

HITACHI

S10mini.

S10mini
HARDWARE MANUAL

CPU

SME-1-100 (J)

S10mini
HARDWARE MANUAL

CPU

First Edition, December 1998, SME-1-100(A) (out of print)
Second Edition, August 2000, SME-1-100(B) (out of print)
Third Edition, October 2001, SME-1-100(C) (out of print)
Fourth Edition, January 2002, SME-1-100(D) (out of print)
Fifth Edition, March 2003, SME-1-100(E) (out of print)
Sixth Edition, April 2004, SME-1-100(F) (out of print)
Seventh Edition, September 2004, SME-1-100(G) (out of print)
Eighth Edition, July 2006, SME-1-100(H) (out of print)
Ninth Edition, September 2008, SME-1-100(I) (out of print)
Tenth Edition, March 2009, SME-1-100(J)

All Rights Reserved, Copyright © 1998, 2009, Hitachi, Ltd.

The contents of this publication may be revised without prior notice.

No part of this publication may be reproduced in any form or by any means without permission in writing from the publisher.

Printed in Japan.

BI-BI-YS<IC-IC> (FL-MW20, AI8.0)

SAFETY PRECAUTIONS

Be sure to read this manual and all other attached documents carefully before installing, operating inspecting or conducting maintenance on this unit. Always use this unit properly. Be sure to carefully read the information about the device, the safety information and precautions before using this unit. Be sure that the person(s) responsible for maintenance receives and understands this manual completely.

This manual divides the safety precautions into DANGERS and CAUTIONS.



: Failure to observe these warnings may result in death or serious injury.



: Failure to observe these cautions may result in injury or property damage.

Failure to observe any  may lead to serious consequences.

All of these DANGERS and CAUTIONS provide very important precautions and should always be observed.

Additional safety symbols representing a prohibition or a requirement are as follows:



: Prohibition. For example, “Do not disassemble” is represented by:



: Requirement. For example, if a ground is required, the following will be shown:





DANGER

- An emergency stop circuit must be provided externally to this product. Disregarding this rule may result in a damage to the equipment or a hazard to the user if this product fails.
- The input or output current of any I/O module used must not exceed their maximum allowable current values. If an overcurrent flows in an I/O module, it may not only damage its component part(s) but also cause a safety hazard, fire, or a failure.
- Choose an external power supply with overvoltage and overcurrent protection features.
- When the programmable controller smokes, gives off an offensive smell, or otherwise misbehave, turn it off immediately and probe into the cause.
(See page 1-8.)
- Do not connect or disconnect modules and cables in the power-on state of the power supply. Disregarding this rule may result in an electric shock or damage to the equipment. Be sure to switch off the hardware unit before connecting or disconnecting it or its cable.
(See page 4-8.)
- Do not connect or disconnect modules and cables in the power-on state of the power supply. Disregarding this rule may result in an electric shock or damage to the equipment. Be sure to switch off the hardware unit before connecting or disconnecting it or its cable.
(See page 5-7.)
- Electrical shock hazards can result if you touch the terminal block or connector pins while the system is energized. Never touch the terminal block and connector pins while the system is energized.
(See page 5-13.)
- Touching this product in its energized state may result in an electric shock. To prevent this, install the product in an appropriate enclosure or structure provided with a safety interlock.



CAUTION

- To prevent possible failures, house the programmable controller in a drip-proof enclosure in cases where it is feared to be wetted with water.
(See page 1-3.)
- Even if the input voltage of the power supply module falls within a specified range, assume it to be in a power abnormality when it is close to the upper or lower limit of the range, and call upon the power supply facility manager for a checkup.
(See page 1-4.)
- Choose a power supply matching the rating of a module and connect it to that module. Connecting an improper power supply to a module can cause the module to fire.
- Some component parts of this product, such as photo-couplers and LEDs, contain gallium arsenide (GaAs). Gallium arsenide is designated as a harmful substance by law. When scrapping this product, ask a specialized agent to dispose of it as industrial waste.
- Use the same power supply for the external power supply (fed to the +V terminal) of the output module and for the load power supply. Use of different power supplies can cause malfunctioning.
- This product (module) might malfunction or go down due to electromagnetic noise from transceivers, cell phones, and other similar apparatuses. Do not use such apparatuses near this product.
(See page 1-9.)
- To avoid possible failures, allow for at least one second between turning-on and turning-off of the power switch.
(See page 3-9.)



CAUTION

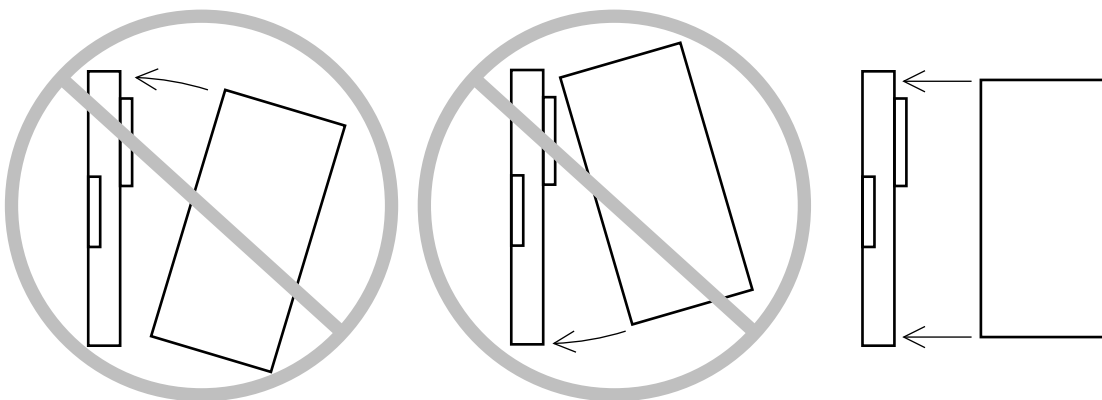
- Heat may build up inside the enclosure to such a degree that it will cause the units to fail. Units may malfunction under the influence of electromagnetic interference from the adjoining units. Allow specified clearances between the enclosure walls and each unit and between the units to assure heat dissipation and lessen electromagnetic interference.
- The temperature rise in the enclosure varies depending on the manner of operation. The above specified clearances should be considered as recommended values. After the installation of units, perform a test run and measure the temperature around the installed units to ensure that it is within allowable limits. If the temperature is found higher than the allowable upper limit, increase the clearances or use forced air cooling by cooling fans.

(See page 4-3.)

- Dust and dirt deposited on the connector can be a risk of poor connection. Install and wire the equipment immediately after unpacking.
- Modules are susceptible to damage. Note the following points when installing or removing modules.
 - Check that the connectors are free from bent or broken pins and the pins are aligned straight and are free from dust.
 - When securing a module, be sure to attach it to the mount base while keeping its mating face parallel to the vertical surface of the mount base, as shown below. If a module is attached or removed aslant from the connector, the connector pins may be bent.

[Bad example]

[Good example]



(See page 4-8.)



CAUTION

- Have qualified technicians wire cables. Improper wiring can lead to fires, failures, and electrical shock hazards.
(See page 5-13.)
- Even if the input voltage of the power supply module falls within a specified range, assume it to be in a power abnormality when it is close to the upper or lower limit of the range, and call upon the power supply facility manager for a checkup.
- Hot swapping of modules can lead to hardware or software destruction. Be sure to replace the module with the power off.
(See page 9-3.)
- Be sure to use this product in an environment specified in a product catalog or manual for it. Use of the product in an environment subject to high temperature/humidity, dust and dirt, corrosive gases, vibrations, and shocks may lead to an electric shock, fire, or malfunction.
- Install this product according to the installation instructions given in this manual. Any improper installation may result in a fall of the product, malfunction, or failure.
- Care must be taken not to enter foreign matter into this product, such as copper wire fragments. Any such material in the product may cause a fire, malfunction, or failure.



PROHIBITION

- Do not install, wire, handle, or remake the programmable controller beyond such an extent as may be defined in this manual. We will not be liable for any damages to our programmable controller and ancillary equipment and for physical injury arising out of such actions.
(See page 1-9.)
- Keep the insulating sheets in position to insulate the mount base from the enclosure.
- Never insert fingers or foreign matter into the clearances between parts of the connectors and mount base. Disregarding this rule may result in injuries.
(See page 4-6.)
- Do not install, wire, handle, or remake the programmable controller beyond such an extent as may be defined in this manual. We will not be liable for any damages to our programmable controller and ancillary equipment and for physical injury arising out of such actions.
- To prevent noise-caused malfunctioning, keep the 100 VAC/VDC or 200 VAC cable and the network cable at least 100 mm apart from each other, rather than bundle them together.
(See page 5-13.)



PROHIBITION

- Do not disassemble or retrofit any module. Disregarding this rule may result in a malfunction, failure, or a fire.
(See page 4-8.)
- Except the CPU module battery, the internal parts are not customer-serviceable. We will not be liable for any damages to our programmable controller and ancillary equipment and for physical injury arising out of such actions. If the module should fail, replace it in its entirety.
(See page 9-18.)



REQUIREMENT

- Attach a fuse or circuit protector to the external power supply for I/O and option modules to protect against short circuits. Use a circuit protector matching the rating of the power supply.
- Verify the wiring before turning on the programmable controller.
- Do not shut down (turn off or reset) the programmable controller without making sure that the peripheral equipment is off or will be unaffected by the shutdown of the programmable controller.
- Memory contents can be corrupted by module failures. Be sure to back up sensitive data.

(See page 1-9.)

- Screw the mount base to the predetermined vertical surface in the enclosure. If it is screwed to a horizontal surface, heat dissipation would be impeded, resulting in failures or degraded parts due to temperature rises.

(See page 4-6.)

- Tighten the screws fully. Inadequately tightened screws can cause malfunctioning, smoking, or firing.
- Damage to the module can result from static electricity. Discharge static charges from your body before starting your installation work.

(See page 4-9.)

- A surge voltage may cause hardware units to malfunction or to be damaged. When a coil, such as a relay, is connected to the PCs OK output circuit, install a surge-absorbing diode or similar device. Use a diode with its peak inverse voltage at least 10 times higher than the circuit voltage and with its forward current equal to or higher than the load current.

(See page 5-7.)



REQUIREMENT

- Before proceeding with power wiring, make sure that the power cable does not have a voltage applied to it. Attach the terminal cover immediately upon power wiring.
- Damage to the module can result from static electricity. Discharge static charges from your body before starting your wiring work.
- Wire the communications and power cables each separately, particularly at least 300 mm apart from the power cables for inverters, motors, and power controllers. Wire the communications and power cables in separate piping or ducts.

(See page 5-13.)

- Excessive accumulation of heat in the enclosure may cause a fire or hardware failure. If the ambient temperature reaches 48°C or higher, reduce the output current of the power supply module. At 55°C, for instance, it is reduced to 5.85 A. Where the ambient temperature tends to be high, install a cooling fan(s) in the enclosure or decrease the number of modules installed therein.

(See page 8-16.)

- Modules may be damaged due to static electricity. Discharge static charges from your body before starting your maintenance work.

(See page 9-2.)

- If the battery is handled improperly, it may catch fire or explode. Some used batteries may still have a considerable amount of charge. To deliver such used batteries to a waste disposal site safely, follow the general rules for collection, packing, and transportation. For concrete methods of packing and transportation, consult with professionals of your local waste disposal business.

(See page 9-12.)



REQUIREMENT

An electric shock may lead to a death or burn. Noise may cause the system to malfunction. Ground the line ground (LG), frame ground (FG), and shield (SHD) terminals, as described below.

- Electrically insulate the mount base from the enclosure. To accomplish this, do not remove the insulating sheet from the mount base.
- Ground the LG and FG terminals separately. The LG terminal is provided to prevent intrusion of power supply noise, while FG and SHD are grounding terminals that suppress intrusion of line noise into external interfaces for remote I/O station modules, communication modules, or other modules. To prevent mutual interference, ground the LG and FG terminals separately.
- Connect the FG terminal on each module to the FG terminal on the mount base. Ground each of the FG terminals of remote I/O lines and OPCN-1 (J.NET) lines at a separate point (on the CPU unit side). (Be sure to ground all the FG terminals of remote I/O station or OPCN-1 station (J.STATION) modules that can be grounded along with the CPU unit at the same point.)

(See page 5-6.)

Notes for using Windows PC software

The Windows® PC (tool) software works with both S10mini and S10/2 α Series.

The user should note the following points:

For the PC software that can be used on the S10mini, see the next page titled “Controller Models and Compatible Software Packages.”

1. CPMS or CPMSE load system -- No need to load the operating system

The S10mini operating system or OS (CPMS) is stored in flash memory in the CPU module. Thus, the S10mini’s operating system needs to be handled differently from the operating system (CPMS) of the S10/2 α series, as described below.

- (1) Loading of the operating system is needed on S10/2 α series controllers, but it is not on S10mini controllers. Do not load the OS from the CPMS or CPMSE load system. Should such loading be carried out, reset the CPU module. The S10mini OS will then boot.
- (2) Since the S10mini control does not require loading of the operating system, the message “LOAD OS” normally is not displayed by the indicator on the CPU module. Should the message appear, turn the power off and then back on again at least 10 seconds later. The CPU module will then be restored to normal, in which case reloading of the OS is not required. As for the user programs and various settings, they need to be reloaded or made again from scratch. If the message “LOAD OS” does not disappear, clear all the memory by following “Clearing all the memory” on page 107. If the CPU module is still not recovered, it is a hardware problem. Replace the CPU module.

2. Batch save/load feature -- Disallowing loading and saving of files between different models

After saving files in a batch on the S10mini controller, do not load these backup files in a batch to an S10/2 α series controller, or vice versa. If batch saving and loading like this is performed, a controller malfunction may occur.

3. RS-232C module (LQE060)

(1) LGB editing -- Unable to power down and then up again at the end of editing

At the end of LGB editing with the Windows PC software, the message “Reset or power down and then on again” appears as a guidance. When working on the S10mini controller, you can use only the Reset option. When you power down the controller and then on again, the editing result becomes insignificant.

(2) System program loading -- No such loading required

Since the S10mini controller contains the system program for the RS-232C module in flash memory within the module, loading of the system program is not required. If you load it inadvertently, reset the CPU module. The S10mini system will then start up.

4. Analog or pulse counter module loading (LQA000, LQA100, LQA200, LQA500, LQA600, or LQC000) -- No such loading required

Since the S10mini controller contains system programs for the analog modules and pulse counter module in flash memory within the CPU module, loading of the system programs is not required (loading of the various settings, however, is required). If you load the four-channel analog/pulse counter system inadvertently, reset the CPU module. The S10mini system will then start up.

Controller Models and Compatible Software Packages

■ Usable PCs controller models

- HITACHI S10/2 α , 2 α E, 2 α H, and 2 α Hf
- HITACHI S10/4 α , 4 α F, and 4 α H
- S10mini models S, H, F, and D

■ PCs models and compatible software packages

Software packages that can run on particular PCs models are listed below.

Package	Model	Applicable PCs model				
		4 α 4 α F	4 α H	2 α	2 α E 2 α H 2 α Hf	All S10mini models
S10Tools system	S-7890-01	–	–	✓	✓	✓
Ladder chart system	S-7890-02	–	–	✓	✓	✓
HI-FLOW system	S-7890-03	–	–	✓	✓	✓
CPMS load system	S-7890-04	–	–	✓	–	–
CPMSE load system	S-7890-05	–	–	–	✓	–
CPMS debugger system	S-7890-06	–	–	✓	–	–
CPMSE debugger system	S-7890-07	–	–	–	✓	✓
GP-IB system	S-7890-08	–	–	✓	✓	–
Batch save/load system	S-7890-09	–	–	✓	✓	✓
4 α ladder chart system	S-7890-17	✓	–	–	–	–
4 α H ladder chart system	S-7890-18	–	✓	–	–	–
RS-232C higher-level link system	S-7890-20	–	–	✓	✓	–
High-speed remote I/O system	S-7890-21	–	–	✓	✓	–
CPU link system	S-7890-22	–	–	✓	✓	✓
Four-channel analog/pulse counter system	S-7890-23	–	–	✓	✓	✓
External equipment link system	S-7890-24	–	–	✓	✓	✓
ET link system	S-7890-25	–	–	✓	✓	–
J.NET system	S-7890-27	–	–	✓	✓	✓
OD.RING system	S-7890-28	–	–	✓	✓	✓
ET.NET system	S-7890-29	–	–	✓	✓	✓
C development environment system (RPDP/S10)	S-7890-10	–	–	✓	✓	✓
Cross C compiler	MCP68K	–	–	✓	✓	✓

✓: Applicable

WARRANTY AND SERVICING

Unless a special warranty contract has been arranged, the following warranty is applicable to this product.

1. Warranty period and scope

Warranty period

The warranty period for this product is for one year after the product has been delivered to the specified delivery site.

Scope

If a malfunction should occur during the above warranty period while using this product under normal product specification conditions as described in this manual, please deliver the malfunctioning part of the product to the dealer or Hitachi Engineering & Services Co., Ltd. The malfunctioning part will be replaced or repaired free of charge. If the malfunctioning is shipped, however, the shipment charge and packaging expenses must be paid for by the customer.

This warranty is not applicable if any of the following are true.

- The malfunction was caused by handling or use of the product in a manner not specified in the product specifications.
- The malfunction was caused by a unit other than that which was delivered.
- The malfunction was caused by modifications or repairs made by a vendor other than the vendor that delivered the unit.
- The malfunction was caused by a relay or other consumable which has passed the end of its service life.
- The malfunction was caused by a disaster, natural or otherwise, for which the vendor is not responsible.

The warranty mentioned here means the warranty for the individual product that is delivered. Therefore, we cannot be held responsible for any losses or lost profits that result from the operation of this product or from malfunctions of this product. This warranty is valid only in Japan and is not transferable.

2. Range of services

The price of the delivered product does not include on-site servicing fees by engineers. Extra fees will be charged for the following:

- Instruction for installation and adjustments, and witnessing trial operations.
- Inspections, maintenance and adjustments.
- Technical instruction, technical training and training schools.
- Examinations and repairs after the warranty period is concluded.
- Even if the warranty is valid, examination of malfunctions that are caused by reasons outside the above warranty scope.

This manual provides information for the following hardware product:

<Hardware product>

CPU-S (LQP000)

CPU-H (LQP010)

CPU-F (LQP011)

CPU-D (LQP120)

<Changes added to this manual>

Description of added changes	Page
Subsection 9.1.1, "Replacing the S10mini CPU module" is newly added.	9-5
Subsection 9.1.2, "Replacing or adding on the S10mini memory module" is newly added.	9-6

In addition to the above changes, all the unclear descriptions and typographical errors found are also corrected without prior notice.

Revision record

Revision No.	Revision Record (revision details and reason for revision)	Month, Year	Remarks
H	<p>Information for the model LQV010 is added to the description under “■ Installation” in Chapter 1, “BEFORE USE.”</p> <p>Information for the model LQV010 is added to the description under “3.5 Power Supply Module.”</p> <p>The model LQV010 is additionally mentioned under “4.3 Outside Dimensions.”</p> <p>Information for the model LQV010 is added to the description under “5.4 Wiring the Power Supply Module.”</p> <p>The graph shown under “8.4.5 Clock precision” is replaced with a new one.</p> <p>Additional option module models are mentioned under “8.6 Restrictions on Mounting Option Modules” and information for I/O modules is added to that section.</p> <p>The model LQV010 is additionally mentioned under “8.7 Output Current of the Power Supply Module” and information for option and I/O modules is added to that section.</p> <p>The indicator indication “PIO PTY” is added to the description under “8.8 Memory Backup.”</p> <p>Information for the model LQV010 is added to the description under “9.1 Preventive Maintenance.”</p> <p>A brief description of the error message “PIO PTY” is added to Section 9.3, “Troubleshooting.”</p> <p>Revisions are made to the actions required for the error messages “ADDR ERR”, “ILG INST”, “INV INT”, “ZERO DIV”, and “PRIV VIO”, and for floating-point operation error messages in Section 9.3, “Troubleshooting.”</p> <p>The descriptions entitled “■ Troubleshooting ‘CPU down’ problems,” “■ PCs (error stack information) presented and actions required for the option modules,” and “■ Collecting error stack information” are added to Section 9.3, “Troubleshooting.”</p> <p>Information for the model LQV010 is added to Chapter 10, “SPECIFICATIONS.”</p>	July 2006	
I	<p>Subsection 9.1.1, “Replacing the S10mini CPU module” is newly added.</p> <p>Subsection 9.1.2, “Replacing or adding on the S10mini memory module” is newly added.</p>	October 2008	
J	<p>A change is made to the front panel of the LQS000 module -- an additional LED indicator is added.</p>	March 2009	

PREFACE

Thank you for your purchasing of Hitachi's programmable controller, S10mini. This manual explains how to handle basic component modules of the S10mini, such as CPUs, power supplies, mount bases, memory modules, etc. For information on I/O and option modules and associated software, refer to the relevant manuals or user's guides. Read these manuals to ensure proper handling.

Unless otherwise stated specifically, the terms "CPU" and "CPU module" used in this manual are interchangeable and represent a CPU of model S, H, F, or D.

The products in the S10mini Series are available in two editions: standard and environmentally resistant. The environmentally resistant edition features a higher part plating thickness and harder coating than the standard edition. The model name of an environmentally resistant product is that of its standard counterpart suffixed by "-Z".

(Example) Standard product: LQP000

Environmentally resistant product: LQP000-Z

This manual is applicable to both the standard model and environmentally resistant model. Although the descriptions contained in this manual are based on the standard model, follow the instructions set forth in the manual for proper use of the product even if you use the environmentally resistant model.

<Trademarks>

- Microsoft® Windows® operating system, Microsoft® Windows® 95 operating system and Microsoft® Windows® 98 operating system are registered trademarks of Microsoft Corporation in the United States and/or other countries.
- Ethernet® is a registered trademark of Xerox, Corp.
- Autonomous Decentralize is a product name of Hitachi, Ltd.

Other product names written in this manual are trademarks of each manufacturer.

<Note for storage capacity calculations>

- Memory capacities and requirements, file sizes and storage requirements, etc. must be calculated according to the formula 2^n . The following examples show the results of such calculations by 2^n (to the right of the equals signs).
 - 1 KB (kilobyte) = 1,024 bytes
 - 1 MB (megabyte) = 1,048,576 bytes
 - 1 GB (gigabyte) = 1,073,741,824 bytes
- As for disk capacities, they must be calculated using the formula 10^n . Listed below are the results of calculating the above example capacities using 10^n in place of 2^n .
 - 1 KB (kilobyte) = 1,000 bytes
 - 1 MB (megabyte) = $1,000^2$ bytes
 - 1 GB (gigabyte) = $1,000^3$ bytes

CONTENTS

1	BEFORE USE.....	1-1
2	OVERVIEW	2-1
2.1	Outline of the System.....	2-2
2.2	Module Configuration in the CPU Unit.....	2-4
2.3	Module Configuration in the I/O Unit	2-5
3	NAMES AND FUNCTIONS OF PARTS	3-1
3.1	CPU Module	3-2
3.2	Remote I/O Station Module	3-4
3.3	Extension Memory Module	3-6
3.4	I/O Module.....	3-7
3.5	Power Supply Module.....	3-8
3.6	Mount Base	3-10
4	INSTALLATION.....	4-1
4.1	Installation.....	4-2
4.2	Clearances	4-3
4.3	Outside Dimensions	4-4
4.4	Securing the Mount Base	4-6
4.5	Securing Modules	4-7
5	WIRING.....	5-1
5.1	Cable Specifications.....	5-2
5.2	Wiring the Power Supply.....	5-3
5.3	Wiring for Grounding	5-5
5.4	Wiring the Power Supply Module	5-7
5.5	Wiring for External Input/Output Signals.....	5-7
5.5.1	Wiring for the PCs OK signal	5-8
5.5.2	Wiring for the RI/O STOP and RUN/STOP signals.....	5-8
5.6	Wiring Remote I/O Cables.....	5-9
5.6.1	Examples of improper wiring	5-10
5.6.2	Examples of remote I/O cable wiring	5-11
5.6.3	Setting terminating resistors	5-12

6	SETTINGS	6-1
6.1	Outline of I/O Number Settings	6-2
6.2	Configuration and Assignment Range of I/O Numbers	6-3
6.3	Setting I/O Numbers.....	6-4
6.3.1	Setting the mounting status of PI/O modules.....	6-5
6.3.2	Setting partition status (FREE/FIX).....	6-6
6.3.3	Setting the number of I/O points	6-8
6.3.4	Output hold setting.....	6-11
6.3.5	Setting station numbers	6-12
6.4	Setting an Extension Memory Module.....	6-14
7	OPERATION PROCEDURES	7-1
7.1	Overview	7-2
7.2	Procedures	7-3
7.2.1	Turning on the power	7-3
7.2.2	STOP mode	7-3
7.2.3	RUN (ladder program execution) mode.....	7-4
7.2.4	SIMU (simulated ladder program execution) mode.....	7-4
7.2.5	RESET mode.....	7-4
7.2.6	PROTECT ON mode	7-5
7.2.7	PROTECT OFF mode.....	7-5
8	EXPLANATION OF OPERATION	8-1
8.1	Ladder Program.....	8-2
8.1.1	Execution.....	8-2
8.1.2	Program execution order	8-3
8.1.3	Executing arithmetic functions.....	8-4
8.1.4	When to start execution.....	8-4
8.2	Remote I/O	8-5
8.2.1	Remote I/O transfer	8-5
8.2.2	Output mode setting for use in case of a stop of remote I/O transfer.....	8-5
8.3	Processing Time	8-6
8.4	Clock Features.....	8-7
8.4.1	Clock control system registers.....	8-7
8.4.2	Setting the time using the ladder program.....	8-9
8.4.3	Updating the date.....	8-10

8.4.4	Restrictions on the setting of dates and times	8-10
8.4.5	Clock precision	8-10
8.5	Conditions of the I/O Input/Output Registers and Internal Registers in Case of Errors.....	8-11
8.6	Restrictions on Mounting Option Modules.....	8-12
8.7	Output Current of the Power Supply Module	8-14
8.8	Memory Backup.....	8-17
8.9	Output Timing of the PCs OK Signal	8-20
9	MAINTENANCE	9-1
9.1	Preventive Maintenance	9-2
9.1.1	Replacing the S10mini CPU module	9-5
9.1.2	Replacing or adding on the S10mini memory module.....	9-6
9.2	Replacing the Backup Battery	9-9
9.2.1	Procedure	9-9
9.2.2	Disposing of used batteries	9-11
9.3	Troubleshooting	9-13
10	SPECIFICATIONS.....	10-1

1 BEFORE USE

1 BEFORE USE

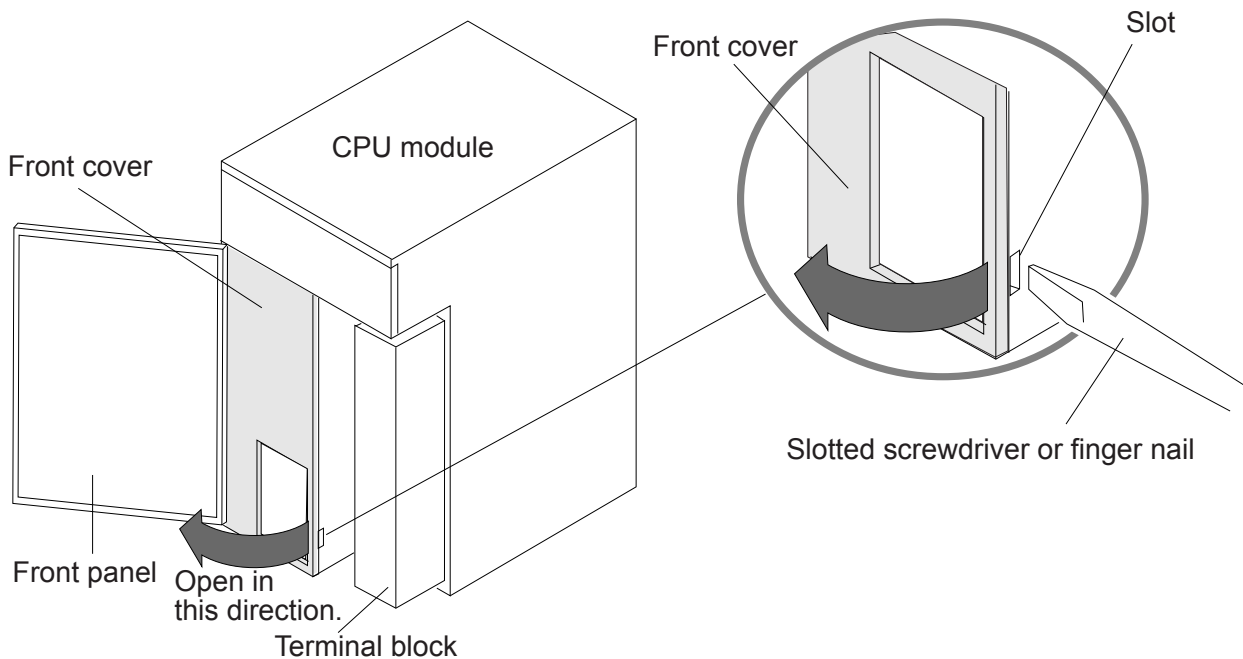
■ Connecting the battery

The backup battery contained in the CPU module is left unconnected during shipment to prolong its useful life. Before using the CPU module, connect the battery by performing the following procedure:

- ① Before handling the CPU module, ground yourself to discharge any static electricity.
- ② Turn off the power switch on the power supply module.
- ③ Open the front panel as shown below.
- ④ Insert a finger nail or the tip of a slotted screwdriver about 1 mm into the slot at the lower right of the front cover (see the figure below). Then carefully open the front cover in the direction of the arrow.

NOTICE

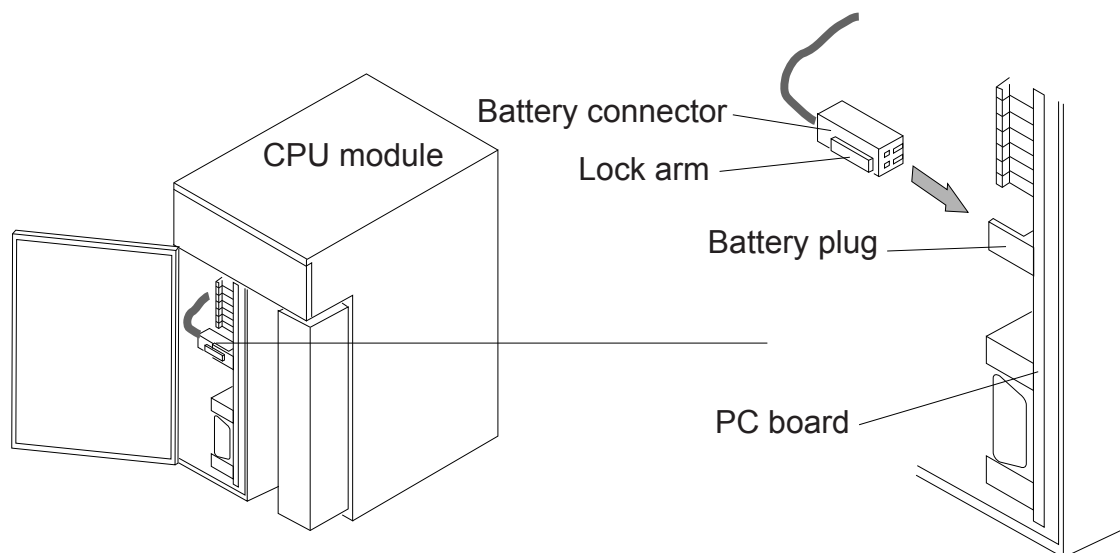
Do not insert the slotted screwdriver more than about 1 mm. Otherwise the internal PC board may be damaged.



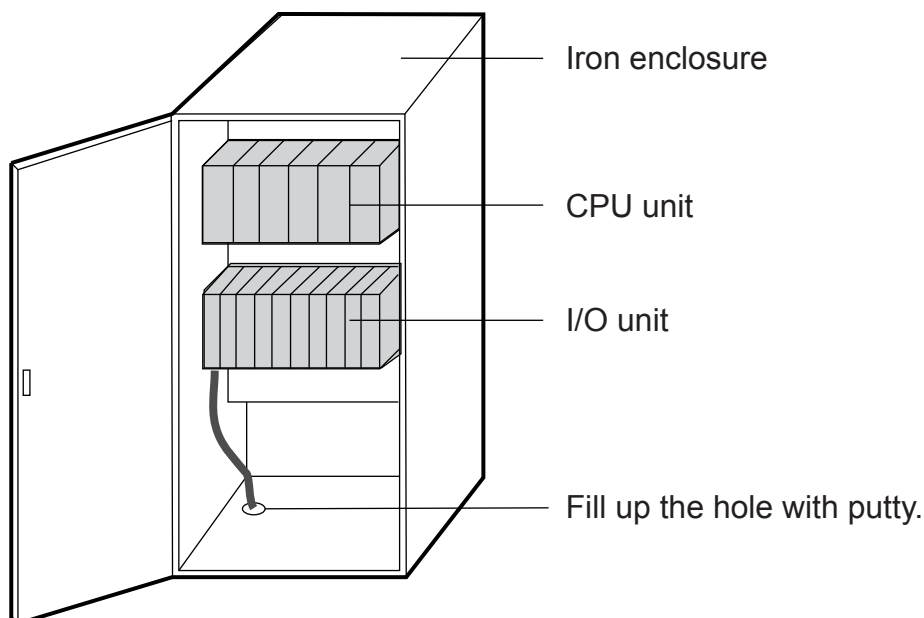
- ⑤ Push the battery connector of the battery installed in the CPU module case into the battery plug on the PC board. Make sure that the lock arm of the battery connector is facing toward the front. Otherwise, the battery connector cannot be inserted (see the next page).
- ⑥ Re-install the front cover of the module.

NOTICE

A loose battery connector may be disconnected easily. If it is disconnected during operation, backup data may be lost. To avoid this, push the battery connector sufficiently into the plug on the PC board until it snaps into place.

**■ Installation**

The programmable controller is not fireproof, dustproof, or dripproof. At installation time, house the programmable controller in an iron-made dust-proof, drip-proof enclosure and install it in a proper place to avoid exposure to water.

**CAUTION**

To prevent possible failures, house the programmable controller in a drip-proof enclosure in cases where it is feared to be wetted with water.

1 BEFORE USE

Use the programmable controller within the allowable limits of environmental conditions specified below. Use in a room-temperature, room-humidity environment (15 to 35°C, 45 to 85%RH) is recommended to assure extended periods of normal operation. Use in a high-temperature, high-humidity environment where sharp temperature changes are experienced within one day may detract from the product's useful life.

Supply voltage	LQV000: 100 to 120 VAC single-phase 50/60 Hz \pm 5 Hz LQV010: 100 to 120 VAC single-phase 50/60 Hz \pm 5 Hz LQV100: 100 to 120 VAC single-phase 50/60 Hz \pm 5 Hz 100 to 110 VDC LQV020: 24 VDC LQV200: 200 to 240 VAC single-phase 50/60 Hz \pm 5 Hz
Voltage regulation	LQV000: 85 to 132 VAC LQV010: 85 to 132 VAC LQV100: 85 to 132 VAC 85 to 132 VDC LQV020: 20.4 to 28.8 VDC LQV200: 170 to 264 VAC
Temperature	Operating: 0 to 55°C, Storage: -20 to 75°C (Rate of temperature change: 10°C/h or lower)
Relative humidity	Operating: 30 to 90%RH, Storage: 10 to 90%RH (Non-condensing)
Resistance to vibration	Compliant with JIS C0040 Frequency: 10 to 150 Hz; Acceleration: 10 m/s ² 20 sweep cycles in X/Y/Z directions each, 8-minute sweep
Resistance to impact	Compliant with JIS C0041 Peak acceleration: 147 m/s ² Sinusoidal half-wave pulses, three cycles in X, Y, Z directions each
Atmosphere	Dust class: 1 million, no corrosive gases



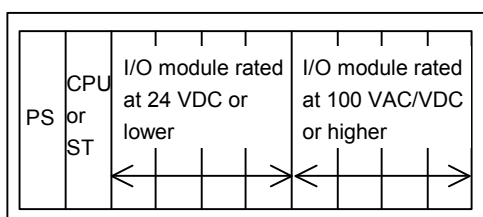
CAUTION

Even if the input voltage of the power supply module falls within a specified range, assume it to be in a power abnormality when it is close to the upper or lower limit of the range, and call upon the power supply facility manager for a checkup.

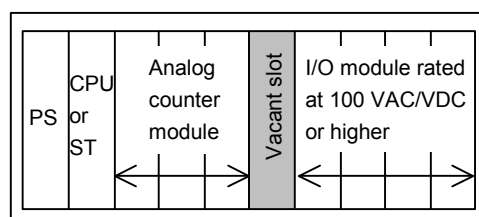
■ Mounting modules

When you mount I/O or option modules in the CPU unit or I/O unit, follow the following instructions to avoid noise interference from connections external to the I/O unit:

- Do not mount an I/O module rated at 100 VAC/VDC or higher in the slot next to the CPU module, but mount it as remote from the CPU module as possible. If it is unavoidable to have an I/O module mounted in the slot next to the CPU module, keep the cable connection as remote possible (at least 100 mm) to guard against noise interference with such means as a shielded cable or surge killer.
- Mount an I/O module rated at 24 VDC or lower and an I/O module rated at 100 VAC/VDC or higher well away from each other.
- Leave one slot vacant between an analog counter module and an I/O module rated at 100 VAC/VDC or higher.
- Wire each I/O module separately in accordance with each supply voltage used.

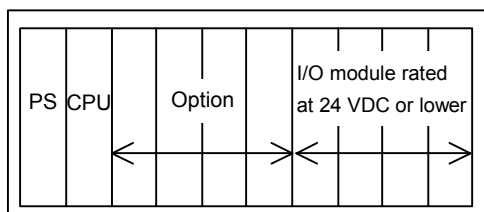


Mount I/O modules separately according to the supply voltage.

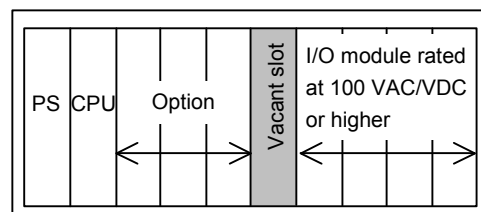


Leave one slot vacant between an analog counter module and an I/O module.

- Mount option modules in a group on the side of the CPU module, apart from the I/O module.
- When mounting an option module and an I/O module rated at 100 VAC/VDC or higher, leave one slot vacant between them.
- Separate wiring for I/O modules and option modules.



Mount I/O modules and option modules separately.

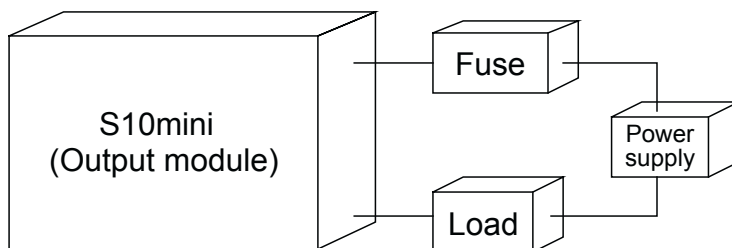


Leave one slot vacant between an I/O module and an option module.

1 BEFORE USE

■ Output module

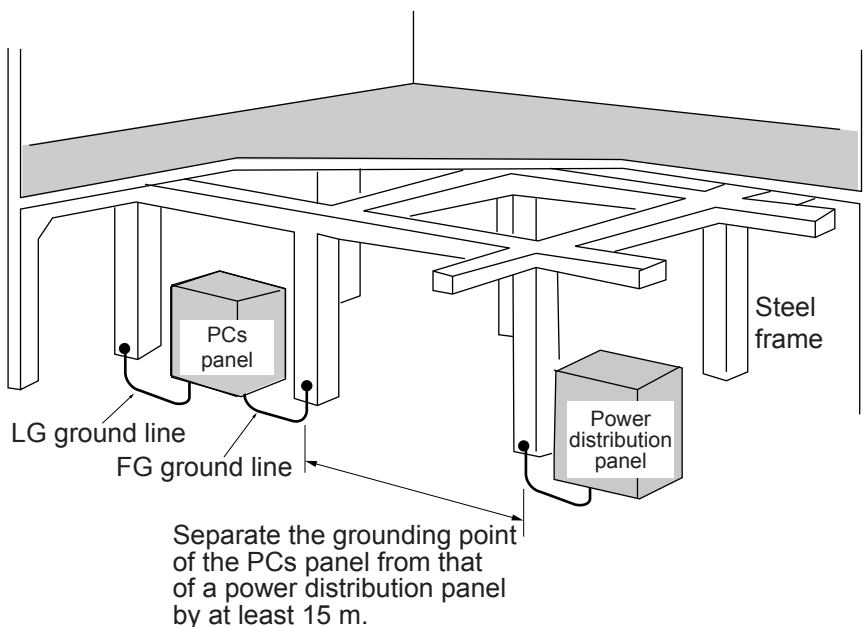
Attach a fuse to the load power supply of the output module for protecting against short circuits. Use a fuse matching the rating of the load. If a fuse in excess of the rating is used, short circuits in the load could burn the printed circuit board, casing and other components.



■ Grounding

Do not ground the PCs panel together with other equipment. Ground it independently at Class D* or higher. Never ground the PCs panel within a distance of 15 m from the grounding point of a power distribution panel.

It is best to ground the S10mini to a steel frame of a building. If such grounding is not possible, bury a grounding rod in the ground.



* Class D grounding is defined in the Technical Standard for Electrical Facilities of Japan. This standard states that the grounding resistance must be 100 ohms for equipment operating on 300 VAC or less, and 500 ohms or less for devices that shut down automatically within 0.5 seconds when shorting occurs in low tension lines.

■ Noise

Do not install the programmable controller in or a near an enclosure that houses high-voltage equipment, such as an inverter. If it is unavoidable to have the programmable controller mounted in such a place, install a shielding plate to prevent electromagnetic and static induction in the CPU unit or I/O unit and the cables.

■ Emergency stop circuit

Even if a component part of the programmable controller fails, it may affect the entire programmable controller. Devise the emergency stop circuit to be installed in the programmable controller as an external relay circuit.

■ Internal replacement parts

The user should not replace any internal part other than those described in the manual. If such a part fails, replace the module in its entirety. When it becomes necessary to replace any internal part other than those mentioned in this manual, ask a Hitachi maintenance person.

■ Inserting and removing modules

Be sure to turn off the power switch before plugging modules in or out to avoid failures and electrical shock hazards.

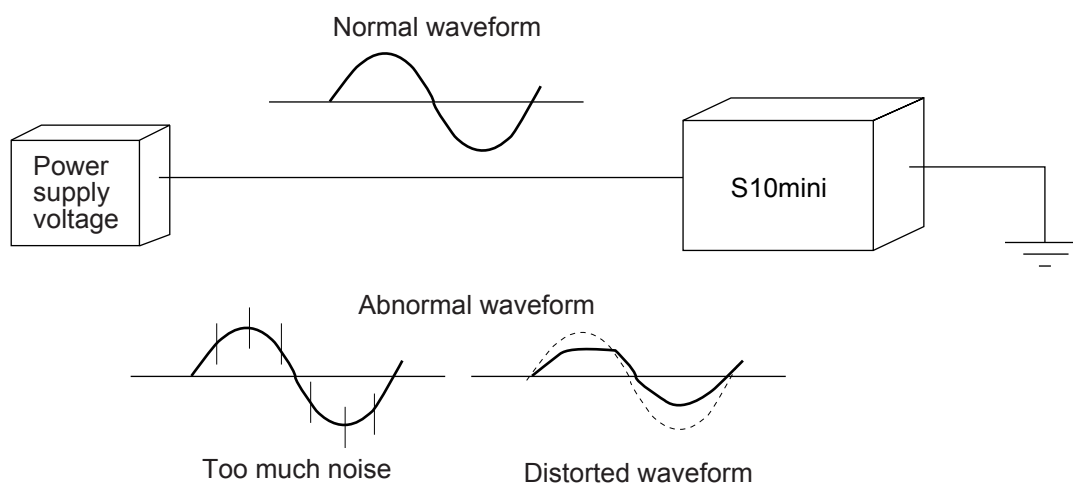
■ Installing additional facilities

If an additional peripheral facility has been installed or the existing setup of peripheral facilities has been changed, check the programmable controller for any abnormality, as described in “9.1 Preventive Maintenance.” During checking, pay special attention to the power supply and grounding, as described below.

● Power supply

* Check the power supply voltage and waveform.

- Is there a voltage drop?
- Is the amount of noise on the power line too much?



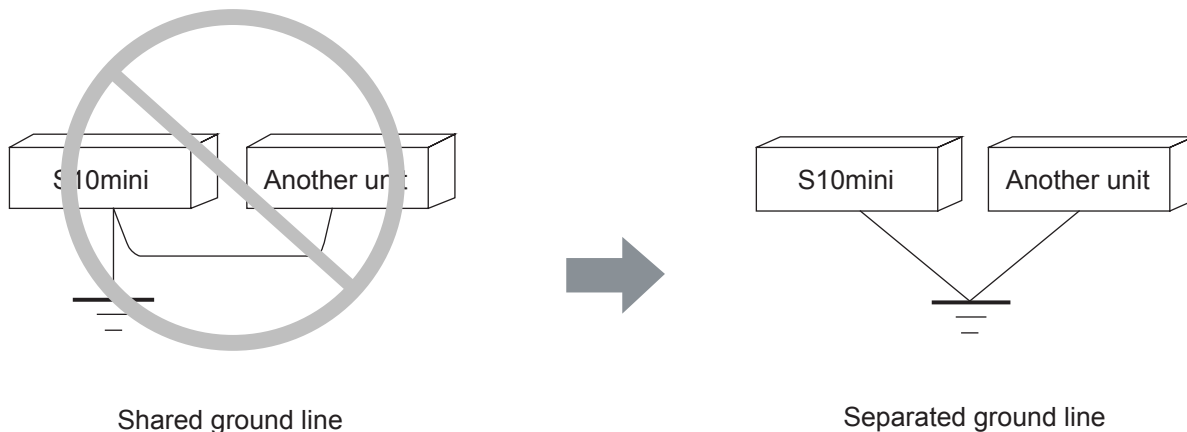
1 BEFORE USE

- Grounding

- * Check the wiring made for grounding.

- Is the ground line shared with other units?
 - Is the grounding point of the S10mini controller separated from that of a power distribution panel by at least 15 m?

- * Check that all installed signal cables, such as the remote I/O cable, are well separated from any existing power cable or lead cable.



DANGER

- An emergency stop circuit must be provided externally to this product. Disregarding this rule may result in a damage to the equipment or a hazard to the user if this product fails.
- The input or output current of any I/O module used must not exceed their maximum allowable current values. If an overcurrent flows in an I/O module, it may not only damage its component part(s) but also cause a safety hazard, fire, or a failure.
- Choose an external power supply with overvoltage and overcurrent protection features.
- When the programmable controller smokes, gives off an offensive smell, or otherwise misbehave, turn it off immediately and probe into the cause.

**CAUTION**

- Choose a power supply matching the rating of a module and connect it to that module. Connecting an improper power supply to a module can cause the module to fire.
- Some component parts of this product, such as photo-couplers and LEDs, contain gallium arsenide (GaAs). Gallium arsenide is designated as a harmful substance by law. When scrapping this product, ask a specialized agent to dispose of it as industrial waste.
- Use the same power supply for the external power supply (fed to the +V terminal) of the output module and for the load power supply. Use of different power supplies can cause malfunctioning.
- This product (module) might malfunction or go down due to electromagnetic noise from transceivers, cell phones, and other similar apparatuses. Do not use such apparatuses near this product.

**PROHIBITION**

Do not install, wire, handle, or remake the programmable controller beyond such an extent as may be defined in this manual. We will not be liable for any damages to our programmable controller and ancillary equipment and for physical injury arising out of such actions.

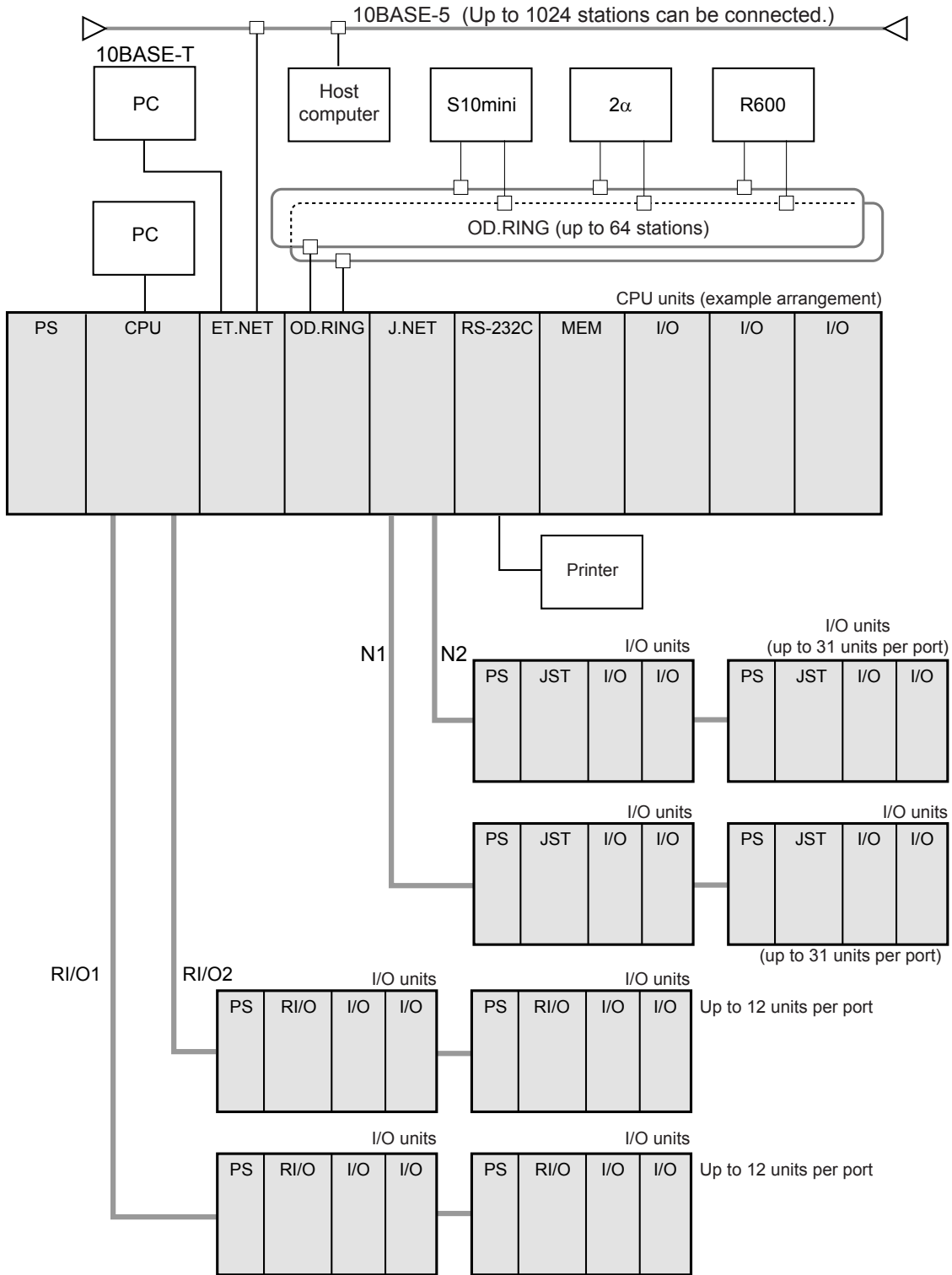
**REQUIREMENT**

- Attach a fuse or circuit protector to the external power supply for I/O and option modules to protect against short circuits. Use a circuit protector matching the rating of the power supply.
- Verify the wiring before turning on the programmable controller.
- Do not shut down (turn off or reset) the programmable controller without making sure that the peripheral equipment is off or will be unaffected by the shutdown of the programmable controller.
- Memory contents can be corrupted by module failures. Be sure to back up sensitive data.

2 OVERVIEW

2.1 Outline of the System

The optional modules (ET.NET, OD.RING, and J.NET) for a network and communication modules for the I/O unit (RI/O and JST) are arranged as shown below.



■ Compact, space saving

Compact, space saving - takes up only about one half of the space requirement of the S10/2 α when mounted.

■ Standard real-time, multitasking operating system -- Compact PMS

The S10mini controller comes standard with the Compact PMS, which is a full-scale, real-time, multitasking operating system. Up to 128 tasks can be processed under real-time multitasking.

■ Compatible with S10/2 α H user programs

The S10mini controller provides compatibility with user programs running on the S10/2 α H controller designed for high-speed, large-scale control. Valuable software assets can be used without wasting.

■ Large memory capacity (expandable to 4 MB)

The CPU modules (Models H, F, and D) have built-in memory to store C programs and data (1 MB for Models H and F, 2 MB for Model D). The memory is expandable to 4 MB when 1 MB extension memory modules (LQM000), available as CPU options, are installed.

■ The CPU comes standard with remote I/O capabilities

Remote I/O units can be connected directly from the CPU module without an optional remote I/O option module.

■ Three programming languages supported (ladder chart, C, and HI-FLOW)

In addition to the ladder chart language, the CPU module also supports the easy-to-see, easy-to-understand flowchart language HI-FLOW and the general-purpose programming language C.

■ Compatible with open networks

Option modules extend support to general-purpose Ethernet® networks and field networks called OPCN-1 and DeviceNet®. It also supports autonomously distributed communication (NX program).

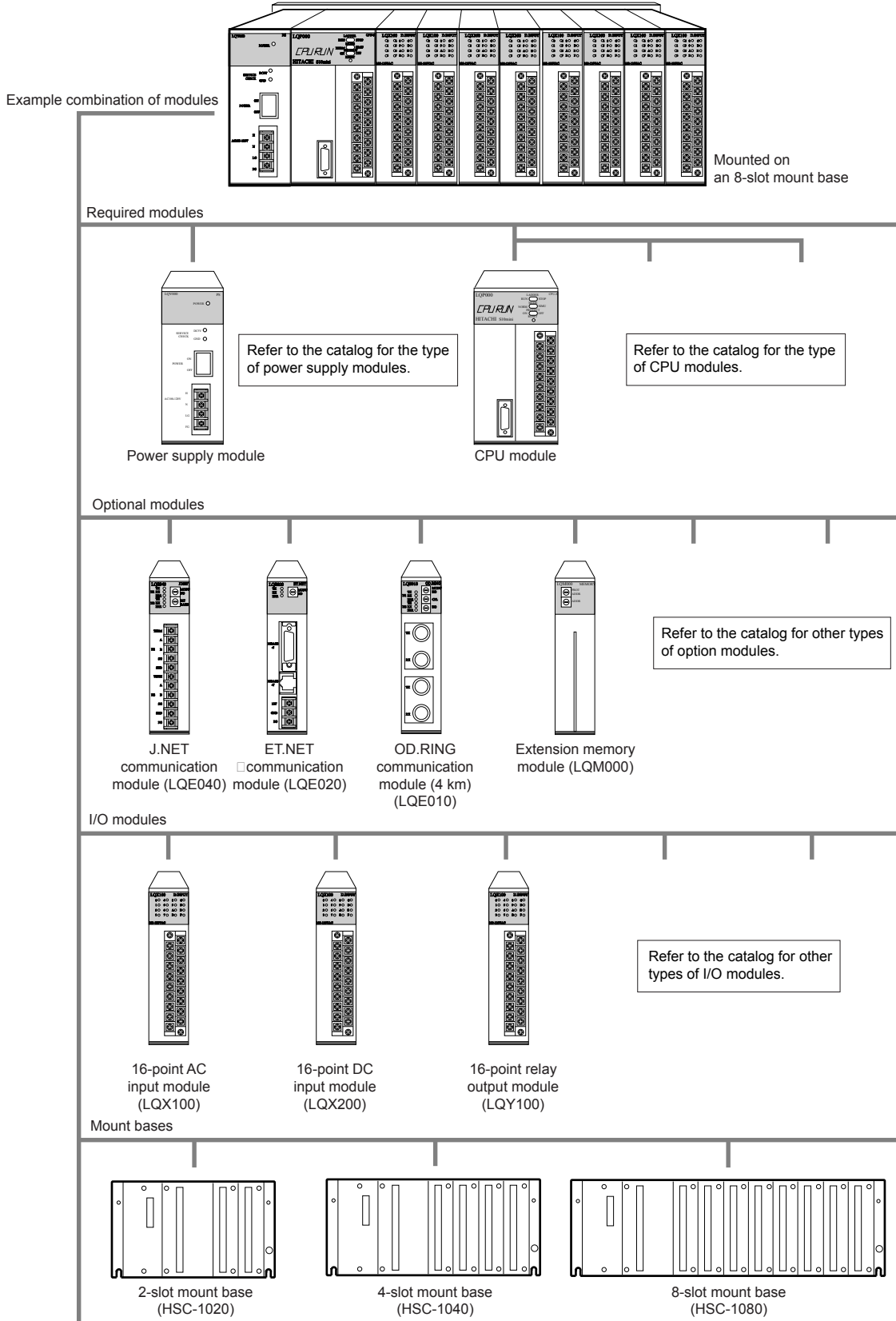
■ Use of I/O modules in the CPU unit

A flexible module configuration achieves an efficient system layout.

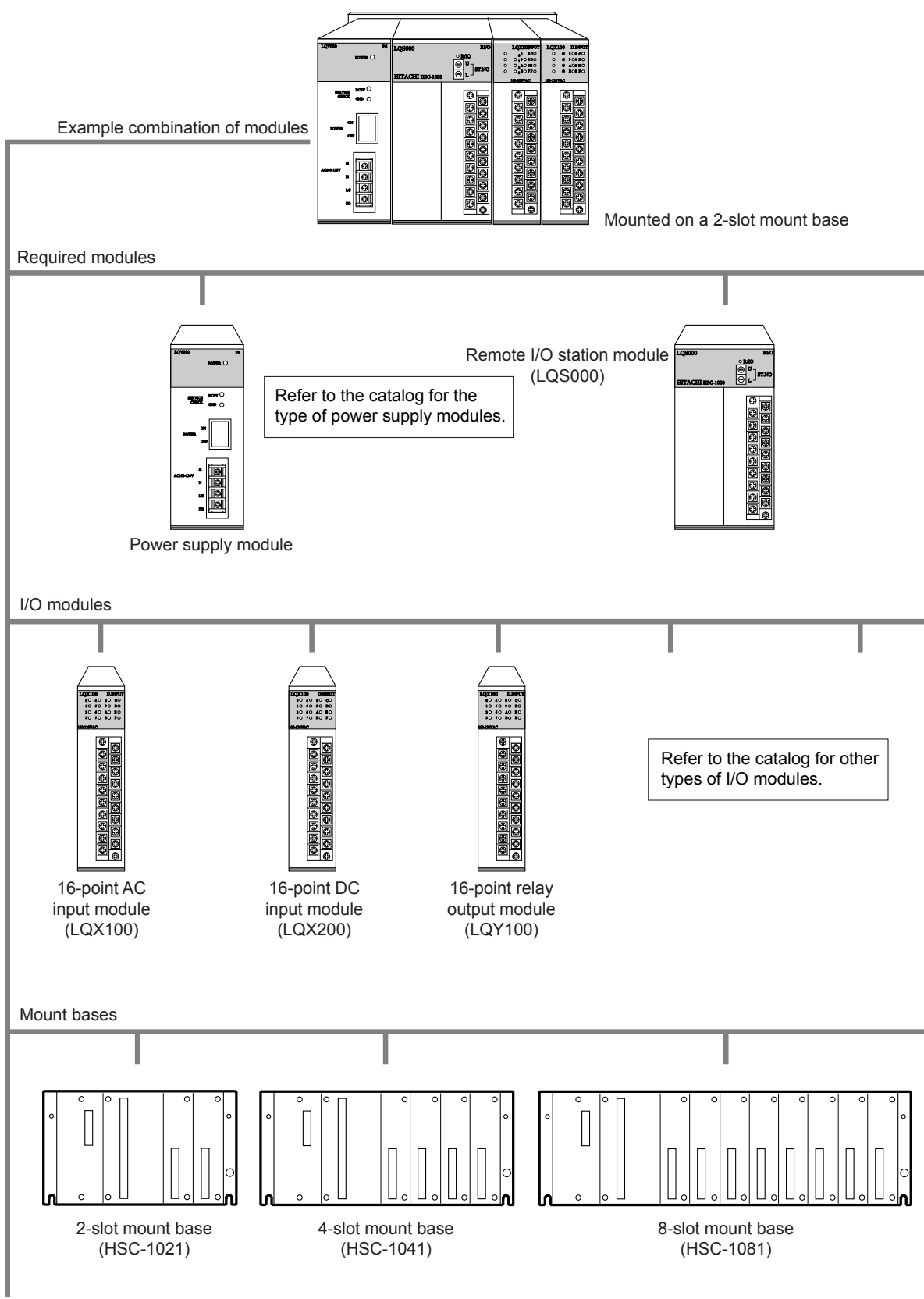
■ Up to 8192 controllable I/O points flexibly usable in small or large systems

The remote I/O unit installed as standard can control up to 2048 points. Where the J.NET is used, up to 8192 points can be controlled.

2.2 Module Configuration in the CPU Unit



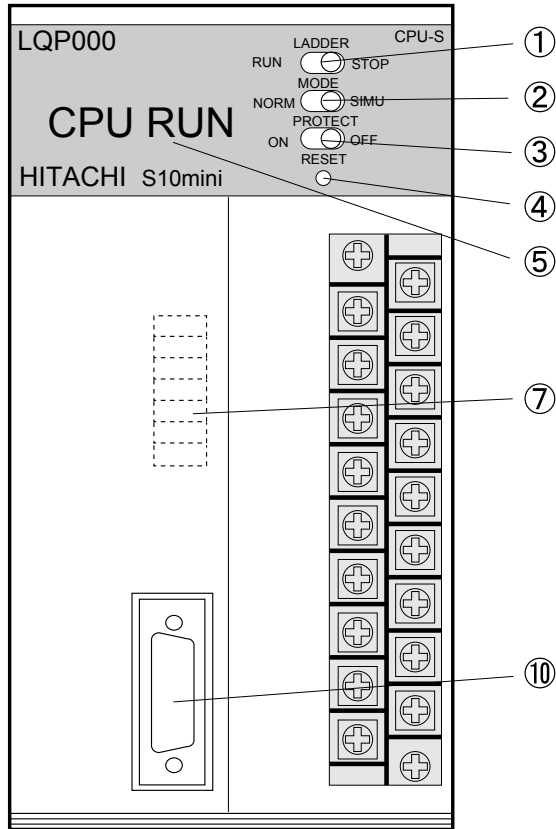
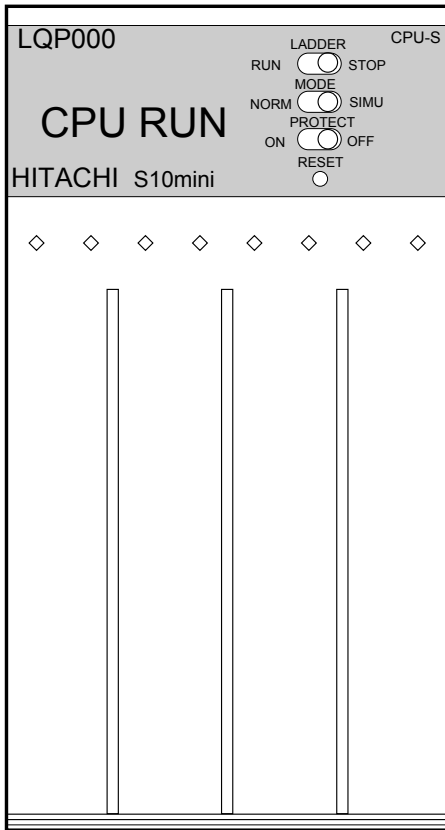
2.3 Module Configuration in the I/O Unit



3 NAMES AND FUNCTIONS OF PARTS

3 NAMES AND FUNCTIONS OF PARTS

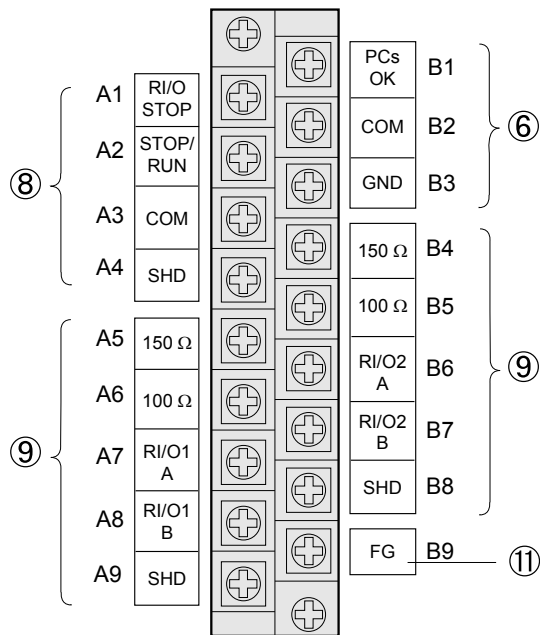
3.1 CPU Module



● CPU modules

CPU model	Type	Built-in memory capacity
Model S	LQP000	None
Model H	LQP010	1 MB
Model F	LQP011	1 MB
Model D	LQP120	2 MB

For details of the specifications, see “10 SPECIFICATIONS.”



Signals on the terminal block

3 NAMES AND FUNCTIONS OF PARTS

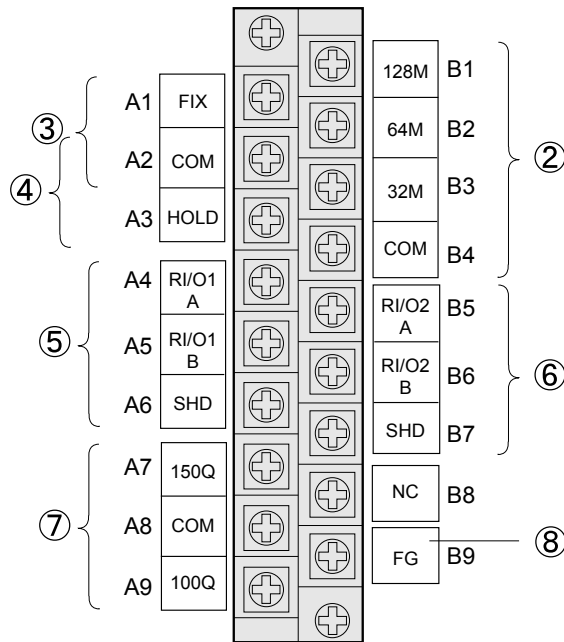
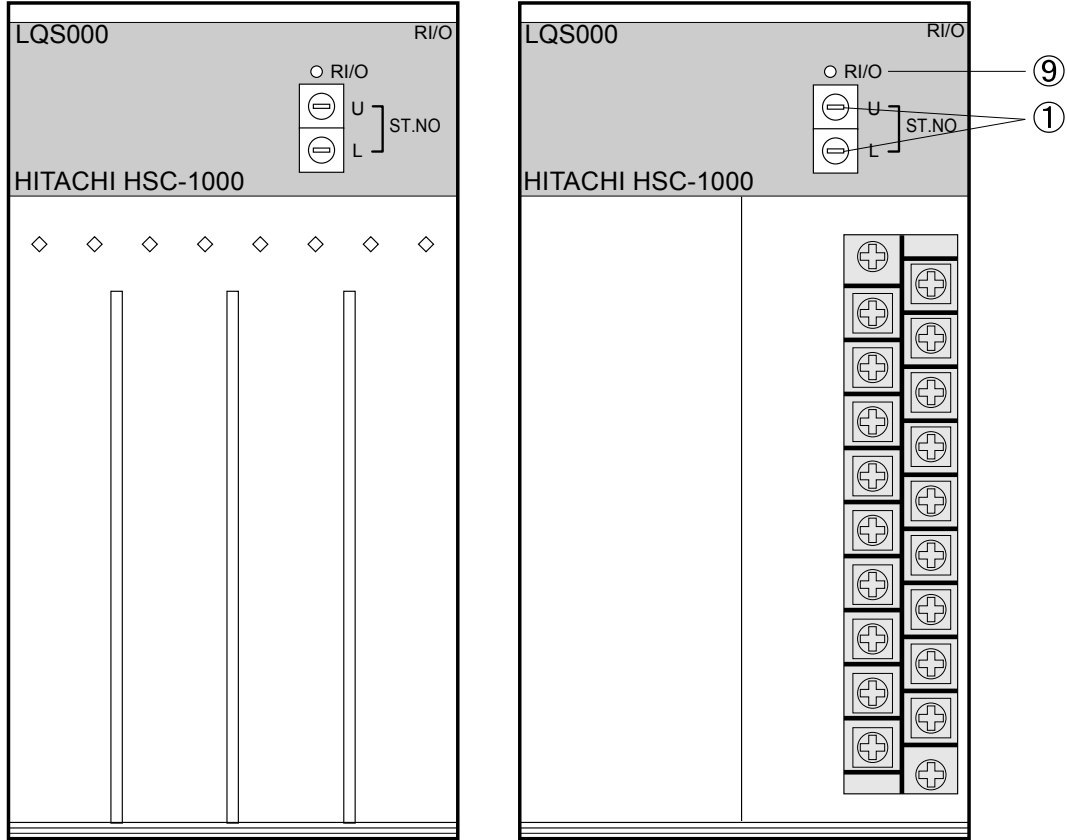
No.	Name	Function
①	Ladder program execution switch LADDER RUN/STOP	Starts or stops the execution of the ladder program ---- • RUN: Executes the ladder program. • STOP: Stops the ladder program.
②	Mode switch MODE NORM/SIMU	Sets the mode of operation for running a ladder program. • NORM: Executes the ladder program in normal mode. • SIMU: Simulates execution of the ladder program or stops I/O transfer.
③	Protection switch PROTECT ON/OFF	Enables or disables memory write ---- • OFF: Enables writing to all writeable memory areas. • ON: Disables writing to all memory areas except the ON/OFF status memory (I/O memory) for the ladder program. (For more details, see page 7-6.)
④	Reset switch RESET	Resets the modules mounted in the CPU unit.
⑤	Indicator	Displays the status of system operation in eight alphanumeric characters.
⑥	PCs OK contact output	Indicates it to the outside that the CPU is running normally. The contacts are opened at the time of a stop, reset or power-down.
⑦	I/O setting switches (*2)	Set the following operation conditions for the I/O modules mounted in the CPU unit. • Partition (FIX or FREE) • Number of input/output points (16, 32, 64, or 128) • Setting for I/O mounting (*1) • Output hold setting (HOLD)
⑧	RI/O STOP contact input	Controls transfer by a remote I/O module from the outside.
	STOP/RUN contact input	Controls ladder program execution remotely from the outside.
⑨	RI/O line input	Connects the remote I/O cable.
⑩	Tool connector	Connects the personal computer or PSEα.
⑪	Frame ground	Connected to the mount base.

(*1) When a setting is made for I/O mounting, the I/O number defined is the first one (000).

(*2) Under the factory setting, all jumper plugs are connected, in which case the set parameters are FREE, 16, I/O not mounted, and RESET.

- For details of the settings, see “6 SETTINGS.”
- For details of the connection, see “5 WIRING.”

3.2 Remote I/O Station Module



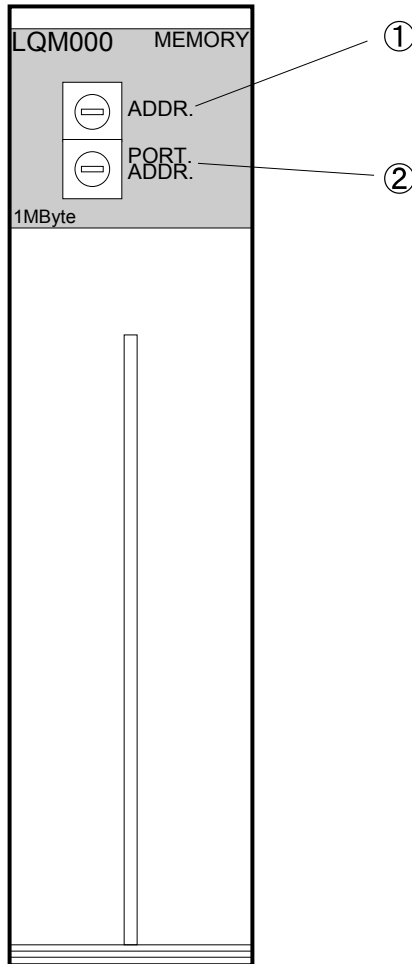
Signals on the terminal block

3 NAMES AND FUNCTIONS OF PARTS

No.	Name	Function
①	Station number setting switches	Each sets a station number. Set the first two digits of the I/O number as follows: higher-order digit using the U-switch and low-order digit using the L-switch.
②	Input/output point count setting	Selects the number of input/output points occupied by one slot on the mount base (16, 32, 64, or 128).
③	FIX/FREE setting	Defines the partition of the mount base as free or fixed.
④	Output hold setting	Selects one of the output states RESET or HOLD which the output modules enters when the remote I/O line is broken.
⑤	RI/O line input	Used to connect the remote I/O cable defined as upper level.
⑥	RI/O line branching	Used to connect the remote I/O cable defined as lower level.
⑦	Terminating resistor setting	Terminates the station module through a built-in terminating resistance (100 Ω or 150 Ω) when the remote I/O station module is connected as the last module on the remote I/O line. When using a non-specified remote I/O cable, see “5.6.3 Setting terminating resistors.”
⑧	Frame ground	Connects the remote I/O cable to the FG terminal on the mount base to ground the cable.
⑨	RI/O communication LED indicator	Is lit when remote I/O communication is in progress.

- For details of the settings, see “6 SETTINGS.”
- For details of connection, see “5 WIRING.”

3.3 Extension Memory Module



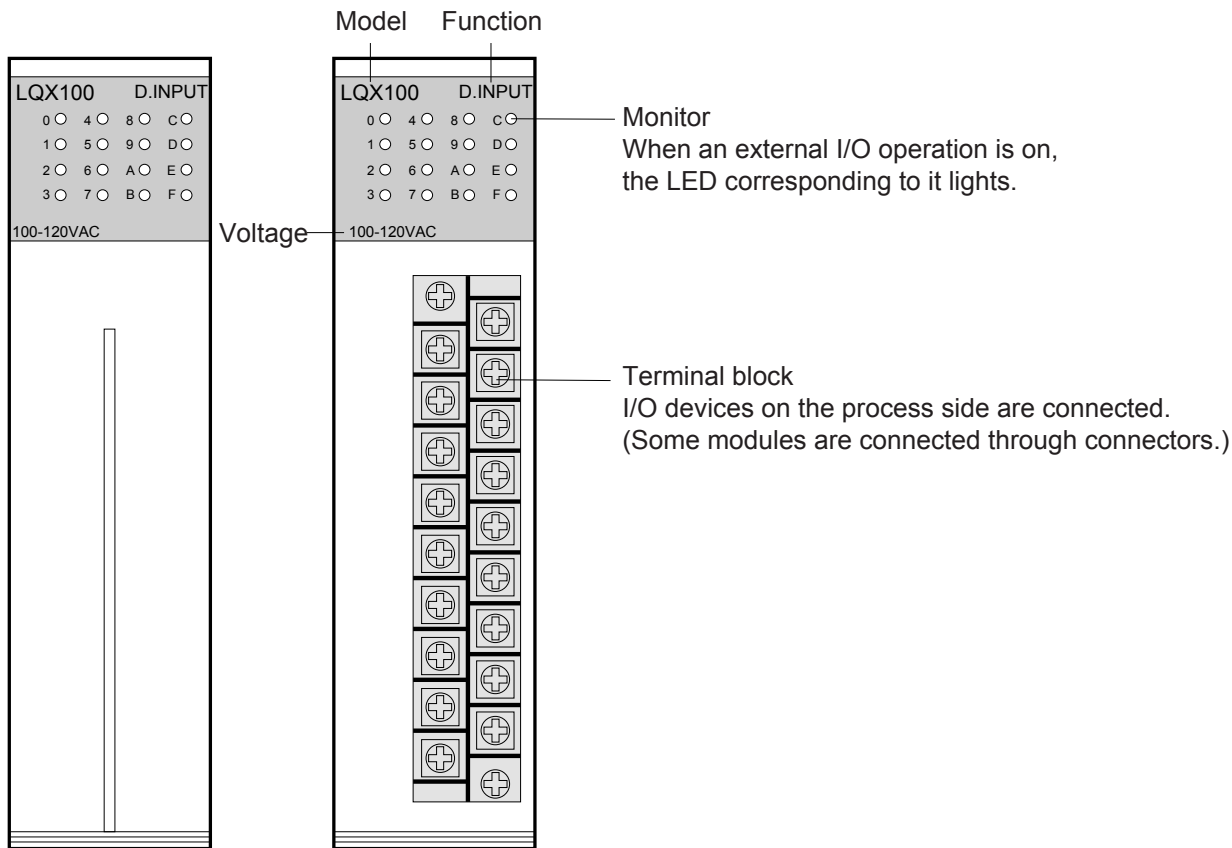
No.	Name	Function
①	Memory address switch	Sets the first address of an extension memory area.
②	Protected memory address switch	Sets the write-protected area.

NOTE

An extension memory module receives backup voltage from the CPU when the CPU unit is mounted. Memory on the extension module is not backed stand-alone. Therefore, note the following points:

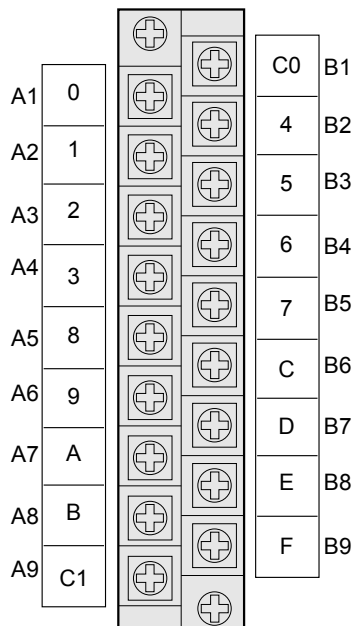
- When using the extension memory module for the first time, clear the data in the extension memory.
(PCs edition - Perform PCs memory initialization.)
- When the extension memory module is removed, the internal data becomes unpredictable.

3.4 I/O Module

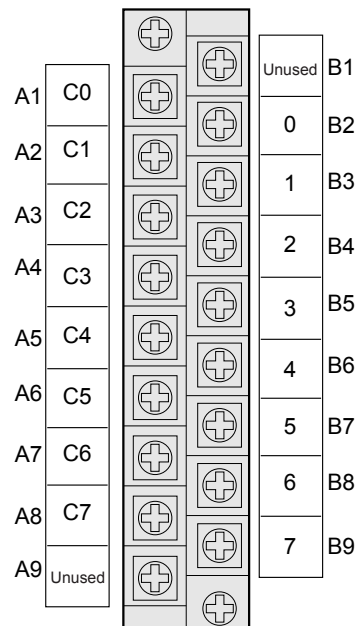


Example signals on the terminal block. (For details, see the specifications of each I/O module.)

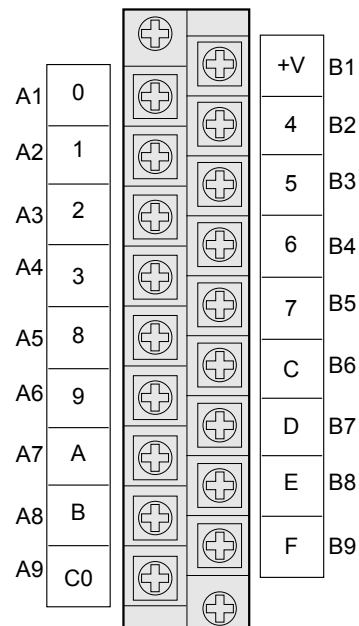
LQX100, LQX200, LQY100



LQY140



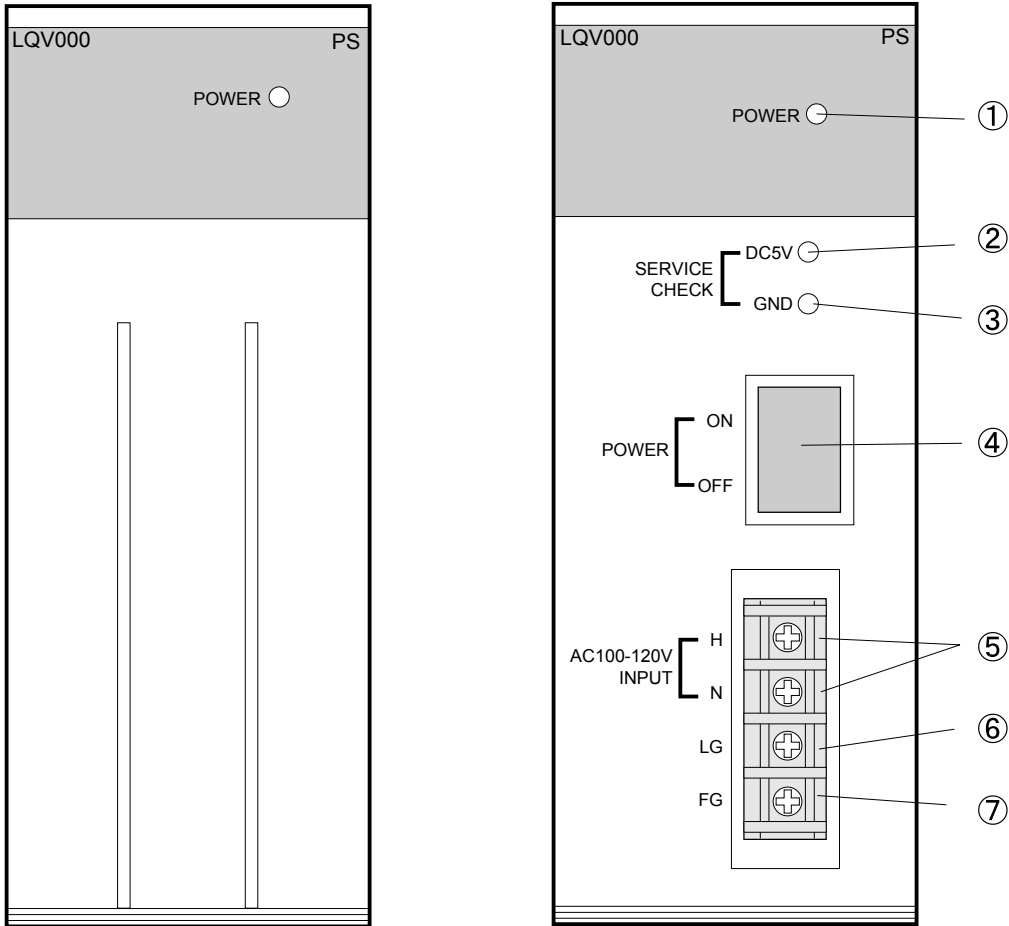
LQY200



3 NAMES AND FUNCTIONS OF PARTS

3.5 Power Supply Module

The power supply module of the same type is used for the CPU unit and I/O unit.



● Power supply modules

Name	Type	Remarks
AC input power supply	LQV000	100 VAC to 120 VAC input power supply
AC input power supply	LQV010	100 VAC to 120 VAC input power supply
DC input power supply	LQV020	24 VDC input power supply
AC/DC input power supply	LQV100	100 VAC to 120 VAC /100 VDC to 110 VDC input power supply
AC input power supply	LQV200	200 VAC to 240 VAC input power supply

For details of the specifications, see “10 SPECIFICATIONS.”

3 NAMES AND FUNCTIONS OF PARTS

No.	Name	Function
①	Power indicating LED (POWER)	Lights when the power switch is turned on.
②	Voltage check terminal (DC5V)	Checks the voltage of the 5 V output. (Normal: 4.75 to 5.25 V) (Do not use this terminal for other than voltage check.)
③	Voltage check terminal (GND)	Check the 0 V reference voltage. (Do not use this terminal for other than voltage check.)
④	Power switch (POWER)	Turns on or off the power input to the power supply module.
⑤	Power supply terminal block (H, N)	Supplies input power to the power supply module. The input voltage varies with each type of power supply module.
⑥	Line filter ground terminal (LG)	Ground terminal for the power supply line filter. Connected to the enclosure (unit) ground.
⑦	Frame ground terminal (FG)	Connected to the mount base FG terminal or to a single-point ground plate.



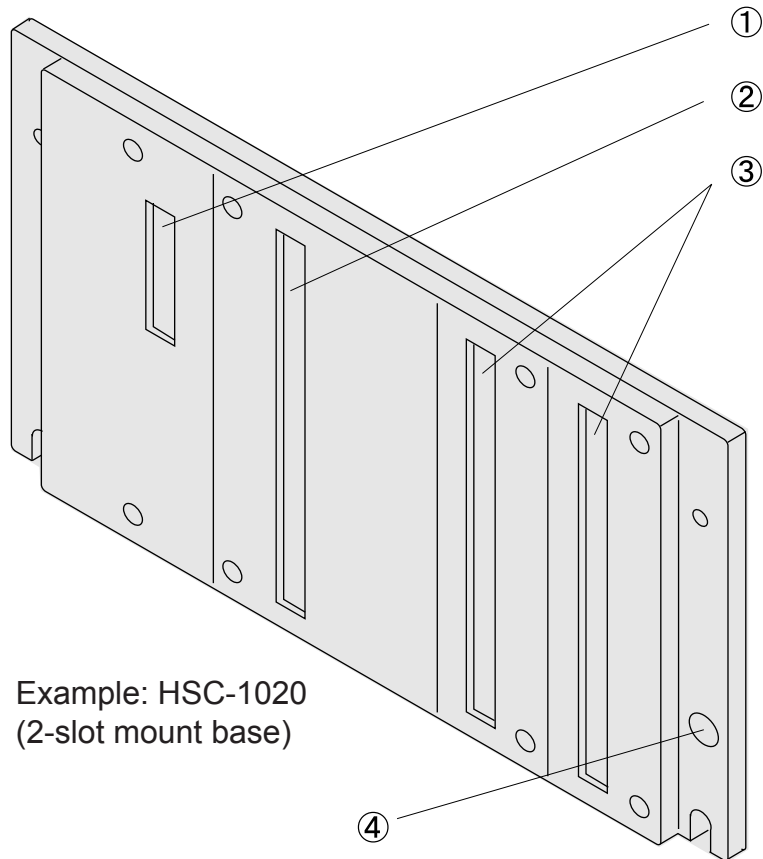
CAUTION

To avoid possible failures, allow for at least one second between turning-on and turning-off of the power switch.

3 NAMES AND FUNCTIONS OF PARTS

3.6 Mount Base

The mount base is used to secure CPU modules (or remote I/O station modules), power supply modules, and I/O modules. Two types of mount bases are available for the CPU unit and I/O unit.



■ Names and functions

Unit mounted	Name	Model	Remarks
CPU unit	2-slot mount base	HSC-1020	Power supply + CPU + 2 slots (for CPU options and I/O modules)
	4-slot mount base	HSC-1040	Power supply + CPU + 4 slots (for CPU options and I/O modules)
	8-slot mount base	HSC-1080	Power supply + CPU + 8 slots (for CPU options and I/O modules)
I/O unit	2-slot mount base	HSC-1021	Power supply + station + 2 slots (for I/O modules)
	4-slot mount base	HSC-1041	Power supply + station + 4 slots (for I/O modules)
	8-slot mount base	HSC-1081	Power supply + station + 8 slots (for I/O modules)

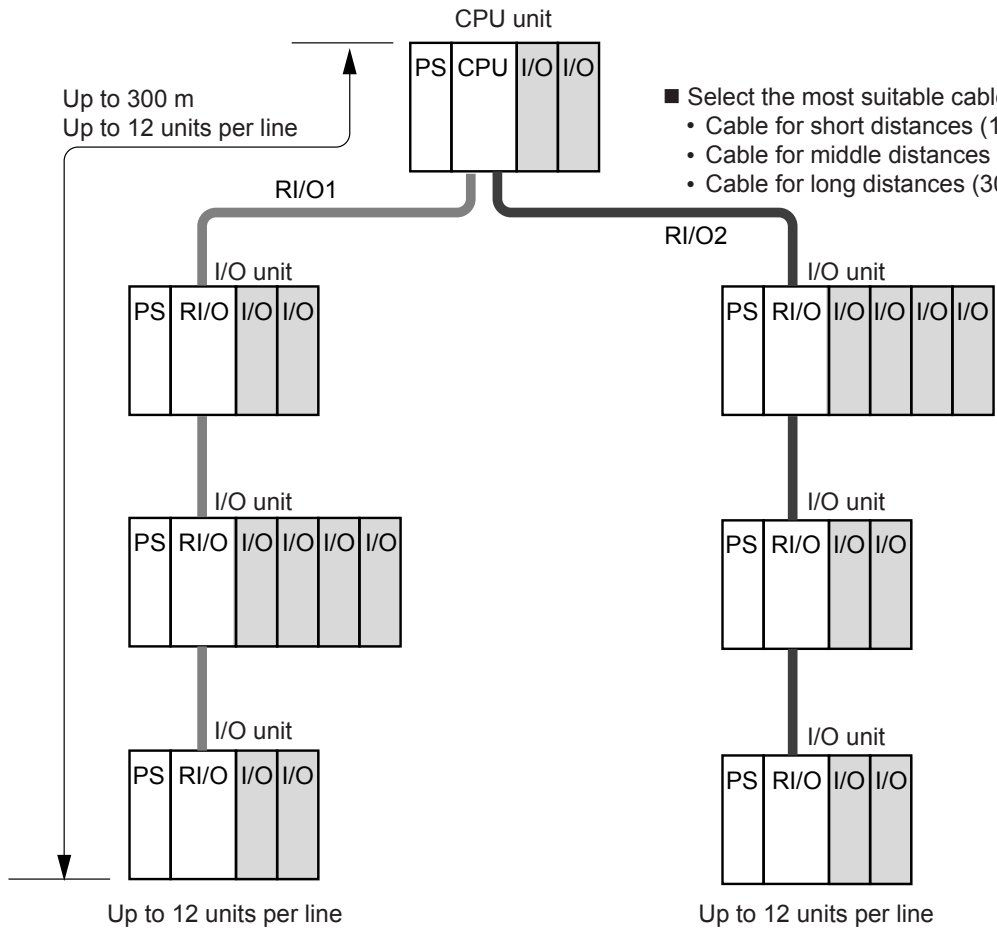
No.	Name	Function
①	PS slot	Used to insert the power supply module.
②	CPU slot (station slot)	Used to insert the CPU module (or remote I/O station module). (Remote I/O station modules and CPU modules cannot be mounted in the CPU unit and I/O unit, respectively.)
③	I/O slot	Used to insert an I/O module or optional module.
④	FG terminal	Connected to the frame ground terminal on each module.

4 INSTALLATION

4.1 Installation

Remote I/O cables can be connected to two communications lines (RI/O1 and RI/O2). Each line can connect up to 12 I/O units (a total of 24 I/O units with the two lines).

- Make sure that the distance between the CPU unit and the I/O unit at the far end is within 300 m.
- Three types of remote I/O cables are available for long distances (300 m or less), middle distances (200 m or less), and short distances (100 m or less). Select the most suitable cable according to the total length between hardware units.
- Use the same type of cables on the same communications line. Do not use different types of cables. Otherwise, normal operation is not guaranteed.
- Set a different station number for each station.

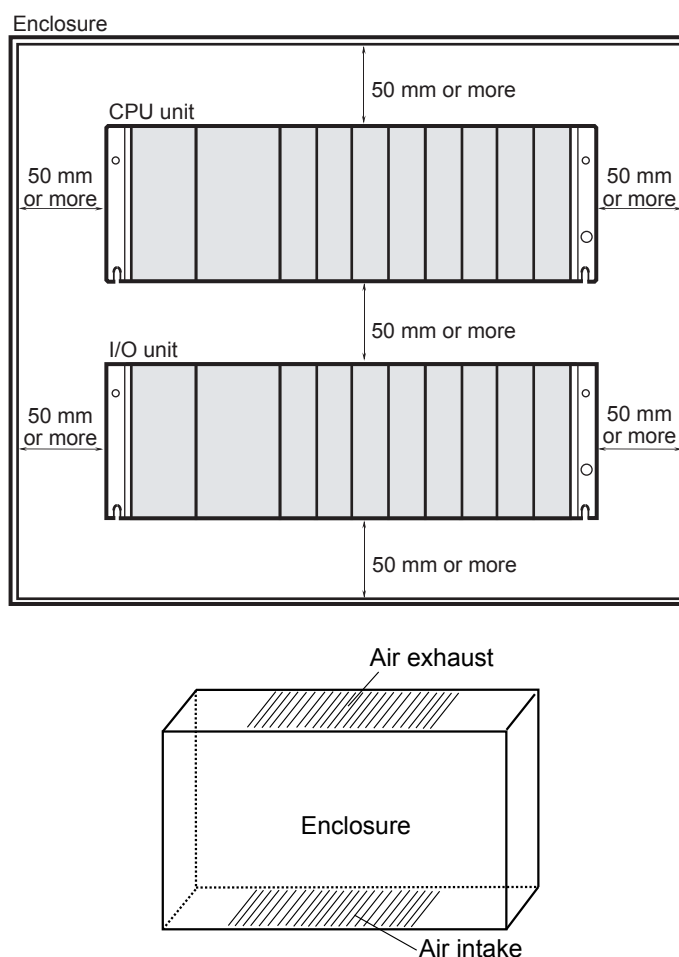


- Select the most suitable cable according to the total length.
 - Cable for short distances (100 m or less)
 - Cable for middle distances (200 m or less)
 - Cable for long distances (300 m or less) □

- Distributes up to 12 units to one line, according to the place of installation.
- Use the same type of cables on the same line.
- Set a different station number for each unit.

4.2 Clearances

To ensure normal operation of this product, provide an air inlet/outlet with an air filter on the top and bottom of the enclosure each, allowing clearances between the enclosure walls and each unit as shown below. These clearances are recommended values, not mandatory. Test-run the system to make sure that the temperature around the module is within allowable limits.



CAUTION

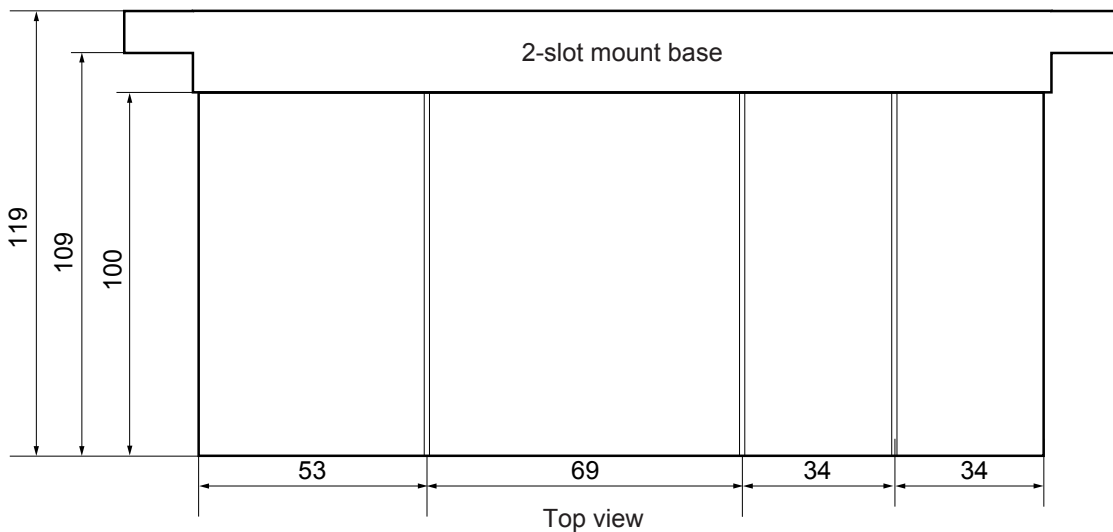
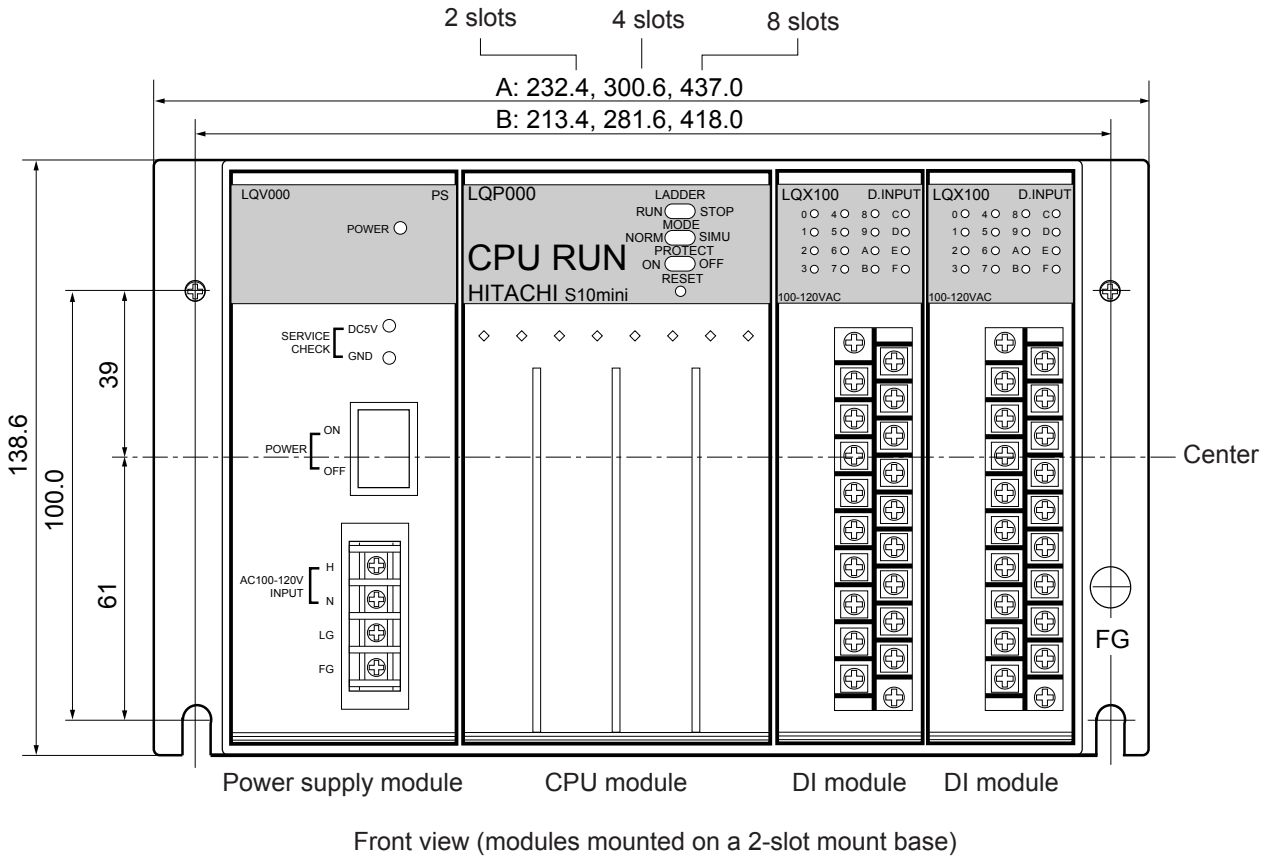
- Heat may build up inside the enclosure to such a degree that it will cause the units to fail. Units may malfunction under the influence of electromagnetic interference from the adjoining units. Allow specified clearances between the enclosure walls and each unit and between the units to assure heat dissipation and lessen electromagnetic interference.
- The temperature rise in the enclosure varies depending on the manner of operation. The above specified clearances should be considered as recommended values. After the installation of units, perform a test run and measure the temperature around the installed units to ensure that it is within allowable limits. If the temperature is found higher than the allowable upper limit, increase the clearances or use forced air cooling by cooling fans.

4 INSTALLATION

4.3 Outside Dimensions

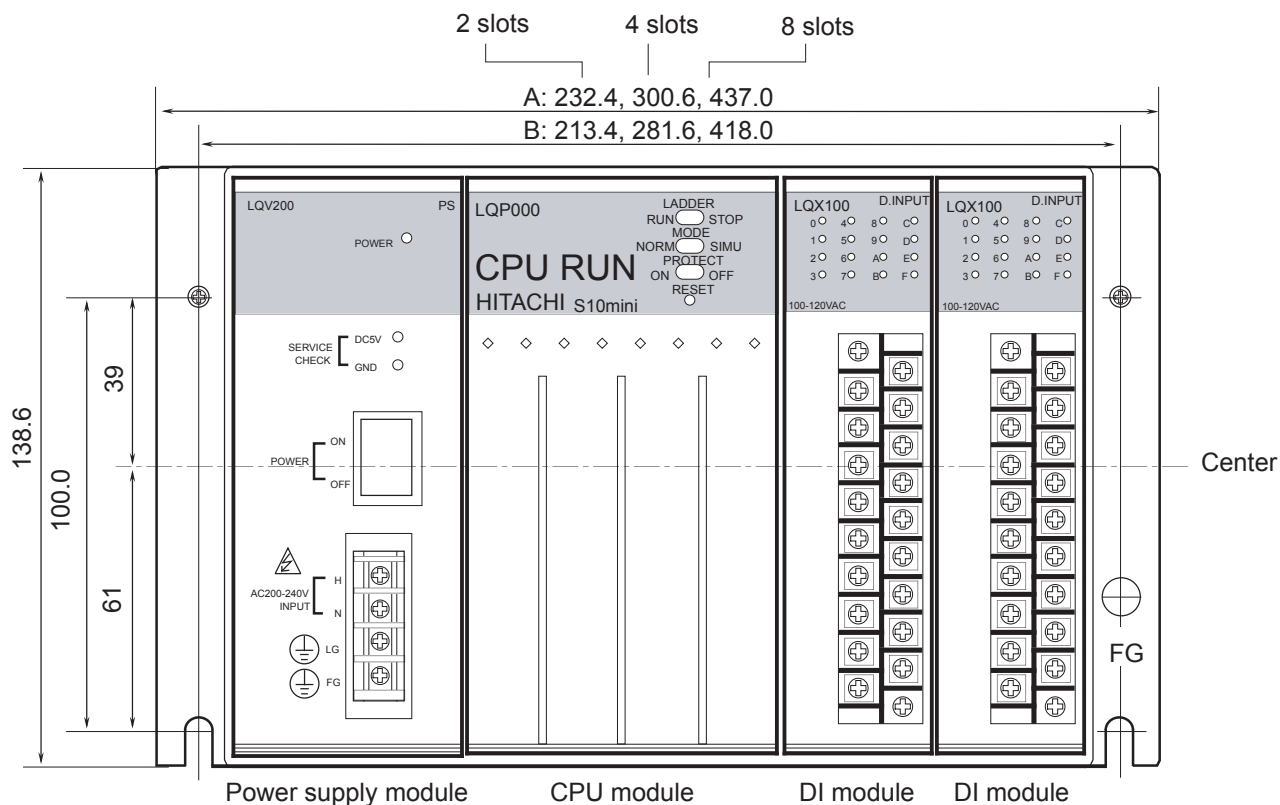
The CPU unit and I/O unit are the same in size. The mounting base varies in the full width (A) and the mounting screw hole dimension (B), depending on the number of I/O slots provided.

(1) Unit dimensions when the power supply module is LQV000, LQV020, or LQV100.

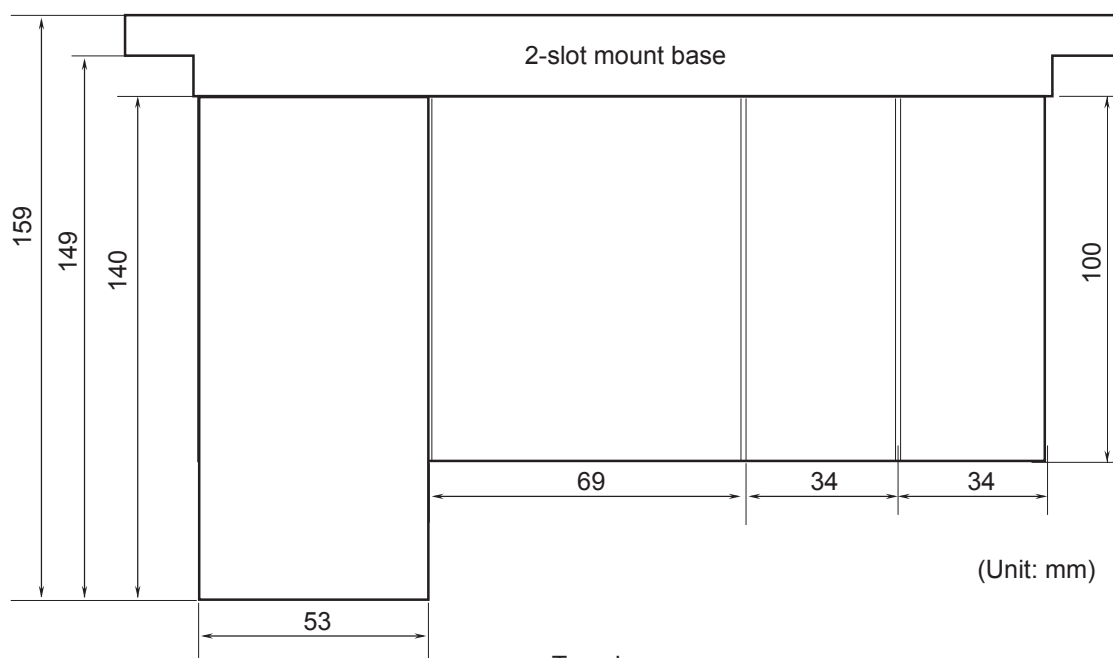


(Unit: mm)

(2) Unit dimensions when the power supply module is LQV010 or LQV200.



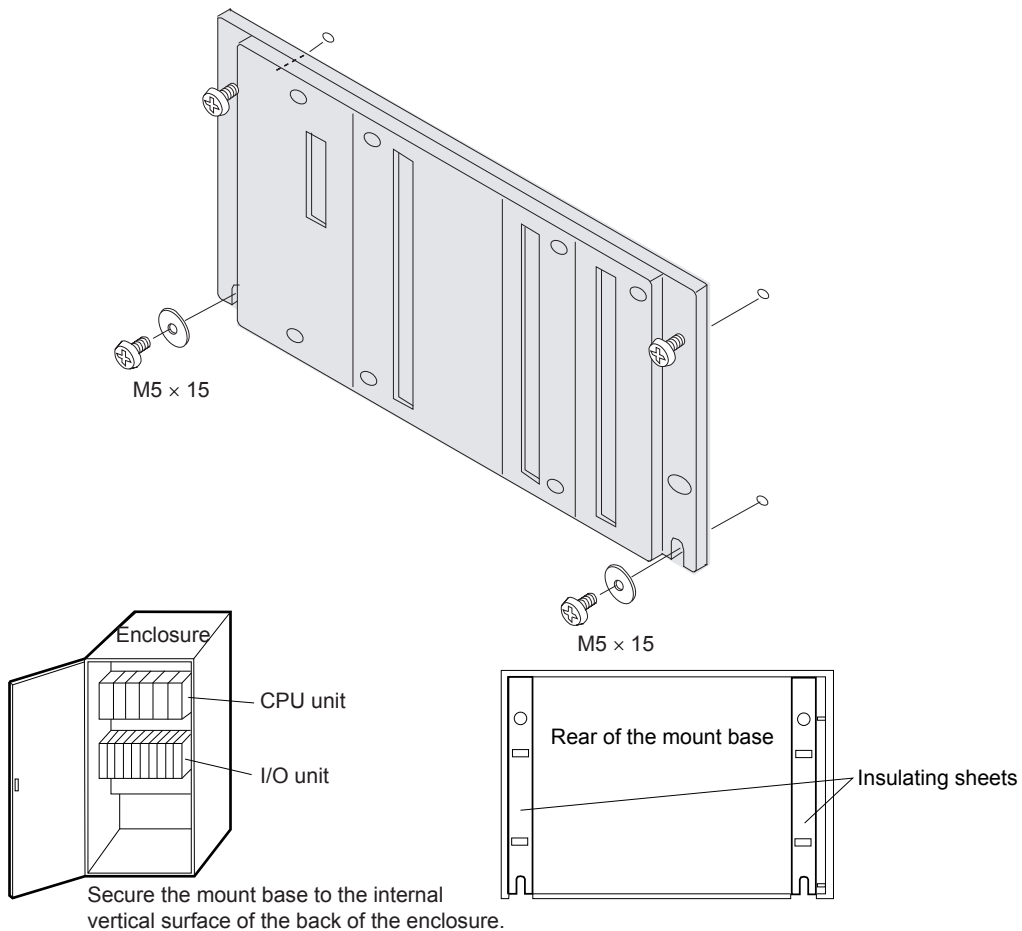
Front view (modules mounted on a 2-slot mount base)



Top view

4.4 Securing the Mount Base

Secure the mount base to the internal vertical surface of the back of the enclosure. Do not mount it horizontally or make it face up or down. Modules are designed so that they provide the best heat dissipation efficiency when they are installed on that vertical surface.



PROHIBITION

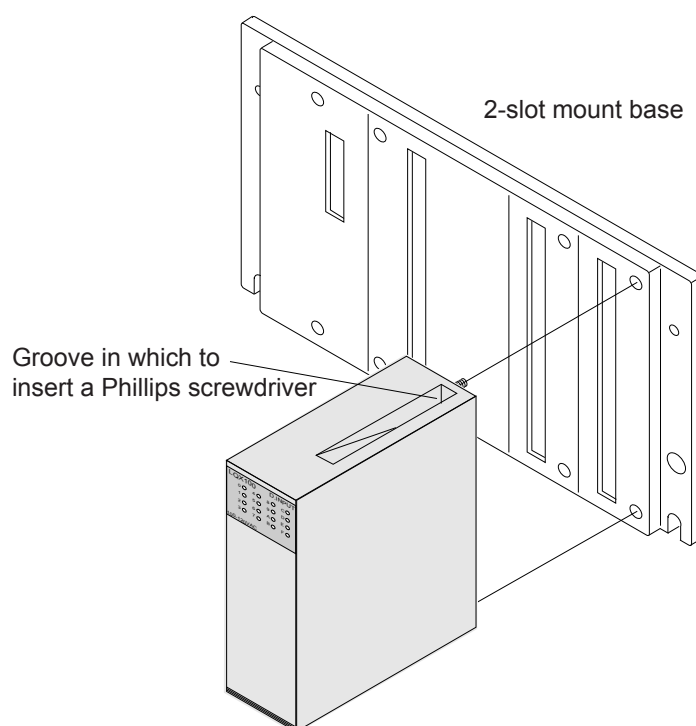
- Keep the insulating sheets in position to insulate the mount base from the enclosure.
- Never insert fingers or foreign matter into the clearances between parts of the connectors and mount base. Disregarding this rule may result in injuries.

REQUIREMENT

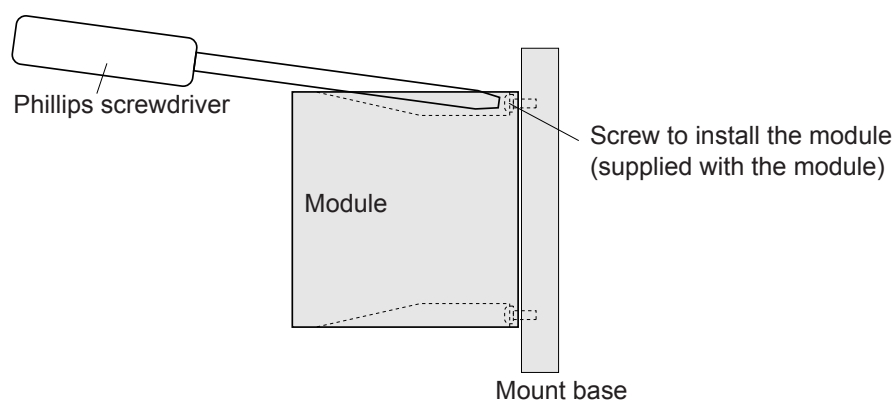
Screw the mount base to the predetermined vertical surface in the enclosure. If it is screwed to a horizontal surface, heat dissipation would be impeded, resulting in failures or degraded parts due to temperature rises.

4.5 Securing Modules

When mounting the module for the first time, detach the dust cover from the mount base connector. Before leaving the module out of the mount base for a long period of time, seal the mount base connector with the dust cover to protect the connector. Dust entering the inside of the connector can cause malfunctioning or failures.



Insert a Phillips screwdriver into the groove and tighten the screw.



4 INSTALLATION



PROHIBITION

Do not disassemble or retrofit any module. Disregarding this rule may result in a malfunction, failure, or a fire.



DANGER

Do not connect or disconnect modules and cables in the power-on state of the power supply. Disregarding this rule may result in an electric shock or damage to the equipment. Be sure to switch off the hardware unit before connecting or disconnecting it or its cable.

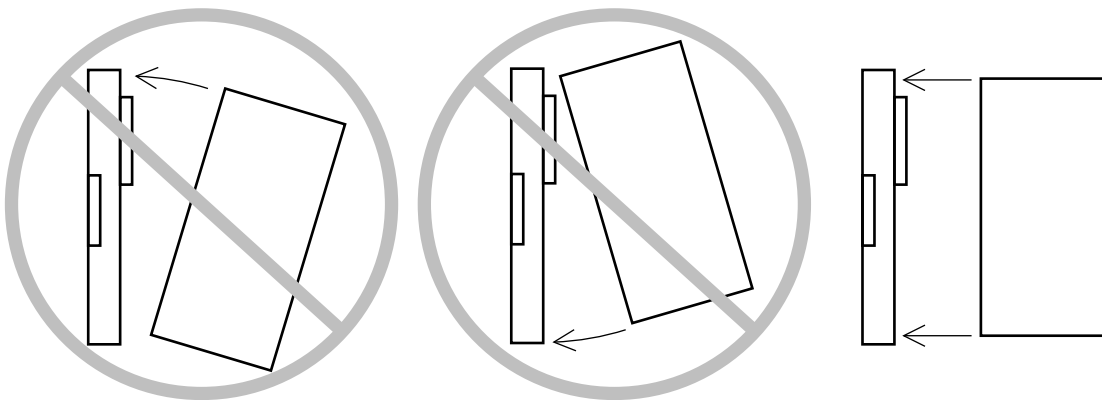


CAUTION

- Dust and dirt deposited on the connector can be a risk of poor connection. Install and wire the equipment immediately after unpacking.
- Modules are susceptible to damage. Note the following points when installing or removing modules.
 - Check that the connectors are free from bent or broken pins and the pins are aligned straight and are free from dust.
 - When securing a module, be sure to attach it to the mount base while keeping its mating face parallel to the vertical surface of the mount base, as shown below. If a module is attached or removed aslant from the connector, the connector pins may be bent.

[Bad example]

[Good example]



**REQUIREMENT**

- Tighten the screws fully. Inadequately tightened screws can cause malfunctioning, smoking, or firing.
- Damage to the module can result from static electricity. Discharge static charges from your body before starting your installation work.

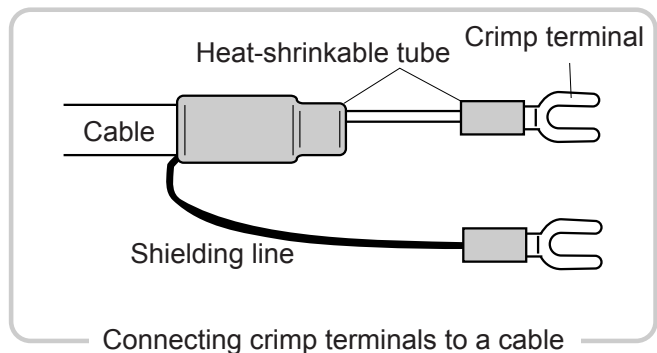
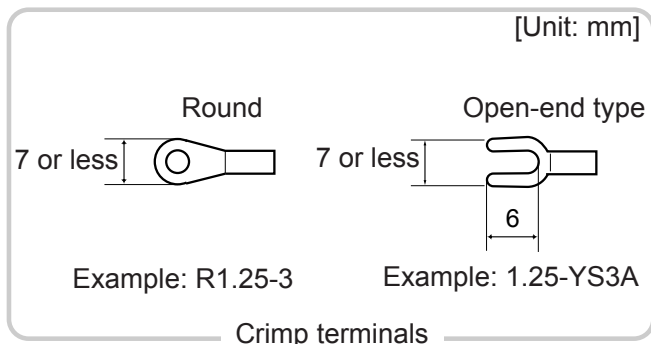
5 WIRING

5.1 Cable Specifications

Use telecommunication cables, power cables, and grounding lines that satisfy the following specifications:

Item		Specifications	Remarks		
Remote I/O cables	For long distances (300 m or less per line)	Characteristic impedance	150 Ω		
		Attenuation ratio	10 dB/km	750 kHz	
		Sectional area of wire	• 0.75 mm ² (CO-EV-SX-1P × 0.75SQ) • 0.3 mm ² (CO-EV-SB-1P × 0.3SQ)		
		Recommended cables	• CO-EV-SX-1P × 0.75SQ • CO-EV-SB-1P × 0.3SQ		Manufactured by Hitachi Cable, Ltd.
		Resistance of terminating resistor	150 Ω		
	For middle distances (200 m or less per line)	Characteristic impedance	150 Ω		
		Attenuation ratio	12 dB/km	750 kHz	
		Sectional area of wire	0.18 mm ²		
		Recommended cables	CO-EV-SB-1P × 0.18SQ	Manufactured by Hitachi Cable, Ltd.	
		Resistance of terminating resistor	150 Ω		
	For short distances (100 m or less per line)	Characteristic impedance	100 Ω		
		Attenuation ratio	21 dB/km	750 kHz	
		Sectional area of wire	0.3 mm ²		
		Recommended cables	CO-SPEV-SB-1P 0.3 mm ²	Manufactured by Hitachi Cable, Ltd.	
		Resistance of terminating resistor	100 Ω		
PCs OK		Wire type	Shielded twisted pair		
		Cable length	100 m or less		
		Sectional area of wire	0.5 mm ² or more		
CPU STOP/RUN, RI/O STOP		Wire type	Shielded twisted pair		
		Cable length	100 m or less		
		Sectional area of wire	0.5 mm ² or more		
Power supply cable		Wire type	Shielded twisted pair or 3-conductor twisted lines		
		Sectional area of wire	2 mm ² or more	Depending on the load and wire length	
Ground line		Sectional area of wire	2 mm ² or more		

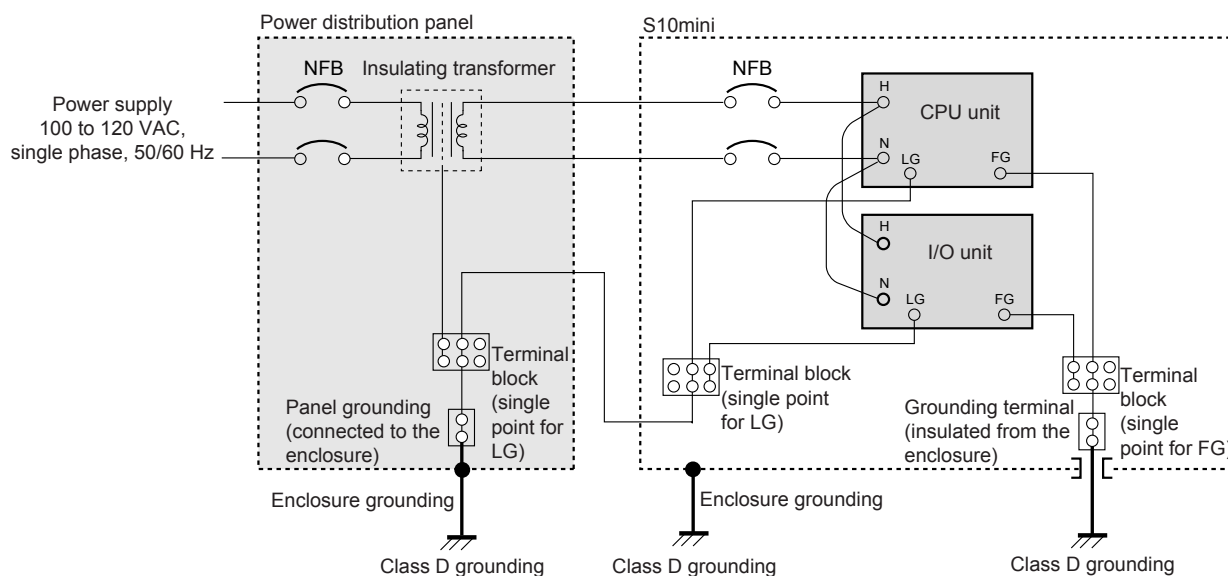
■ When connecting cables, use crimp terminals.



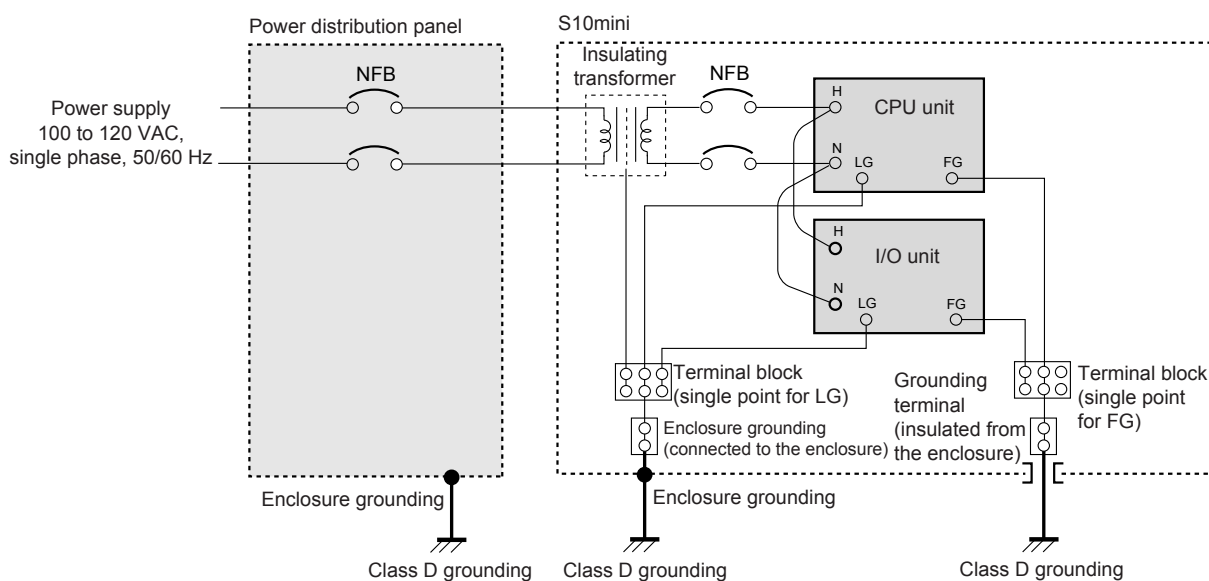
5.2 Wiring the Power Supply

Insulate the input power supply for the S10mini from the control power supply by means of an isolating transformer with electrostatic shielding. Below are wiring diagrams when insulating transformers are installed in the power distribution panel and S10mini.

■ When an insulating transformer is installed in the power distribution panel



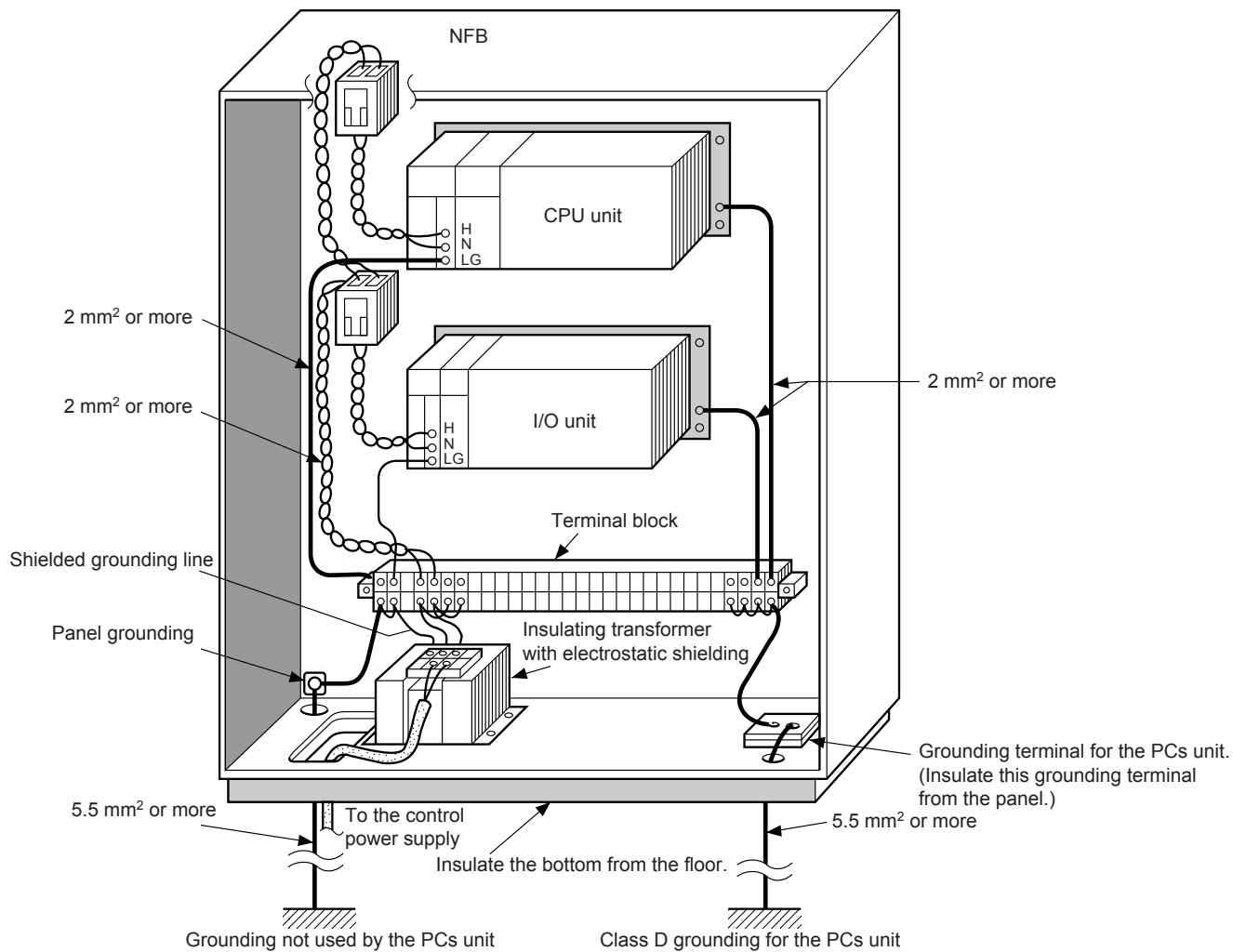
■ When an insulating transformer is installed in the S10mini



- Insulate the grounding terminal on the S10mini from the enclosure.
- Insulate the mount base from the enclosure.
- Cable sizes
 - Power supply cable: 2 mm² or more
 - Grounding lines
 - Inside the enclosure: 2 mm² or more
 - Outside the enclosure: 5.5 mm² or more

5 WIRING

■ Sample wiring inside the S10mini

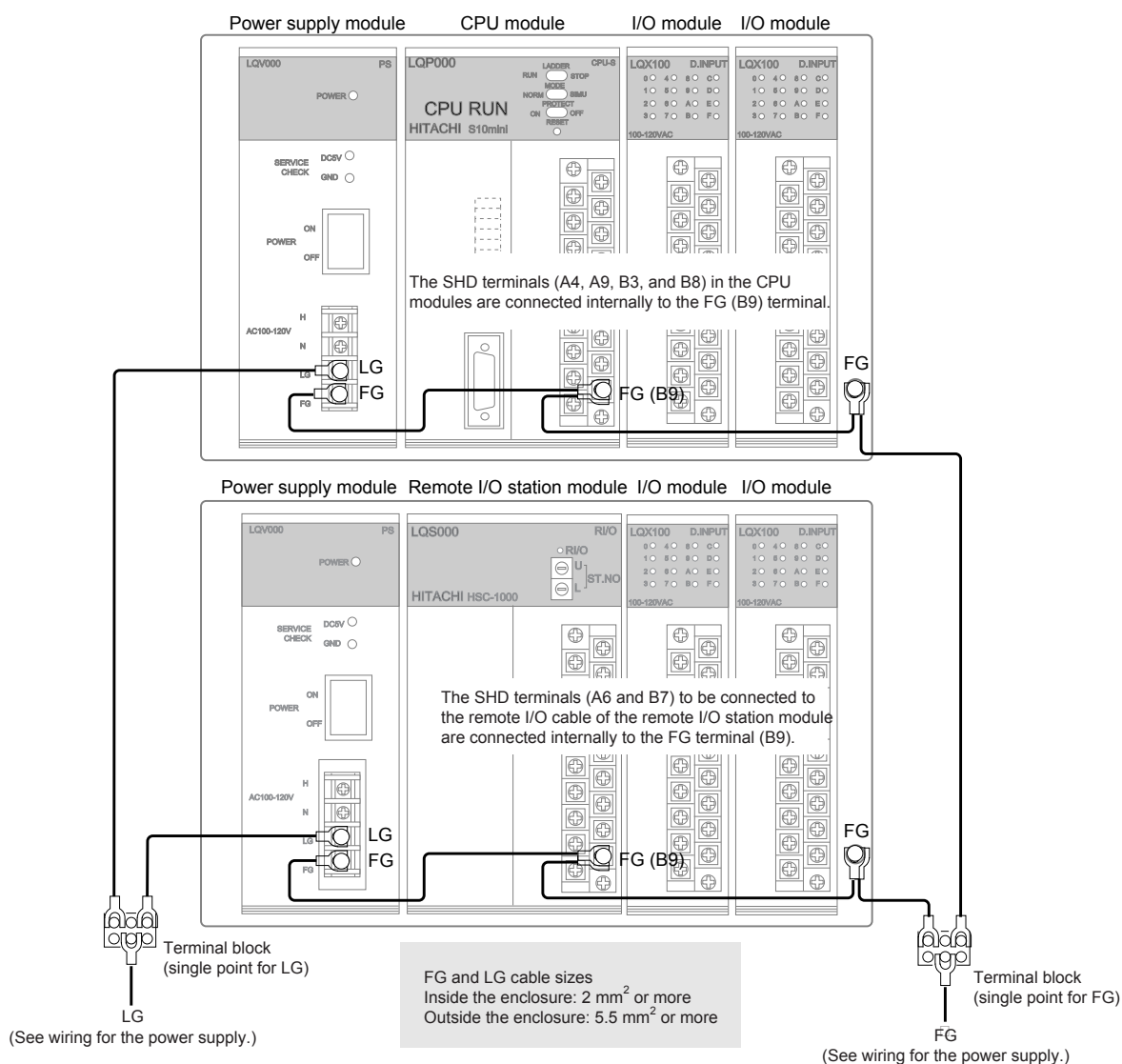


5.3 Wiring for Grounding

- Ground the LG (line ground) and FG (frame ground) terminals separately. LG is a grounding terminal for power noise, while the FG is a grounding terminal for network circuit noise. Keep the LG and FG apart to prevent mutual interference.
- Connect the FG to the mount base FG terminal with the shortest possible separation.
- Give Class D (JIS) grounding to the mount base grounding FG terminal, insulated from the enclosure.

■ Example wiring when the CPU unit and I/O unit are mounted in the enclosure

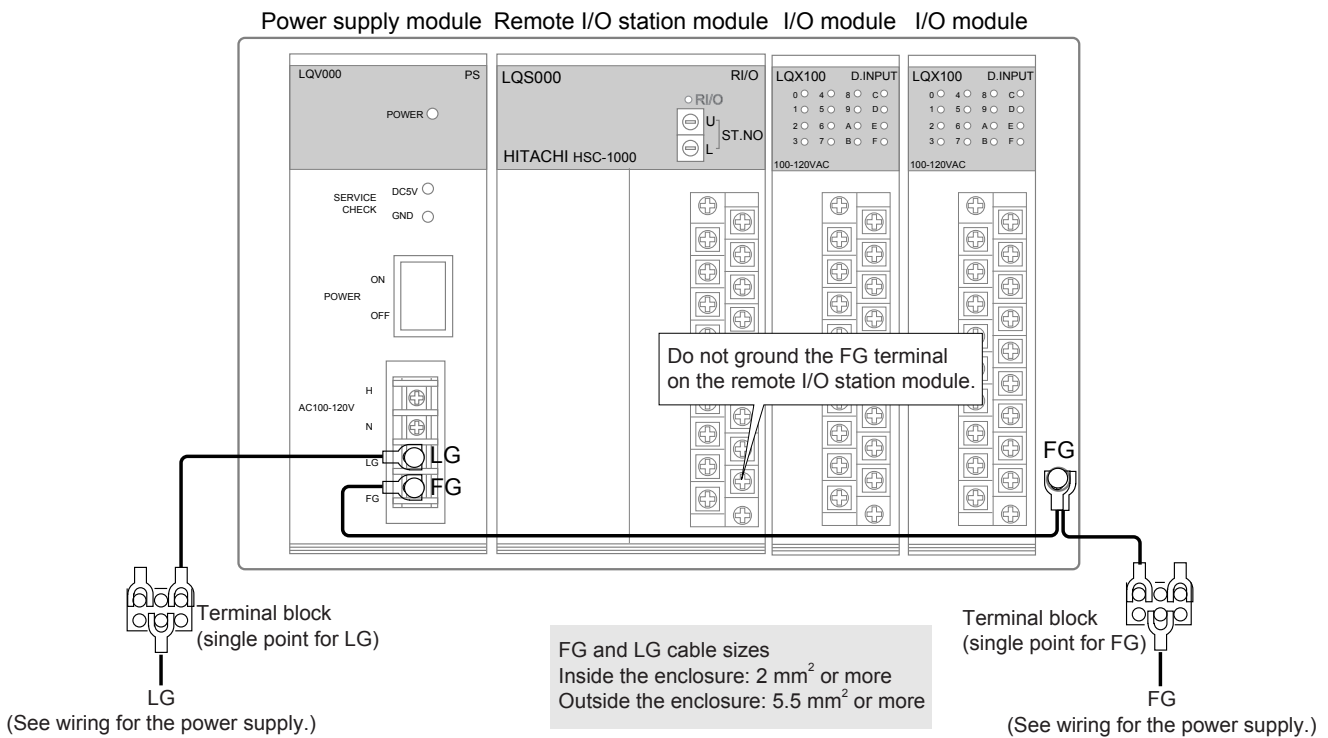
If the CPU unit and I/O unit are mounted in the same enclosure, have the FG terminal of the CPU module and that of the remote I/O station module connected to their respective mount base FG terminals, grounded to the same point. This assures the same ground potential, increasing effectiveness of the grounding and improving immunity to noise.



5 WIRING

■ Sample wiring when the I/O unit is installed in a different enclosure

When a remote I/O cable is used to connect enclosures installed in different places, do not ground the FG terminal on the remote I/O station module positioned between them. If it is grounded, immunity to noise is lowered due to different ground potentials. Ground the FG terminal on only one of the units of the two terminating ends.



REQUIREMENT

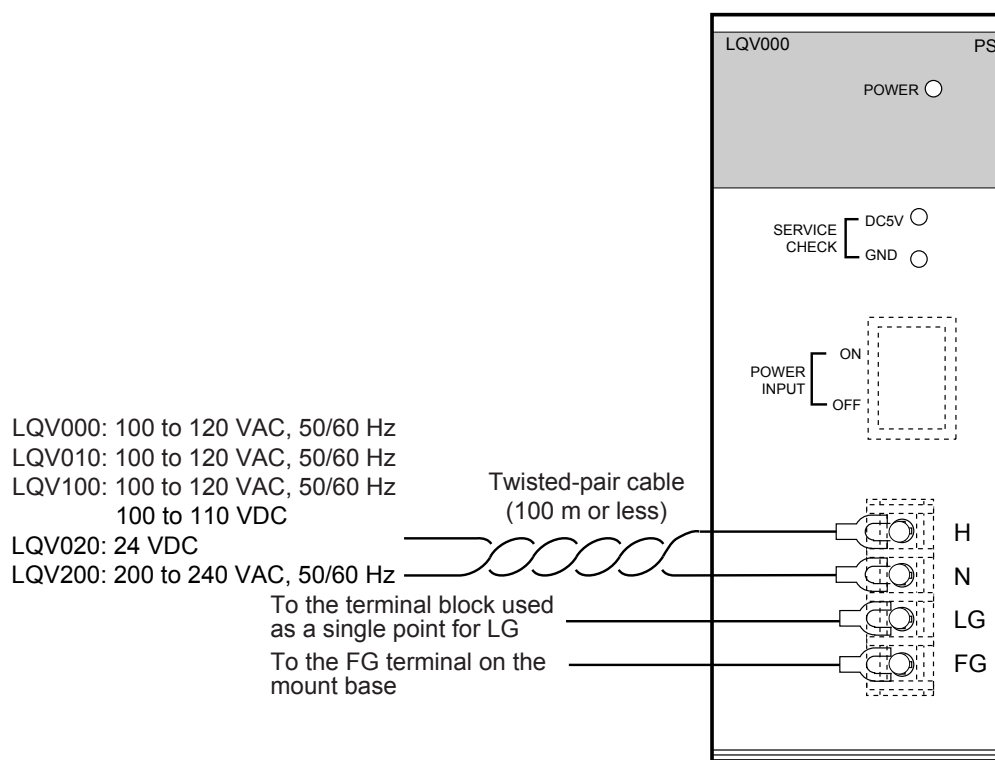
An electric shock may lead to a death or burn. Noise may cause the system to malfunction. Ground the line ground (LG), frame ground (FG), and shield (SHD) terminals, as described below.

- Electrically insulate the mount base from the enclosure. To accomplish this, do not remove the insulating sheet from the mount base.
- Ground the LG and FG terminals separately. The LG terminal is provided to prevent intrusion of power supply noise, while FG and SHD are grounding terminals that suppress intrusion of line noise into external interfaces for remote I/O station modules, communication modules, or other modules. To prevent mutual interference, ground the LG and FG terminals separately.
- Connect the FG terminal on each module to the FG terminal on the mount base. Ground each of the FG terminals of remote I/O lines and OPCN-1 (J.NET) lines at a separate point (on the CPU unit side). (Be sure to ground all the FG terminals of remote I/O station or OPCN-1 station (J.STATION) modules that can be grounded along with the CPU unit at the same point.)

**DANGER**

Do not connect or disconnect modules and cables in the power-on state of the power supply. Disregarding this rule may result in an electric shock or damage to the equipment. Be sure to switch off the hardware unit before connecting or disconnecting it or its cable.

5.4 Wiring the Power Supply Module



5.5 Wiring for External Input/Output Signals

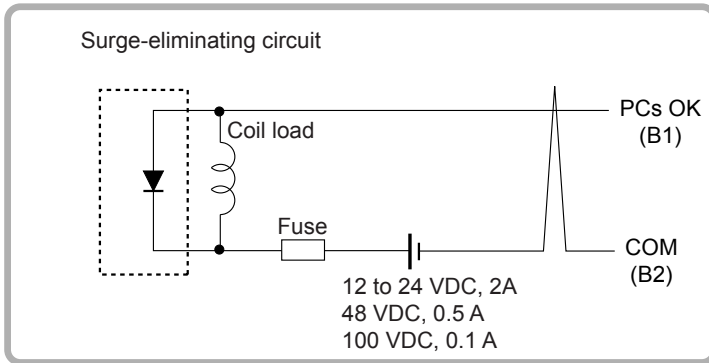
**REQUIREMENT**

A surge voltage may cause hardware units to malfunction or to be damaged. When a coil, such as a relay, is connected to the PCs OK output circuit, install a surge-absorbing diode or similar device. Use a diode with its peak inverse voltage at least 10 times higher than the circuit voltage and with its forward current equal to or higher than the load current.

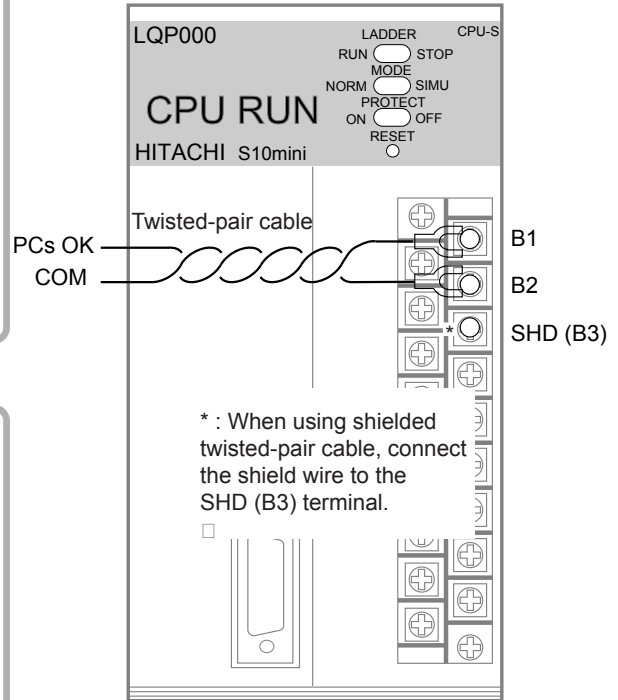
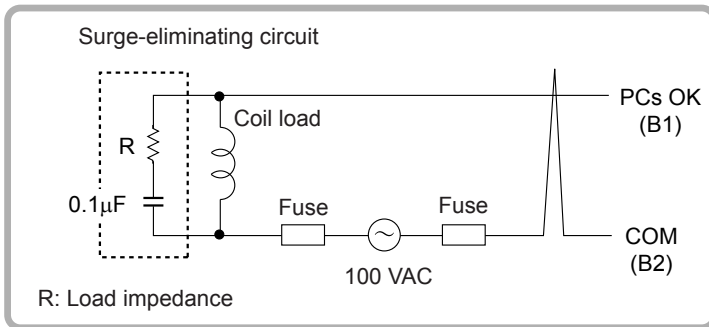
5 WIRING

5.5.1 Wiring for the PCs OK signal

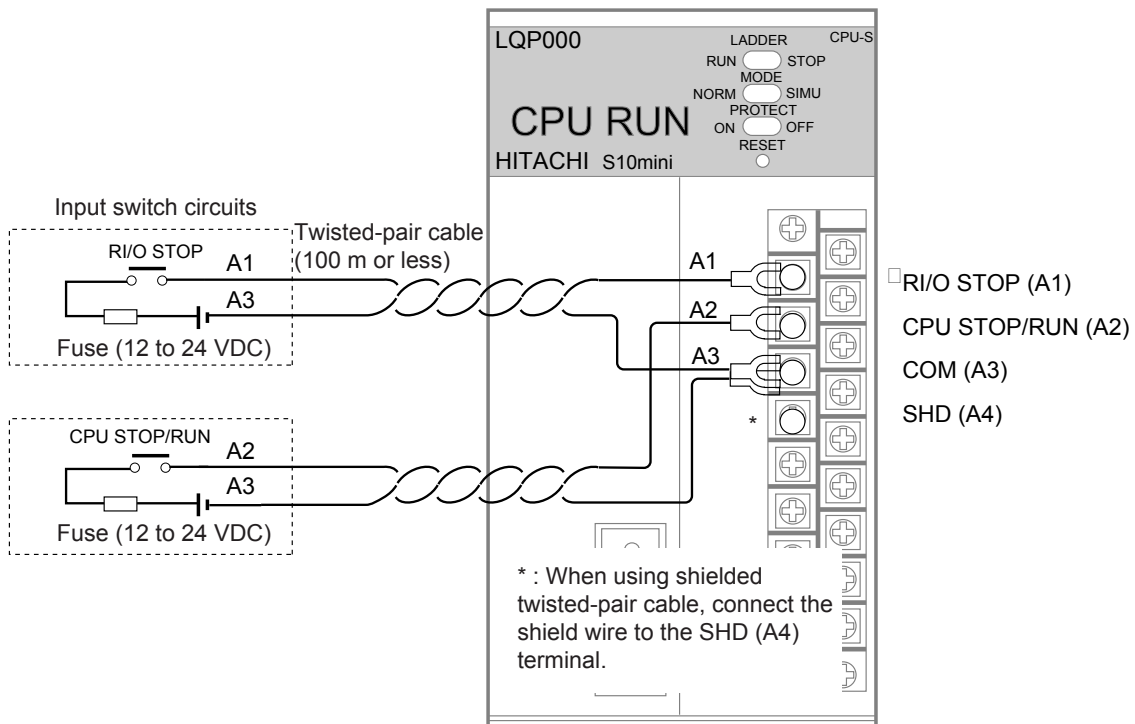
■ DC power supply



■ AC power supply

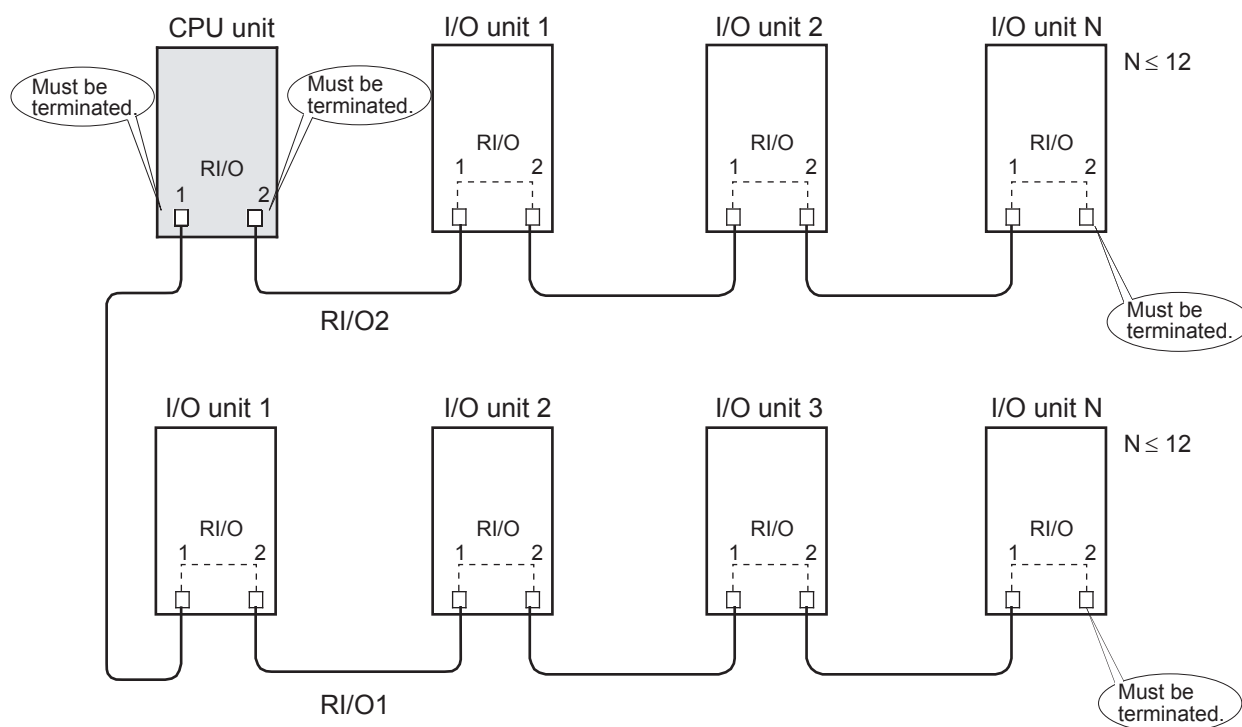


5.5.2 Wiring for the RI/O STOP and RUN/STOP signals



5.6 Wiring Remote I/O Cables

- The CPU unit has two remote I/O cable ports (RI/O1 and RI/O2), each of which can connect up to 12 I/O units.
- The remote I/O cable ports, RI/O1 and RI/O2, on the I/O unit are connected internally. Connect the cable extended from the previous stage to RI/O1, and connect the cable extended to the next stage to RI/O2.
- Use terminating resistors to terminate the CPU modules or remote I/O station modules connected to both ends of a remote I/O line. The user can select the built-in 100 Ω or 150 Ω resistor or an external resistor having a suitable resistance. Check the characteristic impedance of the remote I/O cable to select the most suitable terminating resistor. For details, see “5.6.3 Setting terminating resistors.”
- If the remote I/O cable is connected improperly, communication may fail. Connect the remote I/O cable as specified. For details, see “5.6.1 Examples of improper wiring.”
- After the remote I/O cable is connected, set the CPU module and remote I/O station module, as described in “6 SETTINGS.”
- Ground to a single point the shield terminals of all remote I/O cables that are connected with each communications line. Do not ground the FG terminal for each hardware unit.



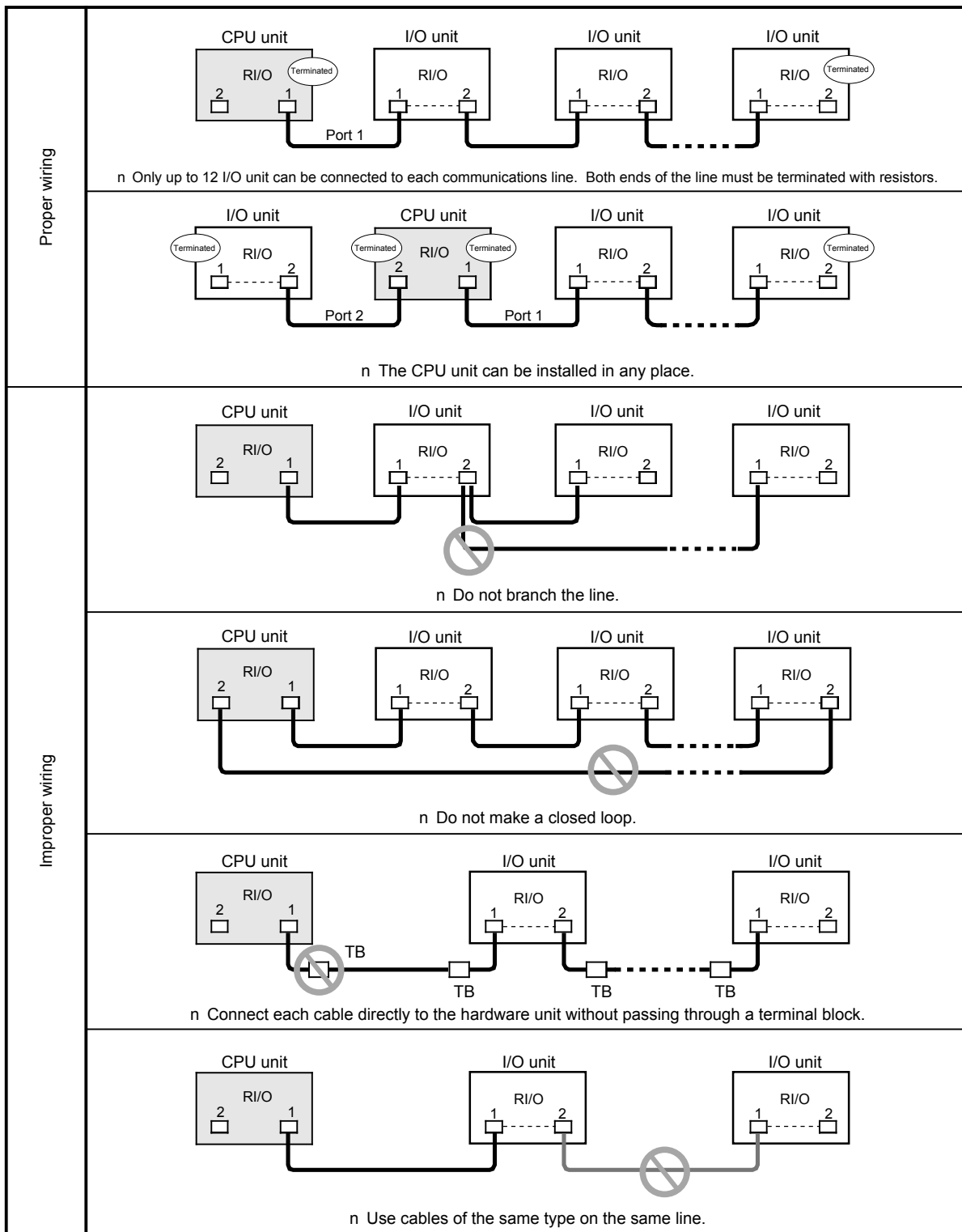
NOTE

Attach a terminator (150 Ω) to those ports to which the remote I/O cable is not connected to guard against external electromagnetic noise.

5 WIRING

5.6.1 Examples of improper wiring

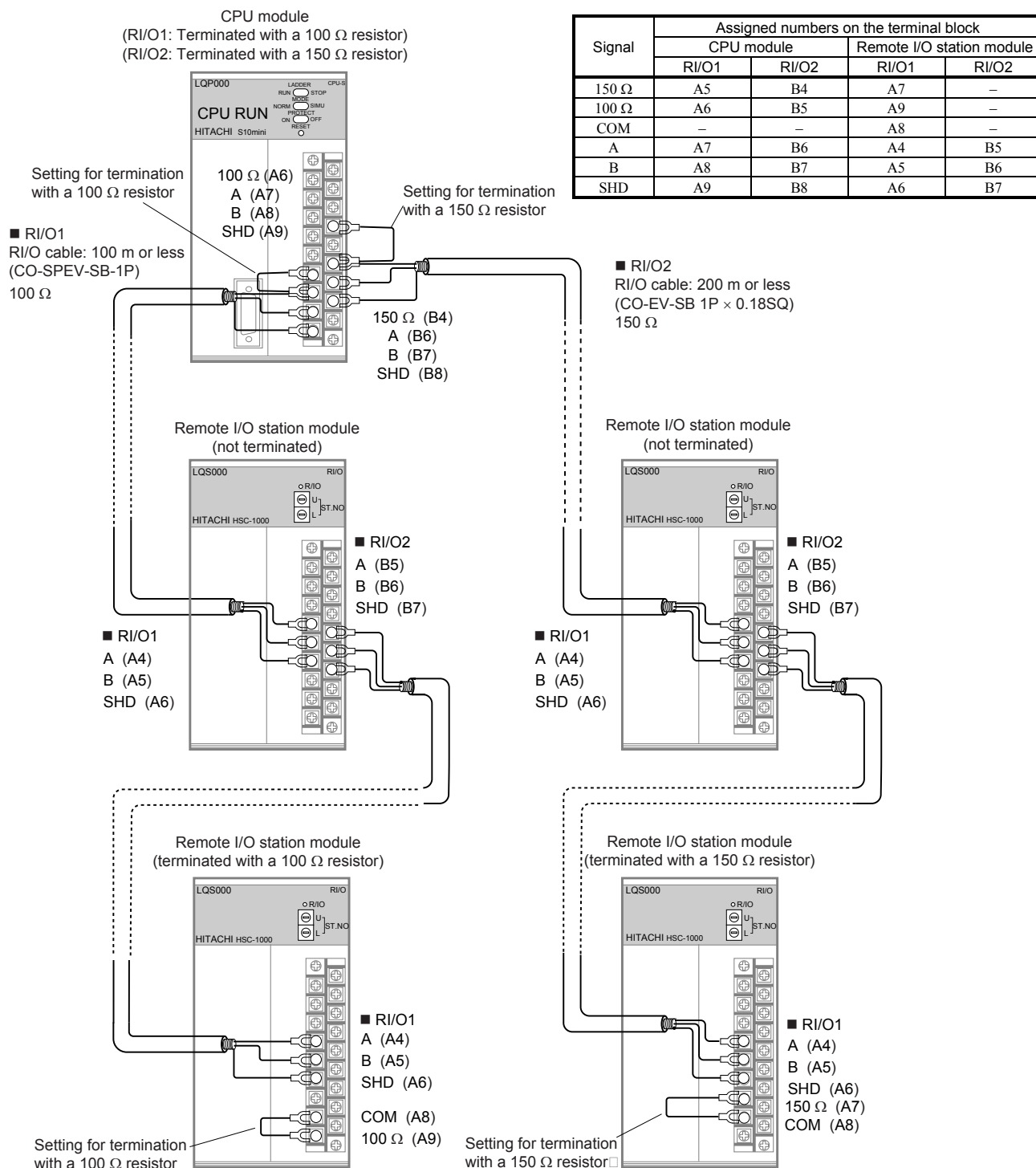
Improper wiring as shown below causes waveforms on the lines to be distorted, resulting in communication errors. Make sure that the cables are connected properly.



5.6.2 Examples of remote I/O cable wiring

In the following example of wiring, cables having different characteristics are connected to the RI/O1 and RI/O2 ports on the CPU module.

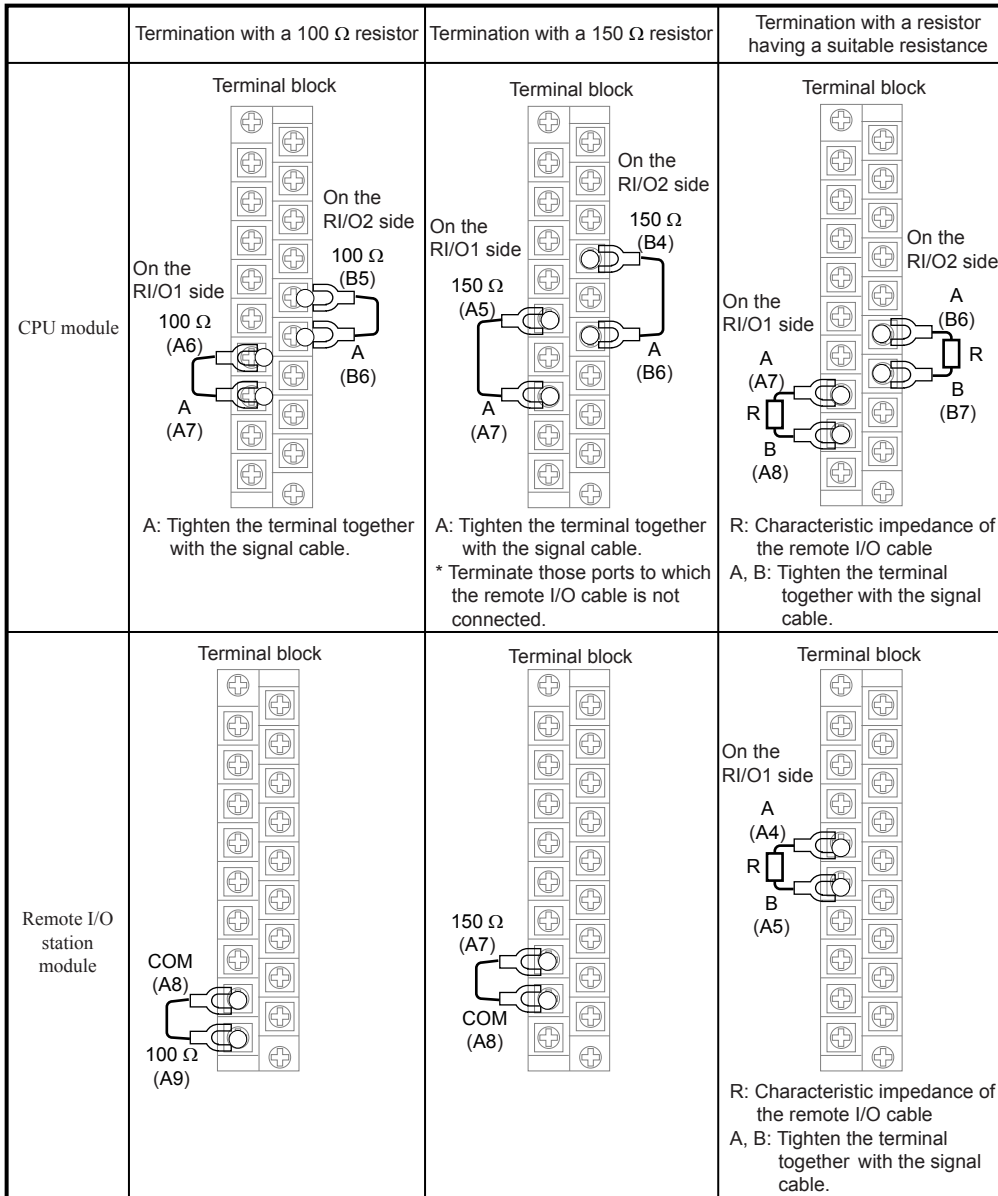
- Connect terminating resistors, as described in “5.6.3 Setting terminating resistors.”
- Connect ground lines, as described in “5.3 Wiring for Grounding.”



5 WIRING

5.6.3 Setting terminating resistors

When a specified cable is used, it must be terminated with a built-in 100 Ω or 150 Ω resistor by connecting terminals, as shown below. When using a non-specified cable and terminating it with a resistor having a resistance other than 100 Ω or 150 Ω, insert a resistor between signal input terminals A and B.



Signal	Number on the terminal block			
	CPU module		Remote I/O station module	
	RI/O1	RI/O2	RI/O1	RI/O2
150 Ω	A5	B4	A7	—
100 Ω	A6	B5	A9	—
COM	—	—	A8	—
A	A7	B6	A4	B5
B	A8	B7	A5	B6
SHD	A9	B8	A6	B7

- Recommended terminating resistors
 Classification by material: Metal oxide film resistor or metal film resistor
 Resistance: Same as the impedance of the cable
 Accuracy: ± 10%
 Capacity: 1/2 W
 Shape: Axial

**DANGER**

Electrical shock hazards can result if you touch the terminal block or connector pins while the system is energized. Never touch the terminal block and connector pins while the system is energized.

**PROHIBITION**

- Do not install, wire, handle, or remake the programmable controller beyond such an extent as may be defined in this manual. We will not be liable for any damages to our programmable controller and ancillary equipment and for physical injury arising out of such actions.
- To prevent noise-caused malfunctioning, keep the 100 VAC/VDC or 200 VAC cable and the network cable at least 100 mm apart from each other, rather than bundle them together.

**REQUIREMENT**

- Before proceeding with power wiring, make sure that the power cable does not have a voltage applied to it. Attach the terminal cover immediately upon power wiring.
- Damage to the module can result from static electricity. Discharge static charges from your body before starting your wiring work.
- Wire the communications and power cables each separately, particularly at least 300 mm apart from the power cables for inverters, motors, and power controllers. Wire the communications and power cables in separate piping or ducts.

**CAUTION**

Have qualified technicians wire cables. Improper wiring can lead to fires, failures, and electrical shock hazards.

6 SETTINGS

6.1 Outline of I/O Number Settings

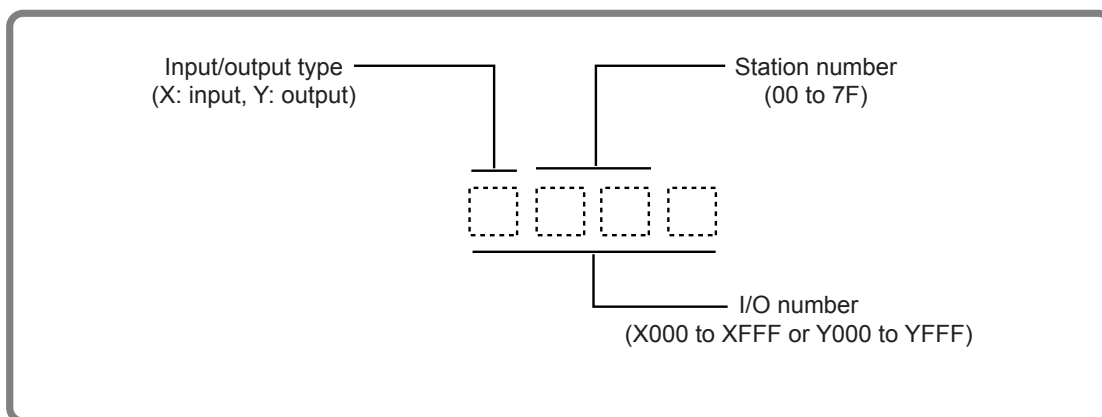
Assign I/O numbers to the mounted CPU units and I/O units, as described below.

Unit	Item to set	Description
CPU unit	Mounting status of PI/O modules	If I/O modules are mounted on the CPU mount base, set this item to "PI/O mounted." The station number 00 will then be assigned to the CPU unit.
	Partition status	Usually, set this item to FREE. If the number of I/O points for the mounted I/O modules exceeds 2048, set it to FIX. In this case, the maximum number of input I/O points is increased to 2048 and that of output I/O points is also increased to 2048. <ul style="list-style-type: none"> • With this item set to FIX, the left half of the I/O slots on the mount base can be used for input modules and the right half for output modules. The input slots are assigned XΔΔΔ as I/O numbers, while the output slots are assigned YΔΔΔ. • With this item set to FREE, each I/O slot on the mount base can be used for an input or output module. Each slot is assigned two I/O numbers (XΔΔΔ and YΔΔΔ) for both input and output. The user can select the I/O number corresponding to the I/O module to be mounted. Since each slot is not restricted to input or output only, an input module can be exchanged with an output module, or vice versa.
	Number of I/O points	Set the number of I/O points occupied by each slot on the mount base. Where each of some mounted I/O modules occupies a different number of I/O points, set the largest number of I/O points for all other modules.
	Output hold setting	Set this item to RESET or HOLD, which is one of the output states of the output module arising in case of an error on a remote I/O line. If it is set to RESET, the output is zeroized or zerofilled. If it is set to HOLD, the value immediately before the error is output.
	Terminating resistor	The CPU unit or I/O unit connected to both ends of a remote I/O line must be terminated with a resistor. When using a specified remote I/O cable, use the built-in 100 Ω or 150 Ω resistor. When using a non-specified cable, terminate the unit with an external resistor suitable for the characteristics of the cable. For information on how to connect and terminate remote I/O cable, see "5.6 Wiring Remote I/O Cables."
I/O unit	Partition status	See "Partition status" for the CPU unit.
	Number of I/O points	See "Number of I/O points" for the CPU unit.
	Output hold setting	See "DO output status" for the CPU unit.
	Terminating resistor	See "Terminating resistor" for the CPU unit.
	Station number	Set the first two digits of the numeric part of the first I/O number of the modules to be mounted. I/O numbers are assigned sequentially from this value, according to the settings of the partition status, the I/O point count, and the number of slots on the mount base. I/O numbers are also assigned to slots in which modules are not mounted.

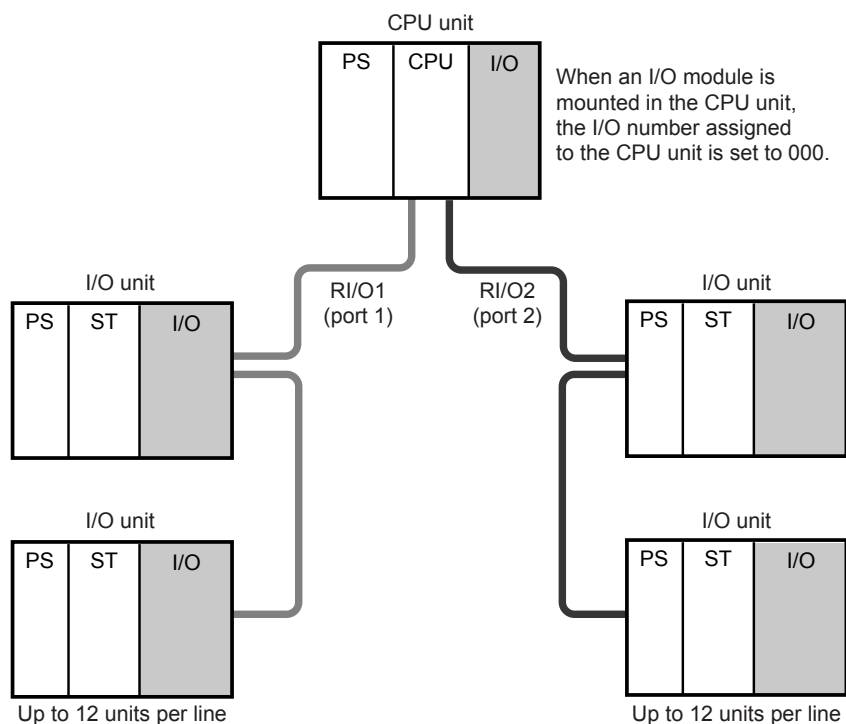
6.2 Configuration and Assignment Range of I/O Numbers

An I/O number consists of four alphanumeric characters, as explained below.

■ Configuration



■ Assignment range

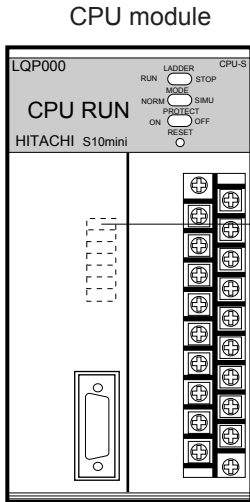


Number of I/O slots on the mount base	Range of I/O numbers	
	RI/O1 (*)	RI/O2
2	000 to 3E0	400 to 7E0
4	000 to 3C0	400 to 7C0
8	000 to 380	400 to 780

(*) If an I/O module is mounted in the CPU unit, the I/O number assigned to the CPU unit is set to 000. When setting I/O numbers for I/O units, take care so that duplication does not occur.

6.3 Setting I/O Numbers

For the CPU module and remote I/O station module, set I/O numbers in the places shown below. For information on how to connect terminating resistors to a remote I/O cable, see “5.6.3 Setting terminating resistors.”



Jumper plugs

- ○ 1: FREE/FIX
- ○ 2: HOLD
- ○ 3: 128 I/O points
- ○ 4: 64 I/O points
- ○ 5: 32 I/O points
- ○ 6: PI/O mounting
- ○ 7: Unused

Jumper plug No.	Jumper plug	
	Connected	Not connected
1	FREE	FIX
2	RESET	HOLD
3	16 points	128 points
4	16 points	64 points
5	16 points	32 points
6	PI/O not mounted	PI/O mounted
7	NC	NC

Under the factory setting, jumper plugs 1 to 6 are connected.

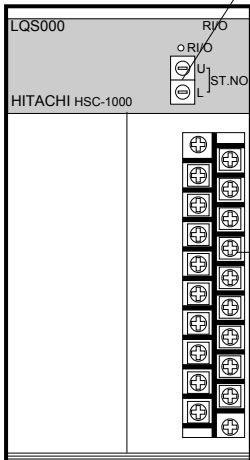
When any of jumper plugs 3 to 5 is connected, the 16-point setting is valid.

Station number setting

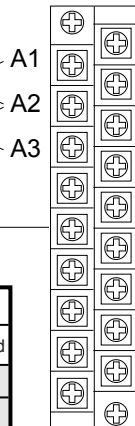
Number of I/O slots on the mount base	Range of I/O numbers	
	RI/O1	RI/O2
2	000 to 3E0	400 to 7E0
4	000 to 3C0	400 to 7C0
8	000 to 380	400 to 780

- As the station number, set the first two digits of an I/O number. □
- When "PI/O mounted" is set for the CPU module, the value 00 cannot be used as this setting.

Remote I/O station module



FREE/FIX is set.
HOLD/RESET is set.



The number of I/O points occupied by each slot on the mount base is set.

A2 short-circuited to:	Setting	
	Connected	Not connected
A1	FIX	FREE
A3	HOLD	RESET

The factory setting is "not connected."

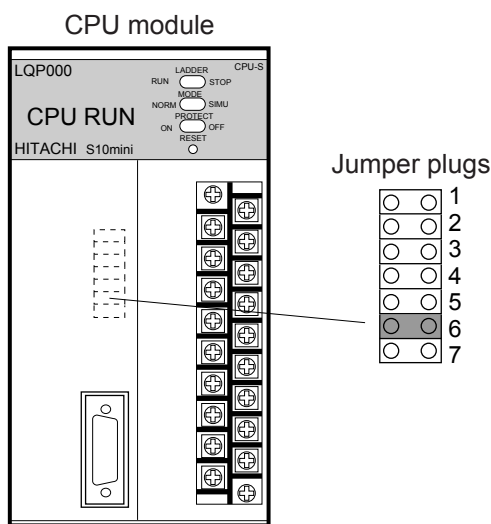
B4 short-circuited to:	Number of I/O points
B1	128 points
B2	64 points
B3	32 points
Not connected	16 points

The factory setting is "not connected."

6.3.1 Setting the mounting status of PI/O modules

If I/O modules are mounted in the CPU unit, remove jumper plug 6 to set “PI/O mounted.” After this, the CPU unit is assigned a station number and I/O number.

- The first station number 00 is assigned.
- The range of I/O numbers is automatically determined, according to the settings of the number of available I/O slots on the mount base, the partition status, and the number of I/O points occupied by each slot on the mount base.



NOTE

At PI/O mounting, attach a terminator (150 Ω) to those ports to which the remote I/O cable is not connected.

Item to set	Setting of jumper plug 6	
	Connected (factory setting)	Not connected
Station number	None	00
I/O number	None	000 to xxx

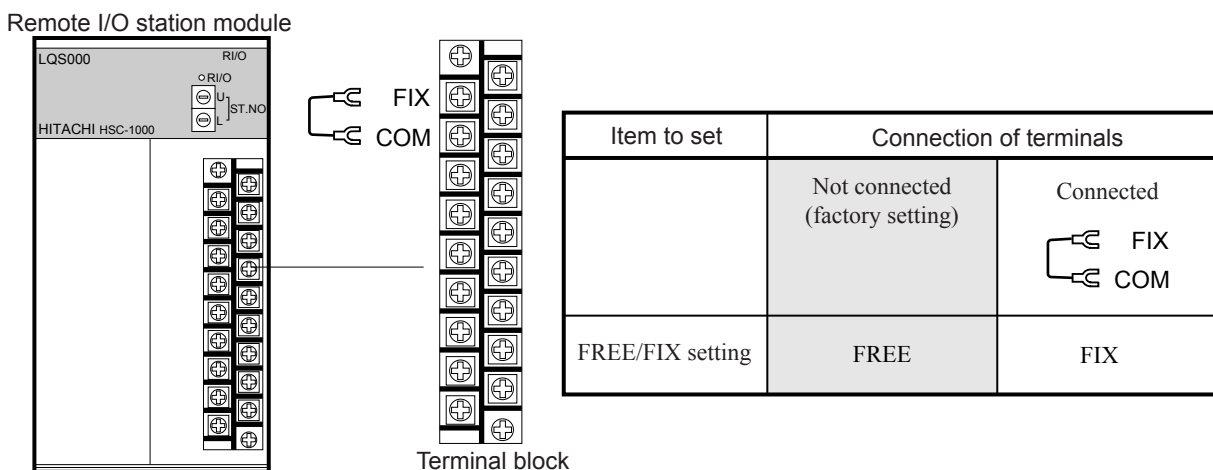
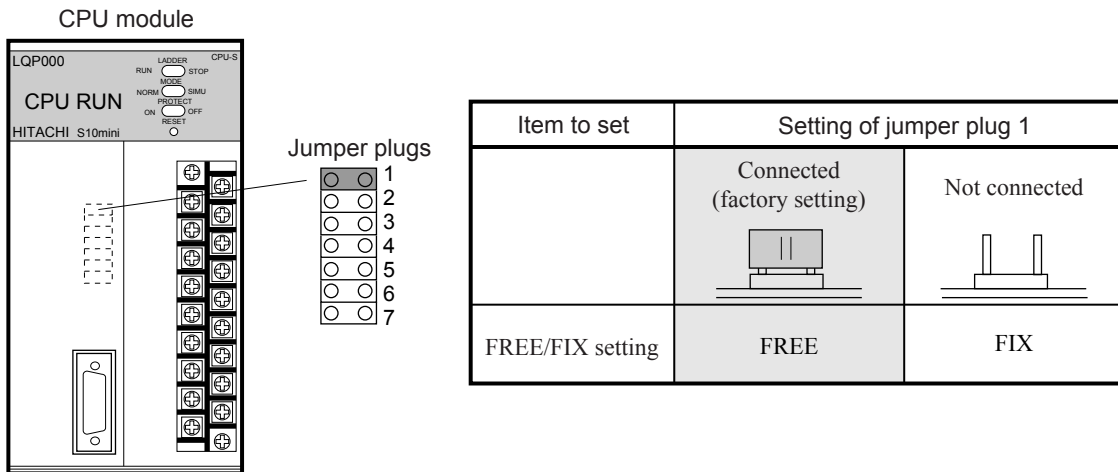
The last I/O number (xxx) of the range of I/O numbers that can be assigned varies with the settings of the number of I/O slots on the mount base, the partition status, and the number of I/O points occupied by each slot on the mount base.

6 SETTINGS

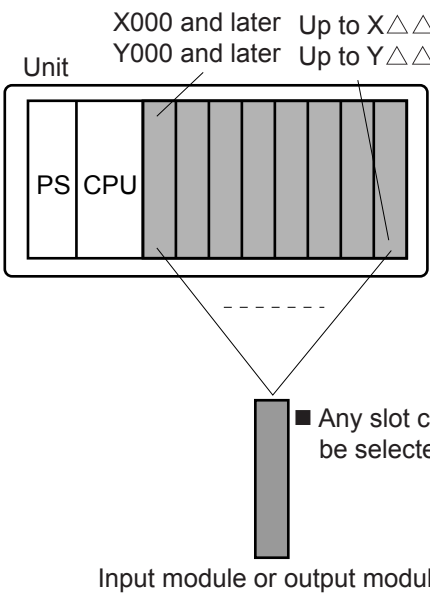
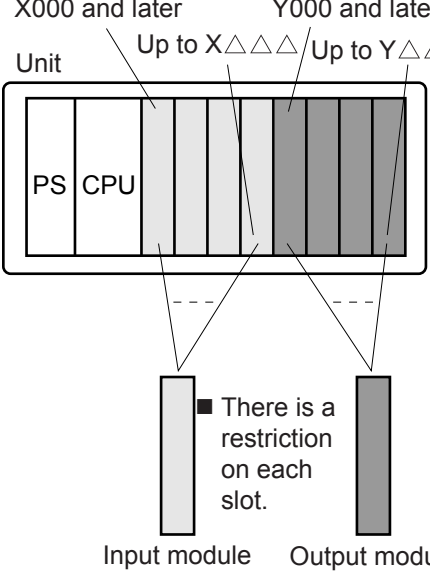
6.3.2 Setting partition status (FREE/FIX)

Usually, set the partition status to FREE. If the number of I/O points for I/O modules exceeds 2048, set it to FIX. In this case, the maximum number of input I/O points is increased to 2048 and that of output I/O points is also increased to 2048.

- With this item set to FIX, the left half of the I/O slots on the mount base can be used for input modules and the right half for output modules. The input slots are assigned X $\Delta\Delta\Delta$ as I/O numbers, while the output slots are assigned Y $\Delta\Delta\Delta$.
- With this item set to FREE, each I/O slot on the mount base can be used for an input or output module. Each slot is assigned two I/O numbers (X $\Delta\Delta\Delta$ and Y $\Delta\Delta\Delta$) for both an input module and an output module. The user can select the I/O number corresponding to the I/O module to be mounted. Since each slot is not restricted to input or output only, an input module can be exchanged with an output module, or vice versa.



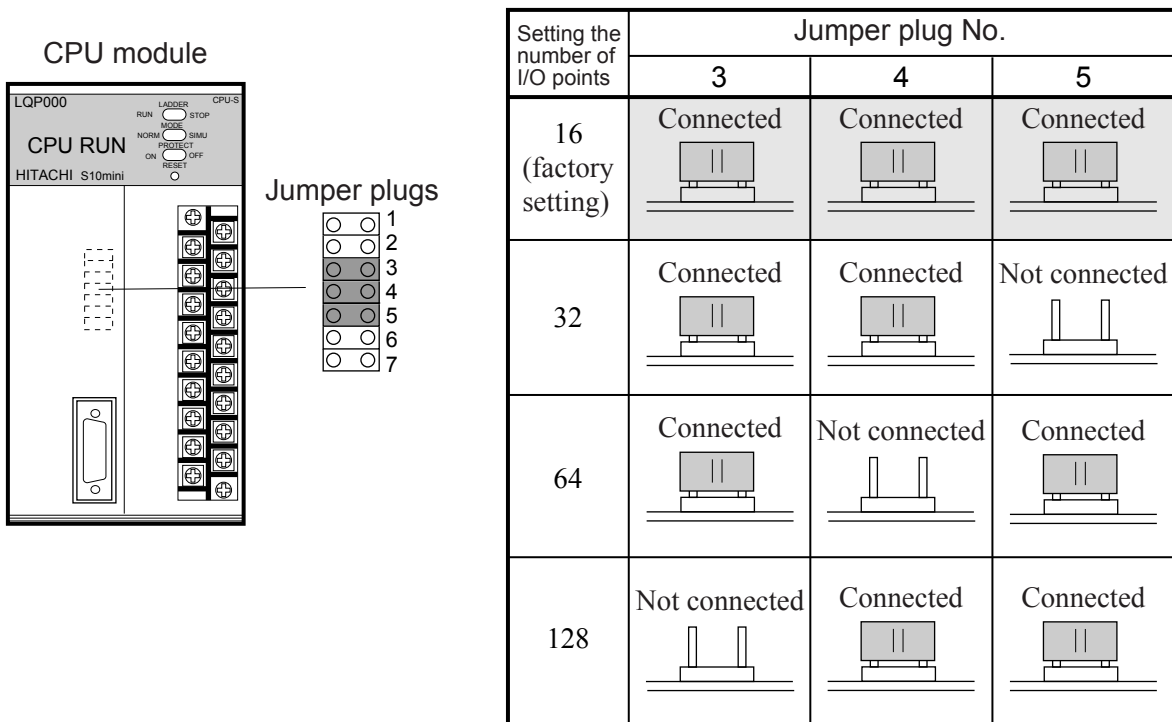
■ Differences between FREE and FIX

Setting	FREE	FIX
Slots in which to mount I/O modules	 <p>Unit</p> <p>PS CPU</p> <p>X000 and later Up to X△△△△ Y000 and later Up to Y△△△△</p> <p>■ Any slot can be selected.</p> <p>Input module or output module</p>	 <p>Unit</p> <p>PS CPU</p> <p>X000 and later Up to X△△△△ Y000 and later Up to Y△△△△</p> <p>■ There is a restriction on each slot.</p> <p>Input module Output module</p>
I/O number assignment	<p>Each slot is assigned two I/O numbers for an input module and an output module in the following range.</p> <p>I/O number for an input module</p> <p style="text-align: center;">X○○○ to X△△△</p> <p style="text-align: center;">and</p> <p>I/O number for an output module</p> <p style="text-align: center;">Y○○○ to Y△△△</p>	<p>Each slot of the left half of all the I/O module slots is assigned an I/O number for an input module in the following range:</p> <p style="text-align: center;">X○○○ to X△△△</p> <p>Each slot of the right half of all the I/O module slots is assigned an I/O number for an output module in the following range:</p> <p style="text-align: center;">Y○○○ to Y△△△</p>
Merit and demerit	<ul style="list-style-type: none"> • An input module or output module can be inserted into any slot. • An input module can be exchanged with an output module, or vice versa. 	<p>Input modules and output modules can be inserted into only particular slots.</p>

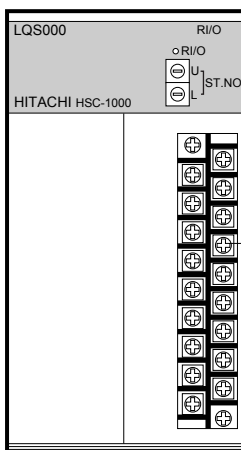
6 SETTINGS

6.3.3 Setting the number of I/O points

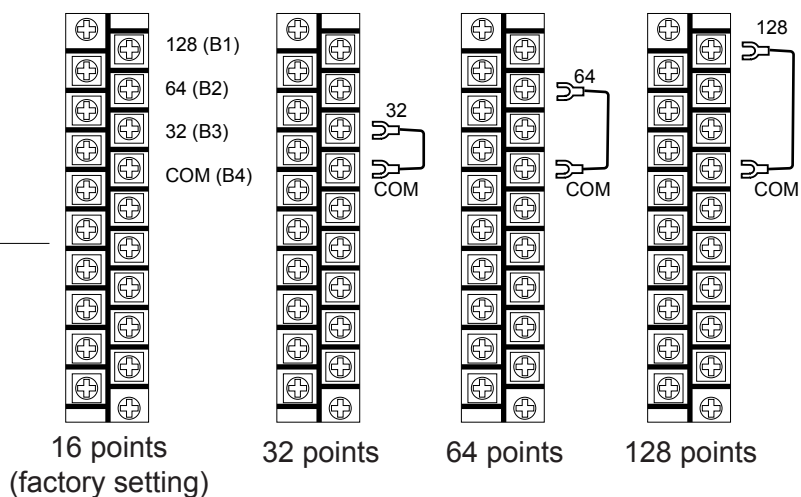
Set the number of I/O points for the modules mounted or those to be added in the future. When each of some modules mounted has a different number of I/O points, set the largest number of I/O points. When mounting a 16-point and a 32-point module, for example, set the number of I/O points to 32. I/O numbers for 32 points are assigned to both modules. However, I/O numbers for 16 points are left unused for the 16-point module. If the number of I/O points is set to 16, the 32-point module is assigned I/O numbers for only 16 points.



Remote I/O station module



Terminal block



■ Number of I/O points and I/O number

- The first I/O number and the range of I/O numbers are determined as follows ----
 - First I/O number: The first two digits are determined by the set station number.
 - Range: The range of I/O numbers is automatically determined, according to the settings of the number of I/O slots on the mount base, the number of I/O points occupied by each slot on the mount base, and the partition status.
- I/O numbers are set for all slots even if there are free slots. Therefore, the I/O numbers remain unchanged even when modules are added later or slots become free.
- One or two I/O numbers are assigned to each input or output point depending on the partition status setting, as described below.
 - FREE: Both an input I/O number (Xxxx) and output I/O number (Yxxx) are assigned. The I/O number (Xxxx or Yxxx) corresponding to the I/O module mounted can be selected. (See Example 1.)
 - FIX: Since I/O slots are classified into two types for input modules and output modules, only one I/O number corresponding to the type (input or output) of the I/O slot is assigned (Xxxx for input or Yxxx for output). (See Example 2.)

Example 1: I/O numbers assigned and number of points occupied when the first I/O number is 000 and the partition status is set to FREE

		Slot number			
		Number of I/O points			
		16	32	64	128
2 slots	I/O numbers	0	0	0	0
		1	1	1	1
Number of points occupied		32	64	128	256
4 slots	I/O numbers	0	0	0	0
		1	1	1	1
		2	2	2	2
		3	3	3	3
Number of points occupied		64	128	256	512
8 slots	I/O numbers	0	0	0	0
		1	1	1	1
		2	2	2	2
		3	3	3	3
		4	4	4	4
		5	5	5	5
		6	6	6	6
		7	7	7	7
Number of points occupied		128	256	512	1024

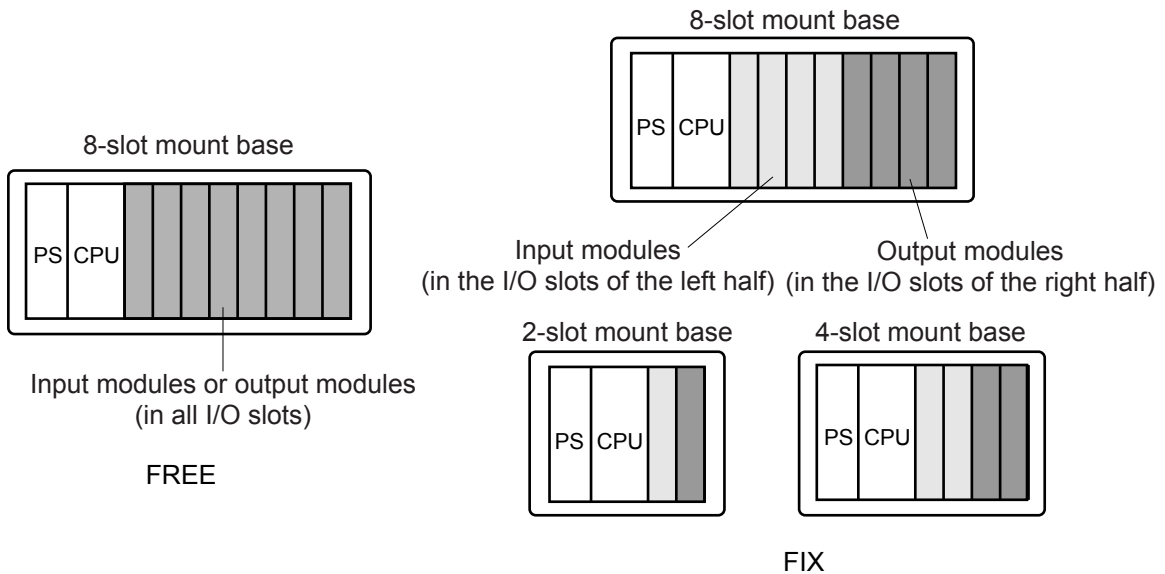
Each slot is assigned an input I/O number (Xxxx) and output I/O number (Yxxx). In this table, X and Y are omitted and only numbers are indicated. The value 000, for example, indicates that both X000 and Y000 are assigned.

Example 2: I/O numbers assigned and number of points occupied when the first I/O number is 000 and the partition status is set to FIX

			Number of I/O points			
			16	32	64	128
2 slots	I/O numbers	Input	0 X000 to X00F	0 X000 to X01F	0 X000 to X03F	0 X000 to X07F
		Output	1 Y000 to Y00F	1 Y000 to Y01F	1 Y000 to Y03F	1 Y000 to Y07F
Number of points occupied			16	32	64	128
4 slots	I/O numbers	Input	0 X000 to X00F	0 X000 to X01F	0 X000 to X03F	0 X000 to X07F
			1 X010 to X01F	1 X020 to X03F	1 X040 to X07F	1 X080 to X0FF
		Output	2 Y000 to Y00F	2 Y000 to Y01F	2 Y000 to Y03F	2 Y000 to Y07F
			3 Y010 to Y01F	3 Y020 to Y03F	3 Y040 to Y07F	3 Y080 to Y0FF
Number of points occupied			32	64	128	256
8 slots	I/O numbers	Input	0 X000 to X00F	0 X000 to X01F	0 X000 to X03F	0 X000 to X07F
			1 X010 to X01F	1 X020 to X03F	1 X040 to X07F	1 X080 to X0FF
			2 X020 to X02F	2 X040 to X05F	2 X080 to X0BF	2 X100 to X17F
			3 X030 to X03F	3 X060 to X07F	3 X0C0 to X0FF	3 X180 to X1FF
		Output	4 Y000 to Y00F	4 Y000 to Y01F	4 Y000 to Y03F	4 Y000 to Y07F
			5 Y010 to Y01F	5 Y020 to Y03F	5 Y040 to Y07F	5 Y080 to Y0FF
			6 Y020 to Y02F	6 Y040 to Y05F	6 Y080 to Y0BF	6 Y100 to Y17F
			7 Y030 to Y03F	7 Y060 to Y07F	7 Y0C0 to Y0FF	7 Y180 to Y1FF
Number of points occupied			64	128	256	512

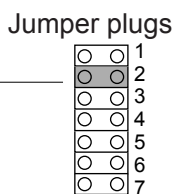
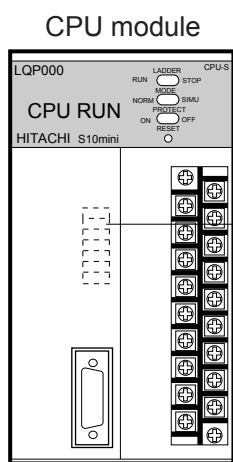
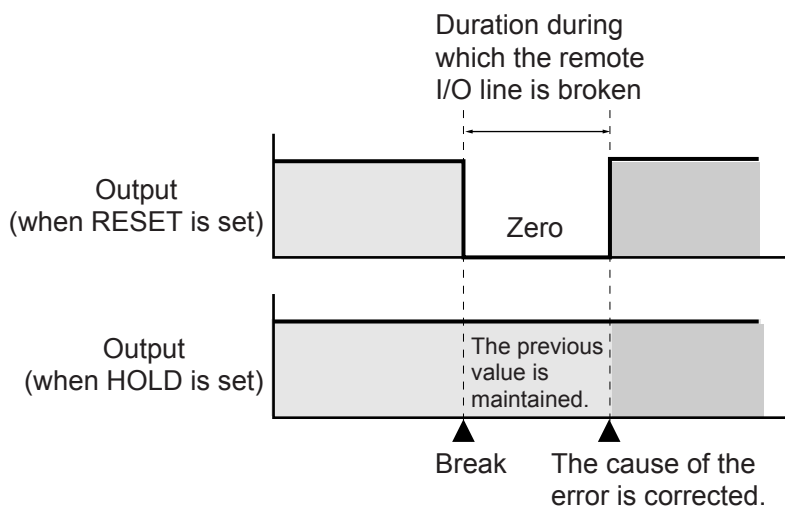
◀ Boundary between input and output modules that is placed according to the partition status setting. The numeric parts of the I/O numbers for an input module and output module pair are the same. Only the characters (X and Y) that indicate input or output differ.

■ Slots into which to insert I/O modules



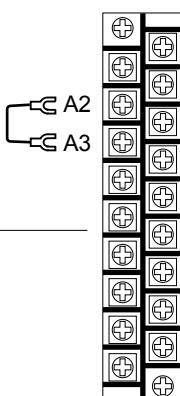
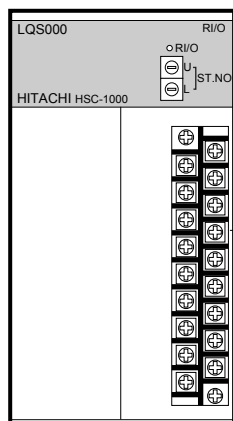
6.3.4 Output hold setting

Set the DO output status to RESET or HOLD, which is one of the output states of the output module arising in case of an error on a remote I/O line. If it is set to RESET, the output is zeroized or zero-filled. If it is set to HOLD, the value immediately before the error is output.



Item to set	Setting of jumper plug 2	
	Connected (Factory setting)	Not connected
Output mode	RESET	HOLD

Remote I/O station module



Item to set	Connection of terminals	
	Not connected (Factory setting)	Connected
Output mode	RESET	HOLD

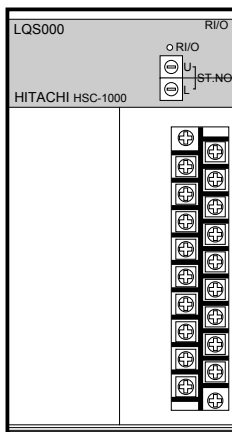
6 SETTINGS

6.3.5 Setting station numbers

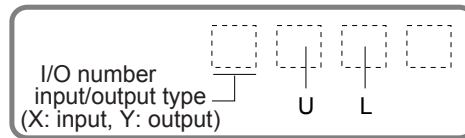
As the station number of an I/O unit, set the first two digits of the numeric part of its I/O number with the station number switch on the front of the remote I/O station module. When setting station numbers, note the following points:

- Do not use duplicate numbers. If I/O modules are mounted in the CPU unit and “PI/O mounted” is set, then the value 00 is assigned as the first station number. Take care so that any other station numbers do not duplicate this number.
- Station numbers need not be assigned in the order in which cables are connected.
- If I/O units are connected to the RI/O1 port on the CPU unit, their station numbers must be within the range of 00 to 3E. If they are connected to the RI/O2 port, the station number range must be from 40 to 7E.

Remote I/O station module



ST.NO U: First digit
L: Second digit



Channel	Setting of ST.NO		First I/O number (*1)	Remarks
	U	L		
RI/O1	0	0	000	(*2)
	0	1	010	
	0	2	020	
	∧	∧	∧	
	3	8	380	Last starting I/O number making all eight slots of 8-slot mount base usable
	3	C	3C0	Last starting I/O number making all four slots of 4-slot mount base usable
	3	E	3E0	Last starting I/O number making the two slots of 2-slot mount base usable
RI/O2	4	0	400	
	4	1	410	
	4	2	420	
	∧	∧	∧	
	7	8	780	Last starting I/O number making all eight slots of 8-slot mount base usable
	7	C	7C0	Last starting I/O number making all four slots of 4-slot mount base usable
	7	E	7E0	Last starting I/O number making the two slots of 2-slot mount base usable

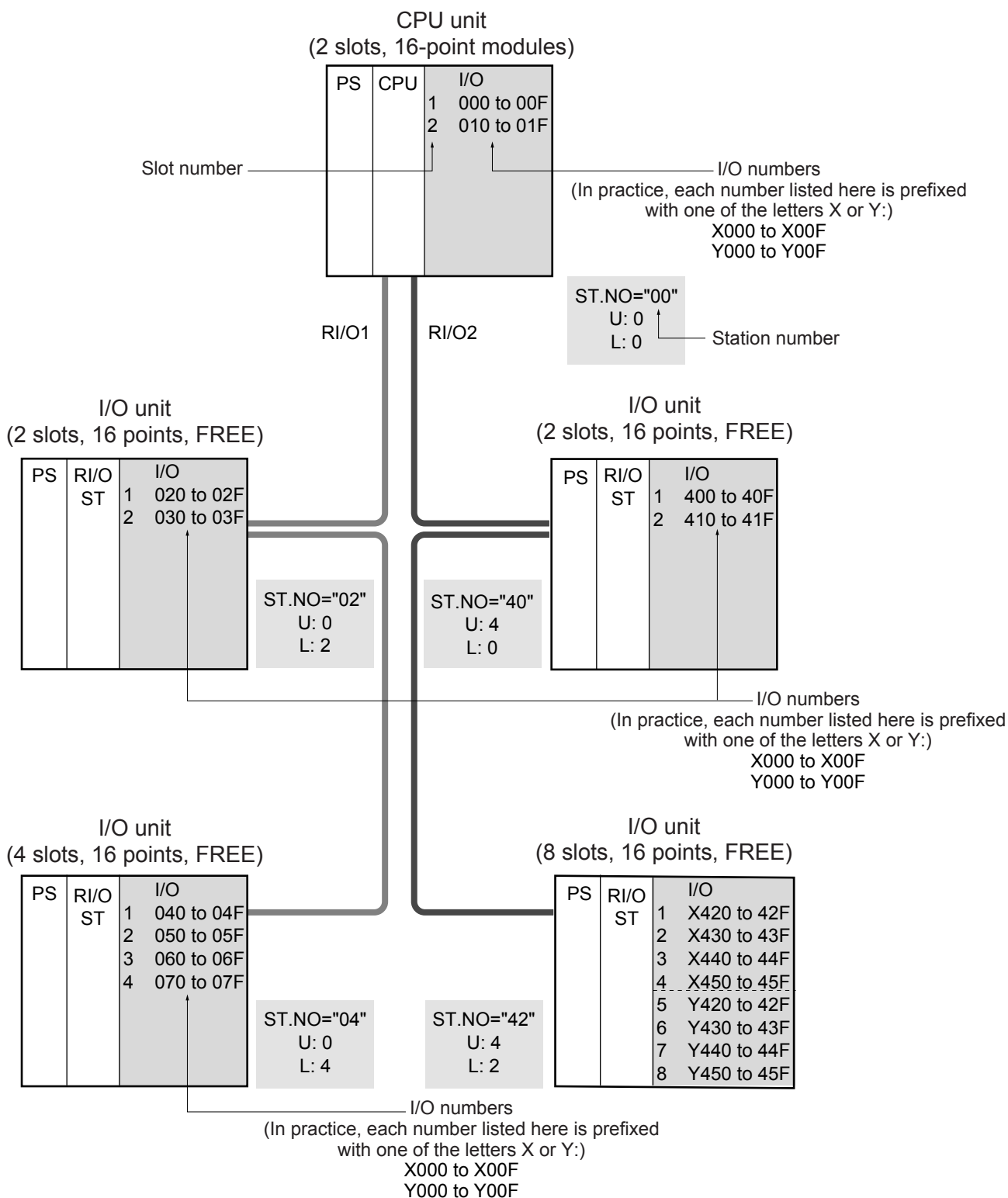
(*1) I/O number is assigned an input I/O number (Xxxx) and output I/O number (Yxxx).

In this table, X and Y are omitted and only numbers are indicated.

(*2) When I/O modules are mounted in the CPU unit, the station number 00 is assigned to the CPU unit. When setting station numbers, take care so that duplication does not occur.

■ Example of setting station numbers and I/O numbers

Suppose that one CPU unit and four I/O units are installed in different locations. Then set station numbers and I/O numbers, as shown below.



6.4 Setting an Extension Memory Module

■ Setting a memory address

Allocate memory areas in an extension memory module in 1 MB units within the range of /100000 to /4FFFFFF. To do this, use the memory address switch (ADDR.) on the front of the extension memory module, as shown below.

Setting of the "ADDR."	Extension memory area
0	Invalid
1	/100000 to /1FFFFFF
2	/200000 to /2FFFFFF
3	/300000 to /3FFFFFF
4	/400000 to /4FFFFFF
5 to F	Invalid

When using a CPU that contains memory, take care so that duplication will not occur. The table below shows the memory areas usable in the extension memory module for each CPU.

CPU	Memory area in the CPU	Usable memory areas in the extension memory module
LQP000	None	/100000 to /4FFFFFF
LQP010	/100000 to /1FFFFFF	/200000 to /4FFFFFF
LQP011	/100000 to /1FFFFFF	/200000 to /4FFFFFF
LQP120	/100000 to /2FFFFFF	/300000 to /4FFFFFF

NOTE

- When mounting multiple extension memory modules in the same unit, take care so that memory areas will not overlap each other.
- Take care so that the memory area in the CPU module, if any, will not overlap any memory area in the extension memory module.

■ Write-protecting memory

The data in extension memory can be write-protected so that it is not overwritten with C programs. Set the memory areas to be write-protected with the protected memory address switch (PROT.ADDR.) on the front of the extension memory module, as shown below.

Setting of the "PROT.ADDR."	Area to be write-protected	Size
0	Not write-protected	0 KB
1	/*00000 to /*1FFFF	128 KB
2	/*00000 to /*2FFFF	192 KB
3	/*00000 to /*3FFFF	256 KB
4	/*00000 to /*4FFFF	320 KB
5	/*00000 to /*5FFFF	384 KB
6	/*00000 to /*6FFFF	448 KB
7	/*00000 to /*7FFFF	512 KB
8	/*00000 to /*8FFFF	576 KB
9	/*00000 to /*9FFFF	640 KB
A	/*00000 to /*AFFFF	704 KB
B	/*00000 to /*BFFFF	768 KB
C	/*00000 to /*CFFFF	832 KB
D	/*00000 to /*DFFFF	896 KB
E	/*00000 to /*EFFFF	960 KB
F	/*00000 to /*FFFFFF	1024 KB

An asterisk in an address in the area to be write-protected indicates a value set during memory address setting.

NOTE

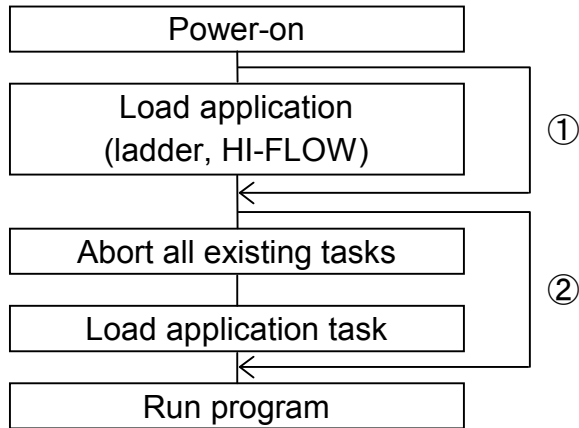
The feature to write-protect memory is invalidated for data that is written:

- On the TOOL connected to the CPU.
- By arithmetic functions.
- Using the H-7338 protocol.

7 OPERATION PROCEDURES

7.1 Overview

Operations should be carried out as flowcharted below. The user program (application) needs to be loaded only when you run the programmable controller for the first time. (It will be backed up by the battery thereafter.) For details, refer to software manual supplied with the programming tool.



- ① The ladder and HI-FLOW need to be loaded only when you run the programmable controller for the first time. Reload them if you have remade the programmable controller thereafter.
- ② The application task, too, needs to be loaded only when you run the programmable controller for the first time. If the application task has to be reloaded for reasons, such as remaking to the programmable controller, abort all existing application tasks and then reload the application task. Application tasks are running even when the CPU switch is in the STOP position as indicated in the table below. Rewriting a running application task may result in a CPU error.

Relationship between the CPU switch and application software

Application \ CPU switch	STOP	RUN	SIMU.RUN
Ladder and HI-FLOW	Stopped	Running	Running
Application task	Running	Running	Running

7.2 Procedures

7.2.1 Turning on the power

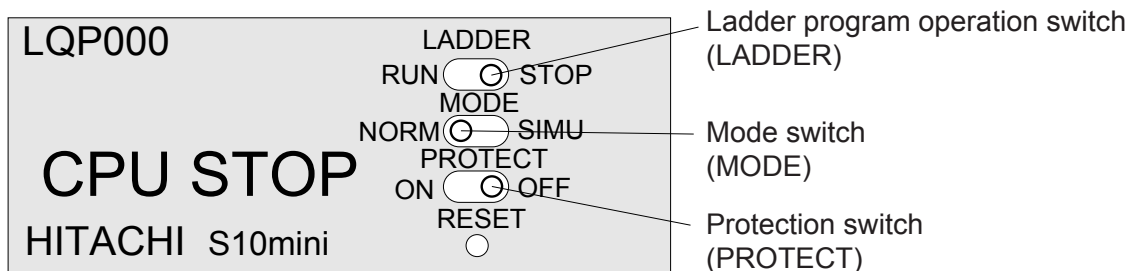
- (1) Set the LADDER, MODE, and PROTECT switches on the front of the CPU module to determine the CPU operation to be performed immediately after the power is turned on.

Operation of the user program (ladder) immediately after power-up	Settings of the switches on the CPU module			Display in the indicator immediately after power-up
	LADDER	MODE	PROTECT	
Preparation for loading	STOP	NORM/SIMU	OFF	CPU STOP
Stop (STOP)	STOP	NORM/SIMU	(*)	CPU STOP
Execution (RUN)	RUN	NORM	(*)	CPU RUN
Simulated execution (SIMU)	RUN	SIMU	(*)	CPU SIMU

(*) Set the switch to ON, if necessary.

- (2) Turn on the power switch on the power module. When the CPU starts up normally, the following indications are provided:

- The operation LED on the power module lights.
- The indicator on the CPU module displays the operation status of the CPU.



Note: Immediately after power-up, the indicator may display unpredictable character string instantaneously. This is not a failure.

7.2.2 STOP mode



■ Setting

Set the ladder program operation switch (LADDER) to STOP.

■ CPU status

- The user program (ladder) stops.
- The I/O section holds the operation status immediately before the CPU stops.
- User tasks continue their execution.
- Remote I/O transfer continues.

7.2.3 RUN (ladder program execution) mode



- **Setting**
 - Set the ladder program operation switch (LADDER) to RUN.
 - Set the mode switch (MODE) to NORM.
- **CPU status**

The user program (ladder) is executed.

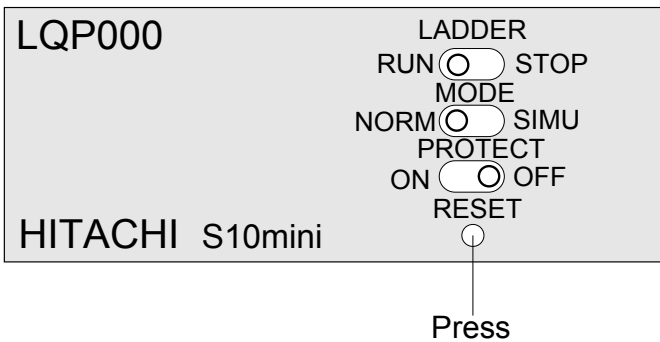
7.2.4 SIMU (simulated ladder program execution) mode



- **Setting**

Set the ladder program operation switch (LADDER) to RUN, and also set the mode switch (MODE) to SIMU.
- **CPU status**
 - The user program (ladder) is debugged with the I/O section stopped.
 - User tasks continue their execution.
 - Remote I/O transfer stops.

7.2.5 RESET mode



- **Setting**

Hold down the reset switch (RESET) for one second.
Note: Do not press the RESET switch hard.
- **CPU status**

During resetting:

 - The indicator displays nothing.
 - The program and remote I/O transfer stop.

After resetting:

 - The I/O registers (X and Y) and internal registers (identified by other letters) are cleared. However, the keep relay (K), counter (C), or fixed-constant (D) register is not cleared.
 - The CPU starts according to the settings of the LADDER, MODE, and PROTECT switches on the CPU module.

7.2.6 PROTECT ON mode



■ Setting

Set the protect switch (PROTECT) to ON.
(Usually, leave the switch set to ON.)

■ CPU status

- When a user-created C program is executed, the operating system, the ladder program, and other programs are protected.
- The protect switch cannot protect optional extension memory. For details, see “Protect switch (PROTECT)” in “7.2.7 PROTECT OFF mode.”

7.2.7 PROTECT OFF mode



■ Setting

Set the protect switch (PROTECT) to OFF.

■ CPU status

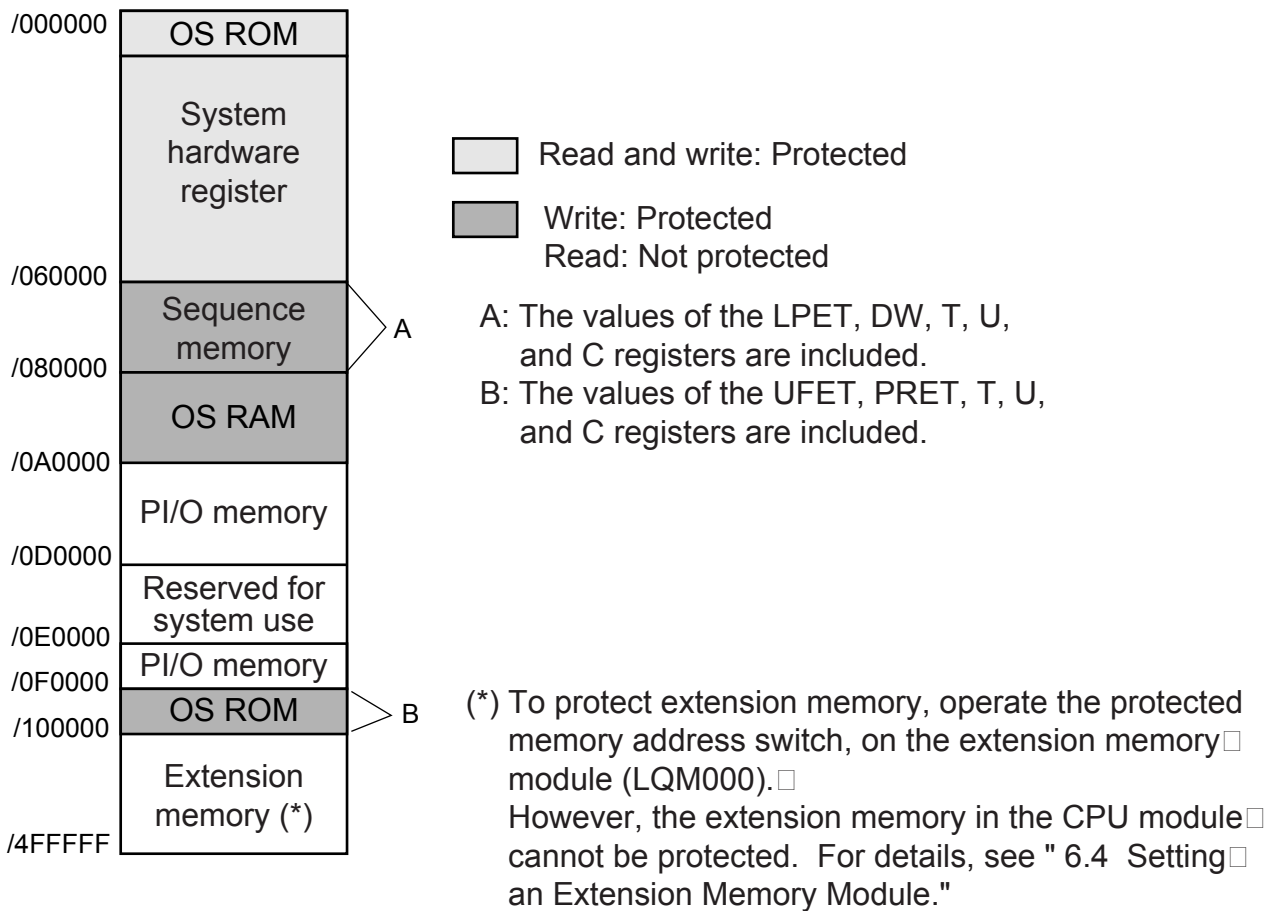
Tasks can rewrite all memory areas.

- When changing the setting of the timer, one-shot coil, or counter, set the protect switch to OFF.

7 OPERATION PROCEDURES

■ Protect switch (PROTECT)

The PROTECT switch protects the system area so that it is not destroyed by user tasks coded in C or FA-BASIC. This switch has no effect for arithmetic functions including user arithmetic functions. Memory is protected in the following range:



● Protection error

Where memory write protection is made effective by setting with the protected memory address (PROT.ADDR.) switch, any related task abortion is limited to user tasks.

When user tasks are registered in the table that registers user arithmetic functions (UFET), rather than program edition table (PRET), the protected memory address switch has no effect.

8 EXPLANATION OF OPERATION

8.1 Ladder Program

8.1.1 Execution

■ Execution conditions

- Ladder program operation switch (LADDER): RUN
- Mode switch (MODE): NORM or SIMU
 (In SIMU mode, only the ladder program is executed without remote I/O transfer being performed.)

■ Starting the ladder program

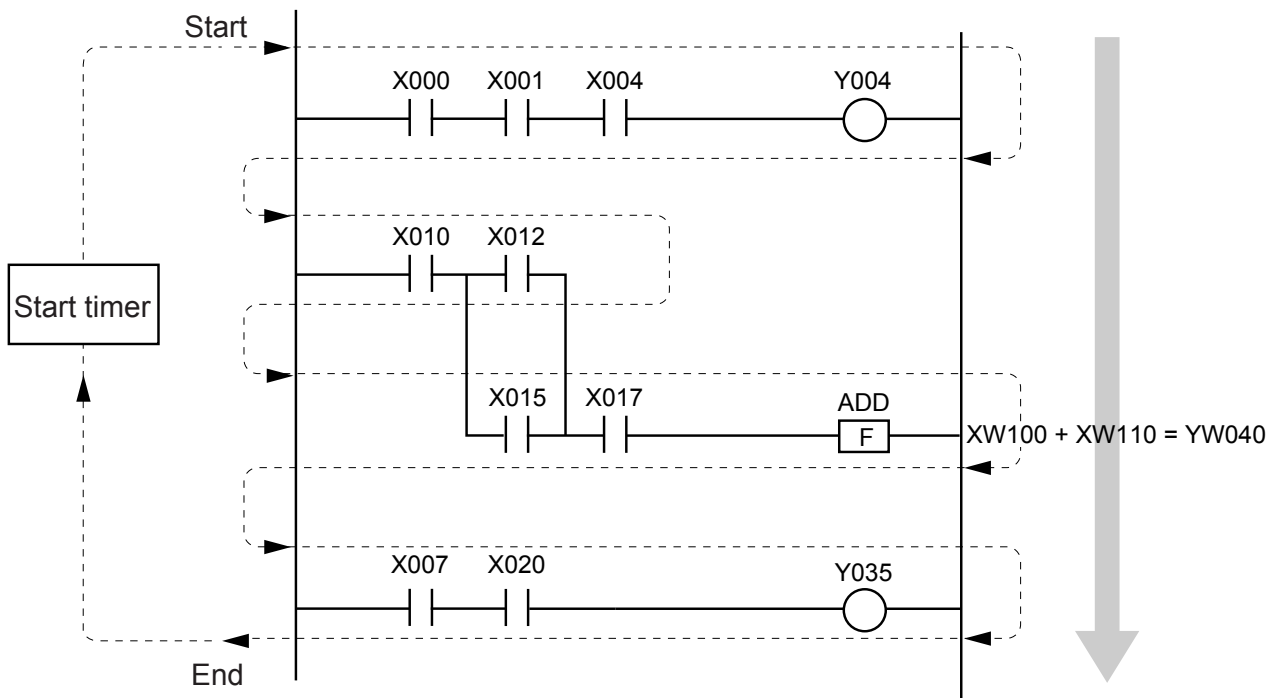
The ladder program can be started in one of two ways: cyclically or repeatedly.

• Cyclic start

If the specified sequence cycle time is longer than the processing time taken by the ladder program, it starts at the interval equal to the sequence cycle time. Upon completion of processing by the ladder program, it waits until the next start time comes. This method is used for integration, differential, and other operations.

• Repeated start

If the specified sequence cycle time is shorter than the processing time taken by the ladder program, the sequence cycle time is used only for the first start. Then, the ladder program starts at the interval equal to its processing time. Upon completion of processing by the ladder program, control is returned to the starting point of the ladder program to execute it repeatedly.

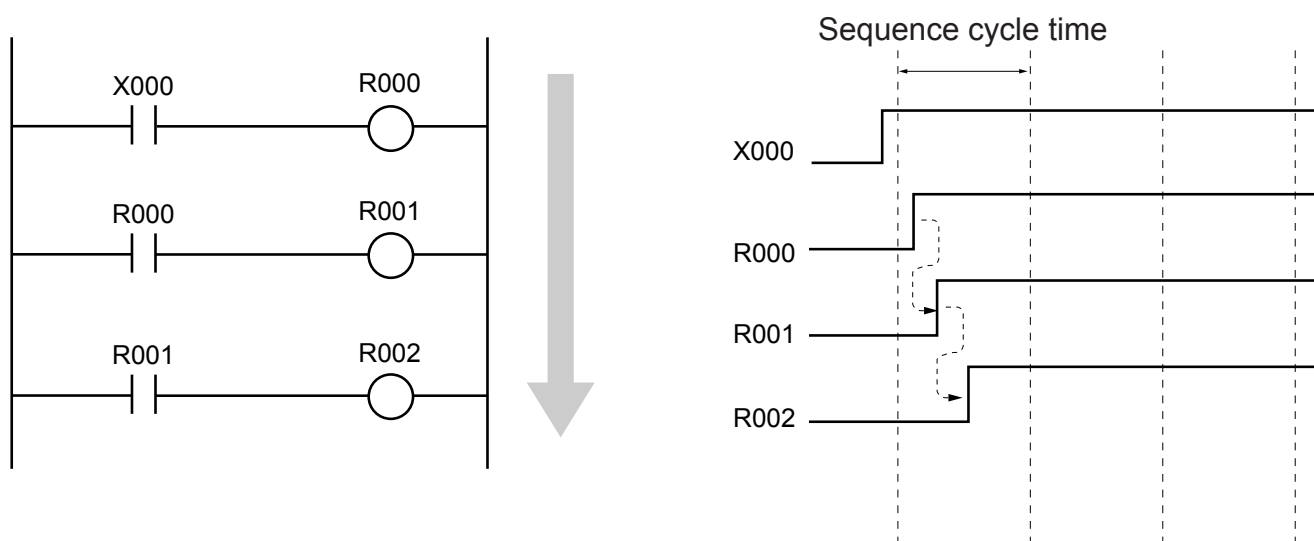


8.1.2 Program execution order

Create a ladder program in such a way that control flows in the order of processing from the top. Otherwise, much time is wasted, hampering high-speed processing.

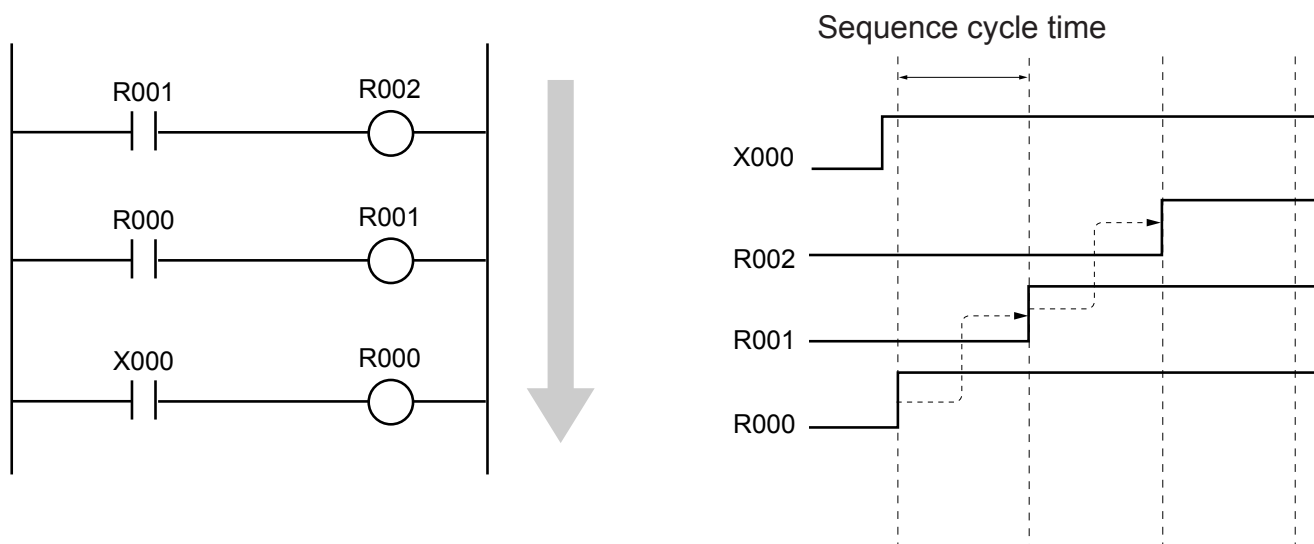
■ Correct ladder program example

Since the ladder program shown below is created in the order in which processing is performed, its processing is completed within the sequence cycle time.



■ Incorrect ladder program example

Suppose that processing is programmed in such a way that the conditions to start that processing are checked after it is actually started. The program requires three sequence cycles until the processing is started. This wastes two sequence cycle. When the execution speed of the program is important, carefully consider the processing procedure during creation of a ladder program.



8 EXPLANATION OF OPERATION

8.1.3 Executing arithmetic functions

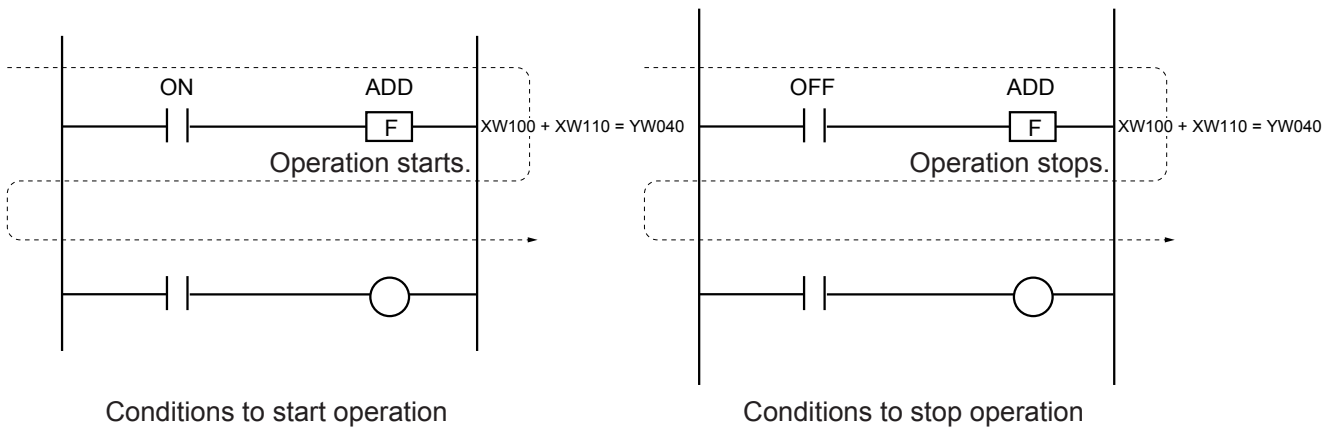
Arithmetic functions are executed according to the status (On or Off) of excitation, as described below.

■ Starting operation

Operation starts when the status of excitation is On. The value of XW100 is added to XW110 and the result is output to YW040.

■ Stopping operation

Operation stops when the status of excitation is Off. The result of the previous operation is output to YW040.

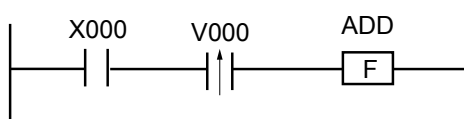


8.1.4 When to start execution

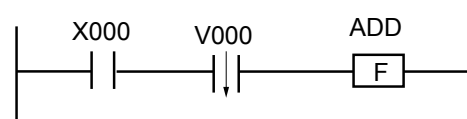
When to start execution of an arithmetic function can be set using the rising or falling edge of a signal. Which of the rising and falling edges of a signal to use is determined by the direction of the arrow indicated by the edge detector (V000) shown below.

- (↑): Operation starts when X000 changes from “off” to “on” (a rising edge is detected).
- (↓): Operation starts when X000 changes from “on” to “off” (a falling edge is detected).

Note: Make sure that the same type of edge is not set for the edge detector (such as V000).



Operation starts on a rising edge.



Operation starts on a falling edge.

8.2 Remote I/O

8.2.1 Remote I/O transfer

The table below shows remote I/O transfer by the CPU module in each mode.

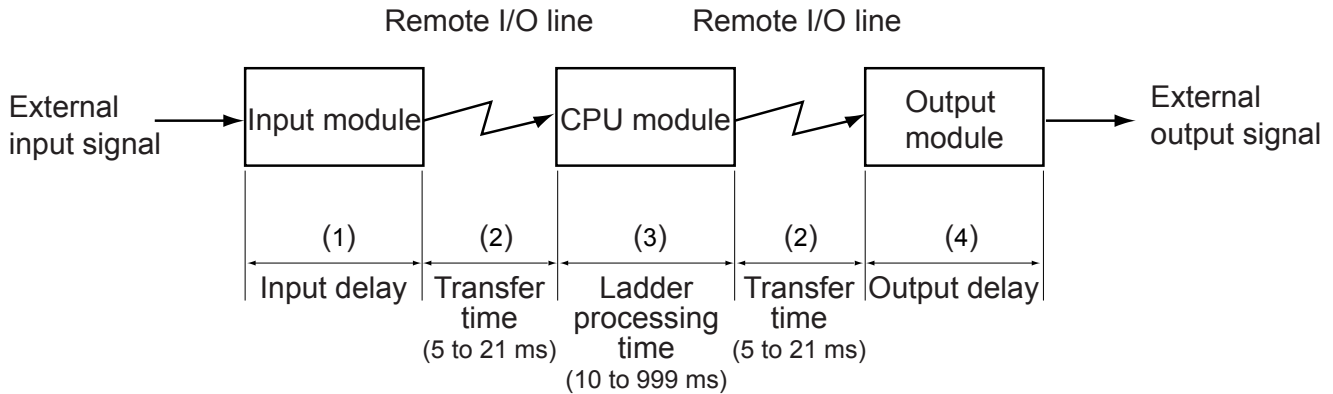
Setting of the power switch	Settings of the switches on the CPU module			R/I/O transfer
	Reset switch (RESET)	Ladder program operation switch (LADDER)	Mode switch (MODE)	
OFF	–	–	–	Disabled
ON	ON	–	–	Disabled
ON	OFF	STOP	NORM	Enabled
ON	OFF	STOP	SIMU	Enabled
ON	OFF	RUN	NORM	Enabled
ON	OFF	RUN	SIMU	Disabled

8.2.2 Output mode setting for use in case of a stop of remote I/O transfer

When an error occurs during remote I/O transfer, the output from the output module can be zeroized or held at the value immediately before the transfer stopped. For details of holding the previous value, see “6.3.4 Output hold setting.”

8.3 Processing Time

Processing time is measured from when an input signal enters the input module until it is output from the output module. That time is the sum of (1) to (4) shown below.



(1) Input delay

An input delay is taken by the input module to respond. The response time varies with the type of the input module. For details, refer to the “S10mini HARDWARE MANUAL I/O MODULE (manual number SME-1-114).”

(2) Remote I/O transfer time

The remote I/O transfer time is taken for data transfer on the remote I/O line. That time varies with the specified number of I/O points.

512 points: About 5 ms

1024 points: About 10 ms

1536 points: About 16 ms

2048 points: About 21 ms

(3) Ladder processing time

The ladder processing time is taken by the ladder program for processing. That time is equal to the sequence cycle time (10 to 999 ms).

(4) Output delay

An output delay is taken by the output module to respond. The response time varies with the type of the output module. For details, refer to the “S10mini HARDWARE MANUAL I/O MODULE (manual number SME-1-114).”

Calculate the processing time using the following formula:

$$\text{Processing time} = (\text{input delay}) + (\text{RI/O transfer time}) + (\text{ladder processing time}) + (\text{RI/O transfer time}) + (\text{output delay})$$

8.4 Clock Features

This section describes the features of the clock as well as how to set it.

8.4.1 Clock control system registers

Clock control system registers are used by the ladder program for real-time control. They consist of time registers, a time control register, and a time display control register.

(1) Time registers

The time registers store information on the year, month, day, hours, minutes, and seconds. To set a time, set such information in these registers in binary format.

	(MSB) 2^{15}	2^8 2^7	2^0 (LSB)
SW280	Unused		Seconds
SW290	Unused		Minutes
SW2A0	Unused		Hours
SW2B0	Unused		Day
SW2C0	Unused		Month
SW2D0	Year		
SW2E0	Unused		Day of the week

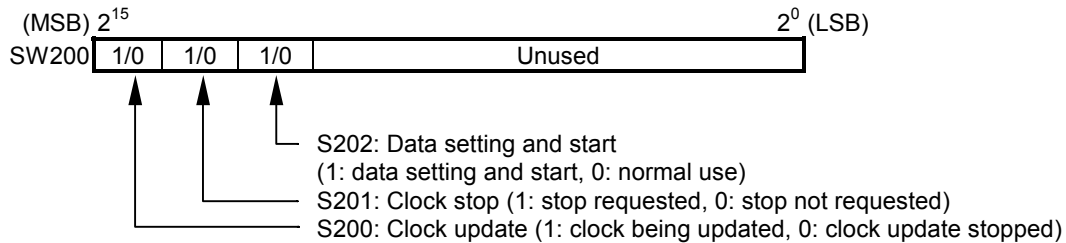
Notes on setting a time

- Enter the day of the week using a number: 1 for Sunday, 2 for Monday, ..., and 7 for Saturday.
- Invalid dates cannot be set. For example, the value 0 or 13 cannot be set as a month, or 0 or 35 as a day.

8 EXPLANATION OF OPERATION

(2) Time control register

The time control register controls the setting of the current time of the day. Its bit assignment is shown below.



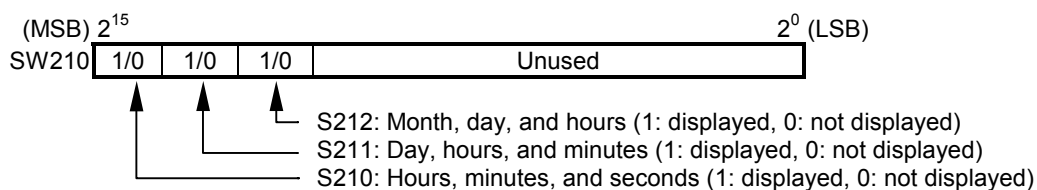
Setting a time

Set the current time as follows:

- ① Set a 1 in S201 of the time control register. The clock stops.
- ② Set the time information (seconds, minutes, hours, day, month, year, and day of the week) in time registers SW280 to SW2E0.
- ③ Set a 1 in S202 of the time control register. The clock starts from the set time.
- ④ Set 0s in both S201 and S202 of the time control register. The clock returns to ordinary operating condition.

(3) Time display control register

The time display control register is used to set the format in which time is displayed in the indicator. The bit assignment of the register is shown below.

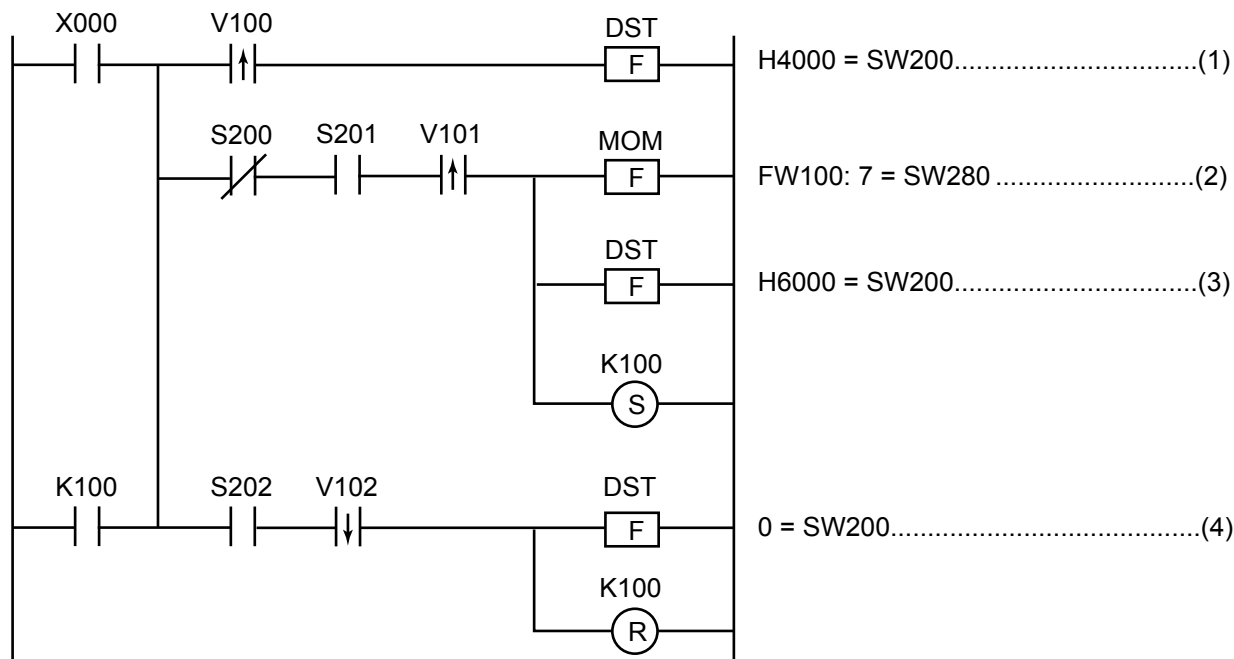


Display conditions

When 1s (displayed) are set in two or more bits, the setting of the bit having the smallest number takes precedence. When 1s are set in both S210 and S212, for example, the setting of S210 is used. When all bits are set to 0 (not displayed), the year, month, and day are displayed.

8.4.2 Setting the time using the ladder program

The ladder program shown below sets the time information stored in F registers FW100 to FW106 in time registers SW280 to SW2E0 when X000 is turned on. This subsection describes only the items required for creation of a ladder program.



Procedure:

- (1) When X000 is turned on, the program sets S201 to 1.
- (2) The program moves the clock information (seconds, minutes, hours, day, month, year, and day of the week) stored in F registers FW100 to FW106 in advance to time registers SW280 to SW2E0.
- (3) The program sets S202 to 1.
- (4) The program sets both S201 and S202 to 0.

F registers			Time registers	
FW100	Seconds	⇒	SW280	Seconds
FW101	Minutes		SW290	Minutes
FW102	Hours		SW2A0	Hours
FW103	Day		SW2B0	Day
FW104	Month		SW2C0	Month
FW105	Year		SW2D0	Year
FW106	Day of the week		SW2E0	Day of the week

8 EXPLANATION OF OPERATION

8.4.3 Updating the date

The date is automatically updated as follows:

January, March, May, July, August, October, or December 31 → first day of the next month

April, June, September, or November 30 → first day of the next month

February 28 in a common year → March 1

February 29 in a leap year → March 1

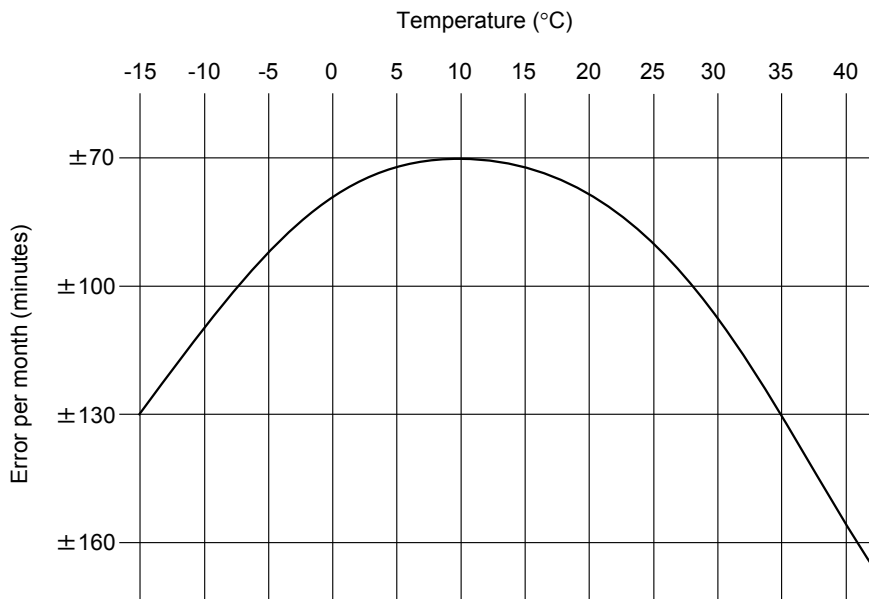
8.4.4 Restrictions on the setting of dates and times

Do not set the following dates and times. Otherwise, the date or time would not be updated.

Setting	Example
23:59:59 on 29 of any month. When this date and time is set, it is updated to the first day of the next month except for February in a leap year.	March 29 → April 1
23:59:59 on April, June, September, or November 30. When this date and time is set, it is updated to 31 of that month.	April 30 → April 31
23:59:59 on February 28 in a common year. When this date and time is set, it is updated to February 29.	February 28 → February 29
23:59:59 on February 28 in a leap year. When this date and time is set, it is updated to March 1.	February 28 → March 1

8.4.5 Clock precision

The clock precision varies with the ambient temperature. The following graph shows typical precisions at various temperatures. There are variations in precision between products. Use the values in the graph plus or minus one minute per month as a reference. When a high precision is required, use the clock while calibrating it or at the appropriate temperature range (around 25°C).



8.5 Conditions of the I/O Input/Output Registers and Internal Registers in Case of Errors

Procedure and condition Name			Initialization	Startup	Normal operation			Error					
			ROM IDLE	OS loading	Power-up Reset-off → ON → OFF	STOP →RUN	STOP→ SIMU, RUN	STOP	PROT. ERR	I/O error (*1)	CPU CELL	CPU down (*2)	
I/O input/ output	External input	X	Input stopped	Zeroized	Input after zeroizing	–	Input stopped	–	–	–	–	Input stopped	
	External output	Y	Output stopped	Zeroized	Output after zeroizing	–	Output stopped	–	–	–	–	Output stopped	
Internal register	Internal register	R	–	Zeroized	Zeroized	–	–	–	–	–	–	–	
	Keep relay	K	–	Zeroized	Held	–	–	–	–	–	–	–	
	On-delay timer	T	Paused	Zeroized	Zeroized	Started	Started	Paused	–	–	–	Paused	
	One-shot timer	U	Paused	Zeroized	Zeroized	Started	Started	Paused	–	–	–	Paused	
	Up/down counter	CU	–	Zeroized	Held	–	–	–	–	–	–	–	–
		CD											
		CR											
		CO											
	Global link register	G	–	Zeroized	G input after zeroizing	G input, G output	G input, G output	G input	–	–	–	G input	
	Nesting coil	NM	–	Zeroized	Zeroized	–	–	–	–	–	–	–	–
		NZ											
		NO											
	Process register	P	–	Zeroized	Zeroized	–	–	–	–	–	–	–	
	Event register	E	–	Zeroized	Zeroized	–	–	–	–	–	–	–	
Edge contact	V	–	Zeroized	Zeroized	–	–	–	–	–	–	–		
Z register	Z	–	Zeroized	Zeroized	–	–	–	–	–	–	–		
System register	S	The condition at that time is recorded.											
Function data register	DW	–	Zeroized	Held	–	–	–	–	–	–	–	–	
Function work register	FW	–	Zeroized	Held	–	–	–	–	–	–	–	–	
Program execution	Ladder program		STOP	Zeroized	STOP	RUN	RUN	STOP	–	–	–	STOP	
	CPMS task (also true for P coil)		STOP	Zeroized	Aborted	–	–	–	Only that task is aborted.	–	–	Aborted	
	PCs OK		OFF	OFF	OFF	ON	OFF	OFF	–	–	–	OFF	

(*1) I/O phase error or I/O time-out

(*2) NST OVER, SSP OVER, WDT ERR, OS PTY, SMD PTY, or SMD INV

– : Not affected by the procedure or condition.

8.6 Restrictions on Mounting Option Modules

■ Restrictions on mounting option modules

The table below shows all the restrictions imposed on the number of option modules mounted in each CPU or I/O unit. The total number of modules, including LPU, option, and I/O modules, that are mounted in a single CPU or I/O unit, in particular, is restricted by the total allowable amount of electric currents drawn by those modules, which is limited to 7 A (at an ambient temperature of 48°C). For more information, see “8.7 Output Current of the Power Supply Module.”

Description	Model	CPU unit	I/O unit	Remarks
Power supply	LQV000	1	1	Shared by CPU and I/O unit
	LQV010	1	1	Shared by CPU and I/O unit
	LQV100	1	1	Shared by CPU and I/O unit
	LQV020	1	1	Shared by CPU and I/O unit
	LQV200	1	1	Shared by CPU and I/O unit
CPU (Model S)	LQP000	1	–	
CPU (Model H)	LQP010	1	–	
CPU (Model F)	LQP011	1	–	
CPU (Model D)	LQP120	1	–	
Extension memory	LQM000	3 (*3)	–	Mounted starting with the leftmost position. (*2)
ET.NET	LQE020/LQE520	2 (*7)	–	Mounted starting with the leftmost position.
SV.LINK	LQE021/LQE521	2 (*7)	–	Mounted starting with the leftmost position.
OD.RING (4 km)	LQE010/LQE510	2 (*1)	–	Mounted starting with the leftmost position.
OD.RING (1 km)	LQE015/LQE515	2 (*1)	–	Mounted starting with the leftmost position.
SD.LINK	LQE030/LQE530	2 (*1)	–	Mounted starting with the leftmost position.
FL.NET	LQE000/LQE500/LQE502	2	–	Mounted starting with the leftmost position.
CPU link	LQE050/LQE550	2	–	Mounted starting with the leftmost position.
RS-232C	LQE160/LQE560	2 (*5)	–	Mounted starting with the leftmost position.
RS-422	LQE165/LQE565	2 (*5)	–	Mounted starting with the leftmost position.
J.NET	LQE040/LQE540/LQE541	2 (*4)	–	Mounted starting with the leftmost position.
J.NET-INT	LQE045/LQE545/LQE547	2 (*4)	–	Mounted starting with the leftmost position.
IR.LINK	LQE046/LQE546/LQE548	2 (*4)	–	Mounted starting with the leftmost position.
D.NET	LQE170/LQE570	4 (*6)	–	Mounted starting with the leftmost position.
D.NET (power supplied from on external source)	LQE175/LQE575	4 (*6)	–	Mounted starting with the leftmost position.

(*1) Up to two modules of LQE010/LQE510/LQE015/LQE515/LQE030/LQE530 can be mounted per CPU.

Set either module as main, the other as subordinate.

(*2) Assign addresses to avoid duplication.

(*3) Up to four units of the CPU module LQP000 can be mounted.

(*4) Up to two modules of LQE040/LQE540/LQE541/LQE045/LQE545/LQE547/LQE046/LQE546/LQE548 can be mounted per CPU.

Set either module as main, the other as subordinate.

(*5) Up to two modules of LQE160/LQE560/LQE165/LQE565 can be mounted per CPU.

In this case, the channel setting must be unique.

(*6) Up to four modules of LQE170/LQE570/LQE175/LQE575 can be mounted per CPU.

In this case, the channel setting must be unique.

(*7) Up to two modules of LQE020/LQE520/LQE021/LQE521 can be mounted per CPU.

Set either module as main, the other as subordinate.

■ Restrictions on mounting I/O modules

The table below shows all the restrictions imposed on the number of I/O modules mounted in each CPU or I/O unit. The total number of modules, including STATION and I/O modules, that are mounted in a single CPU or I/O unit, in particular, is restricted by the total allowable amount of electric currents drawn by those modules, which is limited to 7 A (at an ambient temperature of 48°C). For more information, see “8.7 Output Current of the Power Supply Module.”

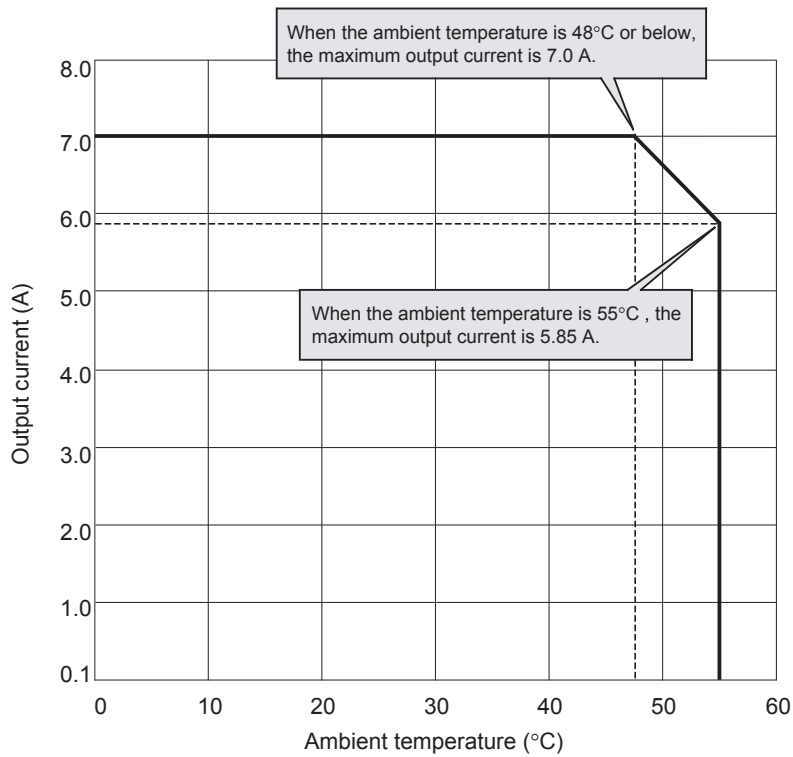
Description	Model	CPU unit	I/O unit	Remarks
Remote I/O station	LQS000	–	1	Mountable only in an ST slot.
J.STATION	LQS020	–	1	Mountable only in an ST slot.
IR.Station	LQS021	–	1	Mountable only in an ST slot.
D.Station	LQS070	–	1	Mountable only in an ST slot.
Digital input	LQX110	8	8	
	LQX130	8	8	
	LQX150	8	8	
	LQX151	8	8	
	LQX200	8	8	
	LQX201	8	8	
	LQX210	8	8	
	LQX211	8	8	
	LQX220	8	8	
	LQX240	8	8	
	LQX250	8	8	
	LQX300	8	8	(*1)
	LQX310	8	8	
	LQX350	8	8	(*1)
	LQX360	8	8	(*1)
Digital output	LQY100	6	8	
	LQY140	8	8	
	LQY150	8	8	
	LQY160	8	8	
	LQY170	8	8	
	LQY200	8	8	
	LQY300	8	8	(*2)
	LQY310	8	8	
	LQY350	8	8	(*2)
Digital input and output in mixed-use environment	LQZ300	8	8	(*2)
Analog input	LQA000	8	8	
	LQA050	8	8	
	LQA055	8	8	
	LQA100	8	8	
	LQA150	8	8	
	LQA155	8	8	
	LQA200	8	8	
	LQA201	8	8	
Analog output	LQA500	8	8	
	LQA600	8	8	
	LQA610	8	8	
Pulse counter	LQC000	8	8	

(*1) The number of data points that can be concurrently in ON state is restricted by the ambient temperature.

(*2) The number of data points that can be concurrently in ON state is restricted by the ambient temperature and load current.

8.7 Output Current of the Power Supply Module

When the power supply module is LQV000, LQV020, or LQV100 and the ambient temperature is high, output current is restricted as shown below. Use the module after being sure that current consumption of it is less than output current. (LQV010 and LQV200 have no restriction to be used. When ambient temperature is 55°C, the maximum output current is 7.0 A.)



Output current of the power supply mode

Current consumptions of available option modules

Description	Model	Module REV	Current consumption
CPU	LQP000	Before the [H]	1500 mA or less
	LQP010	Before the [H]	
	LQP011	Before the [I]	
	LQP120	Before the [F]	
	LQP000	[I] or later	1630 mA or less
	LQP010	[I] or later	
	LQP011	[J] or later	
	LQP120	[G] or later	

Description	Model	Current consumption
FL.NET	LQE000/LQE500	725 mA or less
FL.NET (VER.2)	LQE502	725 mA or less
OD.RING (4 km)	LQE010/LQE510	695 mA or less
OD.RING (1 km)	LQE015/LQE515	680 mA or less
ET.NET	LQE020/LQE520	725 mA or less
SV.LINK	LQE021/LQE521	725 mA or less
SD.LINK	LQE030/LQE530	1050 mA or less
J.NET	LQE040/LQE540	715 mA or less
	LQE541	660 mA or less
J.NET-INT	LQE045/LQE545	715 mA or less
	LQE547	660 mA or less
IR.LINK	LQE046/LQE546	715 mA or less
	LQE548	660 mA or less
CPU.LINK	LQE050/LQE550	445 mA or less
RS-232C	LQE160/LQE560	410 mA or less
RS-422	LQE165/LQE565	420 mA or less
D.NET	LQE170/LQE570	510 mA or less
D.NET (power supplied from on extenal source)	LQE175/LQE575	460 mA or less
HDLC	LQE590	700 mA or less

- When designing unit installation, always calculate the total current consumption of the CPU module, option modules and I/O modules and ensure the total consumption does not exceed the rated output of the power supply module.
If the total current consumption exceeds the rated output current of the power supply module, divide the modules into units.

8 EXPLANATION OF OPERATION

Current consumptions of available I/O modules

Module name	Model	Current consumption
Remote I/O station module	LQS000	150 mA or less
J.STATION	LQS020	700 mA or less
IR.Station	LQS021	700 mA or less
D.Station	LQS070	300 mA or less
Digital input	LQX110	110 mA or less
	LQX130	70 mA or less
	LQX150	110 mA or less
	LQX151	110 mA or less
	LQX200	80 mA or less
	LQX201	80 mA or less
	LQX210	110 mA or less
	LQX211	170 mA or less
	LQX220	110 mA or less
	LQX240	110 mA or less
	LQX250	110 mA or less
	LQX300	150 mA or less
	LQX310	150 mA or less
	LQX350	170 mA or less
	LQX360	170 mA or less
Digital output	LQY100	780 mA or less
	LQY140	400 mA or less
	LQY150	800 mA or less
	LQY160	320 mA or less
	LQY170	320 mA or less
	LQY200	120 mA or less
	LQY300	260 mA or less
	LQY310	260 mA or less
Digital I/O	LQY350	400 mA or less
	LQY360	400 mA or less
Digital I/O	LQZ300	300 mA or less
Analog input	LQA000	Module REV.A: 500 mA or less Module REV.B: 580 mA or less
	LQA050	550 mA or less
	LQA055	550 mA or less
	LQA100	Module REV.A: 500 mA or less Module REV.B: 580 mA or less
	LQA150	550 mA or less
	LQA155	550 mA or less
	LQA200	Module REV.A: 500 mA or less Module REV.B: 580 mA or less
Analog output	LQA201	Module REV.A: 500 mA or less Module REV.B: 580 mA or less
	LQA500	Module REV.A: 500 mA or less Module REV.B: 530 mA or less
	LQA600	Module REV.A: 500 mA or less Module REV.B: 530 mA or less
Pulse counter	LQA610	Module REV.A: 500 mA or less Module REV.B: 530 mA or less
	LQC000	150 mA or less



REQUIREMENT

Excessive accumulation of heat in the enclosure may cause a fire or hardware failure. If the ambient temperature reaches 48°C or higher, reduce the output current of the power supply module. At 55°C, for instance, it is reduced to 5.85 A. Where the ambient temperature tends to be high, install a cooling fan(s) in the enclosure or decrease the number of modules installed therein.

8.8 Memory Backup

The user program is stored in the RAM (Random Access Memory) and backed up by lithium battery at a power outage. Replace the lithium battery before it is over backup guaranteed time. When the power is turned off while the battery is run down or the battery voltage becomes low, the contents in the backup memory may be damaged. The backup guaranteed time varies depending on the CPU module REV and memory capacity (see the following table).

CPU module REV and backup guaranteed time

CPU Module Model	Module REV	Total memory capacity (CPU internal memory + extended memory)				
		No memory	1 MB	2 MB	3 MB	4 MB
LQP000 (No internal memory)	[A] to [C]	62,000 h (7 years)	49,000 h (5.5 years)	40,000 h (4.5 years)	35,000 h (4 years)	31,000 h (3.5 years)
LQP010 (Internal memory 1 MB)	[A] to [C]					
LQP011 (Internal memory 1 MB)	[A] to [D]					
LQP120 (Internal memory 2 MB)	[A]					
LQP000 (No internal memory)	[D] to [E]	31,000 h (3.5 years)	30,000 h (3.4 years)	29,000 h (3.3 years)	28,000 h (3.1 years)	27,000 h (3 years)
LQP010 (Internal memory 1 MB)	[D] to [E]					
LQP011 (Internal memory 1 MB)	[E] to [F]					
LQP120 (Internal memory 2 MB)	[B] to [C]					
LQP000 (No internal memory)	[F]	22,000 h (2.5 years)	21,000 h (2.3 years)	20,000 h (2.2 years)	19,000 h (2.1 years)	18,000 h (2 years)
LQP010 (Internal memory 1 MB)	[F]					
LQP011 (Internal memory 1 MB)	[G]					
LQP120 (Internal memory 2 MB)	[D]					
LQP000 (No internal memory)	[G] or later	13,500 h (1.5 years)	13,500 h (1.5 years)	13,500 h (1.5 years)	13,500 h (1.5 years)	13,500 h (1.5 years)
LQP010 (Internal memory 1 MB)	[G] or later					
LQP011 (Internal memory 1 MB)	[H] or later					
LQP120 (Internal memory 2 MB)	[E] or later					

The total memory capacity listed above corresponds to the extended memory module and the CPU module in combination as shown below.

No memory: LQP000

1 MB: LQP000 + LQM000 × 1 board, LQP010, LQP011

2 MB: LQP000 + LQM000 × 2 boards

: LQP010 + LQM000 × 1 board, LQP011 + LQM000 × 1 board, LQP120

3 MB: LQP000 + LQM000 × 3 boards

: LQP010 + LQM000 × 2 boards, LQP011 + LQM000 × 2 boards

: LQP120 + LQM000 × 1 board

4 MB: LQP000 + LQM000 × 4 boards

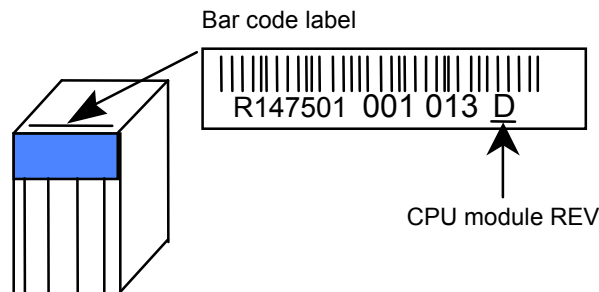
: LQP010 + LQM000 × 3 boards, LQP011 + LQM000 × 3 boards

: LQP120 + LQM000 × 2 boards

8 EXPLANATION OF OPERATION

- CPU module REV check position

Check the bar code label to confirm the CPU module REV as illustrated below.



- The life expectancy of a lithium battery under the ambient temperature and humidity is seven years. Replace the battery if you have used it over seven years even if it has not reached the backup guaranteed time.

The life expectancy of the lithium battery may decrease and leakage may occur, depending on the environment. Replace the battery if you have used it in five to six years even if it has not reached the backup guaranteed time under the use of high temperature and humidity.

- Replace the lithium battery within three minutes after removing the battery connector. The memory data is backed up by the built-in super condenser instead of the battery during the three minutes.

- If the power supply is shut off for three minutes or longer while the CPU module indicator shows “CPU CELL” (Battery expired), backup memory content may be lost. Furthermore, the backup memory may be lost if the CPU module has a lithium battery and is stored unused for a long time (longer than the preset backup assurance period). When backup memory is lost, the CPU module may not be able to start as no data is available in the backup memory.

Indicator indication	Possible error cause
OFF	OS program error or C mode program error
Unknown data	OS program error or C mode program error
CPU DOWN	CPU error that stops CPU operation
ROM IDLE	Error in memory for the OS program
ILG INST	Illegal-instruction exception occurred
INV INT	Invalid interrupt occurred
OS PTY	Parity error in memory for the OS program
PIO PTY	Parity error in PI/O memory.
SMD INVL	Illegal instruction detected by a ladder program
SMD PTY	Parity error in memory for the ladder program
SMD CERR	Error in the ladder program table
SMD PERR	Ladder program error

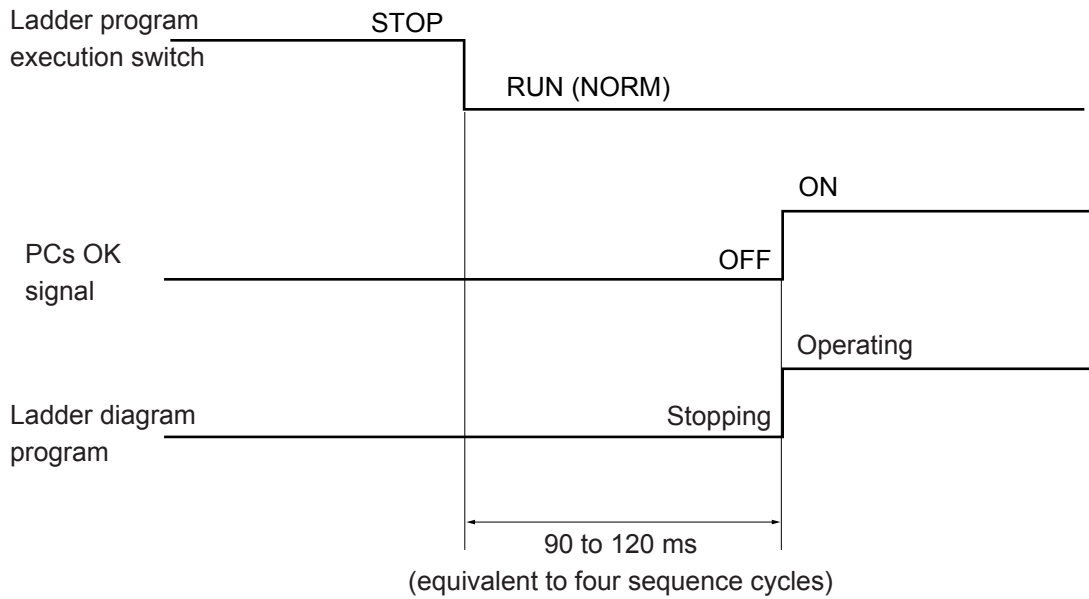
By referring to “9 MAINTENANCE” (Pages 9-19 and 9-20), clear all memory.

After all memory has been cleared, the CPU module is cleared and saved data can be transferred to the CPU module.

If no saved data is available, reload the application program and reset the parameters.

8.9 Output Timing of the PCs OK Signal

When the ladder program execution switch on the CPU module is switched from STOP to RUN, output of the PCs OK signal changes as shown below.



Specifications of the PCs OK signal

Output type: Relay output (insulation by a relay)

Rated outputs: 100 VAC; 12 to 24 VDC, 2A; 48 VDC, 0.5 A; 100 VAC, 0.1 A

Minimum output: 10 VDC, 20 mA

Response time: 15 ms or less

Cable: Twisted-pair cable, 100 m or less

9 MAINTENANCE

9.1 Preventive Maintenance

To use the S10mini under its best condition, check the items listed below on a day-to-day basis or periodically (at least twice per year).

No.	Item to check
①	Appearances of the modules
②	States of the LEDs and indicator
③	Mounting screws and screws on the terminal blocks
④	Sheaths of cables including power cables
⑤	Dust
⑥	Input supply voltage
⑦	Power supply voltage (Power supply module and various external power supplies)

① Appearances of the modules

Check the cases of the modules for crazes and cracks. If a case has a defect, internal circuits may have been damaged, causing the system to malfunction.

② Status of the LEDs and indicator

Check the status of the LEDs and indicator to see whether there is an abnormal condition.

③ Mounting screws and screws on the terminal blocks

Check the screws that secure modules, the screws on the terminal blocks, and other screws for looseness. If loose screws are found, re-tighten them. Loose screws may cause the system to malfunction. At worst, circuits may be burnt due to excessive heat.

④ Cable sheaths

Check the cable sheaths to see if they are not heated or otherwise faulty. Heated or removed cable sheaths can cause the system to malfunction, lead to electrical shock hazards or burn components as a result of short circuits.

⑤ Dust

Check the modules for dust buildups. If dust is built up, remove it with a vacuum cleaner. Dust may cause internal circuits to be shorted and burnt.



REQUIREMENT

Modules may be damaged due to static electricity. Discharge static charges from your body before starting your maintenance work.

⑥⑦ Power supply voltage

Check to see if the I/O voltage of the power supply module and the voltage of the external power supply are within allowable limits of specifications. Too low or high a power supply voltage may cause the system to malfunction.

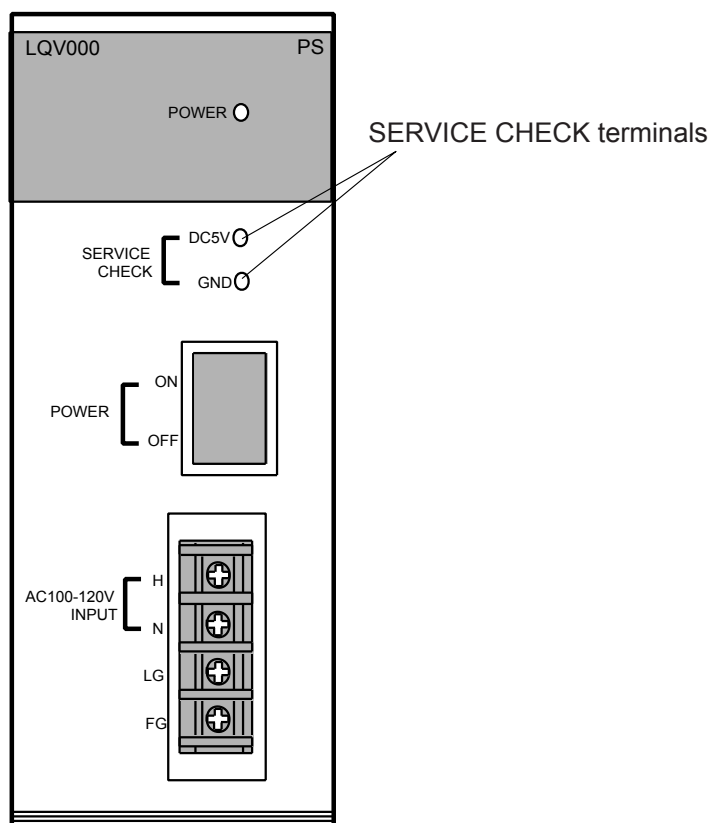
Power supply module specifications are as follows:

Input voltage regulation --- LQV000: 85 to 132 VAC
 LQV010: 85 to 132 VAC
 LQV100: 85 to 132 VAC, 85 to 132 VDC
 LQV020: 20.4 to 28.8 VDC
 LQV200: 170 to 264 VAC

Output voltage regulation --- 5 VDC \pm 5%

Determine the output voltage of the power supply module from the voltage measured at the SERVICE CHECK terminals shown below.

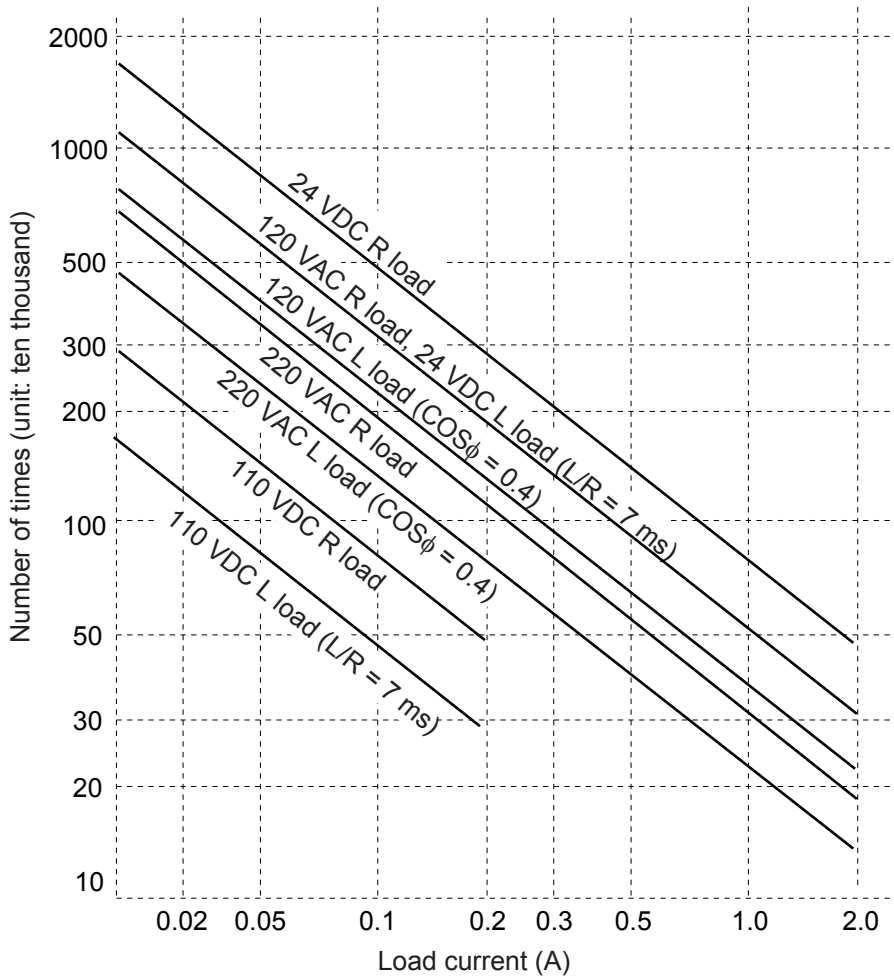
(For the operating power supply voltage of each module and the voltage of the external power supply, see the manual supplied with the module.)

**CAUTION**

- Even if the input voltage of the power supply module falls within a specified range, assume it to be in a power abnormality when it is close to the upper or lower limit of the range, and call upon the power supply facility manager for a checkup.
- Hot swapping of modules can lead to hardware or software destruction. Be sure to replace the module with the power off.

■ Useful life of the relay

For an I/O module, such as the LQY100 or LQY140, that contains a relay, the useful life of the relay contacts must be considered. Plan periodic replacement of the I/O module if it is used in a system in which the relay opens and closes frequently or either the output voltage or the power current is high.



The L load includes surge current.

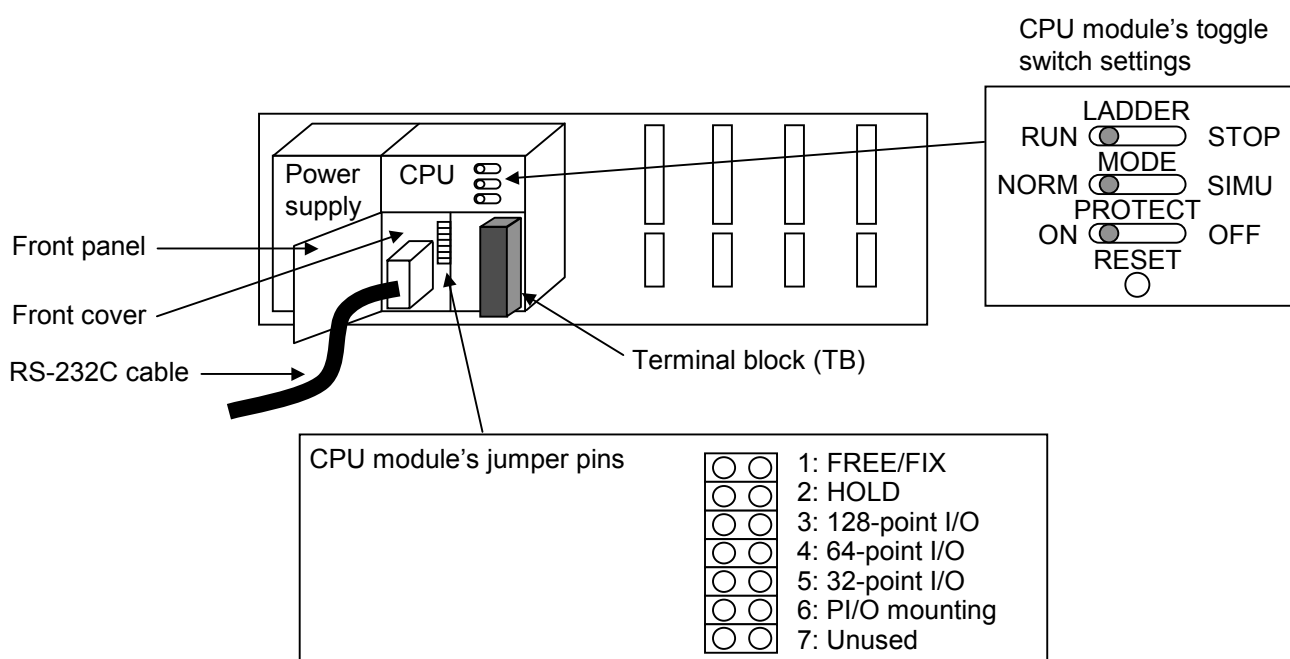
9.1.1 Replacing the S10mini CPU module

- What you should get in preparation

- ① Personal computer (with S10mini SYSTEM installed in it)
- ② RS-232C cable (or 10BASE-T cable if the communication module used is an ET.NET module)
- ③ New CPU module (one of the models LQP000, LQP010, LQP011, or LQP120) in its initial condition, or with its battery removed from it. If this module's memory is backed up by battery, perform the memory clearing procedure. For details, see the description under "Clearing all the memory" (on page 9-19) in this chapter.
- ④ Copies of application programs and other items stored in the CPU or memory module
- ⑤ The above-mentioned ET.NET module is an optional module and, if it is mounted in place, may be selected as the type of communication module to be used. For more information, refer to Section 1.2, "Mounting Optional Modules," and Section 3.1, "Names and Functions of Each Part," in the S10mini HARDWARE MANUAL OPTION ET.NET (manual number SME-1-103).

- Replacement procedure

- ① Write down, on a piece of paper, the current settings of the toggle switches (LADDER, MODE, and PROTECT) that are, as shown below, accessible at the front side of the existing CPU module to be replaced. Then, open the front panel and cover of the existing CPU module and write down the current settings of the jumper pins.



- ② Ensure that your application system has been shut down. Then, set the existing CPU module's LADDER switch in STOP position and turn off the power supply of the controller unit.
- ③ Remove the terminal block or TB from the existing CPU module.
- ④ Connect a battery to the new CPU module and replace the existing CPU module with the new one.
- ⑤ Set the new CPU module's jumper pins in the same way as you wrote down in Step ①. Set also its LADDER switch in STOP position and its PROTECT switch in OFF position.
- ⑥ Turn on the power supply of the controller unit.
- ⑦ Connect the personal computer and the new CPU module together with the RS-232C cable. Then, start the S10mini system and load all necessary application programs to the controller's CPU module.

Note 1: Where an optional ET.NET module is installed, the IP address must be set again.

Note 2: Where an optional inter-CPU link module is installed, the send-area must be set up again.

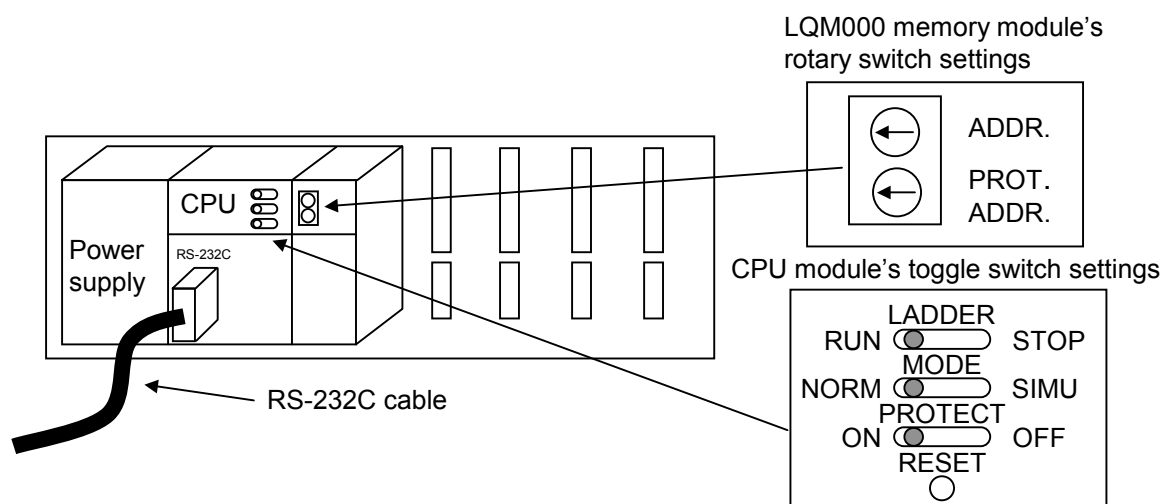
- ⑧ Reset the new CPU module by pressing the RESET switch at its front.
- ⑨ Turn off the power supply of the controller unit.
- ⑩ Attach the TB that you removed in Step ③ to the new CPU module.
- ⑪ Set the new CPU module's toggle switches in the same way as you wrote down in Step ①.
- ⑫ Turn on the power supply of the controller unit and check that the new CPU module is running normally.

9.1.2 Replacing or adding on the S10mini memory module

- What you should get in preparation
 - ① Personal computer (with S10mini SYSTEM installed in it)
 - ② RS-232C cable (or 10BASE-T cable if the communication module used is an ET.NET module)
 - ③ New or add-on memory module (model LQM000)
 - ④ Copies of application programs and other items stored in the memory module
 - ⑤ The above-mentioned ET.NET module is an optional module and, if it is mounted in place, may be selected as the type of communication module to be used. For more information, refer to Section 1.2, "Mounting Optional Modules," and Section 3.1, "Names and Functions of Each Part," in the S10mini HARDWARE MANUAL OPTION ET.NET (manual number SME-1-103).

- Replacement procedure

- ① Write down, on a piece of paper, the current settings of the rotary switches (ADDR. and PROT.ADDR.) that are, as shown below, accessible at the front side of the existing memory module to be replaced.
- ② Write down also the current settings of the toggle switches (LADDER, MODE, and PROTECT) that are, as shown below, accessible at the front side of the CPU module.



- ③ Ensure that your application system has been shut down. Then, set the CPU module's LADDER switch in STOP position and turn off the power supply of the controller unit.
- ④ Replace the existing memory module with the new one. Then, set the new memory module's rotary switches in the same way as you wrote down in Step ①.
- ⑤ Connect the personal computer and the CPU module together with the RS-232C cable. Then, turn on the power supply of the controller unit.
- ⑥ Start the S10mini system and load all the prepared copies of application programs and other items to the new memory module.
- ⑦ Turn off the power supply of the controller unit.
- ⑧ Set the CPU module's toggle switches in the same way as you wrote down in Step ②.
- ⑨ Turn on the power supply of the controller unit and check that the new memory module is running normally.

- Add-on procedure

- ① Write down, on a piece of paper, the current settings of the toggle switches (LADDER, MODE, and PROTECT) that are accessible at the front side of the CPU module.
- ② Ensure that your application system has been shut down. Then, set the CPU module's LADDER switch in STOP position and turn off the power supply of the controller unit.
- ③ Mount the add-on memory module in place according to the instructions given in Chapter 1, "BEFORE USE."
- ④ Set the add-on memory module's rotary switches in such a way that a new setting will not duplicate with the current ADDR. switch setting(s) of the existing memory module(s).
- ⑤ Connect the personal computer and the CPU module together with the RS-232C cable. Then, turn on the power supply of the controller unit.
- ⑥ Start the S10mini SYSTEM and load all the prepared copies of application programs and other items to the add-on memory module.
- ⑦ Set the CPU module's toggle switches in the same way as you wrote down in Step ①, and check that the add-on memory module is running normally.

9.2 Replacing the Backup Battery

When the backup battery is low, the message “CPU CELL” appears in the indicator on the CPU module. This requires that the battery be replaced. Replace the backup battery periodically by establishing the intervals of replacement to meet the size of extension memory and the operating environment from a preventive maintenance standpoint. Even in a system that is never turned off, replace the backup battery periodically because its service life is seven years. Also replace the battery if you have used it in five to six years under the use of high temperature and humidity. For more information on the battery, see “8.8 Memory Backup.”

■ Notes on replacing the battery

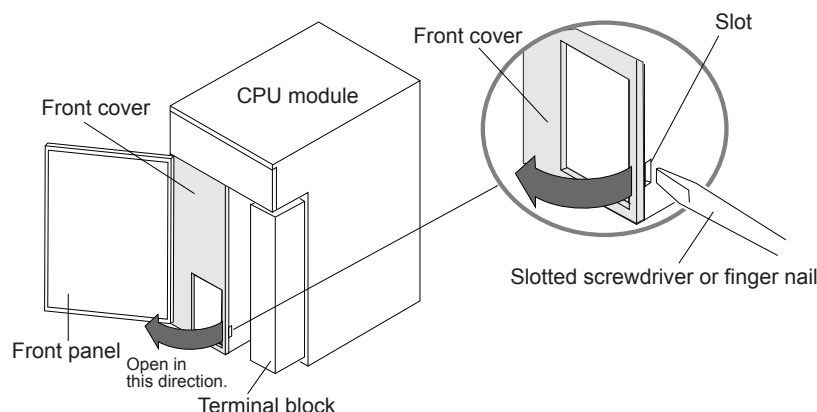
- When replacing the battery in response to the message “CPU CELL” in the indicator on the CPU module, save all the existing programs to floppy disks before replacing the battery. This action assures that a program can be restored if it is destroyed during replacement.
- Replace the battery within three minutes. With the battery removed, the clock and memory can be retained only for up to five minutes.
- The clock may stop during replacement. Upon completion of replacement, check the time of the day.

9.2.1 Procedure

- ① Before handling the CPU module, ground yourself to discharge any static electricity.
- ② Possible to exchange the battery under the power switch on of the power supply module.
- ③ Open the front panel as shown below.
- ④ Insert a finger nail or the tip of a slotted screwdriver about 1 mm into the slot at the lower right of the front cover (see the figure below). Then carefully lift away the front cover in the direction of the arrow.

■ Notes

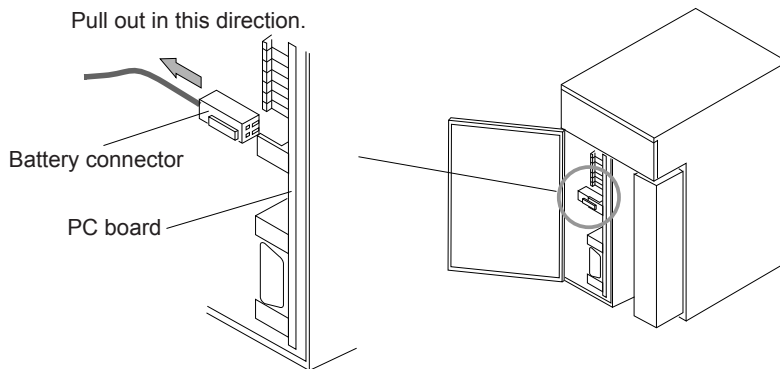
Do not insert the slotted screwdriver more than 1 mm. Otherwise the internal PC board may be damaged. Do not touch the internal boards or components. Otherwise a short circuit may be caused to errors or broken in module.



■ Notes

Steps ⑤ to ⑧ below must be completed within five minutes. To speed up replacement, prepare the replacement battery (ER6T-3WK41-Z from Hitachi Maxell, Ltd.) in advance.

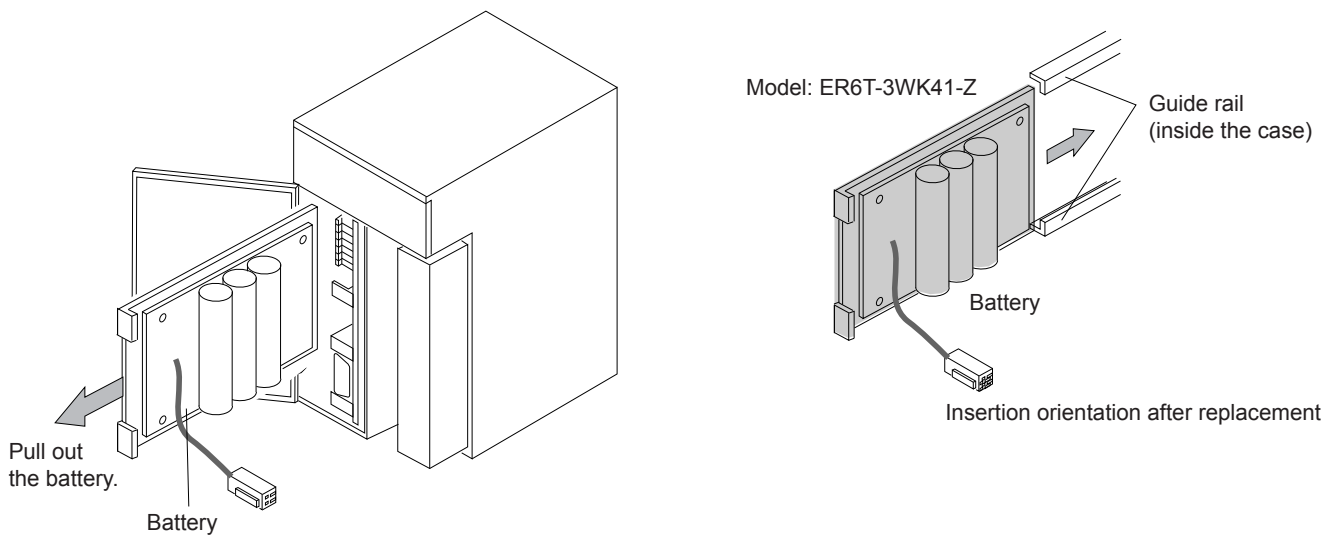
- ⑤ To remove the battery connector from the PC board, carefully pull out the battery connector as shown below in the direction of the arrow.



- ⑥ Carefully pull out the battery as shown on the left figure below in the direction of the arrow.
⑦ Insert the new battery (ER6T-3WK41-Z) along the guide rails installed on the left side in the CPU module (see the right figure below).
⑧ Insert the battery connector into the plug on the CPU board.
⑨ Check the time of the day. If it is incorrect, set the correct time again.

■ Notes

If the battery connector is disconnected or poorly connected, backup data may be lost. Insert the battery connector firmly into the battery plug on the PC board until it snaps into place.



9.2.2 Disposing of used batteries

■ General notes on asking the agent to dispose of used batteries

1. Collection and vessel

Collect used batteries in such a way that a short circuit, charging circuit, or overdischarging circuit is not formed between batteries. Also note the following points:

- Make sure that the vessel in which to collect used batteries is made of insulating materials.
- Place used batteries neatly for each type and size. When stacking used batteries, insert an insulating sheet between each two layers to completely prevent contacts of terminals in different layers.
- Do not mix different types of batteries and do not mix batteries with other metallic parts such as wires or nails.
- Used batteries that generate offensive odors are likely to cause a fire. Place one such battery in a single vinyl bag rather than collecting them together, and place it neatly in the vessel. In general, batteries having an offensive odor must be handled individually.

2. Place of collection

Collect used batteries in place where:

- There is no fire near them.
- There is no dangerous thing as stated by the fire protection law near them.
- They are not wetted by rain or water.

3. Packing

- Take action so that used batteries are not disordered during transportation. For instance, insert foam blocks.
- Place vessels including used batteries in a corrugated cardboard box or wood box together with foam blocks. Make sure that one package must be 10 kg or less.
- Label the following information on the packages:
 - Indication of used lithium batteries
 - Battery type (ER)
 - Warning to inhibit mixing with dangerous things
 - Contact in emergency
 - Warning to prevent the package from being wetted

4. Transportation

- Do not mix used batteries with dangerous things as stated by the fire protection law.
- Do not place used packages in a hot place such as a place near a radiator.
- Secure the packages so that they are not displaced during transportation.
- Take action so that the packages are not wetted.

■ Manifesto information

Used lithium batteries (ER batteries) must be handled as industrial wastes. Ask a professional to dispose of used batteries.



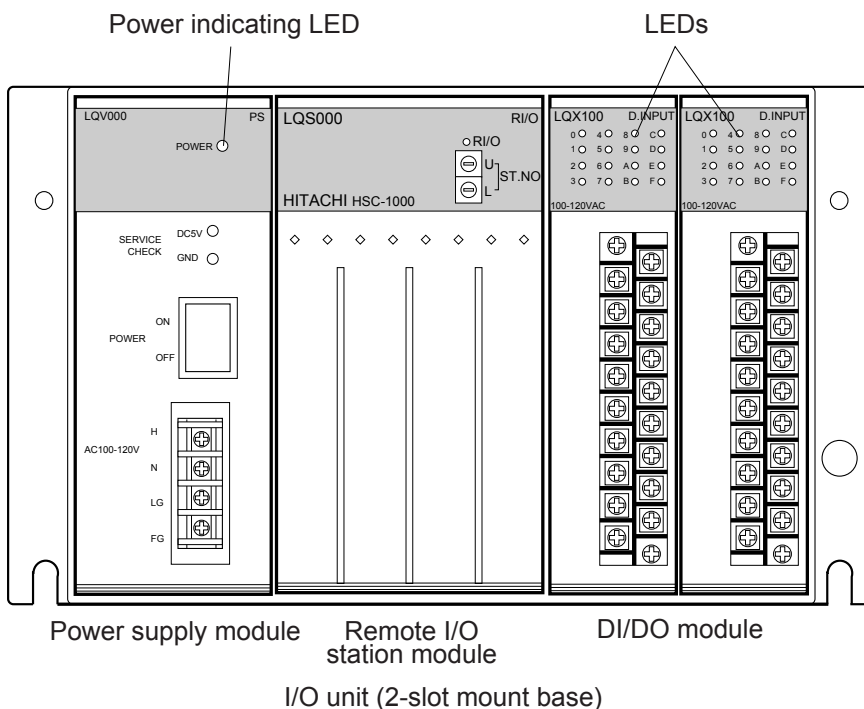
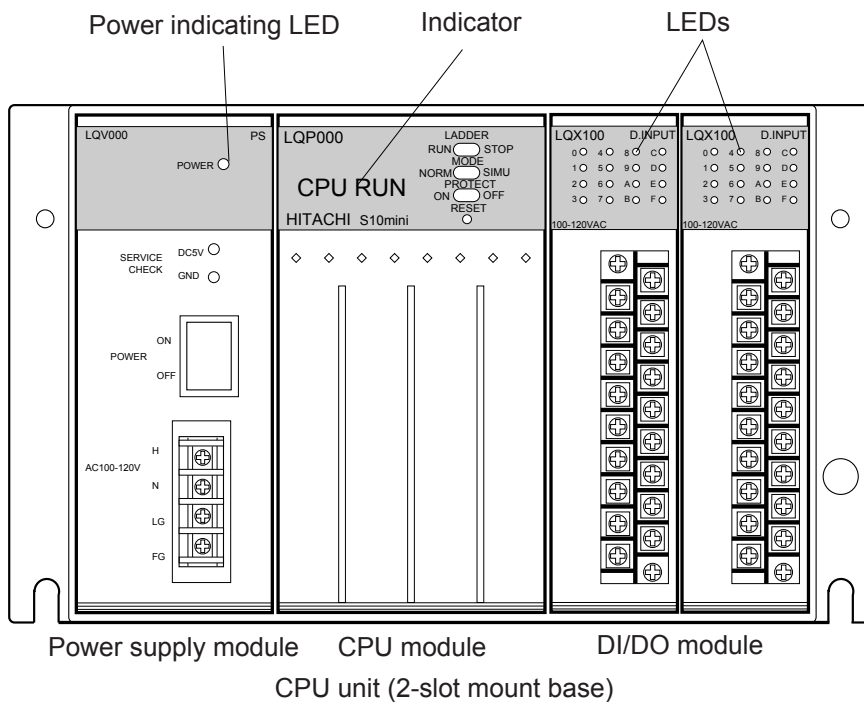
REQUIREMENT

If the battery is handled improperly, it may catch fire or explode. Some used batteries may still have a considerable amount of charge. To deliver such used batteries to a waste disposal site safely, follow the general rules for collection, packing, and transportation. For concrete methods of packing and transportation, consult with professionals of your local waste disposal business.

9.3 Troubleshooting

If the S10mini causes a failure, troubleshoot it as described below.

- (1) Check the status of the operation LED on power supply module and the message in the indicator on the CPU module.
- (2) Replace modules.



■ Diagnosis by checking the power indicating LED status and the message in the indicator

- When the power indicating LED on the power supply module is off, check the power supply voltage and waveform.
- While the CPU is running normally, the indicator on the CPU module displays one of the following messages:

Message	Explanation
CPU STOP	The ladder program stops running but the remote I/O transfer and user tasks are running.
CPU RUN	The ladder program is running together with the remote I/O transfer and user tasks.
CPU SIMU	The remote I/O transfer stops running but the ladder program simulates. The user task is running.
NΔΔΔ	Program NΔΔΔ is being executed
PΔΔΔ	Program PΔΔΔ is being executed.
EΔΔΔ	Event coil EΔΔΔ was turned on.
NO = ΔΔΔΔ	Represents a preset PCs number.
CPMS MΔ□ CPMS DΔ□	Represents version (Δ) and revision (□), respectively of the real-time multi-task OS “Compact PMS.”
○○:ΔΔ:□□	Represents the present time. For display format meanings, see “8.4 Clock Features.”

When the indicator indicates one of the following messages, troubleshoot the S10mini by taking action as described for that message.

Message	Action
ROM IDLE	Hold down the reset switch for at least 20 seconds. In case when the CPU is not recovered by the above method, clear all the memory by following “Clearing all the memory” on page 9-19.
NST OVER	The nesting level of the ladder program is five or more. Correct the program so that it will not go more than four levels deep.
PROT ERR	An attempt was made to write a user-created C program to a protected area in memory. Take actions (1) and (2) below. (1) Check the program and correct its errors. (2) When the program needs to be written to that area, set the protect switch to OFF.
IO-F-ΔΔΔ	The fuse at I/O address YΔΔΔ is blown. Replace the fuse at YΔΔΔ.
IO-T-ΔΔ0	The remote I/O data at I/O address ΔΔ0 could not be transferred. Check the power supply, wiring of the remote I/O cable, termination, and the station number.
LED OFF	Hold down the reset switch for at least 20 seconds. In case when the CPU is not recovered by the above method, clear all the memory by following “Clearing all the memory” on page 9-19.

■ Diagnosis by replacing modules

If the cause of the failure cannot be corrected by diagnosis by checking the operation indicator LED status and the message in the indicator, replace the module as described below.

Module to replace	Failure	Action
Power supply module	The LED does not light.	Replace the power supply module.
I/O module	None of the I/O modules does not operate.	Replace the CPU module
	The I/O modules in the I/O unit do not operate.	Replace the remote I/O station module.
	Only a particular I/O module does not operate.	Replace the I/O module.

■ Error messages (1/4)

Error Message	Explanation	Action
CPU DOWN	CPU down	A fatal error occurred when the OS was running. See the displayed error message and repair.
CPU CELL	Battery low	Replace the backup battery (ER6T-3WK41-Z).
SSP OVER	Program running abnormally	(1) Press the reset switch on the CPU module. (2) Turn on the power switch on the power supply module again.
WDT ERR	Ladder program stagnation monitoring-detected error	
OS PTY	OS process memory parity error	
PIO PTY	PI/O memory parity error	
EXΔΔ PTY ΔΔ: See the 9-18 pages (*).	If ΔΔ is one of the values 10 to 4F, the error is an extension memory parity error.	Clear all the memory. Then, if the same error recurs, replace the extension memory. For information on how to clear the memory, see pages 9-19 through 9-22.
	If ΔΔ is a value other than 10 to 4F, the error is a parity error detected during reading by the CPU module of the optional module's internal memory.	Press the reset switch on the CPU module. Then, if the same error recurs, replace the optional module.
EXMD PTY (displayed along with ROM IDLE)	The error is a parity error detected during reading by the CPU module of extension memory or the optional module's internal memory.	Handle the ROM IDLE error according to the information supplied under “■ Diagnosis by checking the power indicating LED status and the message in the indicator” on pages 9-14. Then, clear all the memory. For information on how to clear the memory, see pages 9-19 through 9-22. If clearing of the memory does not solve the problem, replace the extension memory or optional module.

■ Error messages (2/4)

Error Message	Explanation	Action
EXΔΔ PRT ΔΔ: See the 9-18 page. (*)	If ΔΔ is one of the values 10 to 4F, the error is an extension memory protection error.	Handle the PROT ERR error according to the information supplied under “Diagnosis by checking the power indicating LED status and the message in the indicator” on page 9-14. Then, if the same error recurs, replace the extension memory.
	If ΔΔ is a value other than 10 to 4F, the error is a protection error detected during writing by the CPU module to the optional module’s internal memory.	Press the reset switch on the CPU module. Then, if the same error recurs, replace the optional module.
EXMD PRT (displayed along with ROM IDLE)	The error is a protection error detected during writing by the CPU module to the extension memory or the optional module’s internal memory.	Handle the ROM IDLE error according to the information supplied under “■ Diagnosis by checking the power indicating LED status and the message in the indicator” on page 9-14. Then, if the same error recurs, replace the optional module.
SMD PTY	Ladder program memory parity error	(1) Press the reset switch on the CPU module.
SMD INVL	Illegal instruction detected in the ladder program (ladder program error)	(2) Turn on the power switch on the power supply module again.
SMD CERR	Ladder program table abnormality (detected during initial diagnosis on resetting)	If the error condition persists even after the above procedure is performed, clear all the memory. For information on how to clear the memory, see pages 9-19 through 9-22. If clearing of the memory does not solve the problem, replace the CPU module.
SMD PERR	Ladder program error (detected during initial diagnosis on resetting)	
ADDR ERR	Address error occurred	(1) If the CPU is not down, then: ① Check if the user task’s stack is large enough. ② If it is large enough, load in the user task again. (2) If the problem still persists or the CPU is down, then: Troubleshoot it according to the instructions given under “■ Troubleshooting ‘CPU down’ problems” (page 9-23).
ILG INST	Illegal instruction detected	(1) If the CPU is not down, then: Check if the user task is loaded in normally. If not, load it in properly. (2) If the problem still persists or the CPU is down, then: Troubleshoot it according to the instructions given under “■ Troubleshooting ‘CPU down’ problems” (page 9-23).

■ Error messages (3/4)

Error Message	Explanation	Action
INV INT	Undefined exception occurred	<p>(1) If the CPU is not down, then:</p> <ul style="list-style-type: none"> ① Check if the user task is loaded in normally. If not, load it in properly. ② If it is loaded in normally, an instruction generating an exception, such as a CHK instruction, might be missing, or the destination of a jump instruction might be incorrect. Check if either of these situations is the case. <p>(2) If the problem still persists or the CPU is down, then: Troubleshoot it according to the instructions given under “■ Troubleshooting ‘CPU down’ problems” (page 9-23).</p>
ZERO DIV	Divide by zero	<p>(1) If the CPU is not down, then: Check the user task in which the error occurred.</p> <p>(2) If the problem still persists or the CPU is down, then: Troubleshoot it according to the instructions given under “■ Troubleshooting ‘CPU down’ problems” (page 9-23).</p>
PRIV VIO	Violation of privileged instruction detected	<p>(1) If the CPU is not down, then: The destination of a jump in the user task in which the error occurred might be in the OS program area. Check if this situation is the case.</p> <p>(2) If the problem still persists or the CPU is down, then: Troubleshoot it according to the instructions given under “■ Troubleshooting ‘CPU down’ problems” (page 9-23).</p>
RSV ERR	Unreleased resource occupied by the RSERV macro	Correct the user task to end the task after releasing the resource occupied by the RSERV macro by the FREE macro.
SVC ERR	CPMS macro instruction parameter error occurred	Check parameters in the macro instruction and review the user task.

9 MAINTENANCE

■ Error messages (4/4)

Error Message	Explanation	Action
FBRAN ER	Floating-point operation: Branching or setting when a comparison is disabled	(1) If the CPU is not down, then: The error is a floating-point operation error. Check the user task in which it occurred. This type of error occurs only in the model F. (2) If the problem still persists or the CPU is down, then: Troubleshoot it according to the instructions given under “■ Troubleshooting ‘CPU down’ problems” (page 9-23).
FINEX ER	Floating-point operation: Incorrect result	
FZERO ER	Floating-point operation: 0-division detected	
FUNDR ER	Floating-point operation: Underflow	
FOPRN ER	Floating-point operation: Operand error	
FOVER ER	Floating-point operation: Overflow	
FNAN ER	Floating-point operation: Signaling NaN (not a number)	

NOTE

Clearing of the memory results in the loss of ladder programs, user tasks, and all the set values for the ladder residing in the memory. Thus, be sure to back up all those necessary items before clearing the memory.

(*) The optional module can be determined from the EXΔΔ PTY and EXΔΔ PRT messages by looking up the table below, which shows the relationships between ΔΔ and each optional module.

ΔΔ	Corresponding Optional Module
10 to 4F	Extension memory
80/81	CPU link (80: main module, 81: submodule)
92/93	J.NET/J.NET-INT/IR.LINK (92: main module, 93: submodule)
A0 to A3	RS-232C (A0: channel 0, A1: channel 1, A2: channel 2, A3: channel 3)
B0 to B3	HDLC (B0: channel 0, B1: channel 1, B2: channel 2, B3: channel 3)
D2/D3	ET.NET/SV.LINK (D2: main module, D3: submodule)
E2/E3	FL.NET (E2: main module, E3: submodule)
F0 to F3	D.NET (F0: channel 0, F1: channel 1, F2: channel 2, F3: channel 3)



PROHIBITION

Except the CPU module battery, the internal parts are not customer-serviceable. We will not be liable for any damages to our programmable controller and ancillary equipment and for physical injury arising out of such actions. If the module should fail, replace it in its entirety.

■ Clearing all the memory

If the indicator does not turn on or “ROM IDLE” or “LOAD OS” appears when the power supply is turned on, hold down the reset switch for more than 20 seconds.

If doing so will not solve the problem, clear the memory by performing the procedure described below. Then, restart the system. (The “all the memory” here means the entire internal memory of the CPU module plus the extension memory [LQM000]).

(1) Memory clearing when the Windows® version of the tool is ready for online operation

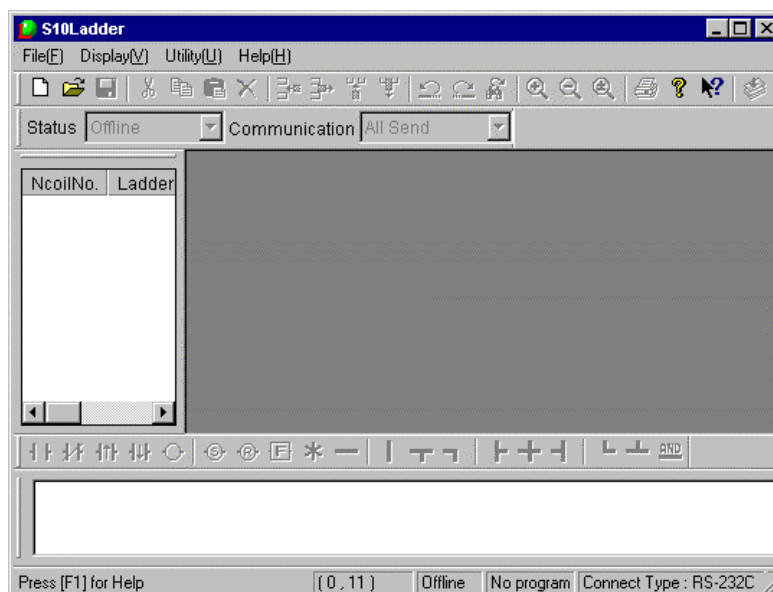
When the Windows® version of the tool and the PCs can both be placed into an online state (without being disturbed by errors, such as an “line error”), all the memory as described above can be cleared with the PCs memory initialization feature of the Ladder Chart System. To accomplish this, perform the following procedure ----

Operation on the PCs:

- ① Put the CPU into the STOP state by operating the Ladder Program (LADDER) switch.

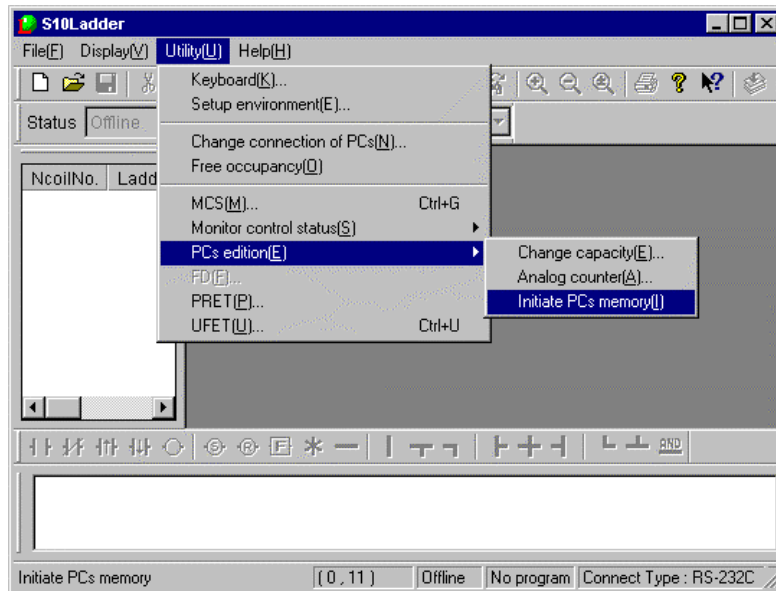
Operation on the tool:

- ① Start the Ladder Chart System. Then, if the file that was previously edited when the Ladder Chart System was ended is opened again on the window, close it by selecting [Close (C)] from the [File (F)] menu. Then, the Ladder Chart System’s window looks like the following:

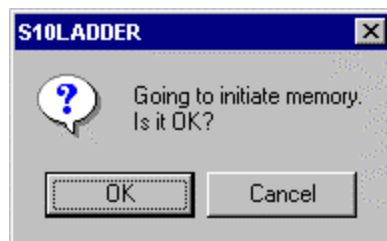


9 MAINTENANCE

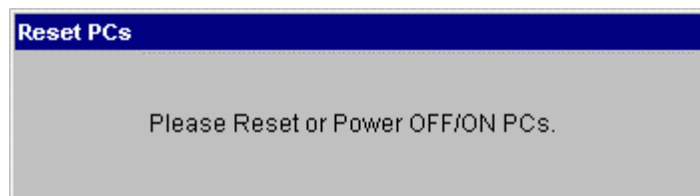
- ② Select [PCs edition (E)]-[Initiate PCs memory (I)] from the [Utility (U)] menu of the Ladder Chart System.



- ③ The following confirmation message is displayed. Click the button.



- ④ The following message is displayed. Reset the PCs, or power it down and then back up again.



- ⑤ When the message displayed in Step ④ disappears from the window, the memory clearing operation is completed. End the Ladder Chart System.

- (2) Memory clearing when the Windows® version of the tool is ready for online operation or when the Ladder Chart System is not purchased yet by the user.

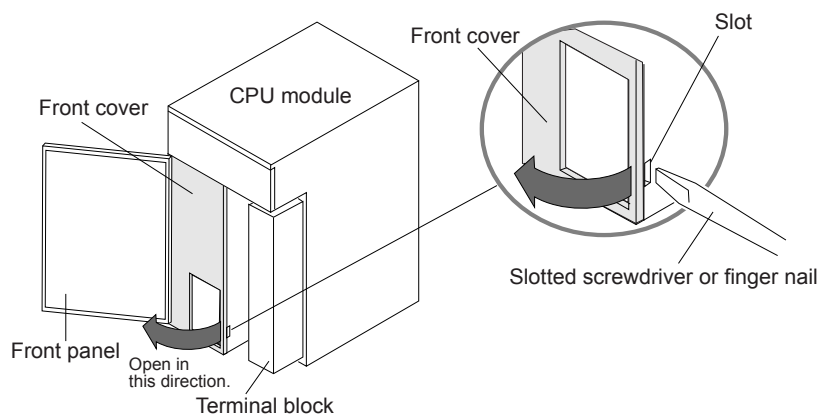
If neither the Windows® version of the tool nor the PCs can be placed into an online state (due to, for instance, an “line error”), discharge all the memory backup energy and clear the memory by performing the procedure described below. Then, restart the system.

Procedure

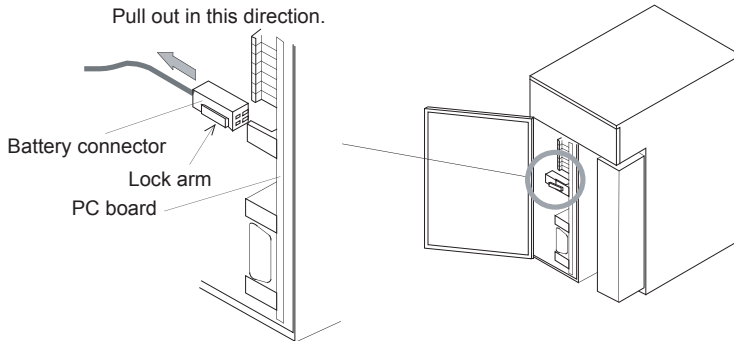
- ① Before handling the CPU module, ground yourself to discharge any static electricity.
- ② Turn off the power switch on the power supply module.
- ③ Open the front panel as shown below.
- ④ Insert a finger nail or the tip of a slotted screwdriver about 1 mm into the slot at the lower right of the front cover (see the figure below). Then carefully lift away the front cover in the direction of the arrow.

■ Notes

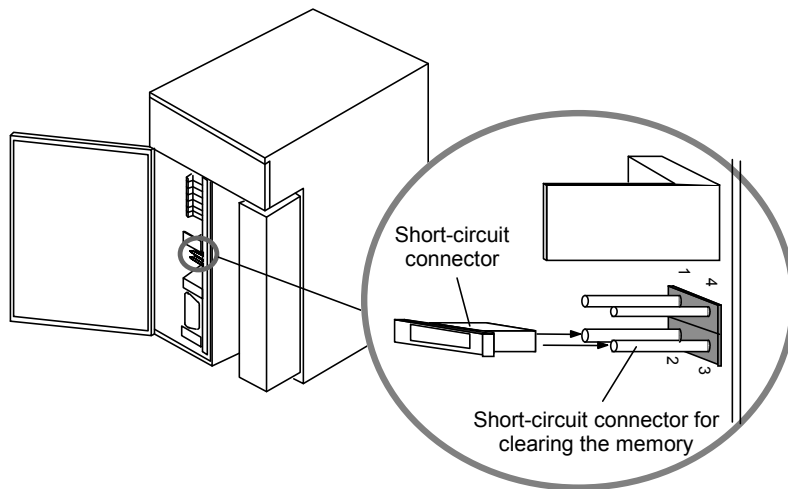
Do not insert the slotted screwdriver more than 1 mm. Otherwise the internal PC board may be damaged.



- ⑤ Remove the lock arm of the battery connector and slowly pull the battery connector out of the PC board in the direction of the arrow as shown below.



- ⑥ Make sure to confirm that the battery connector is removed and then have short-circuit pins 2 and 3 under the battery connector as indicated below shorted by using short-circuit connector (if these pins are shorted while the battery connector is still connected, the battery is discharged and the battery voltage drops or get exhausted). Perform shorting continuously for more than five minutes to discharge the built-in super condenser. Use a connector for I/O setting as the short-circuit connector and make sure to return it to its original position after use.
- ⑦ Disconnect the short-circuit connector for clearing the memory after five minutes of shorting.
- ⑧ Make sure that the short-circuit connector is removed before inserting the battery connector and replace the front cover.
- ⑨ Turn on the power supply. Check that no error messages appear, OS version indicator is shown as “CPMS***” and the CPU has been properly started.
- ⑩ The memory has been cleared and the system has been returned to the initial status. Reload and re-set the programs.

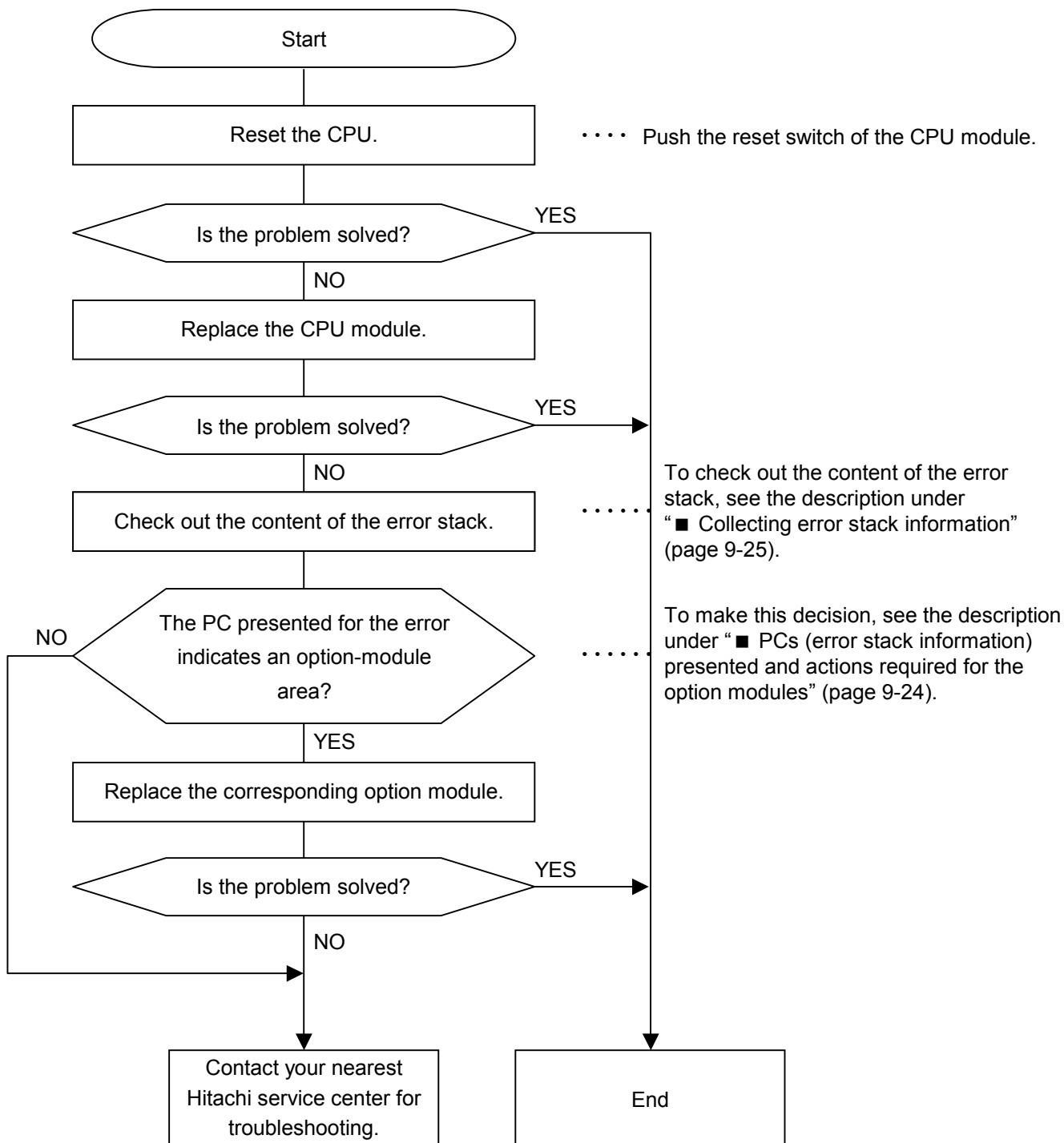


■ Notes

If the battery connector is disconnected or poorly connected, backup data may be lost. Securely connect it to the battery plug of the PC board until it clicks.

■ Troubleshooting “CPU down” problems

If the CPU goes down, or an error is detected in a user task but its cause cannot be found in that user task, then troubleshoot the problems by performing the procedure flowcharted below.



9 MAINTENANCE

■ PCs (error stack information) presented and actions required for the option modules

If the PC presented as error stack information for a detected error indicates any of the addresses listed below, the corresponding option module may be in failure condition. In this case, replace the option module.

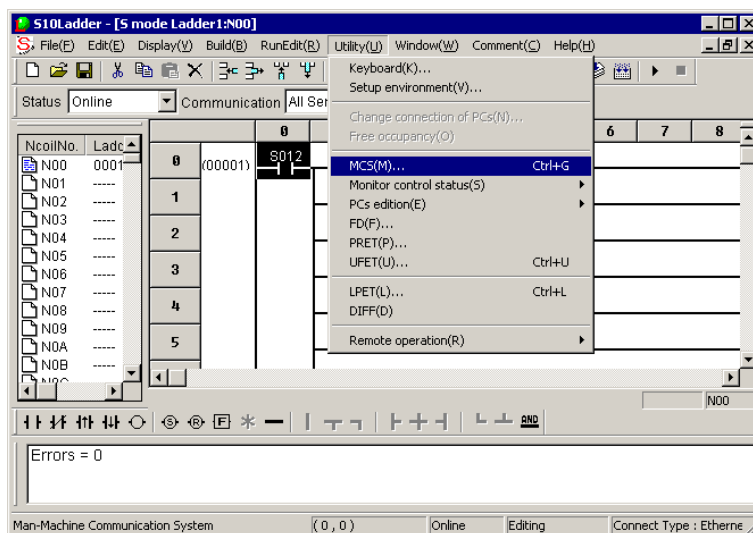
Addresses	Corresponding option module
0x800000 to 0x87FFFFE	ET.NET/SV.LINK (main module)
0x880000 to 0x8FFFFFE	ET.NET/SV.LINK (submodule)
0x900000 to 0x97FFFFE	OD.RING/SD.LINK (main module)
0x980000 to 0x9FFFFFE	OD.RING/SD.LINK (submodule)
0xA00000 to 0xA7FFFFE	J.NET/J.NET-INT/IR.LINK (main module)
0xA80000 to 0xAFFFFFE	J.NET/J.NET-INT/IR.LINK (submodule)
0xB00000 to 0xB3FFFFE	HDLC (channel 0)
0xB40000 to 0xB7FFFFE	HDLC (channel 1)
0xB80000 to 0xBBFFFFE	HDLC (channel 2)
0xBC0000 to 0xBFFFFFE	HDLC (channel 3)
0xD00000 to 0xD7FFFFE	FL.NET (main module)
0xD80000 to 0xDFFFFFE	FL.NET (submodule)
0xE00000 to 0xE3FFFFE	D.NET (channel 0)
0xE40000 to 0xE7FFFFE	D.NET (channel 1)
0xE80000 to 0xEBFFFFE	D.NET (channel 2)
0xEC0000 to 0xEFFFFFE	D.NET (channel 3)
0xF40000 to 0xF4FFFFE	RS-232C/RS-422 (channel 0)
0xF50000 to 0xF5FFFFE	RS-232C/RS-422 (channel 1)
0xF60000 to 0xF6FFFFE	RS-232C/RS-422 (channel 2)
0xF70000 to 0xF7FFFFE	RS-232C/RS-422 (channel 3)

■ Collecting error stack information

Error stack information can be collected by using the ladder system's MCS function, as described below.

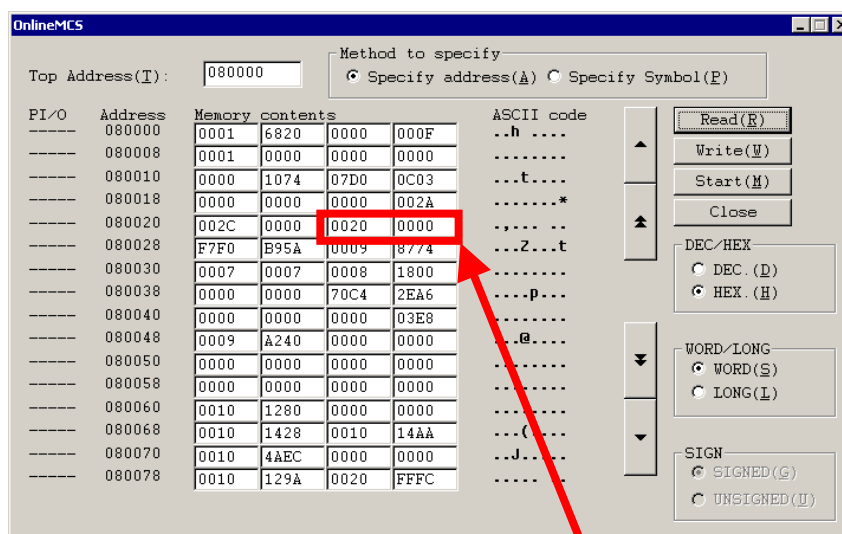
(1) Starting the ladder system

Start the ladder system on the personal computer, establish a connection with the PCs, and then make the ladder system's communication status online with the PCs, as shown below.



(2) Displaying system error information

To display system error information on screen, do the following: 1) choose [MCS] from the [Utility] menu; 2) the MCS window appears; 3) specify the starting address (/80000) of the error stack information storage area in the "Top Address" field; and 4) click the [Read] button. Then, if you want to view the contents of the next address, click the ▼ button. The contents of the previous address can be viewed by clicking the ▲ button.



PC (program counter)

The rest of this section shows the details of the error stack information table.

9 MAINTENANCE

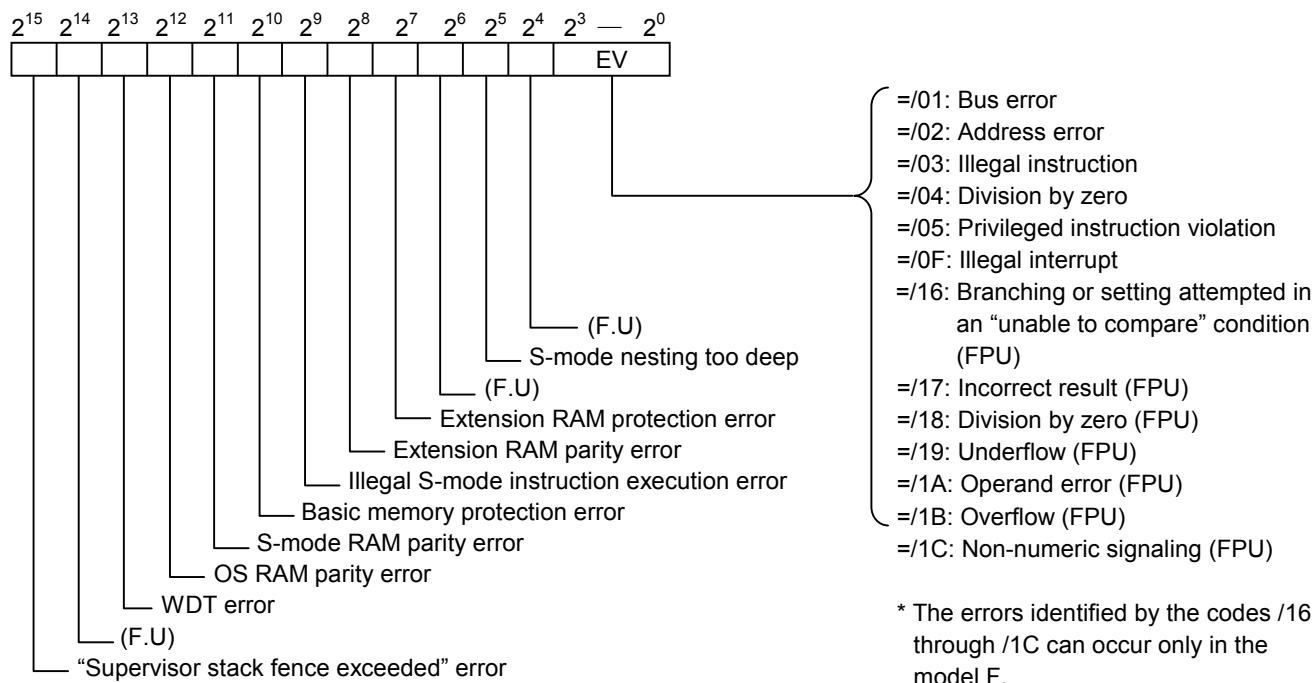
<Error stack information table details>

As shown below, the error stack information table contains two cases of error information if more than one error is detected successively. In addition, it also contains a set of extension information, which varies depending on the information provided in the stack frame format described later.

/80000	Case 1; 256 bytes long	/0	CASEP	/40	D0	/80	Extension info
		/2	TYPE	/44	D1		
/80100	Case 2; 256 bytes long	/4	F.U	/48	D2		
		/6	EC	/4C	D3		
/80200	Save info for case 1; 256 bytes long	/8	CPN	/50	D4		
		/A	SPN	/54	D5		
/80300	Save info for case 2; 256 bytes long	/C	SPC	/58	D6		
		/E	MS	/5C	D7		
		/10	SEC	/60	A0		
		/14	YEAR	/64	A1		
		/16	MONTH DAY	/68	A2		
		/18	SECCNT	/70	A3		
		/1C	SYSCNT	/74	A4		
		/20	SVO	/78	A5		
		/22	SR	/80	A6		
		/24	PC	/7C	USP		
		/28	MSP	/FE			
		/2C	ISP				
		/30	SFC				
		/32	DFC				
		/34	VBR				
		/38	CASHCR				
		/3C	CASHAD				

The above save information is the error information that was saved at the time the CPU was reset.

EC: Error code:



CASEP: Case pointer: = 1: Case 1 is the latest log; = 0: Case 2 is the latest log.

TYPE: = /6820: RAM-OS; = /6821: ROM-OS.

EC: Error code (see above)

CPN: Task (P-coil) number

SPN: S-mode program (N-coil) number

SPC: S-mode program counter (significant only in the case of illegal S-mode instructions or S-mode RAM parity errors)

MS: Milliseconds

SEC: Seconds

YEAR: Year

MONTH: Month

DAY: Day

SECCNT: Seconds counter

SYSCNT: System counter

SVO: Stack frame format plus vector offset

SR: Status register content

PC: Program counter (MPU)

MSP: Master stack pointer

ISP: Interrupt stack pointer

SFC: Source function code

DFC: Destination function code

VBR: Vector base register

CASHCR: Cache control register

CASHAR: Cache address register

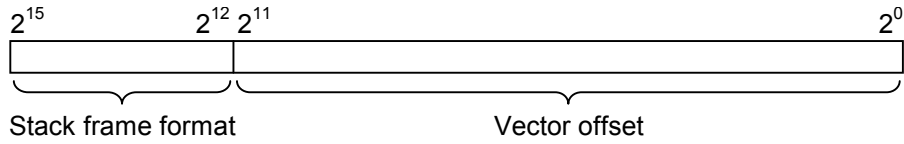
D0 to D7: Data register content

A0 to A6: Address register content

USP: User stack pointer

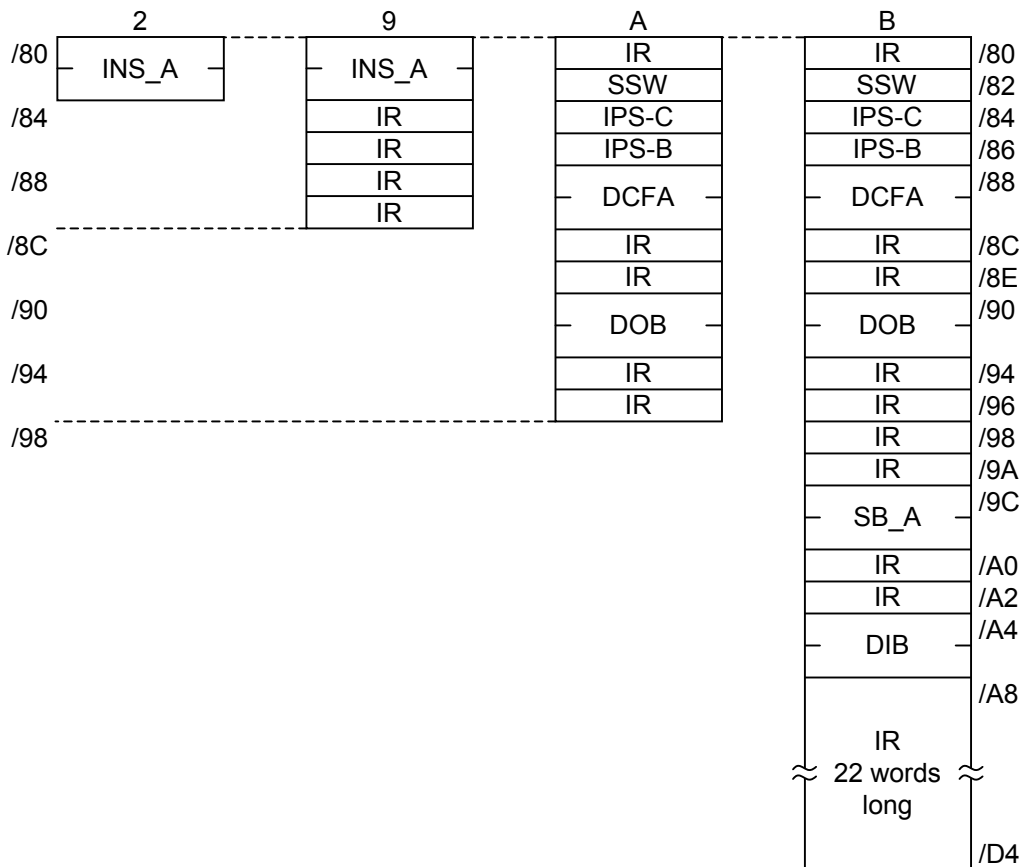
9 MAINTENANCE

SVO: Stack frame format plus vector offset:



Stack frame format and extension information:

Of these two, the extension information is provided only when the type ID code of stack frame format used is other than 2, 9, A, or B.



- INS_A: Instruction address
- IR: Internal register
- SSW: Special status word
- IPS-C: Instruction pipe stage C
- IPS-B: Instruction pipe stage B
- DCFA: Data cycle fault address
- DOB: Data output buffer
- SB_A: Stage-B address
- DIB: Data input buffer

10 SPECIFICATIONS

10 SPECIFICATIONS

(1) General specifications

Item		Specifications		Remarks
Environment	Temperature	Operation	0 to 55°C	Rate of temperature change: 10°C/h or lower
		Storage	-20 to 75°C	
	Relative humidity	Operation	30 to 90%RH	Non-condensing
		Storage	10 to 90%RH	
	Resistance to vibration		Frequency: 10 to 150 Hz; Acceleration: 10 m/s ² 20 sweep cycles in X/Y/Z directions each, 8-minute sweep	Compliant with JIS C0040
	Resistance to shock		Peak acceleration: 147 m/s ² Sinusoidal half-wave pulses, three cycles in X, Y, Z directions each	Compliant with JIS C0041
	Dielectric strength		1500 VAC, one minute	Between the grouped external AC terminals and the case
Grounding		Class D grounding		
Ambient air		Dust: 0.1 mg/m ³ or less, no corrosive gases		No corrosive gases
Power supply	Power supply voltage	LQV000	100 to 120 VAC	Single phase 50/60 Hz ± 5 HZ
		LQV010	100 to 120 VAC	
		LQV100	100 to 120 VAC	
			100 to 110 VDC	
		LQV020	24 VDC	
	Allowable power supply voltage fluctuation	LQV000	85 to 132 VAC	Single phase 50/60 Hz ± 5 HZ
		LQV010	85 to 132 VAC	
		LQV100	85 to 132 VAC	
			85 to 132 VDC	
		LQV020	20.4 to 28.8 VDC	
		LQV200	170 to 264 VAC	
	Allowable outage time	LQV000	10 ms or less	Applicable to rated input
		LQV010	10 ms or less	
		LQV100	10 ms or less (in AC input)	
			5 ms or less (in DC input)	
		LQV020	5 ms or less	
		LQV200	10 ms or less	
Power consumption	LQV000	80 VA maximum	100 VAC input, maximum load	
	LQV010	130 VA maximum (in AC input)		
	LQV100	80 VA maximum (in AC input)		
	LQV020	50 W maximum (in DC input)	100 VDC input, maximum load	
	LQV200	50 W maximum	24 VDC input, maximum load	
	LQV200	120 A maximum	220 VDC input, maximum load	
Surge current	LQV000	15 A or less		
	LQV010	13 A or less		
	LQV100	15 A or less (for both AC and DC)		
	LQV020	12 A or less		
	LQV200	15 A or less		
		15 A or less		
Mass	2-slot CPU mount base (HSC-1020)		580 g	
	4-slot CPU mount base (HSC-1040)		770 g	
	8-slot CPU mount base (HSC-1080)		1150 g	
	2-slot I/O mount base (HSC-1021)		570 g	
	4-slot I/O mount base (HSC-1041)		740 g	
	8-slot I/O mount base (HSC-1081)		1090 g	
	Power supply module	LQV000/100	320 g	
		LQV020	390 g	
		LQV010	440 g	
		LQV200	480 g	
	CPU module	LQP000	530 g	
LQP010/011/120		550 g		
Extension memory module (LQM000)		270 g		
R/O station module (LQS000)		270 g		

(2) Specifications of CPU and RI/O module performance

Item		Specifications				Remarks	
		TYPE-S (model: LQP000)	TYPE-H (model: LQP010)	TYPE-F (model: LQP011)	TYPE-D (model: LQP120)		
Number of I/O points		2048 (extendable to 4096)					
Programming language	Ladder diagram	Option					
	HI-FLOW	Option					
	C	Option					
Instructions	Ladder instructions	18					
	Application instructions	125					
	Computer instructions	Possible (processor: 68020)					
Memory	Device	C-MOS-RAM					
	Battery	Lithium battery					
User memory size	For ladder program	28 k steps					
	For computer processing	Built-in memory	None	1 MB	1 MB	2 MB	Optional
	Extension memory	Up to 4 MB	Up to 3 MB	Up to 3 MB	Up to 2 MB		
Processing speed	Basic ladder instructions	0.075 μ s/step					
	Application instructions	230 μ s/instruction on average			180 μ s/instruction on average		
	Scan time		About 30 ms/28 k steps				
	For computer processing	Built-in memory	1.25 μ s/instruction on average		0.8 μ s/instruction on average		
		Extension memory	1.6 μ s/instruction on average				
Supplementary internal features	Internal register (R)		2048 points				
	Keep relay (K)		512 points				
	Time (T)	Number of points	512 points				
		Type	On-delay				
		Setting	0.1 to 999.9 s				
	One-shot (U)	Number of points	256 points				
		Type	One-shot multivibrator				
		Setting	0.1 to 999.9 s				
	Counter (C)	Number of points	256 points				
		Type	Up/down				
		Setting	1 to 9999				
	Global link register (G)		4096 points				Link between CPUs
	Nesting coil (N)		256 points				Either master control or zone control can be selected.
	Process register (P)		128 points				Used to start computer mode programs
	Event register (E)		256 points				Used to indicate facility failures
	Edge contact (V)		2048 points				Either the rising or the falling edge can be selected.
Z register (Z)		32 points				Used for tracing	
System register (S)		3072 points				Blown fuse flag and other various flags	
Data register (DW)		4096 points				One point = one word	
Work register (FW)		3072 points				One point = one word	
Clock function		Yes					
Floating-point coprocessor		No	Yes	No			
Self-diagnosis features	Detection of CPU errors		Yes				
	Congestion monitoring (WDT)		Yes				
	Input/output error		Yes				
	Detection of invalid instructions		Yes				
	Detection of battery failures		Yes				
Extension memory check		–	One-bit error correction				
Communication interface		RS-232C					
Insertion and removal of live wires		Not possible					
Current consumption		1.63 A					

10 SPECIFICATIONS

(3) External input/output specifications

Item		Specification		Remarks
		Models S, H, F, and D		
External input/output	Remote I/O	Transfer rate	768 kbps	
		Number of lines	2	
		Number of units	Up to 12 per line	
		Number of words to be transferred	64 (1024 points) per port	
		Insulation	Transformer	
		Error check	Comparison of two consecutive inverted bits	
		Modulation	Bipolar	
		Connection form	Bus-based multidrop	
		Terminating resistor	150 or 100 Ω	
	Total cable length	300 m		
	PCs OK	Output form	Relay output (insulation by relay)	
		Output ratings	100 VAC; 12 to 24 VDC, 2 A 48 VDC, 0.5 A; 100 VDC, 0.1 A	
		Minimum output	12 VDC, 20 mA	
		Response time	15 ms or less	
		Cable	Twisted-pair cable, 100 ms or less	
	CPU STOP/RUN, R/O STOP	Input form	Contact input (insulation by optical coupler)	
		Rated input	24 VDC, 10 mA; 12 VDC, 5 mA	
		Input voltage range	10 to 28 VDC	
		On-voltage/ current	10 VDC or more/4 mA or more	
		Off-voltage/ current	4 VDC or less/1.5 mA or less	
		Impedance	2 k Ω	
		Response time	10 ms or less	
		Cable	Twisted-pair cable, 100 ms or less	