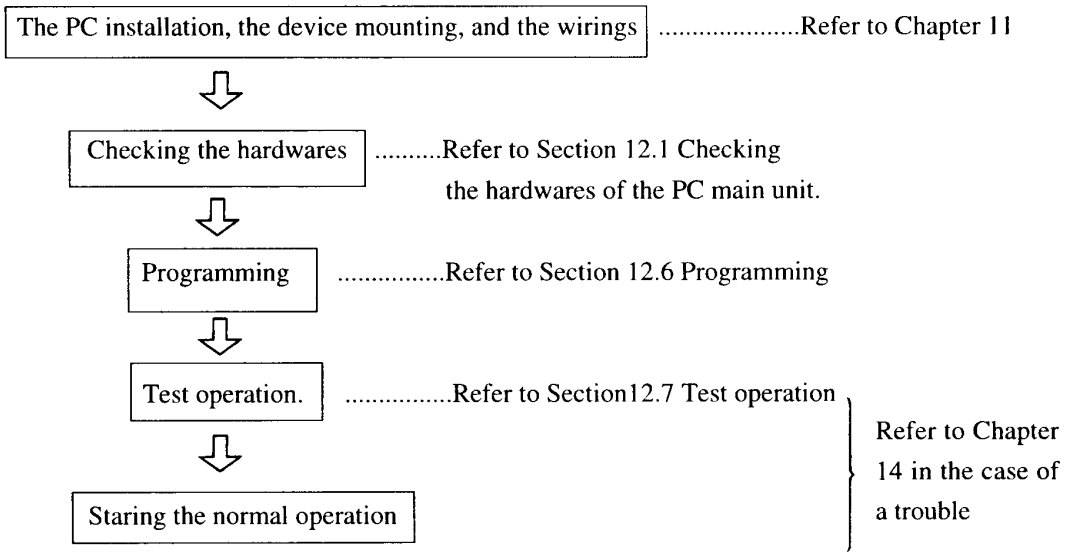
*1 The primary cable set and the secondary cable set should be installed separately and not be in a parallel position each other.

# Chapter 12 Preparations for Operation

Example of procedures for putting into operation is shown below for a PC system.

Descriptions of this chapter are made on the assumption that the PC installation, the device mounting and the wirings have been satisfactorily finished.

**Flow Diagram of the Starting Up**




## 12.1 Checking the Hardwares of the PC Main Unit. (Before supplying the power)

① Checking the battery in the CPU

- Check that the lithium battery is mounted correctly. (Including the connector fitness of the battery connectors).

② Setting the dip switch.

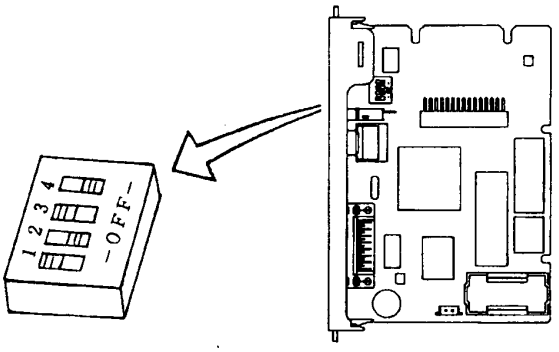


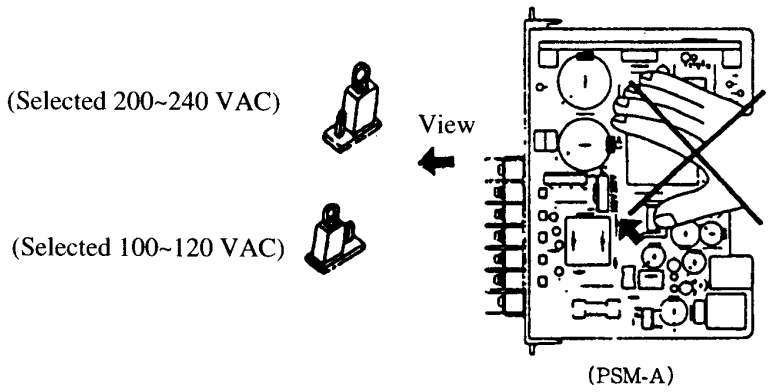

**Table 12.1.1 Setting of the dip switch**

| No. | Function | Setting | | | |
|---|---|---|---|---|---|
| | | 2400bps | 4800bps | 9600bps | 19200bps |
| 1 | Baud rate setting in a personal computer connection | ON | ON | OFF | OFF |
| 2 | | ON | OFF | ON | OFF |
| 3 | I/O processing system | Refresh mode : ON | | Direct mode : OFF | |
| 4 | Remote setting | Remote : ON | | Normal : OFF | |

Factory setting : No.1 ON, No.2 OFF, No.3 ON, No.4 OFF

③ Setting the source voltage.

H-250/252 can be used for either 100 VAC or 200 VAC source by selecting the position of the selecting connector mounted on the power module board. Select the power selector position in accordance with the source voltage as shown below . When the 100VAC is selected, stick the voltage name plate supplied with the equipment. The position is set at 200VAC in the manufacturer's factory.




Caution

If 200 V source is applied when the above setting is selected at 100 V, the module will be damaged. Be sure to confirm avoid such over voltage before connecting the power supply source.

## 12.2 Items to be checked prior to the operation.

### (1) Starting time

**Table 12.2.1 Times necessary to start up the CPU modules**

Unit : second (maximum value)

| Status of the Power source | OFF → ON | ON status | ON status |
|---|---|---|---|
| Position of the key switch | STOP | STOP → RUN | RUN → STOP |
| Capacity of program 4k steps | 2.7 (3.7) | 1.5 (2.6) | 0.06 (0.06) |
| Capacity of program 8k steps | 3.3 (5.4) | 2.8 (5.1) | 0.06 (0.06) |
| Capacity of program 16k steps | 4.3 (8.8) | 5.5 (10.3) | 0.06 (0.06) |

※The Figure shows the case that the memory pack is not mounted. Will become the value in the parenthesis in the care that the memory pack is mounted.

**(2) Internal sequence at the time the power supply is started.**

Figure 12.2.2 shows the operating status of H-250/252 for the power source wave form of H-250/252 and the start switch.

(a) The power is started to be supplied when the start switch of H-250/252 is turned to ON (the switch position in RUN).

The computation processing is started as shown in No.1.

During this period, no external input, even if made ON, will be taken into the system

(b) The start switch is turned to ON after the power supply is started.

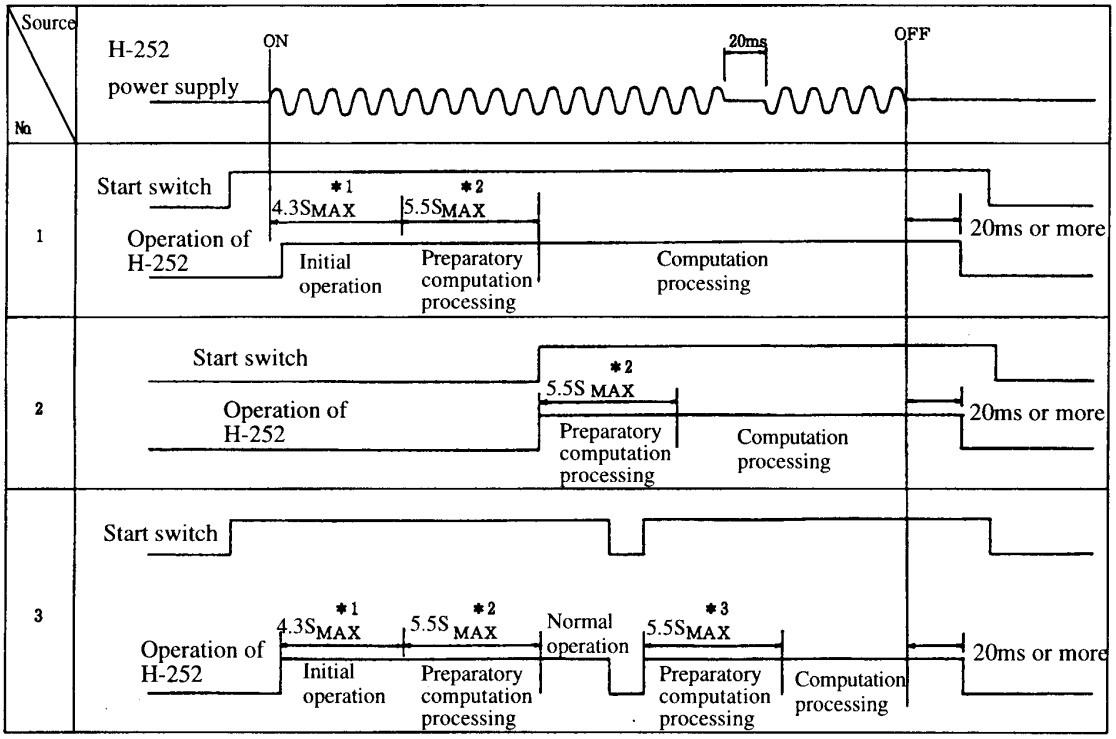
The computation processing is started as shown in No.2.

(c) The start switch is turned OFF during the operation.

The unit is stopped (reset) as shown in N0.3 when the start switch is turned OFF.

When the start switch is released from OFF, H-250/252 will start computation processing again after the preparatory computation processing is completed.

**Table 12.2.2 Internal sequence at the time the power supply is started(H-252)**



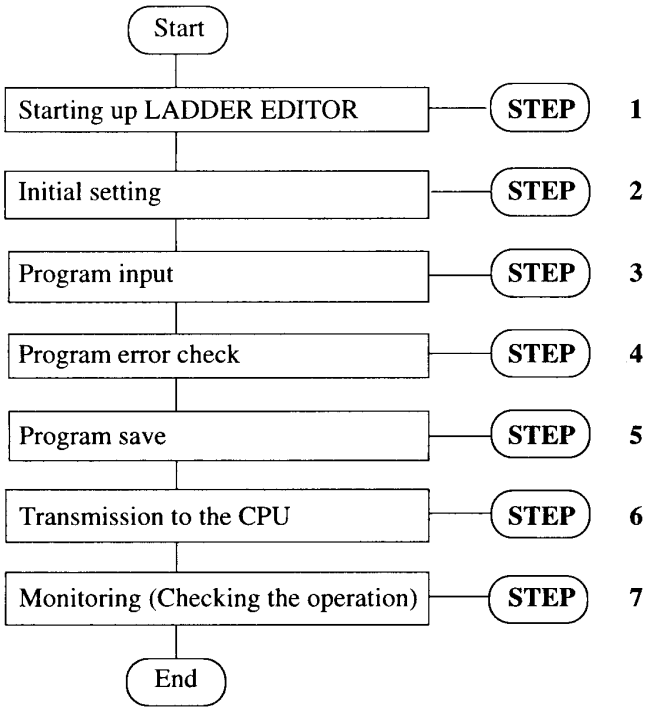

*1 The figure shows the case that the memory is not mounted when the capacity of program is 16k steps. Will become 8.8s MAX in the case that the memory pack is mounted.

*2 The figure shows the case that the memory is not mounted when the capacity of program is 16k steps. Will become 10.3s MAX in the case that the memory pack is mounted.

## 12.3 Brief examples of operations

For a better understanding of the basic operation of H-250/252, this section describes the items to be carried out at least in the process starting from the unpacking and ending at checking the operation by the relay ladder program.

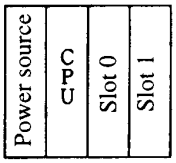
### (1) Checking procedure of the operation



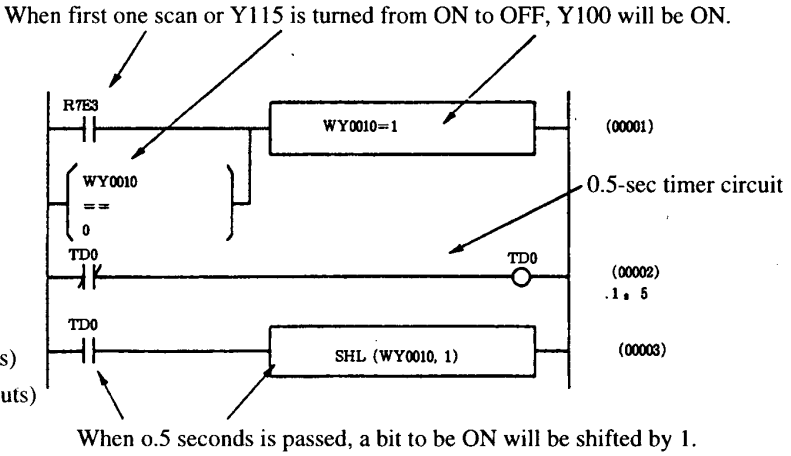

The personal computer LADDER EDITOR is taken as a example of the peripheral equipment. For details, the manuals for the various peripheral equipment.

### (2) Example of the operation

The basic example of operation is explained by the following module and the sample program, being started from STEP 1.




Power source : PSM-A
Basic base : BSH-3
CPU : CPU22-02HB
Slot 0 : PIM-AH (16 inputs)
Slot 1 : POM-RH (16 outputs)



## (STEP) 1 Starting up LADDER EDITOR

1. Starting up the personal computer.

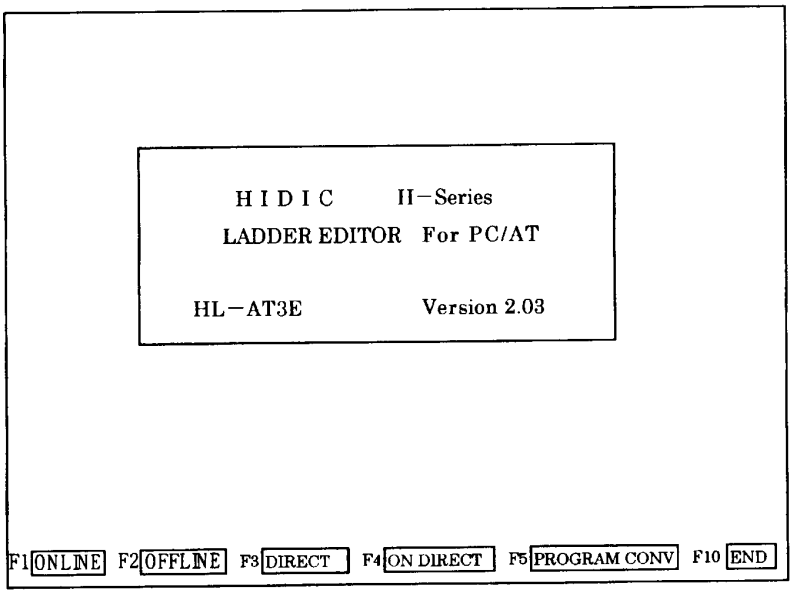
   Start up the personal computer. Make the MS-DOS prompt appear on the screen.

2. Start up LADDER EDITOR (GRS display)

   Enter [H] [L] after the MS-DOS prompt. LADDER EDITOR will start up.

   "GRS screen" will appear.

GRS screen



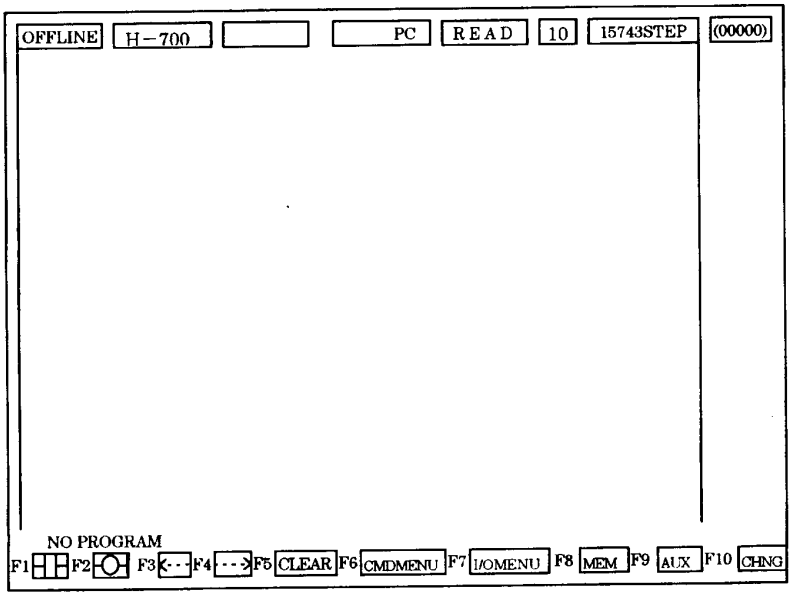

In the following explanation the keys expressed in [ ] mean the function keys (F1~F10), the keys in [ ] mean the keys other than the function keys (Alphabet•Symbols•Numeric).

3. Read out screen

   Select [OFF LINE] in order to switch from the GRS display to "OFF LINE" which requires no CPU.

   "Read out screen" will appear.

Read out screen



## STEP 2 Initial setting

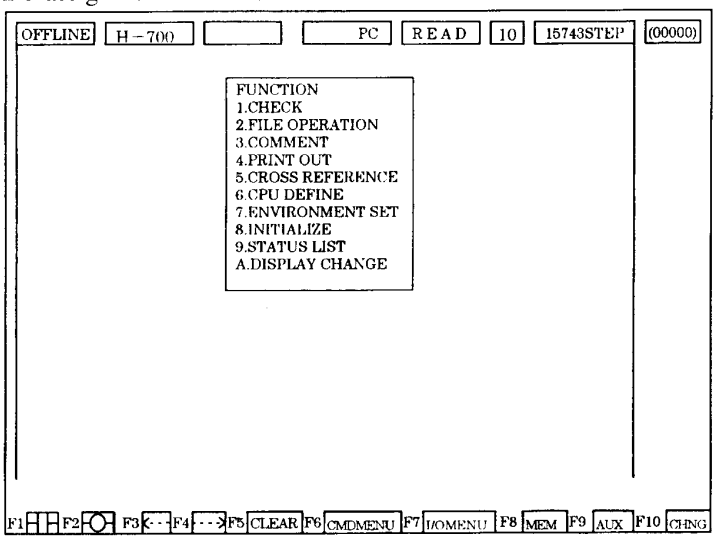
The CPU type, the memory type, and I/O assignment will be set.

1. Setting the CPU type

In the "Read out" screen, select [AUX].

FUNCTION display will appear.

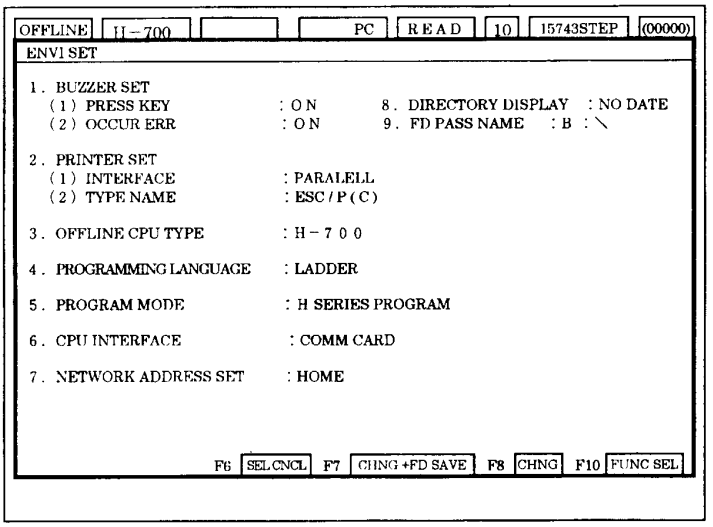
FUNCTION screen




In FUNCTION screen, select ENVISET by [↓] [↑] , press [Enter] (or press [7]).

ENVISET display will appear.

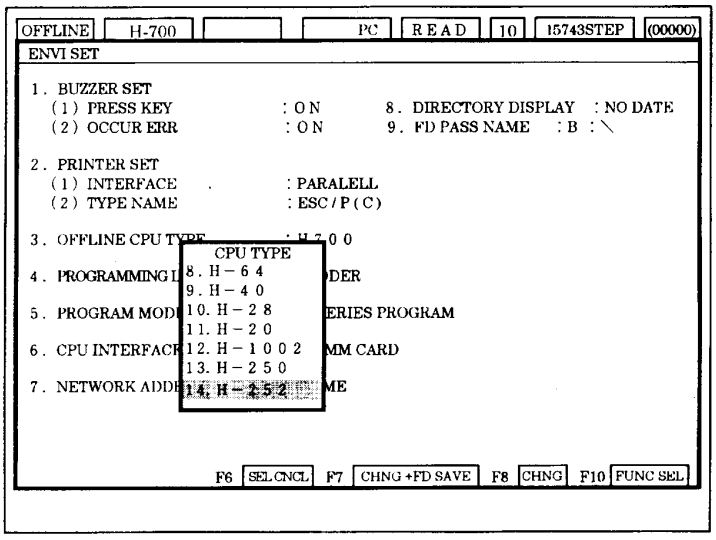
ENVISET screen




In ENVISET screen, select "3. OFF LINE CPU TYPE" by [↑] [↓] , press [Enter] , select the CPU type (H-250 or H-252) by [↑] [↓] , press [Enter].

By pressing [CHNG], the settings will be registered in the memory.

CPU type selecting screen




Press [FUNC SEL].

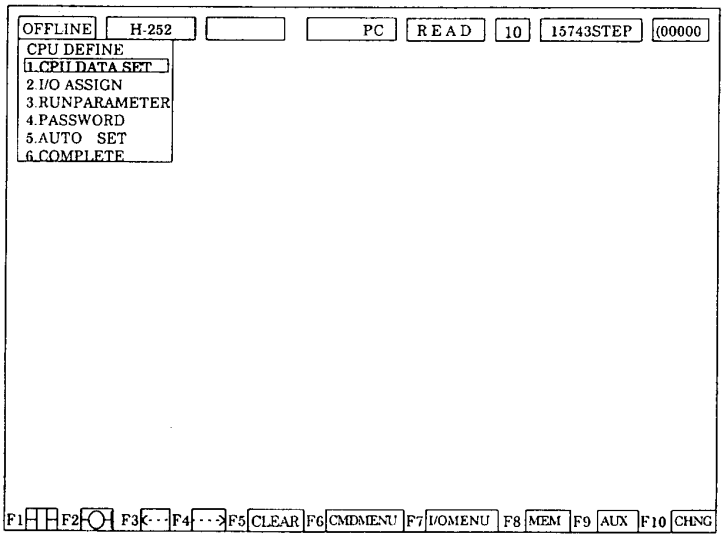
The display will be returned to FUNCTION screen.

When [CHNG + FD SAVE] are pressed, the settings will also be saved in HD (hard disk drive) after they are written in the memory. The same settings will be given subsequent start up after the power is OFF.

2. Setting the memory type

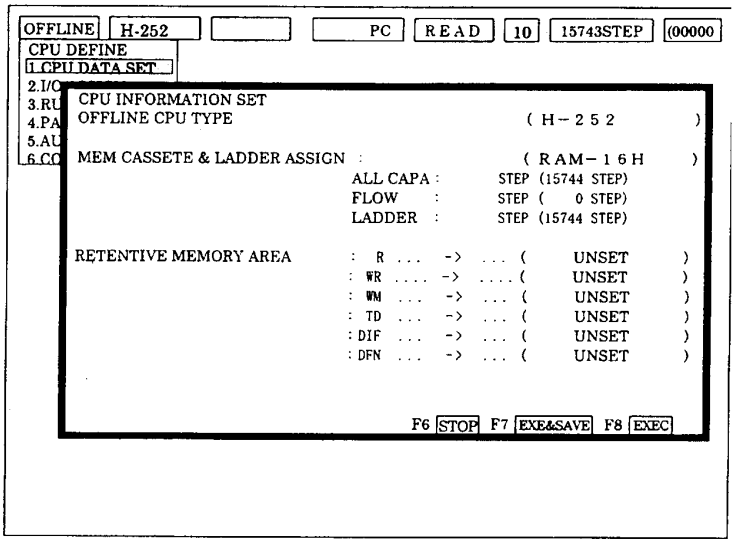
In FUNCTION screen select [CPU DEFINE] by [↑] [↓] , press [Enter] (or press [6] ).

CPU DEFINE



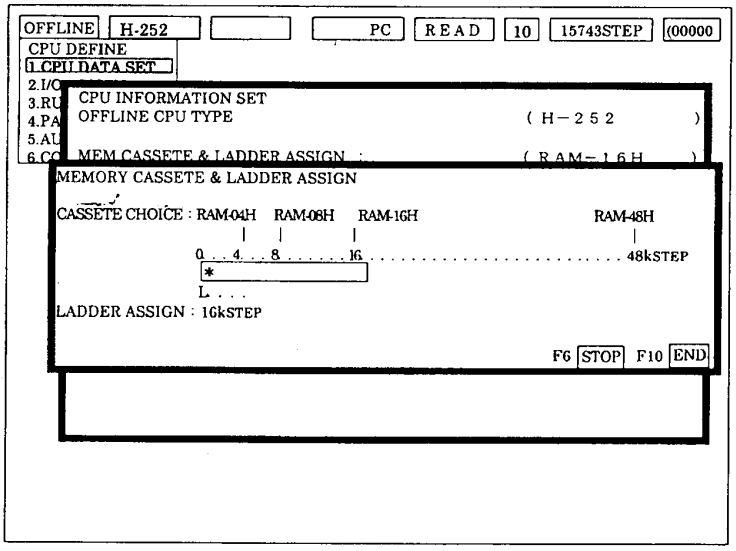

In CPU DEFINE screen, with the cursor at "CPU DATA SET", press [Enter] (or press [1] ).

CPU INFORMATION




With the cursor set at "MEM CASSETE & LADDER ASSIGN", press [Enter] .
Select a memory cassette type by [←] [→] , press [Enter] , select [END].

MEM CASSETE & LADDER ASSIGN




At CPU INFORMATION, press [EXEC], the setting will be written in the memory.

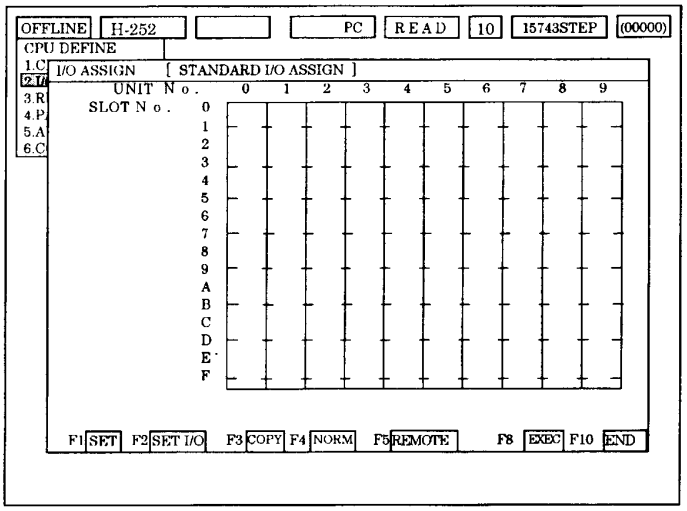
Select RAM-16H for H-252, RAM-08H for H-250

Press [END], the display will be returned to "CPU DEFINE".

3. I/O assignment

At "CPU DEFINE", shift the cursor to "I/O ASSIGN" by [↓], press [Enter] (or press [2]).

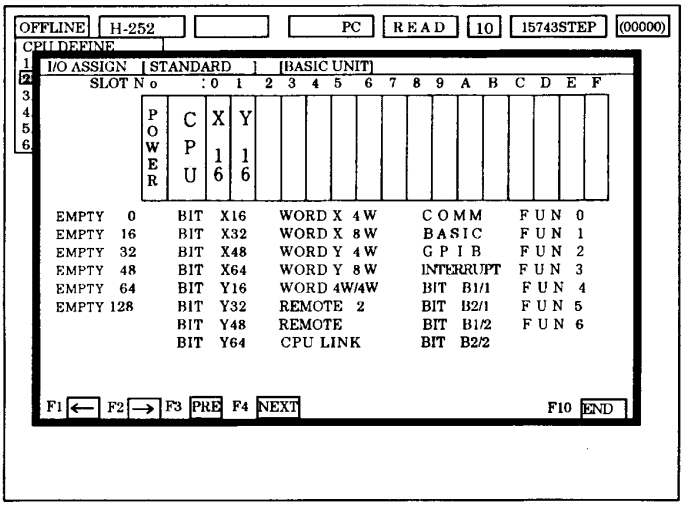
I/O ASSIGN




At "I/O ASSIGN", select [SET]. "Unit Input screen" will appear.

Select a slot by [→]or [←], select the module type to be used by [↓] [↑] [←] [→], press [Enter].

Unit Input screen

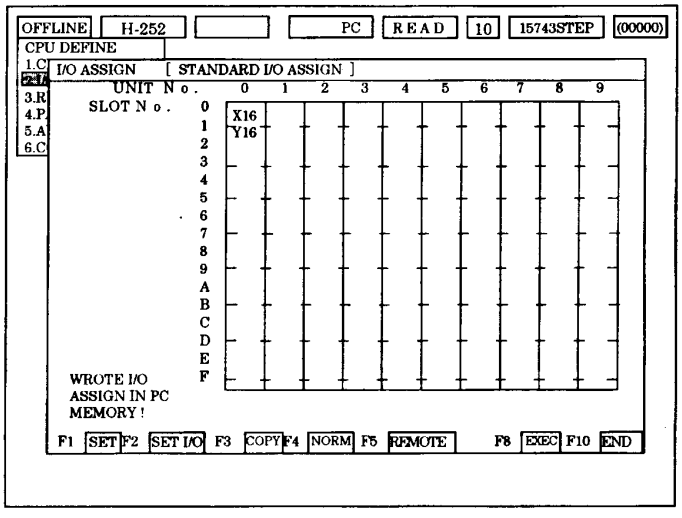



After inputting, select [END], the screen will be returned to "I/O ASSIGN".

If an incorrect input was made, assign "EMPTY 0" to empty the slot. Then the slot will become unassigned.

Confirm the content of setting, select [EXEC] in "I/O ASSIGN". "WROTE I/O ASSIGN IN PC MEMORY !" will appear on the low-left of the screen and the setting will be written in the memory.

I/O ASSIGN END




When [END] is selected, the screen will be returned to "CPU DEFINE".

Press [ESC] twice to return to "Read out" screen.

In H-250/252, reading [SET I/O] is not possible. Select and input a module type in accordance with the module type to be used.

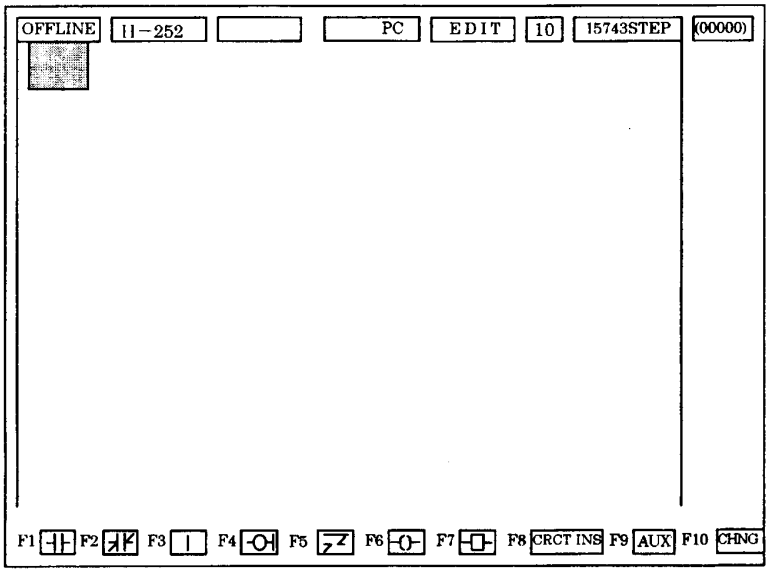
## STEP 3 Program input

Input the sample program

In "Read out" screen, "NO PROGRAM" is shown on low-left of the screen. In this status, "EDIT" is not assigned for the function keys. Select [CHNG] to show "EDIT", then select [EDIT].

EDIT screen will appear.

EDIT screen



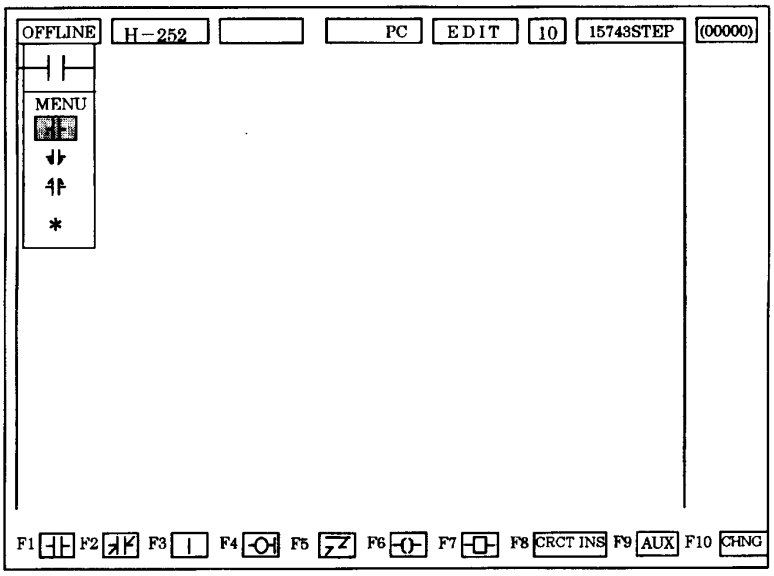

Input " ⊣⊢ R7E3".

Select [ ⊣⊢ ].

MENU screen will appear with "⊣⊢ " shown on it.

Select a symbol to be inputted by [↓] [↑], press I/O No. [R] [7] [E] [3] [Enter] .

" ⊣⊢ R7E3" input screen




Likewise, input for other circuit too as shown below.

(1) Two horizontal lines, and one vertical line.

[-] [Enter] [-] [↓] [ | ] (The vertical line must be inputted top right of the cursor)

(2) Input the Relational Box "[WY10 = = 0]".

Select [—[ ]—] by [←] [→].

Select [S1 = = S2] on MENU screen. (Shift the cursor by [↑] [↓] [←] [→] ).

[W] [Y] [1] [0] [ ] [=] [=] [ ] [0]

Press [Delete] 5 times, press [Enter] .

Note that a space must be entered between I/O No. and a relational operator (in this example between "WY10" and " = = "), and also between a relational operator and a relational data (in this example between " = = " and "0").

(3) Input the operational box "WX10 == 1".

Select [—□H] by [↑].

Press [W][Y][1][0][ ][=][ ][1][→]

Do enter a space in the front and the rear of "=".

(4) Input "b" contact " ⊣/⊢ TD0".

Select [ ⊣/⊢ ] by [↓] .

Press [T][D][0][Enter].

(5) Input On-Delay timer "—○H TD0.1S 5".

Select [ —○H ]. (When [ —○H ] is selected, the cursor will be shifted to the extreme right on the existing cursor line.)

Press [T][D][0][ ][.][1][S][ ][5][Enter]

Do enter a space between I/O No. and the time base (in this example, between "TD0" and ".1s"), and also between the relational time base and the set value (in this example, ".1s" and "5").

(6) Input " ⊣ ⊢ TD0" and the application command "SHL(WY10, 1)"

Select [ ⊣ ⊢ ], and press [T][D][0][Enter].

Select [ —□H ], and press [S][H][L][ ][(][W][Y][1][0][,][1][)][Enter].

Here all circuit have been inputted. But the data now inputted are not written on the editor memory yet. Before the data are written, check that there is no mistake in the input data.

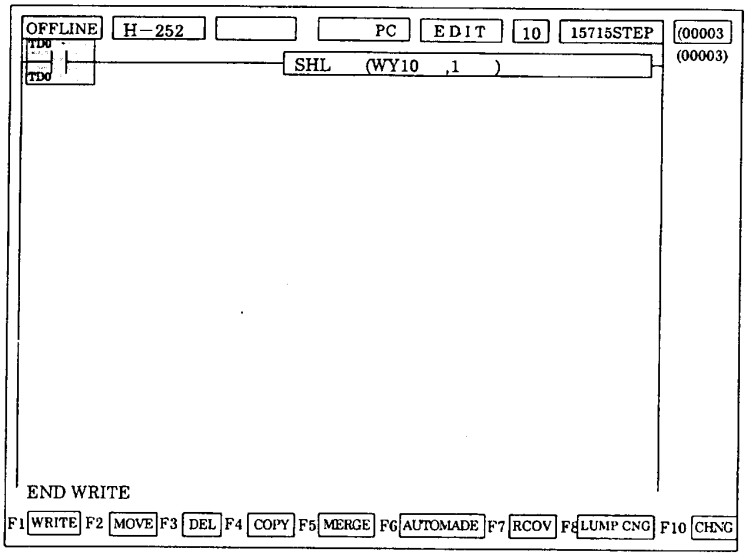
2. Writing on the memory

Show the function key "WRITE" on the screen in order to write the circuits on the memory.

Select [CHNG] twice, and select [WRITE].

END WRITE screen

"END WRITE" will appear on bottom left of the screen.




Press [ESC] , to return to "Read out" screen.

## STEP 4 Program error check

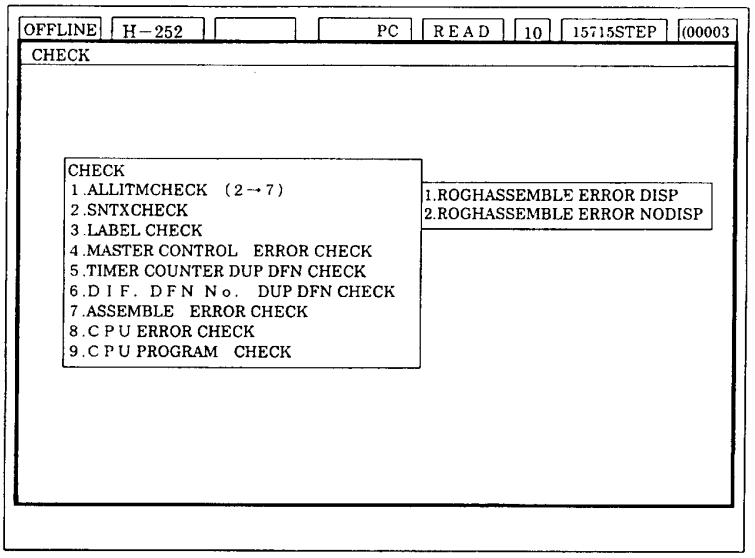
Check that the program is written correctly on the memory.

Select [CHNG], then select [AUX].

Confirm the cursor is on "CHECK" in the "FUNCTION screen", press Enter. (or press 1)

"CHECK screen" will appear.

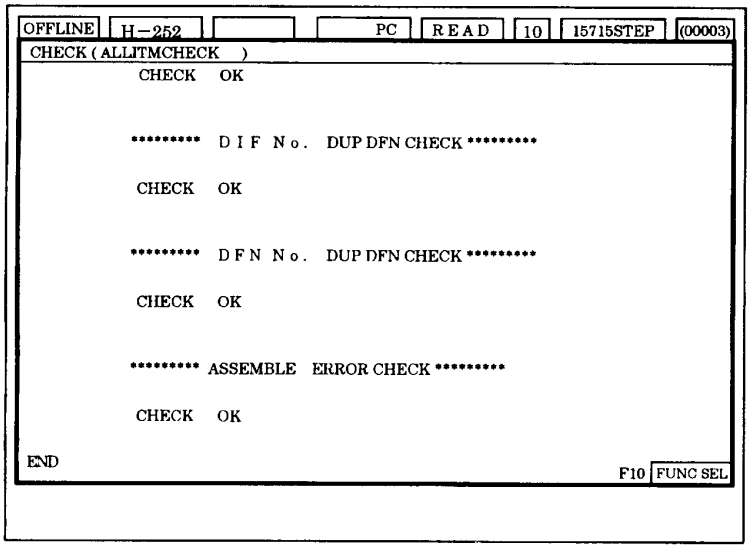
CHECK screen




In "CHECK screen", select "ALLITMCHECK".

Press Enter twice, then the checking will start.

All item check completed screen




After the checking is finished, review the check result and error details scrolling the screens by ↓ ↑.

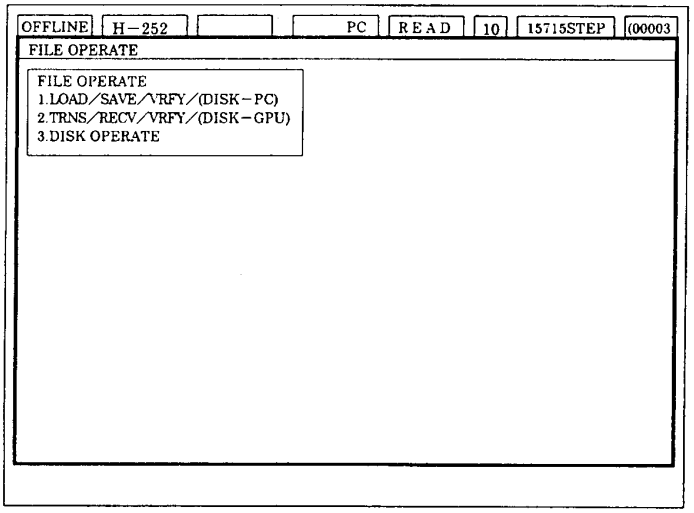
If any error is found, return to "Read out screen" and correct the program. If no error is found, select [FUNC SEL], press ESC. Then "FUNCTION screen" will appear.

## STEP 5 Program save

The written program is saved in a floppy disk. (When using a new unformatted disk, initialize the disk)

In "FUNCTION screen" select "FILE OPERATION" and press [Enter]. (or press [2] )

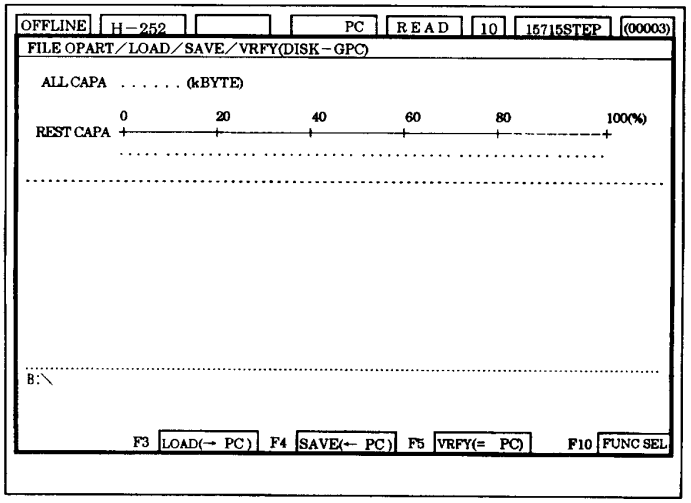
FILE OPERATION screen




In "FILE OPERATION screen", confirm the cursor is on "1. LOAD/ SAVE/VRFY (DISK-PC)", and press [Enter]. (or press [1])

In "File function selection screen", select [SAVE ( ← PC)], confirm the cursor is on "H SERIES PRG" in "FILE TYPE", then press [Enter]. (or press [1])

File function selection screen

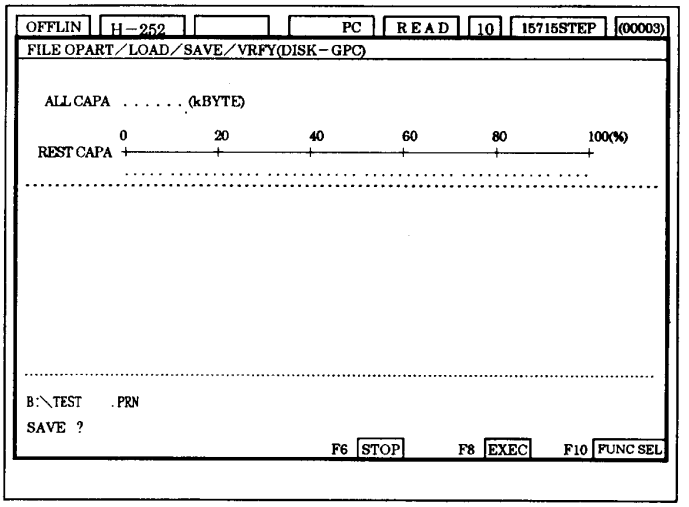



Enter the file name (within eight characters). (The extension "PRN" is fixed)

Here the file name "TEST" is used.

Press [T] [E] [S] [T] [Enter] , then select [EXEC].

File name input screen




"SAVED" will appear on the bottom left of the screen.

In order to return the screen to "GRS", select [FUNC SEL], then press [ESC] twice.

Next select [CHNG], then select [GRS].

## STEP 6 Transmission to the CPU

Write the inputted program into the CPU, confirming the following items.

- The cables are connected correctly to the CPU and the personal computer.
- The power switch of the CPU is turned on.
- The mode selection switch of the CPU is in "STOP".

1. Initialize CPU.

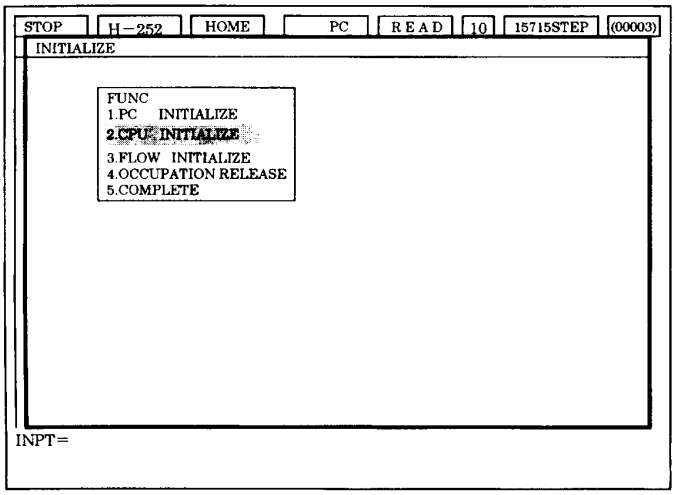
In "GRS screen" select [ONLINE].

In "Reading out screen" select [AUX].

IN "FUNCTION screen" shift the cursor to "8. INITIALIZE", press [Enter]. (or press [8])

"Initialize function selector screen" will appear.

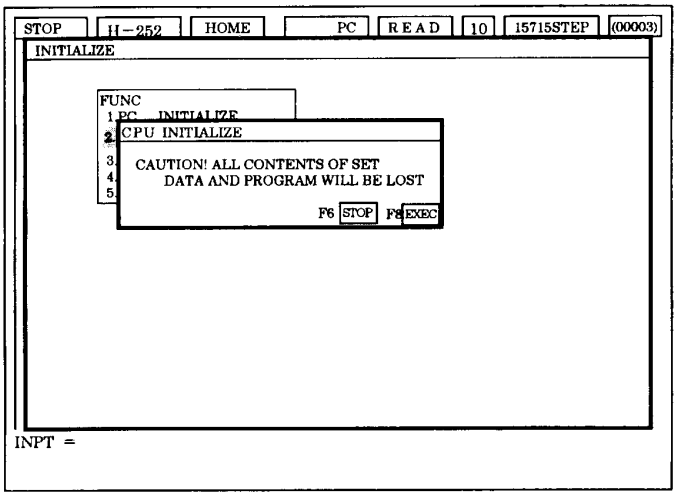
Initialize function selector screen




Select "CPU INITIALIZE" by [↓] and press [Enter] (or press [2])

In order to initialize select [exec]

CPU INITIALIZE screen




When "COMPLETED" appears, select [END].

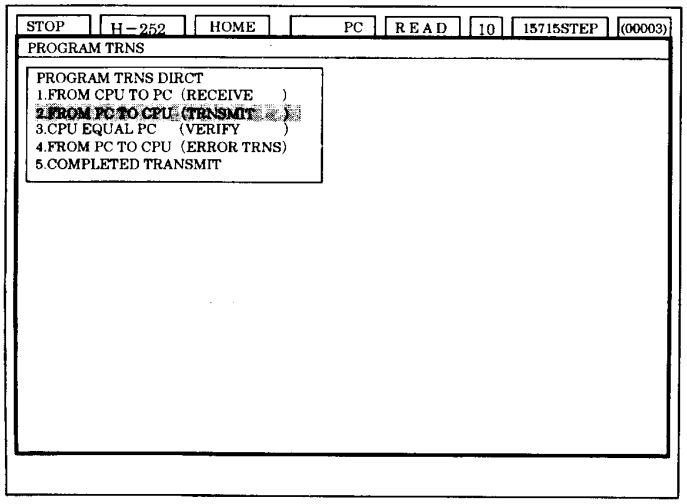
Press [ESC] twice to return to "Read out"screen.

2. Transfer to the CPU.

In "Read out screen" select [CHNG], then select [TRNS].

"PROGRAM TRNS DIRCT" screen will appear.

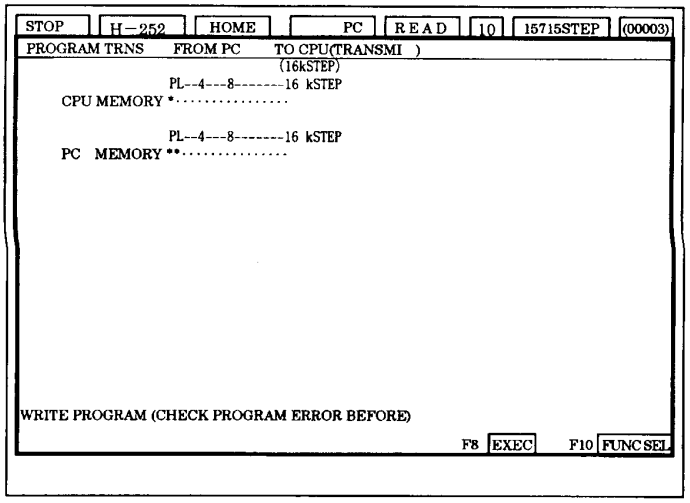
PROGRAM TRNS DIRCT




Select "2. FROM PC TO CPU (TRANSMIT)" by [↓], press [Enter] (or press [2]).

"PROGRAM TRNS screen" will appear.

PROGRAM TRNS screen




When [EXEC] is selected, "NOW WRITING" will appear.

When writing is finished, "WROTE PROGRAM" will appear on the bottom left of the screen.

Press [ESC] twice to return to "Read out" screen.

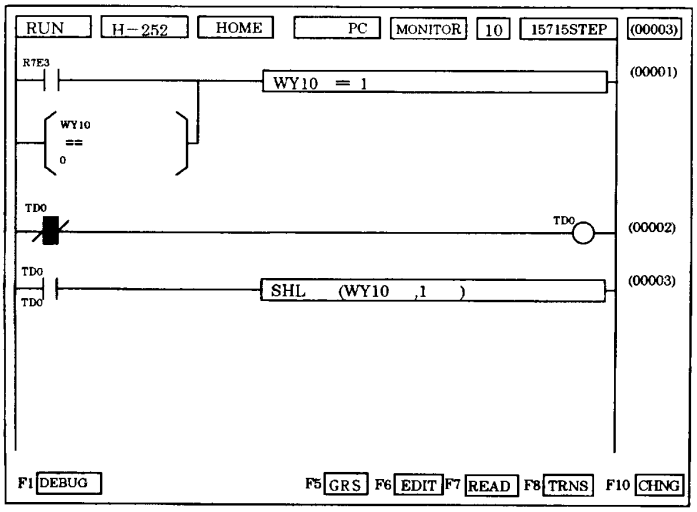
## (STEP) 7 Monitoring (Checking the operation)

Monitor EXEC status of the program in the CPU.

In "Read out screen", select [MONITOR] to show "Monitor screen".

To show from the top circuit, press [1] [Enter].

MONITOR screen

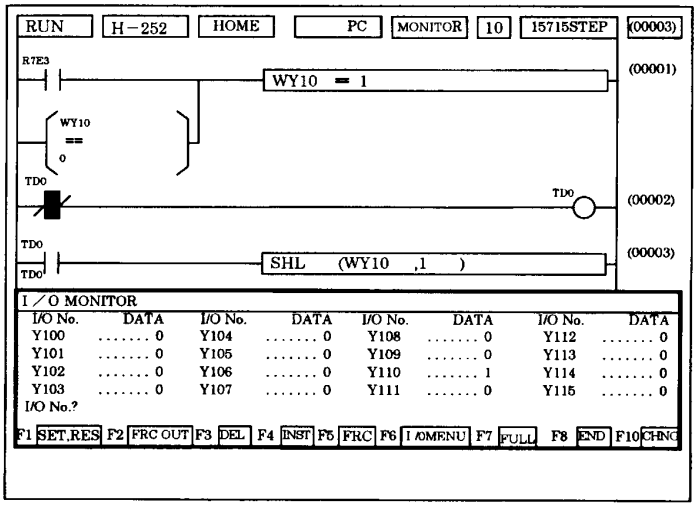



By turning the CPU mode selection switch to "RUN" position, put the CPU into operation.

Select [CHNG], change the function keys, and then select [I/OMON].

"I/O monitor compressed screen" will appear.

I/O monitor compressed screen




Input the top I/O No. (Y100) to be monitored.

Press [Y] [1] [0] [0] [Enter].

Show ON/OFF information from Y100 to Y115.

When [FULL] is selected, "I/O monitor enlarged screen" will appear to enable monitoring 64-points I/O.

In the sample program, the operation can be verified by the monitor screen that output Y100~Y115 is switched over every 0.5 seconds.

Thus the series of operations is completed at STEP 7.

When turning off the power supply for the personal computer, return the LADDER EDITOR to the GRS screen, select [END] twice to return the screen to MS-DOS, then turn OFF the power.

## 12.4 Initial Setting

### (1) Initializing the CPU

When using the new CPU module, it is necessary to initialize the CPU.

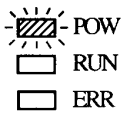
**Caution**

When the CPU is initialized, all the content of the program memory and other settings will be cleared. When initializing the CPU, make sure that clearing all such data is acceptable.

For details of the CPU initializing, refer to the following items in the manuals for the peripheral equipment.

| Peripheral equipment | Reference item |
|---|---|
| Portable Graphic Programmer (PGM-GPH) | Chapter 7 Initializing Function |
| Command Programmer (PGM-CHH) | Chapter 7 Initializing Function (Manual) |
| H-series Ladder diagram/Command software (LADDER EDITOR) | Chapter 2 2.12 Initializing the Memory (Initialize) |

**Checking abnormal operation**




- Check the status indicator (Lighting or extinguishing of each LED) of each module.
- Check that the POW lamp of each power module is lighting.

**Caution**

Check that there is no indication of the error code "71 (Battery error)" of (Special internal output WRF000), etc. or that the ERR lamp is not lighting nor flickering. If any error code is indicated in WRF000, confirm the error code, and take remedial measure referring the error code list attached to the manual.

(2) Setting the CPU

Set each "parameter" necessary for program generation, program transfer to the CPU, etc.. If the CPU is not yet initialized, the CPU initialization must be made first.

Contents of setting are detailed bellow.

<table>
<tr><th>No.</th><th>Function</th><th>Description</th><th>Necessity</th></tr>
<tr><td>1</td><td>Password</td><td>• To registers a 4-digit hexadecimal password in the program.<br>Once a password has been registered for the program, the program does not allow display, change, etc. unless the correct password is inputted. *1<br>No password has been factory-set.</td><td>Use this function to preserve program secrecy.</td></tr>
<tr><td>2</td><td>CPU type</td><td>• To set the CPU name and memory capacity for programming.<br>For H-250/252 CPU, the setting must be as follows. (In the case of LADDER EDITOR, the off-line CPU type must be set as H-250, H-252 each).
<table>
<tr><th rowspan="2">Memory</th><th colspan="2">CPU type</th><th colspan="2">Memory type</th></tr>
<tr><th>H-250</th><th>H-252</th><th>H-250</th><th>H-252</th></tr>
<tr><td>Without memory pack</td><td>H-300</td><td>H-700</td><td>RAM-08H</td><td>RAM-16H</td></tr>
<tr><td>With MPH-4E</td><td>H-300</td><td>H-700</td><td>RAM-04H</td><td>RAM-04H</td></tr>
<tr><td>With MPH-8R</td><td>H-300</td><td>H-700</td><td>RAM-08H</td><td>RAM-08H</td></tr>
<tr><td>With MPH2-4E</td><td>H-300</td><td>H-700</td><td>RAM-04H</td><td>RAM-04H</td></tr>
<tr><td>With MPH-8E</td><td>H-300</td><td>H-700</td><td>RAM-08H</td><td>RAM-08H</td></tr>
<tr><td>With MPH-16E</td><td>H-300</td><td>H-700</td><td>RAM-08H</td><td>RAM-16H</td></tr>
<tr><td>With MPH-16R</td><td>H-300</td><td>H-700</td><td>RAM-08H</td><td>RAM-16H</td></tr>
</table>
(Note) In case ROM is provided, it must be confirmed that the right program is written in the ROM.</td><td>CPU type must be set whenever you conduct programming</td></tr>
<tr><td>3</td><td>Memory assignment</td><td>• To assign ladder program area in the memory and set the range of data memory.</td><td>• Memory assignment is required when using data memory.</td></tr>
</table>

*1. If the password is missed, the password cannot be cancelled by the user. Extra care must be taken to manage the password.

| No. | Function | Description | Necessity |
|---|---|---|---|
| 4 | Operation parameter | •Operation and control<br>To be set when RUN/STOP is controlled by a predetermined one I/O point. (AND condition is formed together with RUN of the key switch)<br>When this condition is not set, turning the key switch to RUN will initiate the start up.<br>• Congestion check time<br>To be set for stopping the CPU when the normal scan exceeds the predetermined maximum processing time of the normal scan.<br>When this setting is not made the timing to stop the CPU will be set automatically at100ms.<br>• Abnormal operation mode<br>To be set for preventing the shutdown and continuing the operation when a minor failure occurs in the CPU.<br>Note) This setting should not be made except while debugging. | Set the parametrs to meet the particular object of the user. |
| 5 | I/O assignment | • To be set I/O assignment information of the CPU.<br>• As the H-250/252 is not provided with the copy function of I/O assignment, do set the I/O assignment in reference to the Table 12.4.1. | Never fail to set this data when programming is made. I/O assignment must be set whenever you condact programing. |
| 6 | Program name | Set the program identification name within 16 alphnumeric character.<br>The program name can be written in the CPU together with the program for the convenience of program management. | Set this data when effective identification and management are desired. |
| 7 | power failure memory protection | Storable range is set for data in a particular area of the CPU while the CPU power supply is OFF or in the course of starting up the RUN. The setting is effective for R, WR, WM, TD, DIF, DFN. | Set this function when some data need be stored while CPU is OFF.<br>Special internal output data of certain I/O No. are suject to the power failure memory protection unconditionally. |

For details of the initial settings, refer to the following parts of the manuals of peripherals.

| **Peripherals** | **Reference item** |
|---|---|
| Portable graphic programmer (PGM-GPH) | Chapter 7 Initial setting function |
| Command programmer (PGM-CHH) | Chapter 7 Initial setting function (Manual) |
| H-series LADDER/Command software (LADDER EDITOR) | Preface |

## Table 12.4.1 Assignment list

| I/O module type | | Specification | Type | I/O assignment code | No. of slots occupied | Installation at remote end |
|---|---|---|---|---|---|---|
| Standard input | 8 points input | 24 V DC | PIM-D | X16 | 1 | O |
| | | 110/220 V AC | PIM-A | X16 | 1 | O |
| | | 24 V DC(source type) | PIM-DP | X16 | 1 | O |
| | 16 points input | 24 V DC | PIM-DH | X16 | 1 | O |
| | | 110/220 V AC | PIM-AH | X16 | 1 | O |
| | | 24 V DC(source type) | PIM-DPH | X16 | 1 | O |
| | 32 points input | 24 V DC | PIH-DM | X32(WX8W) *2 | 1 | × |
| Standard output | 8 points output | Relay output | POM-R | Y16 | 1 | O |
| | | Triac output | POM-S | Y16 | 1 | O |
| | | Transistor output | POM-T | Y16 | 1 | O |
| | | Transistor output (source type) | POM-TP | Y16 | 1 | O |
| | | Relay output (independent contact) | POM-RC | Y16 | 1 | O |
| | 16 points output | Relay output | POM-RH | Y16 | 1 | O |
| | | Triac output | POM-SH | Y16 | 1 | O |
| | | Transistor output | POM-TH | Y16 | 1 | O |
| | | Transistor output (source type) | POM-TPH | Y16 | 1 | O |
| | 32 points output | Transistor output | POH-TM | Y32(WX8W) *2 | 1 | × |
| Hybrid I/O | 16 points I/O | 8 points DC input, 8 points transistor output | PHH-DT | B1/1 | 1 | O |
| | 32 points I/O | 16 points DC/TTL input, 16 points DC/TTL output | PHM-TT | B1/1 | 1 | O |
| Analog I/O | Input | Current 4 ~20mA, 8 points | AGH-I | WX8W | 1 | × |
| | | Voltage 0~10V, 8 points | AGH-IV | WX8W | 1 | × |
| | | Current 4~20mA, Voltage 0~10V, 8 points | AGH-IV2 | WX8W | 1 | × |
| | Output | Current 4 ~20mA, 4 points | AGH-O | WY8W | 1 | × |
| | | Current 4 ~20mA, 2 points | AGH-OD | WY8W | 1 | × |
| | | Voltage 0~10V, 4 points | AGH-OV | WY8W | 1 | × |
| | | Voltage 0~10V, 2points | AGH-ODV | WY8W | 1 | × |
| Communi-cation | Link | Host link, coaxial cable | LINK-02H | Link | 2 | × |
| | | Bypass relay for LINK02H | BYP-02H | DUM16 | 1 | × |
| | | Host link, twist pair cable | TLINK-02H | Link | 1 | × |
| | | I/O link, coaxial cable | RIOM | B1/1 *1 | 2 | O |
| | | Remote I/O mimi link module | REM-LH2 | Link | 1 | × |
| | | Parallel link, twist pair cable | IOLH-T | Link | 1 | × |
| | Remote | Host, twist pair cable | RIOH-TM | Remote | 1 | × |
| | | Local station, twist pair cable | RIOH-TL | Assigned to remote end | 1 | O |
| | | Local station, 32 points I/O | RIOH-DT | B1/1 | 1 (unit type) | O |
| | | Local station, built-in board | HR-20~64 | X16, Y16 | - | × |
| Special | Counter | 2-phase, 10kHz, 16 bits | CTH | FUN3 | 1 | × |
| | Thermo-couple input | Type J, K 8 points | THH | WX8W | 1 | × |
| | Serial I/O | RS-232C | SIH | 4/4W | 1 | × |
| | Positioning | 2-axis pulse | POSH | 4/4W, DUM16 | 2 | × |
| Unused slot | | Unused slot cover | CVM | DUM16 | 1 | O |

*1. B1/1 must be set both on 2 slots of RIOM.
*2. Although WX8W (or WY8W) can be assigned, they can not be handled as bit data.
* If an empty slot is not assigned as "EMPTY 16" (" DUM 16" in the portable graphic programmer), I/O No. since the next slot shifts. Please assign "EMPTY 16" to an empty slot.

○ : possible
× : Impossible

## 12.5 Inspection of I/O cables

① Check cables for the external input devices.
② Check cables for the external intput devices.

### (1) Check cables for the external input devices.

Check in accordance with the following procedure.

① Confirm that the CPU is in STOP.
② Turn ON the power source of each external input device.
③ Check for correct wirings of external input devices, turning ON/OFF external inputs manually.

Such check work consists of the following procedures with the external I/O devices being turned ON/OFF.

| How to check | | Description |
|---|---|---|
| See LED on the I/O module | | Confirm the correctness of the wiring by confirming lighting of LED of the corresponding module. |
| Monitoring by peripheral equipment | I/O monitor | Confirm the correctness of the wiring by reading the input status, specifying the input No. through the monitor function oh a programming device. |
| | Monitor list (only for LADDER EDITOR) | Check procedures will be made efficiently by this function to monitor input status of 64 points simultaneously. |

For details of the monitor function, refer to the manuals of the external devices.

| **Peripheral equipment** | **Reference item** |
|---|---|
| Portable Graphic Programmer (PGM-GPH) | Chapter 5 Monitor |
| Command Programmer (PGM-CHH) | Chapter 5 Monitor (Manual) |
| H-series Ladder diagram/Command software (LADDER EDITOR) | Chapter 3 Monitor |

**(2) Check cables for the external output devices.**

Check in accordance with the following procedure.

| |
|---|
| ① Confirm that the CPU is in STOP. |
| ② Turn ON the power source of each external output device. |
| ③ Check for safety on interlocks and external output devices with related surroundings. |
| ④ Check cables for the external output devices. |

To check the cables for the external output devices, confirm that all related terminal devices in normal conditions, using "Forced outputting" function which enable to turn ON/OFF output bits in each output module.

In such check work, do not use the functions "Forced set/reset", because the possible previous CPU data settings will be outputted together, causing unexpected operations that will impair such check work. Never fail to use "Forced outputting".

For details of "Forced outputting", refer to the following parts of the manuals for the peripheral equipment.

| Peripheral equipment | Reference item |
|---|---|
| Portable Graphic Programmer (PGM-GPH) | Chapter 5 Monitor 5.4 Forced outputting |
| Command Programmer (PGM-CHH) | Chapter 5 Monitor (Manual) |
| H-series Ladder diagram/Command software (LADDER EDITOR) | Chapter 3 Monitor 3.7 External cable check ( Forced outputting) |

## 12.6 Programming

A program can be installed into the CPU in two ways. One is the indirect method that a program is first made in a GPCL or a personal computer, and then the program will be written on the CPU by the memory transfer function. The other is the direct method that a program is directly written on the CPU by a portable graphic programmer or a command programmer.

For details of the programming languages, refer to the Software Edition manual.

For reading and then utilizing a program stored in a floppy disk or a cassette tape, refer to the following parts in the manuals for the peripheral equipment.

<table>
<tr><td rowspan="5">Programming method</td><td colspan="3">Peripheral device and its operating method<br>Refer to the following references</td></tr>
<tr><td colspan="2">Peripheral device</td><td>Operating method</td></tr>
<tr><td colspan="2">Portable graphic programmer (PGM-GPH)</td><td>Chapter 4 Programming and others in Manual (Operation manual) of the Portable graphic programmer</td></tr>
<tr><td colspan="2">Command programmer (PGM-CHH)</td><td>Chapter 4 Programming and others in Manual of the Command programmer</td></tr>
<tr><td colspan="2">H-series Ladder diagram/ Command language software (LADDER EDITOE)</td><td>Chapter 1 Editing</td></tr>
<tr><td rowspan="4">To load a program already stored in a cassette tape or a floppy disk</td><td>Storage medium</td><td>Programming device</td><td>Operating method</td></tr>
<tr><td rowspan="2">Audio cassette tape recorder (CMT)</td><td>Portable graphic programmer (PGM-GPH)</td><td>Chapter 6 Section 6.6 Cassette (CMT) I/F in Manual (Operation manual) of the Portable graphic programmer</td></tr>
<tr><td>Command programmer (PGM-CHH)</td><td>Chapter 6 Section 6.6 Cassette (CMT) I/F in Manual (Operation manual) of the Command programmer</td></tr>
<tr><td>3.5-inch floppy disk drive (FDD)</td><td>H-series Ladder diagram/ Command language software (LADDER EDITOE)</td><td>Introduction Section 0.5 STEP4 (Storing in a floppy disk)</td></tr>
<tr><td>To use a program already stored in the ROM.</td><td colspan="3">Refer to Section 4.2 (2) Forming a ROM program .</td></tr>
</table>

## 12.7 Test running

Follow the steps below.

| |
|---|
| ① Confirmation of the interlocks. |
| ② No load operation. |
| ③ Test running with the actual space and loads. |

**(1) Checking the interlocks**

Confirm that the functions of each interlock is assured to prevent unexpected malfunction.

The emergency shutdown circuit, the protective circuit and the interlock circuit must be arranged outside the programmable controller.

**(2) No load operation**

Before putting into operation, confirm the normal running of the program by running the program in a simulation mode.

Such simulation mode test running is absolutely necessary when a controlled machine would be broken if a defect in the program would cause unexpected malfunction.

H-series PC is provided with the following functions to facilitate the debugging of the above programs.

| Function | | Use | Description | peripheral equipment |
|---|---|---|---|---|
| ① Debug function | Break point | •To know the timing of a fast processing program.<br>•To check a program in the status of the stop at the point where the program condition is fulfilled. | When the CPU is put into operation by the function of the continuing execution, the CPU will stop at the circuit where a preset contact (symbol) is set in the program. | H-series Ladder diagram/Command language software (LADDER EDITOR) |
| | Scan run | | To execute specified number (1~9999) of scans from the top of the program . The scan will be started at the latest stopped position, and the CPU will be stopped in SCAN END after the specified number of scans are finished. | |
| | Step run | | To proceed a symbol or a command one by one in the program execution following the cursor movement starting from the present process step. | |
| | Indicating the circuit where the execution disabled | | To show one display for the circuit monitor starting from the circuit that contains the step where the CPU stops execution at. The cursor will be appeared at the step where the CPU has stopped execution at. | |
| | Specifying CPU halt | | To stop the CPU RUN that has been runningin the "debug scan run function" or in the" execution continuing function", resulting in SCAN END (the last circuit). | |
| | Continuing the execution | | To start execution at the step where the CPU has been in STOP. | |
| ② Forced set/reset | Forced set/reset | •To proceed by force a control statys.<br>To change by force the internal and external output status. | To set by force the internal and external ouputs. | Portable graphic programmer, H-series Ladder diagram/Command language software (LADDER EDITOR) |

For the details of the debug function, refer to the following parts of the manuals of the programming devices.

| **Peripheral equipment** | **Reference item** |
|---|---|
| H-series Ladder diagram/Command software (LADDER EDITOR) | Chapter 3 Section 3.18 (Debug mode set and reset)<br>~<br>3.24 (Execution stop in SCAN END) |

For details of the forced set/reset function, refer to the following parts of the manuals for the programming devices.

| Peripheral equipment | Reference item |
|---|---|
| Portable Graphic Programmer (PGM-GPH) | Chapter 5 Section 5.3 Forced set, reset |
| Command Programmer (PGM-CHH) | Chapter 5 Section 5.3 Forced set, reset (Manial) |
| H-series Ladder diagram/Command software (LADDER EDITOR) | Chapter 3 Section 3.6 I/O data set, reset (Forced set, reset) |

Operation check shall be made by the monitor function.
The following functions are included in themonitor function.

| | Function | Description | Peripheral equipment |
|---|---|---|---|
| 1 | Circuit monitor | To display a circuit serach result for the specified cucuit numbers, I/O numbers, device numbers, including ON/OFF status of the contact coils and other related elements. | Portable graphic programmer.<br>Command programmer.<br>H-series Ladder diagram/Command language software. |
| 2 | I/O monitor | To display ON/OFF status and word contents of the specified I/O (including the internal outputs ), on the message displayer simultaneously with displaying the circuit monitor. | Portable graphic programmer.<br>Command programmer.<br>H-series Ladder diagram/Command language software. |
| 3 | List monitor | To monitor every 16 poits unit (16 word unit) starting from the specified I/O No. One display can contain 64 points (64 words) to be monitorerd. | H-series Ladder diagram/Command language software. |
| 4 | Command monitor | To display ON/OFF status of the circuits by a unit of one circuit or one command, expressing in the command langusge. | Portable graphic programmer.<br>Command programmer.<br>H-series Ladder diagram/Command language software. |
| 5 | Plural circuit monitor | To monitor the specified four circuits (maximum) for the specified I/Os, the application commands, etc. | H-series Ladder diagram/Command language software. |

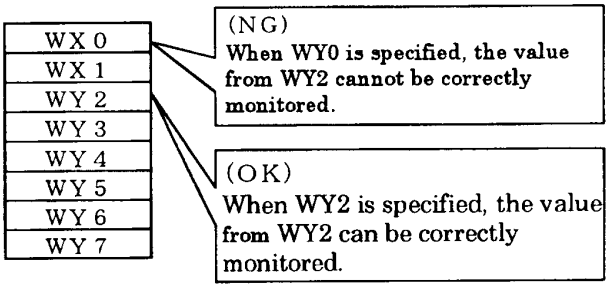
For the details of the monitor function, refer to thefollowing parts of the manuals of the programming devices.

| **Peripheral equipment** | **Reference item** |
|---|---|
| Portable Graphic Programmer (PGM-GPH) | Chapter 5 Monitor |
| Command Programmer (PGM-CHH) | Chapter 5 Monitor |
| H-series Ladder diagram/Command software (LADDER EDITOR) | Chapter 3 Monitor |

In case of monitoring external I/O given with I/O mixed assignment (WORD 4W/4W, BIT B1/1, BIT B2/1, BIT B1/2, BIT B2/2, FUN 0 ~ 6) in using monitor table of HI-LADDER, when input I/O number of assigned I/O is specified as output I/O number, the value of output (Y) can not be correctly monitored.

Please specify the I/O number of corresponding output (Y) and monitor when you monitor the output.

Example. When you monitor the output from WY2 when counter module (FUN3) is used.




**(3) Actual load operation**

Supply the power to the external inputs and the external outputs, and confirm the correct operation.

The procedures of the operation are the same as those for **(2) No load operation** except with the condition the loads are actually operated.

## 12.8 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 selection switch of the CPU.

② Debug running by the peripheral equipment

③ Remote control by the host computer.

### (1) Running and stopping by the mode selection 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.

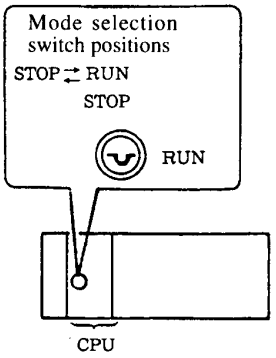
Selection switch STOP: Stop.

RUN: Running of the user's program.

② Input definition is set. (Running control at a special a special point)

Selection switch STOP: Stop.

RUN: Running stopping 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 stopping of the PC.

**[Running conditions]**

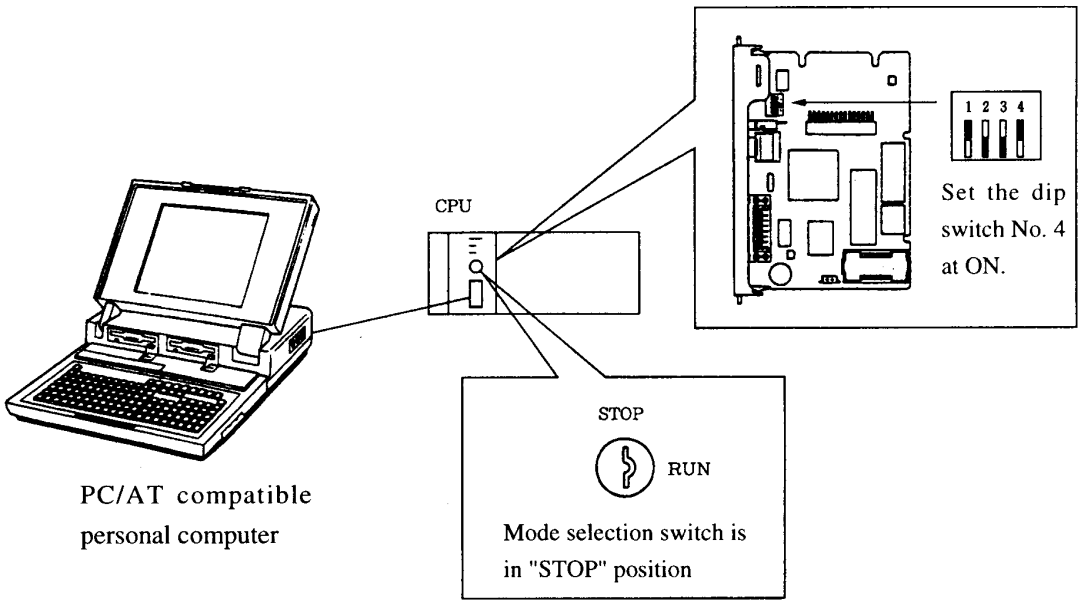
① When the running control input contract is specified by a parameter, the input contact should be ON.

② The CPU should be free of errors. (The ERR indicator LED should de off.)

③ Wiring and transfer of the user's program from the peripheral equipment should be finished (when the user's 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, use H-series Ladder diagram/Command language software (LADDER EDITOR). Set the mode selection switch of the CPU to STOP, and set the No. 4 dip switch of the CPU module at ON (REMOTE).The following two statuses of the CPU are available for debug.

1. Debug run: The user's program is executed by a command from the peripheral equipment.
   - ① Scan RUN
   - ② Step RUN
   - ③ Continuous execution
2. Debug HALT: The user's program is halted by a command from the peripheral equipment.

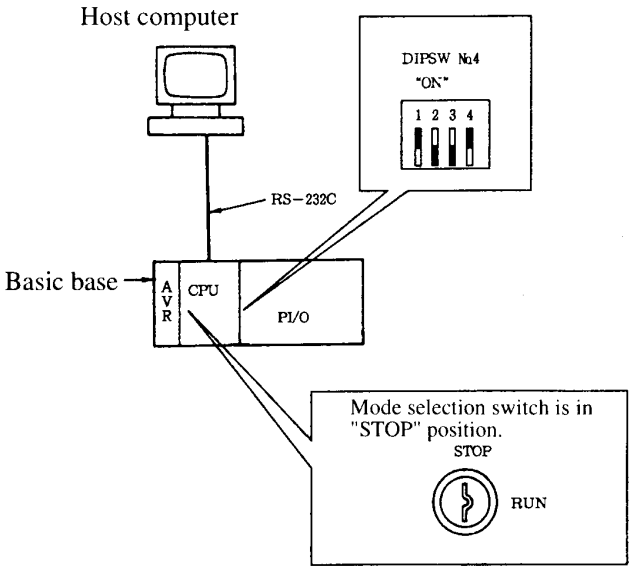
**[Running conditions]**

- ① The mode selection 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's 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's program can not be performed by the portable graphic programmer (PGM-GPH) and command programmer (PGM-CHH).

### (3) Remote running control by the host computer




CPU : CPU module
AVR: Power module
PI/O : I/O module

When the host computer issues a task code (CPU control code) to the PC, the user's program runs or stops.

The communication procedure dedicated to the H-series (HI-PROTOCOL) is used for communication between the host computer and PC. Therefore, when applying remote control, refer to Chapter 4 of Software Edition.

**[Task code example]**

CPU control: Reading of the CPU status (H10), running or stopping of the CPU (H11), etc.

I/O control: I/O No. monitor (H40), I/O forced set or reset (H42), etc.

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 selection 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's 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 status starts normally, the RUN LED lights.

## 12.9 Running in Case of an Error

Running in case of an error is that the PC does not stop but continuous 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 running in case of an error mode set is set, phenomena such that scan time is displayed 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 (special internal output WRF000) is displayed.

| Error code | Error name | Description | Location where the running mode is set |
|---|---|---|---|
| 44 | Delay error (normal scan) | The normalscanning time is more than thespecified one. | Set the special internal output R7C0 to "1". |
| 45 | Delay error (periodic scan) | The periodic scan does not end within the shortest periodic scan. | Set the special internal output R7C1 to "1". |
| 47 | I/O assignment points overflow | The number of assigned I/O points is more than the maximum value of the CPU. | Set the running parameter "I/O assignment mismatch" 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 / reset : Monitor→List monitor →I/O monitor→Forced set/reset.

# Part IV

## Daily Inspection and Periodic Inspection

# Chapter 13 Daily Inspection and Periodic Inspection



To use the functions of H-250/252 in best condition and obtain the correct system operation, the daily inspection and the periodic inspection are required.

## 13.1 Daily Inspection

Confirm the following items under the running status.

**Table 13.1.1 Items to be inspected**

| Item | LED indication | Check method | Normal status | Possible cause |
|---|---|---|---|---|
| Check of CPU module indication | POW | Visual check | ON | Abnormal power supply |
| | RUN | Visual check | ON (during operation) | Congestion error, syntax error, microcomputer over run, abnormal power supply, etc. |
| | ERR | Visual check | OFF | Same as above (if lit) |
| | | | | Battery error (if flickering)* |
| Check of remote I/O error indication | POW | Visual check | ON | Abnormal power supply, etc. |

*1 The contents of memory might be destroyed if the old battery unchanged with the basic base power supply turned off beyond 1 week after the ERR lamp flickers. If the power supply is turned off for a long time, the contents of memory might have already been destroyed since this battery error cannot be detected.

## 13.2 Periodical Inspection

Inspect the following items every six months, after the power supply for external I/O circuit is OFF.

**(1) Periodical Inspection**

**Table 13.2.1 Item of periodical inspection**

| System/Device | Inspection Item | Standard | Remarks |
|---|---|---|---|
| Between the programming device and CPU | Operational check on the programming device | All key swtches and indicators should operate normally | |
| Power supply | Power voltage variation | 85~132 V / 170~264V AC<br>19.2V~30V DC | Use circuit testers |
| I/O modules | Service life of output relays | Electrical: 0.2 million times<br>Mechanical: 10 million times | Refer to the life curve for I/O module output relay |
| | LED | Should be indicated normally | |
| | External power voltage | Should meet the module specifications | Refer to I/O module specifications |
| Battery | Check for voltage and service life | ERR lamp flashes.<br>Replace within every 3 years | |
| Mounting and connection | (1) Fixing of each module<br>(2) Fitting of each connector<br>(3) Tightening of each screw<br>(4) Each cable element | No appreciable failure should be found | Retightening screws<br>Confirm fitting<br>Retightening as needed<br>Visual inspection |
| Ambient condition | (1) Temperature<br>(2) Humidity<br>(3) Others | 0~55°C<br>20~90%RH(no dew condensation)<br>No dust, obstacle, vibration | Visual inspection |
| Spare parts | Check for inventory and soundness | To be normally managed | Visual inspection |
| Program | Check for program contents | CPU contents should match those of the latest valid program archived in FD, ROM, cassette tape, etc. | Check both the master and the back up. |

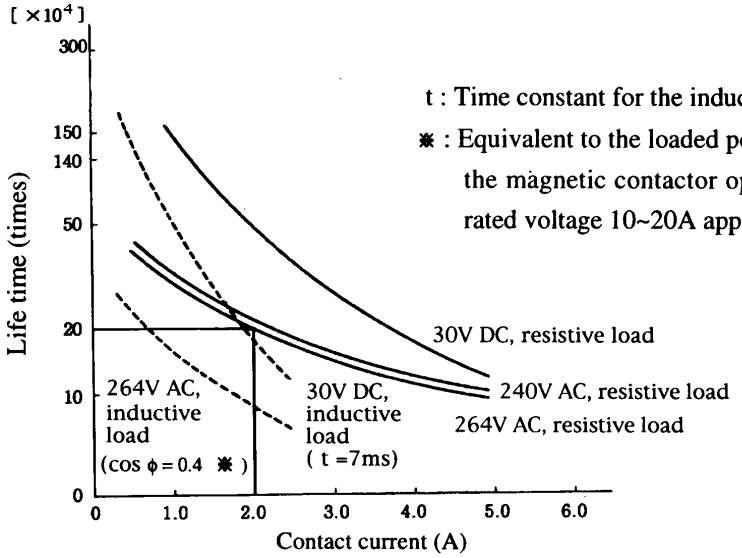



**Figure 13.2.1 Life curve of I/O module ouput module output relay**

### (2) Service Life of Each Power Module

Each power module uses a number of electrolytic capacitors, which have a certain service life. It is said that the service life is reduced to half when the ambient temperature rises 10°C.

Prepare a spare power module taking into account that it has a standard lifetime of about 3 years at the rated ambient temperature (30°C). For longer life, the power module must be mounted in consideration of adequate ventilation and proper ambient temperature.

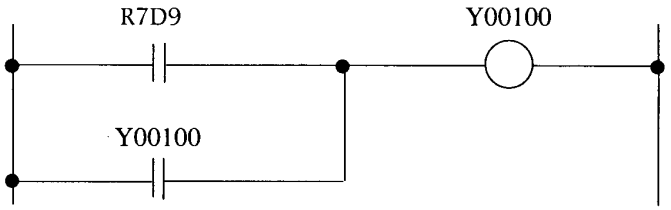
### (3) On Service Life of Battery

Lifetime of battery Guarantee 3 years

- The lifetime of battery indicates the total OFF time of the power module of basic base.
- The battery has reached the end of its service life when the ERR lamp flickers.
- Battery life can also be read via the special internal output "R7D9".

  Shown below is an example of circuit which uses "R7D9".

  In the example, battery error can be output in the external output Y00I00.




- "R7D9" function as a flag which indicates battery error. This flag turns on when the battery has reached the end of its lifetime.

  The self-diagnosis error code "71" indicates that the battery is not mounted or it has reached the end of its service life.
- Be sure to renew the battery every 3 years even if it has not yet reached the end of its life.
- Even when the ROM memory is used, the battery is necessary for backing up the power failure-protected internal output data and maintaining the calendar clock function.
- The term of validity of the battery as stock is one year after buying the battery.

**(4) Procedure of replacing the battery**

① Prepare a new lithium battery (LIBAT-H).

② Confirm that the latest valid program is secured in a floppy disk, a cassette tape, etc.. Never fail to practice such backup for security.

③ Charge the capacitor mounted inside the CPU module by supplying power to the basic base making the power source ON.

④ The preparation is over when the above steps are completed. After the preparation is completed, finish the replacing work within one minute as fast as possible starting from the moment the basic base power is OFF and ending in the moment the lithium battery terminals are securely connected to the mating terminals on the board as will be done in the step ⑧ .

Finish all these steps within one minute

⑤ Turn OFF the power to the basic base

⑥ Remove the CPU module from the basic base.

⑦ Remove the used battery out of the battery case and disconnect the terminals.

⑧ Connect the battery terminals (i) to the board terminals (ii), as shown on Figure 13.2.3.
(Match the polarity by identifying red and black color makings and the wire color)

⑨ Mount the new lithium battery into the battery case as shown on Figure 13.2.2. Lead wires must be accommodated in accordance with Figure 13.2.4

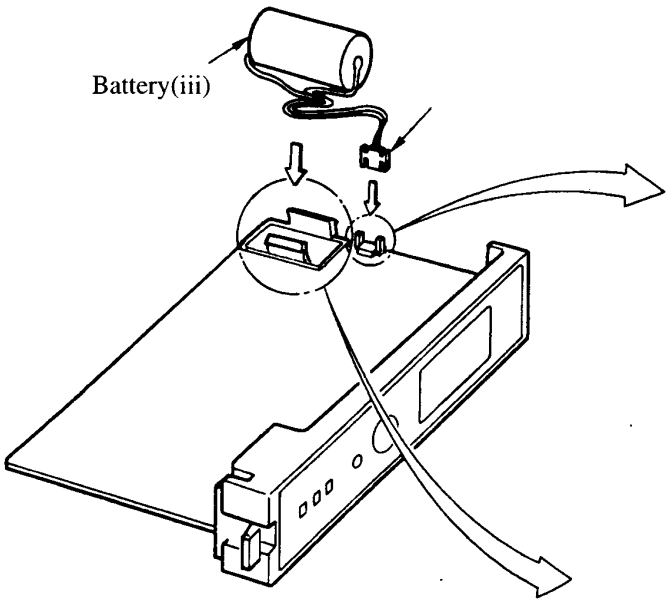



**Figure 13.2.2 Mounting the lithium battery**

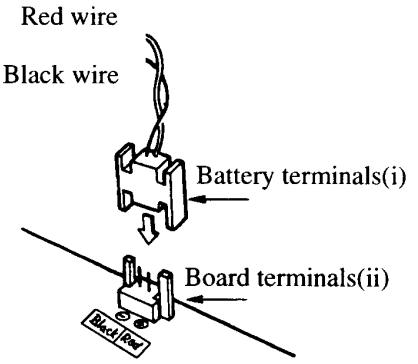
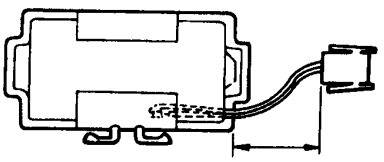



**Figure 13.2.3**
**Connecting the battery terminals**




House the lead wire in the battery case, leaving a portion about 25mm long outside the case.

**Figure 13.2.4**
**Battery case**
**(looked from above)**

# Chapter 14 Trouble Shooting

## 14.1 Error displays and Countermeasures for Faults and Errors

Figure 14.1.1 shows the error display locations in various devices in H-250/252 system. The errors are generally displayed by means of the error codes. Take necessary countermeasures in reference to the descriptions in the error code lists.



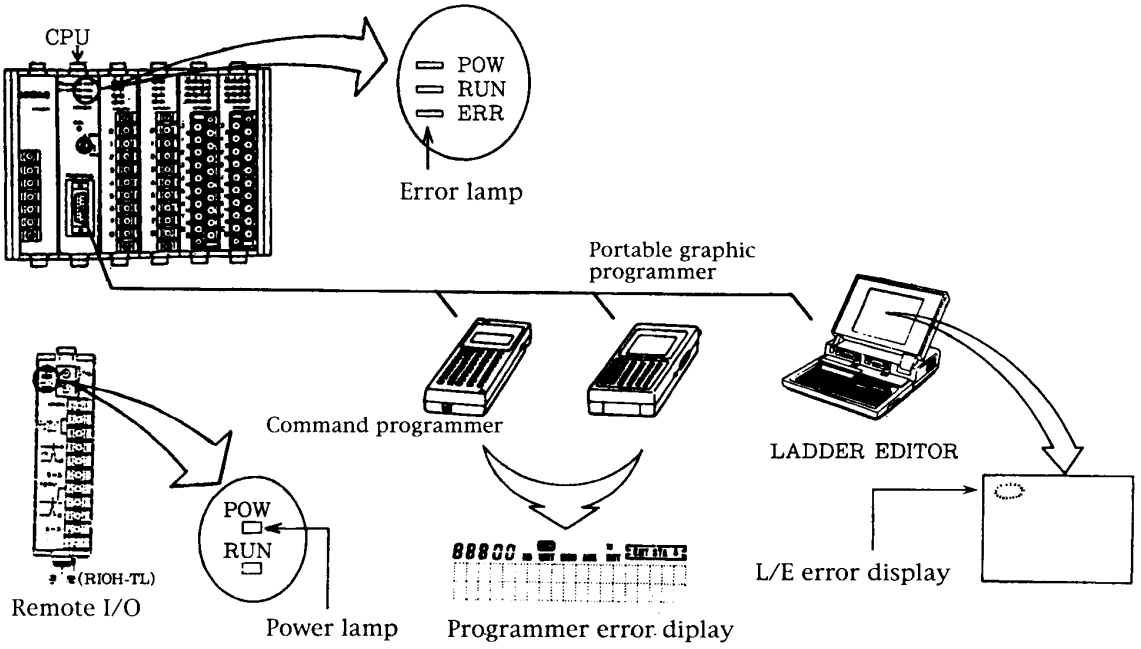



**Figure 14.1.1 Error display locations in H-250/252**

### (a) Error display for the CPU module and how to treat the errors

Error lamp display will indicate the results of the microcomputer-controlled self diagnostic system. Interpretation of the display is shown bellow. For details of the error codes and countermeasures for them refer to the self diagnostic error code lists.

Error lamp
- Flickering : Battery error
  - Battery is not mounted. or Battery should be replaced.
- Illuminating : After the key switch is changed over to STOP from RUN
  - Error lamp remains illuminated.
    - Turn off the power and restart the unit. If this measure does not remove the error, replace the CPU.
  - Error lamp is extinguished
    - Find and remove the cause of the error in accordance with the diagnostic error code (WRF000), syntax, assemble error details (WRF001), computation error code (WRF015). Return the key switch position to RUN after that.

**(b) Programmer error display**

While a programming device is in operation, a double definition error, undefined error, operation error, program overflow error, etc. may appear on the programming device.

For details of error codes, refer to the error code lists included in the manual of the programming device.

For details of error codes, refer to the error code lists for the GPCL.

**(c) Remote I/O (slave station) error display**

When the power lamp is extinguished, inspect for the source power to be normally supplied to the power module.

**(d) How to reset the error lamp of the CPU**

Once an error lamp is illuminated, it will be kept illuminated until one of the following steps is made, even after the cause of the error is removed.

**How to reset the error lamp**

The following four methods are prepared for the reset.

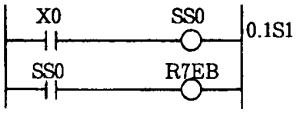
① Change the position of this switch (While in "RUN" position, this operation means the CPU will be brought to STOP)


② Turn on the power supply again (means a restart with a reset).

③ Connect a programming device and set the special internal output R7EB to "1".

④ Incorporate beforehand a program that will set R7EB from an external input.

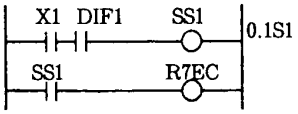
(Example)




Error code is set in the special internal output area (WRF000, etc.). The smaller code numbers implies the heavier troubles which are classified as the serious failure. When two or more errors are occurred simultaneously , the smallest number will be given to WRF000. For example, "71" (battery error) and "31" (user's memory failure) are simultaneously occurred, "31" will be set. When the errors of same classified level are occurred, the code of the latest occurrence will be set.

Clearing off of an error in the special internal output will be realized be setting "1" to R7EC. To set "1" to R7EC, connect a programming device which will set it or incorporate a program beforehand into the active program that will set R7EC.

(Example)






Please turn on R7EC after confirming the factor of the error when you turn on R7EC by the program. When R7EC is turned on by the program where the congestion error occurs, the error factor is cleared after the system detects the congestion error and RUN begins again occasionally.

The following illustration shows the special internal outputs that will be cleared off when "1" is set to R7EC.

| Special internal bit output | Number |
|---|---|
| Serious failure flag | R7C8 |
| Sequense processor failure | 9 |
| User memory error | A |
| (Undefined) | B |
| Memory size over | C |
| (Undefined) | D |
| (Undefined) | E |
| (Undefined) | R7CF |
| (Undefined) | R7D0 |
| Congestion error (normal) | 1 |
| Congestion error (periodical) | 2 |
| (Undefined) | 3 |
| Syntax • Assembler error | 4 |
| (Undefined) | 5 |
| Excessive assignment number in I/O module | 6 |
| Communication module failure | 7 |
| (Undefined) | 8 |
| Battery error | 9 |
| (Undefined) | A |
| Self diagnostic error | B |
| (Undefined) | C |
| (Undefined) | D |
| Link module failure | R7DE |

| Special internal word output | Number |
|---|---|
| Self diagnostic error code | WRF000 |
| Details, Syntax • Assembler error | 1 |
| (Undefined) | 2 |
| (Undefined) | 3 |
| Error slot No. , Communication module failure | 4 |
| (Undefined) | 5 |
| (Undefined) | 6 |
| Error slot No., Link module failure | 7 |
| Error circuit number | WRF008 |

**Figure 14.1.2 Special internal output area to be cleared off by the special internal output R7EC.**

Caution

If the internal output R7DB (WRF000) of the self diagnostic error is used as a condition (interpreted as a system failure) of STOP during CPU RUN, the CPU may be stopped unexpectedly by ON (WRF000 is H71) in R7DB even by an alarm level failure such as the battery error "71". Avoid using an internal output of the self diagnostic error as a STOP condition of the CPU.

## 14.2 Checkpoints at Error Occurrence

If the H-250/252 fails, check the following items:

**[Caution]**

Disconnect the power supply while a module is being replaced.

**(a) Power supply system**

- The source voltage should meet the requirement. (The 100VAC line: 85~132V, The 200VAC line: 170~264V).
- There should be no appreciable distortion in the power source wave forms.
- There should be no excessive noise added to the source supply.
- The power fuse should not be broken.
- All basic bases and expansion bases should be supplied with the required power.
- The system power supply should have adequate capacity to meet the requirement of all the modules in the system.

**(b) CPU and associated components**

- The initial settings should be made correctly. (CPU initialize, I/O assignment, parameter setting, etc.)
- There should be no error code outputted in the internal special output.
- The mode selection switch (the key switch) should be in the correct position.
- The battery should be installed. The battery service life should not be finished.
- The battery with adequate remaining capacity should be installed.
- The fitness of CPU module connector should be well secured with the corresponding base connector.

**(c) Input modules**

- The power supply to input modules should be in a correct type AC or DC.
- The input voltage should meet the requirement of the modules.
- There should be no chattering nor noise in the input signal.
- There should be no mismatching of I/O assignment No. in the program.
- All wirings should be made correctly.

**(d) Output modules**

- The power supply for each load should be in a correct type AC or DC.
- The voltage and current of each load should meet the requirement of the modules.
- The fuse should not be broken.
- There should be no chattering nor noise in the output signal wave form.
- All wirings should be made correctly.
- There should be no intentional double numbering in the program.

**(e) Cabling and wiring**

- The FG wire of the module should be earthed by independent earth.
- The expansion cables should be installed separately from the cables and wires of other types.
- The power cables should be installed separately from the I/O cables.
- There should be no distortion in each connector pin of the modules.

**(f) Communication modules**

- The communication cable of the CPU link module should be connected correctly, TXD with RXD, RXD with TXD.
- The set up switches of the remote local station, the CPU link, etc. should be set correctly.
- There should be no broken cable nor disconnected cable. (Also check for the correct soldering of the BNC connector).
- The communication cables should be installed separately from the cables of high voltage or high current.
- No error display should be appeared on the module.
- The external shield of the communication cable should be earthed correctly.

**[Cautions]**

(a) Disconnect the power supply while a module is being replaced.

(b) When returning a module for repair to us, inform us the status of the failure as detailed as possible. (Error codes, failed I/O bit No., ON disabled, OFF disabled, etc.)

(c) Major tools necessary for the trouble shooting are as follows.

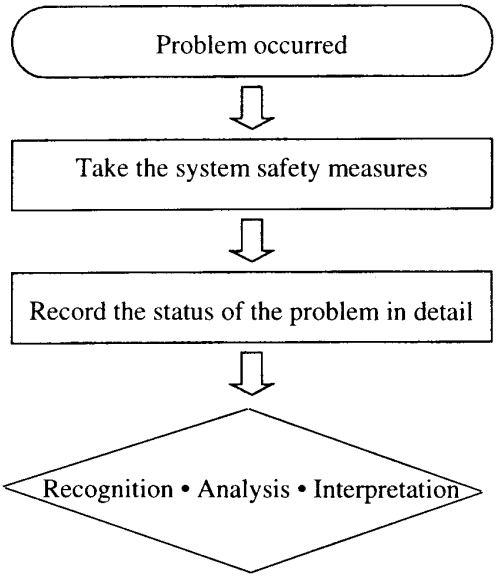
① (+/-) screw drivers

② Digital multi-meters or circuit testers.

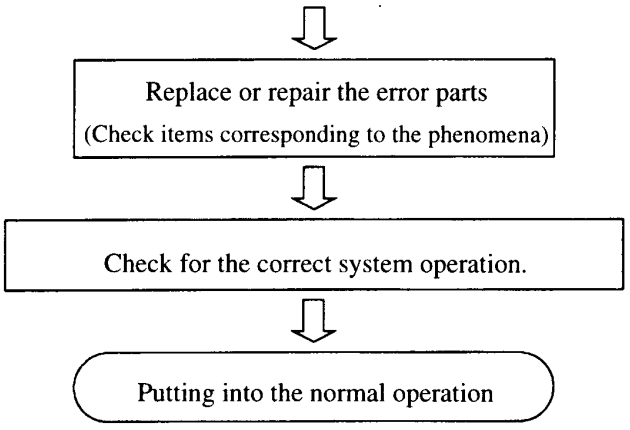
③ Oscilloscopes. (Depending on circumstances).

## 14.3 Troubleshooting Procedure

The troubleshooting procedure is shown below.

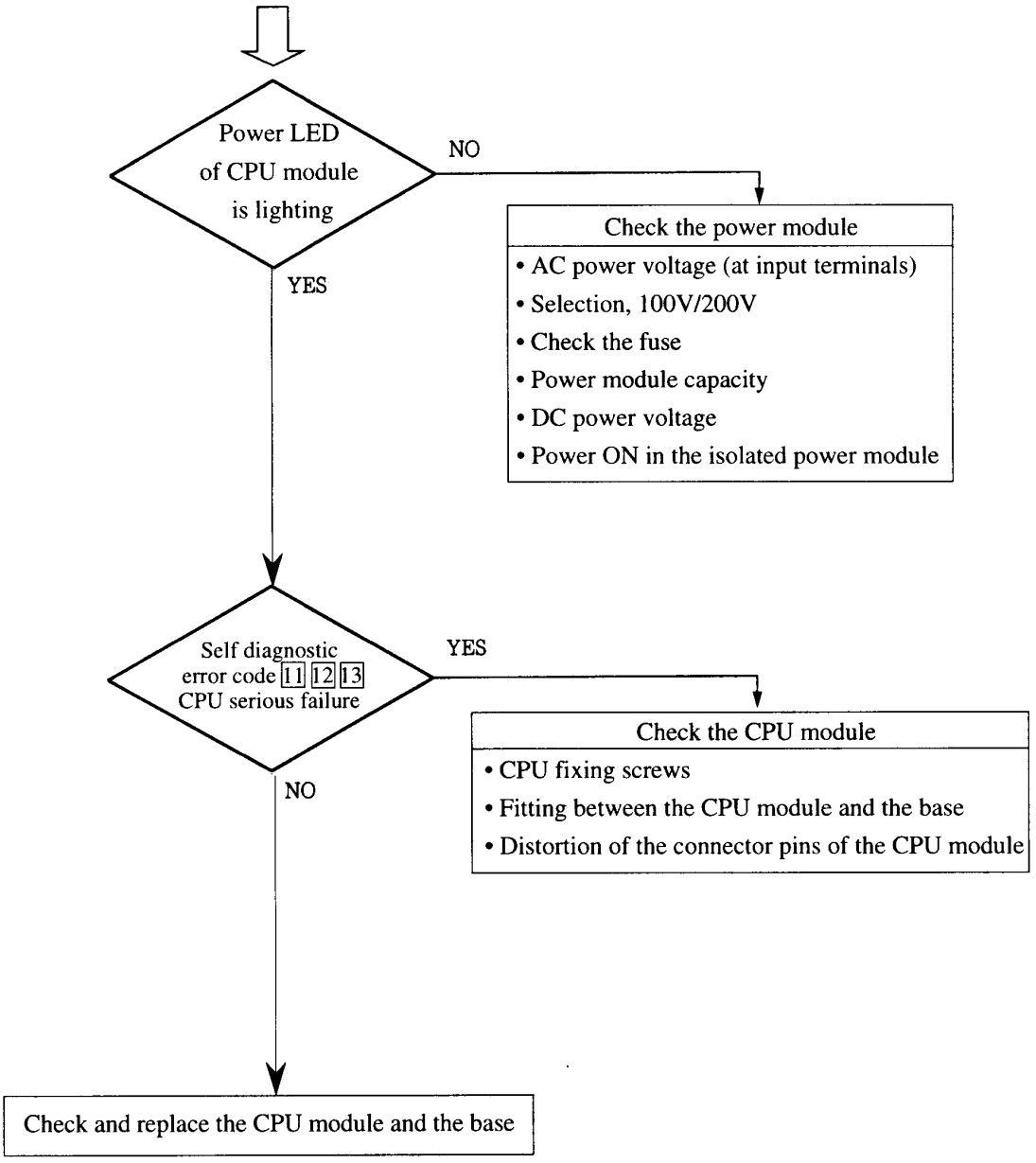



| Major possible problem | Checkpoint | Major possible cause | Reter to the item |
|---|---|---|---|
| PC does not start up | Power LED<br>CPU error codes | Power failure, Power outage, Inadequate power capacity, Module pin distortion, CPU serious failure | (a) |
| PC does not run (RUN disabled) | CPU error codes<br>Error internal outputs | Abnormal I/O assignment, Incorrect parameter setting, User's program defects, Sntax error, Operating condition not fulfilled, Write occupation status | (b) |
| PC stops operation (RUN stops) | Power LED<br>CPU error codes | Power failure, Failure or breakage of the expansion power unit, CPU failure, Memory failure, Communication failure, Base failure | (c) |
| Incorrect input or no input to the module (Abnormal operation) | CPU LED I/O LED<br>Monitor through the peripheral equipment | User's program timing, Input power source, Incorrect connection, Input module failure, I/O inductive noise | (d) |
| Incorrect output or no output to the module (Abnormal operation) | CPU LED I/O LED<br>Monitor or forced reset through the peripheral equipment | User's programming, Incorrect connection, Output module failure, I/O inductive noise | (e) |
| Communication error | CPU error codes, Monitor special internal output data,<br>Communication module error codes | CPU failure, Base failure, Communication module failure, Power source of communication module, Transmission cable failure | (f) |
| The peripheral equipment can not be connected | CPU error codes,<br>In the peripheral side | CPU serious failure,<br>The peripheral equipment failure, Incorrect setting in the peripheral equipment, Cable failure | (g) |



**(a) PC does not start**

[Even when the power is ON, CPU ERR LED does not light or the peripheral equipment can not be connected on-line]

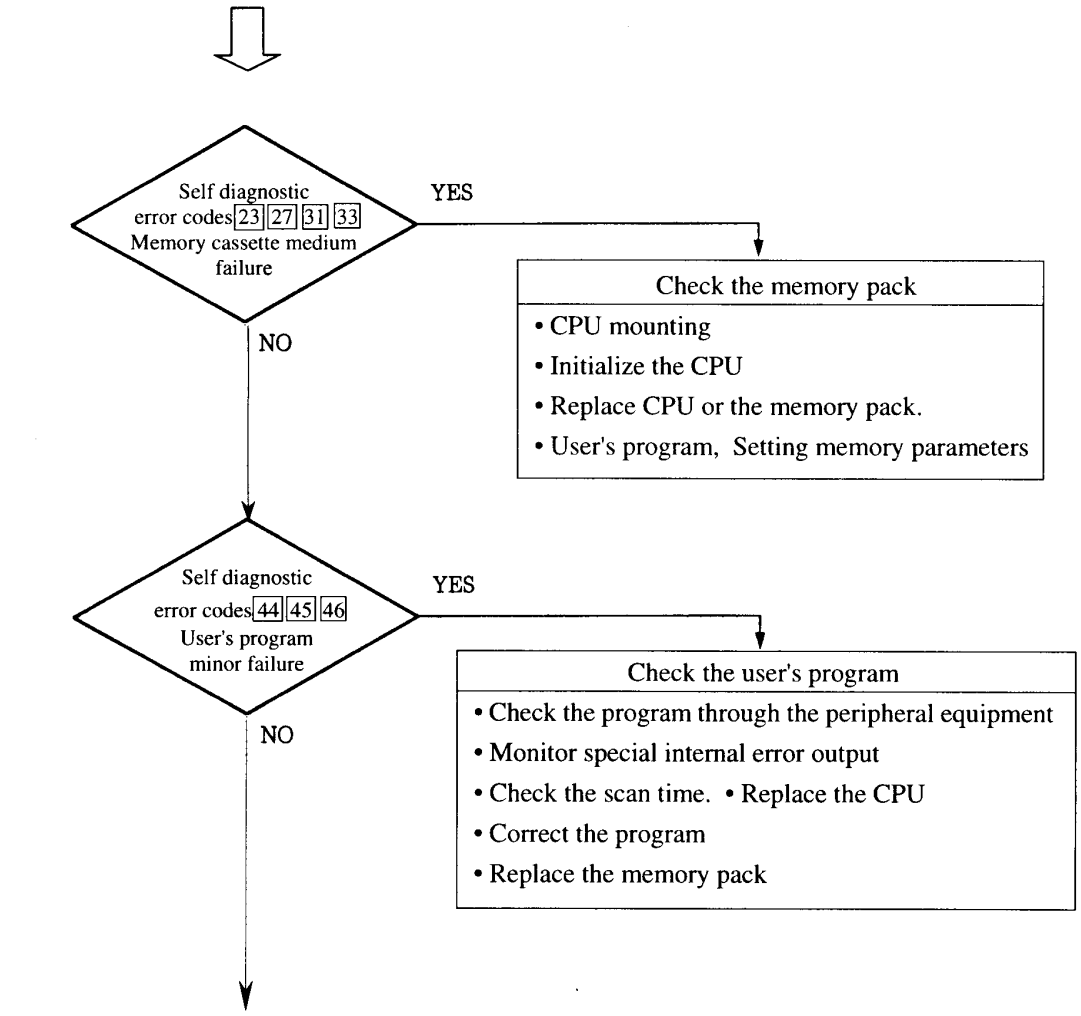


**(b) PC does not run**

PC still remains inoperable ("RUN" LED does not light) even when the operating conditions are given. But the peripheral equipment becomes on-line.

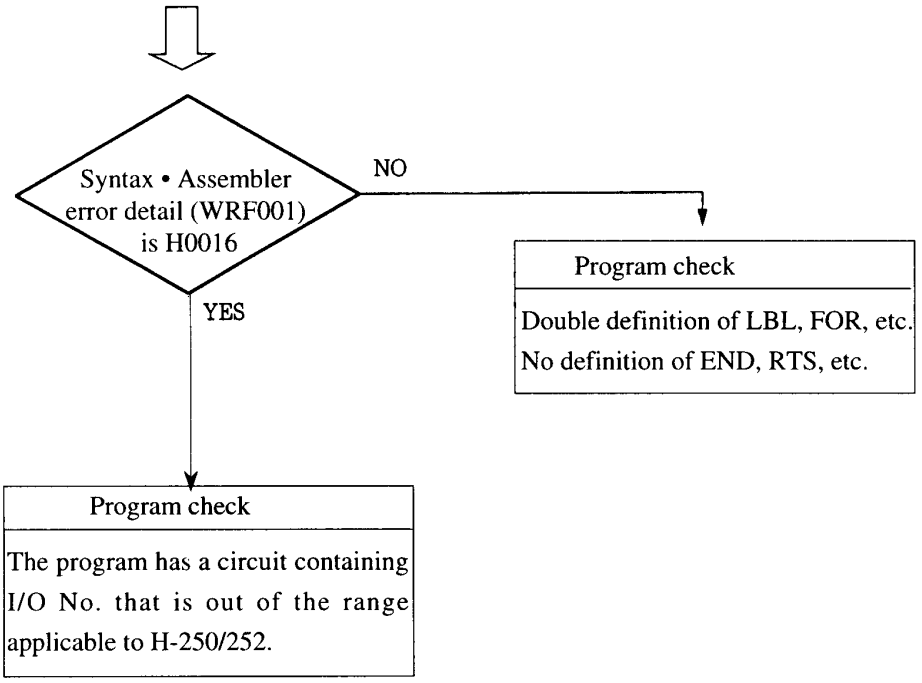
**[Caution]**

When the CPU is in the Write occupied status, The CPU will not run even if the key switch is turned "STOP" to "RUN". CPU will run by pressing GRS key after the peripheral equipment is connected.



[I/O No. error]

(Self diagnostic error code 34 )






When I/O No. is inputted outside the applicable range of I/O No., the CPU will change such inputted I/O No. to the following I/O No.

(When the unit is turned to operation (STOP → RUN), ERR LED will be ON, and "34" and "H0016" will be set to WRF000 and WR0F001 respectively.)

(1) In the case of H-252

Bit : R7FF

Word : WRF019

Double word : DRF018

(2) In the case of H-250

Bit : L13FFF

Word : WL13FF

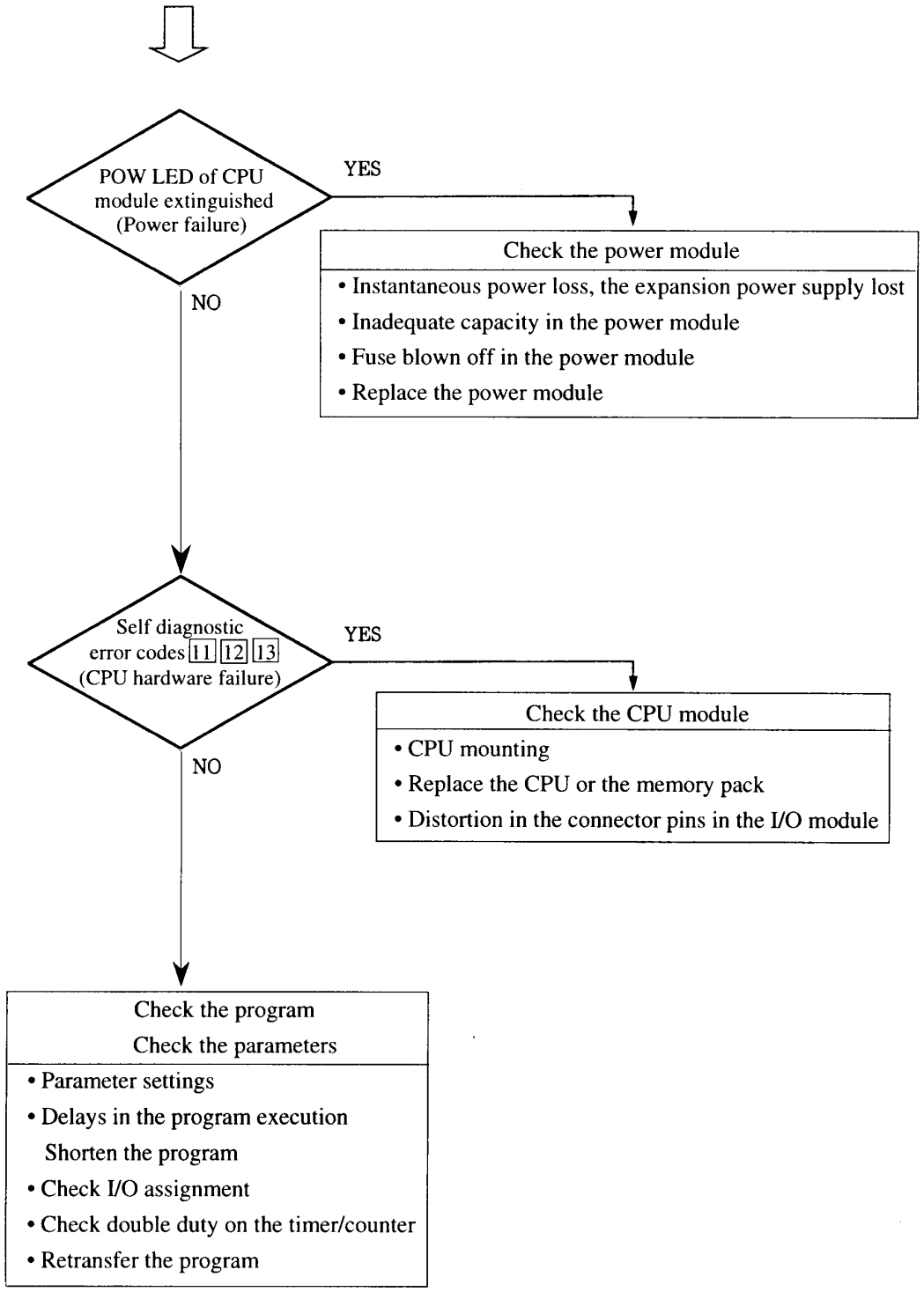
Double word : DL13FE

Search the above I/O No. and change the inputted I/O No. to usable I/O No.

When I/O No. out of the applicable range is included in a program written by LADDER EDITOR , such I/O No. will be converted to I/O No. out of the range in the CPU on transfer of such program to the CPU. In such case, a mismatching will be occurred in verifying the program saved in the memory or a floppy disc after the transfer of the program to the CPU. Further, such program will cause a mismatching also in verifying the program that was saved in a floppy disk before the transfer and the program that was read from the CPU.

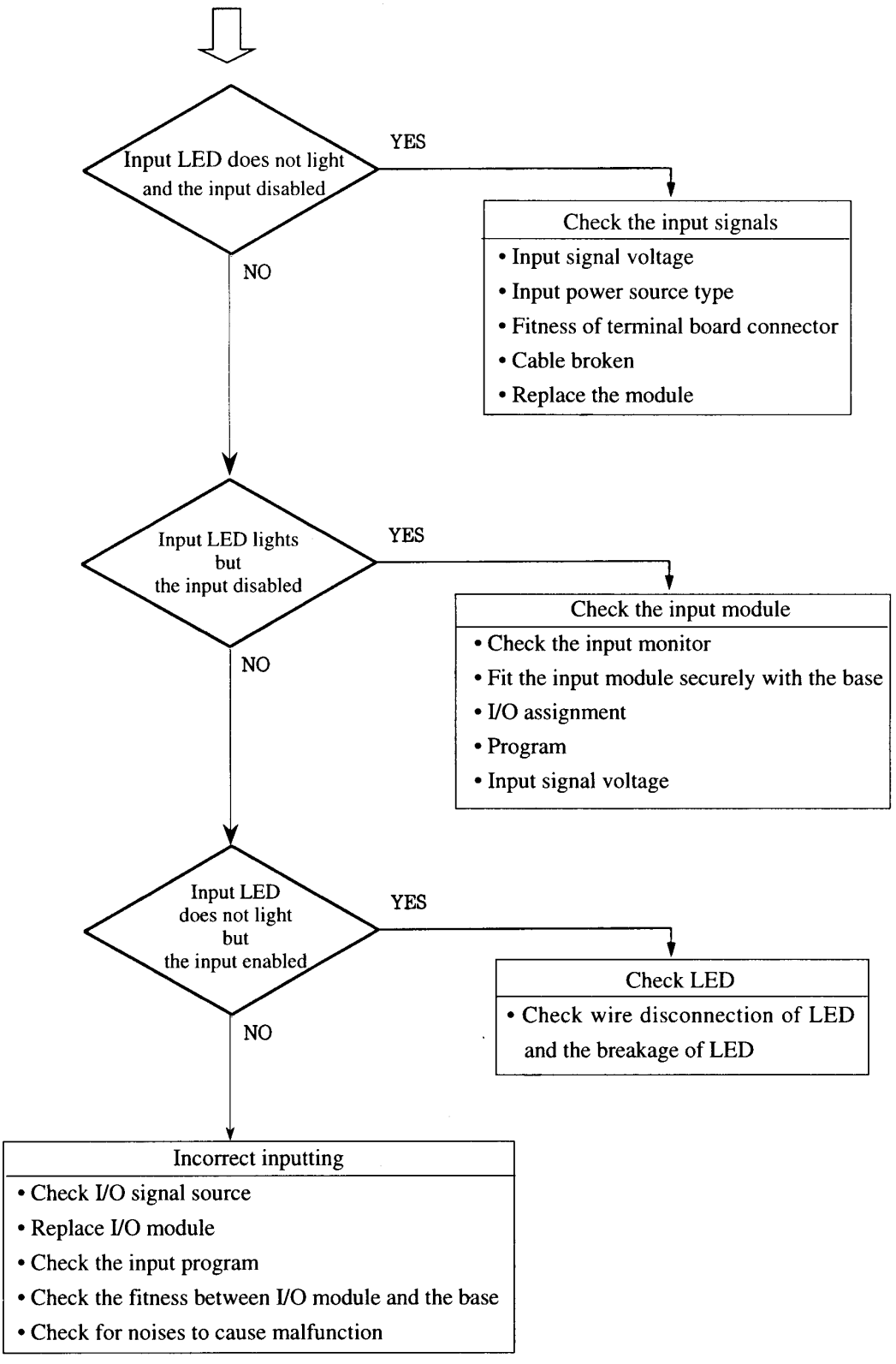
**(c) PC stops operation**

[While the CPU has been in normal operation, the CPU suddenly stops (RUN LED extinguished)]

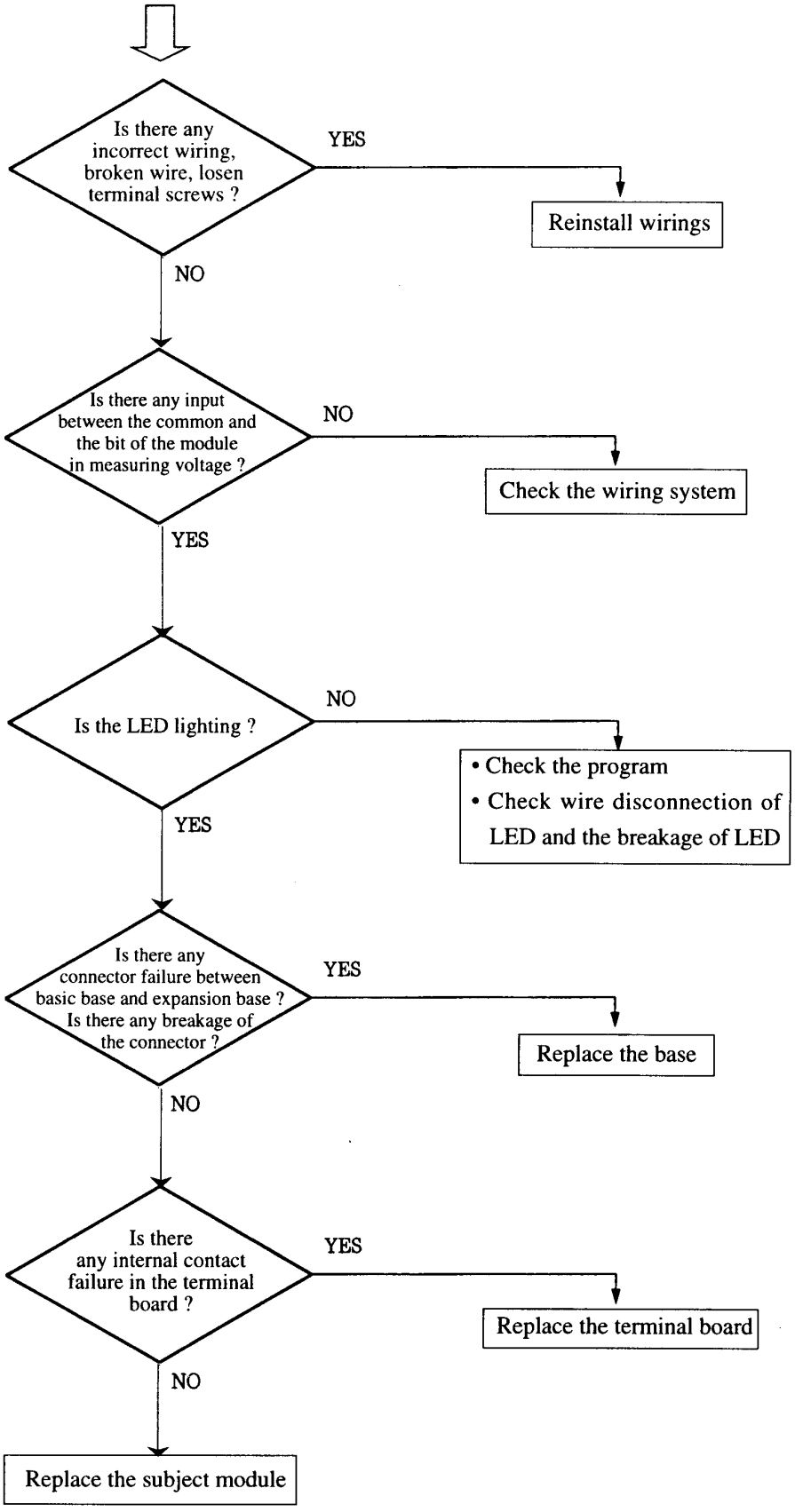


**(d) Incorrect input or no input (Abnormal operation)**

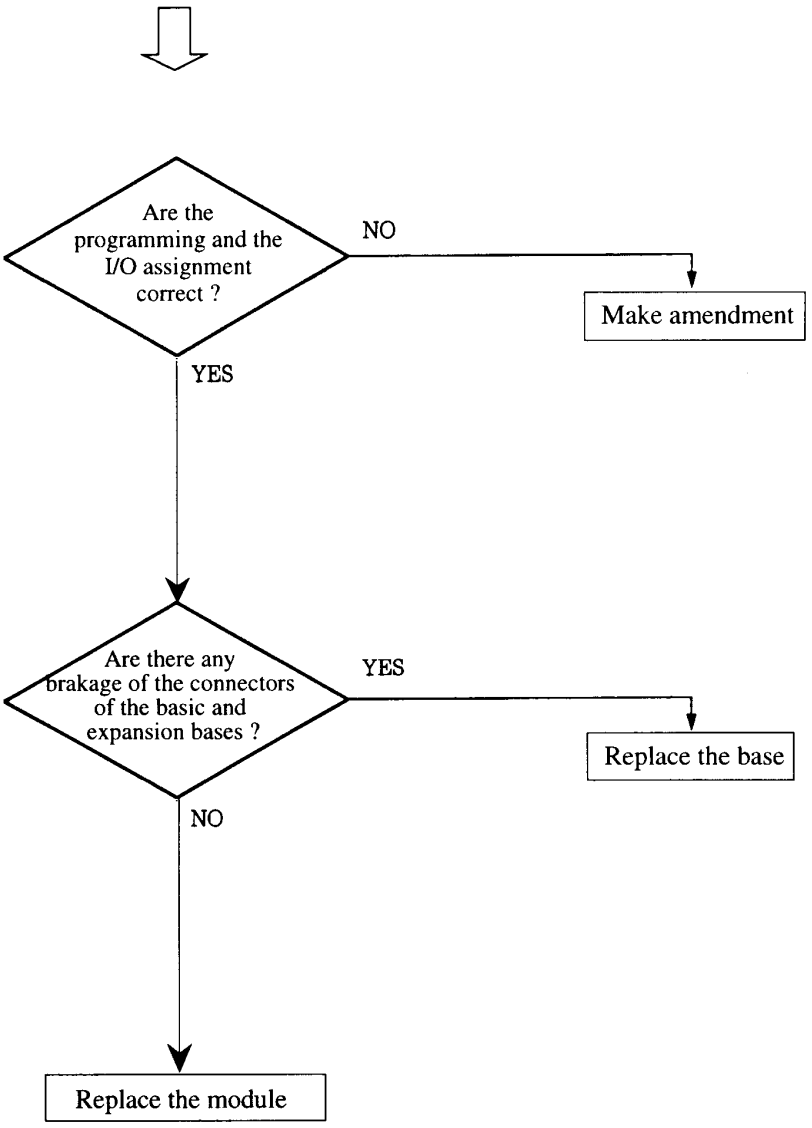
[Input data is incorrect while the CPU runs]



**[Data can not be inputted]**

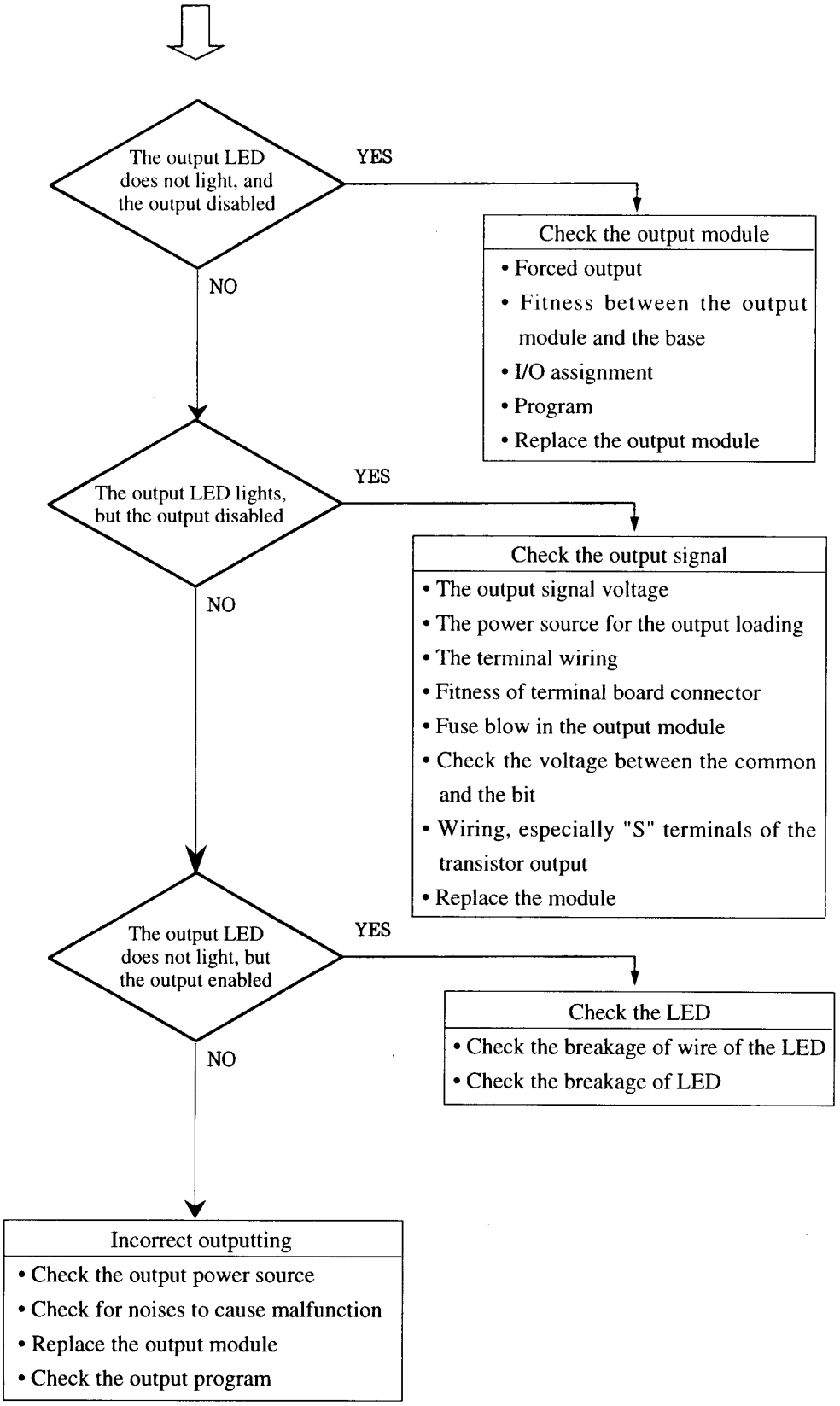


**[Data can be inputted while I/O assignment error appears]**

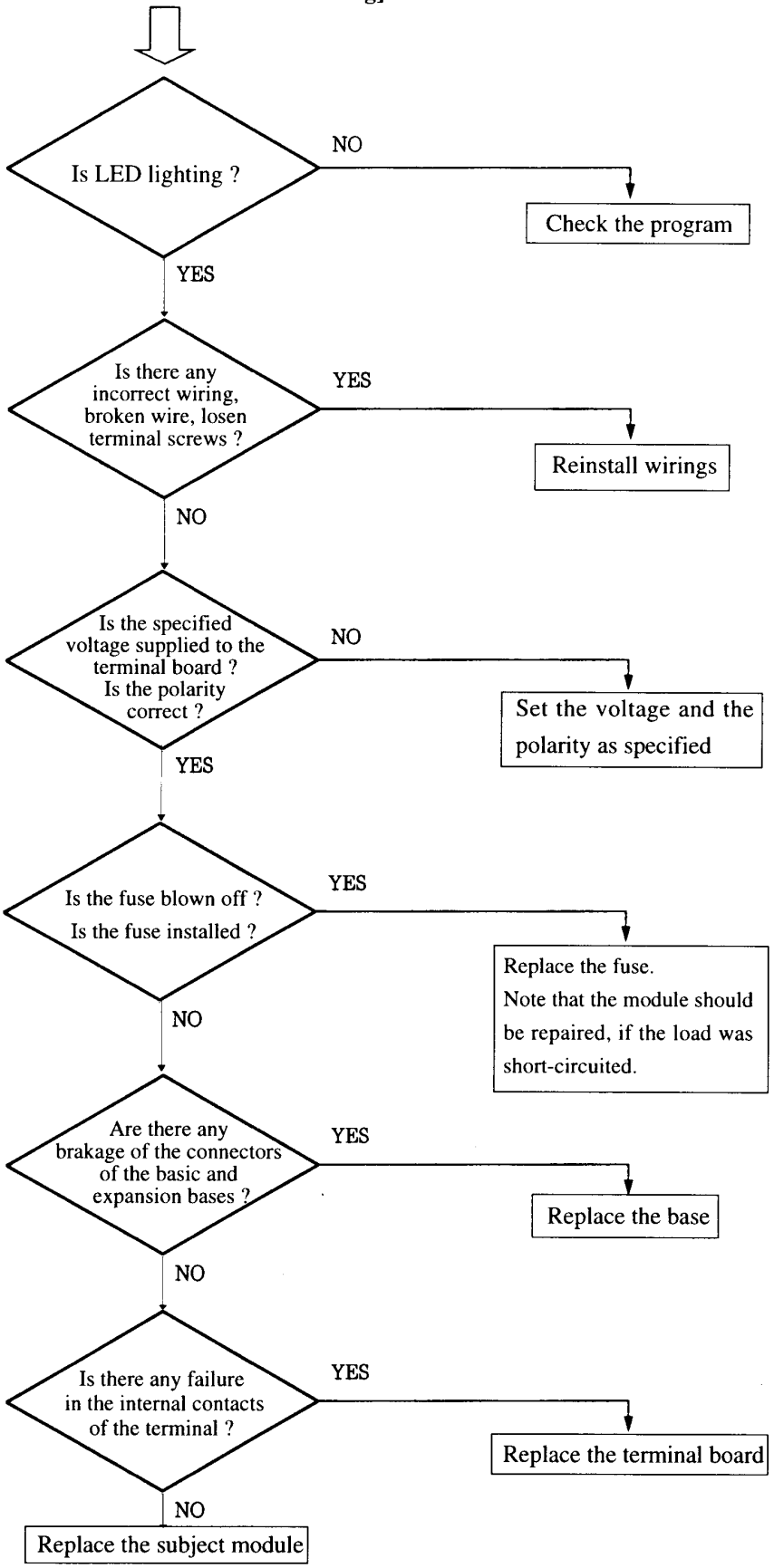


**(e) Incorrect output or no output to the module (Abnormal operation)**

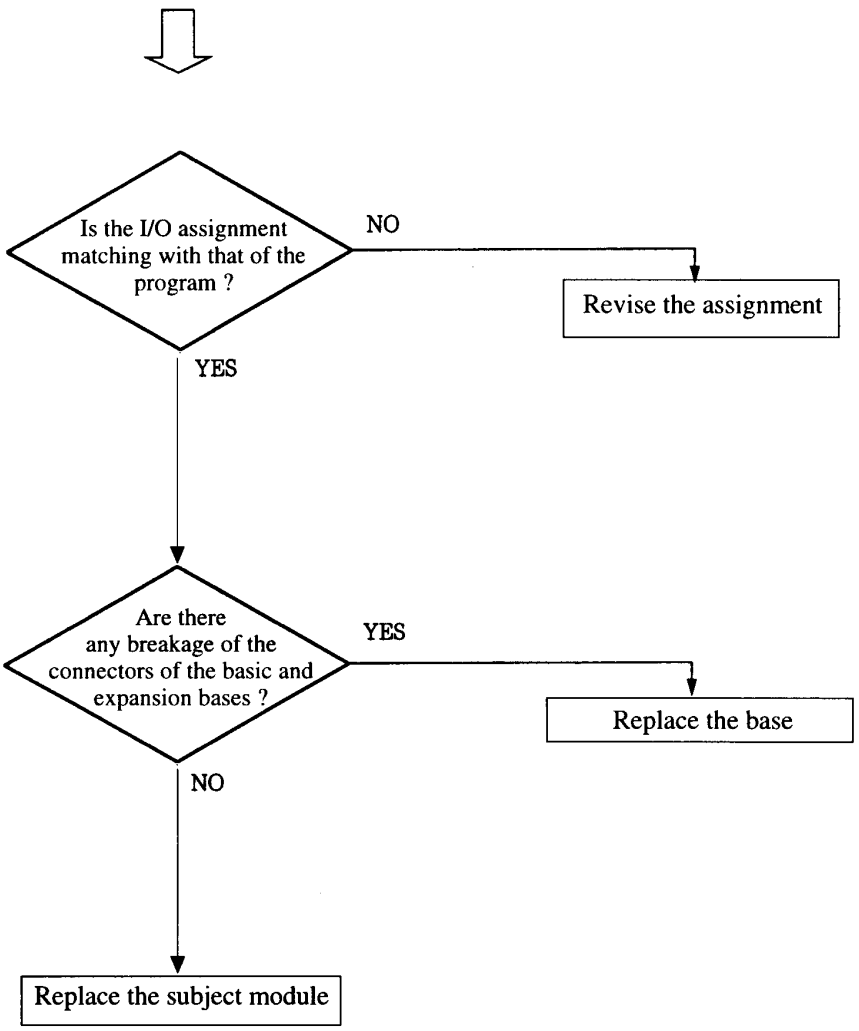
[Output signal is incorrect while the CPU runs]



**[The output signal is not obtained while the CPU is running]**

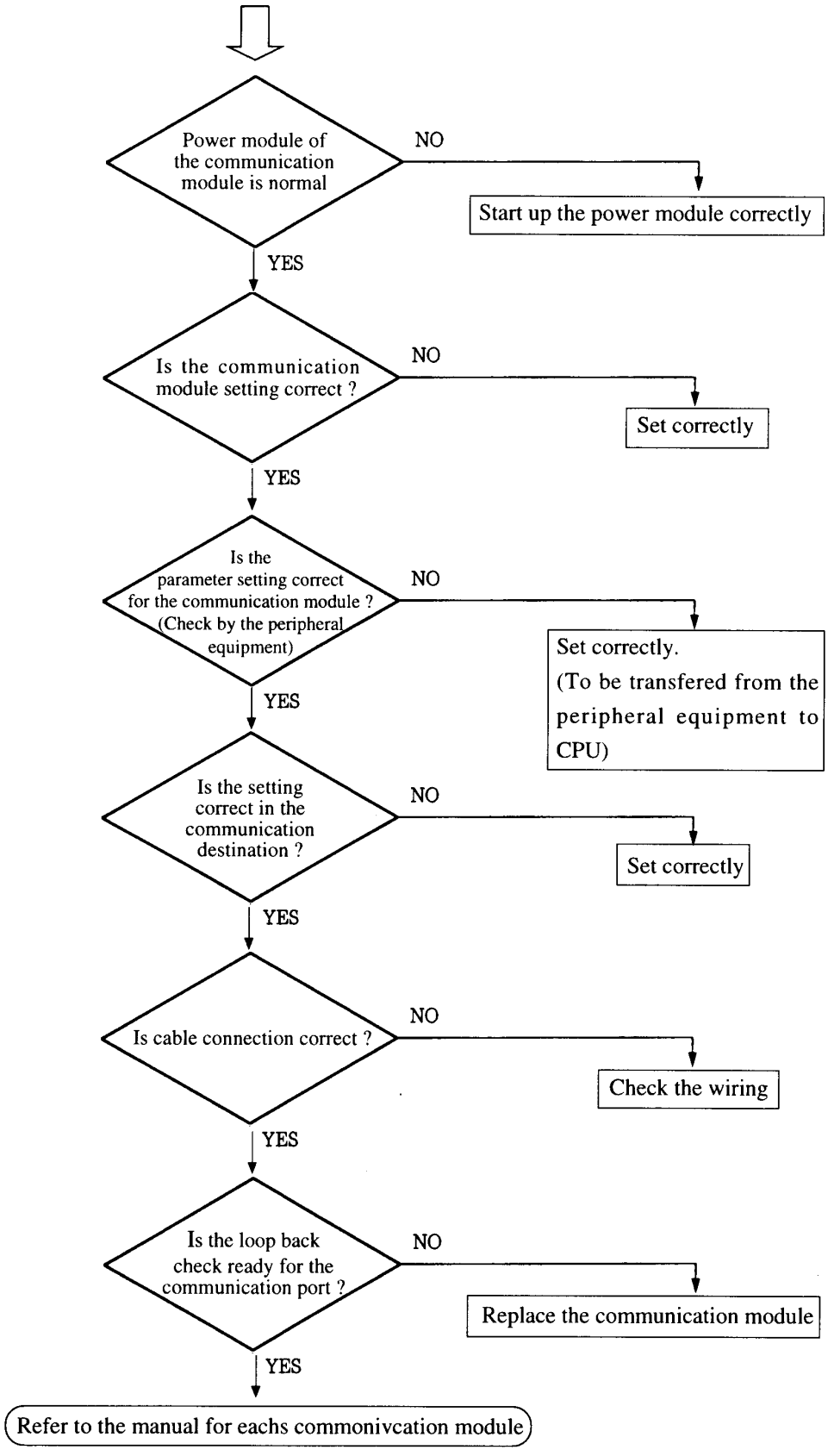


**[The output is normal while I/O assignment error appears]**



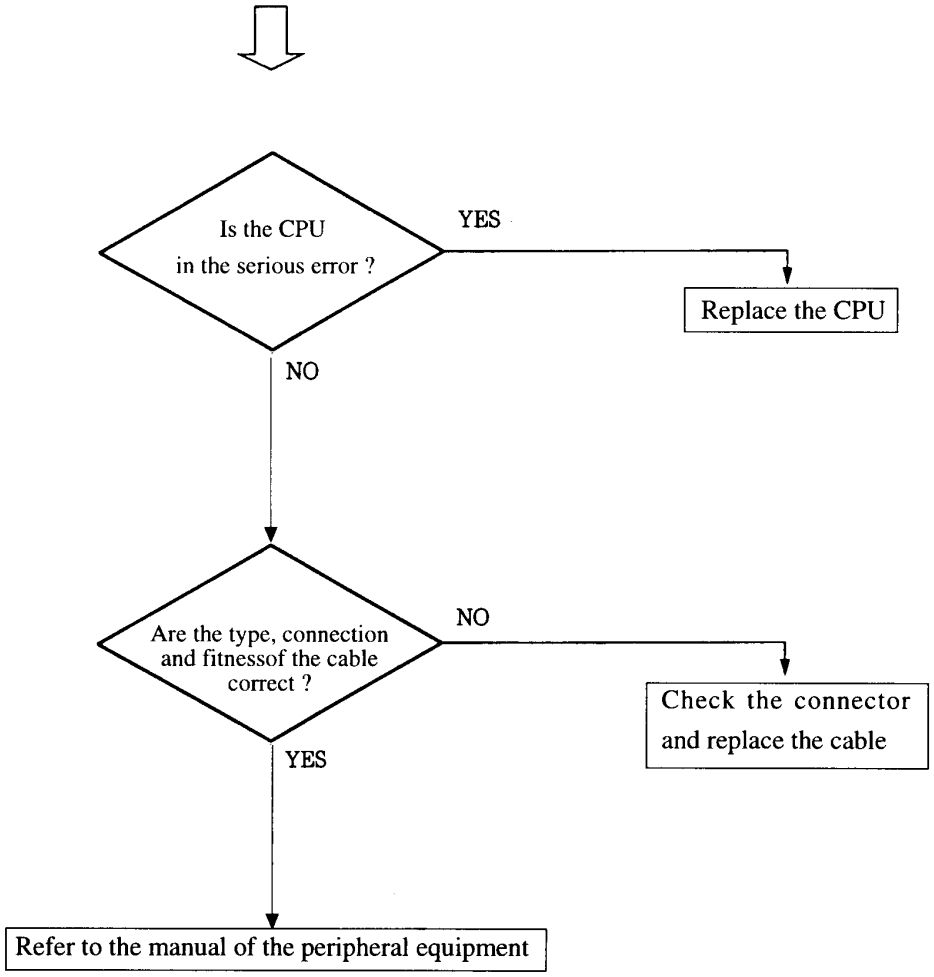
**(f) Communication error**

[Error LED lights in the communication module (CPU link, remote host, remote local)]



**(g) Peripheral equipment failure**

[The peripheral equipment can not be connected]



## 14.4 Self-Diagnosis Error Codes

Listed below are self diagnosis errors and measures to be taken. Each error code will be output in WRF000 of special internal output in hexadecimal.

**Table 14.4.1 Self-Diagnosis Error List (1/4)**

| Error code | Name of errors [Timing for checks] | Class | Description and causes | Measures, etc. | Error lamp | Stop / Run | Special internal output to be set | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bit | Word |
| 11 | System ROM error-1 [ At power source ON] | Fatal failure | Abnormality was detected in sum check of the system ROM by the microcomputer. (System ROM could not be read correctly) | Hardware failure in CPU. When the error is not recovered by turning on power supply again, replace CPU. [Other causes and check points] •Is there any equipment generating electronic noises nearby ? | On | Stopped | — | — |
| 12 | System RAM error-1 [At power source ON] | Fatal failure | Abnormality was detected in read/write check of the system RAM by the microcomputer. (System RAM could not be read/write correctly) | | On | Stopped | — | |
| 13 | Microcomputer error [Continuously] | Fatal failure | Abnormality was detected because the microcomputer attempted execute an undefined command during execution of the system program. [System ROM could not be read correctly) | | On | Stopped | R7C8 | — |
| 23 | Undefined command [Continuously] | Medium failure | Abnormality was detected because the microcomputer attempted execute an undefined command which could not be read by the processor for user program execution. (User program or system ROM could not be read correctly) | | On | Stopped | R7C9 | — |
| 27 | Data memory failure [At power source ON. On an initialization through a programming equipment] | Medium failure | Abnormality was detected in read/write check of data memory. (Data memory could not be read/write correctly) | | On | Stopped | — | — |
| 2C | Sequence processor failure [Continuously] | Medium failure | Abnormality was detected because the processor for user program execution dose not function in accordance with the program by the microcomputer. (The processor for user program execution could not be read correctly) | Hardware failure in CPU. When the error is not recovered by turning on power supply again, replace CPU. [Other causes and check points] •Is the cable connected independently ? • Is there any equipment generating ? | On | Stopped | R7C9 | — |

## Table 14.4.1 Self Diagnosis Error List (2/4)

| Error code | Name of errors [Timing for checks] | Class | Description and causes | Measures, etc. | Error lamp | Stop / Run | Special internal output to be set | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bit | Word |
| 31 | User's memory failure<br>[At power source ON<br>On RUN from STOP<br>During RUN(for RAM only)<br>On a change in parameters<br>On an execution of the memory pack transfer function] | Medium failure | In the case of RAM memory .<br>Abnormality was detected in sum check of the user memory. (The contents of user memory have not been correct.)<br>In the case of ROM memory.<br>Abnormality was detected in sum check of the user memory in ROM. (The contents of ROM memory have not been correct.) | • The contents of user program are destroyed. Perform initialization and transfer program again.<br>• This error is indicated if the battery is completely discharged or the battery is remove for a long time.<br>• When the ROM is used, this error may be indicated in the cases below.<br>1) ROM chip is mounted reversely.<br>2) ROM memory pack is not plugged in correctly.<br>3) Program is not written correctly in ROM. | On | Stopped | R7CA | — |
| 33 | User's memory size error<br>[On RUN from STOP<br>On an execution of the memory pack transfer function] | Medium failure | A capacity of user's program specified by the parameters exceeds the user's memory that is actually provided. | This error might be displayed when the contents of memory in the CPU module are not correct. When the error is not recovered by turning on power supply again, replace CPU. | On | Stopped | R7CC | — |
| 34<br>*1 | Syntax / Assemble error<br>[On RUN from STOP] | Medium failure | A syntax eiror exists in the user's program (Ladder diagram). Details of the error will be set at the special internal output WRFOO1. | A syntax error or an assemble error exists in the user's program. Check the program and the assignment table again for correctness. | On | Stopped | R7D4 | WRF 001 |
| 35 | Mismatching in a comparison<br>[On an execution of the memory pack transfer function] | Medium failure | In the memory pack transfer function, as the result of program comparison made between EEPROM and CPU:<br>(a) Sum error in the memory pack.<br>(b) Sum error in the CPU.<br>(c) Mismatching exists in LADDER program. | — | Flick-ering | Stopped | — | — |

*1 Includes the cases where the program tries to use the commands not supported by H-250/252 or unusable I/O area.

(Note) When MPH-1GE or MPH-16R assigned in 16k steps mount to H-25O, the below errors occur.

- MPH-1GE in transfer mode → "33"
- MPH-16R or MPH-16E in soft - protcct

  Program capacity < 8k steps → "5A" (program can be transferred)

  Program capacity ≥ 8k steps → "33" (program can not be transferred)
- MPH-1GE in matching mode

  Program capacity ≥ 8k steps → "35"

## Table 14.4.1 Self Diagnosis Error List (3/4)

| Error code | Name of errors [Timing for checks] | Class | Description and causes | Measures, etc. | Error lamp | Stop / Run | Special internal output to be set | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bit | Word |
| 36 | Mismatching in memory assignment [On an execution of the memory pack transfer function] | Medium failure | In the memory pack transfer function, as the result of program comparison made between EEPROM and CPU: Mismatching exists in memory assignment | — | Off | Stopped | — | — |
| 44 | Congestion error (Normal scan) [On an execution of END process] | Minor failure | Execution time (scan time) of normal scan was checked of each END command. In consequence, the parameter-set congestion check time (standard 100 msec) was exceeded. So it was detected as an abnormality. | Change the program so as shorten the scan time of the user's program, or change the congestion check time setting. (Note): parameter settings for CPU operation can be changed by peripherals. | On | (Stop) *1 | R7D1 | — |
| 45 * 1 | Congestion error (Periodic scan) [During the periodic process] | Minor failure | Execution time of periodic scan program was checked in periodic processing. As a result, the determined time was exceeded. So it was detected as an abnormality. | Change the program so as shorten the execution time of the periodic inteiruption scan. | On | (Stop) *1 | R7D2 | — |
| 47 *2 | Excessive number of points for I/O assignment [At power source ON On RUN from STOP During RUN(for RAM only) On a change in parameters] | Minor failure | When the sophisticated base is used, number of assigned slots is more than 29. When the standard base is used, number of assigned slots is more than 16. | Make I/O assignment so as to avoid the number of inputs over the maximum permissible value in the CPU unit. | On | Stopped | R7D6 | — |
| 54 *2 | Communication module failure [Continuously] | Alarm | Hardware failure in the communication module. The unit No. and the slot No. of the modules under failure will be set on WRF004. | Provide appropriate recovery measures on the communication module in the error in refereace to error codes. Replace the failed communication module. | Off | Running | R7D7 | WRF004 |
| 59 *2 | Failure in the link module [Continuously] | Alarm | Hardware failure in the link module. Abnormal link parameters. The slot No. where the abnormality exists will be set on WRF007. | Provide appropriate recovery measures on the communication module in the error in reference to error codes. (For remedies from the errors, refer to the manual for the link module.) | Off | Running | R7DE | WRF007 (slot No.) WRF0E0 to F19F (details) |

*1 Running can be continued even in the failure by setting the parameters by a programming equipment.

*2 Effective only H-252.

## Table 14.4.1 Self Diagnosis Error List (4/4)

| Error code | Name of errors [Timing for checks] | Class | Description and causes | Measures, etc. | Error lamp | Stop / Run | Special internal output to be set | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bit | Word |
| 61 | Communication port error (Parity) *1 [During communications] | Alarm | In communication with programming device or personal computer, a parity error of received data was detected.<br>Cable was disconnected in the on-line mode.<br>(Noise is superimposed on cable.<br>Connector cable is not connected properly.<br>Mismatch in transmission speed, etc.) | • Plug in the cable connector again.<br>• Re-confirm wiring and signal allocation inside the connector.<br>• Review setting of transmission speed, etc.<br>• Eliminate noise source from the vicinity of cable<br>• Other proper measure.<br>• Error code 64 might be set in WRF000 by generating "Port transmission error (protocol error)" while monitoring with LADDER EDITOR (edition of PC98). However, the error lamp does not light and the monitor continues. Please disregard or clear this error by turning on special internal output R7EC of an error code clear. | Off | Running | — | — |
| 62 | Communication port error (Framing / Overrun) *1 [During communications] | Alarm | In communication with programming device or personal computer, framing error or overrun error was detected.<br>(Noise is superimposed on cable.<br>Connector cable is not connected properly.<br>Mismatch in transmission speed, etc. | | Off | Running | — | — |
| 63 | Communication port error (Time-out) *1 [During communications] | Alarm | In communication with programming device or personal computer, time-out error was detected.<br>(Noise is superimposed on cable. Connector cable is not connected properly. Processing program on the personal computer side does not agree with CPU specifications.) | | Off | Running | — | — |
| 64 | Communication port error (Protocol error) *1 [During communications] | Alarm | In communication with programming device or personal computer, protocol (transmission procedure) error was detected.<br>(Noise is superimposed on cable.<br>Connector cable is not connected properly.<br>Processing program on the personal computer side does not comply with protocol.) | | Off | Running | — | — |
| 65 | Communication port error (BCC error) *1 [During communications] | Alarm | In communication with programming device or personal computer, data could not be received correctly.<br>(Noise is superimposed on cable.<br>Connector cable is not connected properly.<br>Processing program on the personal computer side does not comply with protocol. | | Off | Running | — | — |
| 71 | Battery error [Continuously] | Alarm | Battery charge has become lower than the specified level. Or the battery is not mounted. | Renew the battery | Flick-ering | Running | R7D9 | — |

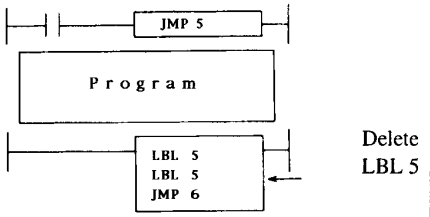
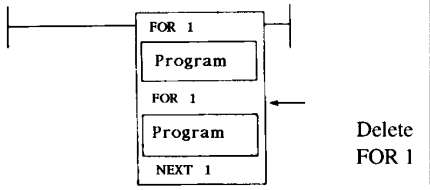
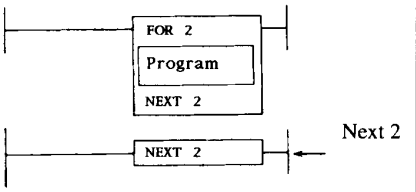
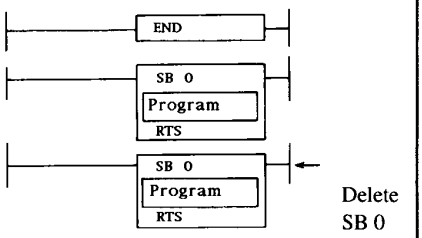
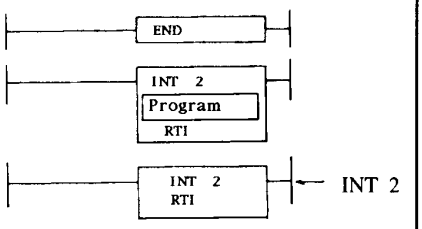
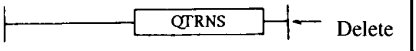
* Errors of code 61 to 65 may also occur the moment the cable is disconnected or reconnected in the live status. This is due to communication in the unstable condition peculiar to disconnection / reconnection time. Since recovery will automatically be made soon, CPU operation remains unaffected. For clearing the error code in CPU module, set the special internal output R7EB to 1.

## 14.5 Details of Syntax • Assembling Errors

(1) The followings are syntax • assembling error codes and corresponding circuit status. Error codes will be set in hexadecimal to WRF001 of the internal output.



**Table 14.5.1 Detailed List of Syntax • Assembling error (1/4)**

| Code (Hexa-decimal) | Item | Error description | Remedy | Example program |
|---|---|---|---|---|
| H0001 | Double definition of LBL | Two or more LBL commands exist with the same number. | Avoid the double numbering. Give single number to single LBL command. |  |
| H0002 | Double definition of FOR | Two or more FOR commands exist with the same number. | Avoid the double numbering. Give single number to single FOR command. |  |
| H0003 | Double definition of NEXT | Two or more NEXT commands exist with the same number. | Avoid the double numbering. Give single number to single NEXT command. |  |
| H0004 | Double definition of SB | Two or more SB commands exist with the same number. | Avoid the double numbering. Give single number to single SB command. |  |
| H0005 | Double definition of INT | Two or more INT commands exist with the same number. | Avoid the double numbering. Give single number to single INT command. |  |
| H000F | Undefined command error | Tried to use a command that is unusable in H-250/252, or found an invalid command. | Delete the command identified as undefined. |  |

## Table 14.5.1 Detailed List of Syntax • Assembling error (2/4)

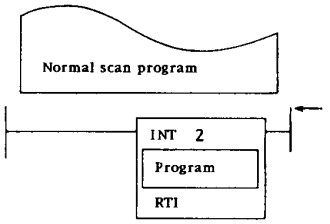
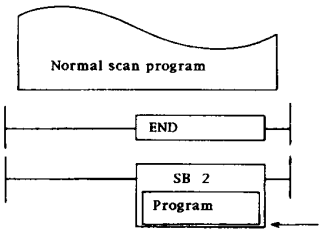
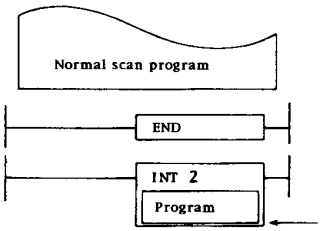
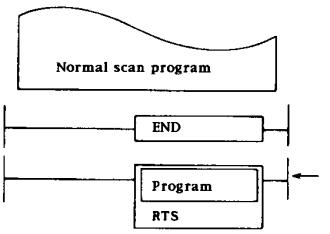
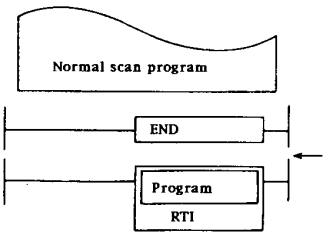
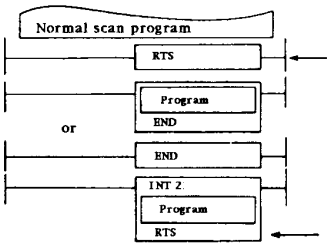
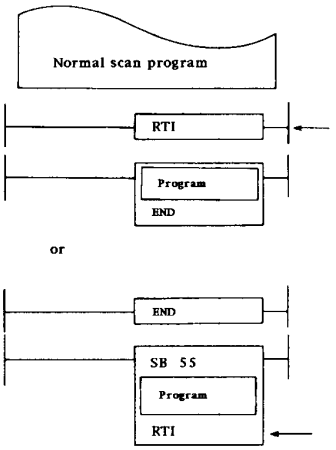
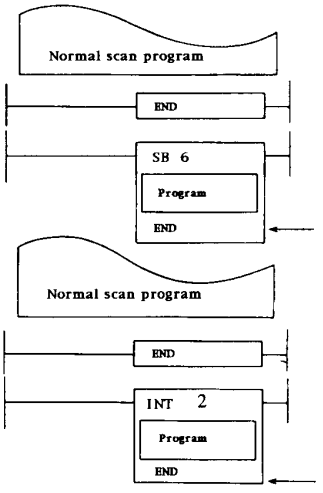
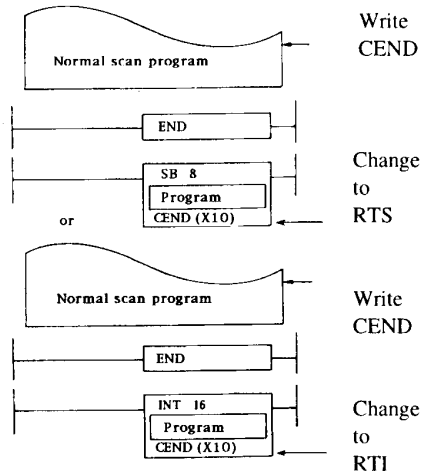
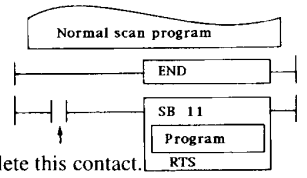
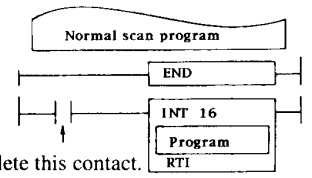
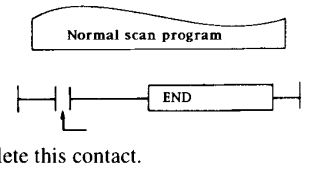
| Code (Hexa-decimal) | Item | Error description | Remedy | Example program |
|---|---|---|---|---|
| H0010 | No definition for END | No END command exists before the commands INT and SB. | Define the command END before the command INT or SB. |  |
| H0011 | NO definition for RTS | No RTS command to be in response to the command SB. | Define the command RTS after the command SB. |  |
| H0012 | No definition for RTI | No RTI command to be in response to the command INT. | Define the command RTI after the command INT. |  |
| H0013 | No definition for SB | No SB command to be in response to the command RTS. | Define the command SB before the command RTS. |  |
| H0014 | No definition for INT | No INT command to be in response to the command RTI. | Define the command INT before the command RTI. |  |
| H0016 | I/O No. error | Exists a circuit containing I/O No. that is out of the applicable range of I/O of H-250/252. | Change or delete No.that is out of the applicable range |  |

**Table 14.5.1 Detailed List of Syntax • Assembling error (3/4)**

| Code (Hexa-decimal) | Item | Error description | Remedy | Example program |
|---|---|---|---|---|
| H0020 | RTS in the error area | The command RTS exists in a normal scan area or in an interruption scan area. | Define RTS in a sub-routine area. |  Delete this circuit / Change to RTI |
| H0021 | RTI in the error area | The command RTI exists in a normal scan area or in a sub-routine area. | Define RTI in an inter-ruption area. |  Delete this circuit / Change to RTS |
| H0022 | END in the error area | The command END exists in an interrup-tion area or in a subroutine area. | Define END at the end of a normal scan area. |  Change to RTS / Change to RTI |

## Table 14.5.1 Detailed List of Syntax • Assembling error (4/4)

| Code (Hexa-decimal) | Item | Error description | Remedy | Example program |
|---|---|---|---|---|
| H0023 | CEND in the error area. | The command CEND exists in an interruption scan area or in a subroutine area. | Define the command CEND in a normal scan area. |  |
| H0030 | A start condition error of RTS. | A condition for the start exists in an operational box that contains the command RTS. | Delete the start condition in the operational box. |  |
| H0031 | A start condition error of RTI. | A condition for the start exists in an operational box that contains the command RTI. | Delete the start condition in the operational box. |  |
| H0032 | A start condition error of END. | A condition for the start exists in an operational box that contains the command END. | Delete the start condition in the operational box. |  |

## 14.6 Computational error codes

(1) When an error occurs in an execution of a control instraction, "1" will be set to the internal special output (R7F3) for the computation error (ERR), and an error code that indicates the error description will be set to WRF015.

(2) To clear to zero for the computation error, execute "R7F3 = 0" which realizes a forced set through a peripheral, or write program preliminary so that R7F3 is reset by external input. To clear the error code, execute "WRF015 = 0" which realizes a forced set through a peripheral, or write program preliminary so that R7F3 is reset by external input.



**Table 14.6.1 List of computational error codes**

| Error code (Hexa-decimal) | Name of the error | Description | Command to call error |
|---|---|---|---|
| H0013 | SB not defined | The command SBn is not given in the program for the same code number "n" of the command CALn. | CAL |
| H0015 | LBL not defined | The command LBLn is not given in the program for the same code number "n". | JMP<br>CJMP |
| H0016 | FOR not defined | The command FORn is not given in the program for the same code number "n" of the command NEXTn. | NEXT |
| H0017 | NEXT not defined | The command NEXTn is not given in the program for the same code number "n" of the command FORn. | FOR |
| H0040 | LBL in the error area | The command LBL is not given in the program for the same code number "n" of the command JMP (CJMP) in the same area. | JMP<br>CJMP |
| H0041 | CAL nesting overflow | Number of nesting layers exceeds six in a subroutine. | CAL |
| H0042 | CAL not defined | RTS is executed even when the command CAL is not executed. | RTS |
| H0043 | NEXT - FOR error | The command NEXTn exists before the command FORn that has the same code number "n". | FOR |
| H0044 | NEXT in the error area | The command NEXTn is not given in the program for the same code number "n" of the command FORn in the same area. | FOR |
| H0045 | FOR - NEXT nesting overflow | FOR n and NEXTn are not properly nested. | FOR |
| H0046 | FOR nesting error | The nesting FOR - NEXT are in six layer or more. | FOR<br>NEXT |

# Appendix Special Internal Output

## (1) List of Special Internal Output

Special Internal Bit Output (64 points)

| | I/O No. | Contents | ON | OFF |
|---|---|---|---|---|
| | R7C0 | Continue processing during cycle time over (normal scan) | U | U |
| | R7C1 | Continue processing during cycle time over (periodic scan) | | |
| | R7C2 | (Undefined) | - | - |
| | R7C3 | Remote Run enabled | U | U |
| | R7C4 | Remote Stop enabled | | |
| | R7C5 | Debug enabled | | |
| | R7C6 | (Undefined) | - | - |
| | R7C7 | Enabled modification during RUN | U | U |
| | R7C8 | Serious failure | S | |
| * | R7C9 | Sequence processor error | | |
| | R7CA | User memory error | | |
| | R7CB | (Undefined) | - | - |
| | R7CC | Memory size over | S | U |
| | R7CD | (Undefined) | - | - |
| | R7CE | (Undefined) | | |
| | R7CF | (Undefined) | | |
| | R7D0 | (Undefined) | | |
| | R7D1 | Congestion error (normal scan) | S | U |
| | R7D2 | Congestion error (periodic scan) | | |
| | R7D3 | (Undefined) | - | - |
| | R7D4 | Syntax or assemble error | S | U |
| | R7D5 | (Undefined) | - | - |
| * | R7D6 | Excessive number of assignment points in I/O module | S | U |
| * | R7D7 | Communication module error | | |
| | R7D8 | (Undefined) | - | - |
| | R7D9 | Battery error | S | S |
| | R7DA | (Undefined) | - | - |
| | R7DB | Self-diagnostic error | S | U |
| | R7DC | (Undefined) | - | - |
| | R7DD | (Undefined) | | |
| * | R7DE | Link module failure | S | U |
| | R7DF | (Undefined) | - | - |
| | R7E0 | Mode key switch in STOP position | S | U |
| | R7E1 | Dip switch in the position "4" | | |
| | R7E2 | Mode key switch in RUN position | | |
| | R7E3 | Single scan ON after RUN | | |
| | R7E4 | Always ON | | X |
| | R7E5 | 0.02 - s clock | | S |
| | R7E6 | 0.1 - s clock | | |
| | R7E7 | 1 - s clock | | |
| | R7E8 | Occupancy flag | | |
| | R7E9 | Disabled RUN | | |
| | R7EA | Modification during RUN | | |
| | R7EB | Error LED display clear | U | |
| | R7EC | Internal special erroneous output clear | | |
| | R7ED | (Undefined) | - | - |
| | R7EE | (Undefined) | | |
| | R7EF | (Undefined) | | |
| | R7F0 | Carry flag (CY) | S | S |
| | R7F1 | Overflow (V) | | |
| | R7F2 | Shift data (SD) | U | U |
| | R7F3 | Calculation error (ERR) | S | S |
| | R7F4 | Data error (DER) | | |
| | R7F5 | (Undefined) | - | - |
| | R7F6 | (Undefined) | | |
| | R7F7 | (Undefined) | | |
| | R7F8 | Request to read calendar clock | U | S |
| | R7F9 | Request to set calendar clock | | |
| | R7FA | Request to adjust calendar clock | | |
| | R7FB | Incorrect calendar clock setting | S | |
| * | R7FC | Trigger condition matching flag | | |
| * | R7FD | Trace monitor flag | | |
| | R7FE | (Undefined) | - | - |
| * | R7FF | Converted I/O number in the case of bit I/O No. error | | |

The user must operate U.
S is controlled by systems. The user must not control S and X.
* : Effective only for H-252.

Special Internal Word Output (512 words)

| | I/O No. | Contents | ON | OFF |
|---|---|---|---|---|
| | WRF000 | Self-diagnostic error code | S | U |
| | WRF001 | Syntax and assembler error details | | |
| | WRF002 | (Undefined) | - | - |
| | WRF003 | (Undefined) | | |
| | WRF004 | Invalid communication module slot number | S | U |
| | WRF005 | (Undefined) | - | - |
| | WRF006 | (Undefined) | | |
| | WRF007 | Invalid link module slot number | S | U |
| | WRF008 | Error circuit number | | |
| | WRF009 | (Undefined) | - | - |
| | WRF00A | (Undefined) | | |
| | WRF00B | Calendar cock reading data (year) | S | S |
| | WRF00C | Calendar clock reading data (month, day) | | |
| | WRF00D | Calendar clock reading data (a day of the week) | | |
| | WRF00E | Calendar clock reading data (hour, minute) | | |
| | WRF00F | Calendar clock reading data (second) | | |
| | WRF010 | Maximum scan time | | |
| | WRF011 | Current scan time | | |
| | WRF012 | Minimum scan time | | |
| | WRF013 | CPU status | | |
| | WRF014 | Internal word output capacity | | |
| | WRF015 | Calculation error code | | U |
| | WRF016 | Residue register (lower order) | | S |
| | WRF017 | Residue register (upper order) | | |
| * | WRF018 | Converted I/O number in the case of double word I/O No. error | | |
| * | WRF019 | Converted I/O number in the case of word I/O No. error | | |
| | WRF01A | (Undefined) | - | - |
| | WRF01B | Calendar clock reading or setting data (year) | U/S | S |
| | WRF01C | Calendar clock reading or setting data (month, day) | | |
| | WRF01D | Calendar clock reading or setting data (a day of the week) | | |
| | WRF01E | Calendar clock reading or setting data (hour, minute) | | |
| | WRF01F | Calendar clock reading or setting data (second) | | |
| | WRF020<br>WRF021 | Status, communication module slot 0 status | S | |
| | WRF022<br>to<br>WRF031 | Status, communication module slot 1 to 8 status | | |
| | WRF032<br>WRF033 | Status, communication module slot 9 status | | |
| | WRF034<br>to<br>WRF03F | (Undefined) | - | - |
| | WRF040<br>WRF041<br>WRF042 | Member registration area 1 | S | S |
| | WRF043<br>WRF044<br>WRF045 | Member registration area 2 | | |
| | WRF046<br>WRF047<br>WRF048 | Member registration area 3 | | |
| | WRF049<br>WRF04A<br>WRF04B | Member registration area 4 | | |
| | WRF04C<br>WRF04D<br>WRF04E | Debug registration area | | |
| | WRF04F<br>to<br>WRF0DF | (Undefined) | - | - |
| | WRF0E0<br>to<br>WRF13F | Link - 1 error flag | S | S |
| | WRF140<br>to<br>WRF19F | Link - 2 error flag | | |
| | WRF1A0<br>to<br>WRF1FF | (Undefined) | - | - |

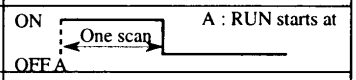
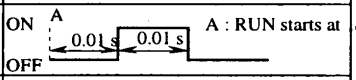
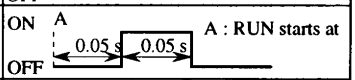
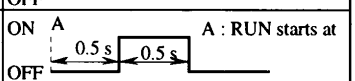
* and WRF020 to WRF1FF are effective only for H-252.

## (2) Details of Special Internal Bit Output

| Number | Name | Interpretation | Detailed descriptions | Conditions of setting | Conditions of resetting |
|---|---|---|---|---|---|
| R7C0 | Continue processing during cycle time over (normal scan) | 0 : Discontinue RUN<br>1 : Continue RUN | Specifies to continue or discontinue RUN in the case of a cycle time over error in a normal scan. | The user must operate "ON" | The user must operate "OFF". "OFF" can also be made by the set switch(R. CL) for the power failure memory area. |
| R7C1 | Continue processing during cycle time over (periodic scan) | 0 : Discontinue RUN<br>1 : Continue RUN | Specifies to continue or discontinue RUN in the case of a cycle time over error in a periodic scan. | | |
| R7C2 | (Undefined) | - | - | | |
| R7C3 | Remote Run enabled | 0 : Prohibit REMOTE RUN<br>1 : Permit REMOTE RUN | Specifies to permit or prohibit of REMOTE RUN (RUN command from a host computer). | | |
| R7C4 | Remote Stop enabled | 0 : Prohibit REMOTESTOP<br>1 : Permit REMOTE STOP | Specifies to permit or prohibit of REMOTE STOP (STOP command from a host computer). | | |
| R7C5 | Debug enabled | 0 : Prohibit to debug<br>1 : Permit to debug | Specifies to permit or prohibit of a debug RUN. | | |
| R7C6 | (Undefined) | - | - | | |
| R7C7 | Enabled modification during RUN | 0 : Prohibit to change<br>1 : Permit to change | Specifies to permit or prohibit of changes of user's program during RUN. | | |
| R7C8 | Serious failure | 0 : No serious failure<br>1 : Exists serious failure | Indicates the manager microcomputer is in a failure or not. | The system will operate "ON" | |
| R7C9 *2 | Sequence processor error | 0 : Normal<br>1 : Abnormal | Indicates the sequence processor (the microcomputer that realize the sequence operations) is in a failure or not. | | |
| R7CA | User memory error | 0 : Normal<br>1 : Abnormal | Indicates the user's memory is in a failure or not. | | |
| R7CB | (Undefined) | - | - | | |
| R7CC | Memory size over | 0 : Normal<br>1 : Abnormal | Indicates the user's program size exceeds or not the user's program memory size assigned by the parameters. | | |
| R7CD | (Undefined) | - | - | | |
| R7CE | (Undefined) | - | - | | |
| R7CF | (Undefined) | - | - | | |
| R7D0 | (Undefined) | - | - | | |
| R7D1 | Congestion error (normal scan) | 0 : Normal<br>1 : Congestion error | Execution time exceeds or not the time specified by the parameters. | | |
| R7D2 | Congestion error (periodic scan) | 0 : Normal<br>1 : Congestion error | Periodic scan is completed or not within that period of time. | | |
| R7D3 | (Undefined) | - | - | | |
| R7D4 | Syntax or assemble error | 0 : Normal<br>1 : error | User's program contains or not a syntax error (Details will be outputted to WRF001) | | |
| R7D5 | (Undefined) | - | - | | |
| R7D6 *2 | Excessive number of assignment points in I/O module | 0 : Normal<br>1 : Excessive | Assignment in I/O exceeds or not the maximum permissible value. | | |
| R7D7 | Communication module error | 0 : Normal<br>1 : Failure | Communication module is in the normal or in a failure (Failed slot No. will be outputted to WRF004). | | |
| R7D8 | (Undefined) | - | - | | |
| R7D9 | Battery error *1 | 0 : Normal<br>1 : Failure | Battery voltage is normal or dropped in the CPU module. | | The system will operate "OFF" |
| R7DA | (Undefined) | - | - | | The user must operate "OFF". "OFF" can also be made by the set switch(R. CL) for the power failure memory area. |
| R7DB | Self-diagnostic error | 0 : Normal<br>1 : Error | Self diagnostic system detected or not an error (Details will be outputted to WRF000). | | |
| R7DC | (Undefined) | - | - | | |
| R7DD | (Undefined) | - | - | | |
| R7DE *2 | Link module error | 0 : Normal<br>1 : Error | Link module is in the normal or in a failure (Failed slot No. will be outputted to WRF007) (Details will be outputted to WRF0E0 to WRF19F). | | |
| R7DF | (Undefined) | - | - | | |

*1 Battery error (R7D9) will be returned to "OFF" automatically on a replacement of the battery.

*2 Effective for H-252 only.

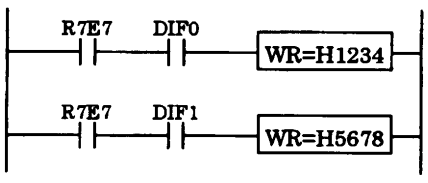
| Number | Name | Interpretation | Detailed descriptions | Conditions of setting | Conditions of resetting |
|---|---|---|---|---|---|
| R7E0 | Mode key switch in STOP position | 0 : Key position, not in STOP<br>1 : Key position, in STOP | Any one of "1" will be ON. (R7E0 or R7E2) | The system will operate "ON" | The system will operate "OFF". |
| R7E1 | Dip switch in the position "4" | 0 : Switch position, not in REMOTE<br>1 : Key position, in REMOTE | | | |
| R7E2 | Mode key switch in RUN position | 0 : Key position, not in RUN<br>1: Key position, in RUN | | | |
| R7E3 | Single scan ON after RUN | 0 : 2nd scan or later after RUN<br>1: 1st scan after RUN |  | | |
| R7E4 | Always ON | 0 : Not assigned<br>1 : Continuation | | | "ON" only Avoid "OFF" |
| R7E5 | 0.02 - s clock *2 | 0 : 0.01 seconds<br>1 : 0.01 seconds |  | | The system will operate "OFF". |
| R7E6 | 0.1 - s clock *2 | 0 : 0.05 seconds<br>1 : 0.05 seconds |  | | |
| R7E7 | 1 - s clock *2 | 0 : 0.5 second<br>1 : 0.5 second |  | | |
| R7E8 | Occupancy flag | 0 : Not occupied<br>1 : Occupied | Indicates the status of occupation in the case of communications with a personal computer or a peripheral. | | |
| R7E9 | Disabled RUN | 0 : Permit RUN<br>1 : Prohibit RUN | Prohibit or permit RUN. | | |
| R7EA | Modification during RUN | 0 : Modification unexecuted during RUN<br>1 : Modification under execution during RUN | RUN is halted (outputs in the hold) or not caused by modifications made during RUN. | | |
| R7EB *1 | Error LED clear | 1: Clear | To clear the error indication in the LED. | The user must operate "ON" | |
| R7EC *1 | Internal special erroneous output clear | 1: Clear | To clear special internal outputs that are set for indications of errors in the error LED (To clear WRF000 ~ WRF008, R7C8 ~ R7DE). | | |

*1 If "1" is set contrary the system turns it to "OFF" automatically.

*2 Clock (R7E5 - R7E7) of a special internal output is changed synchronously with the execution of the user program (scan). Therefore, please replace the clock with an internal output at the head of the program and use the clock when you do the programming on the assumption that the clock does not change for one scan.

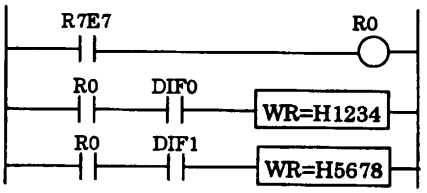
**· Program example when clock can change for one scan**

**(Clock at one second)**




**· The guarantee to which the clock does not change for one scan is a program example if it is necessary.**

**(Clock at one second)**



| | | | | | |
|---|---|---|---|---|---|
| R7ED | (Undefined) | - | - | - | - |
| R7EE | (Undefined) | - | - | | |
| R7EF | (Undefined) | - | - | | |
| R7F0 | Carry flag (CY) | 0 : Carry OFF<br>1 : Carry ON | Carry flag used in the arithmetic commands. | The system will operate "ON" | The system will operate "OFF" |
| R7F1 | Overflow (V) | 0 : No overflow<br>1 : Overflow exists | Overflow flag in the arithmetic commands. | | |
| R7F2 | Shift data (SD) | 0 : Shift data "0"<br>1 : Shift data "1" | Shift data as used in Shift command and other commands. | The user must operate "ON" | The user must operate "OFF" |
| R7F3 | Calculation error (ERR) | 0 : Normal<br>1 : Error | An erroneous command exists or not in the processing (Details will be outputted to WRF015). | The system will operate "ON" | The system will operate "OFF" |
| R7F4 | Data error (DER) | 0 : Normal<br>1 : Congestion Error | Data error is detected or not in the processing. | | |
| R7F5 | (Undefined) | - | - | The user must operate "ON" | The system will operate "OFF" |
| R7F6 | (Undefined) | - | - | | |
| R7F7 | (Undefined) | - | - | | |
| R7F8 *1 | Request to read calendar clock | 1 : Read | To read the calendar clock data, year, month, day, days of a week, hour, minute, second, and set them to WRF01B ~ WRF01F. | | |
| R7F9 *1 | Request to set calendar clock | 1 : Set | To set the data outputted to WRF01B ~ WRF01F on the calendar clock. | | |
| R7FA *1 | Request to adjust calendar clock | 1 : Adjust | Returned to "0" when second data is 0 ~ 29, and to "0 + 1 minute" when second data is 30 ~ 59. | | |
| R7FB | Incorrect calendar clock setting | 0 : Normal<br>1 : Error | An error in the calendar clock setting. | The system will operate "ON" | |
| R7FC | Trigger condition matching flag | 0 : Trigger mismatches<br>1: Trigger matches | "1" will be set when a trigger condition is matched. | | |
| R7FD | Trace monitor flag | 0 : Stop<br>1: Under execution | "1" will be set when the trace monitor is executed. | | |
| R7FE | (Undefined) | - | - | - | - |
| R7FF | Converted in bit I/O No. error | | CPU will covert to R7FF when bit I/O No. in the program is out of usable range. *2 | - | - |

*1 If "1" is set contrary the system turns it to "OFF" automatically.

*2 Only for H-252 (In case of H-252, CPU will convert to L13FFF)

### (3) Details of Special Internal Word Output

| Number | Name | Stored data | Description |
|---|---|---|---|
| WRF000 | Self-diagnostic error code | Self-diagnostic error codes | The error numbers detected by CPU are stored by the binary code. |
| WRF001 (R7D4) | Syntax and assembler error details | Syntax and assembler error codes | Syntax and assembler error codes of a user's program are stored by the binary code. |
| WRF002 | (Undefined) | - | - |
| WRF003 | (Undefined) | - | - |
| WRF004 (R7D7) | Invalid communication module slot number | Identification number of the slots in error *1 | To store the slot identification number of the communication module that is in the error ( The last 4 bits : 1 to 8). |
| WRF005 | (Undefined) | - | - |
| WRF006 | (Undefined) | - | - |
| WRF007 (R7DE) | Invalid link module slot number | Identification number of the slots in error *1 | To store the slot identification number of the link module that is in the error<br>15 12 11 8 7 4 3 0<br>"0" \| a \| b \| "0"<br>a : Unit No. (0 to 2)<br>b : Slot No. (0 to 9) |
| WRF008 | Error circuit number | No. of the circuit having an error | Stores circuit No. that are in undefined command, I/O No. error, or syntax assemble error |
| WRF009 | (Undefined) | - | - |
| WRF00A | (Undefined) | - | - |
| WRF00B | Calendar clock reading data (BCD data) | Year | A.D. in 4 digits is always given.<br>(Example) 1991 : Year 1991 |
| WRF00C | | Month, Day | Data for Month and Day are always given.<br>(Example) 0921 : September 21 |
| WRF00D | | A day of the week | Data for a day of the week is always given.<br>(Example) 0006 : Saturday *2 |
| WRF00E | | Hour, Minute | Hours and Minutes (24 hours system) are always given.<br>(Example) 0805 : 8 hours past 5 minutes |
| WRF00F | | Second | Data for Seconds is always given.<br>(Example) 0015 : 15 seconds |
| WRF010 | Maximum scan time | Maximum execution time of the normal scan | 10ms units |
| WRF011 | Current scan time | Current execution time of the normal scan | 10ms units |
| WRF012 | Minimum scan time | Minimum execution time of the normal scan | 10ms units<br>Minimum execution time is set to 65535 immediately after the initiation of RUN, and after to proper value. |
| WRF013 | CPU status | Status of CPU operation<br>15 10 9 8 7 6 5 4 3 2 1 0<br>Not used \| a \| b \| c \| d \| e \| f \| g \| h \| i<br>a : CPU type : 01 = H-2000, 10 = H-700/ 252 11 = H-300/ 250<br>b : Battery error : 1 = Error, 0 = Normal c : Not used<br>d : Debug : 1 = Under execution, 0 = No execution<br>e : Force : 1 = Under execution, 0 = No execution *3<br>f : Error : 1 = Error, 0 = Normal<br>g : Simulation : 1 = Under execution, 0 = No execution *3<br>h : Halt : 1 = Under execution, 0 = No execution<br>i : Operation : 1 = RUN, 0 = STOP | |
| WRF014 | Internal word output capacity | Number of words for the internal word outputs | H-250 : 0400, H-252 : 4400 |
| WRF015 | Calculation error code | Calculation error codes | To store the error codes during the execution of an operation command. |
| WRF016 | Residue register (lower order) | Division overflow (Remainder of the division operation) | 32-bit operation :<br>Upper order to F017, Lower order to F016 |
| WRF017 | Residue register (upper order) | | 16-bit operation : F016 is used |
| WRF018 | Converted I/O number in the case of double word I/O No. error | CPU converts to DRF018 when double word I/O number in the program is out of usable range. *4 | |
| WRF019 | Converted I/O number in the case of word I/O No. error | CPU converts to WRF019 when word I/O number in the program is out of usable range. *4 | |
| WRF01A | (Undefined) | - | - |

*1 To know which slot is in the error, make the corresponding special internal bit output (shown in parentheses in the Number column) OFF beforehand, or make R7EC ON beforehand.

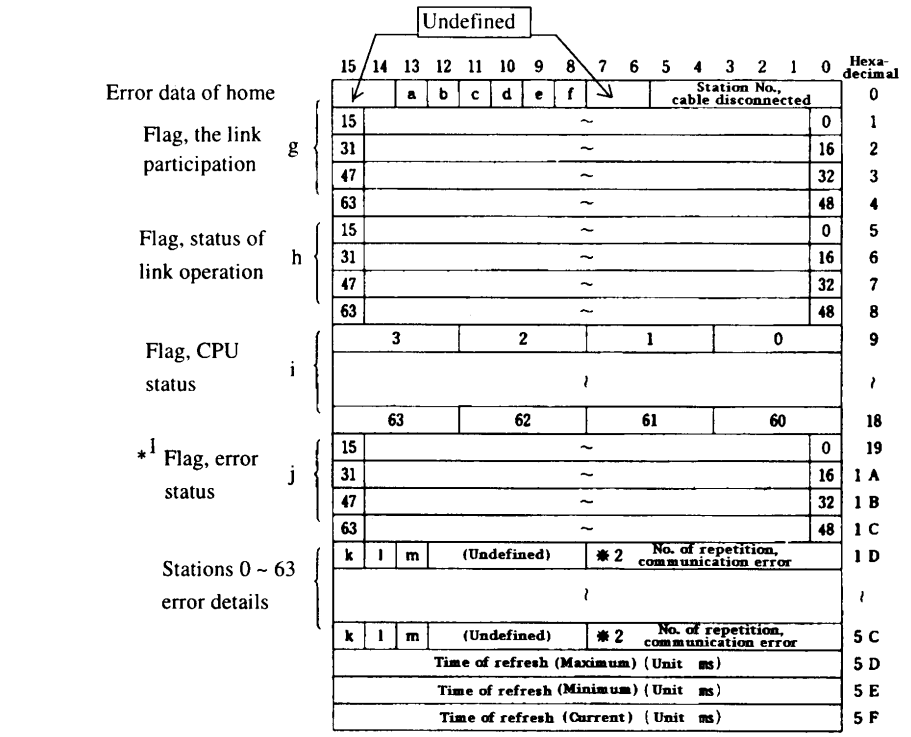
*2 0 : Sunday, 1 : Monday, 2 : Tuesday, 3 : Wednesday, 4 : Thursday, 5 : Friday, 6 : Saturday

*3 Not in use for H-250/252.

*4 Only for H-252 (In case of H-252, CPU will convert to DL13FE or WL13FF).

<table>
<tr><th>Number</th><th>Name</th><th>Stored data</th><th>Description</th></tr>
<tr><td>WRF01B</td><td rowspan="5">Calendar clock reading or setting</td><td>Year</td><td>A.D. reading or setting.<br>(Example) 1991 : Year 1991</td></tr>
<tr><td>WRF01C</td><td>Month, Day</td><td>Month and Day, reading or setting.<br>(Example) 0921 : September 21</td></tr>
<tr><td>WRF01D</td><td>A day of the week</td><td>A day of the week, reading or setting.<br>(Example) 0006 : Saturday *2</td></tr>
<tr><td>WRF01E</td><td>Hour, minute</td><td>Hours and Minutes (24 hours system), reading or setting.<br>(Example) 0805 : 8 hours past 5 minutes</td></tr>
<tr><td>WRF01F</td><td>Second</td><td>Seconds, reading or setting.<br>(Example) 0015 : 15 seconds</td></tr>
<tr><td>WRF020<br>WRF021</td><td>Status, communication module slot 0 status</td><td>Status data (Slot 0)</td><td rowspan="3">15 8 7 0<br>Status 1 | Status 2<br>Status 3 | Status 4<br>Status description will not be given for the slot that the communication module is not mounted on.<br>For details refer to the user's manual for the communication module.</td></tr>
<tr><td>WRF022<br>to<br>WRF031</td><td>Status, communication module slot 1 to 8 status</td><td>Status data (Slot 1 to 8)</td></tr>
<tr><td>WRF032<br>WRF033</td><td>Status, communication module slot 9 status</td><td>Status data (Slot 9)</td></tr>
<tr><td>WRF034<br>to<br>WRF03F</td><td>(Undefined)</td><td>-</td><td>-</td></tr>
<tr><td>WRF040<br>WRF041<br>WRF042</td><td>Member registration area 1</td><td>Port number occupied CPU</td><td rowspan="4">15 8 7 0<br>a | "0"<br>b | c<br>d | e<br>a : 0 = NOT occupied, 1 = READ occupation<br>2 = WRITE occupation<br>b : Loop No.<br>c : Unit No.<br>d : Module No.<br>E : Port No.</td></tr>
<tr><td>WRF043<br>WRF044<br>WRF045</td><td>Member registration area 2</td><td>Port number occupied CPU</td></tr>
<tr><td>WRF046<br>WRF047<br>WRF048</td><td>Member registration area 3</td><td>Port number occupied CPU</td></tr>
<tr><td>WRF049<br>WRF04A<br>WRF04B</td><td>Member registration area 4</td><td>Port number occupied CPU</td></tr>
<tr><td>WRF04C<br>WRF04D<br>WRF04E</td><td>Debug registration area</td><td>Port number under debug</td><td>15 8 7 0<br>Under debug | "0"<br>Loop No. | Unit No.<br>Module No. | Port No.</td></tr>
<tr><td>WRF04F<br>to<br>WRF0DF</td><td>(Undefined)</td><td>-</td><td>-</td></tr>
</table>

* WRF020 to WRF1FF sre effective only for H-252.

<table>
<tr><th>Number</th><th>Name</th><th>Stored data</th><th>Description</th></tr>
<tr><td>WRF0E0<br>to<br>WRF13F</td><td>Link 1,<br>error flag</td><td colspan="2" rowspan="2"> 

a : System bus error b : (Undefined)<br>
c : Area assigned to outside the specified d : Double assignment of the area } 1 = Error<br>
e : Station No. assigned to outside the specified f : Communication route failure } 0 = No error<br>
g : Numbers in the table are the station No., 1 = Participate, 0 = No participate<br>
h : Numbers in the table are the station No., 1 = Under link operation, 0 = Link quitted<br>
i : Numbers in the table are the station No., Details for 4 bits below;<br>
U : 1 = CPU error, 0 = No error<br>
u v w x (4 bits)<br>
V : 1 = In simulation, 0 = Not in simulation<br>
W : 1 = In the halt, 0 = Not in the halt<br>
X : 1 = RUN, 0 = STOP<br>
j : Numbers in the table are the station No. 1 = Error, 0 = No error<br>
k : Time-out error, 1 = Error, 0 = No error<br>
l : Frame error, 1 = Error, 0 = No error<br>
m : Abnormal between CPU and link, 1 = Abnormal, 0 = Normal</td></tr>
<tr><td>WRF140<br>to<br>WRF19F</td><td>Link 2,<br>error flag</td></tr>
<tr><td>WRF1A0<br>to<br>WRF1FF</td><td colspan="2">(Undefined)</td></tr>
</table>

*1 " 1 " will be set to "Flag, error status" in case one of the errors k, l, m as reserved in " Error details" is occurred. Error data will be given to k, l, m when the errors are occurred during the communication with other CPU by means of a peripheral.

*2 "Number of repetition, communication error" is the total sum of occurrence of K or l.

*3 WRF020 to WRF19F are effective only for H-252.