

**HITACHI**  
**S10 $\alpha$  SERIES**

# WIRING MANUAL

**2 $\alpha$**   
**4 $\alpha$**   
**SERIES**

Applicable to :  
HITACHI-S10/4 $\alpha$   
HITACHI-S10/4 $\alpha$  H  
HITACHI-S10/2 $\alpha$   
HITACHI-S10/2 $\alpha$  E  
HITACHI-S10/2 $\alpha$  H  
HITACHI-S10/2 $\alpha$  Hf

**HITACHI**

## **NOTE**

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## **SAFETY AWARENESS SUMMARY**

The following are general safety precautions which must be observed in the application, operation, and maintenance of this equipment. Failure to comply with these precautions or the other caution statements in the manuals violates safety standards of design, manufacture, and intended use. Hitachi assumes no liability for the user's failure to comply with these requirements. This summary, and the caution statements in the manuals, represent warnings of certain dangers of which we are aware. You, as the end user of the equipment, must follow these warnings and all other applicable precautions, including codes and laws, to achieve safe application and operation of this equipment.

### **Safety Disconnects**

As outlined in the manuals, you must provide means to disable the control and power circuits to guard against unexpected or sudden motion or energization of equipment during operation and maintenance. **NEVER WORK ON WIRING WHICH IS ENERGIZED.**

### **Care in Programming and Precautions Against Equipment Failure**

The user must follow procedures as indicated in the manuals and as dictated by sound engineering judgment. Mistakes in programming may result in sudden or unexpected motion or energization. To protect against programming errors or equipment failure, you must provide physical guards and cages to prevent physical contact with equipment, and back-up safety equipment independent of the programmable controller; the latter includes overspeed protection, overtemperature protection, and electro-mechanical stop switches. **NEVER DEPEND ON SOFTWARE OR CONTROLS TO PROTECT PERSONNEL WITHOUT PREPARING APPROPRIATE LOCKOUTS AND EQUIPMENT GUARDS.**

### **Warning Devices**

The user should provide audible and visual warning devices to warn persons to get clear of machines before they start. The user must properly program the programmable controller to operate these devices before the machine starts.

### **Environmental Requirements**

This equipment is not suitable for use in an explosive atmosphere. If inputs or outputs are wired to devices in an explosive atmosphere, you must insert appropriate approved electrical barriers in the wiring conduit, install the equipment in explosion—proof cabinets and wire the installation according to the appropriate electrical code (ex. National Electric Code.) The other environmental requirements in the manuals must also be met, otherwise equipment failure could cause personal injury or property damage.

### **Do Not Service or Adjust Internal Parts**

Personal injury may result from unauthorized servicing or adjusting parts inside the cabinets.

## **Prevent Spillage of Liquid onto the Equipment**

Personal injury could result if any liquid is spilled or poured onto this equipment. The equipment is general purpose (NEMA Type A) and not waterproof.

## **Prevent Entry of Foreign Matter into the Equipment**

Permitting metal chips and/or other foreign matter to enter the equipment could cause a short-circuit that could result in personal injury or property damage.

## **Keep the Plant Free of Vermin**

Rodents, like rats and mice, may chew on cables and equipment. This could cause personal injury or property damage.

## **Do not Install the Equipment Near Strong Magnetic Fields**

Operating the equipment near a strong magnetic field could cause malfunctions that could result in personal injury or property damage.

## **Protect From Shock and Vibration**

Subjecting the equipment to shock or vibration could cause malfunctions that could result in personal injury or property damage.

## **Dangerous Voltages**

Dangerous voltages are present whether the equipment is running or not. These voltages could be inside the programmable controller enclosure or in external control devices.

## **Danger of Manually Operating Limit Switches or Pushbuttons**

Never operate a limit switch by hand. The resulting motion could cause personal injury. If you plan to operate a limit switch, be certain that you are clear of any other moving parts, then use a long wooden pole. Do not operate a pushbutton during checkout or at any other time unless you are sure what action the pushbutton causes, and are sure nobody is near any part that might move or be energized unexpectedly.

### **"RUN/STOP" SWITCH CAUTION**

The "RUN/STOP" switch only stops execution of the ladder logic program or Hi-Flow program. Digital and analog outputs are left in the active state when execution stops, unless the optional rungs described in the CPU manual have been added. The "RUN/STOP" switch does not affect the operation of C-language or FA-BASIC language programs. Outputs can still be produced in response to C-language or FA-BASIC programs, or by the action of programmers typing in commands in these languages, while the "RUN/STOP" switch is in the "STOP" position.

**DO NOT DEPEND ON THE STOP SWITCH TO STOP MOVING PARTS OR TO PREVENT UNEXPECTED MOTION OR ENERGIZATION. USE HARDWIRED SAFETY STOPPING DEVICES, AS EXPLAINED IN THE CPU MANUAL. ALWAYS DISCONNECT AND LOCK OUT POWER AND CONTROL VOLTAGES BEFORE WORKING ON ELECTRICAL CIRCUITS OR PARTS THAT CAN MOVE.**

## General Specifications

Supply voltage	100-120 VAC, single-phase 50/60 Hz $\pm$ 4 Hz	
Supply voltage range	85-132 VAC	
Permissible duration of momentary power failure	10 ms or less (at rated input)	
Temperature	Operational	32 to 131 °F (0 to 55 °C)
	Storage	-4 to 158 °F (-20 to 70 °C)
Humidity	Operational	30-90% RH
	Storage	10-90% RH
Vibration resistance (Max)	0.6 G (1000 rpm)	
Impact resistance (Max)	10 G	
Electrical noise tolerance	Noise Voltage 1,200 Vpp Noise duration 1 $\mu$ sec Noise frequency 50 Hz	
Voltage resistance	1,500 VAC, 1 min. between each external AC terminal and case	
Insulation resistance	5 M $\Omega$ or more as measured with 500 VDC insulation resistance meter between each external AC terminal and case	
Resistance to ground	Less than 100 ohms	
Dust/gases	0.1 mg/m <sup>3</sup> or less; no corrosive gas permitted	
Cooling method	Natural cooling	

**Programming Terminal**  
**PSE $\alpha$  Specifications**

Supply voltage		100–120 VAC $\begin{smallmatrix} +10 \\ -15 \end{smallmatrix}$ % single-phase 50/60 Hz $\pm$ 4 Hz	
Power re- quirement	Continuous	130 VA	
	Surge	6,000 VA	
Temperature		Operational	Storage
		50 to 95 °F (10 to 35 °C)	23 to 122 °F (–5 to +50 °C)
Humidity		40–80% RH	10–98% RH
Vibration (Max)		0.5 G, 17 Hz vibration applied for 30 s	
Dust		0.1 mg/m <sup>3</sup> or less	
Dimensions	EL cover closed	400 W $\times$ 110 H $\times$ 350 D (mm)	
	EL cover open	400 W $\times$ 230 H $\times$ 350 D (mm)	
Weight		Approx. 4.5 kg (10 lb)	



## **PREFACE**

This manual explains the basic wiring connections for the HITACHI—S10 $\alpha$  Series. Please read the manual thoroughly before performing the connections.

Please refer to the individual manuals for the wiring of optional modules which are not explained in this manual.

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# 1 PRECAUTIONS FOR INSTALLATION AND WIRING

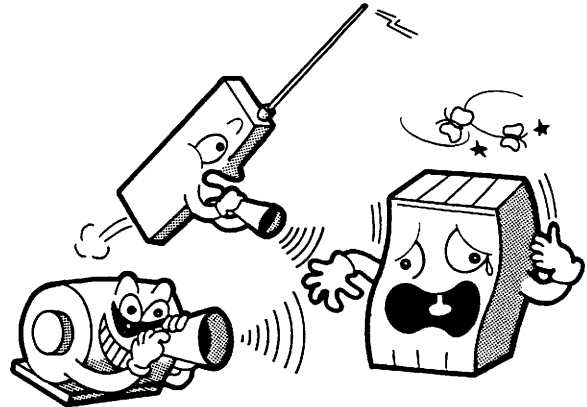
—BEFORE STARTING INSTALLATION AND WIRING—

## 1 PRECAUTIONS FOR INSTALLATION AND WIRING

**Be sure to read this before performing the installation or wiring of the PCs.**

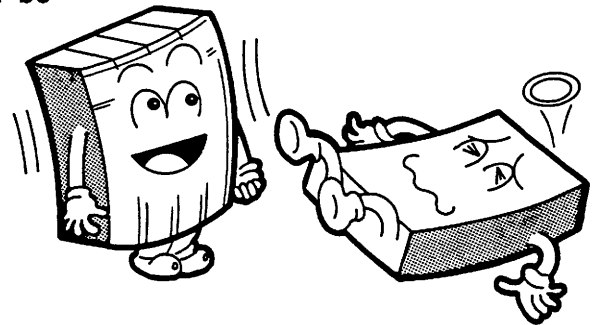
Separate the equipment from noise sources.

- Reflected noise from noise generating equipment can cause faulty operation of the PCs.



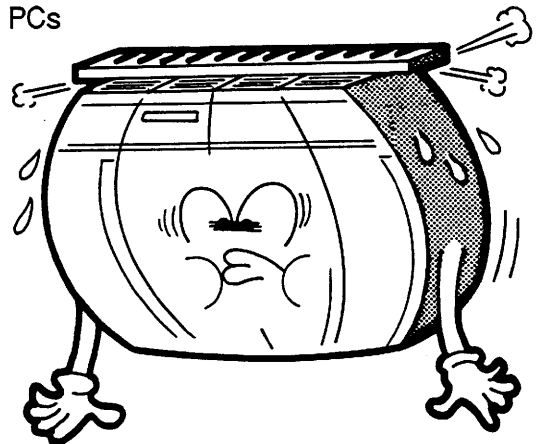
Mount the unit vertically.

- When mounted horizontally, the ventilation is poor, and the life of the power supply can be shortened.



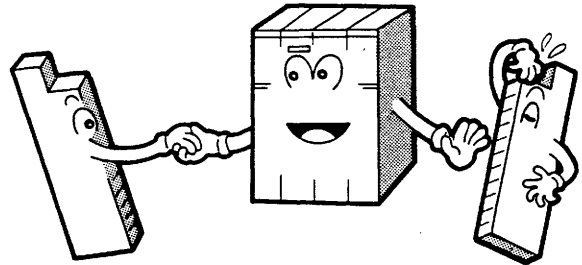
Mount so that the ventilation slots are not blocked.

- The reason is the same as the one above. Refer to Chapter 3 "Maximum and Minimum PCs Unit Spacing".



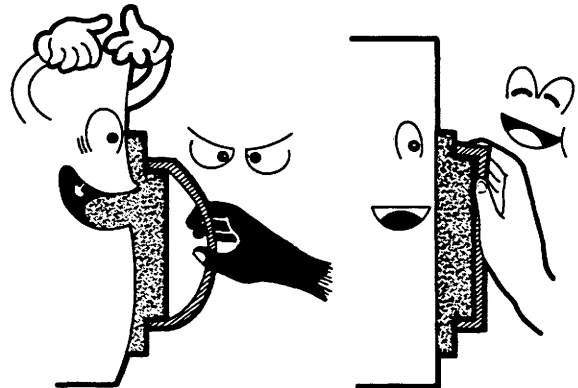
Use the correct terminal block for the module.

- There are terminal blocks with 40 points and terminal blocks with 20 points. Refer to the appropriate table in Chapter 3 "Terminal Blocks and Applicable Modules"



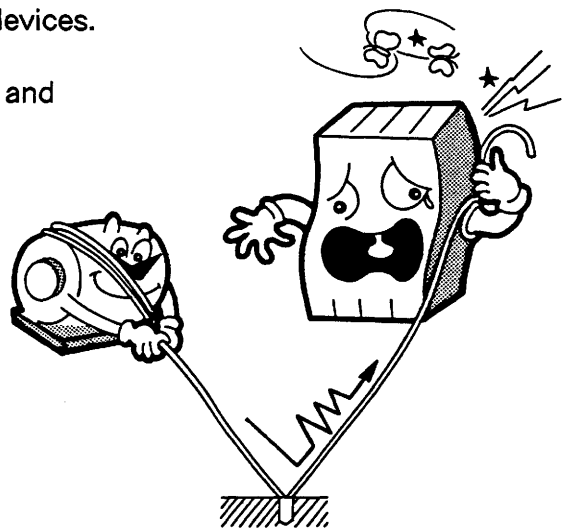
Do not force the terminal block cover when removing it.

- The cover may be damaged if forced. For the correct removal method, refer to Chapter 3 "Terminal Block Cover Removal Method".



Ground the module properly.

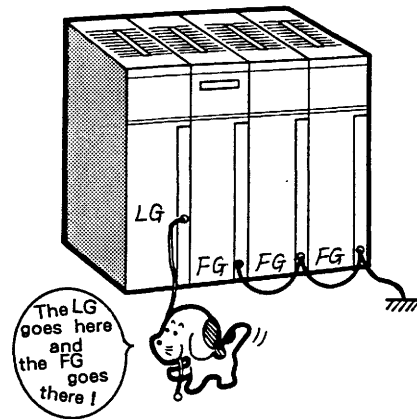
- Do not share a ground with high-voltage devices.
- Use a grounding of Class 3 or higher. Refer to Chapter 3 "Power Supply Wiring and Grounding".



## 1 PRECAUTIONS FOR INSTALLATION AND WIRING

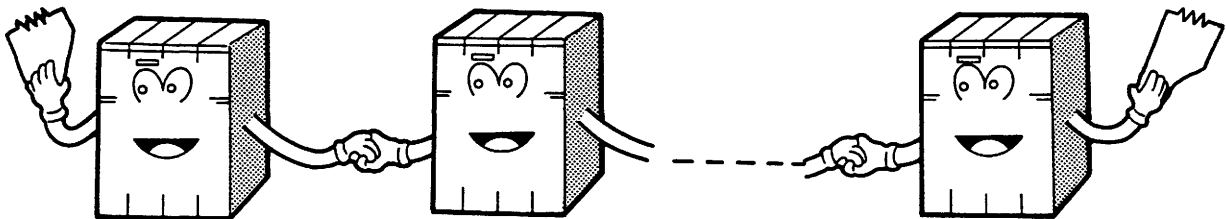
### Separate LG and FG.

- Noise from power supplies can enter the FG through the LG and cause faulty operation.
- Ground the LG on the power supply side.



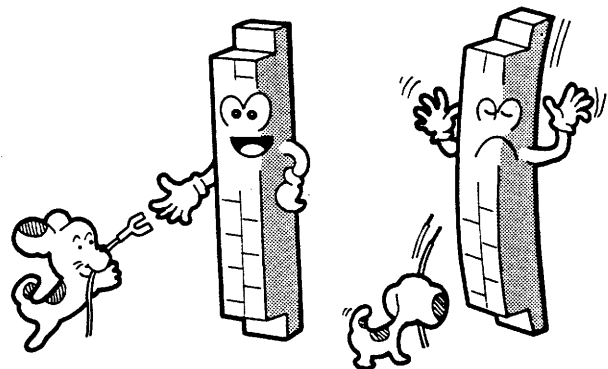
### Always use terminating resistors.

- Terminating resistors are necessary for the link circuit between the remote I/O and the CPU. For details, refer to Chapter 3 "Installing Terminating Resistors on the Link Between Remote I/O and CPU"



### Use solderless terminals for connections to the terminal blocks.

- Connections made with bare wires may not hold.

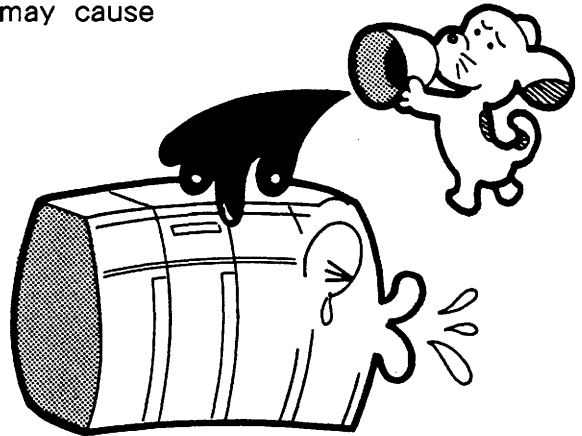




## 1 PRECAUTIONS FOR INSTALLATION AND WIRING

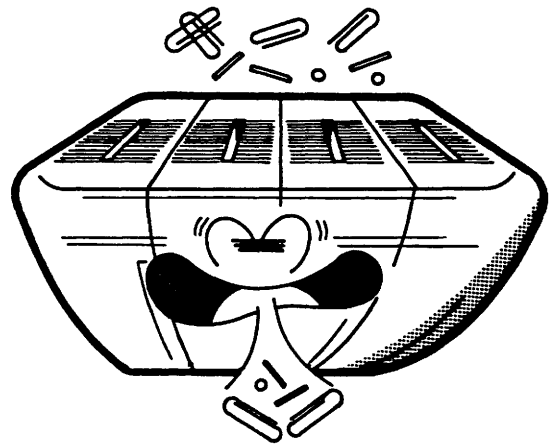
Keep liquids off the modules.

- The units are not waterproof, and liquids may cause problems.



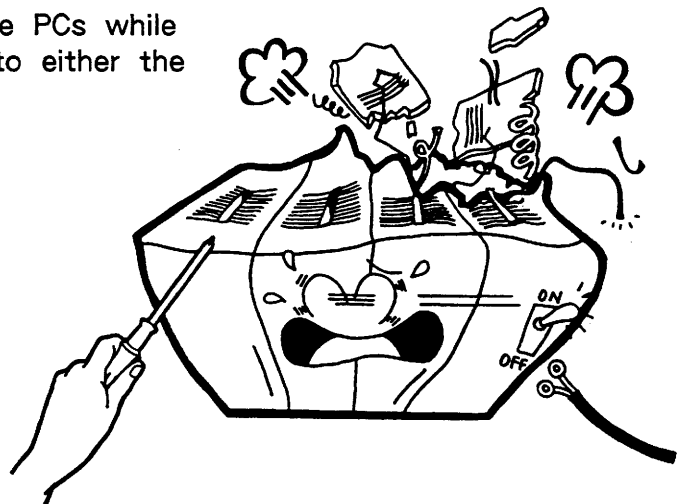
Keep metal particles and other foreign substances out of the modules.

- They could cause problems due to short circuits.



Do not perform wiring or connections to the PCs while the power is turned on.

- Performing wiring or connections to the PCs while the power is on could cause damage to either the hardware or the software or both.



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## **2    EXAMPLES OF WIRING**

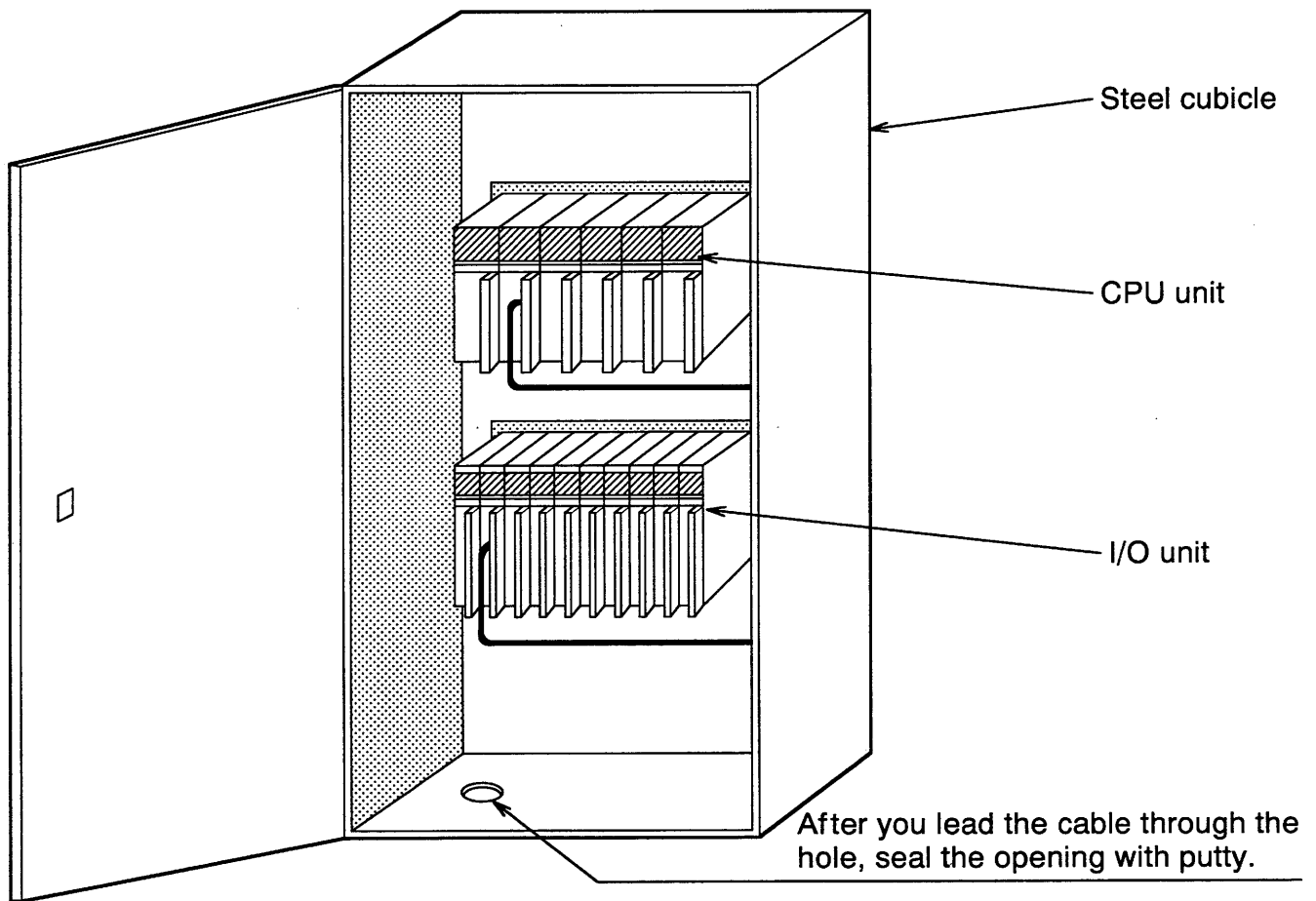
**—THIS IS HOW THE WIRING IS DONE—**

# 1 Centralized Installation

## ■ Precautions for Installation

### Installation

The HITACHI - S10  $\alpha$  Series unit and I/O unit are not fireproof, dustproof, or waterproof. Mount the CPU unit and I/O unit in a steel cubicle.



## Environment

When you use the PCs, take care so that temperature, humidity, atmosphere, and other environmental parameters adhere the restrictions listed below.

Parameter	Restrictions
Temperature	0 to 55°C
Humidity	30 to 90%RH (no condensation)
Atmosphere	No corrosive gas
Vibrarion	None
Shock	None

Check about twice a year that the PCs is being used in the correct environment.

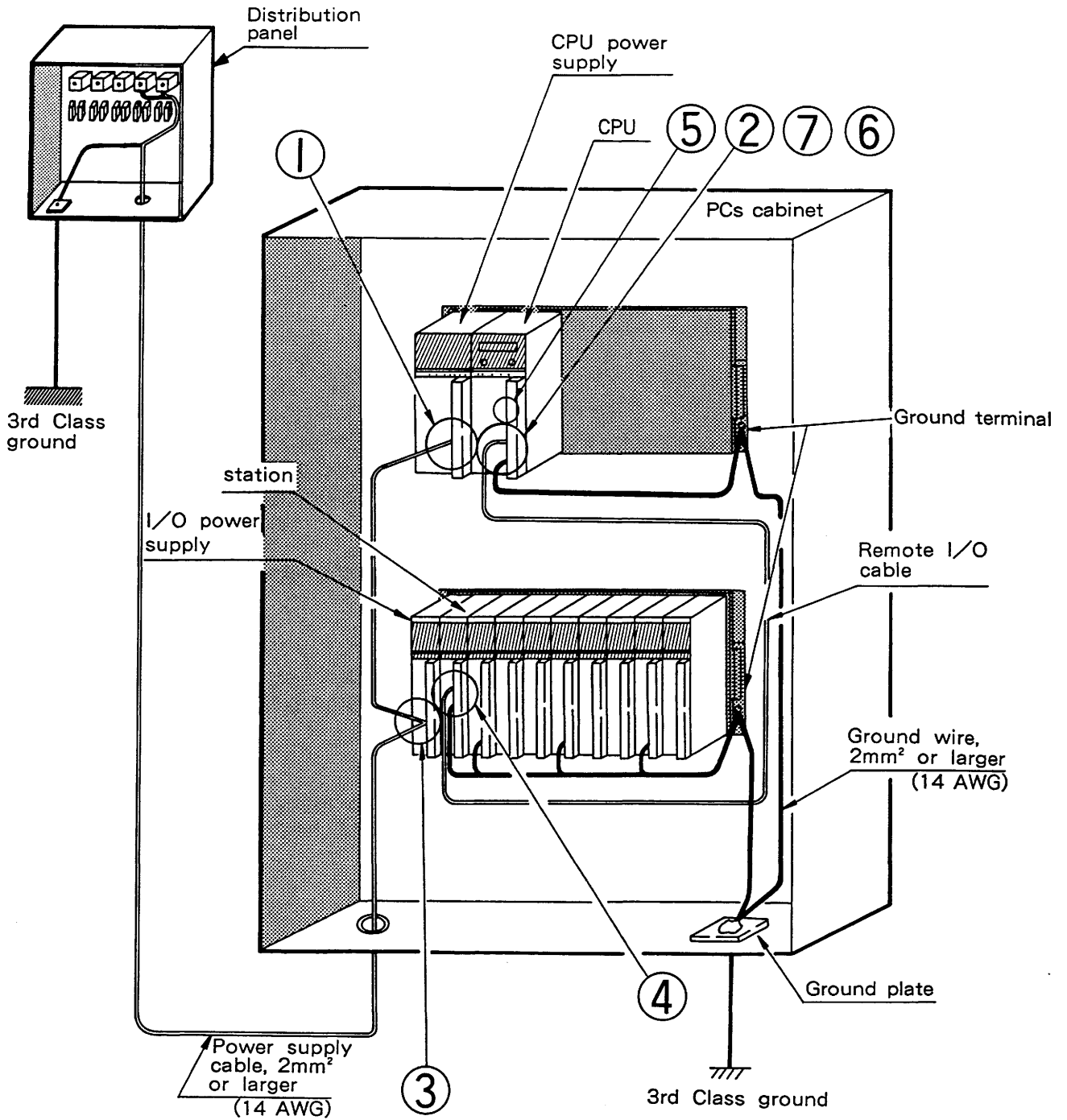
## Inspection

To keep an optimized environment for the HITACHI - S10  $\alpha$  Series, check the following items daily or periodically (about once a year ). Sealing putty will be cured for two or three years. Cured putty results in poor sealing. Perform sealing again.

- **Appearance of the modules**  
Check each module case for cracks and similar defects. If the case has defects, internal circuits may be damaged, causing a system malfunction.
- **Mounting screws and terminal block screws**  
Check whether the screws securing the modules and terminal block screws are firmly tightened. If not, re-tighten them. Loose screw may cause a system malfunction or damage due to heat.
- **Sheaths of the cables and power cord**  
Check the sheaths of the cables and power cord for abnormalities. If sheaths are peeled off, a system malfunction, an electric shock, or damage due to a short-circuit may occur. Sufficiently insulate the unconnected terminals with tape.
- **Dust buildup**  
Check the modules for dust buildup. If dust is built up, remove it with a vacuum cleaner. Dust buildup may cause internal circuit to be shorted. This may further cause damage to these circuits.
- **Power supply voltage**  
Check that the power supply voltage is within 85 to 132 VAC. A power supply voltage outside this range may cause a system malfunction.
- **Protective fuse**  
Check that a fuse is installed for protection against load short-circuit of output modules. Be sure to install a fuse appropriate to the rating of the load. If a fuse is not installed or the rating of the installed fuse is inappropriate when a load short-circuit occurs, output modules may be damaged.

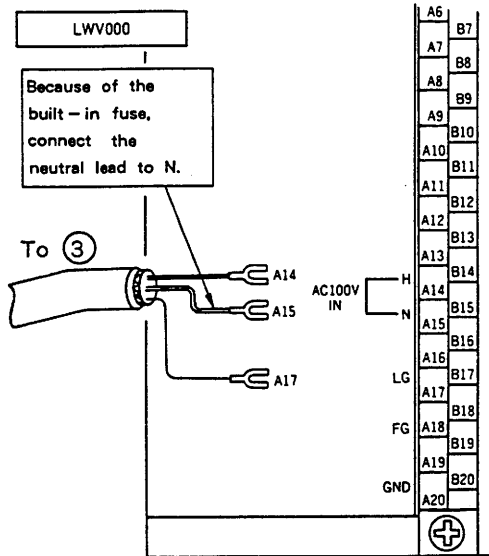
## 2 EXAMPLES OF WIRING

### ■ Centralized Installation of 2 $\alpha$ , 2 $\alpha$ E, 2 $\alpha$ H

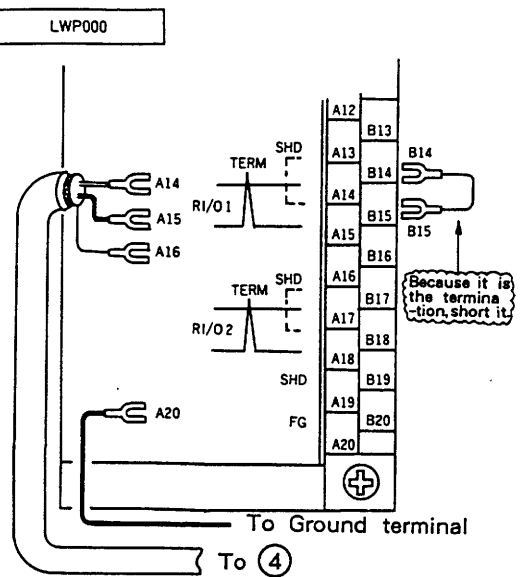


Terminal Block Connection Methods

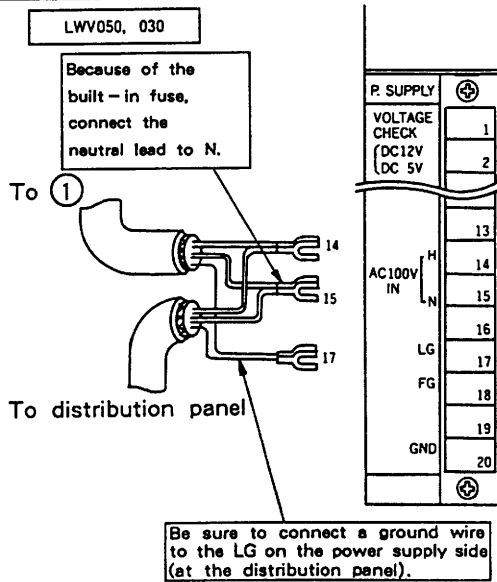
① CPU Power Supply Wiring



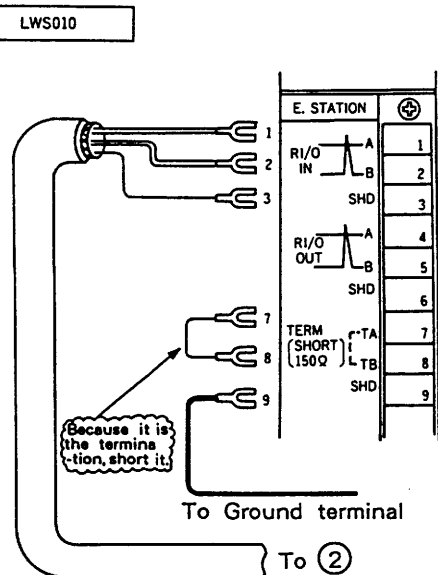
② Remote I/O Wiring (CPU Module Side)



③ I/O Power Supply Wiring

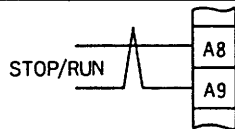


④ Remote I/O Wiring (Station Module Side)

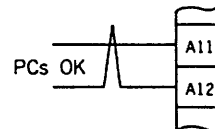
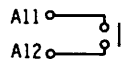


⑤ STOP/RUN, PCs OK Wiring (CPU Module)

When A8 is shorted to A9, the CPU stops.



The PCs OK output is a contact relay output.

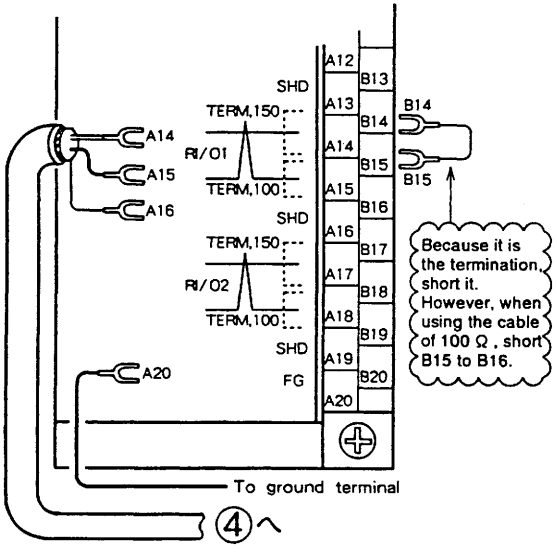


2 EXAMPLES OF WIRING

Terminal Block Connection Methods (Continued)

⑥ Remote I/O Wiring (CPU Module Side)

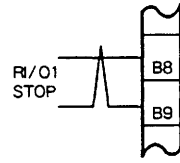
LWPO40,07X



⑦ Remote I/O STOP Wiring

LWPO40,07X

When B8 is shorted to B9, the remote I/O transfer stops.

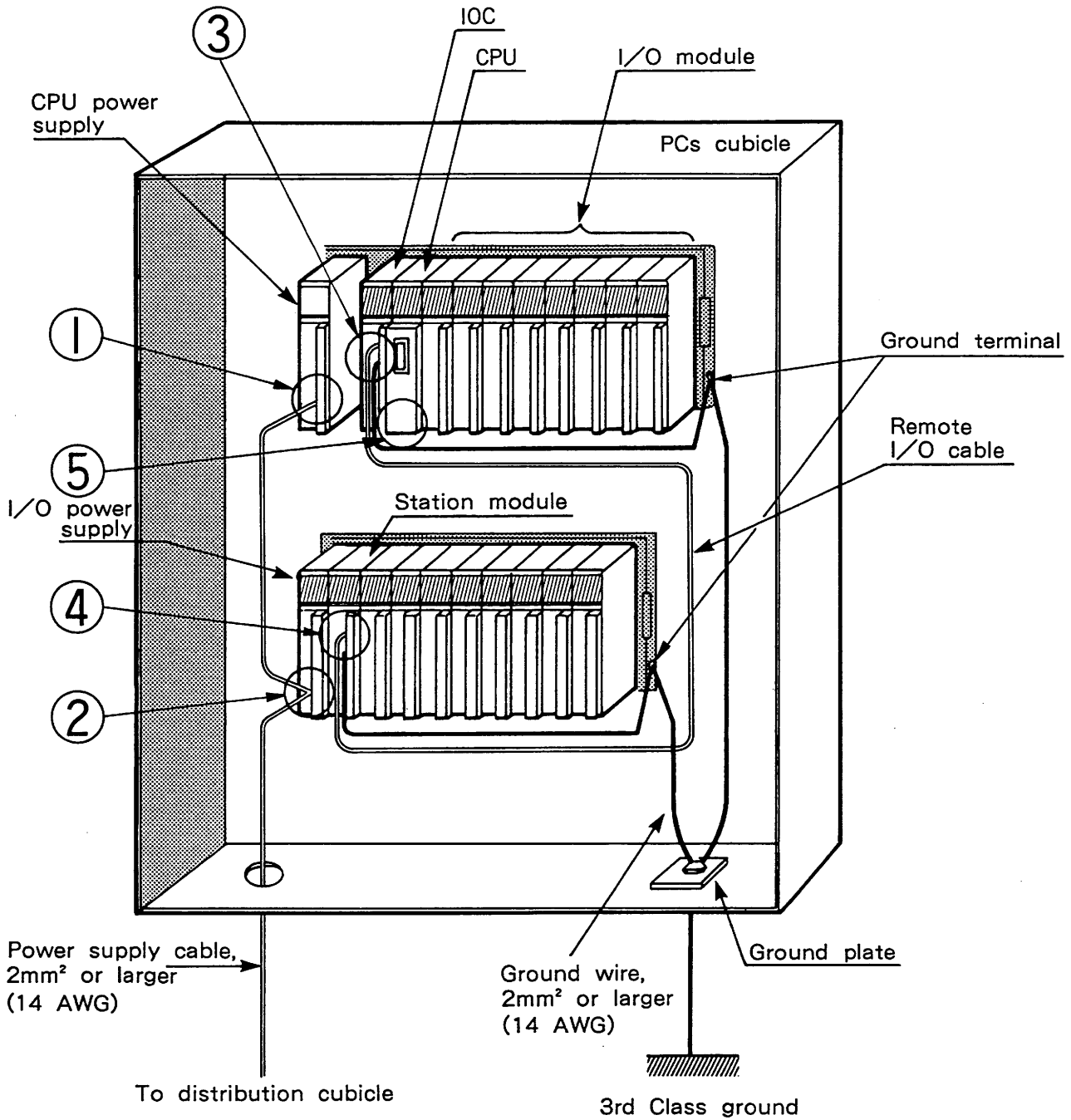




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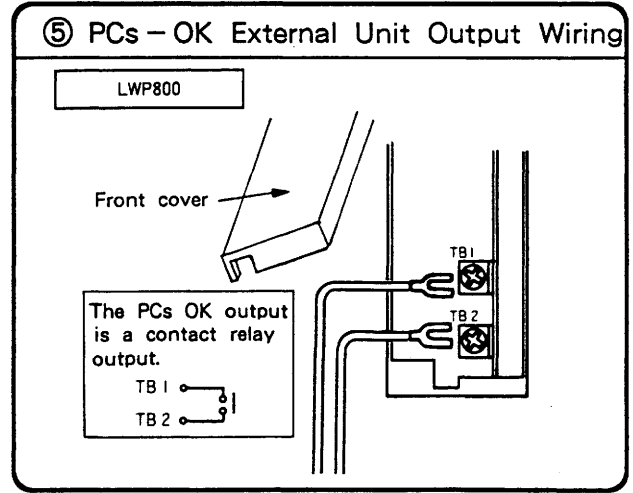
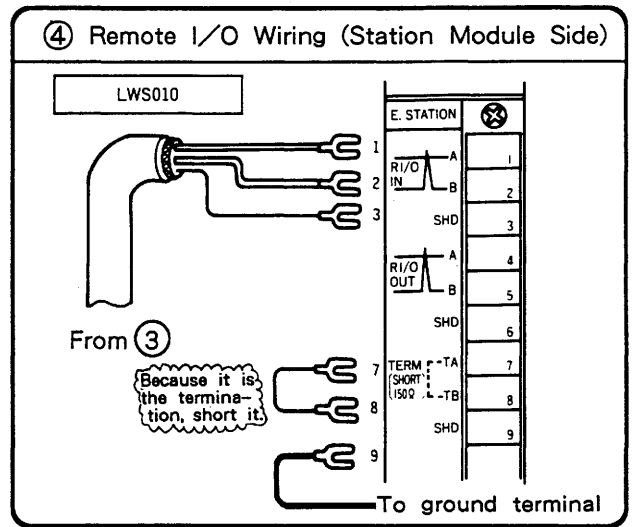
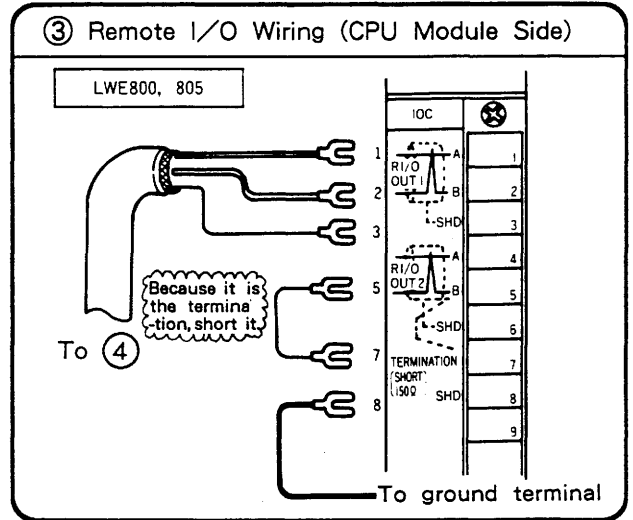
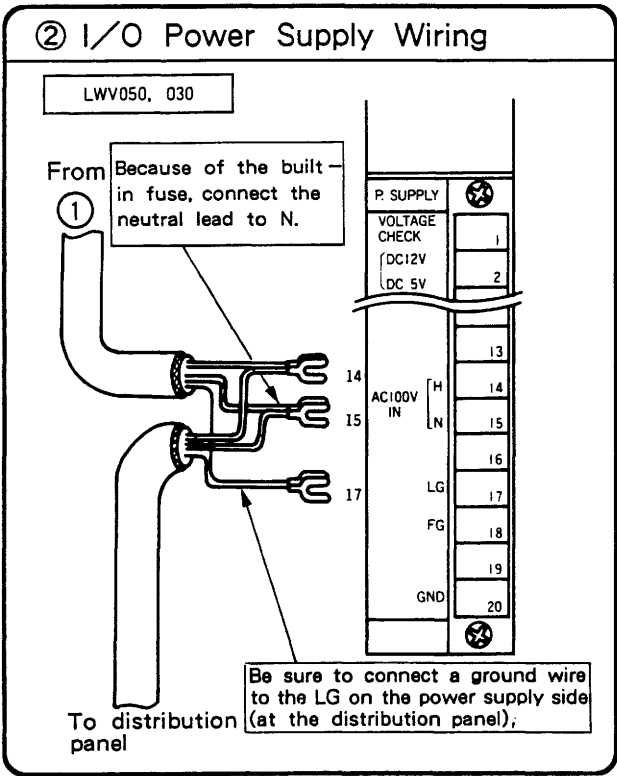
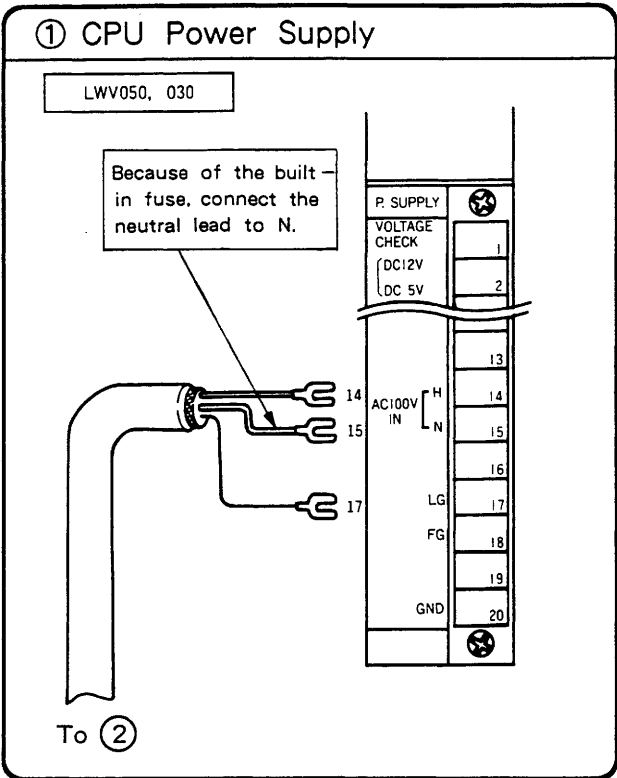
2 EXAMPLES OF WIRING

■ Centralized Installation of 4  $\alpha$

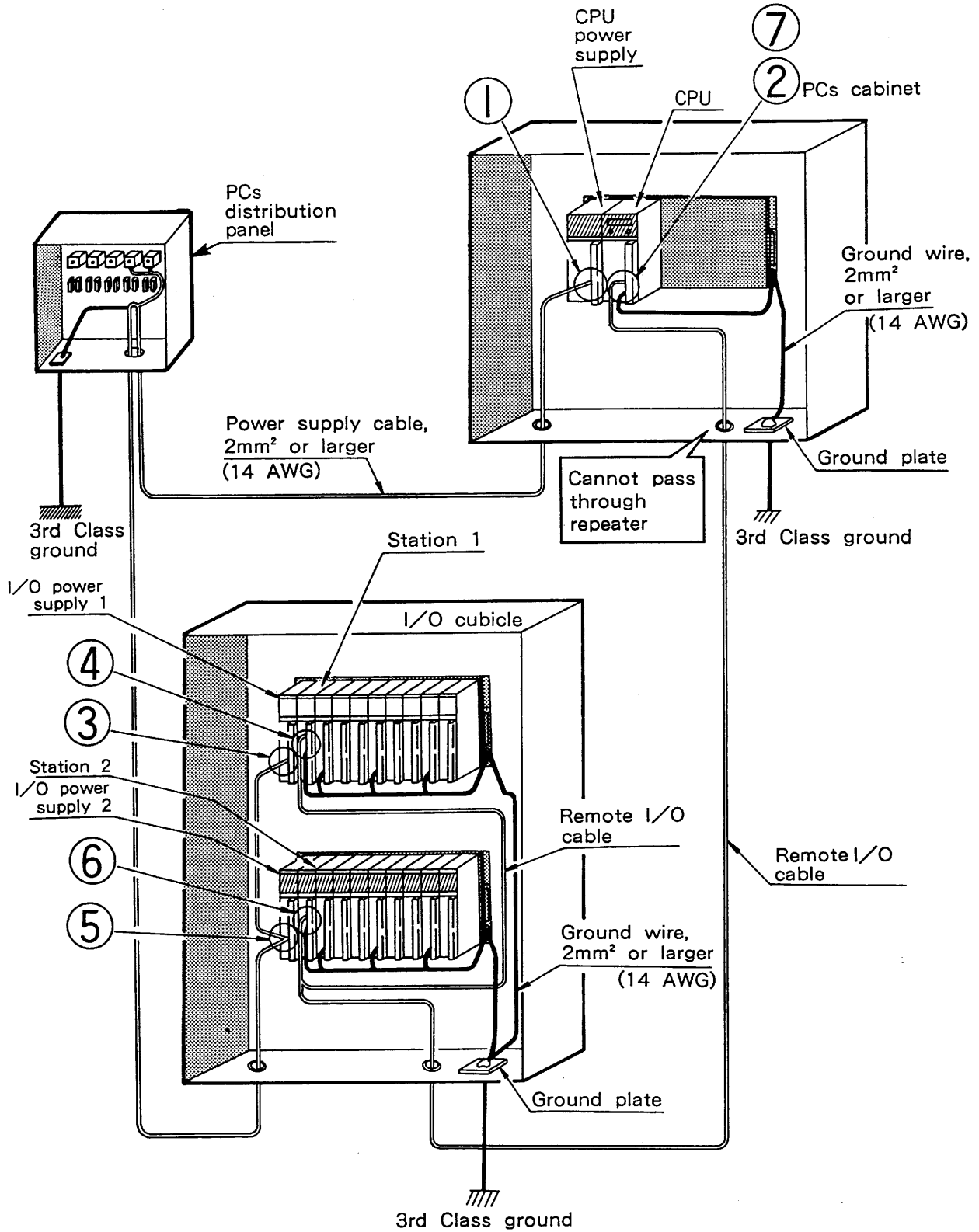


IOC : Extension I/O Interface Module  
(LWE800, LWE805)

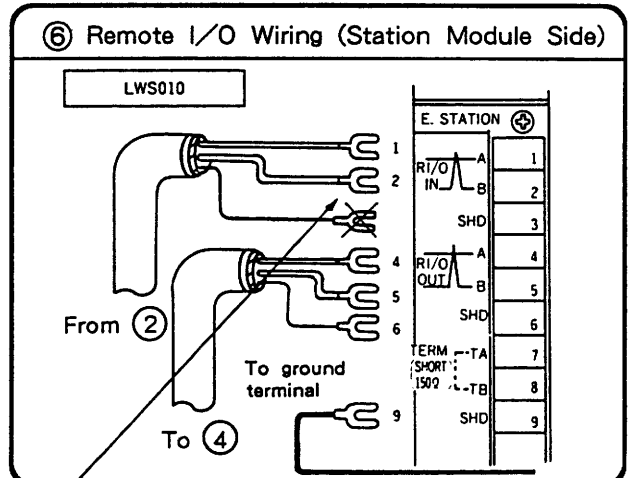
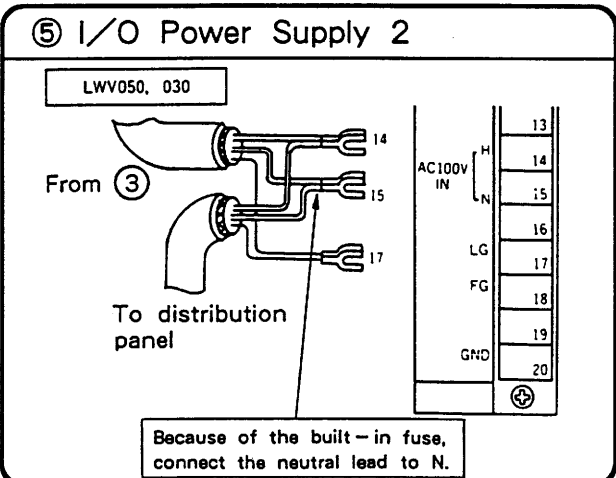
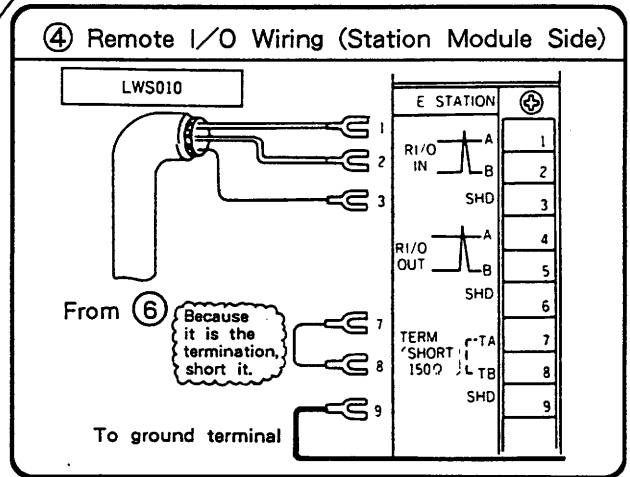
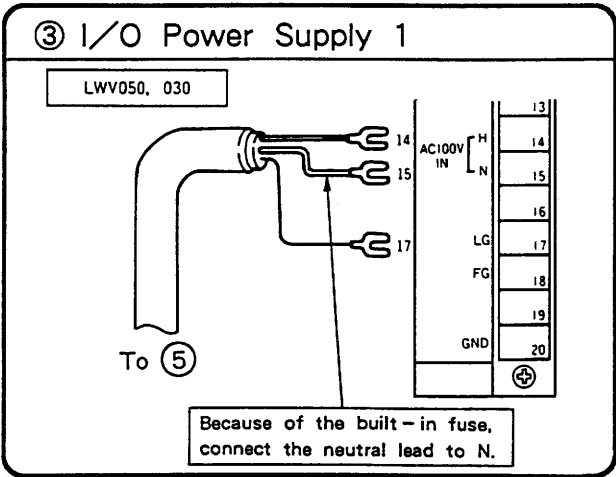
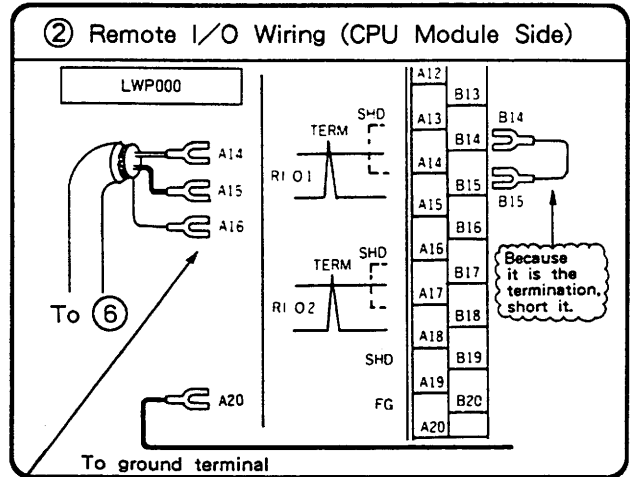
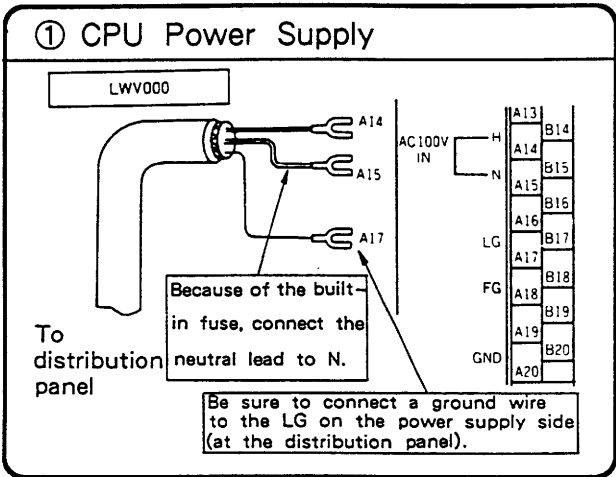
Terminal Block Connection Methods



2 Distributed Installation

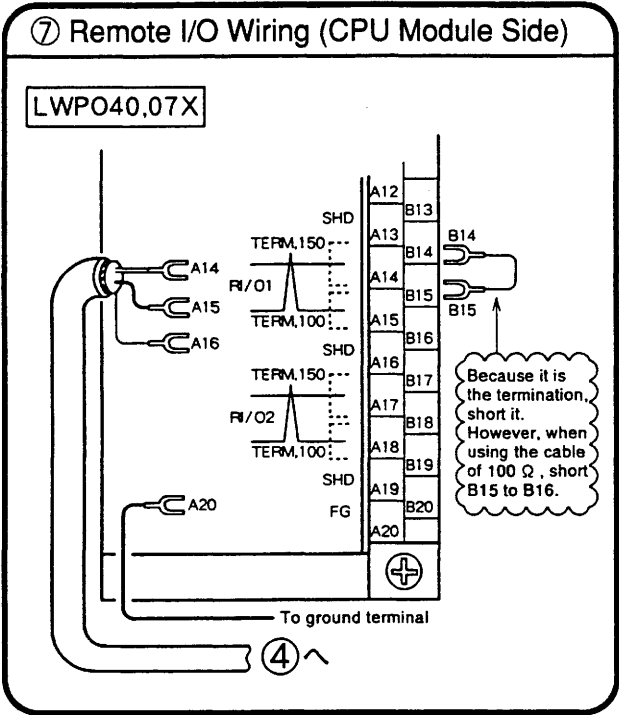


Terminal Block Connection Methods



When the connecting points are on separate panels and the ground cannot be connected to the same point, use one and as a ground.

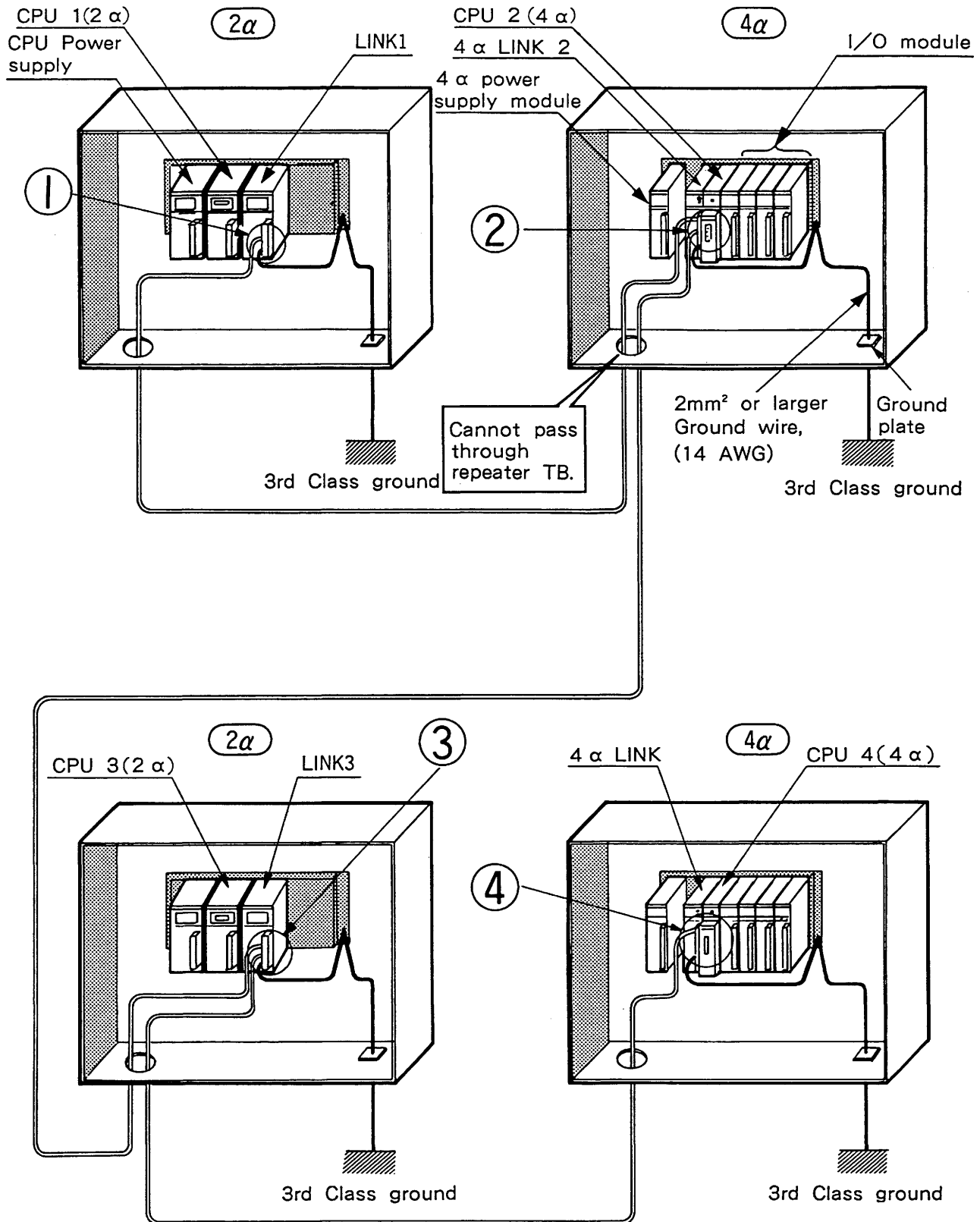
Terminal Block Connection Methods (Continued)



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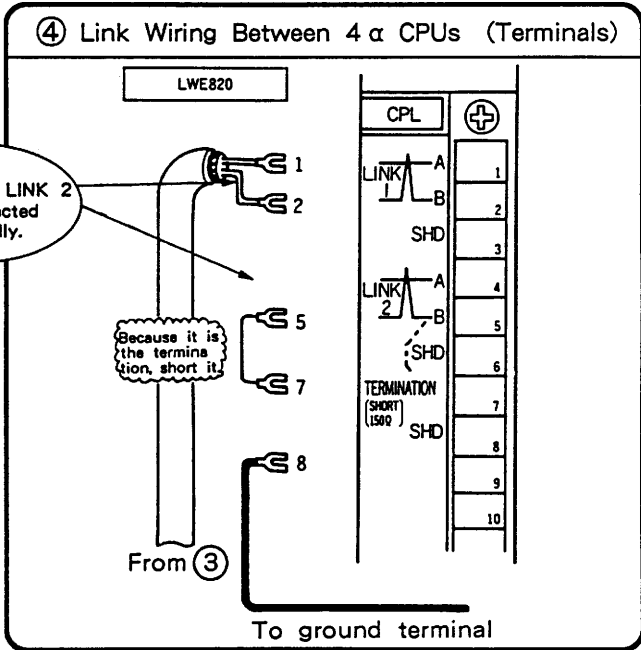
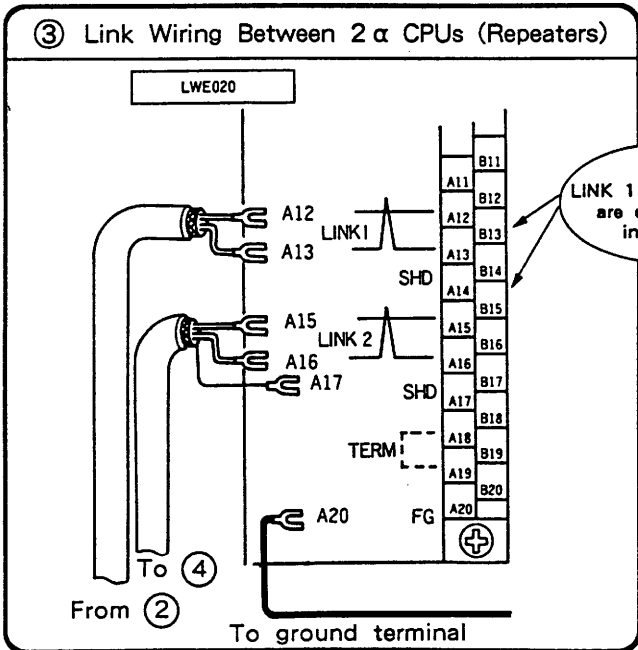
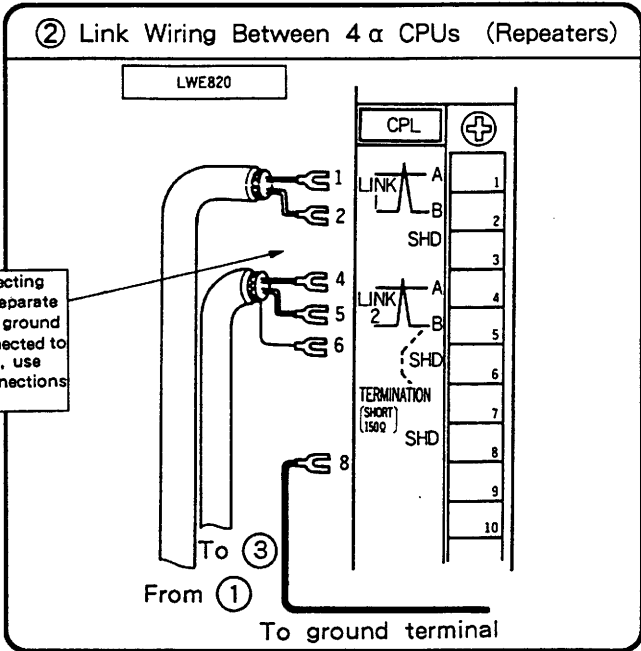
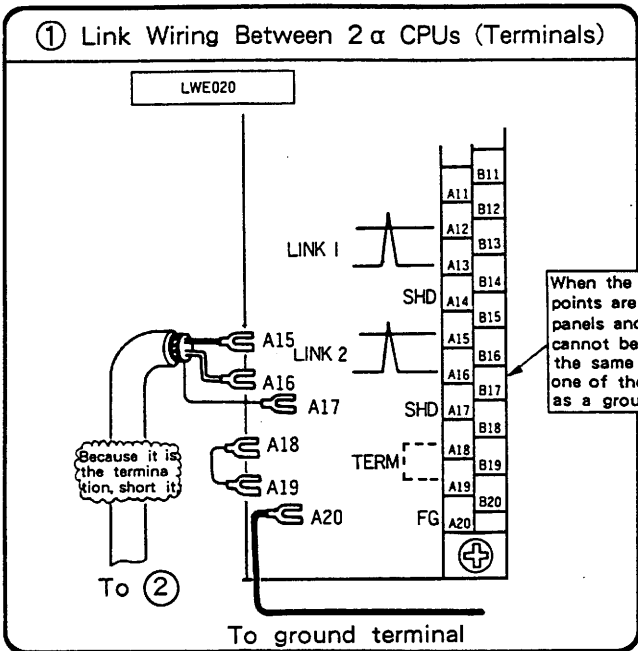
## 2 EXAMPLES OF WIRING

### 3 CPU Link



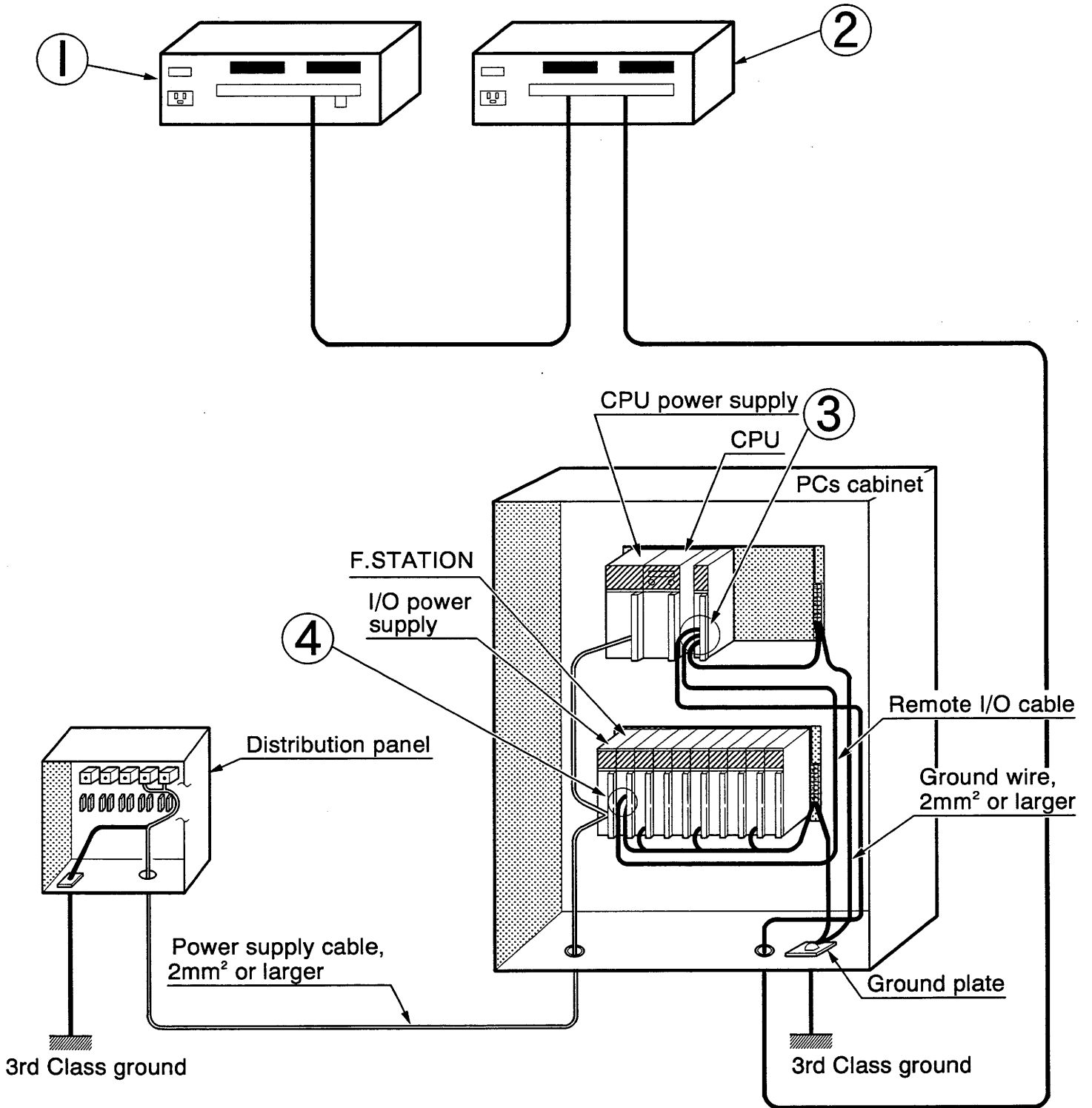


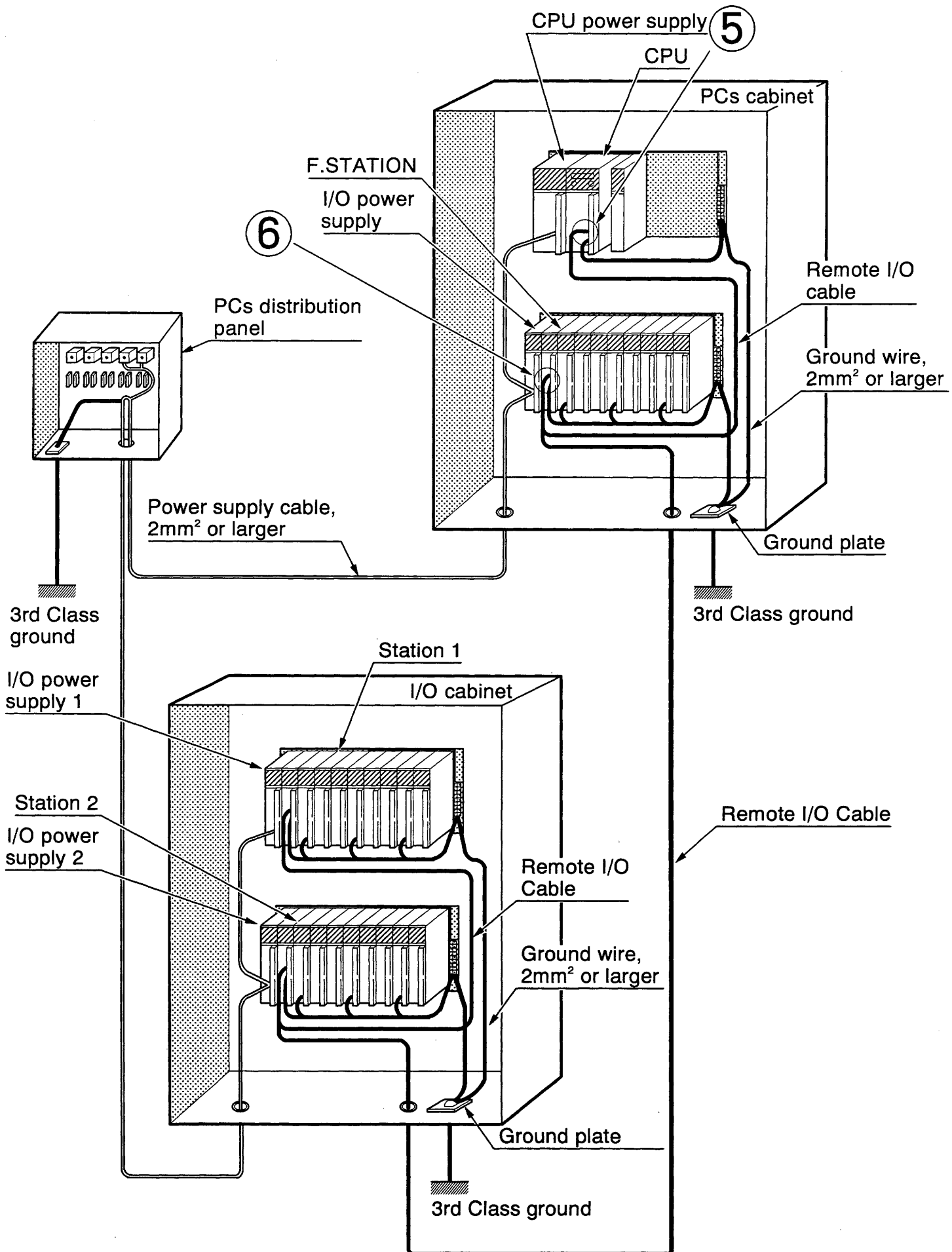
Terminal Block Connection Methods



The link modules installed between the end of a circuit (1 to 4 in the figure above) require cable termination. If the characteristic impedance of the cable is 150 Ω, termination can be performed by shorting the two terminals (Refer to the figure above).

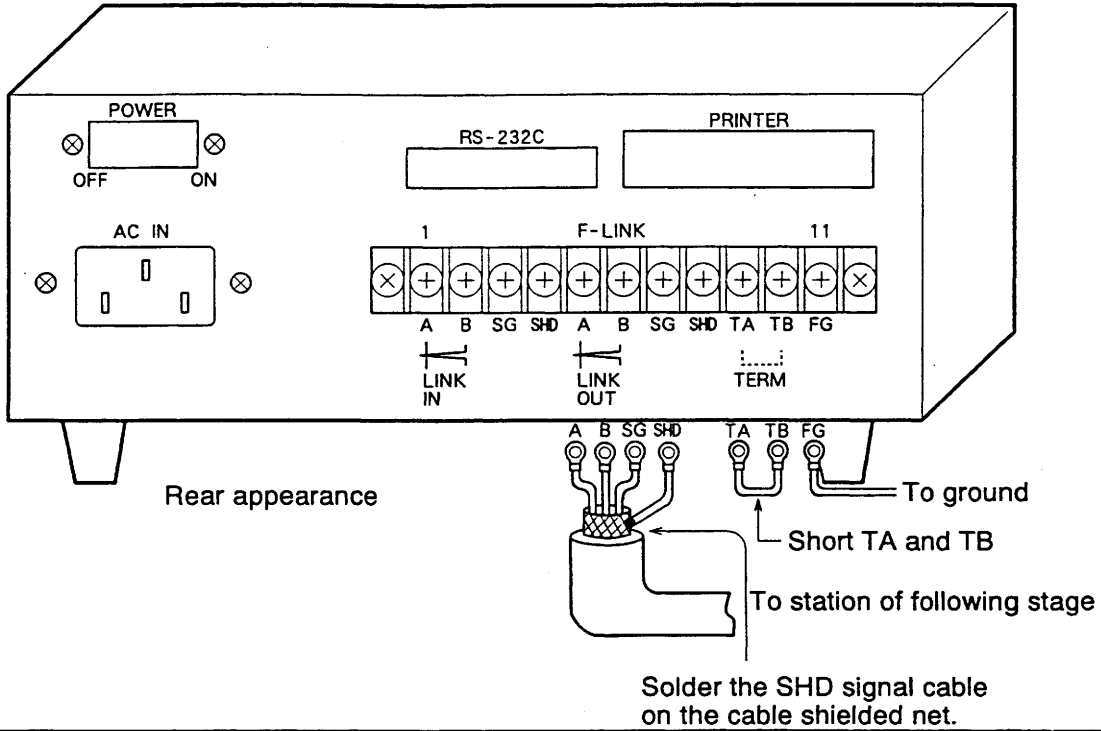
4 F.LINK



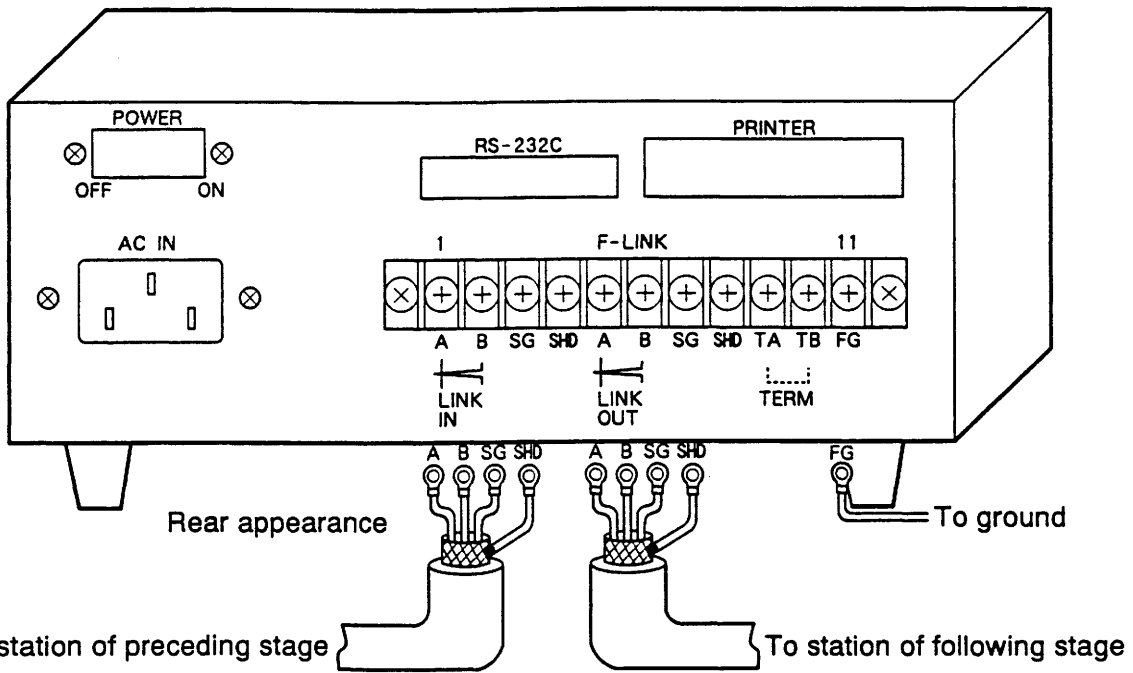


Terminal Block Connection Methods

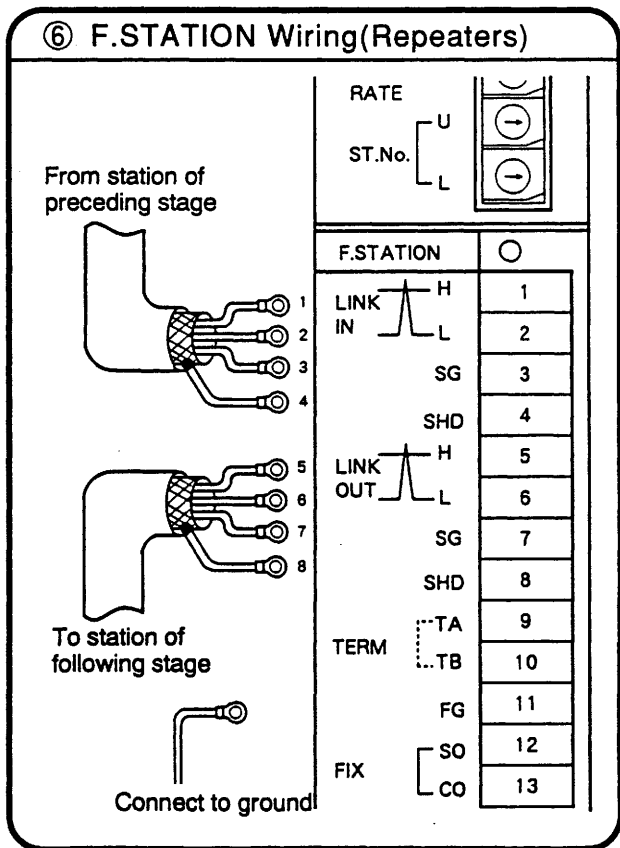
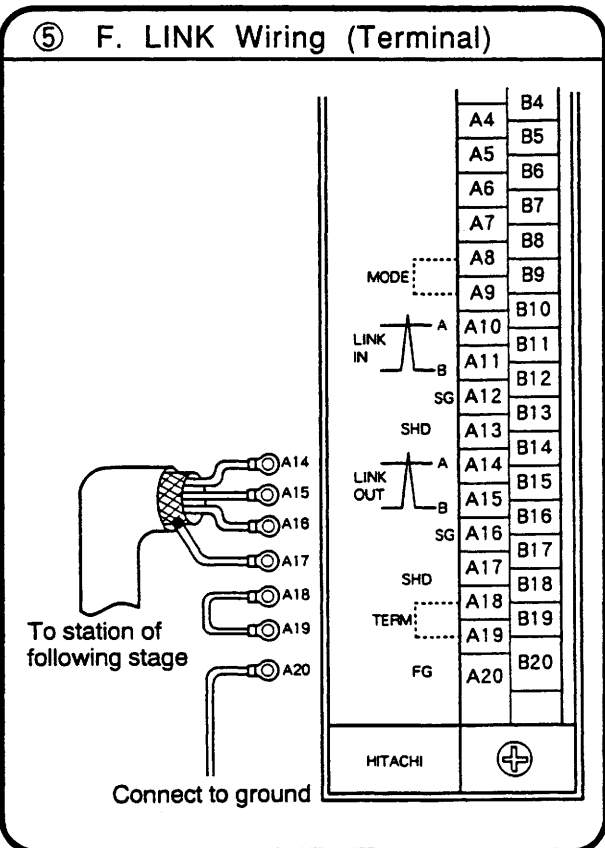
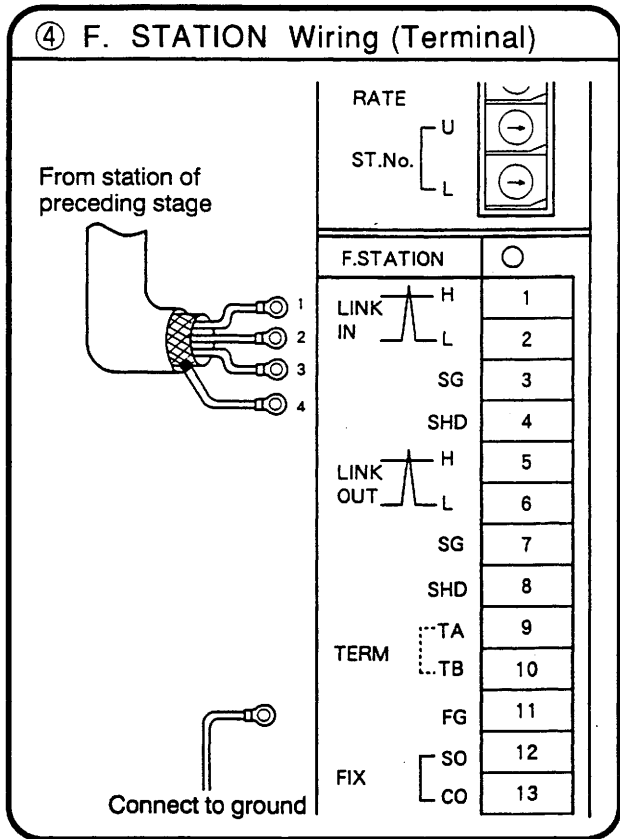
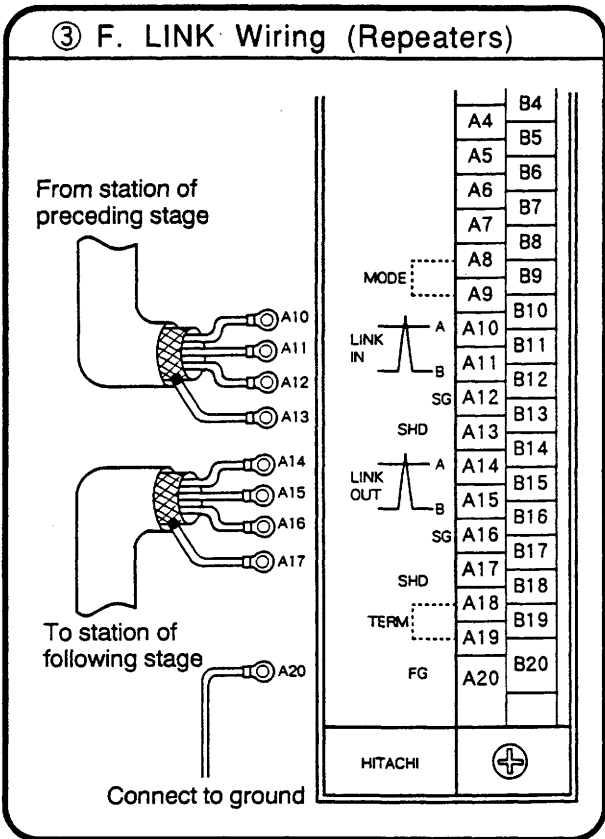
① RS-232C BOX Wiring (Terminal)



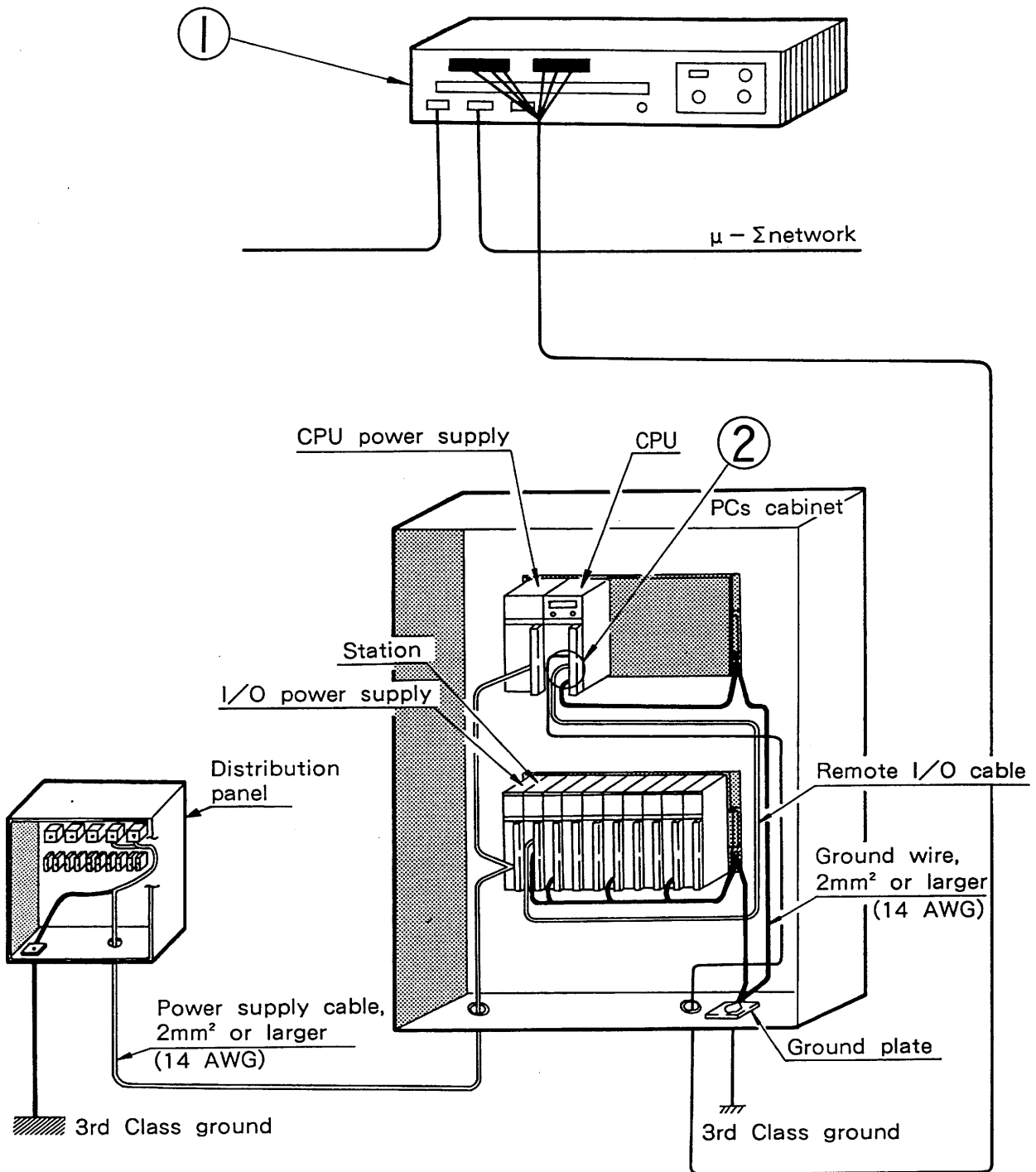
② RS-232C BOX Wiring (Repeaters)



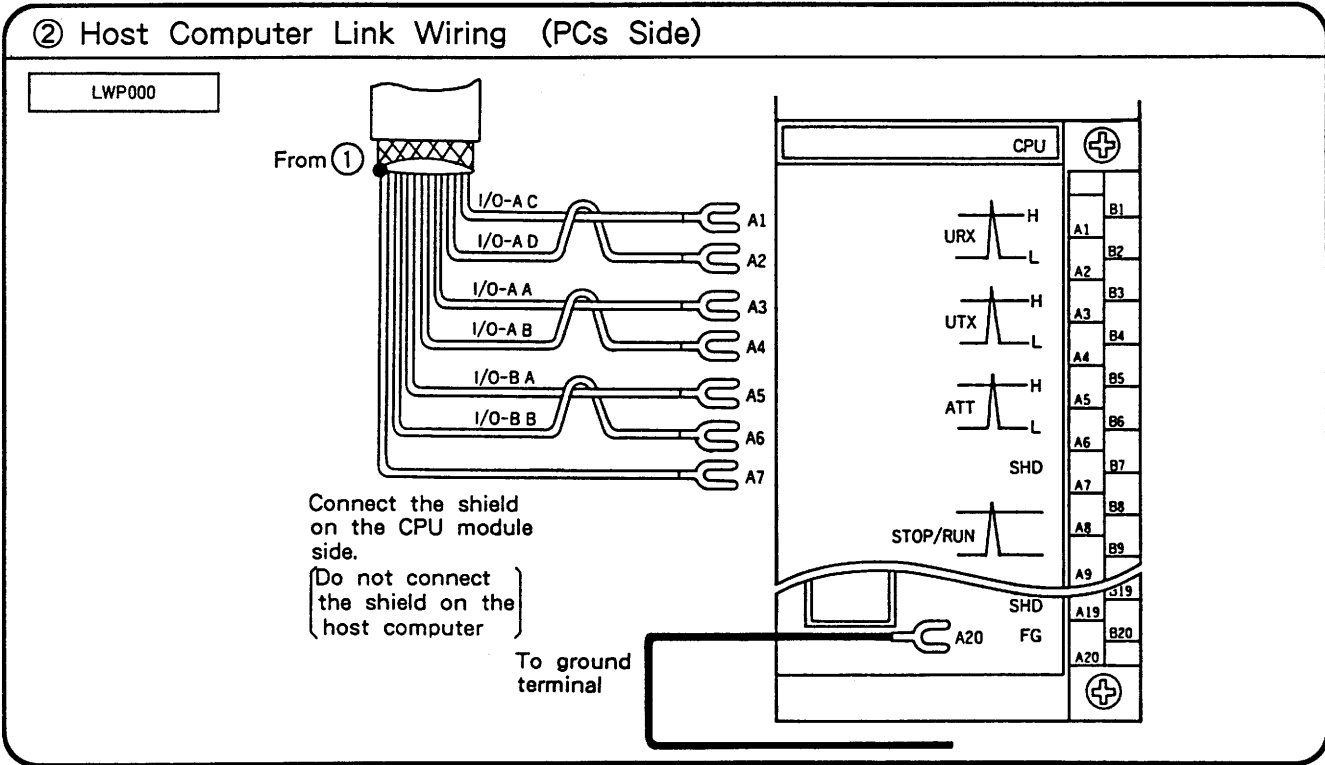
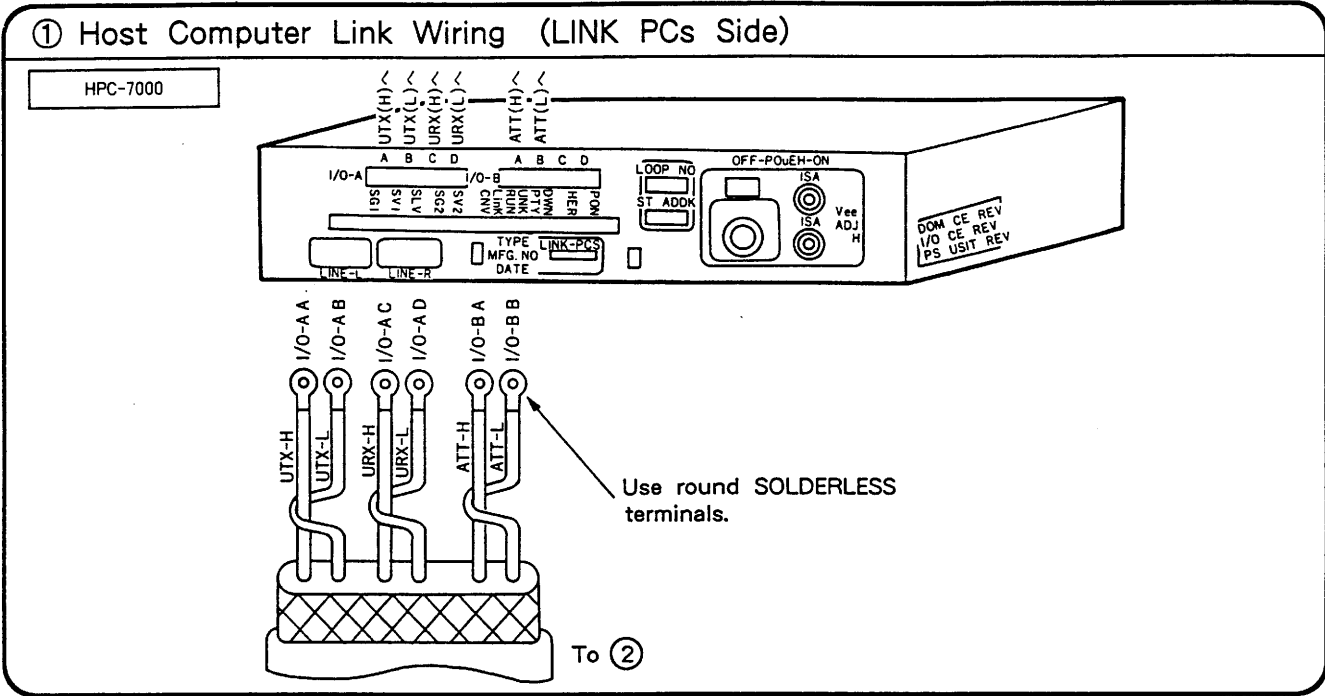
Terminal Block Connection Methods(Continued)



5 Host Computer Link (Link PCs with Interrupt)



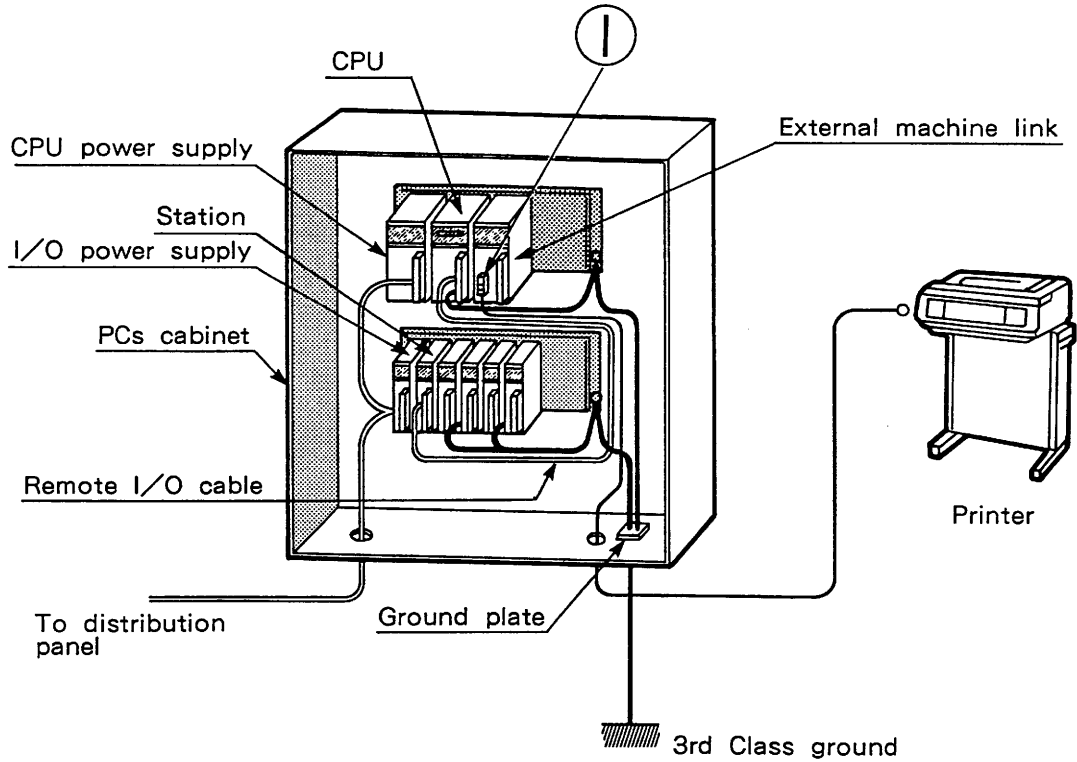
Terminal Block Connection Methods



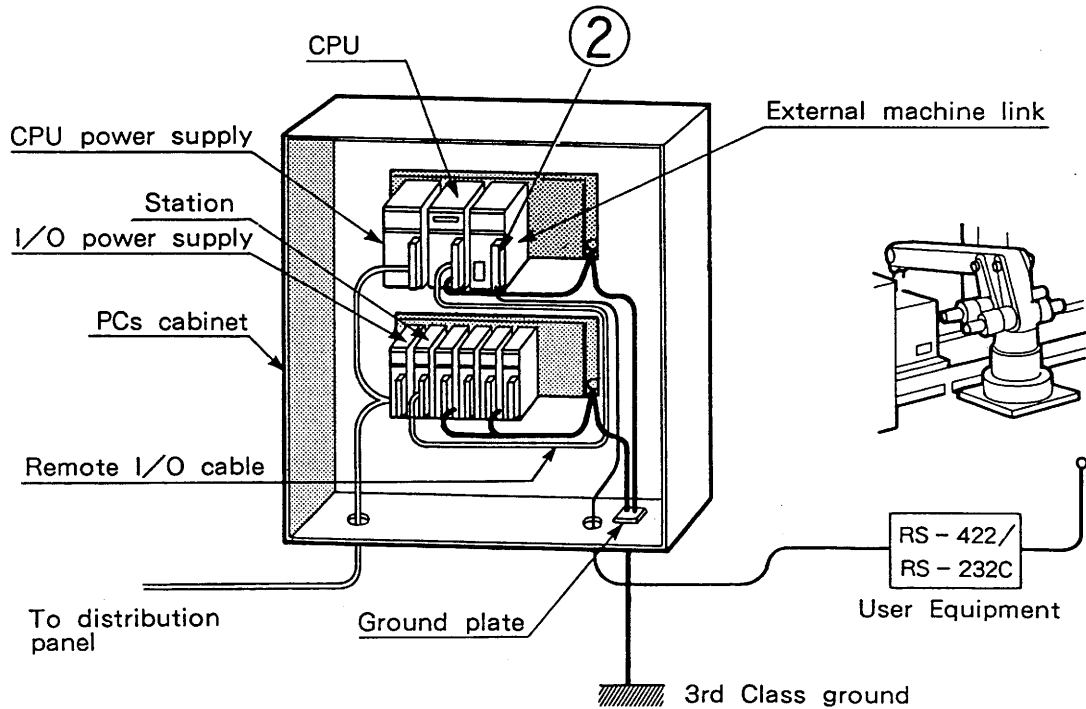
## 2 EXAMPLES OF WIRING

### 6 Links with External Machines

#### ■ RS - 232C Interface



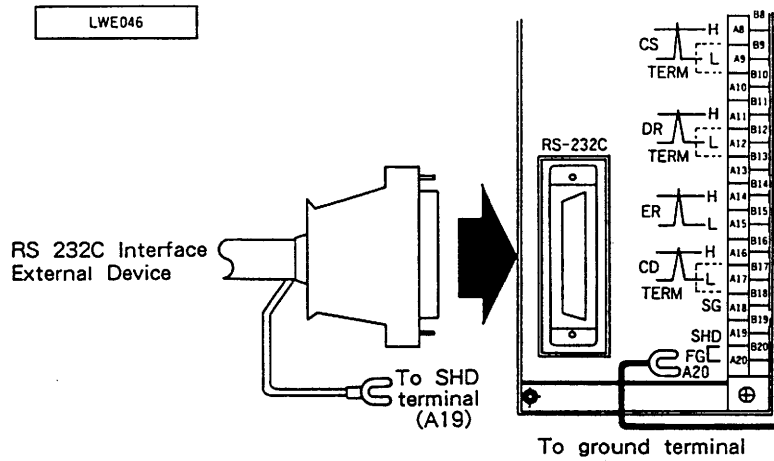
#### ■ RS - 422 Interface



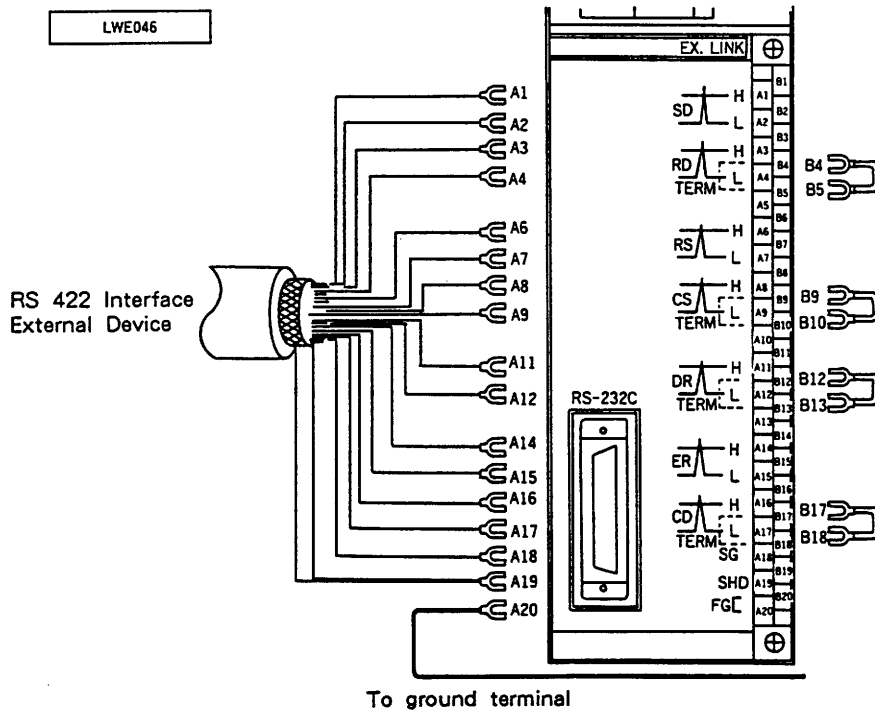


Terminal Block Connection Methods

① RS - 232C Interface Wiring

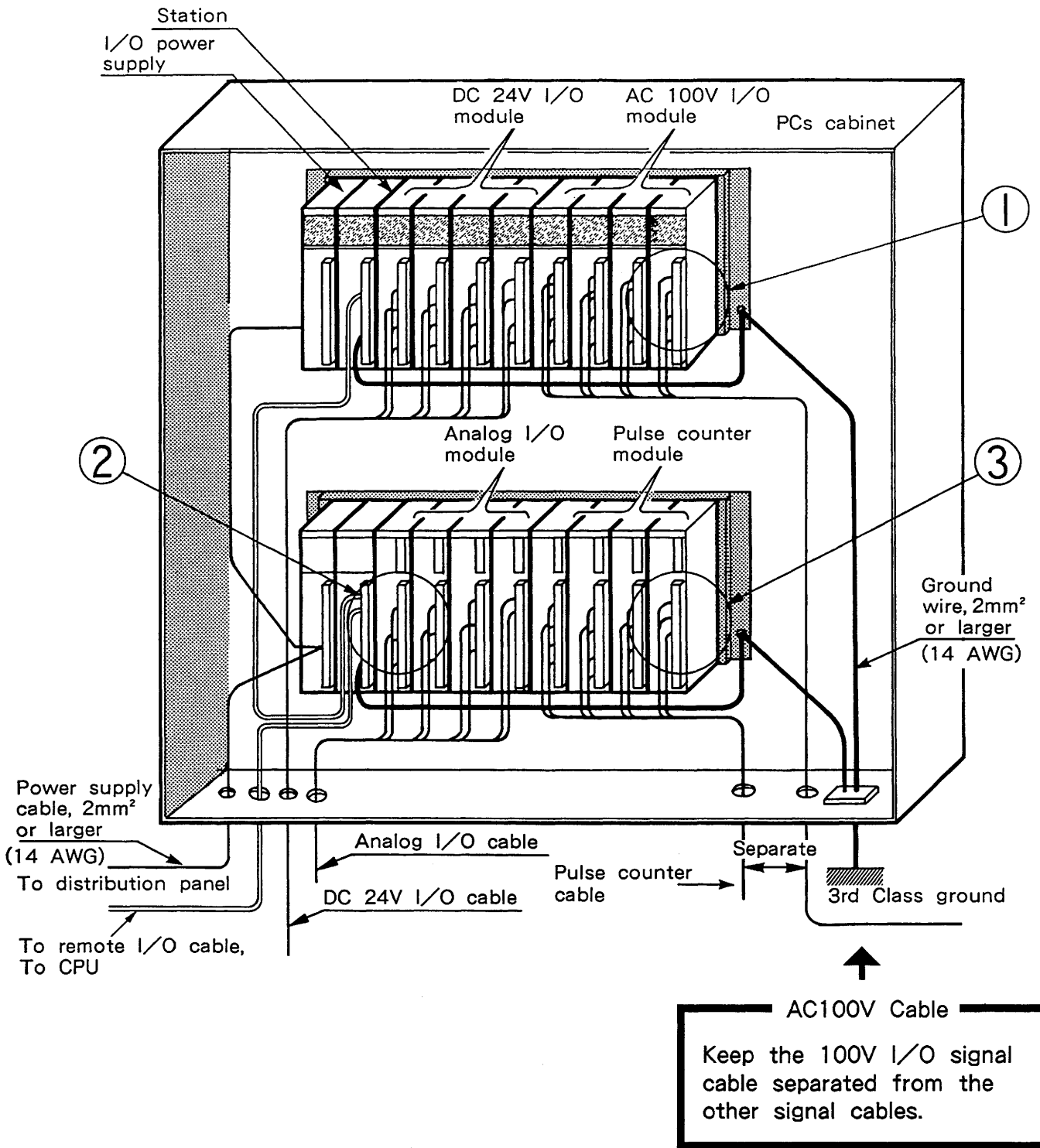


② RS - 422 Interface Wiring



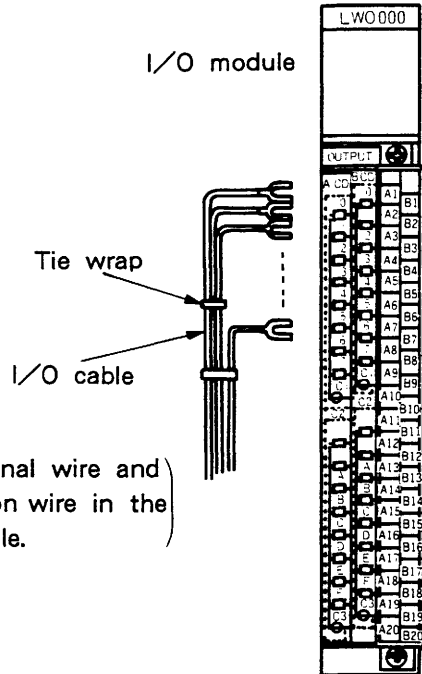
- Notes (1) Be sure to connect the signal grounds (SG) together in the interface cable.
- (2) Be sure to connect the interface cable shields to the protective grounds (FG) at both ends.

**7** Input/Output



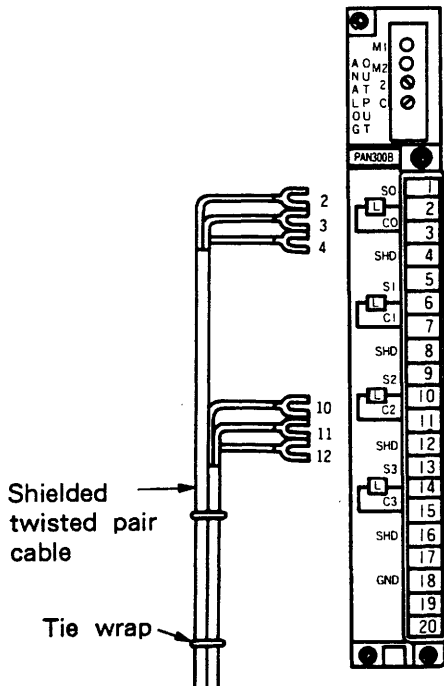
Terminal Block Connection Methods

① Digital I/O Wiring



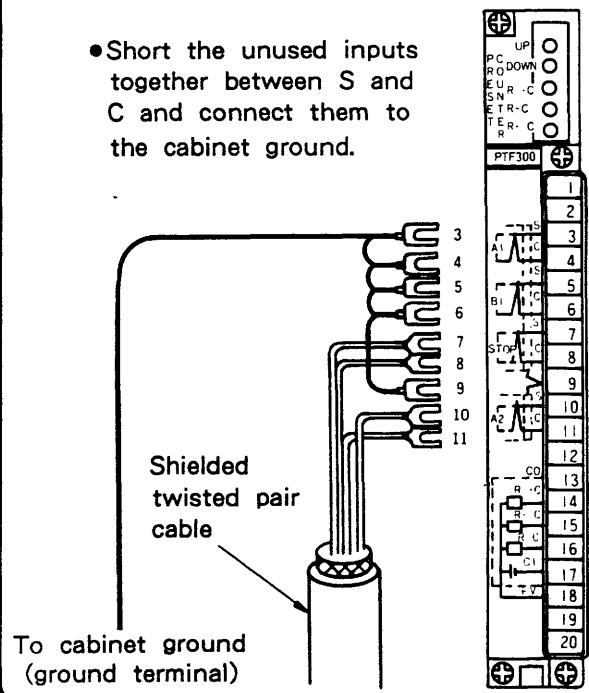
(Tie the signal wire and the common wire in the same bundle.)

② Analog I/O Wiring

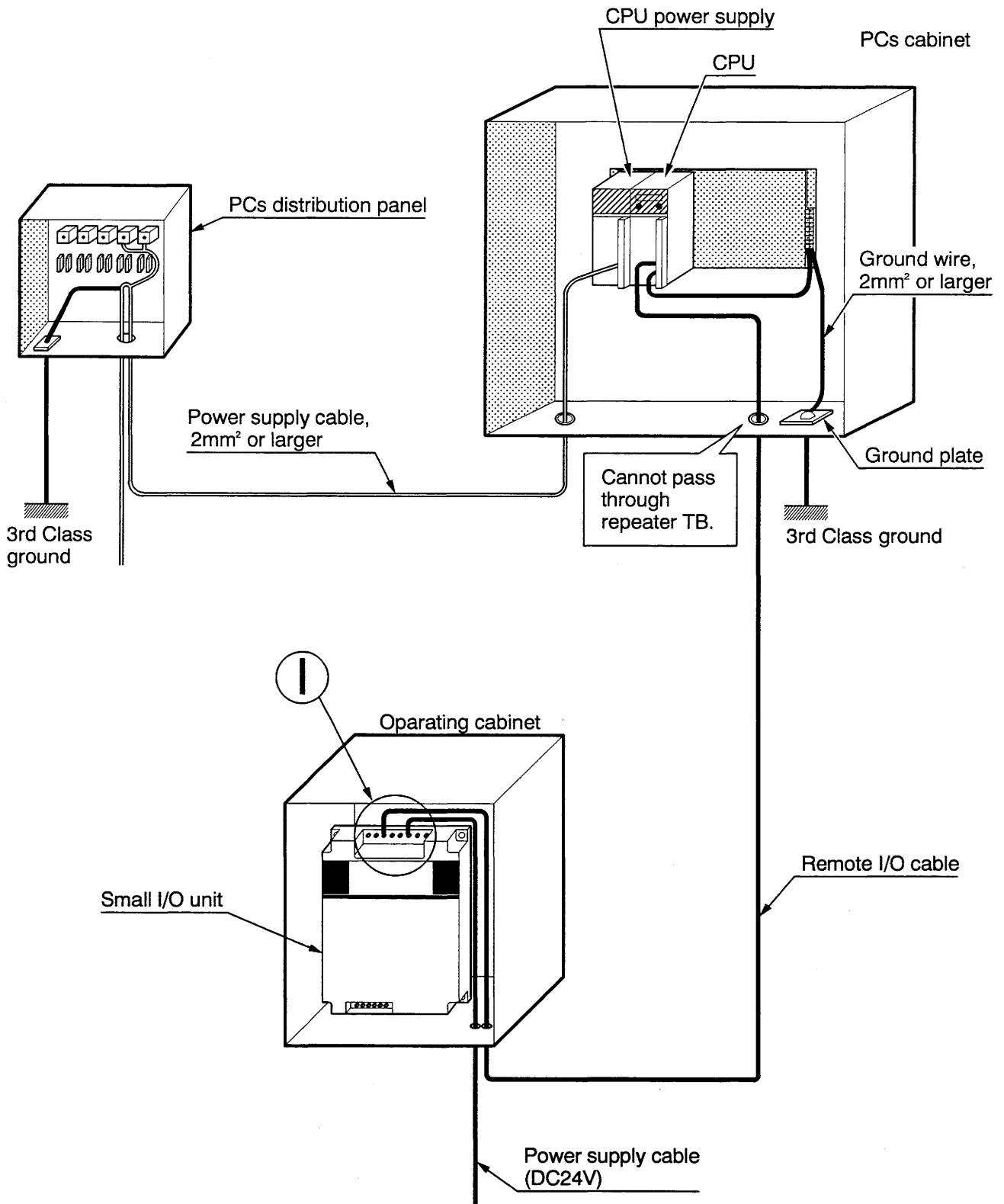


③ Pulse counter wiring

- Short the unused inputs together between S and C and connect them to the cabinet ground.

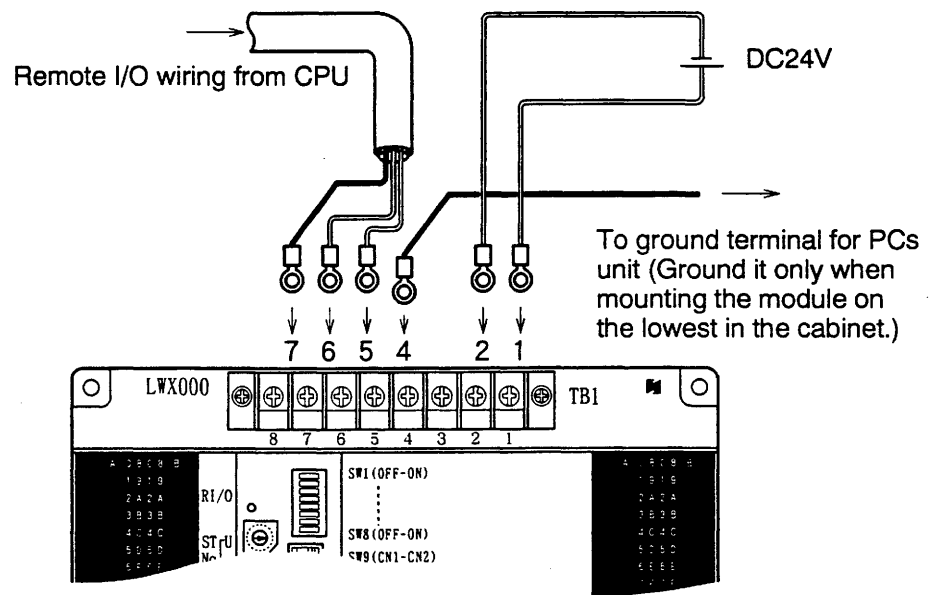


8 Small I/O Unit



Terminal Block Connection Methods

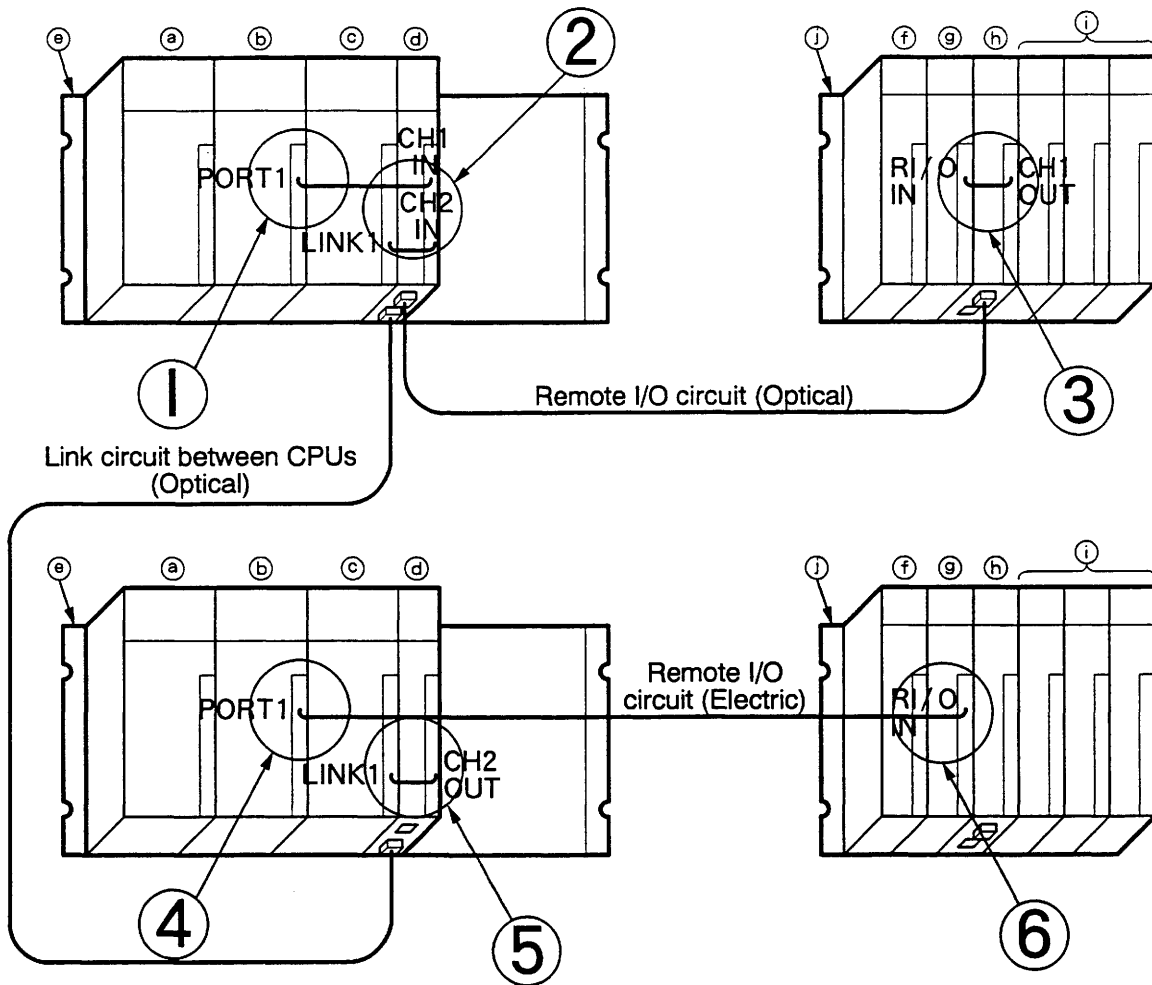
① Remote I/O Power Supply Wiring



When remote I/O circuits are terminated, set SW 1 to SW 4 as shown below.

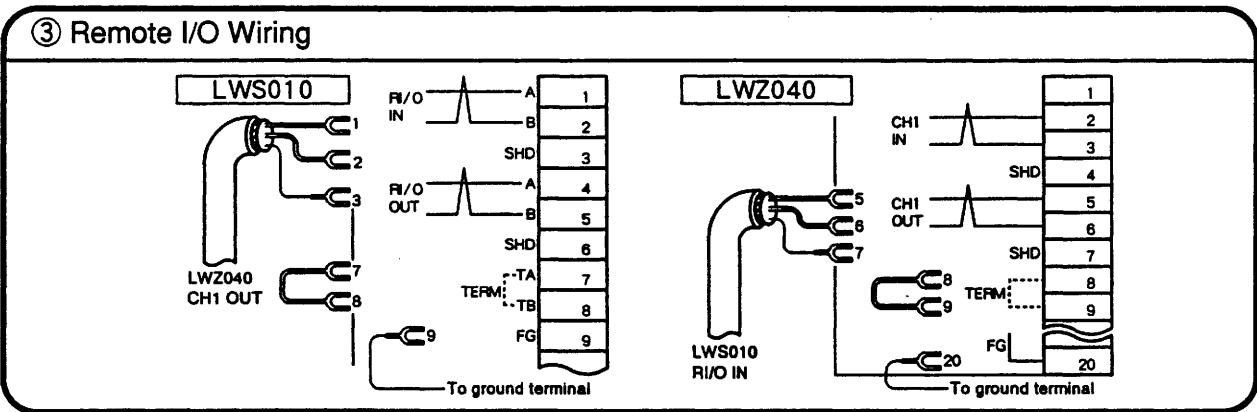
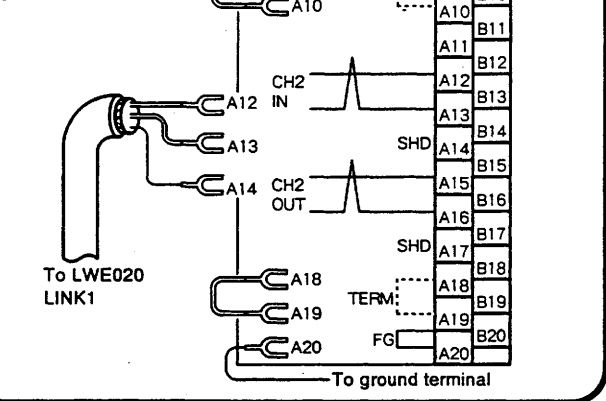
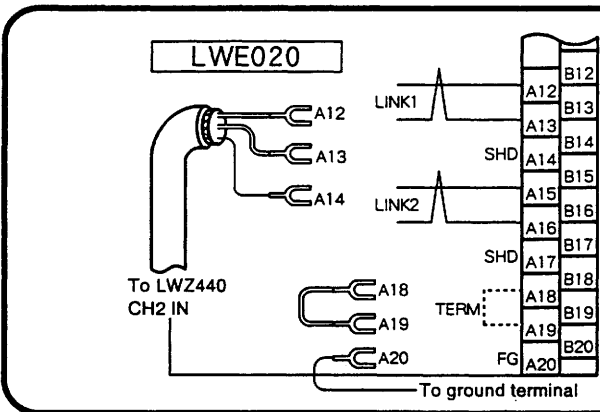
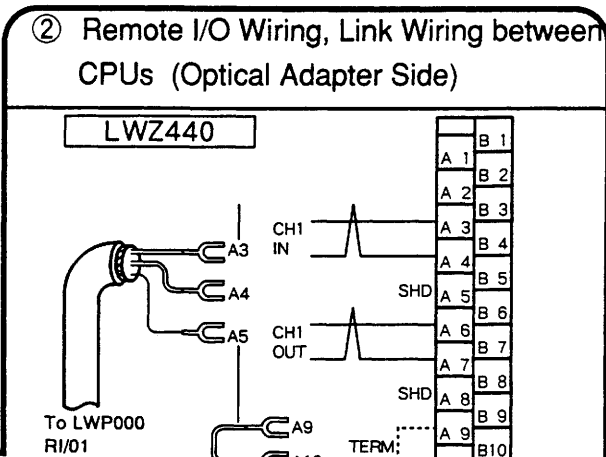
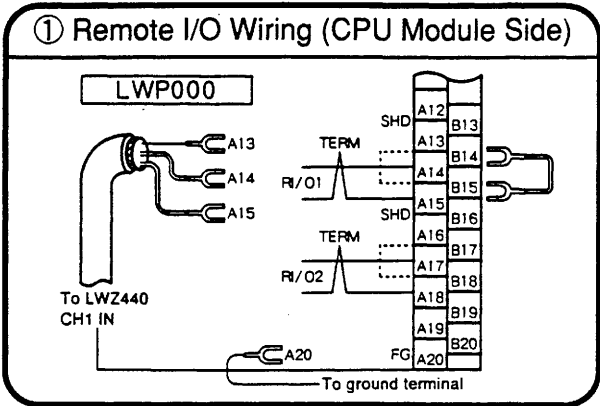
	Cable impedance		Remarks
	100 Ω	150 Ω	
SW1	ON	OFF	Terminated at 100 Ω
SW2	ON	OFF	
SW3	OFF	ON	Terminated at 150 Ω
SW4	OFF	ON	

9 Optical Adapter (CPU Link, Remote I/O )



No.	Type	Name
(a)	LWV000	CPU power supply module
(b)	LWP000	CPU module
(c)	LWE020	CPU Link module
(d)	LWZ440	Optical adapter
(e)	HPC-1000	Expansion 8-slot type CPU mount base
(f)	WV050	I/O power supply module
(g)	LWS010	Station module
(h)	LWZ040	Optical adapter
(i)	Various	I/O module
(j)	HSC-2004	4-slot type I/O mount base

Terminal Block Connection Methods

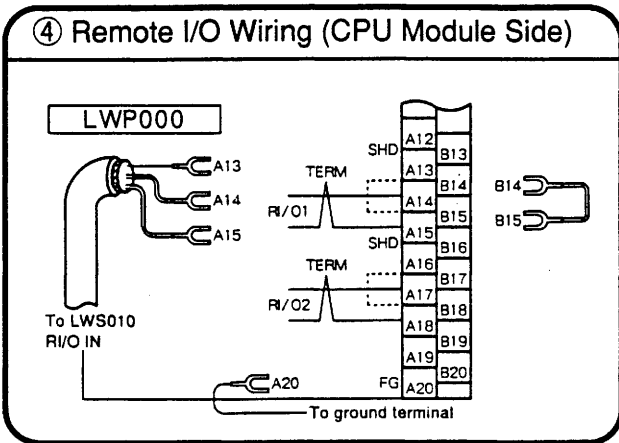


In remote I/O wiring and link wiring between CPUs, short TERM (terminal) of the terminal block at both ends of the electrical cable.  
 If you do not, all data of the connected wires cannot be transmitted normally.

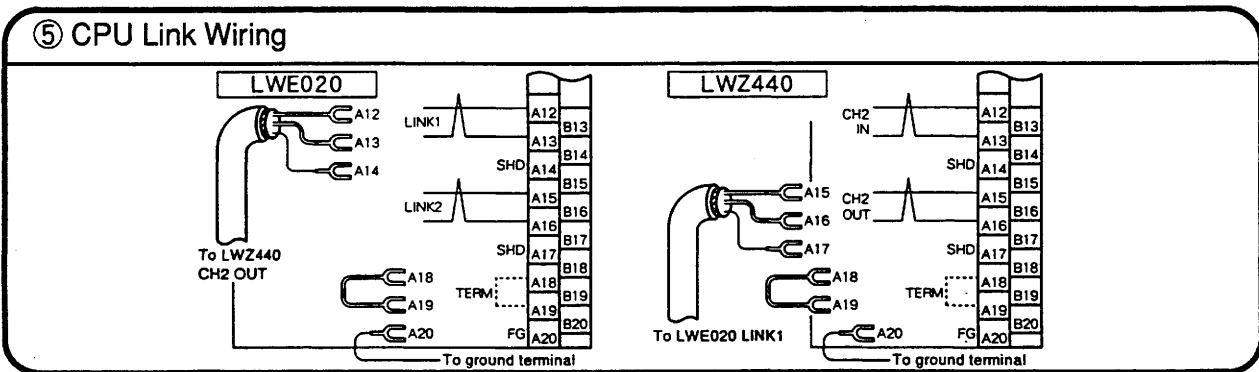
## 2 EXAMPLES OF WIRING

### Terminal Block Connection Methods (Continued)

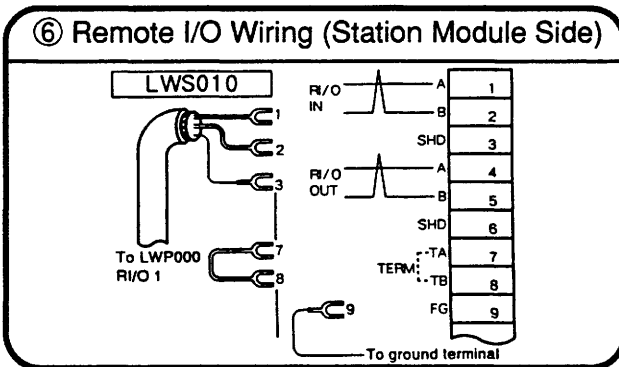
#### ④ Remote I/O Wiring (CPU Module Side)



#### ⑤ CPU Link Wiring



#### ⑥ Remote I/O Wiring (Station Module Side)

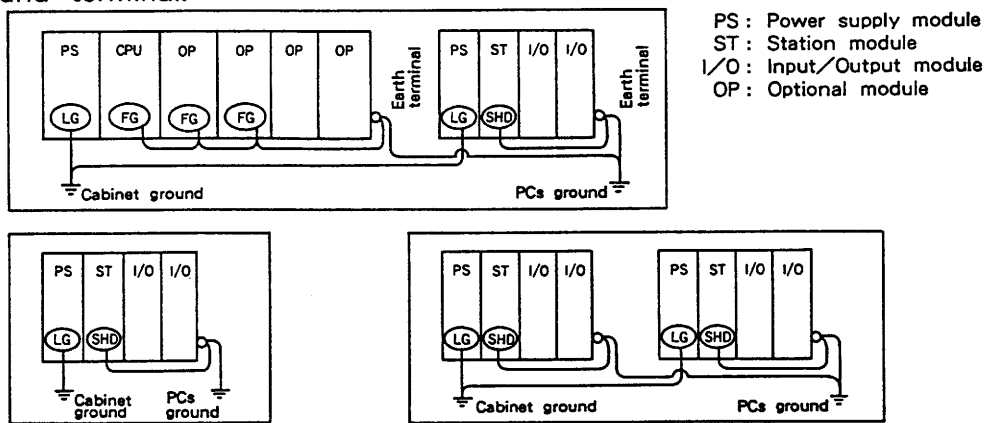




## 10 Ground and Shield Wiring

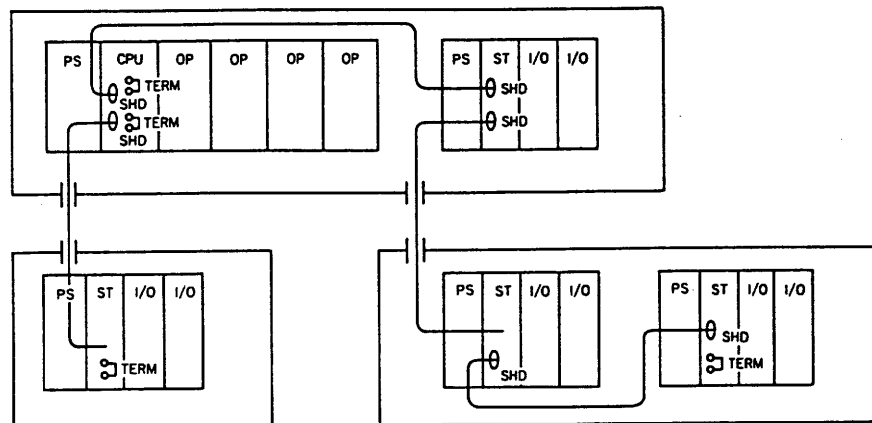
### Ground Wiring

- ① Separate the panel ground and the PCs ground.
- ② Insulate the PCs ground from the cabinet.
- ③ Because the FG of the power supply module is connected internally to the mounting base, do not connect the power supply panel ground to the FG terminal. (Do not connect the FG terminal to the LG terminal).
- ④ When the OP or the I/O has an FG (or SG terminal) do not connect it to the ground terminal. Connect the PAF \*\*\* and PAN \*\*\* GND terminals of the analog I/O module to ground terminal.



### Shield Wiring

- ① When the shield wiring is connected to the same cabinet, ground it at both ends (SHD connection).
- ② When the shield is connected to separate cabinets, and it cannot be grounded to the same point, Ground one end only (SHD connection).  
(Reason)  
When the leads are not grounded at the same point, the ground potential may differ, and it is easy for noise to be generated.



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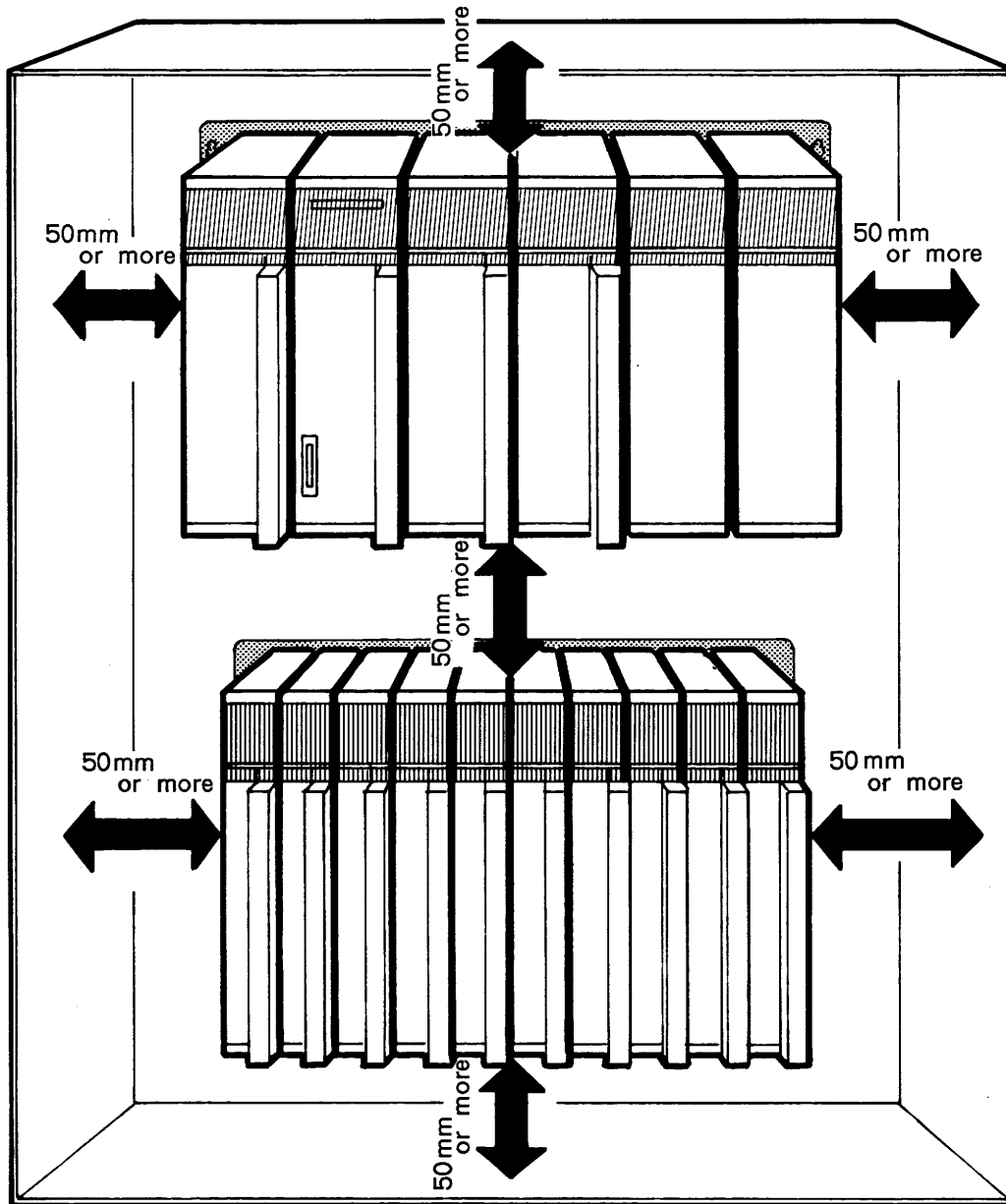
# **3    INSTALLATION          AND WIRING          STANDARDS**

**—TO PERFORM CORRECT INSTALLATION AND WIRING—**

1 Installation

■ Maximum and Minimum PCs Unit Spacing

To provide good ventilation, Provide spaces as shown below on the top bottom and sides of the PCs Unit.

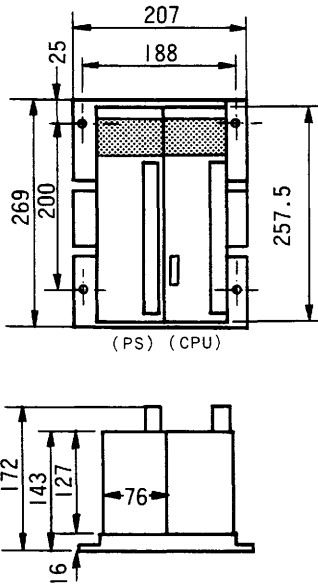


■ Dimensional Diagrams

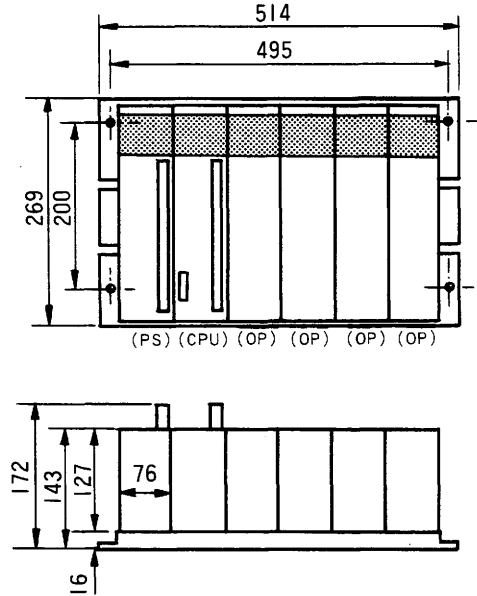
(Unit mm)

2 α CPU Unit

Basic unit

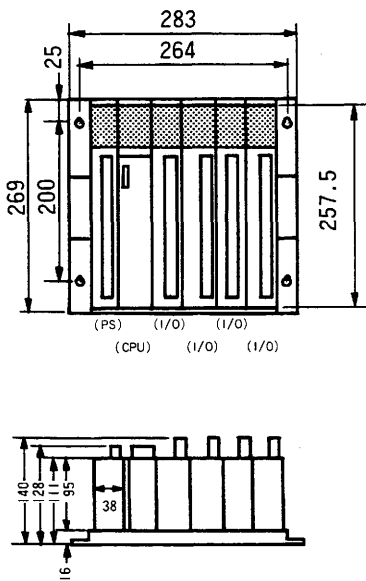


Extension 8 – slot type unit

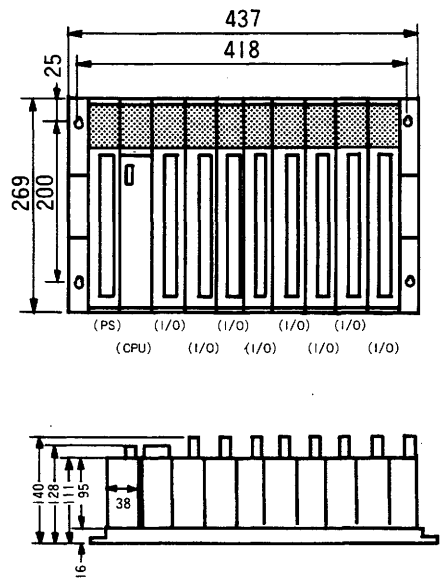


4 α CPU Unit

Basic 4 – slot type unit

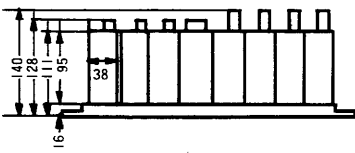
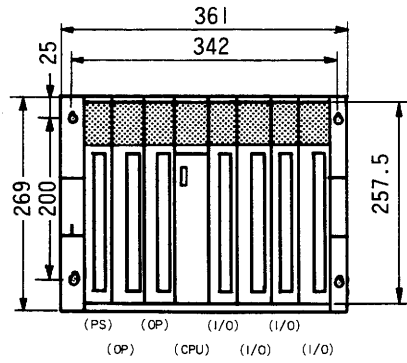


Basic 8 – slot type unit

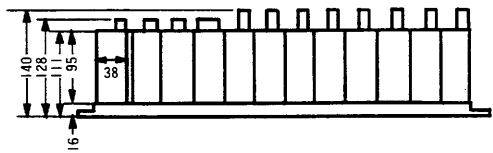
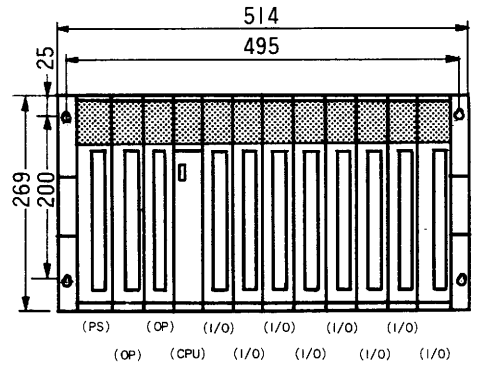


### 3 INSTALLATION AND WIRING STANDARDS

Extension 4 – slot type unit

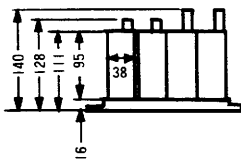
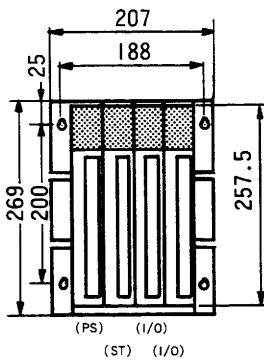


Extension 8 – slot type unit

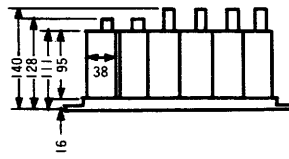
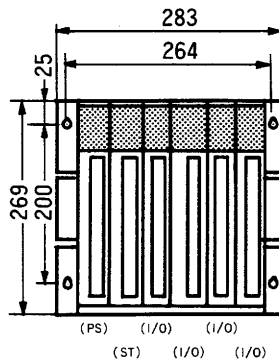


#### I/O Unit

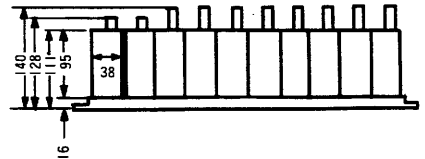
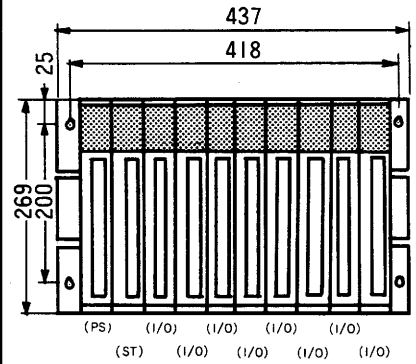
2 – slot type unit



4 – slot type unit

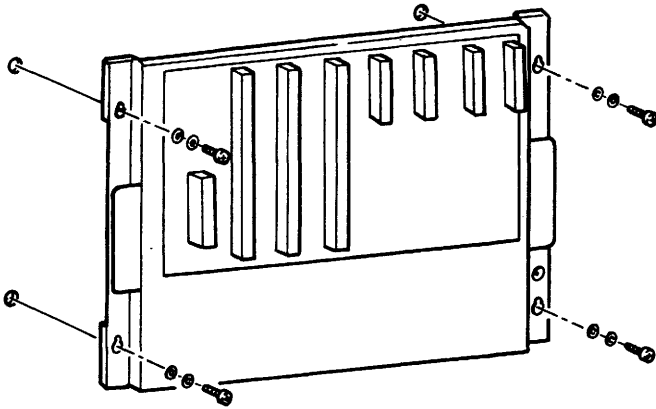


8 – slot type unit

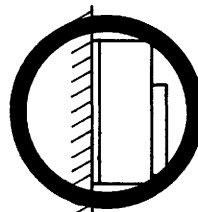


Mount Base and Module Installation

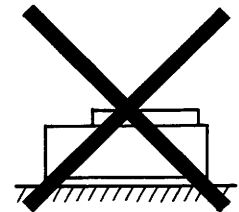
Mount Base Installation



When installing the CPU unit, I/O unit, etc. in the cabinet, mount them vertically as shown in (a) below. If they are mounted horizontally as shown in (b), the internal ventilation of the module will be inadequate. This will shorten the life of the module due to internal heat rise.

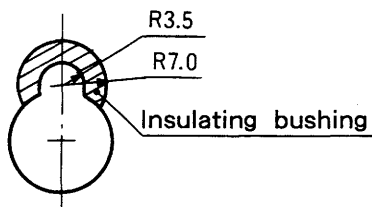


(a) Vertical mounting

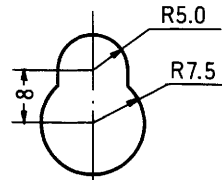


(b) Horizontal mounting

Mount Base Mounting Holes

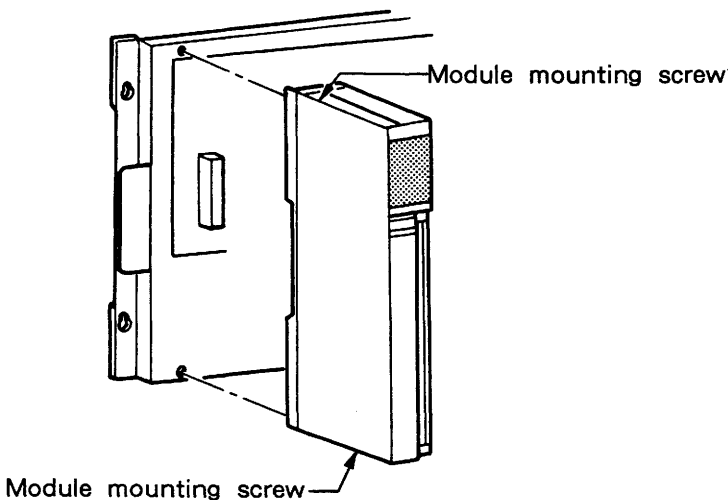


When an insulating bushing is installed

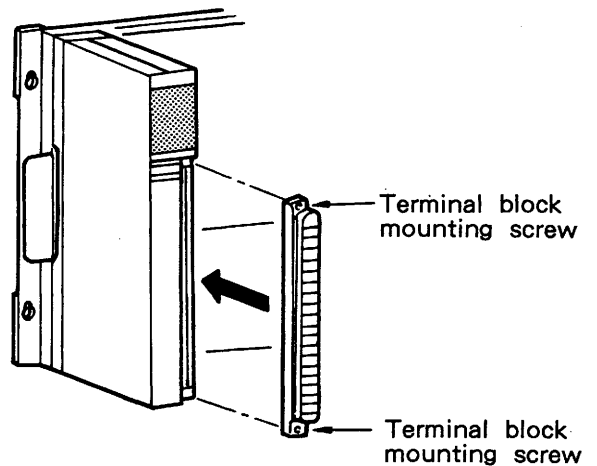


When an insulating bushing is not installed

Module Mounting



Terminal Block Mounting



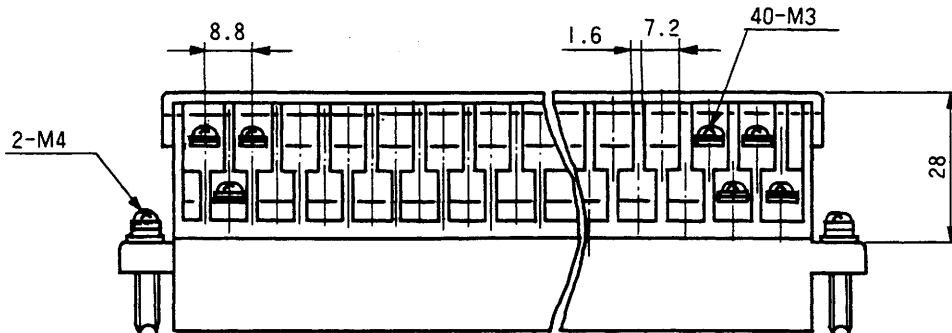
### 3 INSTALLATION AND WIRING STANDARDS

## 2 Wiring

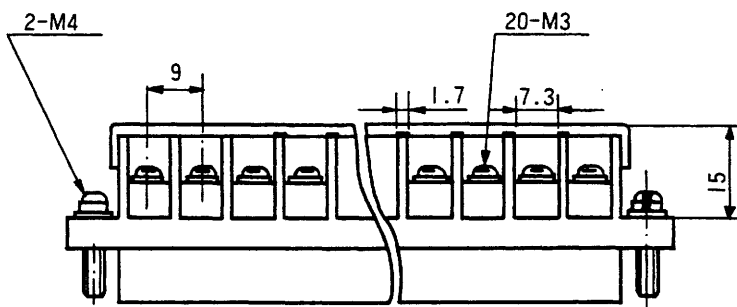
### Terminal Blocks

(Unit : mm)

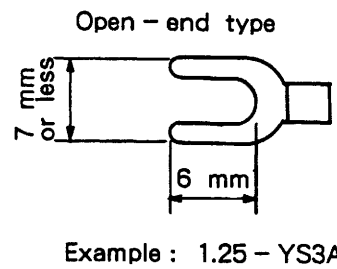
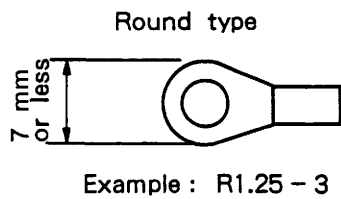
40 - point terminal block



20 - point terminal block



Suitable crimp - on terminals

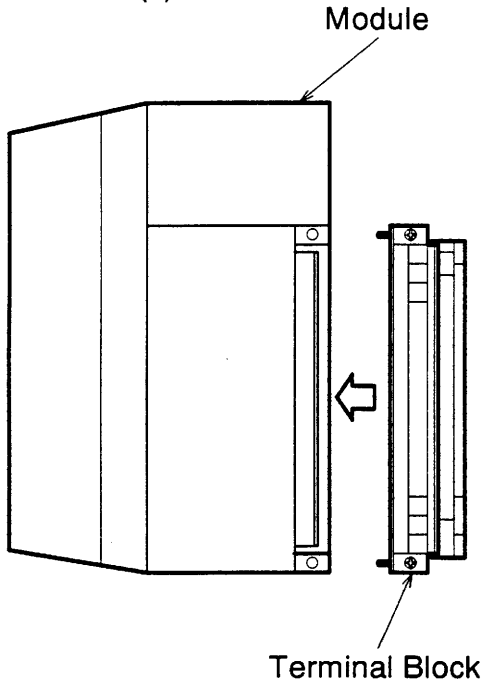




## Terminal Block Mounting Methods

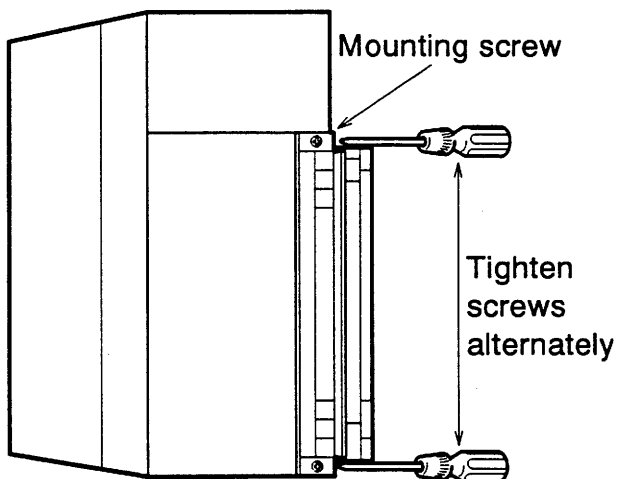
Mount the terminal block(20-point, 40-point)on the module as shown below, or the terminal block contacts with the module badly.

(1)



Put the terminal block into the module. Hold the upper and lower parts of the terminal block and push it into the module until it clicks. However, when you put a 20-point terminal block into the module, it does not click. Fix the terminal block on the module as shown in(2).

(2)



Tighten the upper and lower mounting screws alternately little by little.

[ Tighten mounting each screw equally and check to see if the terminal block is firmly fixed on the module. ]

### 3 INSTALLATION AND WIRING STANDARDS

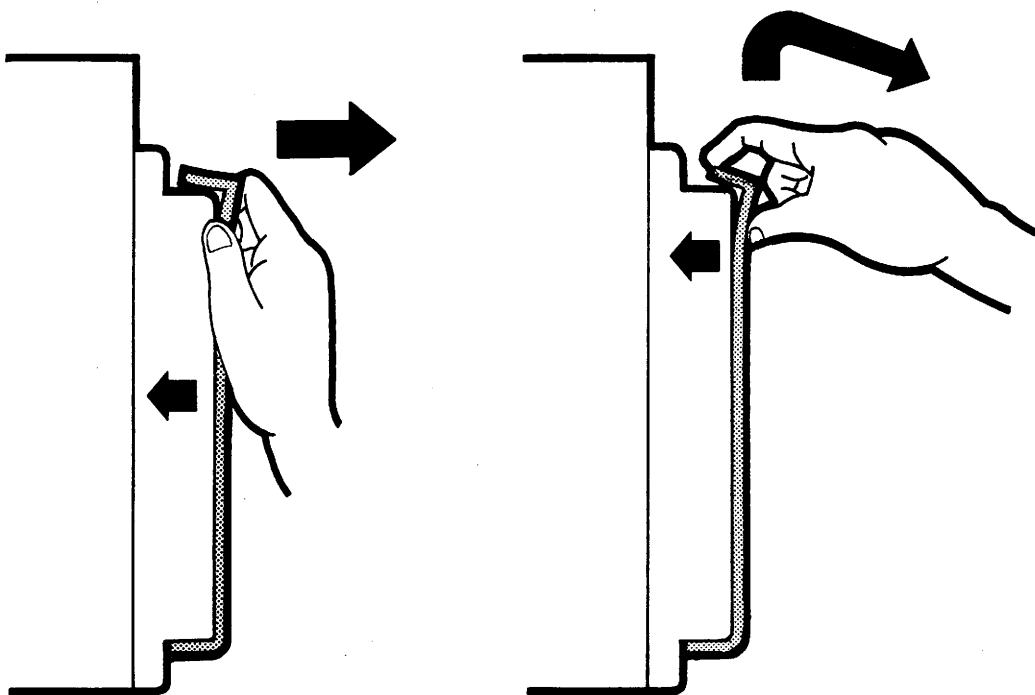
#### Terminal Blocks and Matching Modules

Install the terminal blocks that match the modules as shown below.

Terminal block	Name	Type	Remarks		
40 - point	CPU Power Supply(AC)	LWV000	For 2 $\alpha$ , 2 $\alpha$ E, 2 $\alpha$ H		
	CPU Power Supply(DC)	LWV100			
	CPU			LWP000	
				LWP040	
				LWP070	
				LWP075	
	CPU LINK	LWE020			
	PSE LINK	LWE040			
	External Link	LWE046			
	High - speed Remote I/O	LWE100			
	Analog Slicer	LWA200			
	F.LINK	LWE480			
	Digital Input(AC)	LWI 000			
	Digital Input(DC)	LWI 100			
Digital Output(AC/DC)	LWO000 LWO060				
Digital Output(DC)	LWO100				
20 - point	I/O Power Supply(AC)	LWV050 LWV030	For 2 $\alpha$ , 2 $\alpha$ E, 2 $\alpha$ H, 4 $\alpha$ , 4 $\alpha$ H		
	I/O Power Supply(DC)	LWV150			
	Station	LWS010			
	Digital Input(AC)	LWI 050			
	Digital Input(DC)	PDG330 LWI 150			
	Digital Output(AC/DC)	LWO050 PDS360			
	Digital Output(AC)	PDS330			
	Digital Output(DC)	LWO150			
	Analog Input			PAF300 PAF301 PAF308 PAF309 PAF320 PAF329	
		Analog Output			PAN300B PAN301B PAN309 PAN320 PAN329
				Pulse Counter	PTF300 PTF320
				F.STATION	LWS010
				Extended I/O Interface	LWE800
	Computer Link			LWE805	
	Remote I/O PCs Link	LWE810			
	CPU LINK	LWE820			
					For 2 $\alpha$ , 2 $\alpha$ E, 2 $\alpha$ H
			For 4 $\alpha$ , 4 $\alpha$ H		

■ Terminal Block Cover Removal Method

Remove the terminal block cover as shown below.



Holding the surface of the cover with the palm of the hand, pull on the side of the upper part of the cover.

Holding the surface of the upper part of the cover with the thumb, place the forefinger over the top of the cover as shown in the drawing above, and pull it toward you.

With a 20 – point terminal block

With a 40 – point terminal block

### 3 INSTALLATION AND WIRING STANDARDS

#### ■ Cable Specifications

Cable Type	Application	Items	Specifications
<ul style="list-style-type: none"> <li>• Remote I/O Cable (CPU to Station)</li> <li>• High-speed Remote I/O Cable (High-speed Remote I/O to Station)</li> </ul> <p style="text-align: right;">(Note)</p>	Long distance 300 m or less per port	<ul style="list-style-type: none"> <li>• Characteristic impedance</li> <li>• Attenuation rate</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable type</li> <li>• Terminating resistor value</li> </ul>	150 Ω 10dB/km (750 kHz) 0.75 mm <sup>2</sup> (18 AWG) 300 m or less/port CO - EV - SX - 1P (or 2X) (Hitachi Cable, Ltd.) 0.75 mm <sup>2</sup> 150 Ω (Short the TERM terminal).
	Medium distance 200 m or less per port	<ul style="list-style-type: none"> <li>• Characteristic impedance</li> <li>• Attenuation rate</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable type</li> <li>• Terminating resistor value</li> </ul>	100 Ω 18dB/km (750 kHz) 0.5 mm <sup>2</sup> (20 AWG) 200 m or less/port CO - SPEV - SB - 1P (Hitachi Cable, Ltd.) 0.5 mm <sup>2</sup> 100 Ω (Connect a 100 Ω external resistor.) *
	Short distance 100 m or less per port	<ul style="list-style-type: none"> <li>• Characteristic impedance</li> <li>• Attenuation rate</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable type</li> <li>• Terminating resistor value</li> </ul>	100 Ω 21dB/km (750 kHz) 0.3 mm <sup>2</sup> (22 AWG) 100 m or less/port CO - SPEV - SB - 1P (Hitachi Cable, Ltd.) 0.3 mm <sup>2</sup> 100 Ω (Connect a 100 Ω external resistor.) * Short the TERM terminal only when the CPU unit and the last I/O unit are mounted on the cabinet.  (External resistor not needed).
PCs OK (CPU)		<ul style="list-style-type: none"> <li>• Twisted pair cable</li> <li>• Cable length</li> <li>• Cable size</li> </ul>	200 m or less 0.5 mm <sup>2</sup> or more (20 AWG)
<ul style="list-style-type: none"> <li>• STOP/RUN (CPU)</li> <li>• RI/O STOP (only 2α, 2α E, 2α H)</li> </ul> <p style="text-align: right;">(Note)</p>		<ul style="list-style-type: none"> <li>• Twisted pair cable</li> <li>• Cable length</li> <li>• Cable size</li> </ul>	5 m or less To make less noise, use the shielded twisted pair cable. 0.5 mm <sup>2</sup> or more (20 AWG)
Power Supply Cable (Common)		<ul style="list-style-type: none"> <li>• Shielded twisted pair or 3-core twisted cable</li> <li>• Cable size</li> </ul>	2 mm <sup>2</sup> or more (14 AWG) • Cable dia. depends on load capacity, lgth. etc. Choose the correct one.
Ground Cable (Common)		<ul style="list-style-type: none"> <li>• Cable size</li> </ul>	2 mm <sup>2</sup> or more (14 AWG)

### 3 INSTALLATION AND WIRING STANDARDS

Cable Type	Application	Items	Specifications
CPU Link Cables (Note)	Long distance, 1 km or less	<ul style="list-style-type: none"> <li>• Characteristic impedance</li> <li>• Attenuation rate</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable type</li> <li>• Terminating resistor value</li> </ul>	150 Ω 8.5dB/km (500 kHz) 0.75 mm <sup>2</sup> (18 AWG) 1 km or less CO - EV - SX - 1P (or 2X) (Hitachi Cable, Ltd.) 0.75 mm <sup>2</sup> 150 Ω (Short the TERM terminal).
	Medium distance 600 m or less	<ul style="list-style-type: none"> <li>• Characteristic impedance</li> <li>• Attenuation rate</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable type</li> <li>• Terminating resistor value</li> </ul>	100 Ω 12dB/km (500 kHz) 0.5 mm <sup>2</sup> (20 AWG) 600 m or less CO - SPEV - SB - 1P (Hitachi Cable, Ltd.) 0.5 mm <sup>2</sup> 100 Ω (Connect a 100 Ω external resistor.) *
	Short distance 300 m or less	<ul style="list-style-type: none"> <li>• Characteristic impedance</li> <li>• Attenuation rate</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable type</li> <li>• Terminating resistor value</li> </ul>	100 Ω 17dB/km (500 kHz) 0.3 mm <sup>2</sup> (22 AWG) 300 m or less CO - SPEV - SB - 1P (Hitachi Cable, Ltd.) 0.3 mm <sup>2</sup> 100 Ω (Connect a 100 Ω external resistor.) *
Link Cables to external Machines less (Note)	RS - 232C, 15 m or less	<ul style="list-style-type: none"> <li>• Shielded twisted pair cable</li> <li>• Size</li> <li>• Cable length</li> <li>• Recommended cable type</li> </ul>	0.08 mm <sup>2</sup> or more (28 AWG) 15 m or less CO - MA - VV - SBAWG2813P (Hitachi Cable, Ltd.)
	RS - 422, 1 km or more	<ul style="list-style-type: none"> <li>• Shielded twisted pair cable</li> <li>• Size</li> <li>• Cable length</li> <li>• Recommended cable type</li> </ul>	0.5 mm <sup>2</sup> or more (20 AWG) 1 km or less KPEV - SB - 8P (Hitachi Cable, Ltd.) 0.5 mm <sup>2</sup>
Host Computer Link cable (Note)		<ul style="list-style-type: none"> <li>• Shielded twisted pair cable</li> <li>• Size</li> <li>• Cable length</li> <li>• Recommended cable type</li> </ul>	0.5 mm <sup>2</sup> or more (20 AWG) 300 m or less CO - VV - SB 3P × 0.5MM2 (Hitachi Cable, Ltd.)
F.LINK Cable (Note)		<ul style="list-style-type: none"> <li>• Shielded twisted pair cable</li> <li>• Cable size</li> <li>• Total cable length</li> <li>• Recommended cable size</li> <li>• Terminating resistor value</li> </ul>	0.9 mm <sup>2</sup> (18AWG) 1.0 Mbps...240m 0.5 Mbps...480m 0.25 Mbps...800m 0.125 Mbps...1000m KPEV-S 2P 0.9 mm <sup>2</sup> (Hitachi Cable, Ltd.) 120 Ω (Short the TERM terminal.)

### 3 INSTALLATION AND WIRING STANDARDS

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(Note)

For online communication, do not use the cables of different specifications on the same line.

\* Recommended terminating resistor specifications

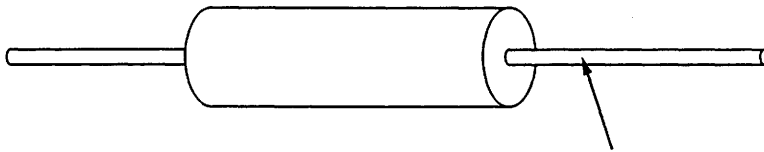
Material : Oxidized metal film resistors or metal film resistors

Resistance value : Same value as cable characteristic impedance

Accuracy :  $\pm 10\%$  or better

Power rating : 1/2W or more

Conditions : We recommend the axial type shown on the right for easy wiring

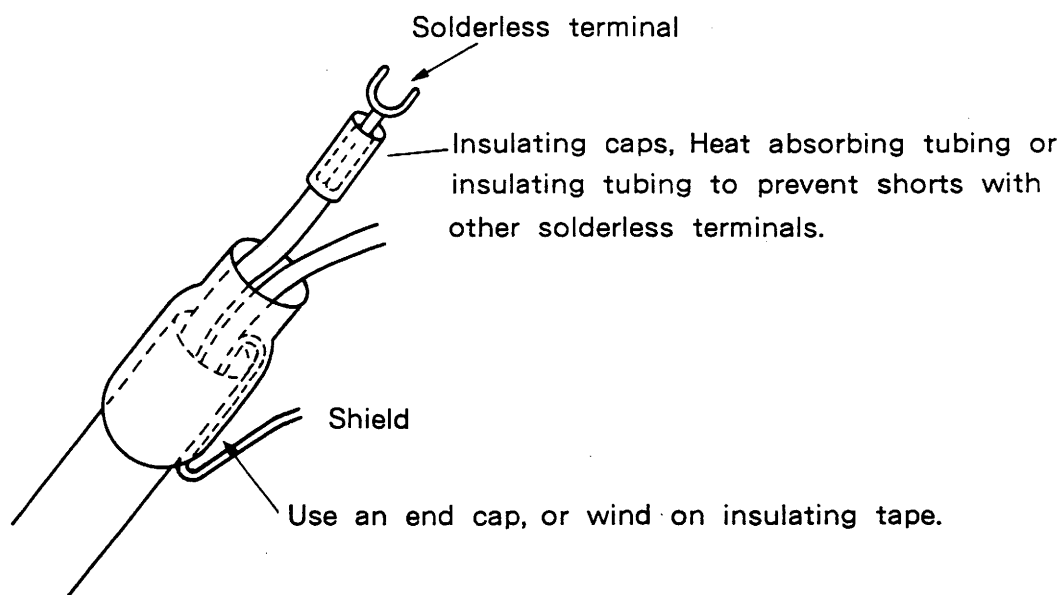


We recommend resistors with large diameter leads.

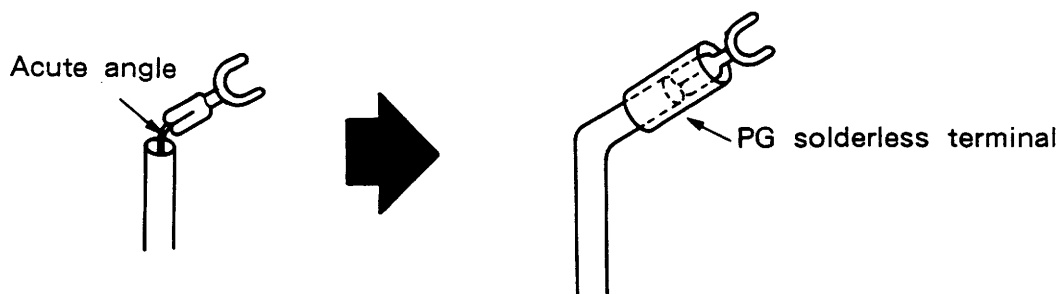
■ Solderless Terminal Installation

We recommend the connection method shown below for wiring with cables and solderless terminals.

- To prevent shorts, etc. caused by exposure of the portion of the lead fastened to the solderless terminal -



- If the lead and the portion fastened to the solderless terminal form a sharp angle, there is danger of broken wires.-



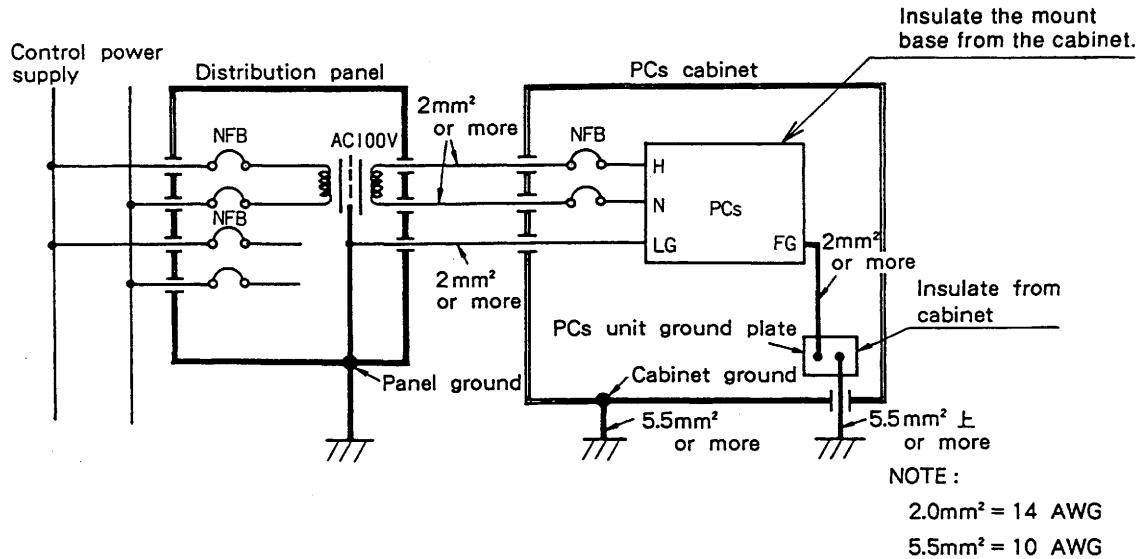
When a PG solderless terminal is used, the end of the lead must be fastened down.

### 3 INSTALLATION AND WIRING STANDARDS

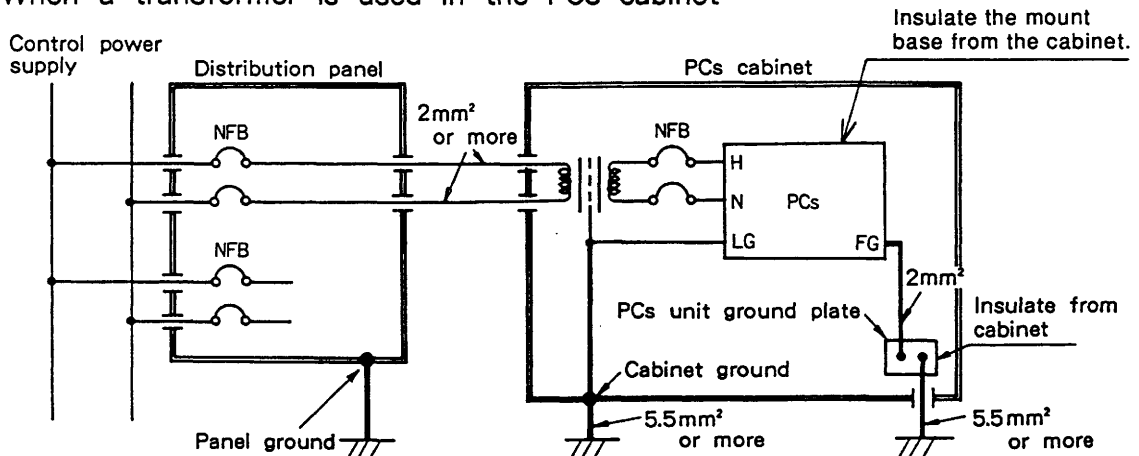
## ■ Power Supply Wiring and Grounding

### Power Supply Wiring Methods

– When a transformer is used in the distribution panel –



– When a transformer is used in the PCs cabinet



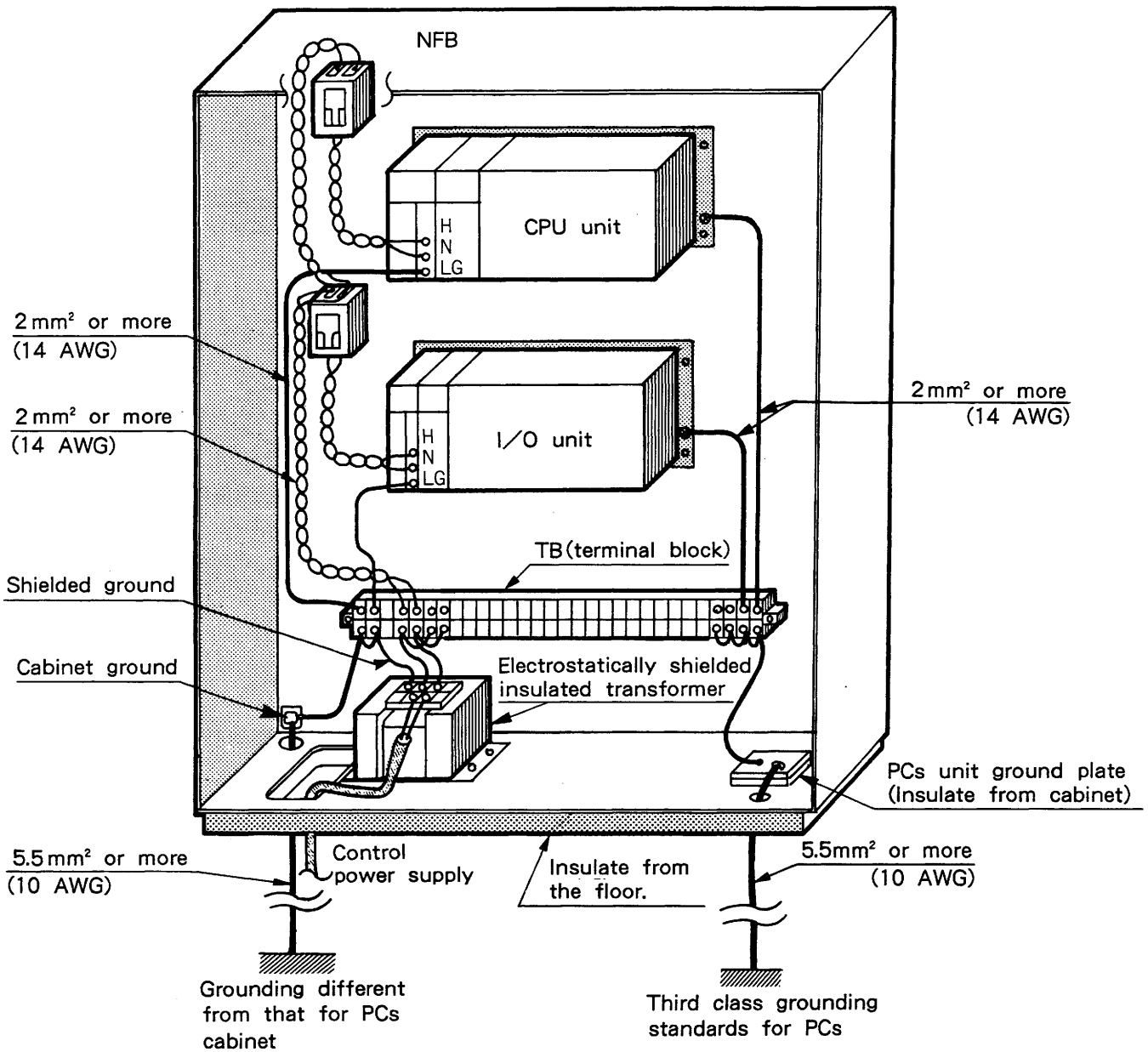
NFB: Non fuse breaker

#### CAUTIONS ON WORK

- ① Isolate the control power supply from the PCs power supply with an electrostatically shielded insulated transformer.
- ② The power source voltage range of the AC 100V supplied to the PCs shall be from 85V to 132V, and a power supply without waveform distortion shall be used.
- ③ Insulate the PCs unit ground terminal and the mount base from the cabinet.

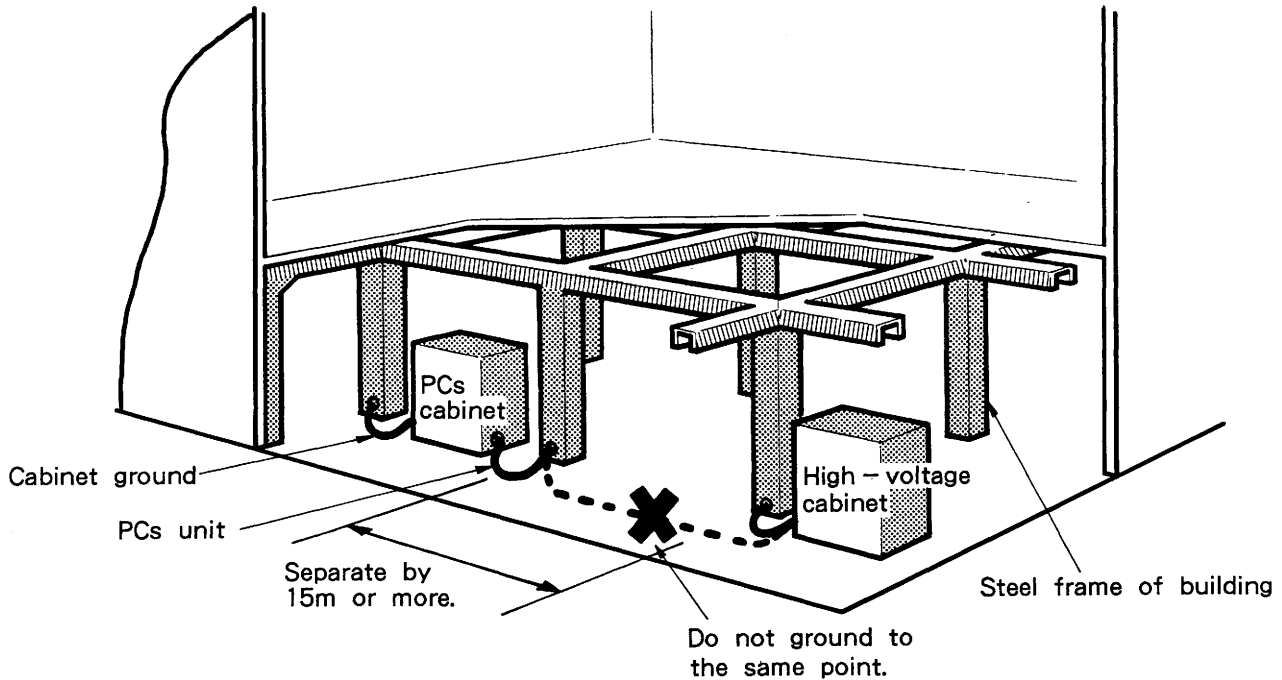


Wiring Example in the PCs Panel



### 3 INSTALLATION AND WIRING STANDARDS

#### Grounding Methods



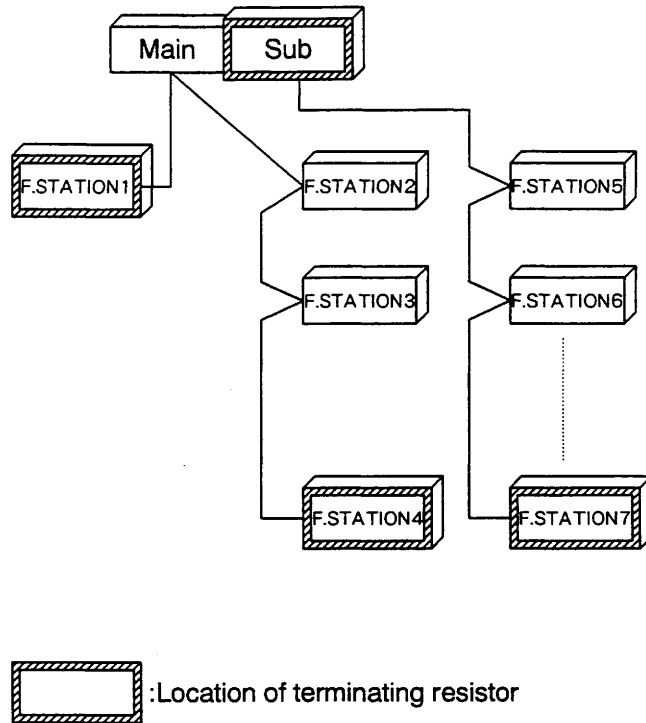
#### CONDITIONS FOR GROUNDING TO STEEL FRAME OF BUILDING

- The frames must be fastened together.
- Third class grounding standards between the ground and the frame must be satisfied.
- The high-voltage panel shall be separated by at least 15 meters from the PCs cabinet grounding point to prevent strong electrical currents from flowing in the PCs circuits.

When all above conditions is not satisfied, drive a ground rod into the earth for the PCs ground.

**■ Installing Terminating Resistor on F.LINK**

— For the F.LINK line —



In the connection example above, on the F.LINK main module side, the F.STATION 1 and F.STATION 4 are terminated, so they need terminating resistors. On the F.LINK sub-module side, F.LINK sub-module and F.STATION 7 are terminated, so they need terminating resistors.

### 3 INSTALLATION AND WIRING STANDARDS

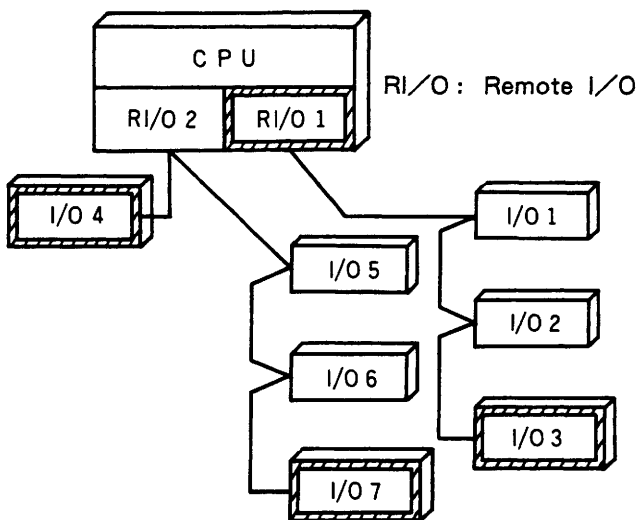
#### ■ Installing Terminating Resistors on the Remote I/O and CPU LINK


The remote I/O CIRCUIT and the CPU LINK CIRCUIT perform high – speed data transfers. When a signal is transmitted through a cable, a phenomenon called “reflection” takes place. When this occurs, the signal is not transmitted properly. To prevent this, a terminating resistor is required.

#### Location of the terminating resistor

As shown below, a terminating resistor is required when there is only one cable connected to the module (the terminal module).

– For the remote I/O circuit –

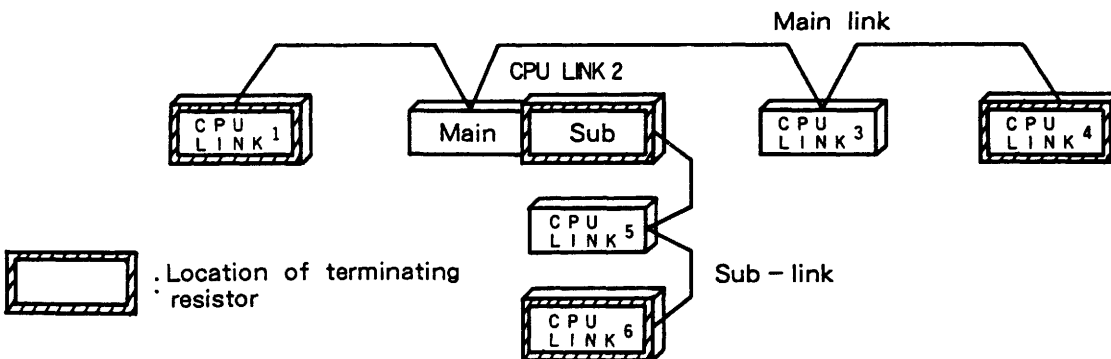


 : Location of terminating resistor

As shown in the connection example on the left, on the RI/O 1 side, the RI/O 1 and I/O 3 are the ends, so they require terminating resistors. On the RI/O 2 side, I/O 4 and I/O 7 need terminating resistors.

Note : Both RI/O 1 and RI/O 2 need terminating resistors

– For the CPU LINK circuit –

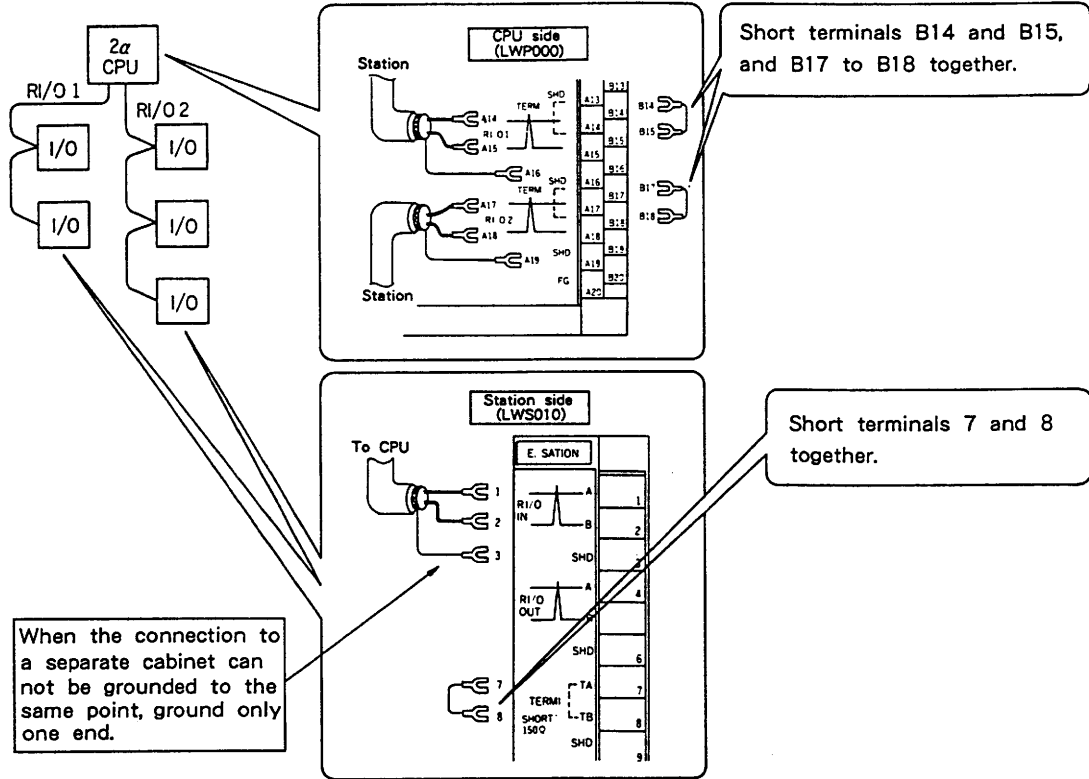


In the connection example above, on the main link side, the CPU link 1 and CPU Link 4 are the ends, so they require terminating resistors. On the sub – link side, CPU link 2 and CPU Link 6 need terminating resistors.

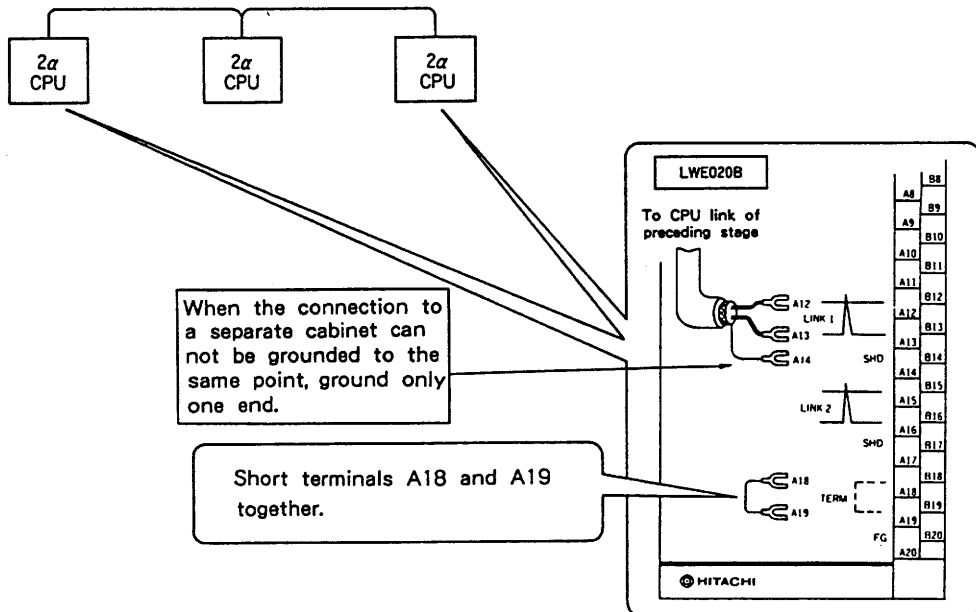
Actual Wiring of the 2α

- With cable type CO-EV-SX-IP 0.75 mm<sup>2</sup> - (AWG 18 - Belden #)

● Remote I/O



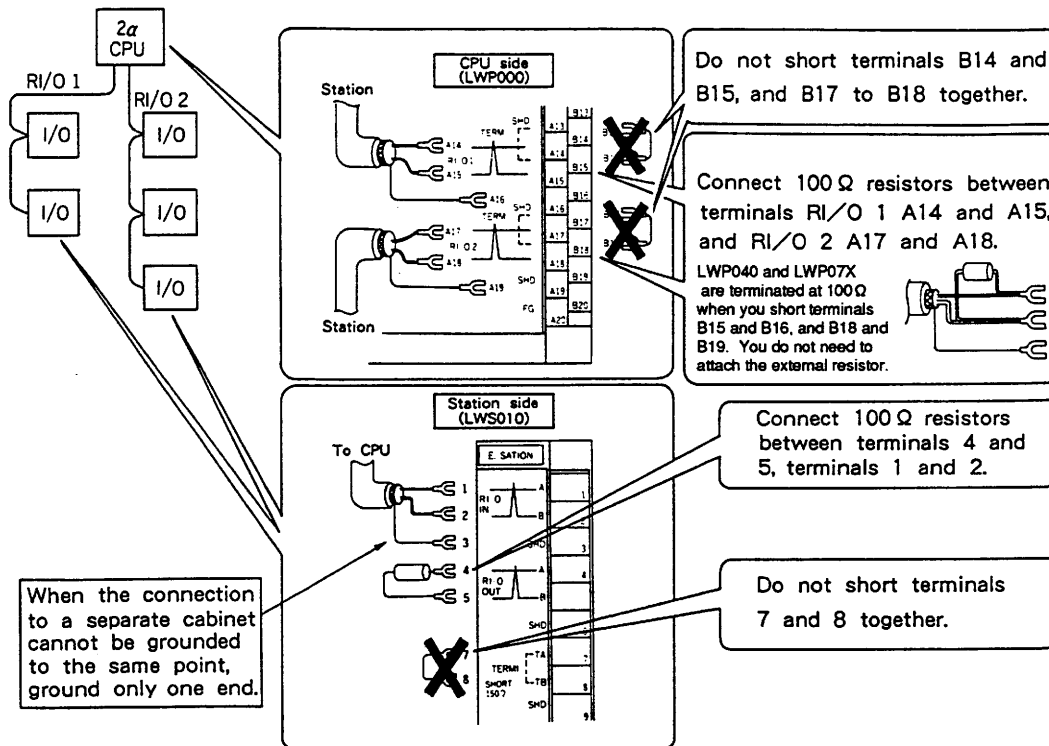
● CPU LINK



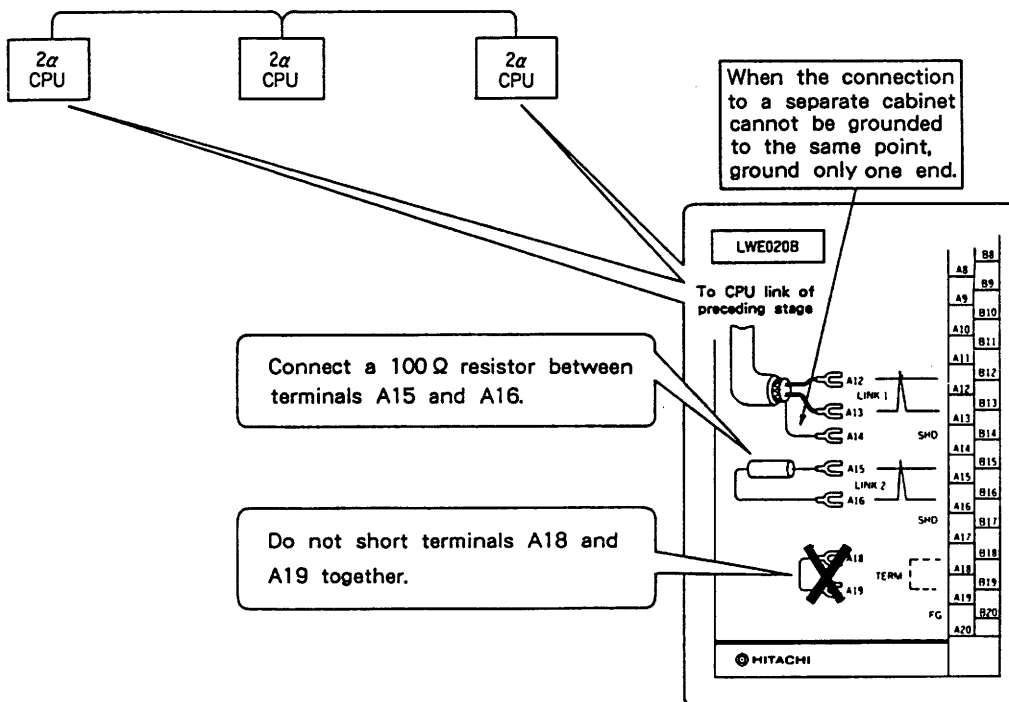
### 3 INSTALLATION AND WIRING STANDARDS

- With cable type CO-SPEV-SB 0.5 mm<sup>2</sup> (0.3 mm<sup>2</sup>) -  
 (20 AWG) (22 AWG)

● Remote I/O



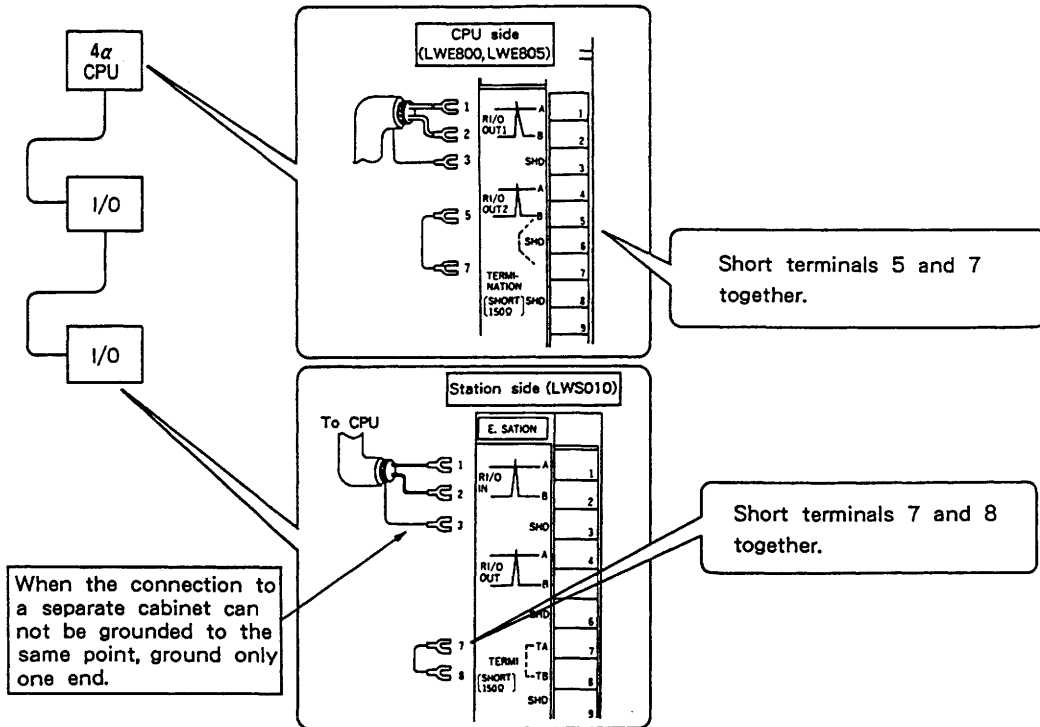
● CPU LINK



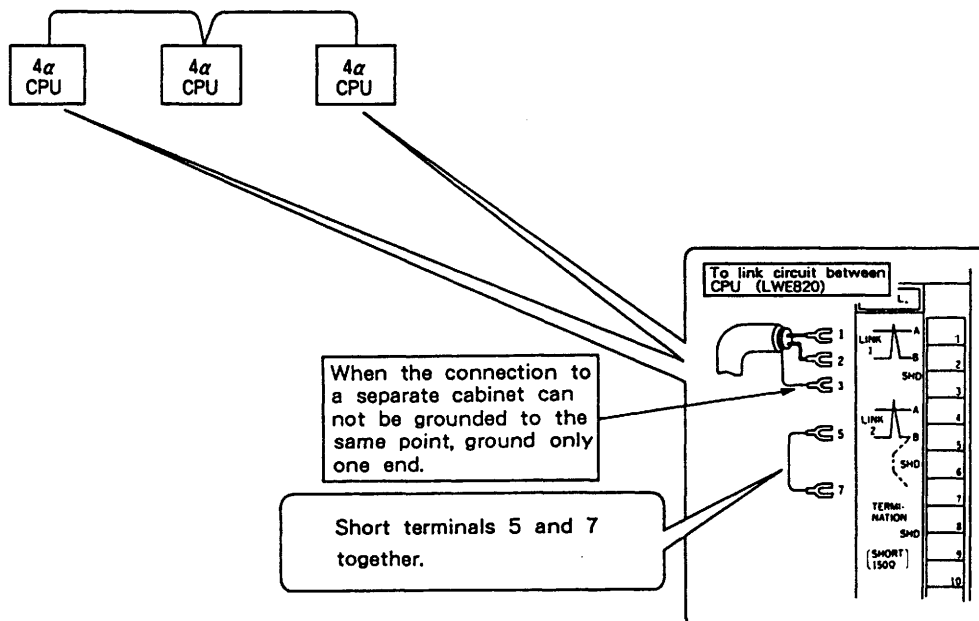
Actual Wiring of the 4α

- With cable type CO-EV-SX-IP 0.75 mm<sup>2</sup> - (18 AWG)

● Remote I/O

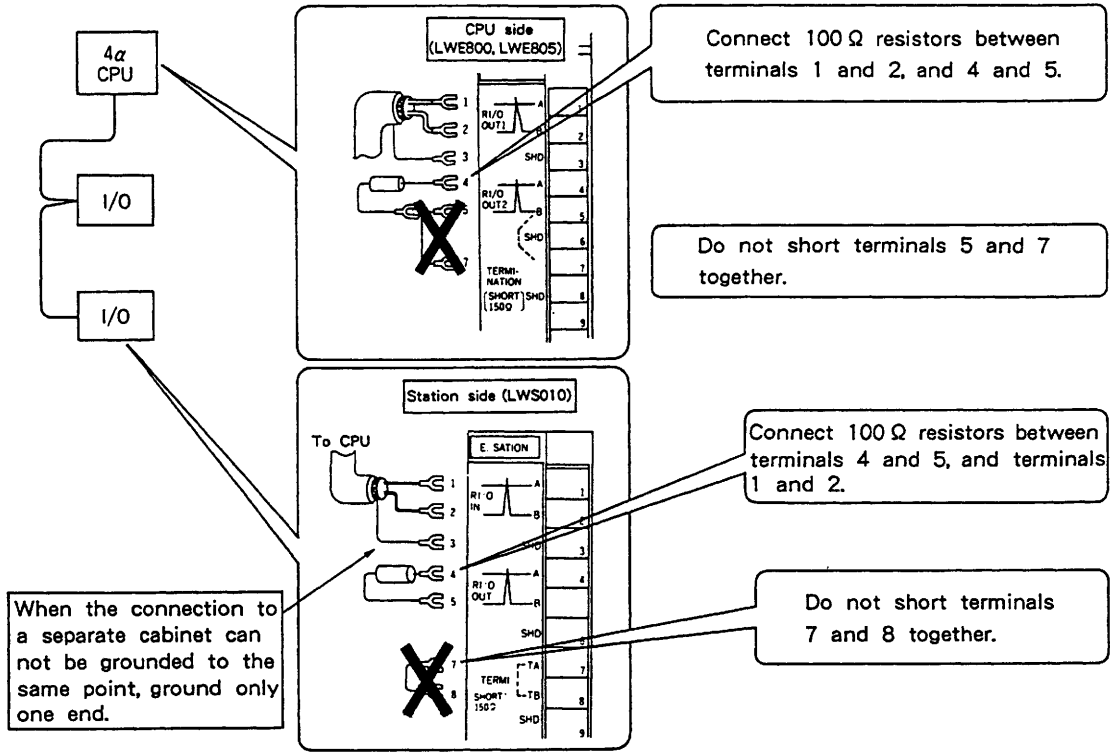


● CPU LINK

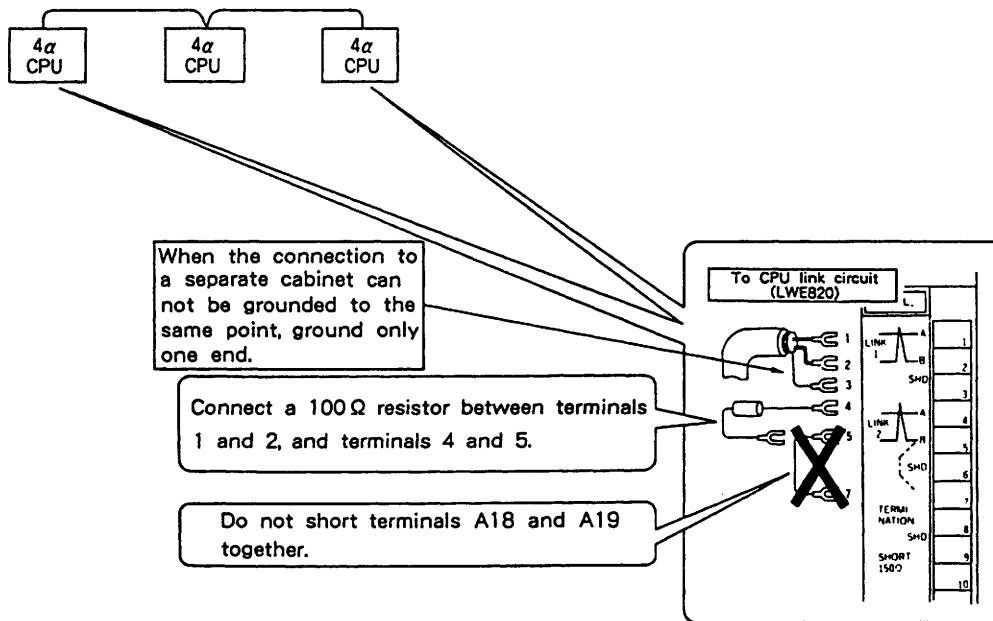


### 3 INSTALLATION AND WIRING STANDARDS

- With cable type CO-SPEV-SB-IP 0.5 mm<sup>2</sup> (0.3 mm<sup>2</sup>) -
- Remote I/O (20 AWG) (22 AWG)



### ● CPU LINK

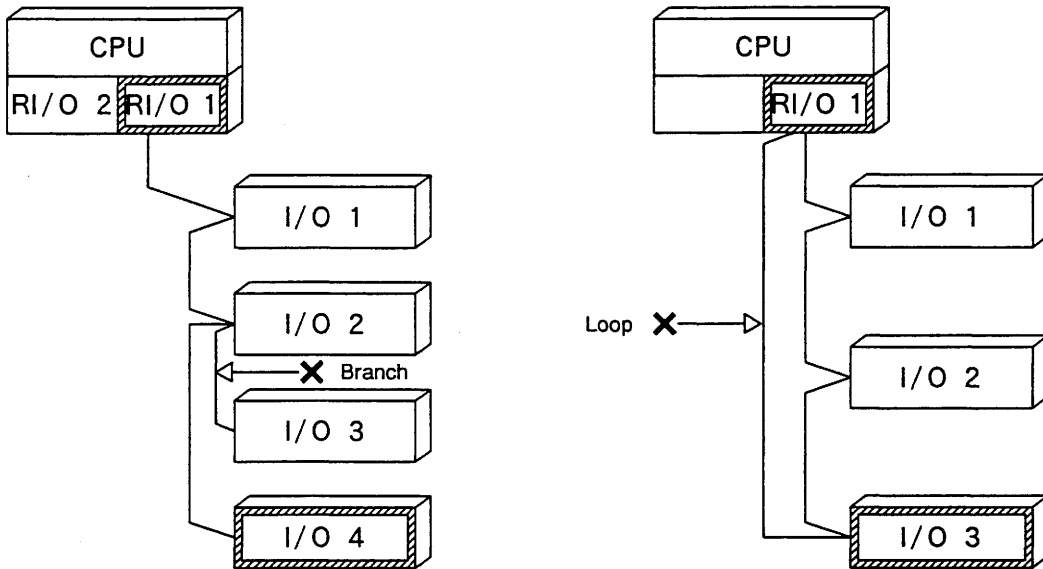




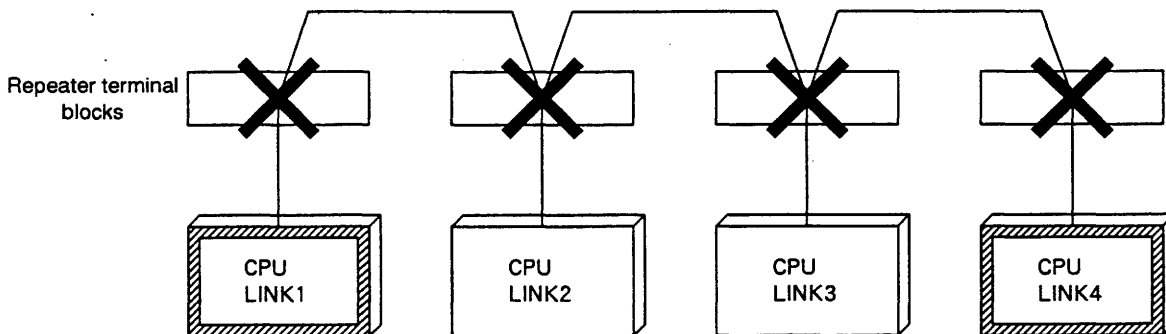
■ Examples of Prohibited Wiring

If the wiring shown below is performed in the remote I/O, the CPU LINK and F.LINK, waveform in the circuit is distorted, and a signal error occurs. Therefore, be careful to perform the correct wiring.

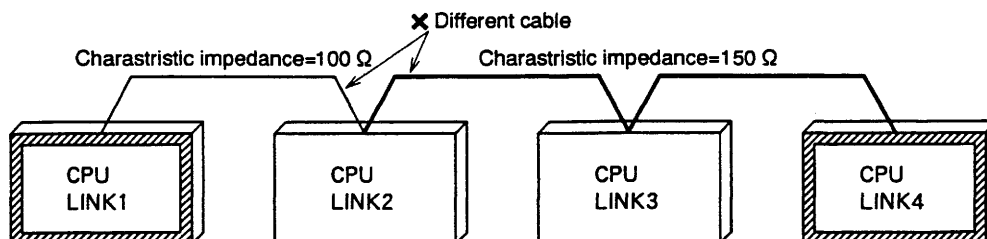
[PROHIBITION EXAMPLE 1] Branch wiring [PROHIBITION EXAMPLE 2] Loop wiring



[PROHIBITION EXAMPLE 3] Repeater terminal block



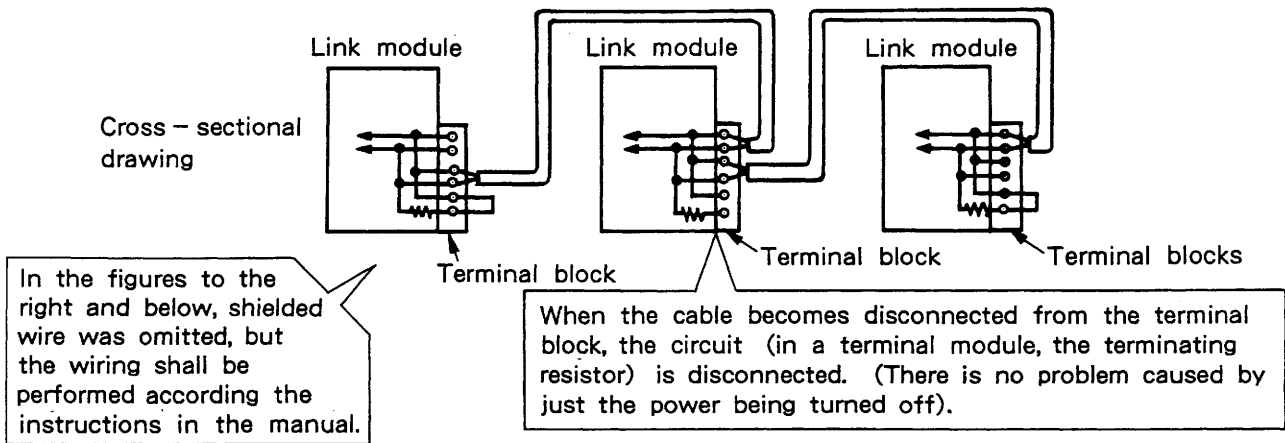
[PROHIBITION EXAMPLE 4] Different cable wiring



### 3 INSTALLATION AND WIRING STANDARDS

#### ■ Cautions on Link Module Connection (When the circuit cable is connected to the terminal block)

With the usual method of connecting the cables to the terminal blocks, if the cable becomes disconnected from the terminal block, the circuit will be open, so care must be taken in the connection.

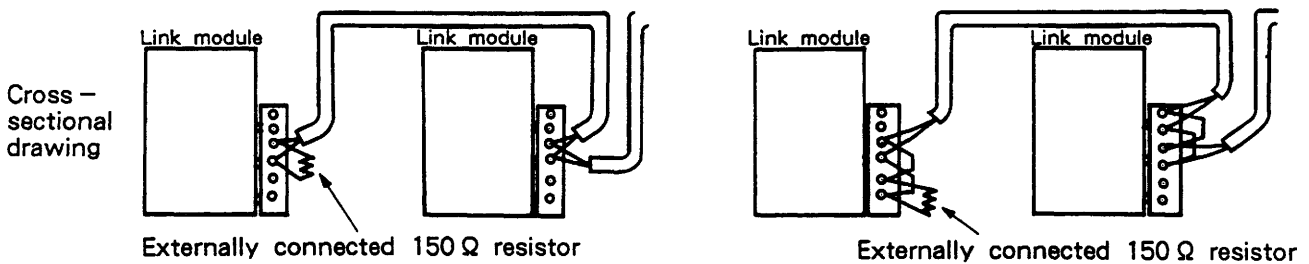


When it is necessary to perform communications during module connection, use the connections shown below.

Either method (a) or (b) can be used.

(a) Common fastening of cables

(b) Connection between input and output terminals



Note : Connect the upper and lower terminals of the terminals as shown above.

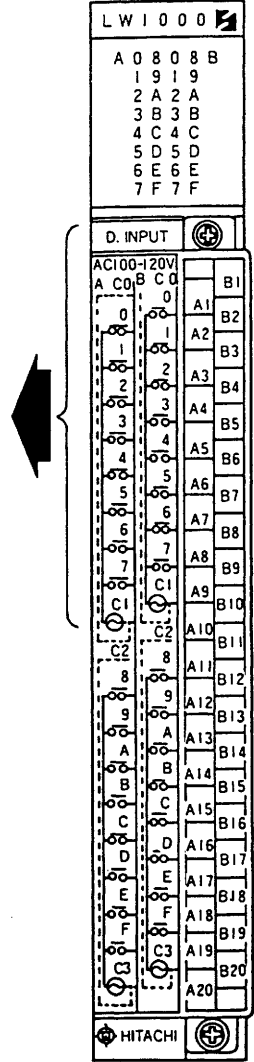
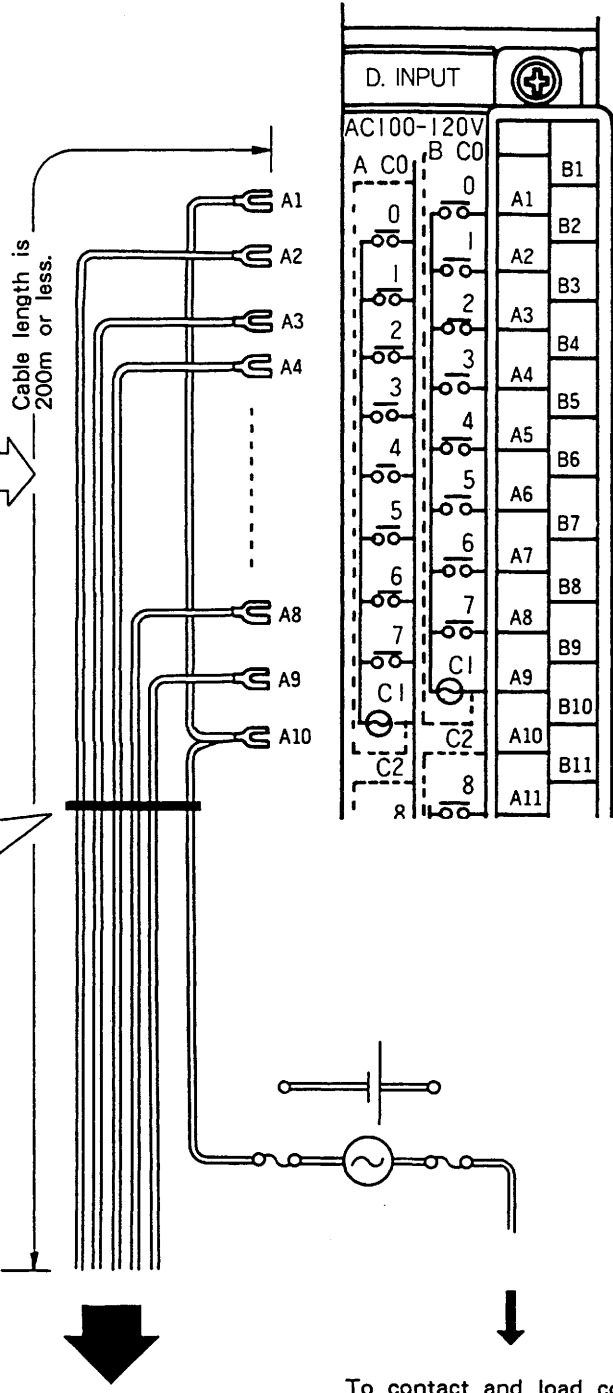
\* The remote I/O circuits are the same as the CPU link, F. LINK circuit.

■ Wiring of the I/O Module

Digital I/O Module Wiring

Wire 8 points at a time.  
DI and DO modules are the 8-point common type. Connecting the 8 points at a time as shown in the figure makes the leads easy to handle.

Tie wraps  
Tie wraps Bundle the leads together with the spacing at which they will not become separated from each other.

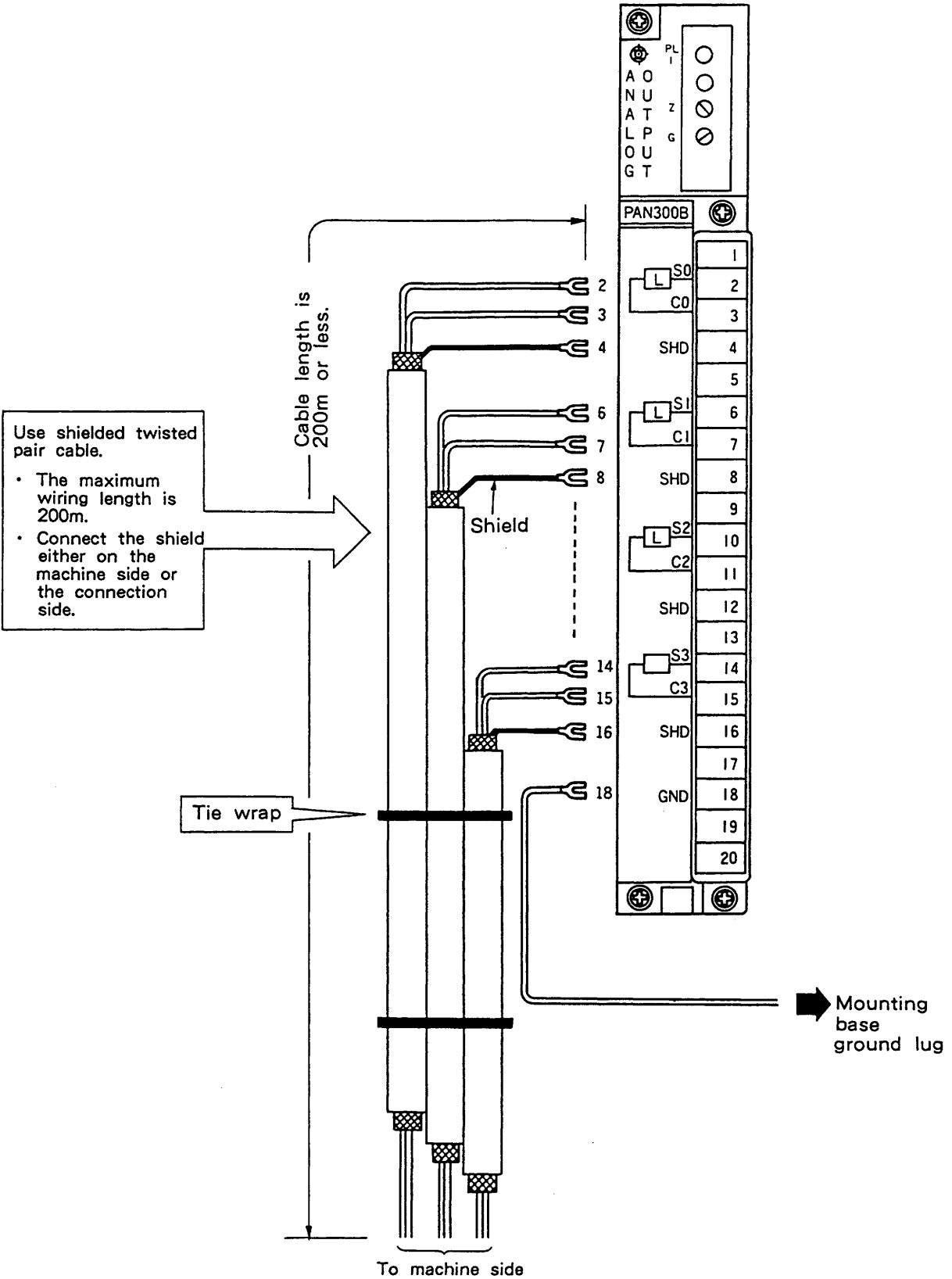


Connect DI to the contact and DO to the load.

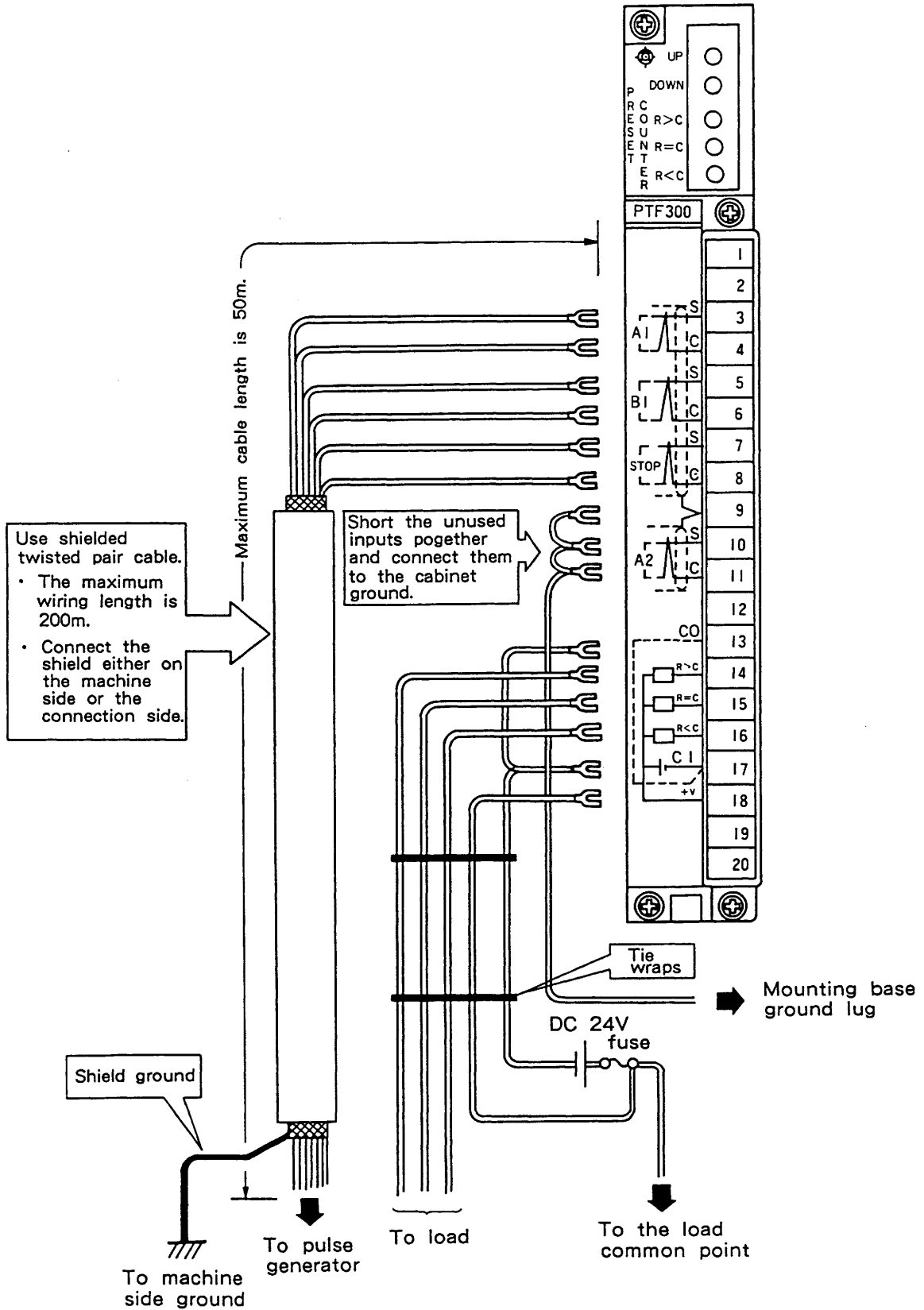
To contact and load common points.

### 3 INSTALLATION AND WIRING STANDARDS

#### Analog Module Wiring



Pulse Counter Module Wiring



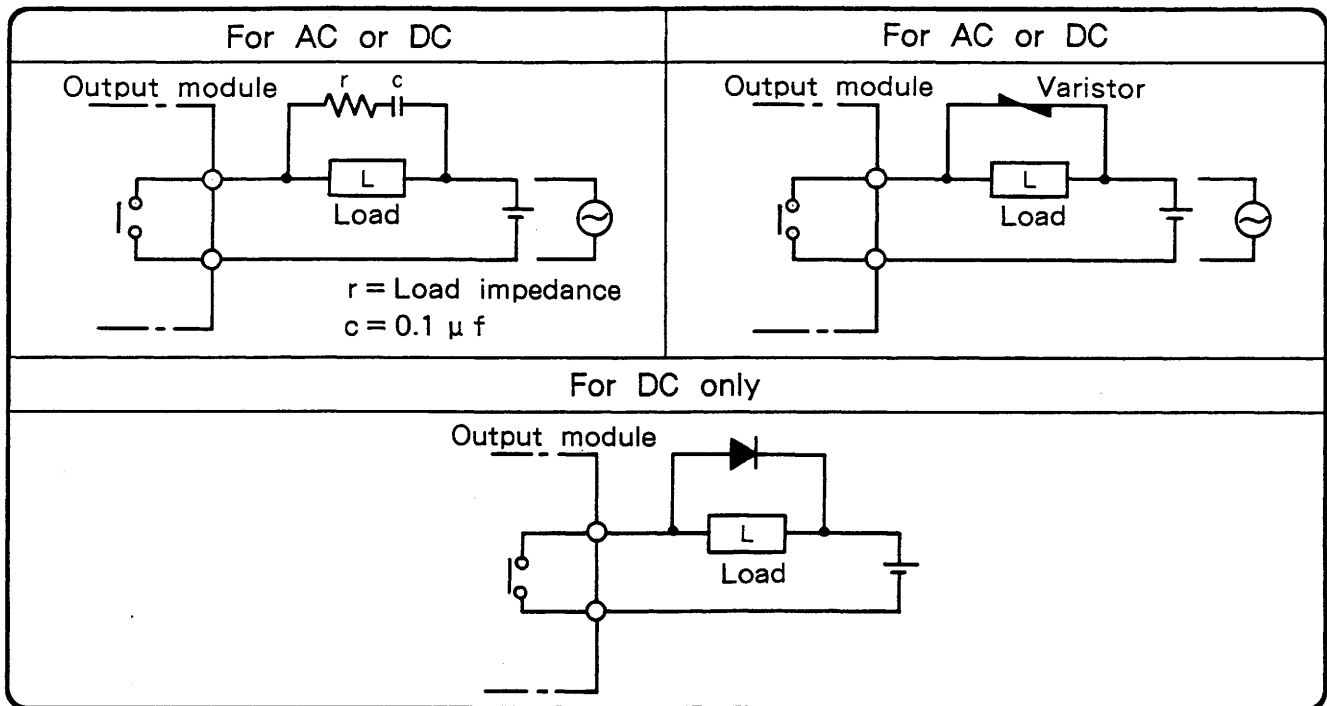
### 3 INSTALLATION AND WIRING STANDARDS

#### ■ Precautions for the Use of Output Modules

##### Contact Protective Circuits

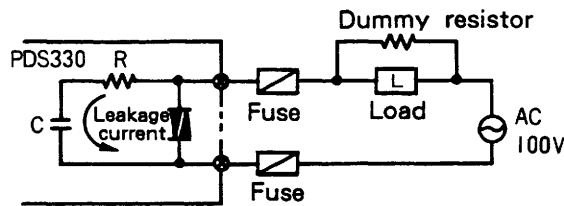
When a load (L) is driven by a contact output module, flyback voltages are generated when the power is turned on and off, and these voltages can be the source of noise. Therefore, we recommend the installation of a surge absorbing circuit such as shown below when the load (L) is used.

When a load (L) is driven by a DC power supply, always use a surge absorbing circuit.



##### Leakage Current

Even when the Triac is off, leakage current flows in the C-R circuit, and with a light load such as a neon lamp or a relay, the circuit may operate (The neon lamp may light, etc.). Therefore, connect a dummy resistor in parallel with the light load as shown below.

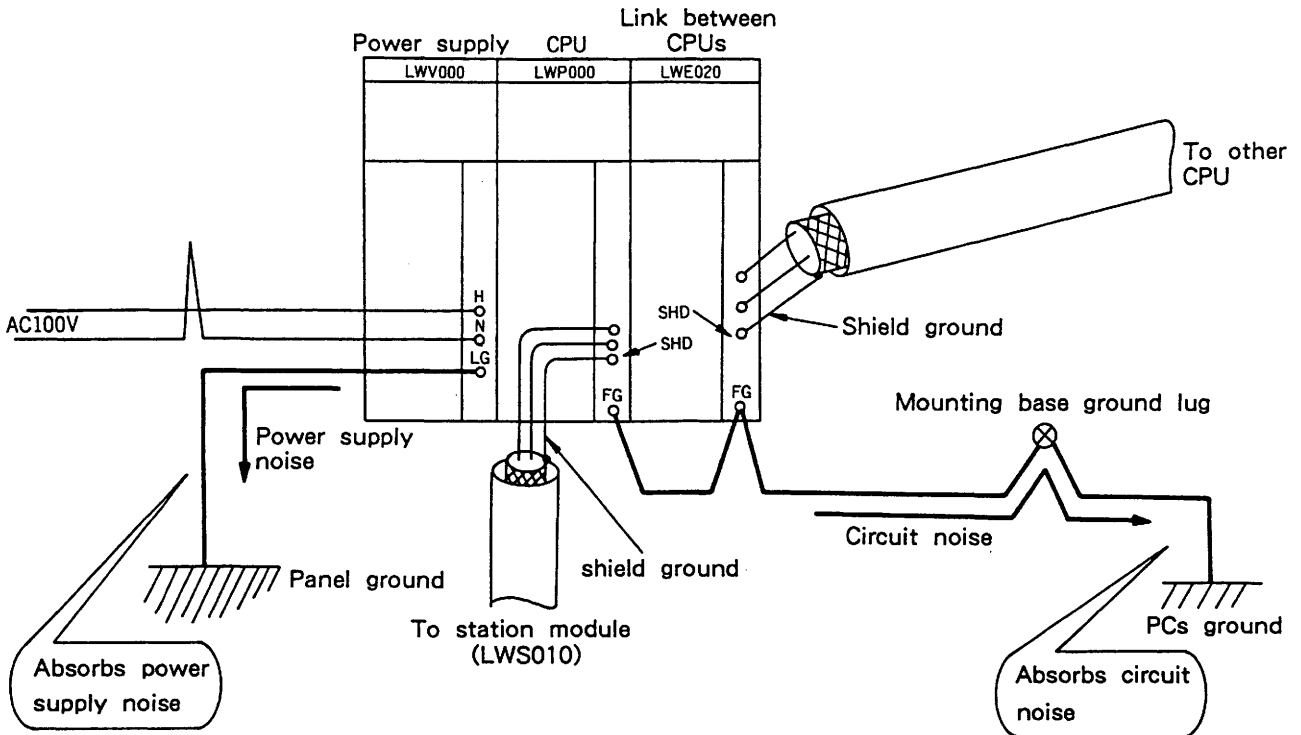


Connection of dummy resistor

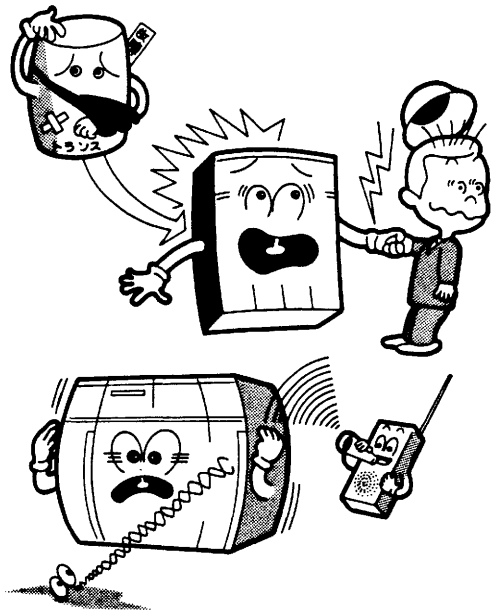
### 3 Supplementary Explanations

#### Reason for Separation of LG and FG

LG and FG each has its own function. LG is an escape path for noise, and FG is an escape path for circuit noise in the remote I/O and the links between the CPUs. Separate them to prevent interference between them.



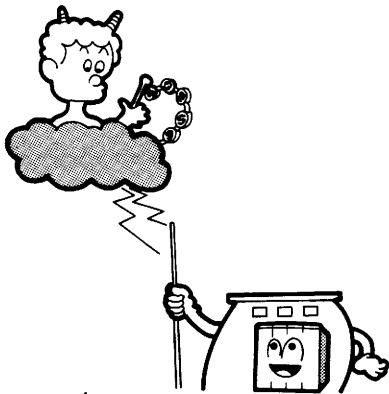
#### Miscellaneous



#### Why Grounds are Necessary

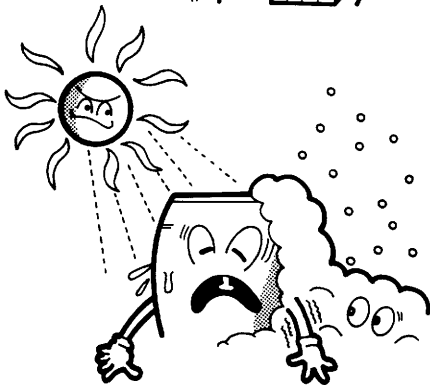
- (1) Grounds are used to protect operators from injury when high voltage is applied from high-voltage equipment to low-voltage equipment due to breakdown of transformers, etc.
- (2) Grounds are used to prevent faulty operation of equipment due to noise caused by the transmission of electromagnetic waves through the air from internal circuits or signal circuits of other equipment.

### 3 INSTALLATION AND WIRING STANDARDS



#### In Areas where Lightning Occurs Frequently

There are frequent cases in which the PCs is damaged by faulty operation caused by high – frequency noise and surge voltage. For this reason, in areas where lightning occurs frequently, devices such as lightning conductors, isolation transformers (with electrostatic shields), etc. are required to interrupt and attenuate the surge voltage.

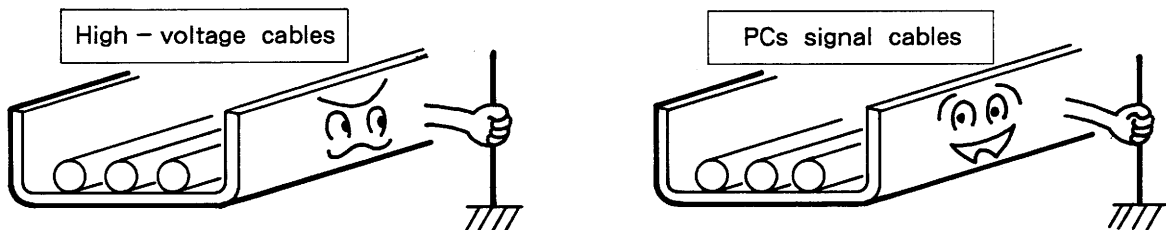


#### In Hot and Cold Areas

The PCs are not guaranteed for operation where the environmental requirements are not met. The temperature and humidity may be out of the specified range where the PCs are installed. Run the air conditioner to regulate the temperature and humidity.

#### Wiring Using Ducts and Electrical Conduits

When the PCs cables and high – voltage cables of other equipment run parallel to each other for long distances, separate them with ducts or conduits. Also, always ground the ducts and conduits.



#### Measures Against Rats

The best measure for preventing rats from chewing cables and entering machines is to destroy the environment in which the rats can live.

Actually, this can be done by blocking the rats' movements and not leaving them any food.

Also, when professional extermination is performed, care must be taken to prevent bad connections caused by the repellent.

