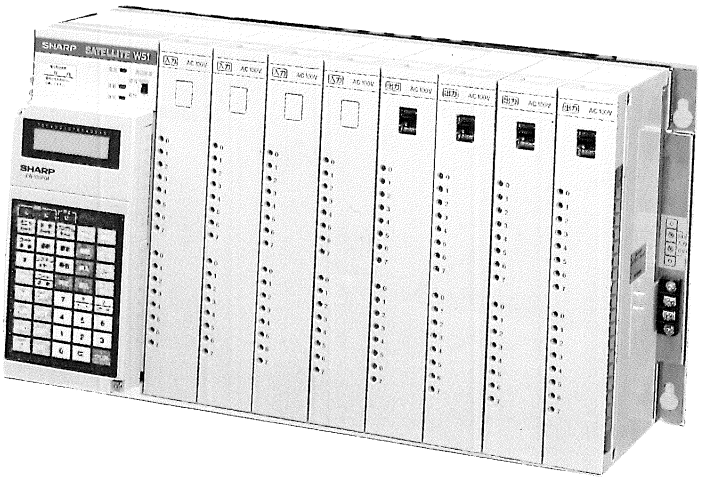
SHARP Programmable Controller Manual

NEW SATELLITE W51

W51 Series Installation Manual



SHARP CORPORATION

Thank you very much for your purchase of Sharp Satellite W-51.

Please be sure to read this manual thoroughly in order to attain correct operation of the W-51.

This manual should be kept close at your hand for your quick reference.

Points of ZW-501CU2 operation

1. Please transfer the expression of ZW-501CU to ZW-501CU2 on every manuals.
2. Available for 7.5KW ROM operation by using optional ROM module (ZW-501MO2). (also 3.5KW ROM operation by using optional ROM module (ZW-501MO).)

Table of contents

§1 What must be cared for

Observe the following cautions before operation or storage of the W-51.

(1) Prepare an independent ground line of Class 3 or above and do not try to share ground with a high tension ground line.

(2) Be sure to provide the emergency circuit in an external relay circuitry and connect it with the halt line from the W-51.

(3) Do not install the W-51 under environments described next:

- Where exposed to a direct sunlight or where ambient temperature exceeds limits of 0 to 55°C.
- Where relative humidity exceeds limits of 35 to 90%RH and where moisture condensation is met by an abrupt temperature change.
- Where corrosive or flammable gas is prevaling.
- Where direct vibration or impact is encountered.

(4) Avoid to store the PC under a hot and damp place as the PC has a battery in it.

(5) Because static electricity is likely to arise under a dry weather, be sure to touch your hand with the grounded metallic part to release static before touching the W-51 directly.

(6) Every locking screws of all modules must be fastened securely.

(7) Firmly engage connectors that interface the standard base unit with I/O rack.

(8) Never use cleaning solution like thinner to clean the modules as it is likely to melt and discolor surface.

(9) Do not handle switches and connector fastening metals with too much force.

(10) Ensure polarity of DC 5V line between the CPU rack and the I/O rack. Wrong connection may destroy input/output modules concerned.

(11) Battery is mandatory to retain data memory contents at a time of power failure, even if the ROM is used for the memory.

(12) Relay numbers of input and output modules are determined by serial number. Pay special attention for the location of the input/output module and relay number when a special module other than the 16-point module, such as the 32-point module, is used. For detail of serial number determination, refer to Section 2-3 of Programming Manual.

(13) No vacant slot should be existing in a midway when the input/output module is installed in the CPU rack and I/O rack. In other words, input/output modules after the vacant number can not be controlled to operate.

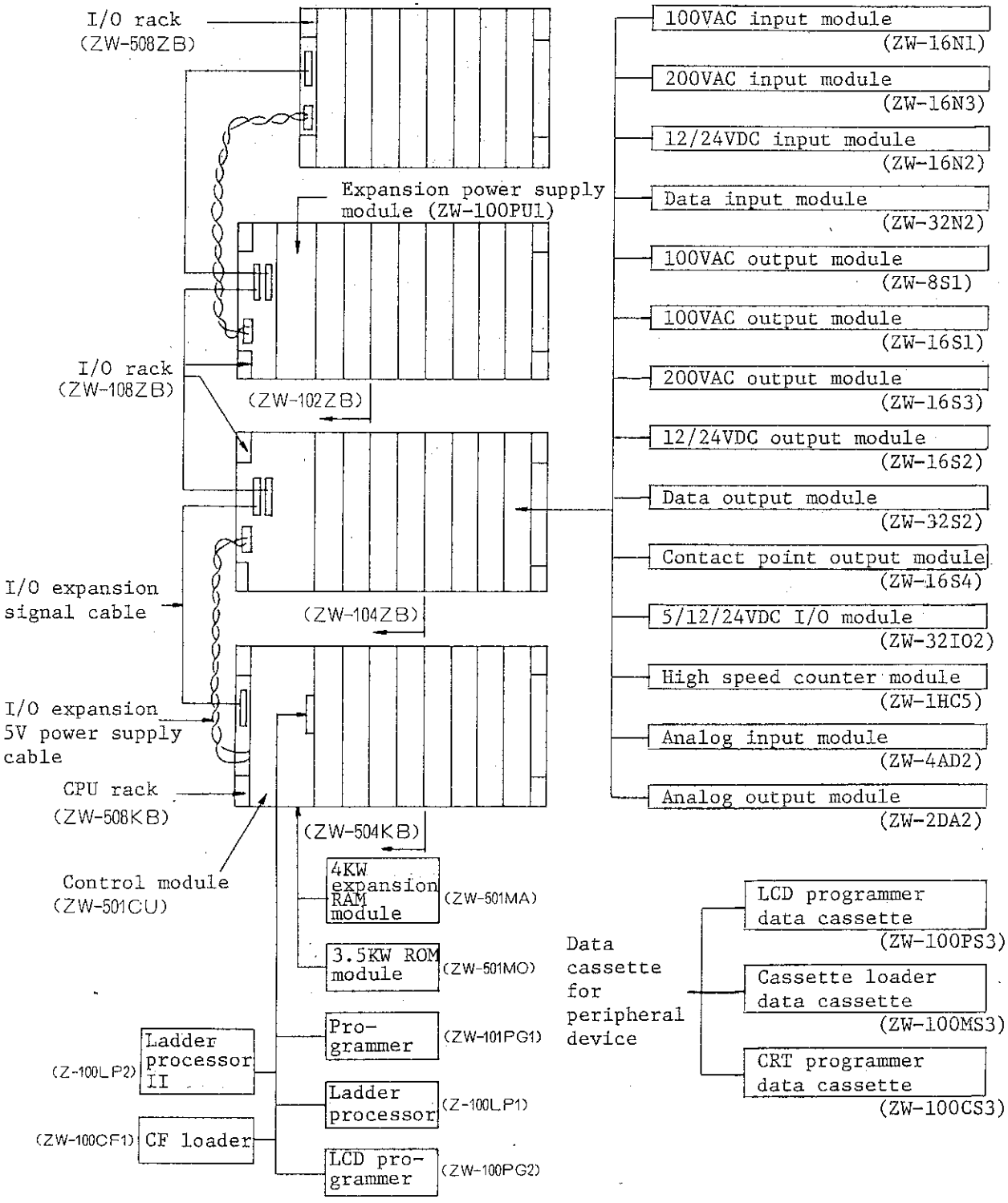
(14) As the maximum I/O point of the W-51 is 512 points and the maximum I/O slot is 32, don't exceed the 512 points I/O when using the 32 points I/O (for example, ZW-32N2) or the special I/O (for example, ZW-4AD2) which occupies 32 points I/O relay erea.

(15) As the watch-dog timer of the W-51 for the self diagnosis is seted at 150 ms, don't exceed 150 ms for the scan time of the programming. If the scan time exceeds 150 ms, the Halt Output of the control module makes OFF (OPEN).

§2 System configuration and general specification

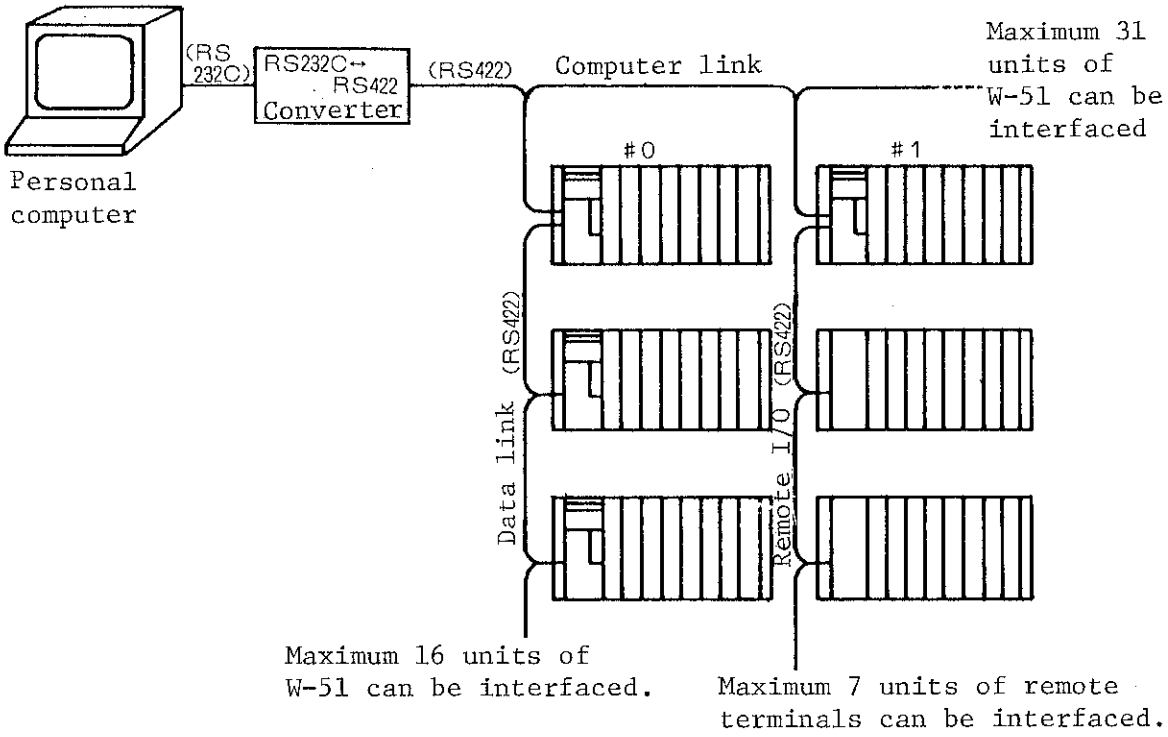
2-1 W-51 series system configuration

[1] Basic system configuration



NOTE: Contact your dealer for detail of the cassette loader and CRT programmer.

[2] Total system by computer link, data link, and remote I/O



The following options are required to comprise the above system.

Function	Unit name	Model name	Note
Computer link	RS232C/RS422 converter	Z-101HE	To be installed near the personal computer.
	Computer link card	ZW-501CL2	Installed in the ZW-501CU control module.
Data link	Data link card	ZW-501DL1 ZW-501DL9	Installed in the ZW-501CU control module.
Remote I/O	Remote I/O master card	ZW-501RM1	Installed in the ZW-501CU control module.
	Remote I/O slave module	ZW-501RS1	Installed in the CPU rack on the remote slave side.

NOTE: For details of computer link, data link, and remote I/O, refer to Instruction Manual related.

2-2 List of modules

Module name	Model name	Description	Accessory	
			Item	Qty
Control module	ZW-501CU	CPU, memory, and power supply are fabricated. Maximum 512 I/O points can be installed. 3.5KW program memory is incorporated.	Glass tube, 250V, 1A, mini-fuse Glass tube, 250V, 2A, mini-fuse Expansion I/O cable (1m) Expansion 5V supply cable (1m) Installation Manual Programming Manual Address label	1 1 1 1 1 1 1
Expansion power supply module	ZW-100PU1	5VDC, 7A	Glass tube, 250V, 1A, mini-fuse Glass tube, 250V, 2A, mini-fuse	1 1
	ZW-100PU2	5VDC, 12A	Glass tube, 250V, 1A, mini-fuse Glass tube, 250V, 3A, mini-fuse	1 1
CPU rack	ZW-508KB	Can be equipped with the control module and 8 I/O modules.		
	ZW-504KB	Can be equipped with the control module and 4 I/O modules.		
I/O rack	ZW-108ZB	Can be equipped with the expansion power supply module and 8 I/O modules.	Expansion signal cable (45cm) Expansion 5V supply cable (60cm) I/O module side plate Side panel securing screw	1 1 1 2
	ZW-104ZB	Can be equipped with the expansion power supply module and 4 I/O modules.	Expansion signal cable (45cm) Expansion 5V supply cable (60cm) I/O module side plate Side panel securing screw	1 1 1 2

Module name	Model name	Description	Accessory	
			Item	Qty
I/O rack	ZW-102ZB	Can be equipped with the expansion power supply module and 2 I/O modules.	Expansion signal cable (45cm) Expansion 5V supply cable (60cm) I/O module side plate Side panel securing screw	1 1 1 2
	ZW-508ZB	Can be equipped with 8 I/O modules.	Expansion signal cable (45cm) Expansion 5V supply cable (60cm) I/O module side plate Side panel securing screw	1 1 1 2
Expansion RAM module	ZW-501MA	4KW expansion program memory		
ROM module	ZW-501MO	3.5KW program memory		
Input module	ZW-16N1	16 input points, 115VAC		
	ZW-16N2	16 input points, 12/24VDC		
	ZW-16N3	16 input points, 200VAC		
	ZW-32N2	32 input points, 12/24VDC	Interfacing connector	1
Output module	ZW-8S1	8 triac output points, 100VAC, 2A	Glass tube, 125VAC, 5A, mini-fuse	2
	ZW-16S1	16 triac output points, 100VAC, 2A	Glass tube, 125VAC, 5A, mini-fuse	2
	ZW-16S2	16 transistor output points, 12/24VDC, 2A	Glass tube, 125VAC, 5A, mini-fuse	2
	ZW-16S3	16 transistor output points, 200VAC, 2A	Glass tube, 250VAC, 5A, mini-fuse	2
	ZW-16S4	16 contact output points, 240VAC/ 30VDC, 2A	Glass tube, 250VAC, 5A, anti-surge, mini-fuse	2

Module name	Model name	Description	Accessory	
			Item	Qty
Output module	ZW-32S2	32 transistor output points, 5/12/24VDC, 0.5A	Glass tube, 125VAC, 5A, mini-fuse Interfacing connector	2 1
I/O module	ZW-31I02	16 input points, 16 transistor output points, 5/12/24VDC	Glass tube, 125VAC, 2A, mini-fuse Glass tube, 125VAC, 300mA, mini-fuse Interfacing connector Installation Manual	1 2 1 1
Special modules	ZW-1HC5	50K PPS (90° phase differential signal), BCD 6-digit up/down, compare functions	Glass tube, 125VAC, 0.5A, mini-fuse Glass tube, 125VAC, 2A, mini-fuse Installation Manual	1 1 1
	ZW-4AD2	Input: 0 to ±20mADC or DC 0 to ±10VDC Output: BCD 3½-digit, 4 channels/module	Installation Manual	1
	ZW-2DA2	Input: BCD 3½-digit Output: 0 to ±10VDC or 0 to 20mADC, 2 channels/module	Installation Manual	1
Programmer	ZW-101PG1	LCD dot matrix display programmer	Control module interfacing cable (3m) Cassette tape recorder interfacing cable (1.5m) Connector lock spring Instllation manual	1 1 2 1
Liquid crystal display programmer	ZW-100PG2	·Message section: 20 columns, 2 rows, LCD dot matrix ·Display section: 11 lines of LCD segments with 11 contacts + 1 coil per line	Control module interfacing cable (3m) Case Shoulder strap Installation Manual	1 1 1 1

Module name	Model name	Description	Accessory	
			Item	Qty
Ladder processor	Z-100LP1	EL display: 6 relay lines + 2 message lines with 1 master control + 12 relay contacts + 1 coil per line	AC cord Ground cord Printer interfacing cable Shoulder strap Installation Manual	1 1 1 1 1
Ladder processor II	Z-100LP2	EL display: 11 relay lines + 2 message lines with 11 relay contacts + 1 coil per line	AC cord Ground cord Printer interfacing cable CF loader interfacing cable 25-p connector Glass tube, 125VAC, 3A, mini-fuse Installation Manual	1 1 1 1 1 1 1
CF loader	ZW-100CF1	Two-sided, 3-inch, 312KB compact floppy disk with 16-column, 2-row, display unit	AC cord Ground cord Glass tube, 125VAC, 2A, mini-fuse Soft case Shoulder strap Installation Manual	1 1 1 1 1 1

NOTE: The ZW-100PS3 LCD display programmer data cassette tape recorder is required when the LCD programmer is used.

2-3 General specification

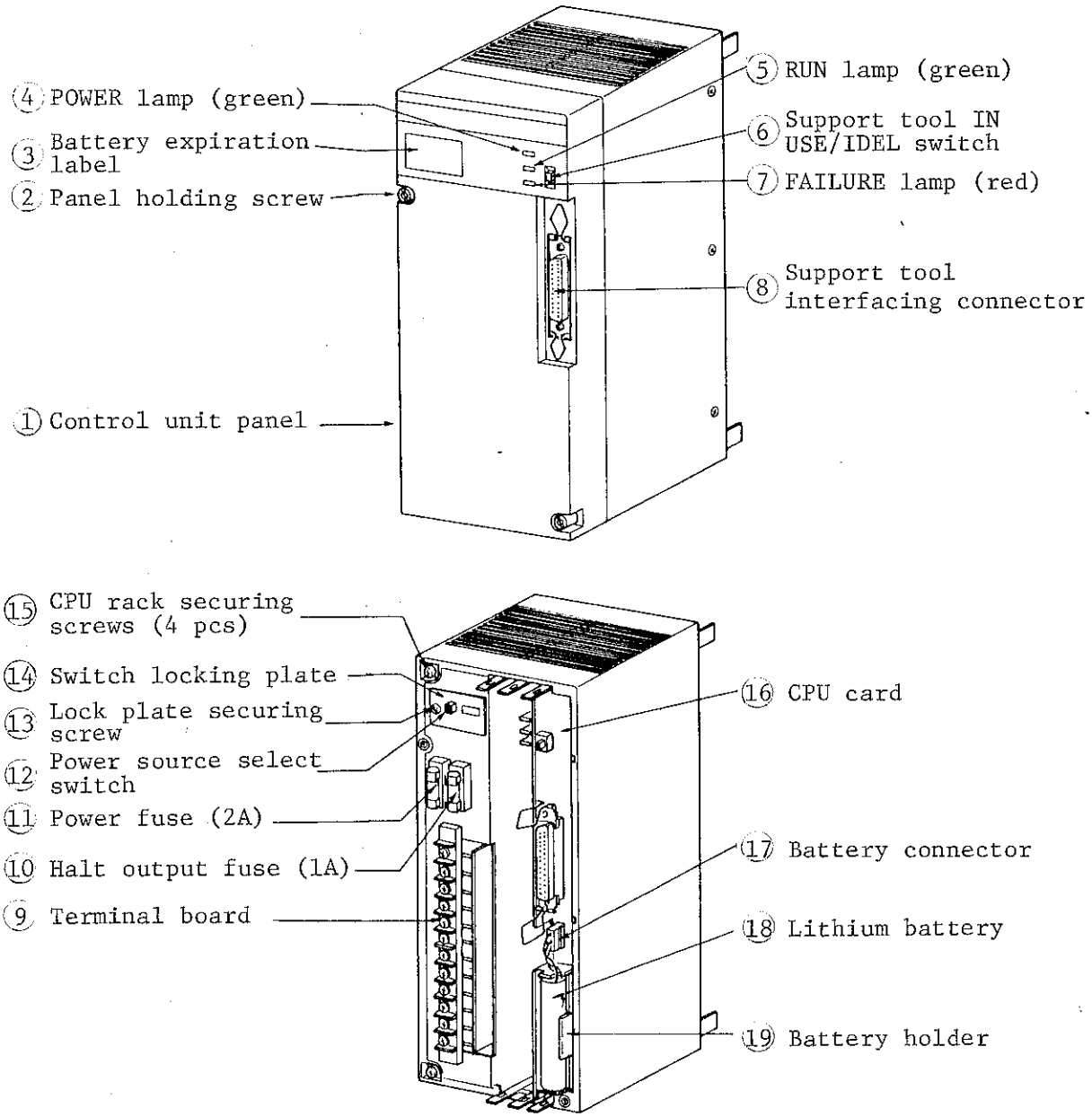
Item	Specification
Supply voltage	115VAC$^{+10}_{-15}$% or 200VAC$^{+10}_{-15}$%
Power source frequency	50/60Hz
Allowable power failure time	Normal operation is ensured for an instantaneous power failure of less than 10ms.
Insulation resistance	More than 10Mohms with 500VDC megger, external high tension terminal vs chassis (ground).
Dielectric strength	1500VAC, 50/60Hz, one minute, external high tension terminal vs chassis (ground).
Noise immunity	1000Vp-p, 1μs, as measured between power line and chassis on the noise simulator.
Storage temperature	-20 ∿ 70°C
Ambient temperature	0 ∿ 55°C
Ambient humidity	35 ∿ 90%RH (non condensed)
Anti-vibration	Conforms to JISC-0911Ⅲ-B , Class 3. (two hours each on X, Y and Z)
Anti-shock	Conforms to JISC-0912
Power consumption	50W, max., at the largest configuration
Weight	Approx. 7Kg (CPU rack, control module and 128 points I/O)
Environmental air	Free of corrosive gas and flammable gas.
Ground	Class 3 (under 100Ω)

NOTE: As concerns the support tool refer to the respective specification for allowable ambient temperature and storage temperature.

§3 Configuration of each module and functions

3-1 ZW-501CU control module

[1] Parts identification and functions



(View without control module panel)

① Control module panel

The panel has to be removed in one of the following conditions. (The panel not to be open during operation.)

- When the power supply, halt output cable, etc. is connected to the terminal board.
- When source voltage is selected.
- When the optional RAM module or ROM module is mounted or dismounted.
- When the fuse is replaced.
- When the battery is replaced.

② Panel securing screw

Not only this screw is used to secure the control module panel, but it also is used to hold the programmer holding screw when the ZW-101PG1 programmer is installed to the control module.

③ Battery expiration label

On this label is indicated the expiration data of the memory backup battery installed on the CPU board. The battery therefore has to be replaced with the fresh one before the data. After the replacement, the label has to be replaced with the label indicated with a new expiration date.

④ POWER lamp (green)

Lights up when 5V source is supplied to the control module.

⑤ RUN lamp (green)

- Lights up under the normal operation.
- Flickers during programming with the support tool in connection (but, the programmable controller halts).
- Goes out when an error is established by the selfcheck.

⑥ Support tool IN USE/IDLE lamp

This switch has to be turned to the "IDLE" side when such as the programmer is connected to or disconnected from the support tool connector. When it set to the "IN USE" side after completion of connection or disconnection, it enables communication between the support tool and the control module.

⑦ FAILURE lamp (red)

Lights up when an error is established by the selfcheck and the programmable controller stops its operation. But, in the cause of a battery failure, the programmable controller continues to operate.

⑧ Support tool interfacing connector

Support tool like the programmer is connected through this connector.

⑨ Terminal board (12 terminals)

Power and halt output cables and communication wires are connected on this terminal board.

⑩ Halt output fuse (1A)

A 250V, 1A, glass tube mini-fuse is used for the halt output circuit.

⑪ Power fuse (2A)

A 250V, 2A, glass tube mini-fuse is used on the primary side of power supply.

⑫ Source voltage select switch

Power source of either AC100V or AC200V can be chosen by means of this switch. Before it left the factory, it has been set to the AC100V side.

⑬ Lock plate securing screw and ⑭ switch locking plate

Holds secure the source voltage select switch knob to prevent incidental changing of the switch.

⑮ CPU rack holding screw

This screw secures the control module on the CPU rack.

⑯ CPU card

By this card is carried out the operation in accordance with the programmed sequence.

⑰ Battery connector

The lithium battery ⑱ is connected through this connector to supply power for retaining memory contents during AC power shutdown.

⑱ Lithium battery (parts code: DUNT-5211NCZZ)

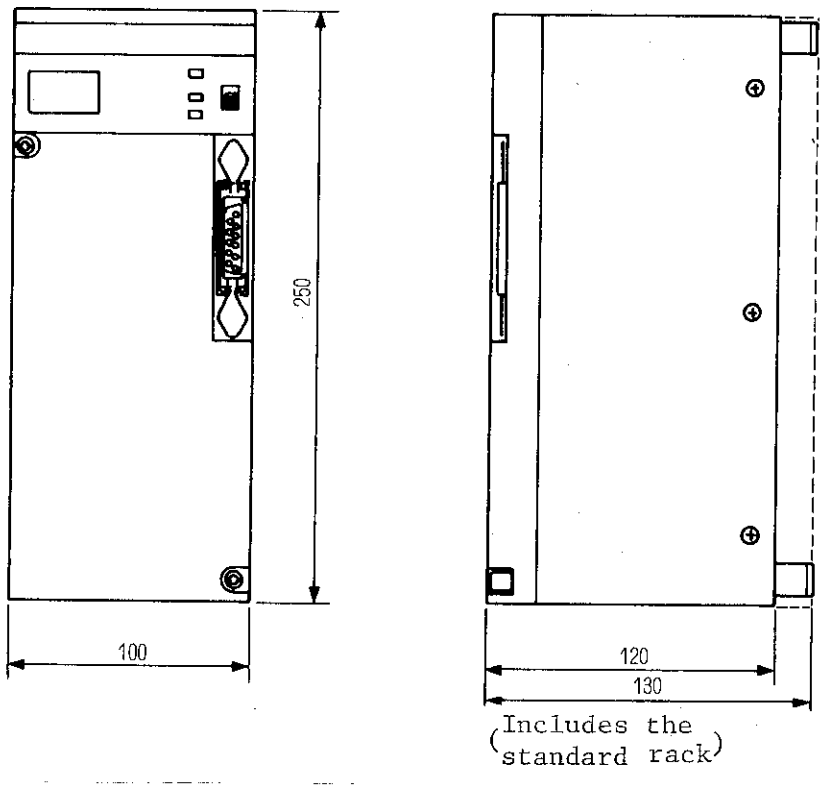
The memory backup battery that required to retain the data memory contents even with the ROM module in use. It has to be replaced with

the fresh one before the battery expiration date mentioned in Item ③ above.

⑲ Battery holder

Used to secure the lithium battery on the CPU card.

[2] Dimensional view



[3] Performance specification

Item	Specification
Programming method	Stored program
Control method	Cyclic operation
Processing speed	About 1.63μs/word for basic instruction excluding timer, counter, MD, and application instructions. (Reference) Processing speed for basic instruction only 2.5KW: abt 5ms 3.5KW: abt 6.7ms 5.5KW: abt 10ms (Note) For details of instruction processing speeds, refer to Programming Manual, Section 3-6.

Item		Specification
Instruction set		Basic instructions: 12
		Application instructions (instruction used in conjunction with the FUN key): 42
Program capacity	RAM	3.5KW, basic Up to a maximum of 7.5KW by the use of optional RAM module.
	ROM	3.5KW by the use of optional ROM module.
User program memory element		CMOS-RAM, with battery backup or PROM (option)
Battery		Lithium battery (parts code: DUNT-5211NCZZ)
Control I/O points		512 points, max.
Data memory	I/O relays	512 points (0000∿0777)
	Link relays	512 points (2000∿2777)
	Auxiliary relays	512 points (4000∿4777)
	Retentive relays	224 points (7000∿7337)
	Special relays	Non-carry flag (7354) Error flag (7355) Carry flag (7356) Zero flag (7357) 0.1 second clock (7360) 1.0 second clock (7364) Preset value change switch (7365) Zero-cross switch (7367) Parity error (7370) CPU error (7371) Battery failure (7372) I/O error (7373) Option error (7374) ROM error (7376) Power failure detect (7377)
	Timer Counter MD	Total 128 points (000 ∿ 177) Timer preset range : 0.1 to 199.9 seconds Counter preset range: 1 to 1999 MD preset range : 0 to 999 Counter and MD current values are retained at a time of power failure. Choice of reset or retention of the contents at time of power failure for the timer.

<table>
<tr><th colspan="2">Item</th><th>Specification</th></tr>
<tr><td rowspan="3">Data memory</td><td>Registers</td><td>256 bytes, 8-bit structure, retained at a time of power failure</td></tr>
<tr><td>Special register</td><td>One byte (□.734) ..... store of error code</td></tr>
<tr><td>File register</td><td>For register expansion of 4KB maximum (30000∿37777)
<table>
<tr><th></th><th>Program memory</th><th>File register</th></tr>
<tr><td rowspan="2">Basic configuration</td><td>3.5KW</td><td>Not usable</td></tr>
<tr><td>2.5KW</td><td>2KB (30000∿33777)</td></tr>
<tr><td rowspan="2">Used in confunction with the optional RAM module</td><td>5.5KW</td><td>4KB (30000∿37777)</td></tr>
<tr><td>3.5KW</td><td>4KB (30000∿37777)</td></tr>
<tr><td rowspan="2">Used in conjunction with the ROM module</td><td>3.5KW</td><td>Not usable</td></tr>
<tr><td>2.5KW</td><td>2KB (30000∿33777)</td></tr>
</table></td></tr>
<tr><td colspan="2">System memory</td><td>For specifying control module operation (memory retention at power failure)
<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>#200</td><td>Keep relay area designation</td></tr>
<tr><td>#201</td><td>Reset/retain choice of timer contents at a time of power failure.</td></tr>
<tr><td>#202</td><td>ON reset/OFF reset choice for the counter instruction</td></tr>
<tr><td>#203</td><td>Output hold address designation at a time of failure</td></tr>
<tr><td>#204</td><td>Program memory capacity designation</td></tr>
<tr><td>#205</td><td>File register capacity designation</td></tr>
<tr><td>#206</td><td>Station number registration during computer link.</td></tr>
<tr><td>#207</td><td>Station number registration during data link 1.</td></tr>
<tr><td>#210∿#217</td><td>Store of error code</td></tr>
</table>
For details of the system memory, refer to Programming Manual, "System memory".</td></tr>
</table>

Item		Specification								
Self-check	Item	Contents	PC state	Halt output	Indicator			Special relay	Error code	
					RUN	FAILURE	POWER		Special register	System memory
	Memory failure	Parity check	Stop	Open	Off	On	On	7370	20	21
	CPU error	Watchdog timer						7371	30	31
		RAM test (W/R)								32
		Parity check								33
		ROM test								34
		Hardware test								35
	I/O failure	I/O data bus						7373	40	44
		I/O module								45
	Power failure	Power interrupt/drop				Off	Off	7377	10	13
	Option in failure	Failure in optional module				On	On	7374	50	53
	Battery failure	Battery voltage drop	Run	Close	On	On	On	7372	20	22
Halt output		AC100/200V, 1A, triac output is active (closed) during the operation of the PC.								

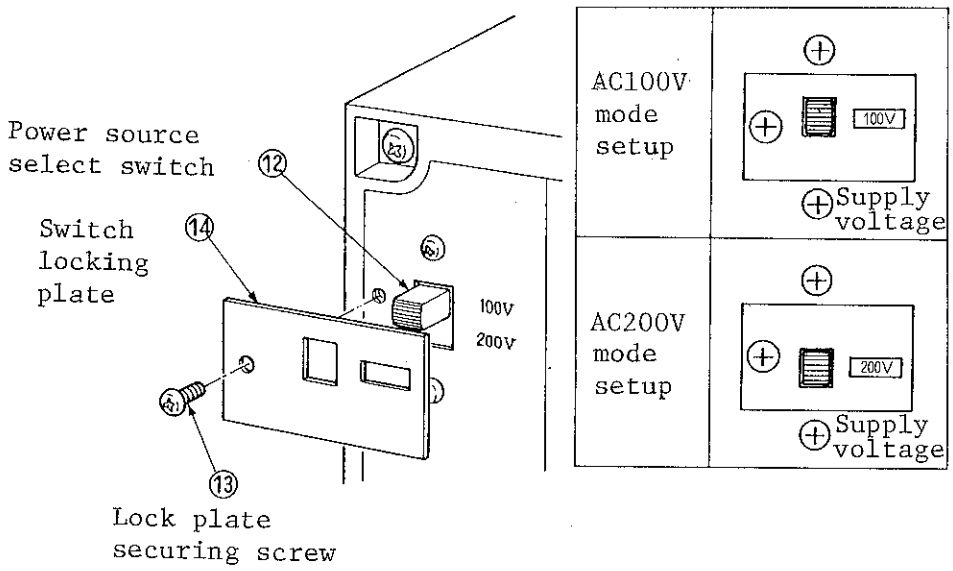
NOTE-1: Retentive relay area (7300∿7337) also is used as the special relay when using computer link data link and remote I/O. Refer to the respective manual for detail.

NOTE-2: Error code is represented in BCD code.

[4] Source power setup

Either AC100V or AC200V supply can be used for the control module drive power.

Before the products left the factory, the power source switch has been set to the AC100V side. The switch must be turned to the AC200V side in the following manner when it has to be operated under AC200V.



(Set in the AC100V mode)

1) Remove the lock plate securing screw (13).
2) Remove the switch locking plate (14).
3) Set the select switch (12) to the 200V side.
4) Use the switch lock plate (14) other side around during AC100V operation and fix it over the switch.
5) Fasten the lock plate securing screw (13).

NOTE-1: When AC200V is supplied with the power source select switch set to the AC100V side, damage may be done to the control module.

[5] About memory module

The 3.5KW RAM is equipped standard for the program memory. The ZW-501MA RAM module option must be used when the program is expanded above 3.5KW or the file register is expanded.

When the PROM is used for the program memory, the ZW-501MO ROM module must be used.

	Program memory		File register	
	Capacity	Address	Maximum capacity	Address
Basic configuration	3.5KW	00000∿06777	Not usable	
	2.5KW	00000∿03777	2KB	30000∿33777
ZW-501MA expansion RAM module in use	7.5KW	00000∿16777	Not usable	
	6.5KW	00000∿14777		
	5.5KW	00000∿12777	4KB	30000∿37777
	4.5KW	00000∿10777		
	3.5KW	00000∿06777		
	2.5KW	00000∿04777		
ZW-501MO ROM module in use	3.5KW	00000∿06777	Not usable	
	2.5KW	00000∿04777	2KB	30000∿33777

The capacity of the program memory and file register are assigned after registration of the respective capacity in the system memory.

Program memory capacity			File register capacity		
System memory #204	000	2.5KW	System memory #205	000	Not used
	001	3.5KW			
	002	4.5KW		001	2KB
	003	5.5KW			
	004	6.5KW		002	4KB
	005	7.5KW			

NOTE-1: The maximum capacity of the file registers will be 4KB, even if the program memory capacity is set to 4.5K, 3.5K or 2.5K using the RAM module option.

NOTE-2: One of the following configurations can be established by the use of the ROM module.

(1) Program memory of 3.5KW without use of file register.

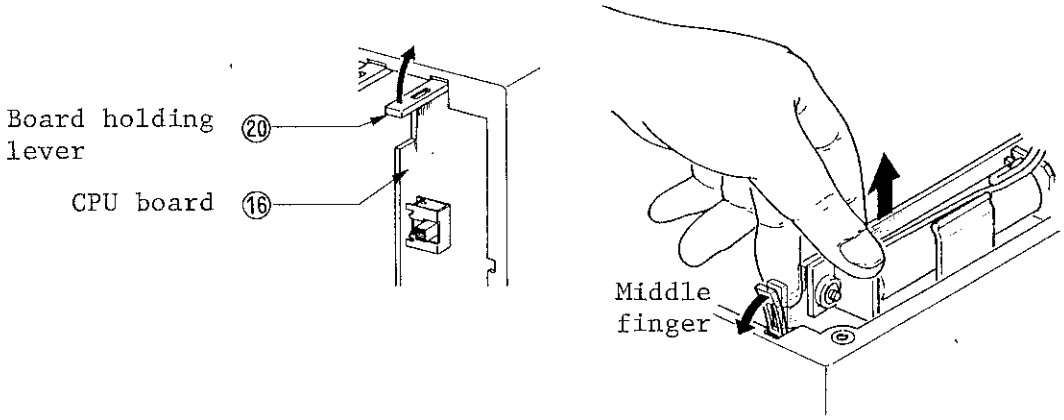
(2) Program memory of 2.5KW with 2KB of file register.

(3) Program memory of 2.5KW without use of file register.

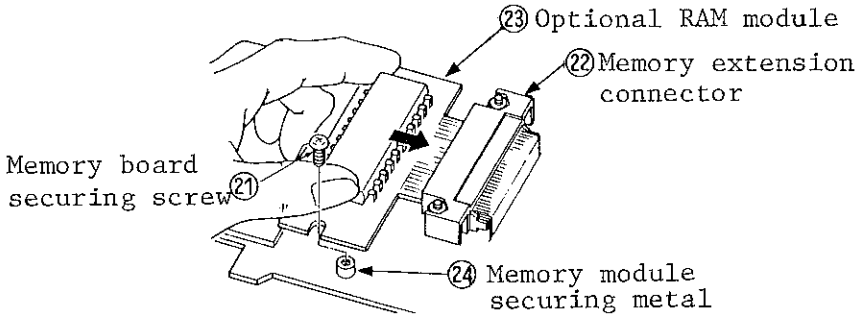
The memory configuration established using the RAM module option (ex. program memory of 3.5KW with 4KB of file register) is not applicable when the ROM module is used.

How to mount the memory module

RAM module option can be mounted in the following manner.



1) Shut off AC power to the control module.
2) Remove two screws that secure the control module panel (2) and remove the control module panel (1) from the control module.
3) Open the two board holding levers (20) in outward direction (arrowhead) and pull out the CPU board from the casing. Push away two levers in the arrowhead direction using your middle fingers and hold the baord with your thumb and index finger.



4) Remove the memory board securing screw (21).
5) Fasten the option RAM module (23) to the memory extension connector (22) of the CPU board.
6) Put the memory board securing screw (21) through a cut in the RAM module option (23) and fasten it to the memory module securing metal of the CPU board.
7) Replace the CPU board back into its place.

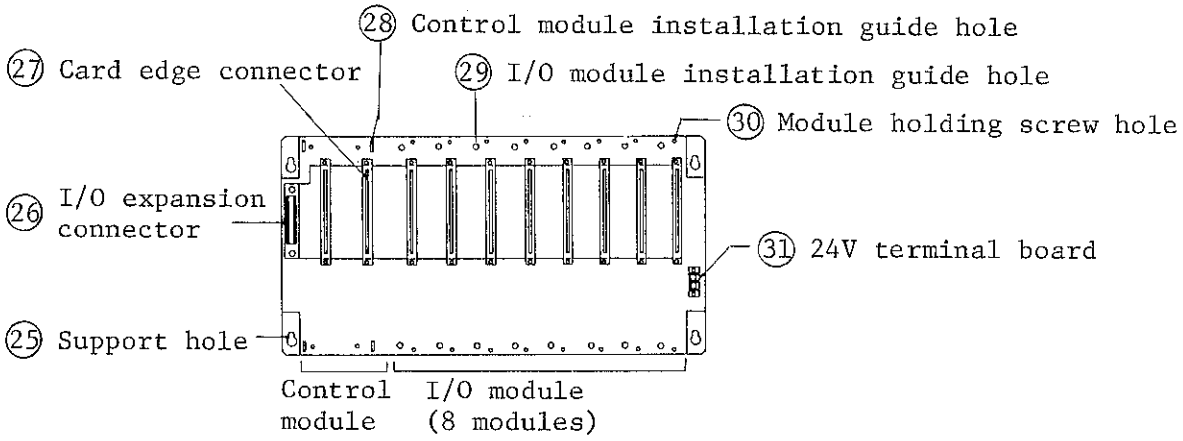
8) Replace the control module panel back into its place.

9) Turn on AC power to the control module.

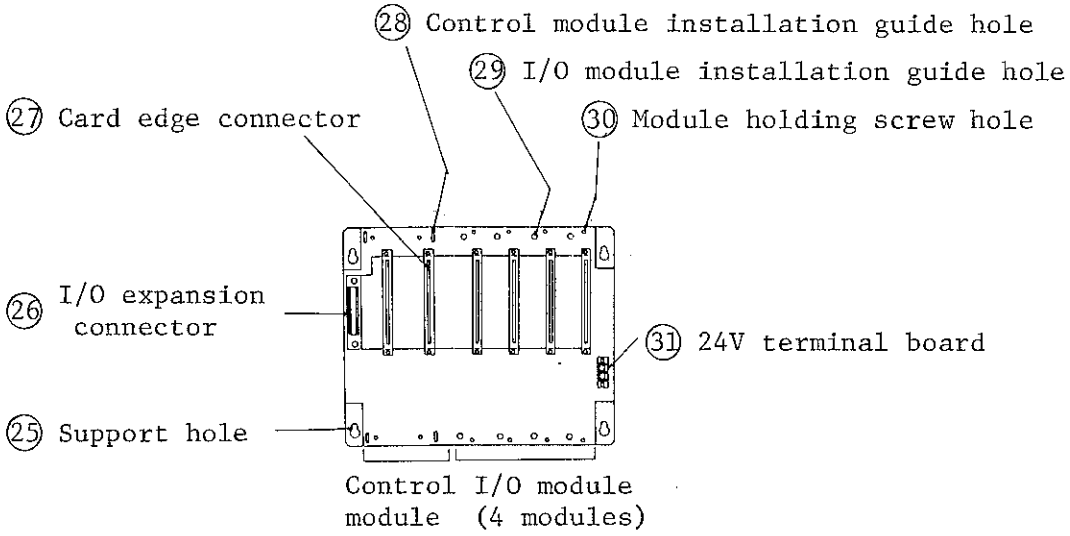
10) Clear the memory area by means of such as the programmer. However, it does not need to apply for the ROM module.

3-2 CPU rack and I/O rack

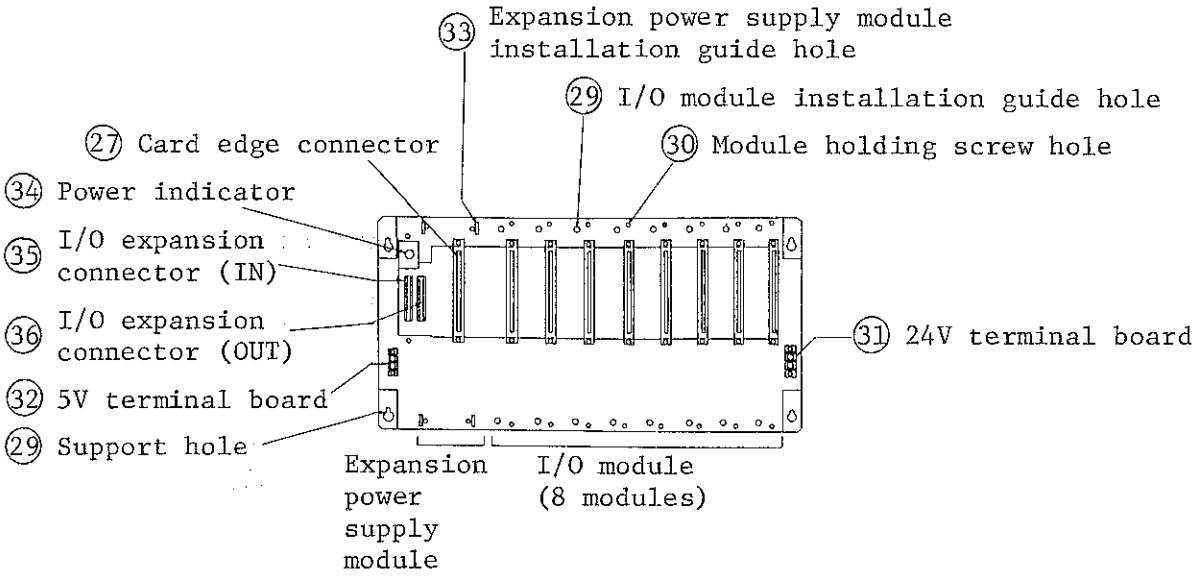
[1] Parts identification and functions



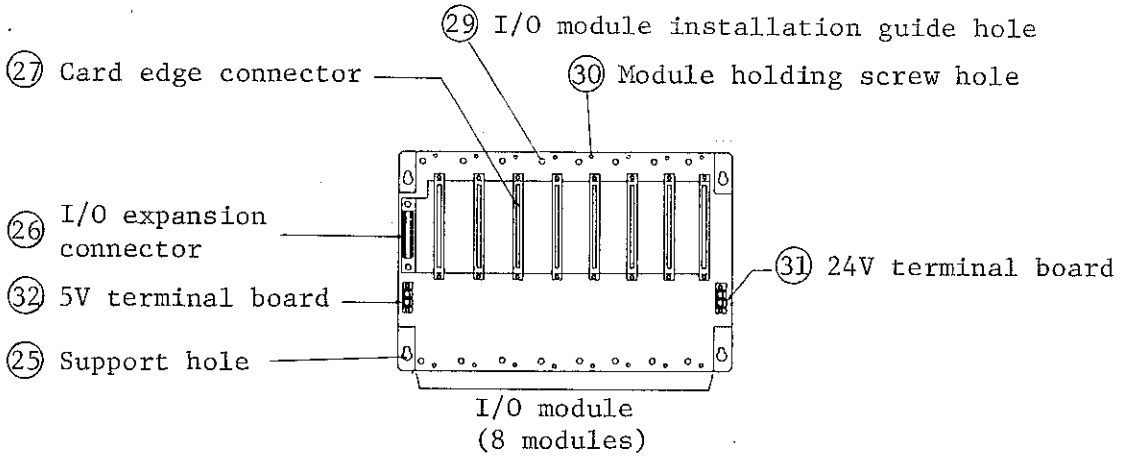
CPU rack (ZW-508KB)



CPU rack (ZW-504KB)



I/O rack (ZW-108ZB)



I/O rack (ZW-508ZB)

㉕ Support hole

It is an oval hole which support the rack on the control panel. Use the M5 screw.

㉖ I/O expansion connector

It is the signal connector used to interface the CPU rack with the I/O rack. Use the I/O expansion cable that comes with the I/O rack or the control module.

The connector is protected by the cover when the machine is delivered.

㉗ Card edge connector

It is the connector used to interface the control module, I/O module, and expansion power supply module to the rack. The CPU rack has two control module interfacing connectors and eight I/O module interfacing connectors for the ZW-508KB (or four connectors for the ZW-504KB). The I/O rack has eight I/O module interfacing connectors, and, the ZW-108ZB has one expansion power supply module interfacing connector.

The connectors are protected by the cover when the machine is delivered.

The connector not used must be left protected with the cover.

㉘ Control module installation guide hole

Used to hole the control module on its position.

㉙ I/O module installation guide hole

Used to hold the I/O module on its position.

㉚ Module holding screw hole

Used to secure the control module, I/O module, and expansion power supply module to the rack.

㉛ 24V terminal board

External 24VDC (or 12VDC) is supplied when the ZW-16S2 DC output module is used for the I/O module.

㉜ 5V terminal board (I/O rack only)

5VDC is supplied from the control module. Use the I/O rack or the 5VDC cable that comes with the control module for the interfacing cable.

㉝ Expansion power supply module installation guide hole
Used to hold the expansion power supply module on its position.

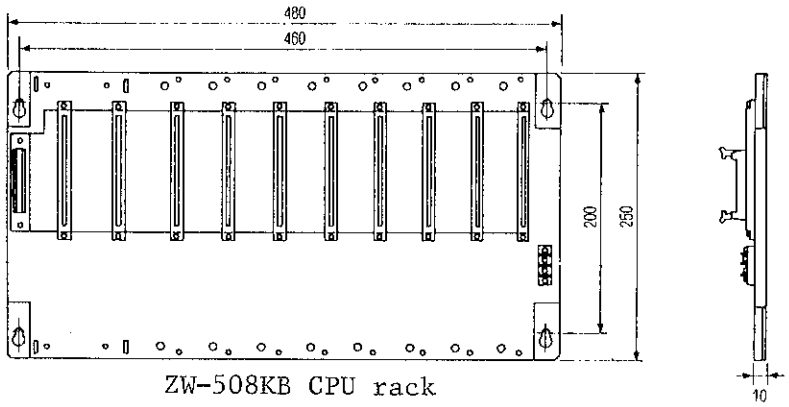
㉞ Power indicator
Used to indicate supply of 5VDC to the ZW-108ZB I/O rack.

㉟ I/O expansion connector (IN)
Signals are connected from the ZW-108ZB I/O rack or CPU rack from the preceding stage.

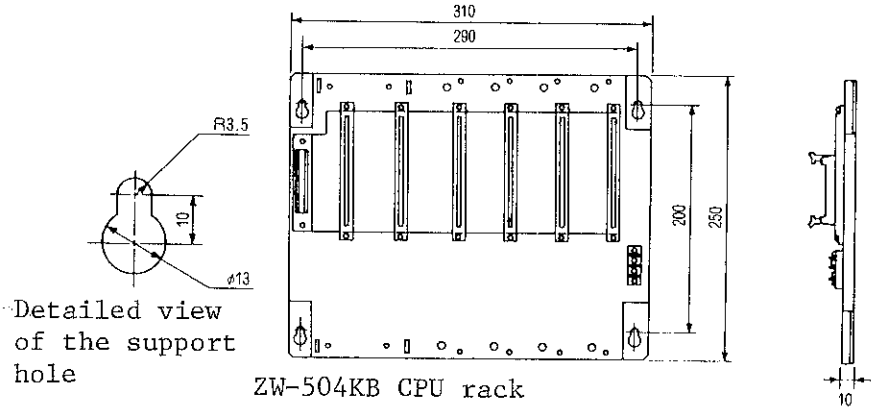
㊱ I/O expansion connector (OUT)
Signals are connected to the I/O rack in succeeding stage.

NOTE-1: In addition to the above four kinds of racks, there are two kinds of racks available; the ZW-104ZB which can contain an expansion power supply module and a maximum of four I/O modules and the ZW-102ZB which can contain an expansion power supply module and a maximum of two I/O modules.

[2] Dimensional view

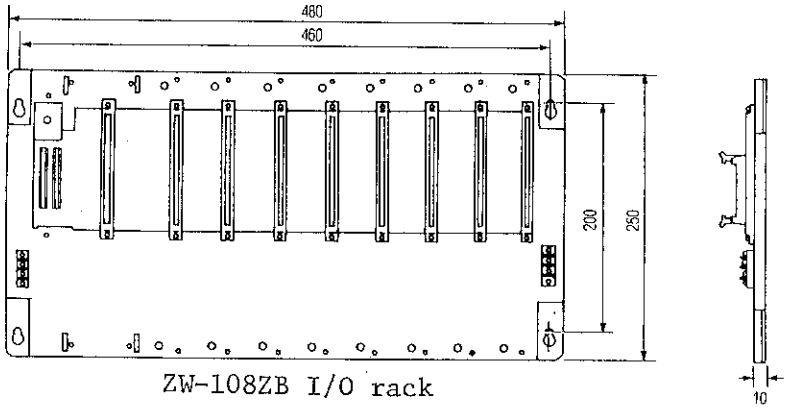


ZW-508KB CPU rack

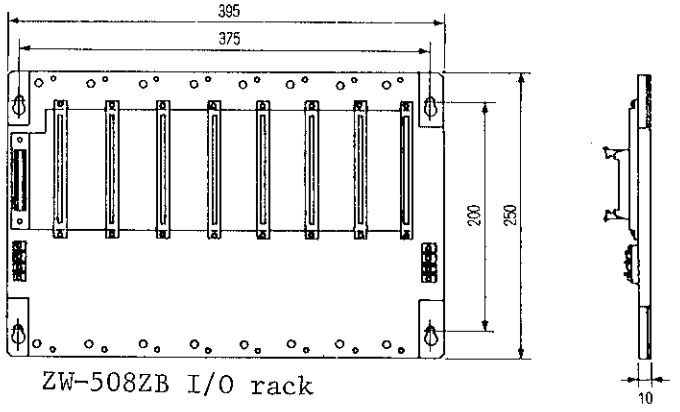


Detailed view of the support hole

ZW-504KB CPU rack



ZW-108ZB I/O rack



ZW-508ZB I/O rack

[3] Precautions about the CPU and I/O racks

1) In case the I/O module installation space (8 modules) of the ZW-508KB CPU rack is not sufficient, it is possible to expand with 16 I/O modules with the ZW-508ZB or ZW-108ZB I/O racks in use.

2) For a smaller system, the ZW-504KB CPU rack is available that permits expansion for 4 I/O modules with which permits expansion with 12 I/O modules with the ZW-508ZB or ZW-108ZB I/O racks in use.

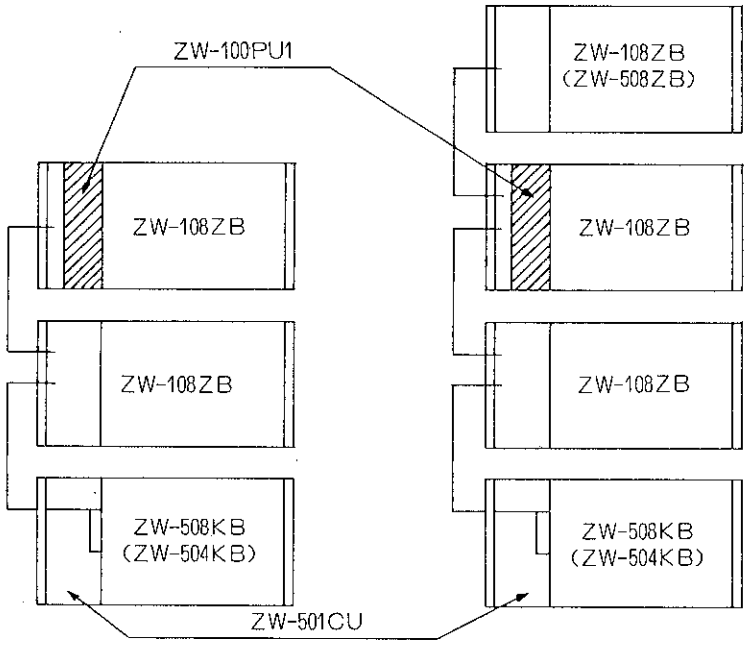
	ZW-508KB CPU rack	ZW-508KB CPU rack + ZW-508ZB or ZW-108ZB I/O rack	ZW-504KB CPU rack	ZW-504KB CPU rack + ZW-508ZB or ZW-108ZB I/O rack
Maximum number of I/O modules	8	16	4	12
Maximum number of I/O points when 16-point module is used for all	16×8=128	16×16=256	16×4= 64	16×12=192
Maximum number of I/O points when 32-point module is used for all	32×8=256	32×16=512	32×4=128	32×12=384
When "n" number of 16-point modules are used in conjunction with "m" number of 32-point modules	16×n+32×m			
	$n+m \leqq 8$	$n+m \leqq 16$	$n+m \leqq 4$	$n+m \leqq 12$

3) To expanded to 512 points with 16-point modules, use two or three units of the ZW-108ZB I/O racks.

	ZW-508KB CPU rack + ZW-108ZB CPU rack ×2	ZW-508KB CPU rack + ZW-508ZB CPU rack ×2 + ZW-508ZW or ZW-108ZB I/O rack	ZW-504KB CPU rack + ZW-108ZB I/O rack ×2	ZW-504KB CPU rack + ZW-108ZB I/O rack ×2 + ZW-508ZB or ZW-108ZB I/O rack
Maximum number of I/O modules	24	32	20	28
Maximum number of I/O points when 16-point module is used for all	16×24=384	16×32=512	16×20=320	16×28=448
When "n" number of 16-point modules are used in conjunction with "m" number of 32-point modules	$16 \times n+32 \times m \leq 512$			

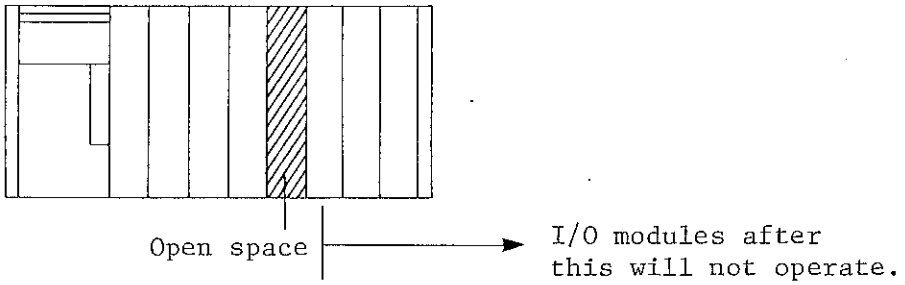
4) When two or three units of the I/O racks are used, the second unit must be equipped with the ZW-100PU1 expansion power supply module.

NOTE-1: Do not install the expansion power supply module to the first and third ZW-108ZB.



5) Use the 5VDC I/O expansion signal cable for connection of the I/O rack with the control module or other I/O rack. The cable comes with the I/O rack or the control module.

6) Do not allow existence of any unoccupied space when the input module or output module is to be installed on the CPU rack or the I/O rack. All modules must be installed successively without any unoccupancy. The I/O module installed next to an unoccupancy will not operate. Existence of an open space in the CPU rack will not permit all I/O modules installed after the open space to operate.

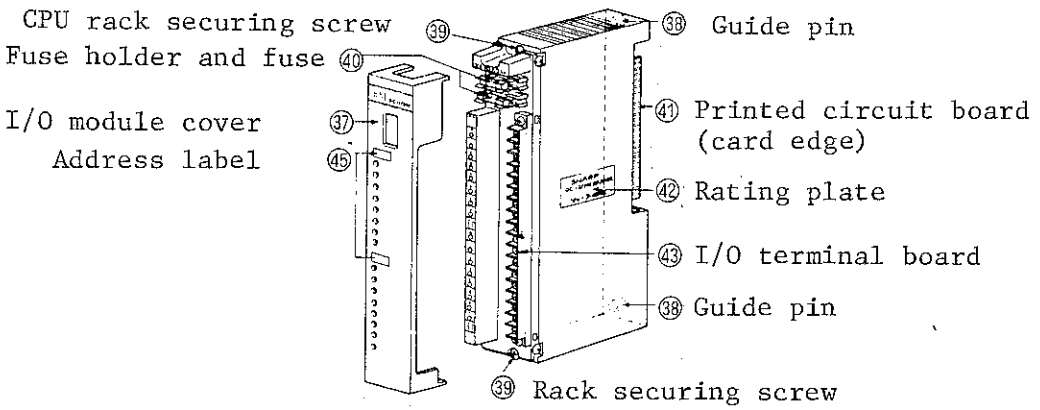


7) Actuation of the power indicator (34) must be confirmed before the operation when the ZW-108ZB is used for the I/O rack. If the power indicator is not active, check the wiring as 5VDC is not in supply to the I/O rack.

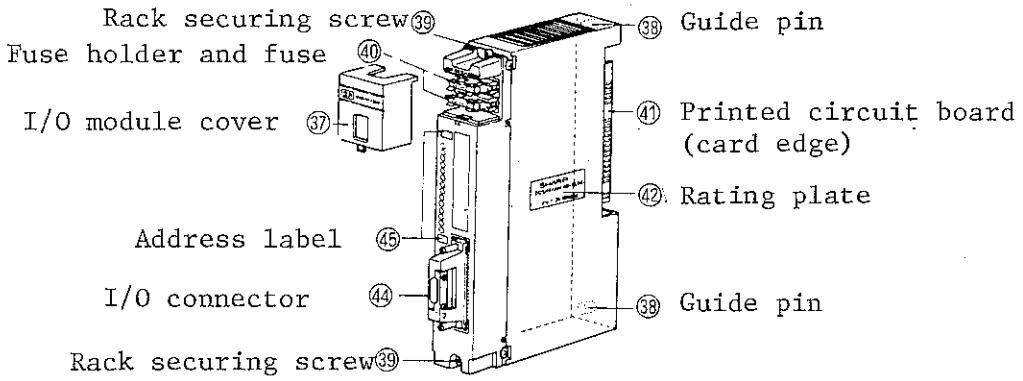
8) See §4, Installation, and §5, Wirings, for installation and wiring of racks and modules.

3-3 Input modules and output modules

[1] Parts identification and functions



(Figure shows the ZW-16S2)



(Figure shows the ZW-32S2)

㊲ I/O module cover

Live portions of the fuse ㊵ and I/O terminal board ㊸ are protected from casualty using the cover.

㊳ Guide pin (two)

Used for easier mounting of I/O module on the CPU and I/O rack.

㊴ Rack securing screw (two)

Used to secure the I/O module on the CPU and I/O rack.

㊵ Fuse holder and fuse (not equipped on the input module)

Protect fuse is used for the I/O module.

㊶ Printed circuit board (card edge)
For connection with the CPU or I/O rack.

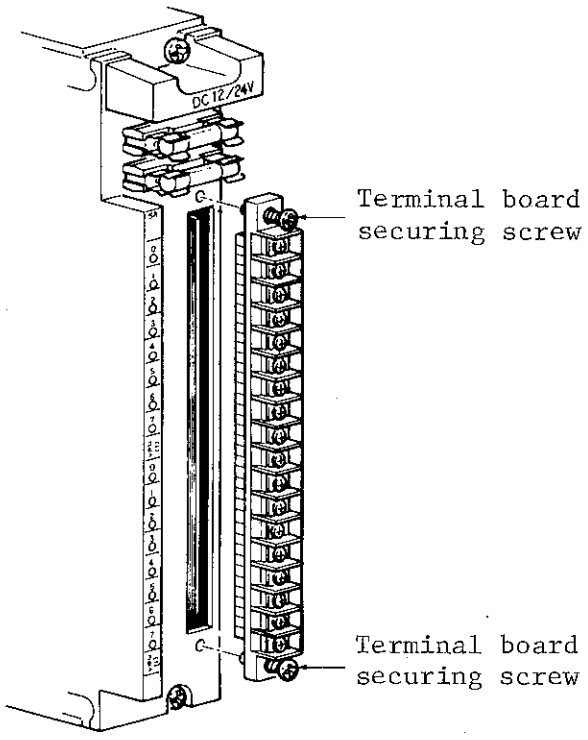
㊷ Rating plate

㊸ I/O terminal board
For connection with I/O device. As it is removable, it permits replacement of the I/O module without removing the I/O device cable from the terminal board.

㊹ I/O connector
For connection with the cable from I/O device.

㊺ Address label
It comes with the control module as an accessory. It has to be bonded on the location of the I/O module installed. The address label indicates the second and third digits of a relay number. [23] is used to represent 0230 ∿ 0237.

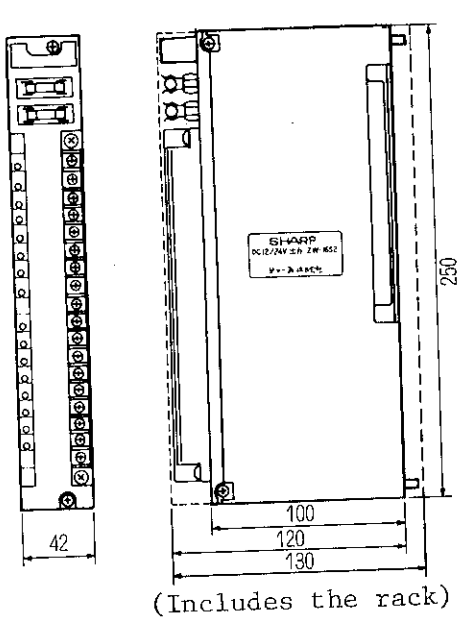
- Installation and removal of the I/O terminal board



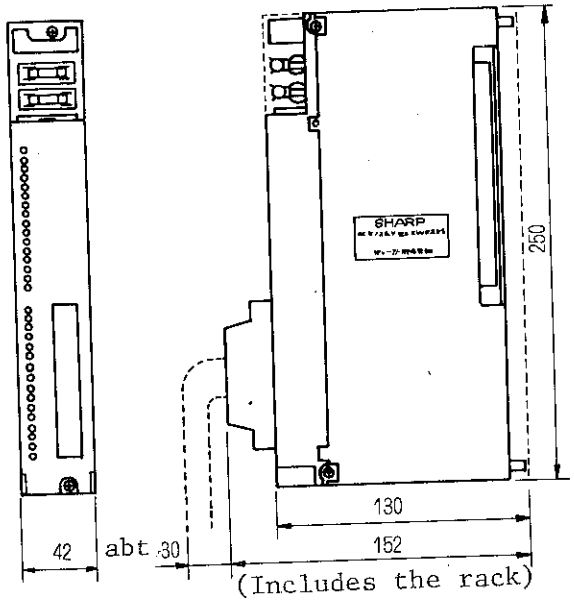
Loosen two screws of the terminal board and remove the terminal board from the cabinet.

NOTE) Because the screw is retained by the stopper, it cannot be removed from the terminal board.

[2] Dimensional view

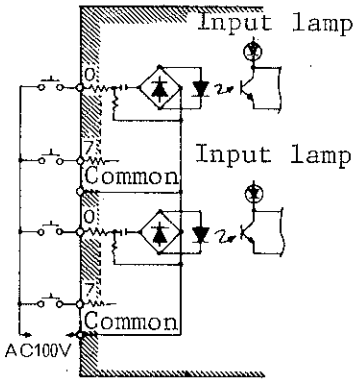
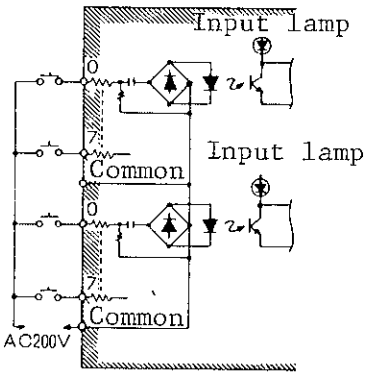


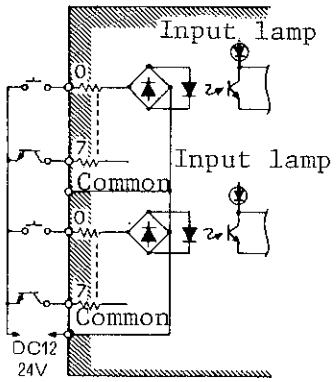
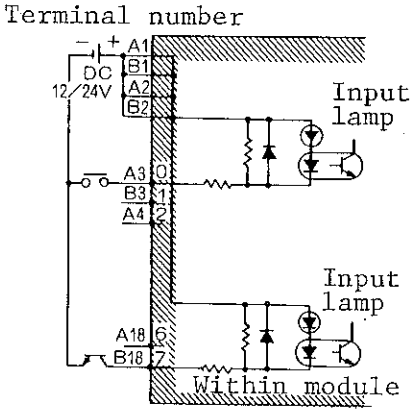
Jack type



Connector type

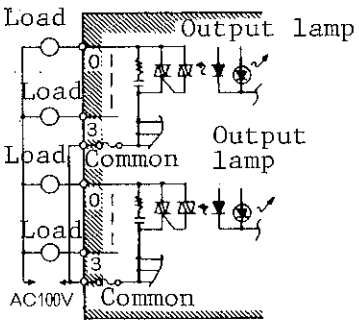
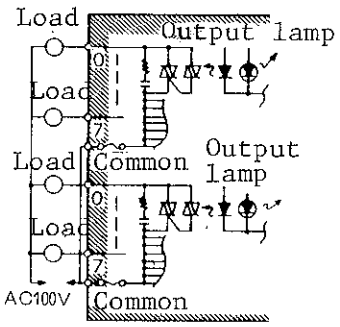
[3] Input module specification

		ZW-16N1 115VAC input module	ZW-16N3 200VAC input module
Circuit configuration			
Number of input points		16 points	16 points
Rated input voltage		100VAC, 50/60Hz, with less than 5% of waveform distortion	200VAC, 50/60Hz, with less than 5% of waveform distortion
		NOTE-2) Pay attention for the OFF level when such as the proximity switch and photoelectric switch is used as it may not turn OFF properly, sometimes.	
Input voltage range		0VAC ∿ 132V	0VAC ∿ 242V
Input voltage level	ON level	80V, max.	160V, max.
	OFF level	30V, min.	50V, min.
Input current level	ON level	9.5mA, max.	10mA, max.
	OFF level	3.0mA, min.	3.5mA, min.
Input impedance		Abt 8.3Kohms	Abt 16Kohms
Res-ponse time	OFF → ON	15ms, max. (115VAC)	15ms, max. (200VAC)
	ON → OFF	20ms, min. (115VAC)	20ms, min. (200VAC)
Internal power consumption (5VDC)		120mA, max.	120mA, max.
Operational status		LED active when ON	LED active when ON
Connections		18-jack terminal board (16 inputs and 2 commons) Common ... one common per 8 points P=9, M3.5×8 Self-locking screw in use Terminal board resin in blue color	
Operating temperature		0 ∿ 55°C	
Operating humidity		35 ∿ 90% RH	
Insulation registance		500VDC, more than 10Mohms across input terminal and secondary circuit	
Dielectric strength		1500VAC, one minute, across input terminal and secondary circuit	

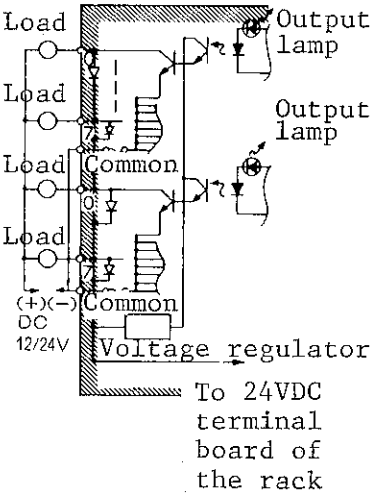
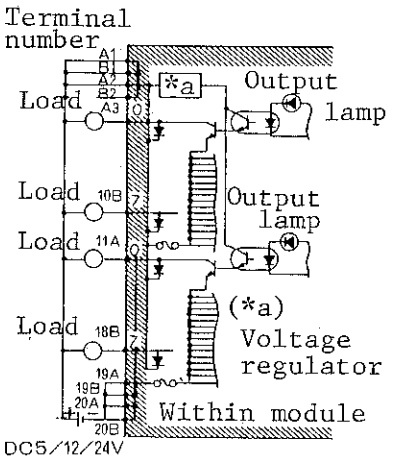
		ZW-16N2 12/24VDC input module	ZW-32N2 data input module
Circuit configuration			
Number of input points		16 points	32 points
Rated input voltage		12/24VDC NOTE-1) Power supply of less than 10% ripple must be used when used under 12VDC.	12/24VDC NOTE-1) Ripple must be less than 5% in the case of 12VDC and 15% in the case of 24VDC.
		NOTE-2) Pay attention for the OFF level when such as the proximity switch and photoelectric switch is used as it may not turn OFF properly, sometimes.	
Input voltage range		0VDC ∿ 30V	0VDC ∿ 26.4V
Input voltage level	ON level	10V, max.	10V, max.
	OFF level	3.6V, min.	6V, min.
Input current level	ON level	4.0mA, max.	3mA, max.
	OFF level	1.5mA, min. (full wave pulse: 1.0mA)	1.5mA, min.
Input impedance		Abt 2Kohms	Abt 2.5Kohms
Response time	OFF → ON	15ms, max. (12/24VDC)	15ms, max. (12/24VDC)
	ON → OFF	20ms, min. (12/24VDC)	20ms, min. (12/24VDC)
Internal power consumption (5VDC)		120mA, max.	85mA, max.
Operational status		LED active when ON	LED active when ON
Connections		18-jack terminal board (16 inpus and 2 commons) Common ... one common per 8 points P=9, M3.5×8 Self-locking screw in use Terminal board resin in blue color	40-pin connector Common ... 32 points, one common, (+ common)

	ZW-16N2 12/24VDC input module	ZW-32N2 data input module
Operating temperature	0 ∿ 55°C	
Operating humidity	35 ∿ 90% RH	
Insulation resistance	500VDC, more than 10Mohms across input terminal and secondary circuit	
Dielectric strength	1500VAC, one minute, across input terminal and secondary circuit	

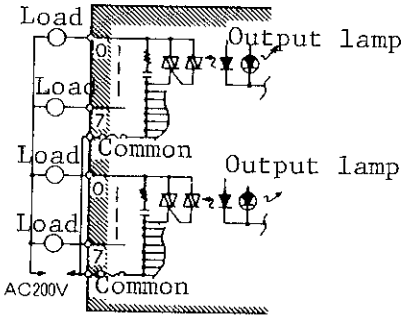
[4] Output module specification

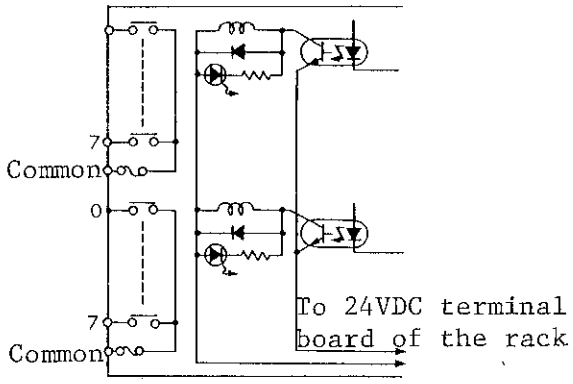
		ZW-8S1 100VAC output module	ZW-16S1 100VAC output module
Circuit configuration			
Number of output points		8 points	16 points
Rated output voltage		100VAC, 50/60Hz, less than 5% of waveform distortion	100VAC, 50/60Hz, less than 5% of waveform distortion
Output voltage range		15VAC ∿ 121V	15VAC ∿ 121V
Maximum rated output current		AC 2A (5A maximum per 4 points of 1 group)	AC 2A (5A maximum per 8 points of 1 group)
Surge on current		Output element performance: 80A (single cycle)	Output element performance: 80A (single cycle)
Fuse		125VAC, 5A, normal class, mini-fuse, one fuse per four points	125VAC, 5A, normal class, mini-fuse, one fuse per eight points
Leak current		2mA, max. (sine wave)	2mA, max. (sine wave)
		NOTE) When such as the neon lamp or light load relay is used, it may not be controlled OFF due to a leak current.	
On voltage		2V, max. (2A)	2V, max. (2A)
Response time	OFF → ON	1ms, max.	1ms, max.
	ON → OFF	10ms, max.	10ms, max.
Internal power consumption (5VDC)		400mA, max.	400mA, max.
External power supply capacity		———	———
Operational status		LED active when ON	LED active when ON

	ZW-8S1 100VAC output module	ZW-16S1 100VAC output module
Connections	10-jack terminal board (8 outputs and 2 commons) Common ... one common per 4 points	18-jack terminal board (16 outputs and 2 commons) Common ... one common per 8 points
	P=9, M3.5×8 Self-locking screw in use Terminal board resin in red color	
Operating temperature	0 ∿ 55°C	
Operating humidity	35 ∿ 90% RH	
Insulation resistance	500VDC, more than 10Mohms across output terminal and secondary circuit	
Dielectric strength	1500VAC, one minute, across output terminal and secondary circuit	

		ZW-16S2 12/24VDC output module	ZW-32S2 data output module
Circuit configuration			
Number of output points		16 points	32 points
Rated output voltage		12/24VDC	5/12/24VDC
Output voltage range		10VDC ∿ 30V	4.75VDC ∿ 30V
Maximum rated output current		DC 2A (5A maximum per 8 points of 1 group)	External supply voltage: 12/24VDC °Simultaneous activation of one group consisting of 16 points: Less than 8 points; 0.5A/point More than 9 points; 0.3A/point 5VDC external supply voltage: 0.1A/point
Surge on current		Output element performance: 8A (10ms, max.)	Output element performance: 8A (10ms, max.)
Fuse		125VAC, 5A, normal class, mini-fuse, one fuse per 8 points	125VAC, 5A, normal class, mini-fuse, one fuse per 16 points
On voltage		2V, max. (2A)	0.3V, max. (0.1A), 1.0V, max. (0.5A)
Response time	OFF → ON	1ms, max.	1ms, max.
	ON → OFF	1ms, max.	1ms, max.
		NOTE) A delay of more than one second may encountered in the ON to OFF response time when an inductive load is used, depending on the value of the load "L".	

	ZW-16S2 12/24VDC output module	ZW-32S2 data output module
Internal power consumption (5VDC)	200mA, max.	320mA, max.
External power supply capacity	12/24VDC, 5mA/point maximum	12/24VDC, 5mA/point maximum
Operational status	LED active when ON	LED active when ON
Connections	18-jack terminal board (16 output and 2 commons) Common ... one common per 8 points P=9, M3.5× Self-locking screw in use Terminal board resin in red color	40-pin connector Common ... 32 points/ common
Operating temperature	0 ∿ 55°C	
Operating humidity	35 ∿ 90% RH	
Insulation resistance	500VDC, more than 10Mohms across output terminal and secondary circuit	
Dielectric strength	1500VAC, one minute, across output terminal and secondary circuit	

		ZW-16S3 200VAC output module
Circuit configuration		
Number of output points		16 points
Rated output voltage		200VAC, 50/60Hz, with less than 5% of waveform distortion
Output voltage range		15VAC ∿ 242V
Maximum rated output current		AC 2A (5A maximum per 8 points of 1 group)
Surge on current		Output element performance: 80A (single cycle)
Fuse		250VAC, 5A, normal class, mini-fuse, one fuse per 8 points
Leak current		3mA, max. (sine wave) NOTE: When such as the neon lamp or light load relay is used, it may not turn off because of the leak current.
On voltage		2V, max. (2A)
Response time	OFF → ON	1ms, max.
	ON → OFF	10ms, max.
Internal power consumption (5VDC)		400mA, max.
External power supply capacity (12/24VDC)		_____
Operational status		LED active when ON
Connections		18-jack terminal board (16 outputs and 2 commons) Common ... one common per 8 points P=9, M3.5×8 Self-locking screw in use Terminal board resin in red color
Operating temperature		0 ∿ 55°C
Operating humidity		35 ∿ 90% RH
Insulation resistance		500VDC, more than 10Mohms across output terminal and secondary circuit
Dielectric strength		1500VAC, one minute, across output terminal and secondary circuit

		ZW-16S4 relay contact output module
Circuit configuration		
Number of output points		16 points
Maximum make/break voltage current		240VAC/30VDC, 2A, resistance load (5A maximum per 8 points of 1 group)
Minimum load		5V, 1mA
Operational life		Mechanical: 20,000,000 times minimum Electrical: 1. Maximum make/break voltage current resistance load; More than 100,000 times 2. Electromagnetic relay load; More than 200,000 times at 10.5A of 200VAC, normally 0.5A, cosϕ=0.2
Fuse rating		250VAC, 5A, anti-surge, mini-fuse (one piece per 8 points)
Leak current		None
Response time	OFF → ON	15ms, max.
	ON → OFF	20ms, max.
Internal power consumption (5VDC)		180mA, max.
External power supply		24VDC±10% (all waveform pulse usable) 20mA maximum per point
Common terminal		1 common per 8 points
Operational status		LED active when ON
Connections		Connector terminal board (16 outputs, 2 commons) 18P, P=9, M3.5×8 Self-lock screw in use Terminal board resin in red color
Operating temperature		0 ∿ 55°C
Operating humidity		35 ∿ 90% RH, without moisture condensation
Dielectric strength		1500VAC, one minute, across output terminal and secondary circuit
Insulation resistance		500VDC, more than 10Mohms across output terminal and secondary circuit

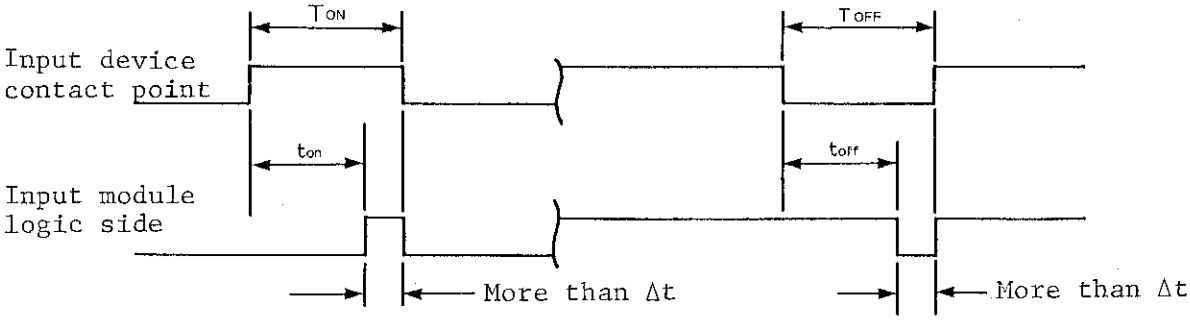
NOTE-1: Refer to the instructions of the respective module for a special I/O module.

[5] Precautions about input modules

1) Input signal ON/OFF timings

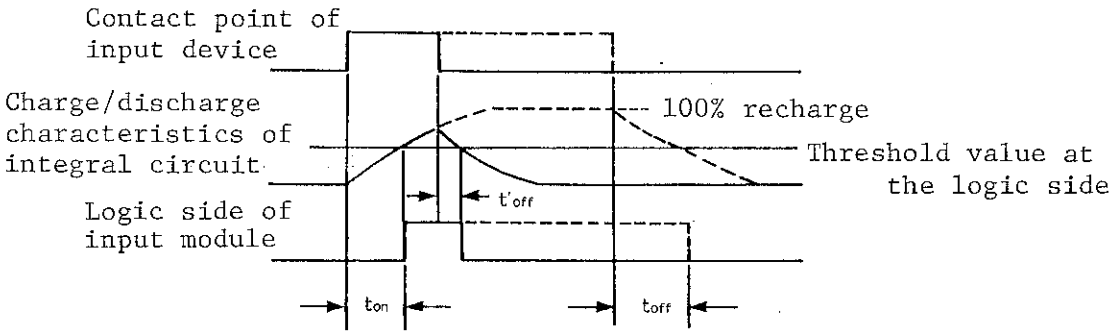
There is a need of satisfying the following condition in order to positively reflect the ON/OFF state of the input device (such as limit switch) to the operation of the PC.

Input device ON time (T_{ON})	$T_{ON} > \Delta t + t_{on}$
Input device OFF time (T_{OFF})	$T_{OFF} > \Delta t + t_{off}$
	Δt ..... One scan time of PC
	t_{on} .... Input module OFF to ON response time
	t_{off} ... Input module ON to OFF response time



In the I/O process at the beginning of each scan cycle, the ON/OFF state of the input logic side is stored in the data memory, to be used for the input information required for the operation of the user program during that scan cycle. Therefore, if the ON/OFF time of the input logic side should not continue for more than one scan time (Δt), the state of ON/OFF may not be stored in the data memory.

NOTE-1: Response time of input module depends on the charge/discharge characteristics of the integral circuit of the input module, therefore, it may vary according to the time that ON or OFF state continued.



If the ON time of the input device were too long as shown with a dotted line, there is a difference in "t_{off}" than the case the ON time is shorter as shown with a solid line.

(Worksheet example when the ZW-16N2 is used for the input module)

If one scan time is assumed to be 5ms, the following result is obtained.

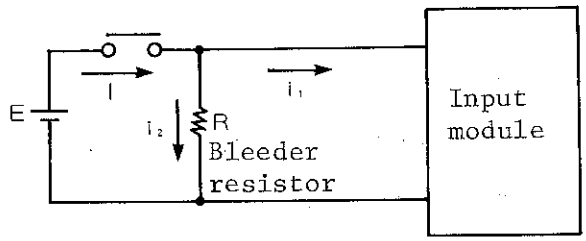
$T_{ON} > \Delta t + t_{on} = 5 + 15 = 20(ms)$

$T_{OFF} > \Delta t + t_{off} = 5 + 20 = 25(ms)$

2) Bleeder resistor

Only a certain amount of current which is dependent on the input impedance and input supply voltage can flow through the contact point of the input device. (About 3.5mA when 12VDC is added to the ZW-32N2.)

As this current value may evoke a contact failure depending on the type of the contact point, an external bleeder resistor should be inserted in such event.



$I = i_1 + i_2 = i_1 + \frac{E}{R}$

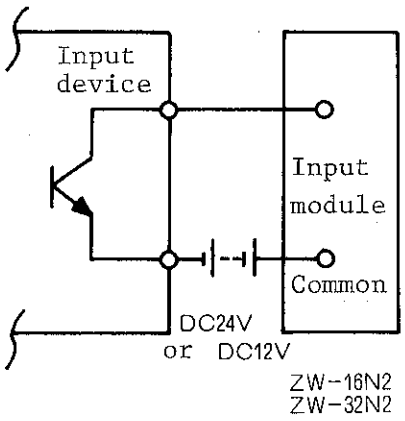
Wattage shall be $P > \frac{E^2}{R} \times 2$

3) DC input module power input polarity

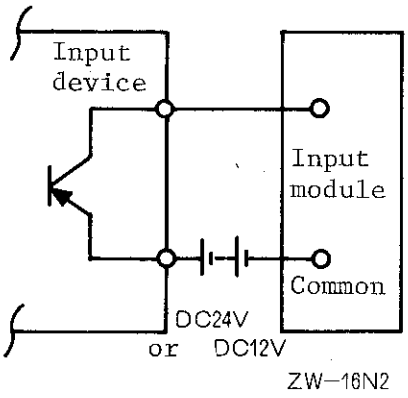
Since the bridge rectifier circuit is used in the ZW-16N2, either plus common or minus common may be used. Plus common must be used for the ZW-32N2.

4) To connect a transistor output device to the DC input module
Choose the open collector output type to use the input device such as contactless relay, photoelectric switch, proximity switch.

NPN transistor output example
(+ common)



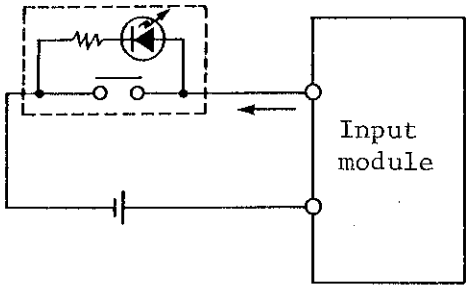
PNP transistor output example
(- common)



NOTE-1: Make sure that the rating of the transistor meets the given input supply voltage and input current.

5) Pay attention for the OFF time current of the input device.

(a) Limit switch with LED



The input module may not turn OFF because of the LED driving current, even if the limit switch is OFF.

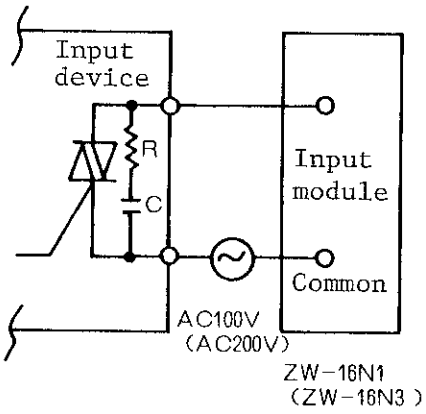
(b) Proximity switch, photoelectric switch

For those of the AC, two-wire type, consumption current flows through the detect circuit during the OFF time, which may not turn the input module OFF. As it is noted as "leak current" for the specification of such as the photoelectric switch, make sure that the value is below the OFF level of the input module.

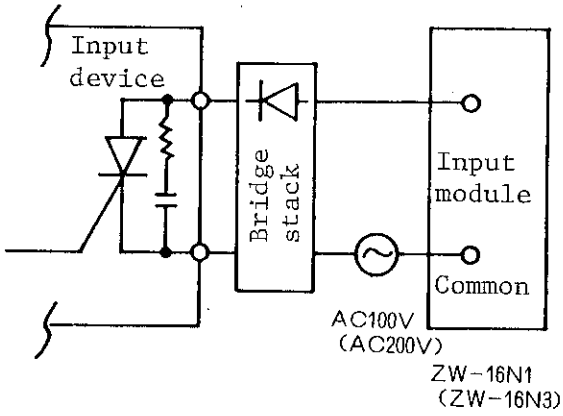
6) When the output circuit of the input device is of a triac output or thyristor output.

Since a CR network is sometimes used as a surge killer for the triac or thyristor to prevent an arc error, it may impede to turn the input module OFF due to a leak current caused by this CR network. Though it is preferable to remove the CR network, the value of C should be set below 0.033 microfarads for 100VAC, in case it is not possible to remove it. In the case of 200VAC, use a capacitor below 0.015 microfarads.

Triac output example



Thyristor output example



[6] Precautions about output modules

1) Maximum voltage and current that can be broken and made at the output module

Within the given rating, every output module is capable of directly driving the output device such as the solenoid valve, magnetic switch, etc.

	Rated voltage	Maximum voltage	Maximum rated current	Surge on current
ZW-8S1 ZW-16S1	100VAC	121VAC	2A (NOTE-1)	80A (one cycle)
ZW-16S2	12/24VDC	30VDC	2A (NOTE-1)	8A (10ms, max.)
ZW-16S3	200VAC	242VAC	2A (NOTE-1)	80A (one cycle)
ZW-16S4		240VAC	2A (NOTE-1)	
		30VDC	2A (NOTE-1)	
ZW-32S2	5/12/24VDC	30VDC	0.5A (NOTE-2)	8A (10ms, max.)

NOTE-1: If plural number of items (8 points, or 4 points for the ZW-8S1) were to be ON at the same time within a group of the same common, the total current should be less than 5A.
In the case of the ZW-16S4, it is the value of the resistance load. In the case of the solenoid valve and magnetic switch, take the power factor of the inductive load into consideration.

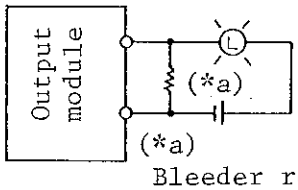
NOTE-2: If the fuse is in the same one common group (16 points) and up to 8 points are to actuate simultaneously, it permits the current of up to 0.5A per point. If more than 8 points are to actuate simultaneously, every point must be limited 0.3A at a maximum. In case the external supply voltage is 5VDC, the limit is 0.1A per point.

NOTE-3: Surge on current indicates the output element performance.

2) Lamp load and rush current

For the incandescent lamp, a rush current of 10 to 20 times the normal current flows for a period of about 10 milliseconds. As a means to reduce the rush current, there are two ways; to insert a bleeder resistor or a current limit resistor.

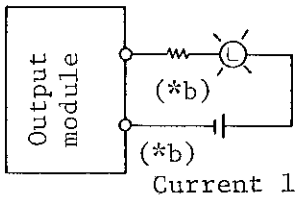
(a) Insertion of bleeder resistor



(*a)
Bleeder resistor

Slight degree of the current that does not activate the lamp should be applied during the output module OFF time.

(b) Insertion of current limit resistor

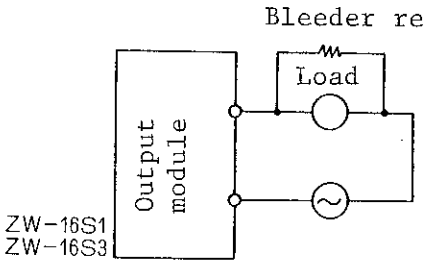


(*b)
Current limit resistor

Current must be limited with the current limit resistor. Because it abates the voltage added to the lamp if the resistor is too large, the resistor value should be determined on the basis of the brightness required for the lamp.

3) AC output module leak current

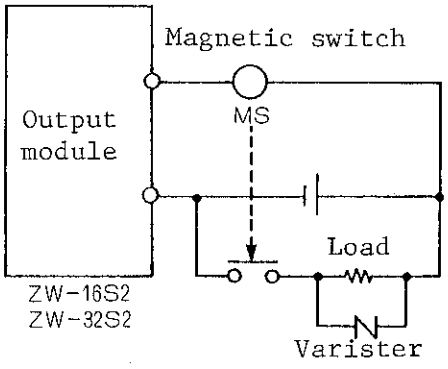
During the OFF time of the AC output module, a leakage current of less than 2mA flows through the ZW-8S1, ZW-16S1 and 3mA for the ZW-16S3. In case the load that does not go OFF because of this leakage current, a bleeder resistor should be inserted parallel to the load.



The value of resistor must be calculated on the basis of the load used, it may possibly be about 10Kohms and 3 watts for 100VAC or 6 watts for 200VAC.

4) To drive a large current inductive load with the DC output module

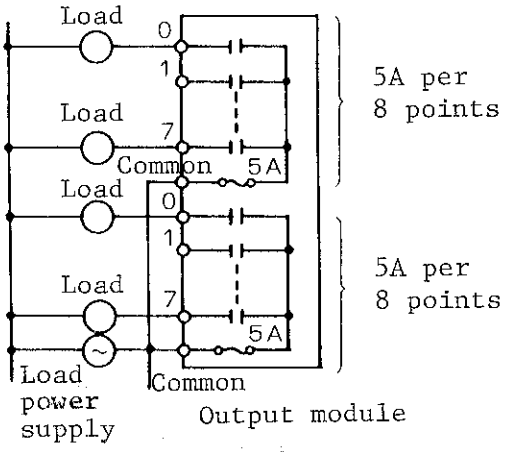
A surge absorbing diode is implemented in the module to prevent destruction of the output transistor of the DC output module (ZW-16S2, ZW-32S2) when connected with the load "L". Energy accumulated in the coil is consumed in the diode by the resistance of the inductive load as Joule heat when the output turns from ON to OFF. Delay will be met for the restoration time until the energy goes below the load retention force.



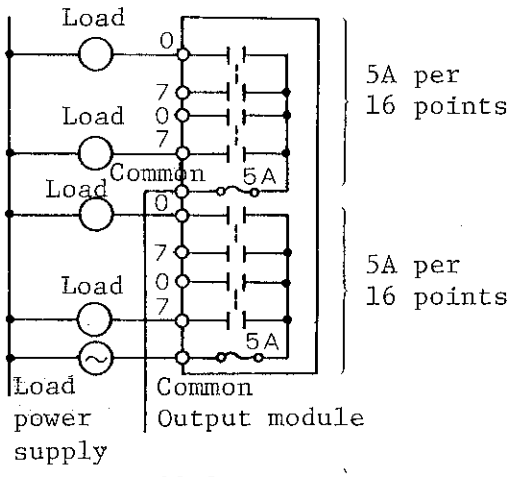
The delay time is determined by the value of "L", resistor value, and retention force. If this delay time should be a problem after actual measurement, the load should be driven via the magnet switch. It makes the value relatively smaller than the use of the solenoid valve, and it improves the response time.

5) Protect fuse

Fuse is used for protection of the printed circuit pattern and signal lines from burn-out; one each per 4 points with the ZW-8S1, 8 points with the ZW-16S2, ZW-16S3, and ZW-16S4, and 16 points with the ZW-32S2. But, the fuse is not used for overcurrent protection of the output element or load.



ZW-16S1,ZW-16S2
ZW-16S3,ZW-16S4

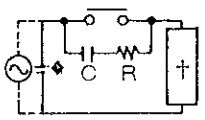
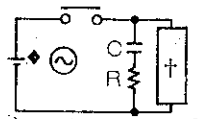


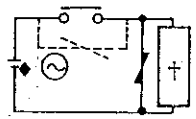
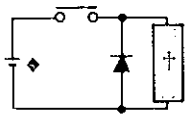
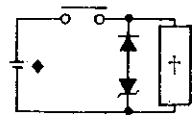
ZW-32S2

6) Surge preventing means

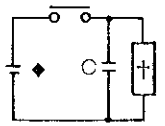
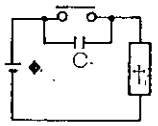
There is a possible generation of a several thousands volts surge in making and breaking the load "L", depending on the kind of the load. Although output surge preventive means has been implemented for the ZW-8S1, ZW-16S1, ZW-16S2, ZW-16S3, and ZW-32S2, it requires a specific surge prevention for the ZW-16S2 and ZW-32S2 when a long signal wire is used to the load. Since the internal surge prevention has not been used for the relay output module (ZW-16S4), use of an external surge killer is required in order to extend the life of contact points, to prevent noise, to reduce generation of carbon by arc and raising of nitric acid. However, incorrect use of the arc killer may invite an adverse effect. Also, it must be noted that the use of the arc killer causes the restoration time to prolong in some degree.

Typical arc killer examples

Circuit example		Use AC	Use DC	Features, etc.	Choice of element
CR method	 ♦)Power supply †)Inductive load	* Δ	o	*When operated under AC power The impedance of the load should be sufficiently smaller than that of the CR network.	The following may be used for the approximate value: C: 1 to 0.5 microfarads per 1A of contact point. current R: 0.5 to 1 ohms per 1V of contact points. They may not coincide necessarily depending on a variation of the load performance and relay characteristics. Considering that C is assigned for suppressing discharge during breaking of the contact points and R for current limiting when power is applied next, make confirmation in the actual case. C must have the voltage withstanding about 200V to 300V. In the case of the AC circuit, use the AC capacitor (without polarity).
	 ♦)Power supply †)Inductive load	o	o	When the load is a relay and solenoid, a delay may appear in the restoration time. When the supply voltage is 24V or 48V, the CR network should preferably be inserted between loads. In the case of 100V to 200V, it should be between contact points.	

Circuit example		Use AC	Use DC	Features, etc.	Choice of element
Varister method	 ◆) Power supply †) Inductive load	o	o	With this method, not so much voltage is added across contact points taking advantage of the constant voltage characteristics of the varister. Even with this method, there may be a slight delay in the restoration time. When the source voltage is 24V or 48V, it is preferable to insert it across the load for more effect. For 100V to 200V, make it inserted across the contact points.	The varister voltage shall be as follows: For 100VAC ... 220V to 290V For 200VAC ... 390V to 430V
Diode method	 ◆) Power supply †) Inductive load	x	o	Energy stored in the coil is released in a form of the current through the parallel connected diode to consume it as Joule heat by the resistance of the inductive load. This method requires more delay in the restoration time than the CR method.	Use the diode whose counter voltage withstanding is ten times the circuit voltage having the forward current of more than the load current. For the electronic circuit of not so high in its circuit voltage, it may be possible to use the one having the counter voltage withstanding of two or three times the power supply voltage.
Diode + Zener diode method	 ◆) Power supply †) Inductive load	x	o	It is recommended to use when too much delay is met with the diode method.	The zener voltage of the zener diode should be about the same as the supply voltage.

Avoid the use of the arc killer in the following way.

 ♦)Power supply †)Load	This circuit is more effective to kill arc during braking, but it is likely to cause the contact points to melt as the charge current flows to C at a time of making the contact points.
 ♦)Power supply †)Load	This circuit is more effective to kill arc during braking, but it is likely to cause the contact points to melt as a short current at C flows in making the contact on account of the energy stored in C.

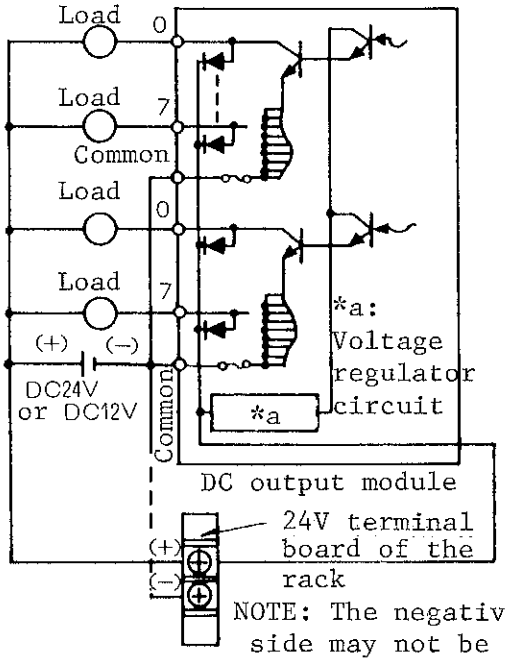
Though the direct current inductive load is normally assumed to be more difficult to make and break the contact points than the resistance load, use of an appropriate arc killer may improve its performance as much as in the case of the resistance load.

7) External power supply

Connection with the external power supply is required when the ZW-16S2 and ZW-32S2 DC output module and ZW-16S4 relay output module is used. Base current is supplied for the DC output module and coil current is supplied for the relay output module.

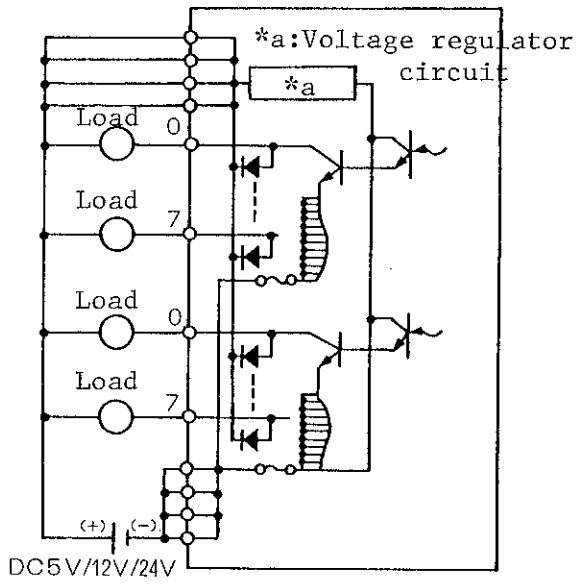
If the DC output module is operated without external power supply, it may result in unstable operation or the internal surge killer diode is invalidated which causes the output transistor to destruct.

The external power supply must be connected to the 24V terminal board of the rack when the ZW-16S2 or ZW-16S4 is connected. It has to be connected through the connector for the ZW-32S2.

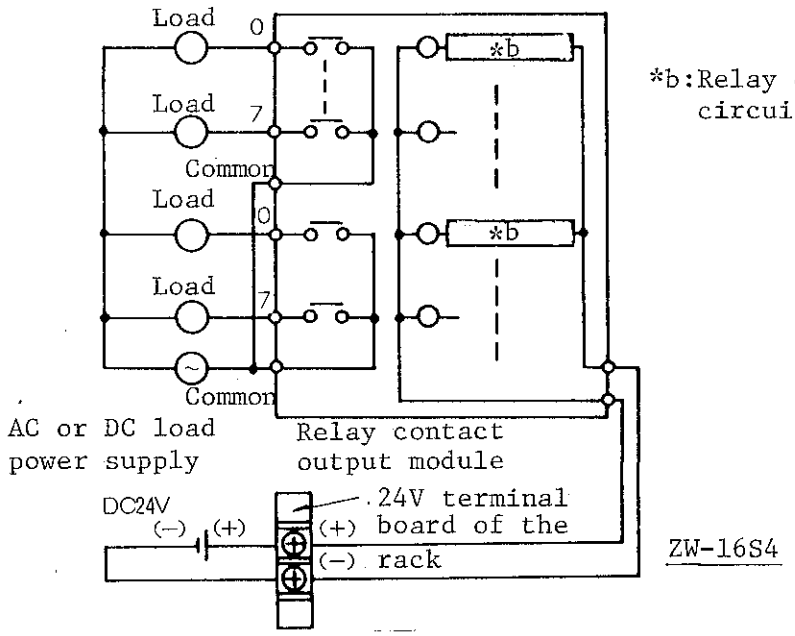


NOTE: The negative(-) side may not be connected necessarily.

ZW-16S2



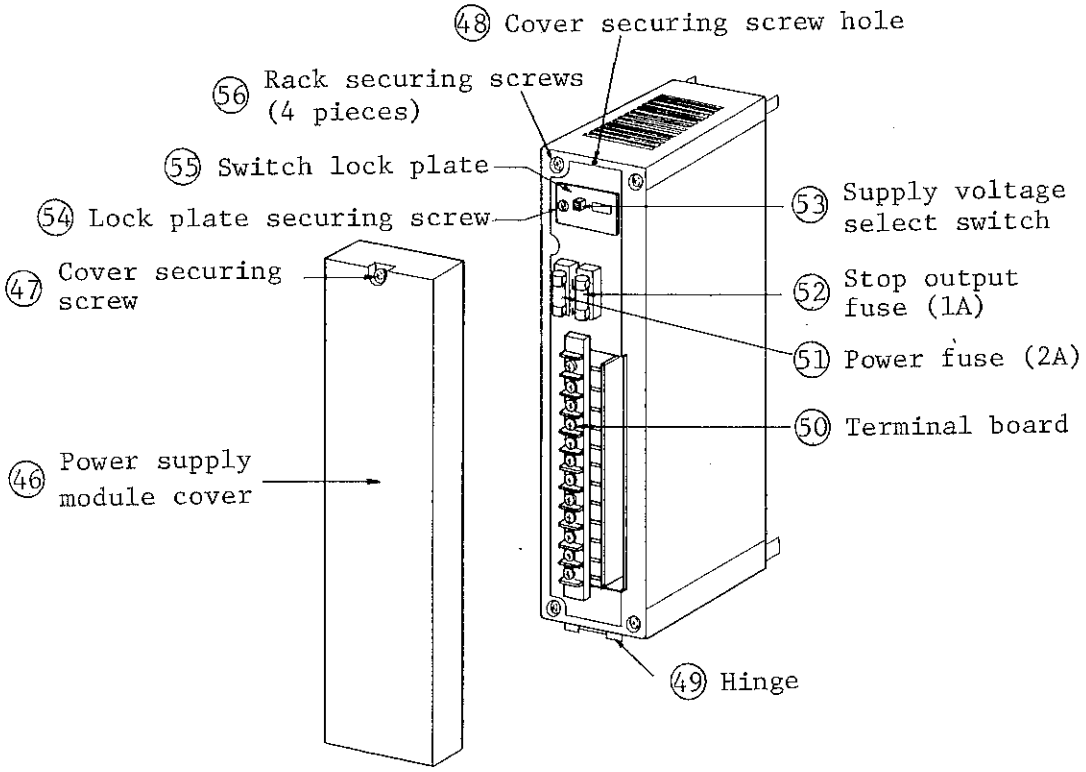
ZW-32S2



ZW-16S4

3-4 Expansion power supply module (ZW-100PU1)

[1] Parts identification and functions



(46) Power supply module cover

The cover needs to be removed in one of the following conditions. It has to be installed during the operation.

° When the power supply and stop output cable is connected to the terminal board.

° When the fuse is replaced.

° When the supply voltage is changed.

(47) Cover securing screw, (48) cover securing screw hole, (49) hinge

They are used to secure the power supply module cover on its place.

(50) Terminal board (12 jacks)

The power supply and stop output cable is connected on this terminal board.

(51) Power fuse (2A)

The 250V, 2A, glass tube, mini-fuse for the primary side.

(52) Stop output fuse (1A)

The 250V, 1A, glass tube, mini-fuse for the stop output circuit.

(53) Supply voltage select switch

There is a choice of 100VAC and 200VAC for the supply voltage input. The switch has been factory set to the 100VAC side.

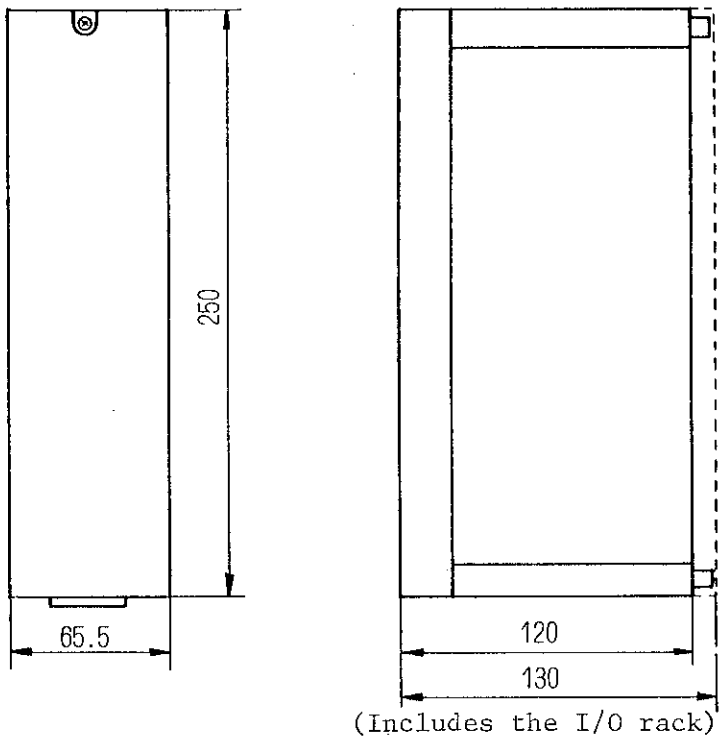
(54) Lock plate securing screw, (56) switch lock plate

Used to secure the supply voltage select switch knob to avoid incidental switch relocation.

(56) Rack securing screw

Used to secure the expansion power supply module to the ZW-108ZB I/O rack.

[2] Dimensional view



[3] Specification

Item	Specification
Supply voltage	100VAC$^{+10}_{-15}$% or 200VAC$^{+10}_{-15}$%
Output voltage	5.1V±0.05V 7A
Power consumption	50W, max. (at the largest configuration)
Ground	Class 3 ground
Weight	1.5kg

[4] Supply voltage selection

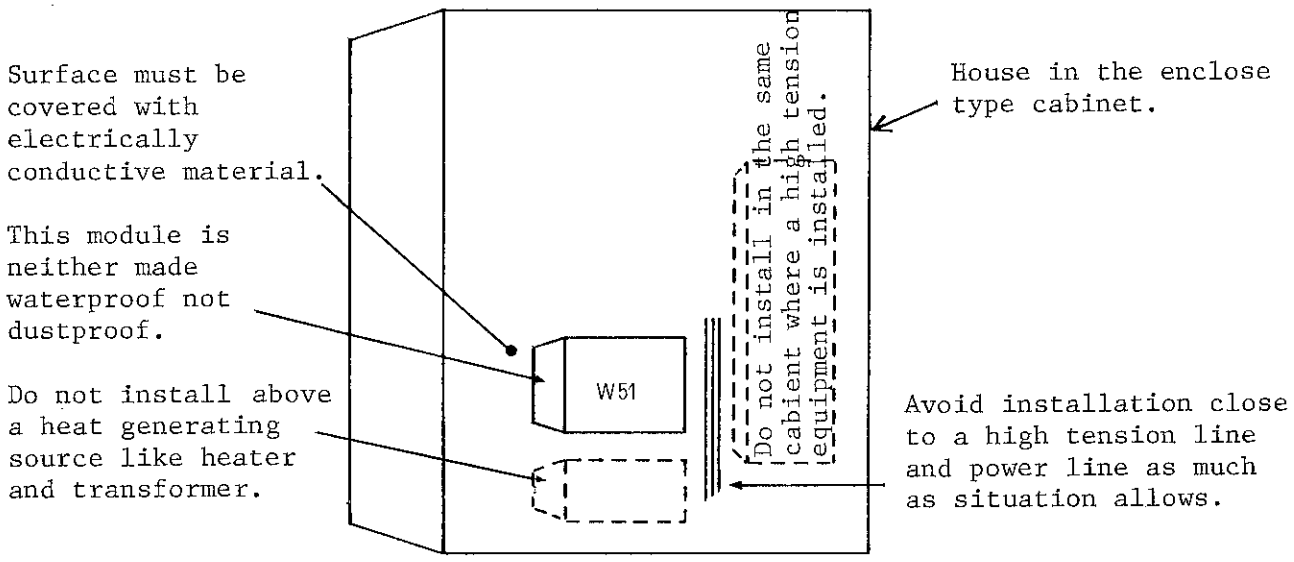
It is possible to make choice of 100VAC and 200VAC power supply from the expansion power supply module. The select switch has been set to the 100VAC when the machine left the factory. Refer to 3-1[4] "Source power setup".

§4 Installations

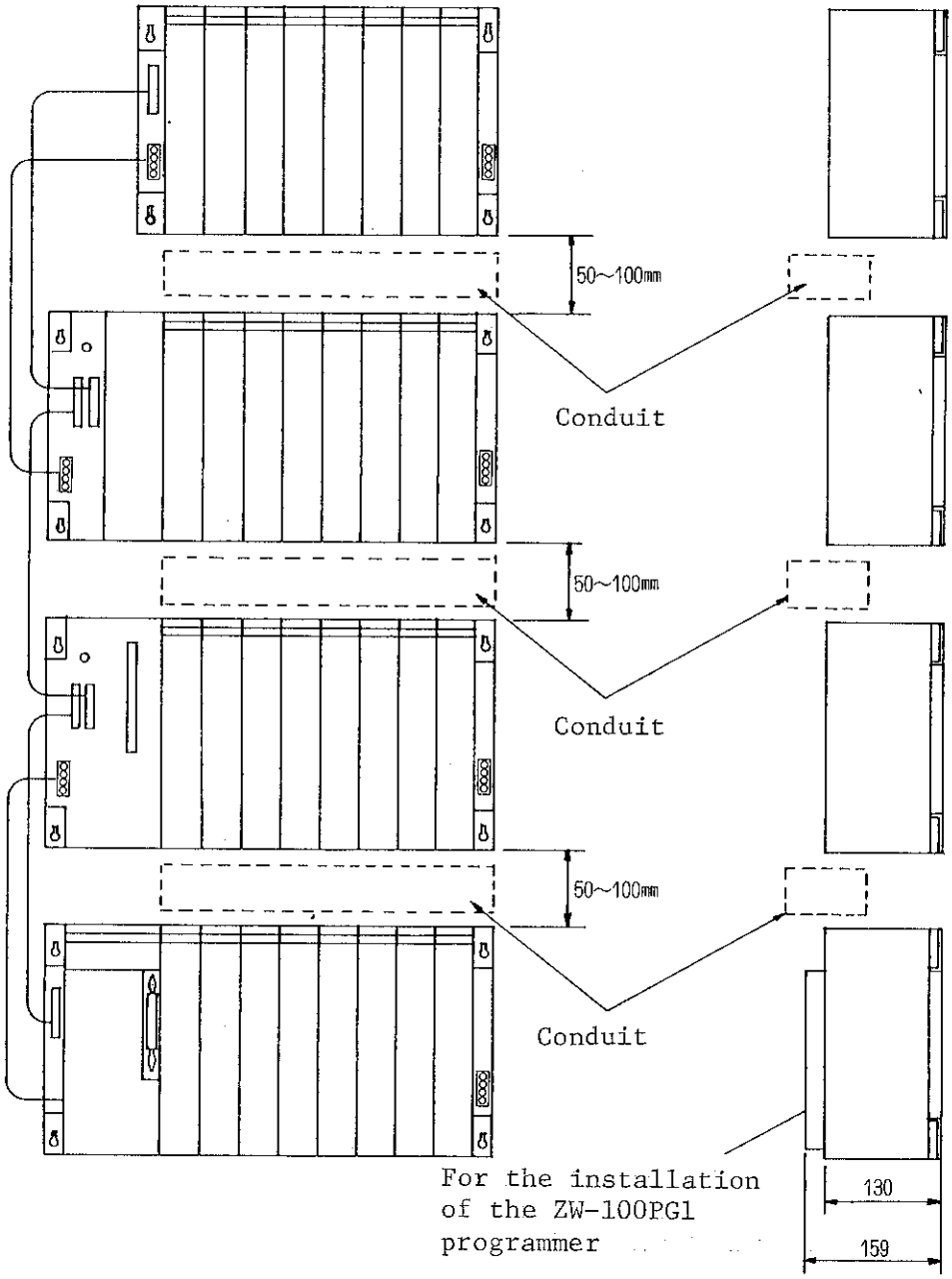
4-1 Installation cautions

The following conditions must be taken into consideration during installation, in order to enhance system reliability, as well as attaining full performance of all functions, even though it has been built with high degree of performance reliability as a programmable controller stout against environmental conditions.

1) Because the module is made neither dustproof not waterproof, it is recommended to install inside the enclosed type cabinet, so far as condition allows.
2) Never install the module in such a location where strong vibration and impact are existing.
3) Do not allow any other equipment installed close to the unit and avoid installing directly above a heat generating source like heater, transformer, and large capacity resistor.
4) Do not share the cabinet with that of a high tension equipment.
5) Keep away from a high tension line and power line as much as condition allows.
6) Install the module on the surface that covered with an electrically conductive material for the purpose of insuring positive ground connection and for better noise immunity. Avoid installation on a paint finished board.
7) Use the galvanized M5 screw for securing the module.

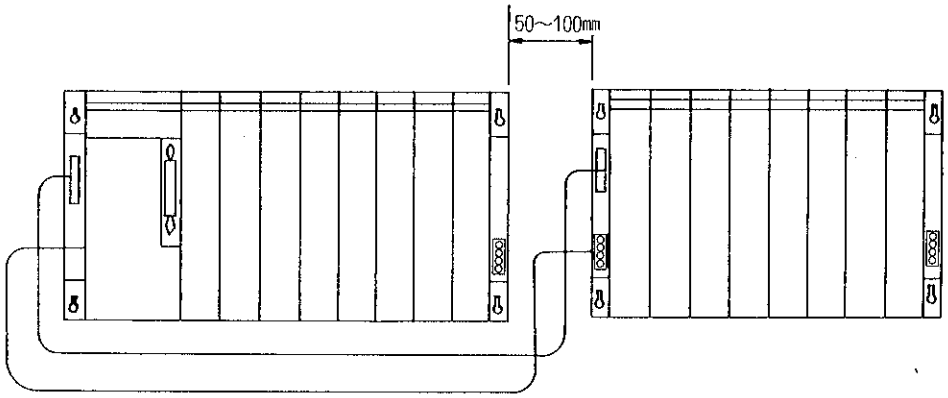


4-2 Installation of the I/O rack on the panel

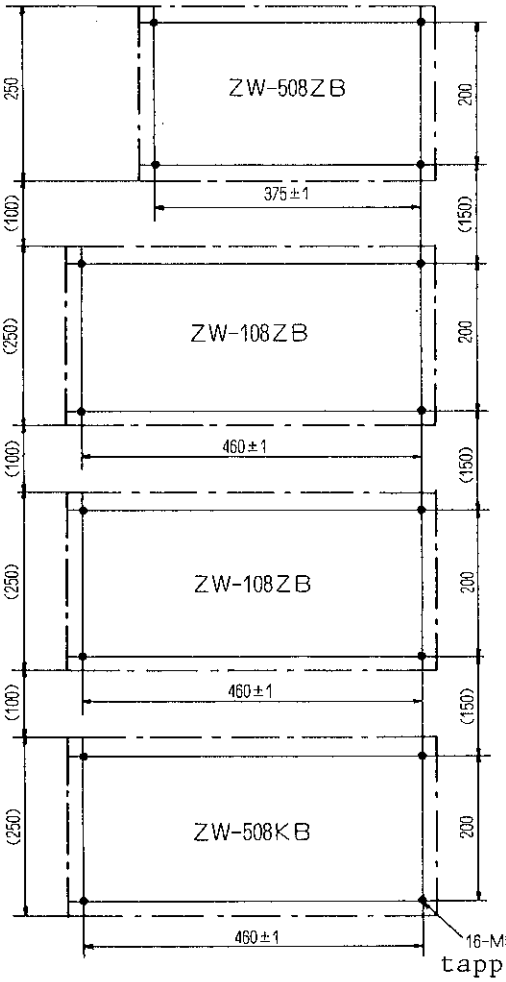


- Reserve an open area of 50 to 100mm between racks.
  It should have a space of 50mm to avoid heat rising.
- The left side of the CPU rack must have a clearance of more than 50mm against other panel or device.

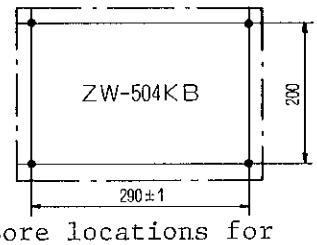
- When both racks are to be installed side by side, it must have a clearance of more than 50 to 100mm.



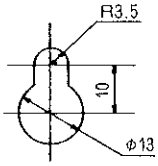
NOTE-1: Use the I/O expansion signal cable (1m) and I/O expansion 5V power supply cable (1m) when both racks are arranged side by side. Cables come with the ZW-501CU control module. Since one each of cables is supplied, it is not possible to lay more than three modules side by side.



Panel bore locations when the rack-to-rack space is set to 100mm.

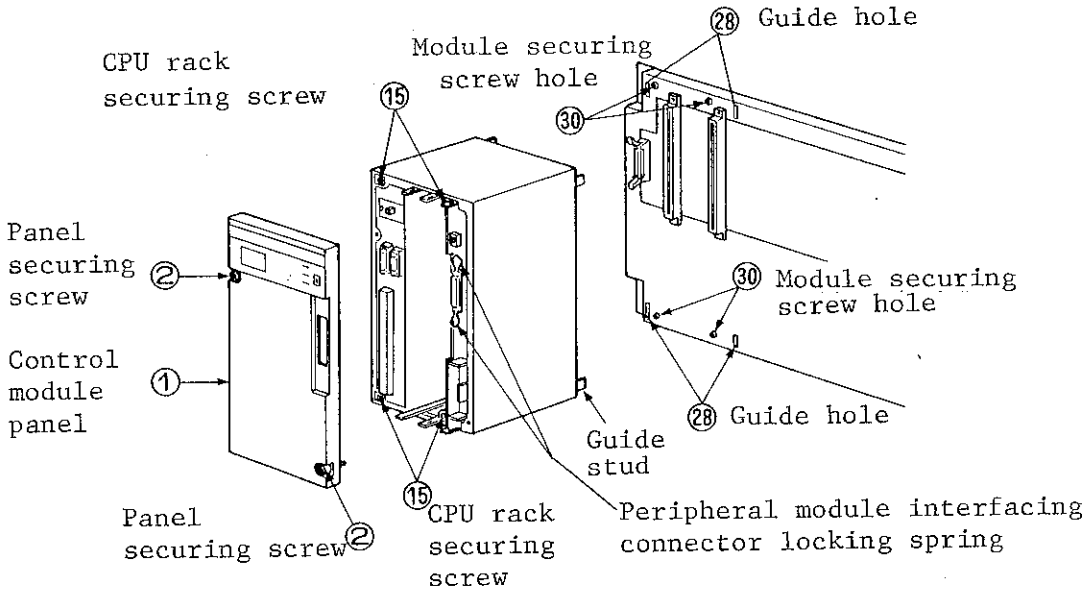


Bore locations for the ZW-504KB



Dimension of the rack support hole

4-3 Installation of control module



1) Loosen two panel securing screws (2) of the control module panel (1) using the flat-tip screwdriver.

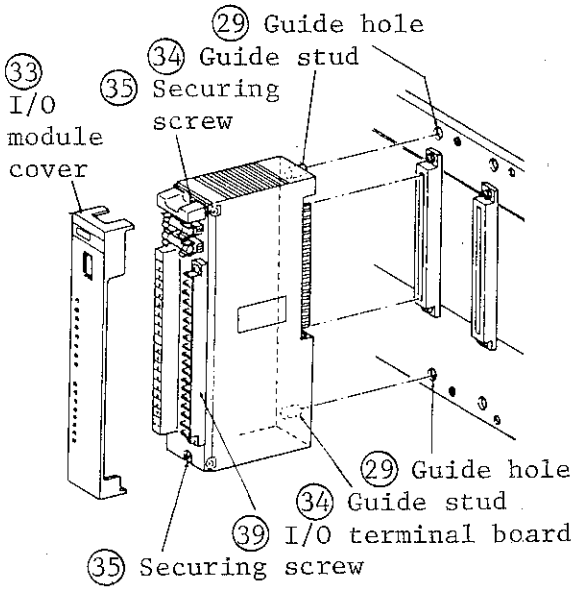
   NOTE) Since the screw is fixed to the panel, never try to remove it from the panel.

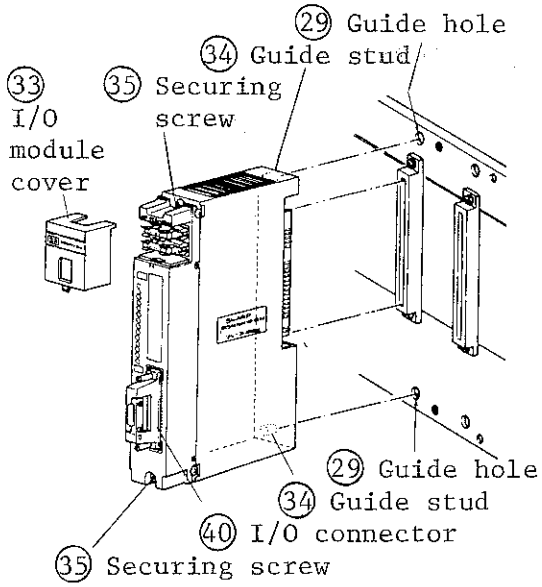
2) Lift the peripheral interfacing connector locking spring upright to remove it from the panel (1).

3) Insert four guide studs of the control module into guide holes of the CPU rack, then push in the control module to the CPU rack install.

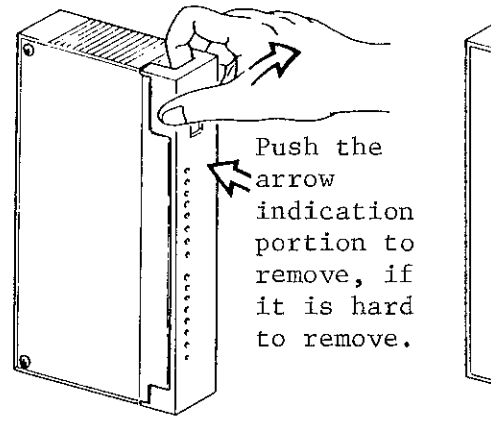
4) Tighten four CPU rack securing screws (15) of the control module to the module securing screw holes (30) of the CPU rack.

4-4 Installation of input modules and output modules

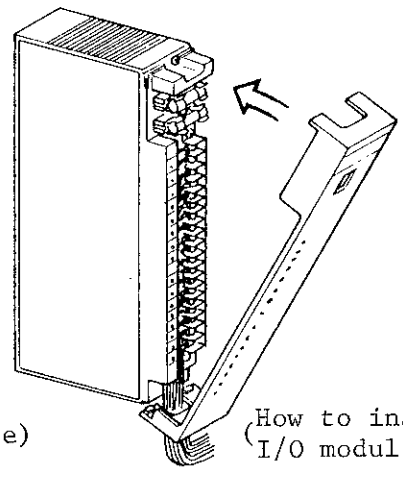




1) Remove the I/O module cover (33). Hold the opening on top part of the cover by finger tip, then lift it to remove.
2) Insert the guide studs (34) on the reverse side of the I/O module into the guide holes (39) of the CPU rack or I/O rack, then put in the I/O module to install.
3) Tighten two securing screws (35) to the CPU rack or I/O rack.
4) Fasten the cable from the I/O device to the I/O terminal board (39).
5) House the cable from the I/O device through the cable slit below the I/O module cover, then fit the cover on.



(How to remove the I/O module)

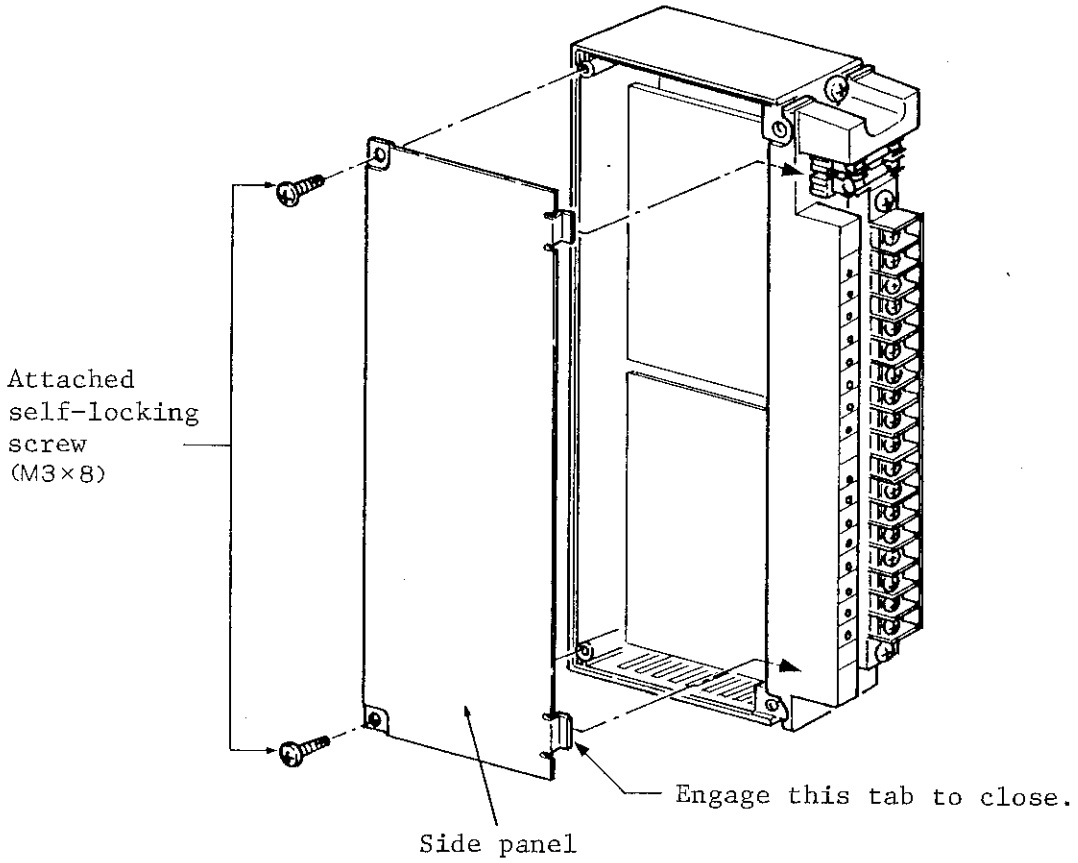


(How to install the I/O module cover)

NOTE) Be sure to shut off AC power to the control module before mounting and dismounting the I/O module to/from the rack.

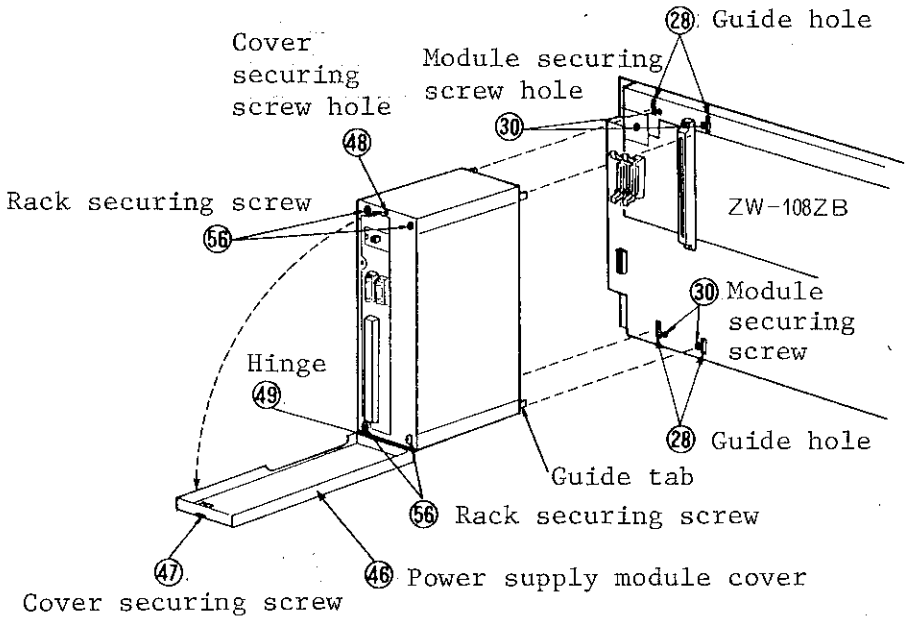
4-5 Installation of input/output module side panel

When the I/O rack is used, the side panel attached to the I/O rack must be fitted to the I/O module on the left side.



- Tighten the self-locking screw with a torque less than 5kg-cm.

4-6 Installation of expansion power supply module



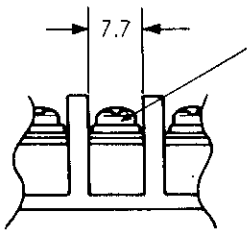
1) Loosen the cover securing screw ㊼ of the power supply module cover ㊻ with the phillips screwdriver and remove the power supply module cover.
2) Insert four guide tabs of the expansion power supply module into the guide holes ㉘ of the ZW-108ZB I/O rack, and install the expansion power supply module to the ZW-108ZB I/O rack.
3) Tighten four rack securing screws ㊻ of the expansion power supply module through the module securing screw holes ㉚ of the ZW-108ZB I/O rack.

§5 Wirings

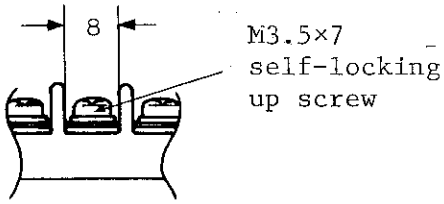
5-1 Wiring cautions

1) Keep away the power supply and signal cables from a high tension line and power supply line and do not install cables parallel to such a line.
2) Use the I/O signal expansion and DC5V supply cables that contained among accessories.
3) Avoid to install the I/O expansion cable and DC5V supply cables inside a conduit.
4) Choose such a wiring layout that may facilitate easier installation and removal of I/O module.
5) Install wirings to I/O module in such a manner that the operating status of I/O module may be easily recognized.
6) Use more than KIV1.25 square twisted wire for connection of the control module to the AC source input terminal.
7) Use more than KIV0.5 square wire for connection of the input module from the junction terminal board.
8) For wiring from the junction terminal board to the output module use more than KIV0.75 square wire for connection of a relatively large capacity item like a solenoid valve and KIV0.5 square wire for others.
9) For wiring from the junction terminal board to I/O device, use the wire of more than KIV1.25 square.
10) In case an entire factory is high tension grounded and not suitable for grounding of the module, simply connect the ground terminal to the metallic enclosure cabinet.
11) Be sure to use the crimped terminal lug for the wire connected to the terminal board of the module. Choose the crimp terminal lug according to the size of the I/O module terminal board, control module terminal board, or rack terminal board.

Dimensions of the I/O module terminal board

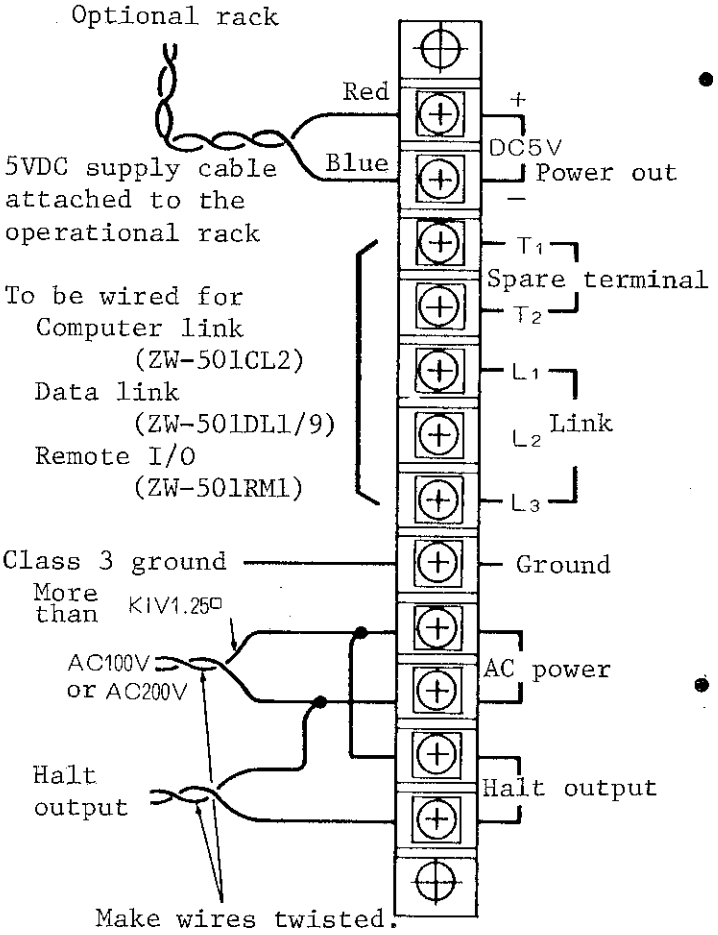


Dimensions of the control module and rack terminal board



5-2 Control module wiring

After removal of the control module panel, wires must be connected to the terminal board in the following manner.

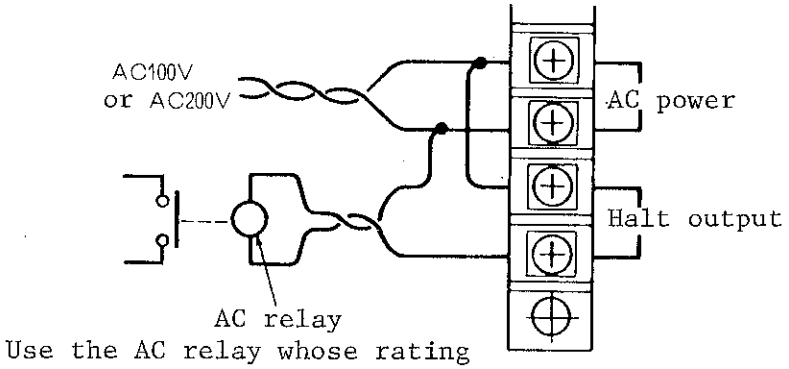


- For wiring of T_1, T_2, L_1, L_2, L_3, refer to Instruction Manual of option module.

NOTE)
Do not use terminals T_1, T_2, L_1, L_2, and L_3 for other purpose.

- When the DC output module is used for the output module, connect the AC relay with the halt output and route the contact to the emergency stop circuit.

NOTE) Tighten the terminal board screw with a torque of less than 12Kg-cm.

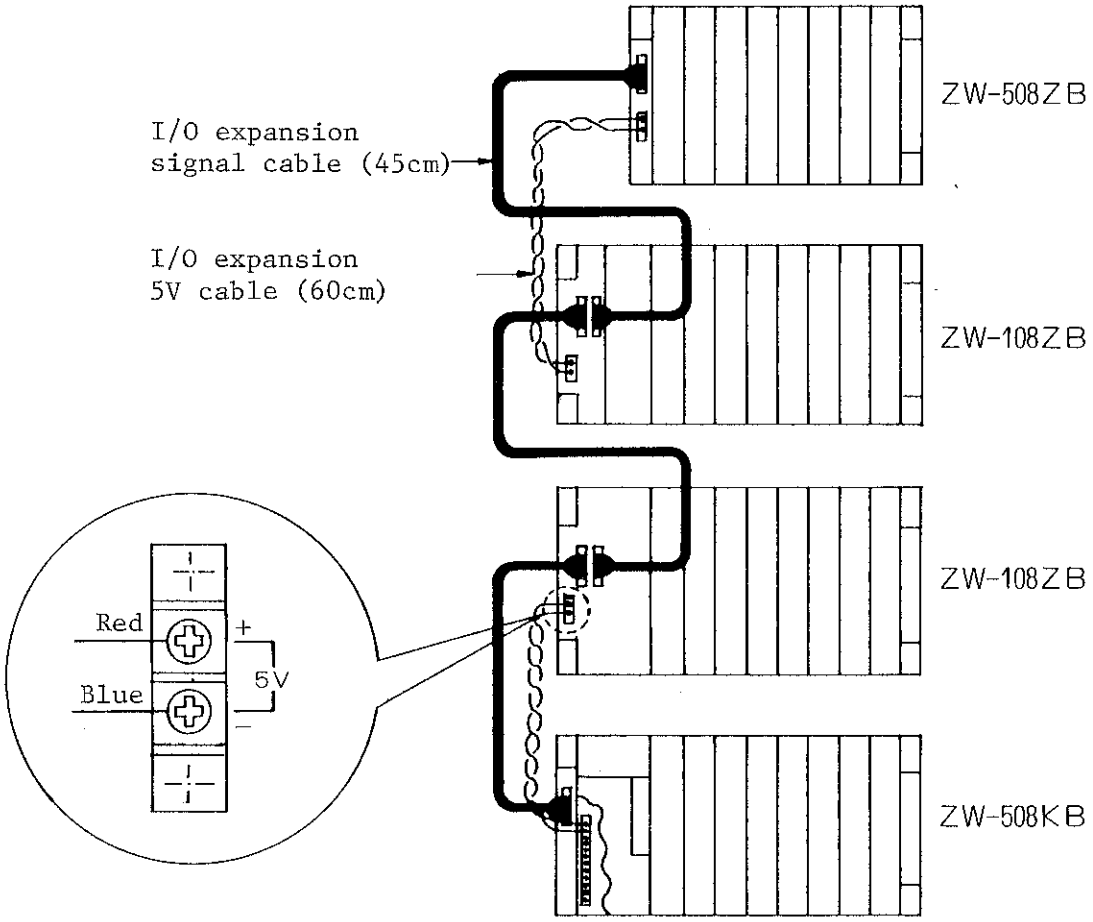


Use the AC relay whose rating is suitable for the power supply voltage.

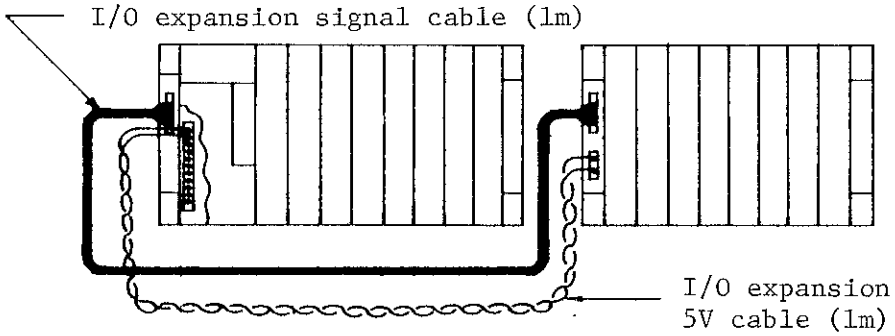
NOTE) When 200VAC is used for the AC supply source, the power source select switch of the control module must be set to the 200VAC side. Refer to Section 3-1[4], "Source power setup". Supplying 200VAC while the select switch is at the 100V side will result in damage of the control module.

5-3 I/O rack wirings

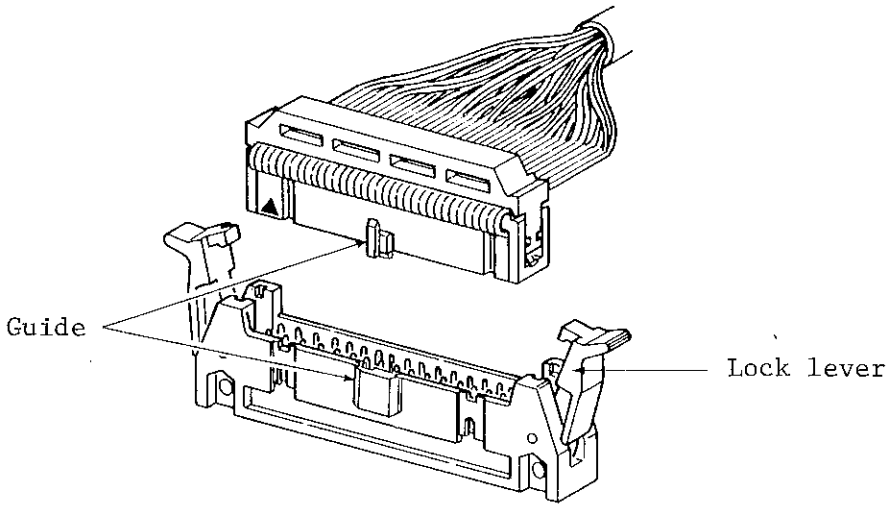
When the I/O rack is used, make the control module connected with the CPU rack or I/O rack using the I/O expansion signal cable and the expansion 5V cable that come with the I/O rack. (See the figure below.) Pay attention for IN and OUT connections of the I/O expansion connector.



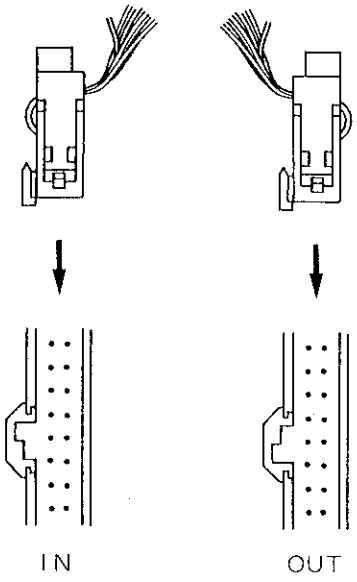
When the I/O racks are to be installed side by side, use the I/O expansion signal cable and the expansion 5V cable that come with the control module.



NOTE) Tighten the terminal board screw with a torque of less than 12kg-cm.



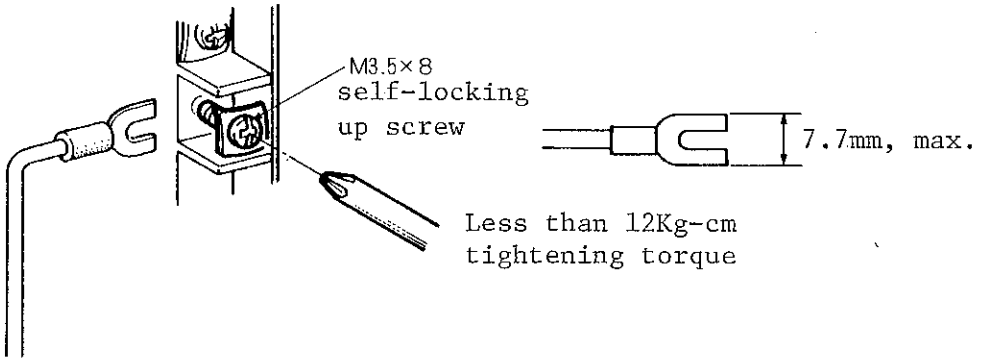
The I/O expansion signal cable connector has the guide.
The connector must be fastened firmly by the lock lever after the insertion.



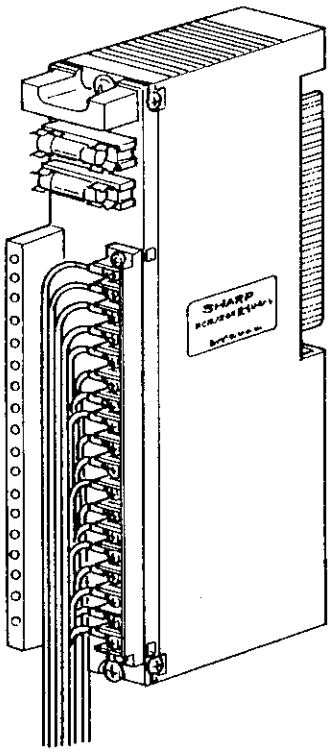
5-4 Input/output module wiring

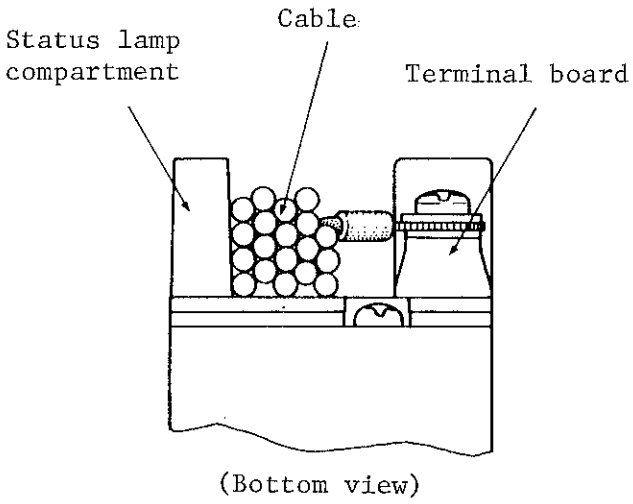
[1] Terminal board type

Use the crimped terminal lug to connect the I/O module with an external device such as limit switch and solenoid valve.



After fastening of the lug, the cable has to be threaded between the terminal board and the status lamp.

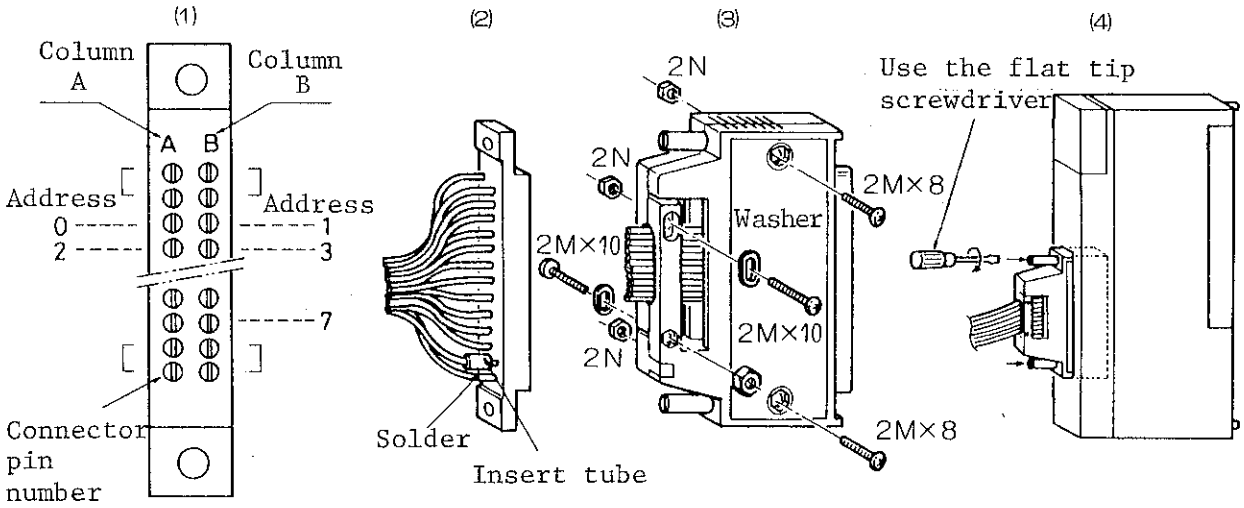




(Bottom view)

Since the terminal board used for the I/O module is detachable, an entire terminal board may be removed with the cable fixed to the terminal board.

[2] Connector type

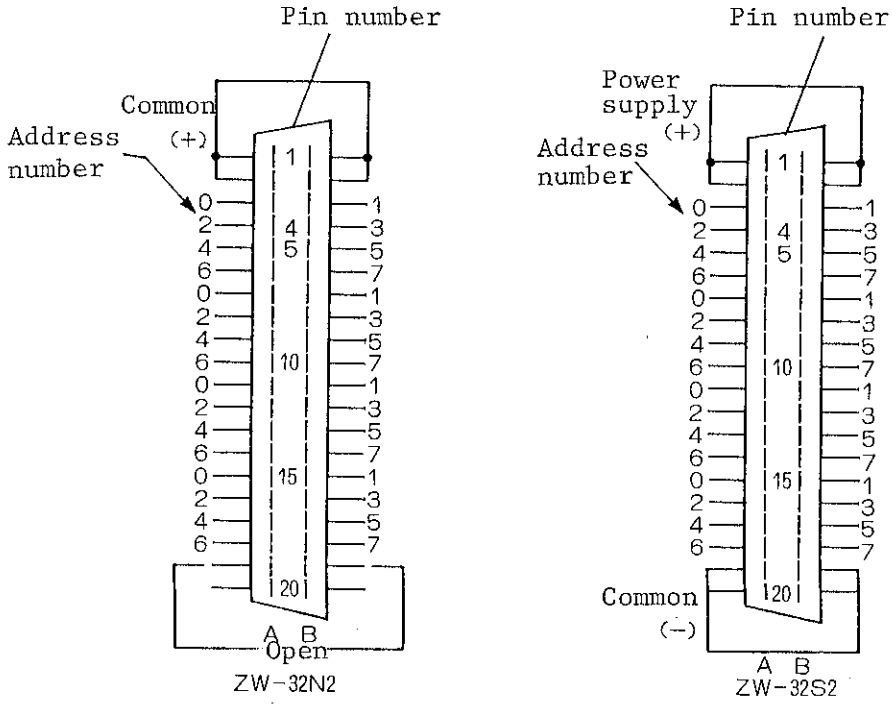


1) Pay attention for the address numbers as they are arranged different from the connector pin numbers.
2) Solder the signal wire to the connector pin with the cover inserted for insulation.
3) Fasten the connector to the module using the flat tip screwdriver.

Recommended cable:

Multi-pair, vinyl insulated, sheathed cable

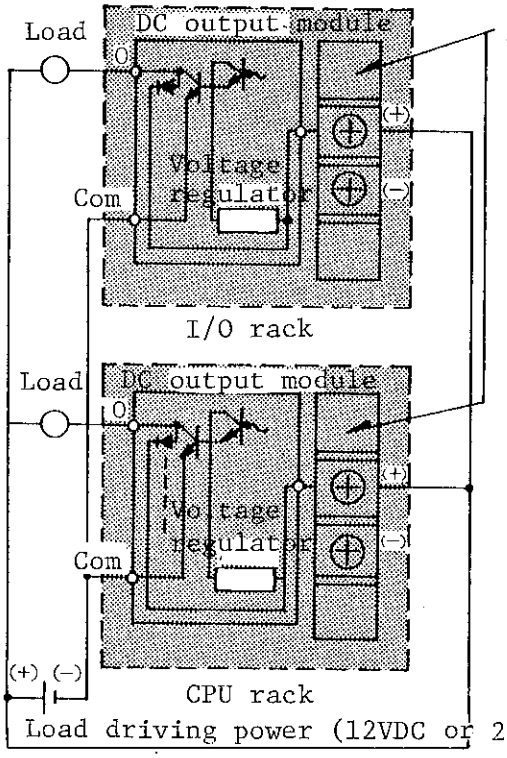
* Use a larger common wire in case a large current is applied through the common line of the output module, as the allowable current per line is 1.3A.



5-5 24VDC terminal board wiring

When the DC output module (ZW-16S2) or contact output module (ZW-16S4) is used for the output module, the external power supply source must be connected to the 24VDC terminal board of the CPU rack and I/O rack.

[1] To drive a load of 12VDC or 24VDC using the DC output module



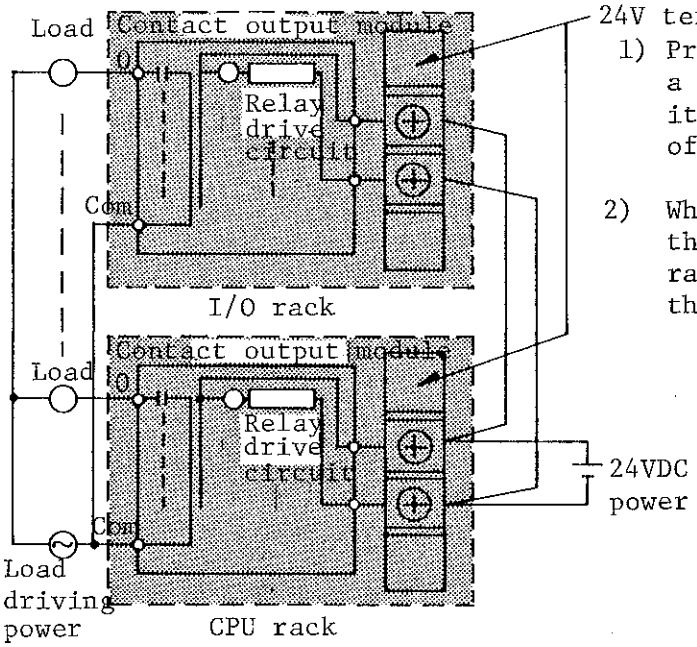
24V terminal board

1) Connect the positive side of the load driving power to the positive side of the 24V terminal board of the CPU rack.

2) When the I/O rack is used, connect the positive side of the 24V terminal board of the CPU rack with the positive side of the 24V terminal board of I/O rack.

3) To drive a load of 12VDC by the DC output module, the voltage of the external power supply source connected to the rack must be at least equal or greater than the voltage of the load driving power. (12VDC/24VDC)

[2] When the contact output module is used

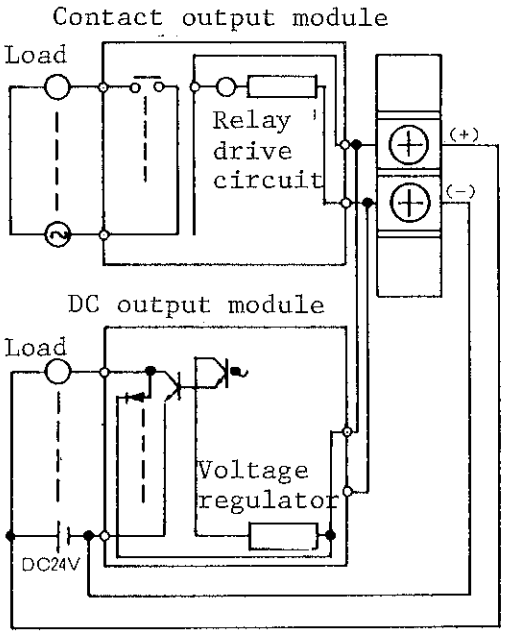


24V terminal board

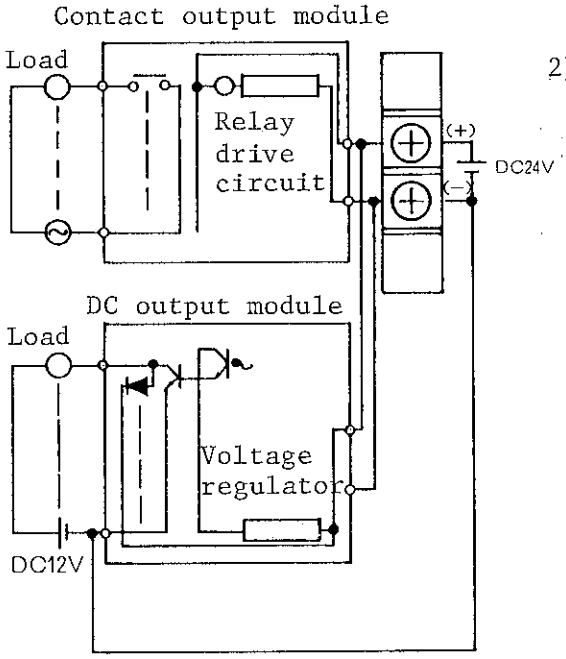
1) Provide 24VDC source separately as a load driving source and connect it through the 24V terminal board of the CPU rack.

2) When the I/O rack is used, connect the 24V terminal board of the CPU rack with the 24V terminal board of the I/O rack.

[3] When both the DC output module and the contact output module are used



1) When a load of 24VDC is driven by the DC output module both lines of the load driving power (24VDC) must be connected to the 24V terminal board of the CPU rack.

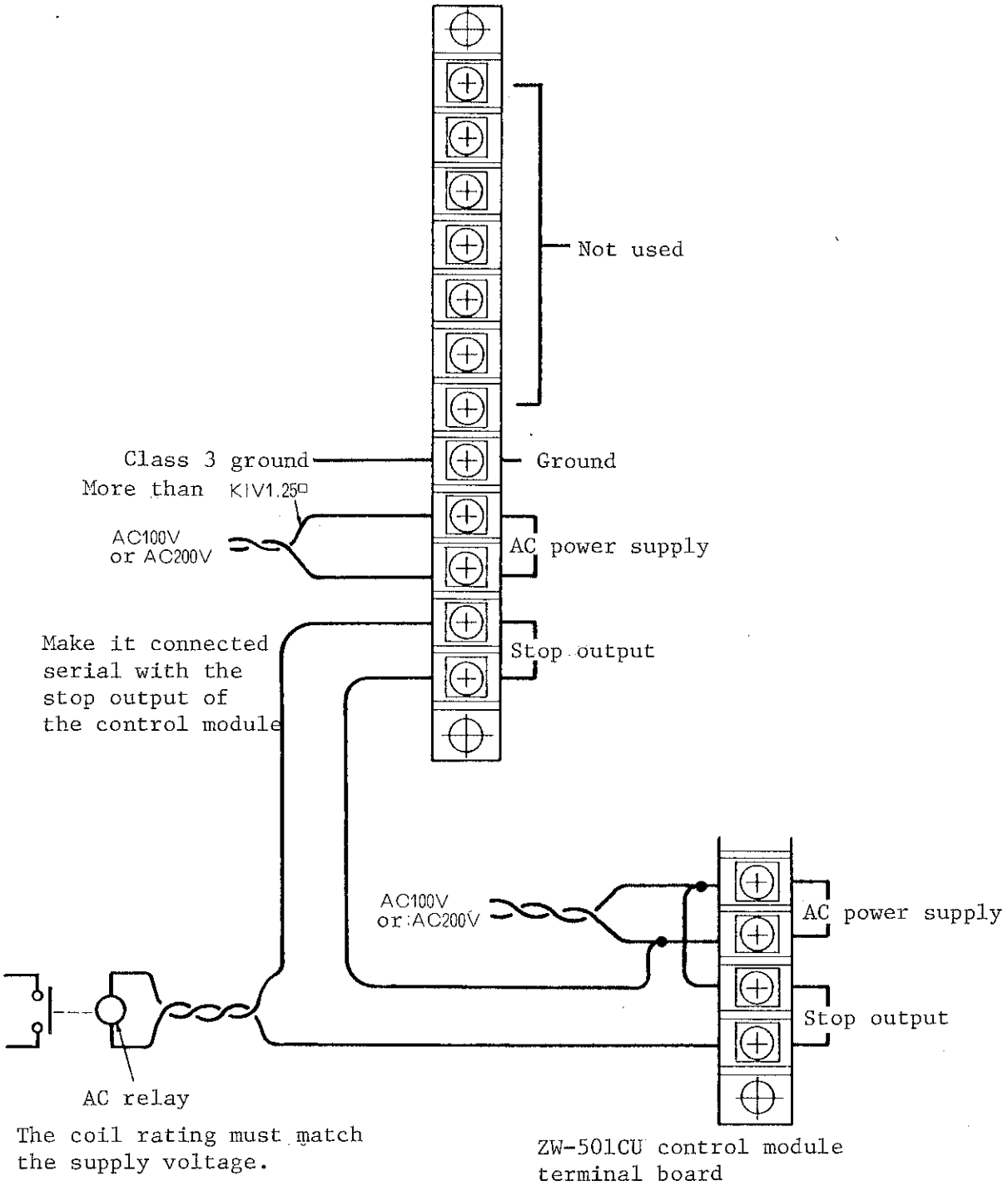


2) When a load of 12VDC is driven by the DC output module, connect the 24VDC source to the 24V terminal board of the CPU rack apart from the load driving power (12VDC) and connect the negative side of the load driving power line with the negative side of the 24V terminal board. To drive the relay inside the contact output module, it needs a 24VDC power.

NOTE) Tighten the terminal board screw with a torque of less than 12Kg-cm.

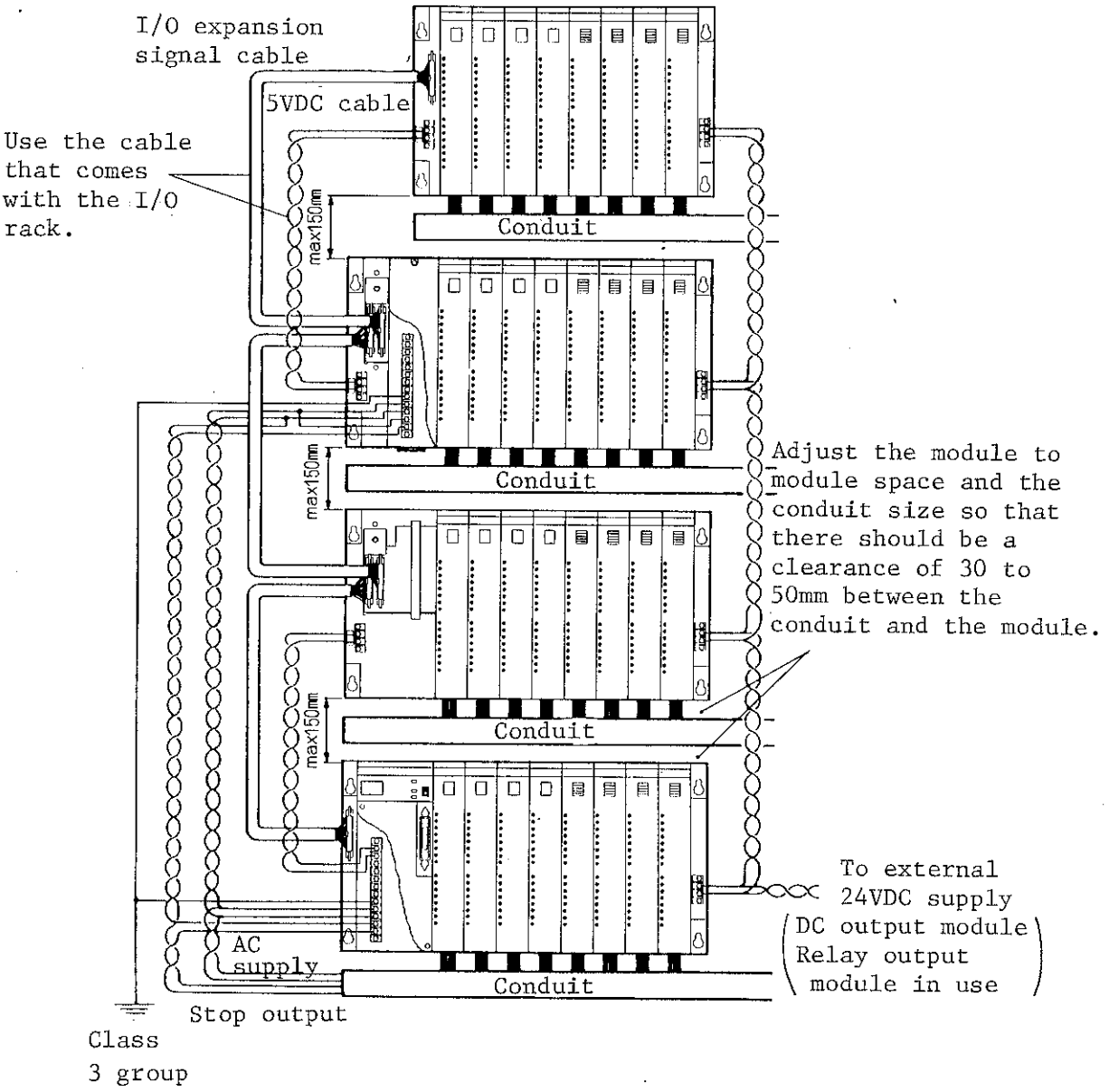
5-6 Expansion power supply module wiring

Remove the power supply module cover, and make wires connected to the terminal board in the following manner.



NOTE) The terminal board screw must be fastened with a torque of less than 12Kg-cm.

5-7 Example of internal panel wiring



§6 Maintenance and inspections

6-1 Routine maintenance

[1] Check items

In the following table are listed routine check items that required to be checked for operating the machine under an optimum conditions.

1) General items

Item	Contents	Criterion	Note
Ambient temperature	Check if it is within a range specified in the specification. (In the case of in-panel installation, the temperature inside the panel becomes the ambient temperature.)	0 ∿ +55°C	Free of moisure condensation
Ambient humidity		35 ∿ 90%RH	
Ambient air		Free of corrosive gas	
Vibration		Not permitted	
Impact		Not permitted	

2) Control module

Item	Contents	Criterion	Note
Input power source	Make voltage measure on the terminal board to check if the input voltage is within a range of the given rating.	-15 to +10% of the rating	
Control module FAILURE lamp	Visually observe the FAILURE lamp.	Must be off.	
Battery	Check if the battery date is not expired.	Must be within the effective period.	
Installed conditions	Check if the control module is firmly secured.	Free of looseness	
	Check for any loosened screw.	Free of looseness	
	Check if connector locking metal of the I/O signal expansion cable is firmly engaged.	The locking screw must be in firm engagement.	

3) I/O module

Item	Contents	Criterion	Note
Input power source or output power source	Check if the supply voltage to every I/O module is within the given voltage.	°100VAC input module 85VAC to 110VAC	ZW-16N1
		°DC input module 10VDC to 30VDC	ZW-16N2
		°Data input module 10VDC to 26.4VDC	ZW-32N2
		°200VAC input module 170VAC to 220VAC	ZW-16N3
		°100VAC output module 15VAC to 121VAC	ZW-8S1 ZW-16S1
		°DC output module 10VDC to 30VDC	ZW-16S2
		°Data output module 4.75VDC to 30VDC	ZW-32S2
		°200VAC output module 15VAC to 242VAC	ZW-16S3
		°Relay contact output module AC: 240VAC, max. DC: 30VDC, max.	ZW-16S4
Installed condition	Check if every module is firmly secured.	Free of looseness	
	Check if the terminal board securing screw is fastened firmly.	Free of looseness	

4) Expansion power supply module

Item	Contents	Criterion	Note
Input power source	Check if the input voltage measured on the terminal board is within the given rating.	Must be -15% to +10% of the rating.	
Installed condition	Check if every module is firmly secured.	Free of looseness	
	Check if the terminal board securing screw is fastened firmly.	Free of looseness	

5) Others

Verify the program on the cassette tape or PROM with the program currently in operation.

6-2 Battery replacement procedure

The memory backup battery must be replaced with the fresh one before its expiration date. The expiration date is noted on the label posted on the control panel.

Contents of both the program memory and the data memory are retained by the backup battery during power failure.

Even if the ROM is used for the program memory, it also need battery replacement.

The battery can be replaced while power is on to the control module.

1) Parts code of the battery unit DUNT-5211NCZZ

2) Battery replacement procedure

Get the fresh battery ready.

↓

Loosen two screws ② that secure the panel, then remove the control module panel ①.

↓

Unfasten the connector ⑰ of the used battery on the CPU board and put the connector of the fresh battery into connection within one minute.

↓

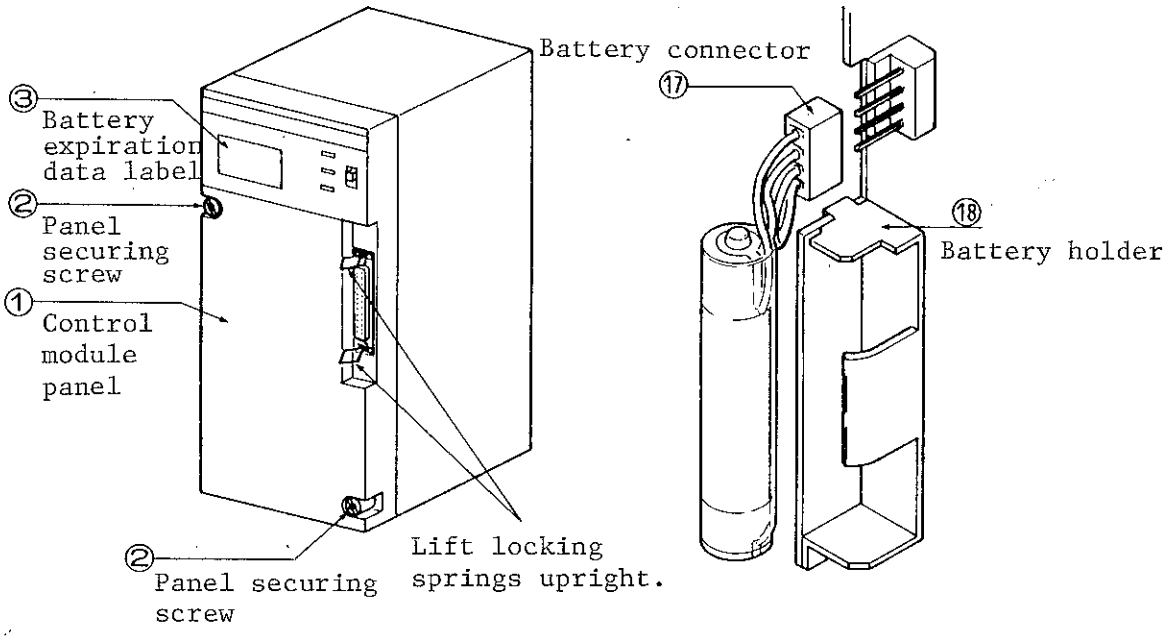
Take out the used battery from the battery holder ⑱ and replace it with the fresh battery.

↓

Replace the control module panel ① back into its original place.

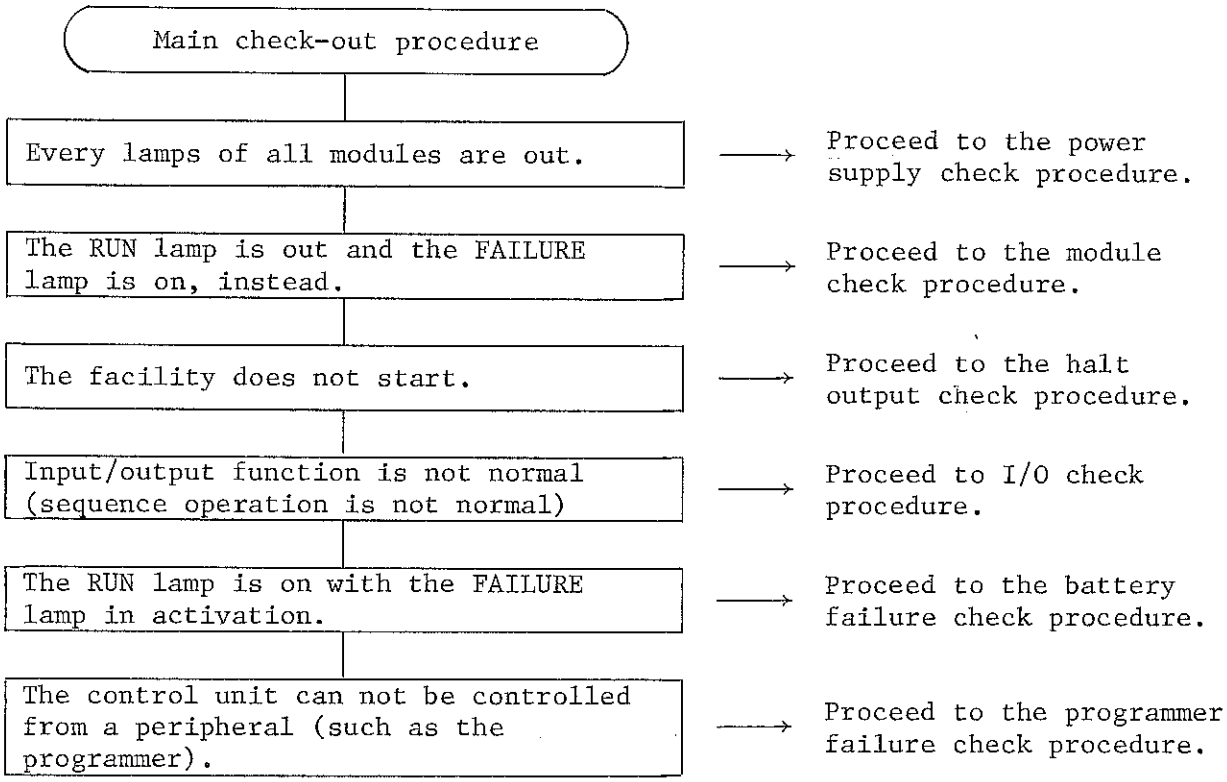
↓

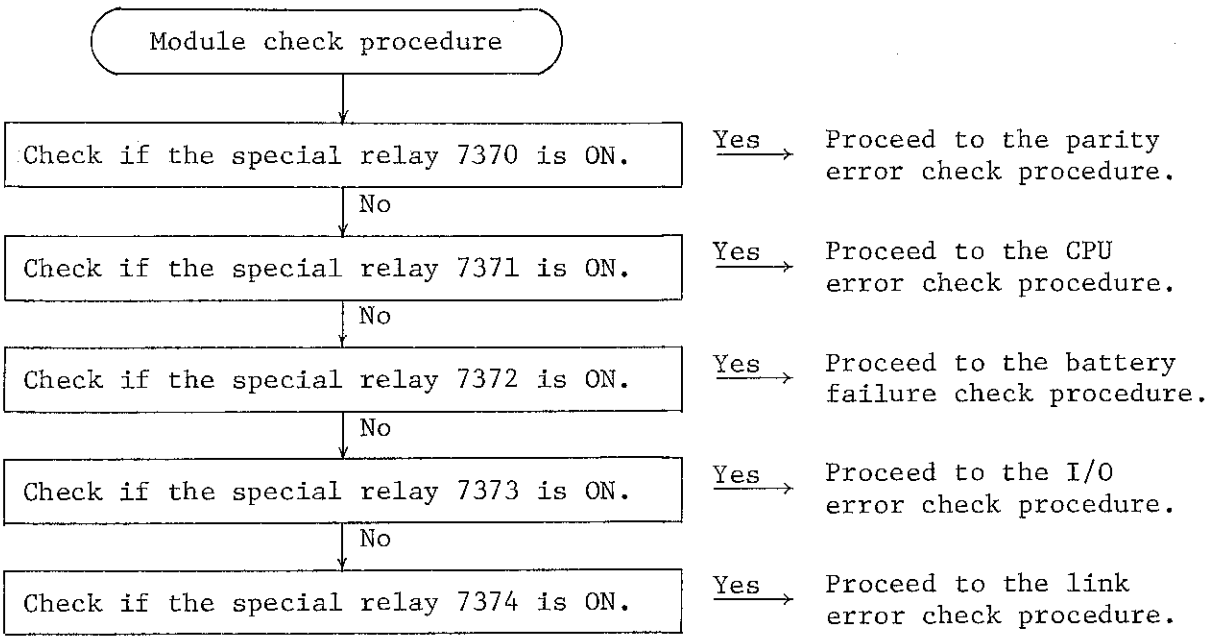
Revise the battery expiration label.

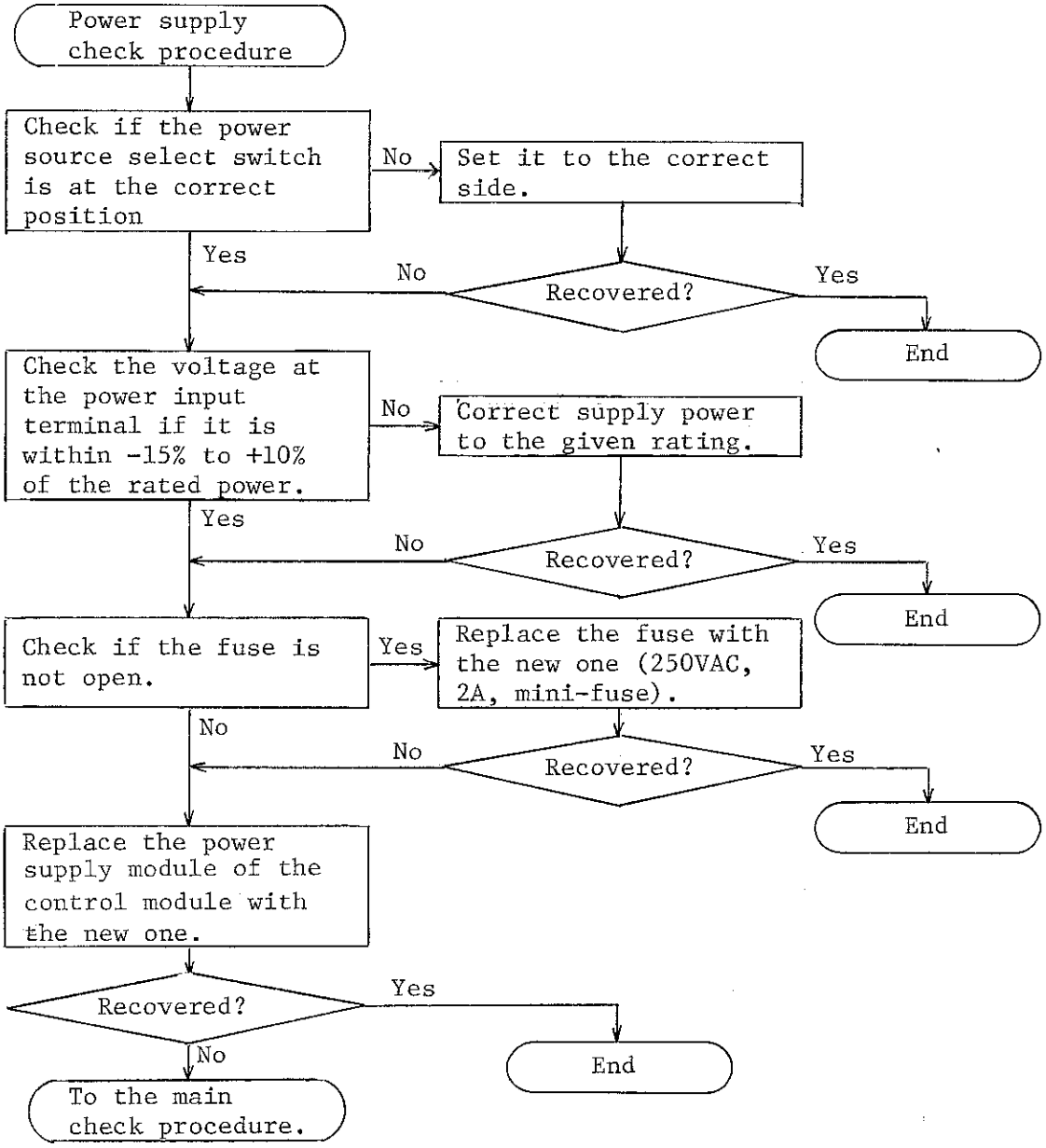


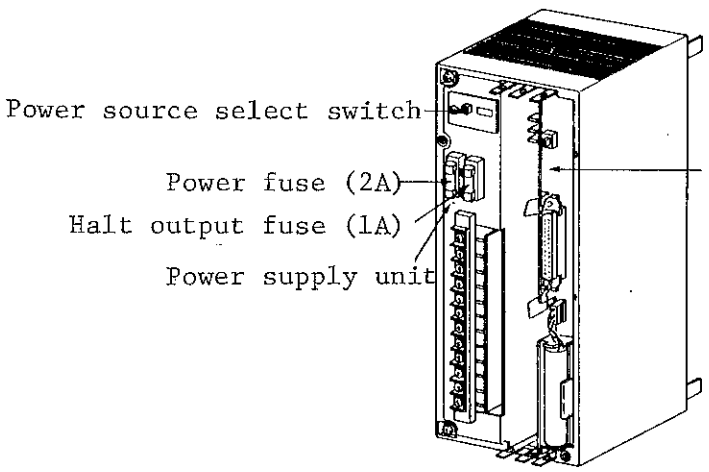
6-3 Error checks

Shown next are basic error check procedures.

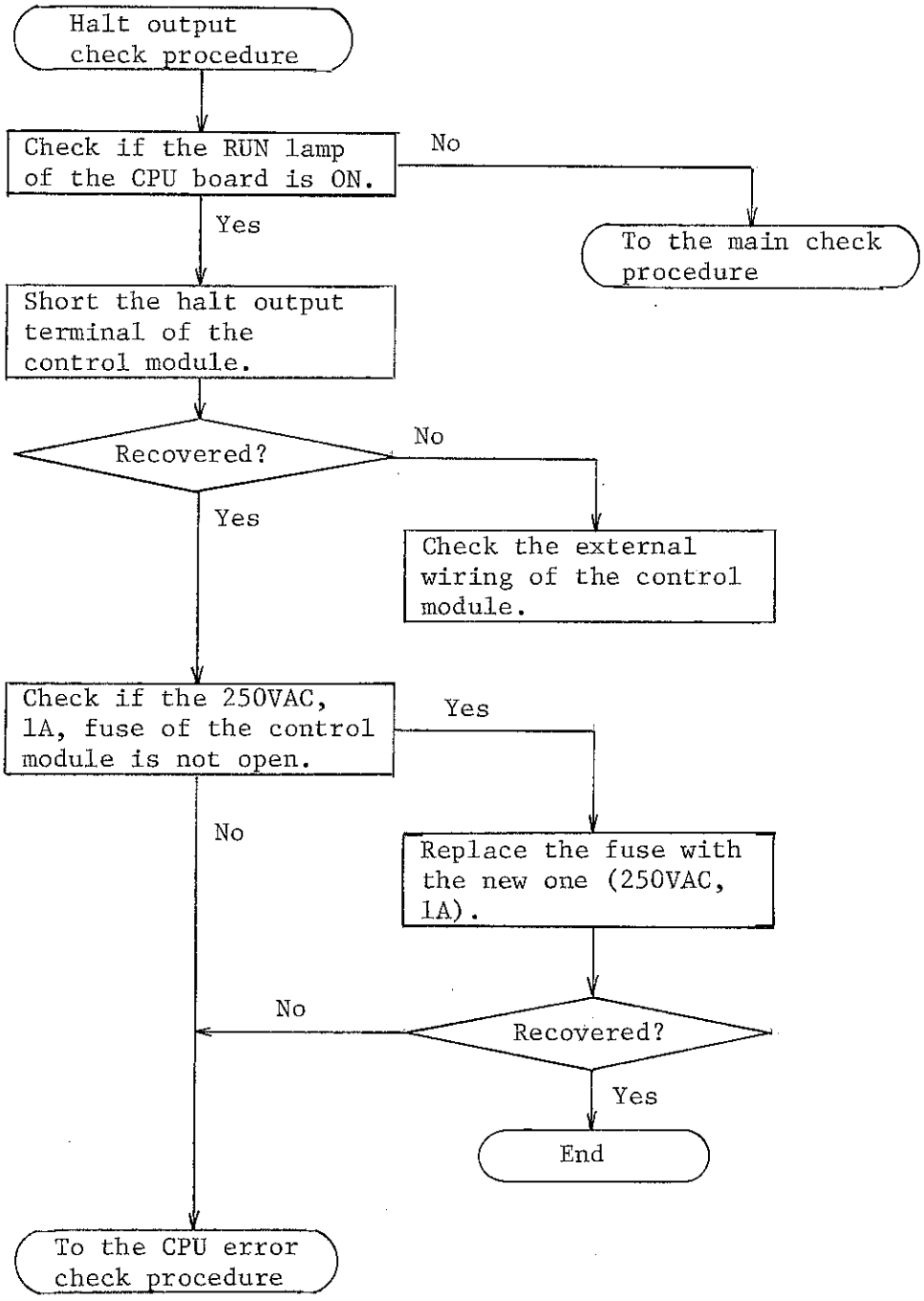


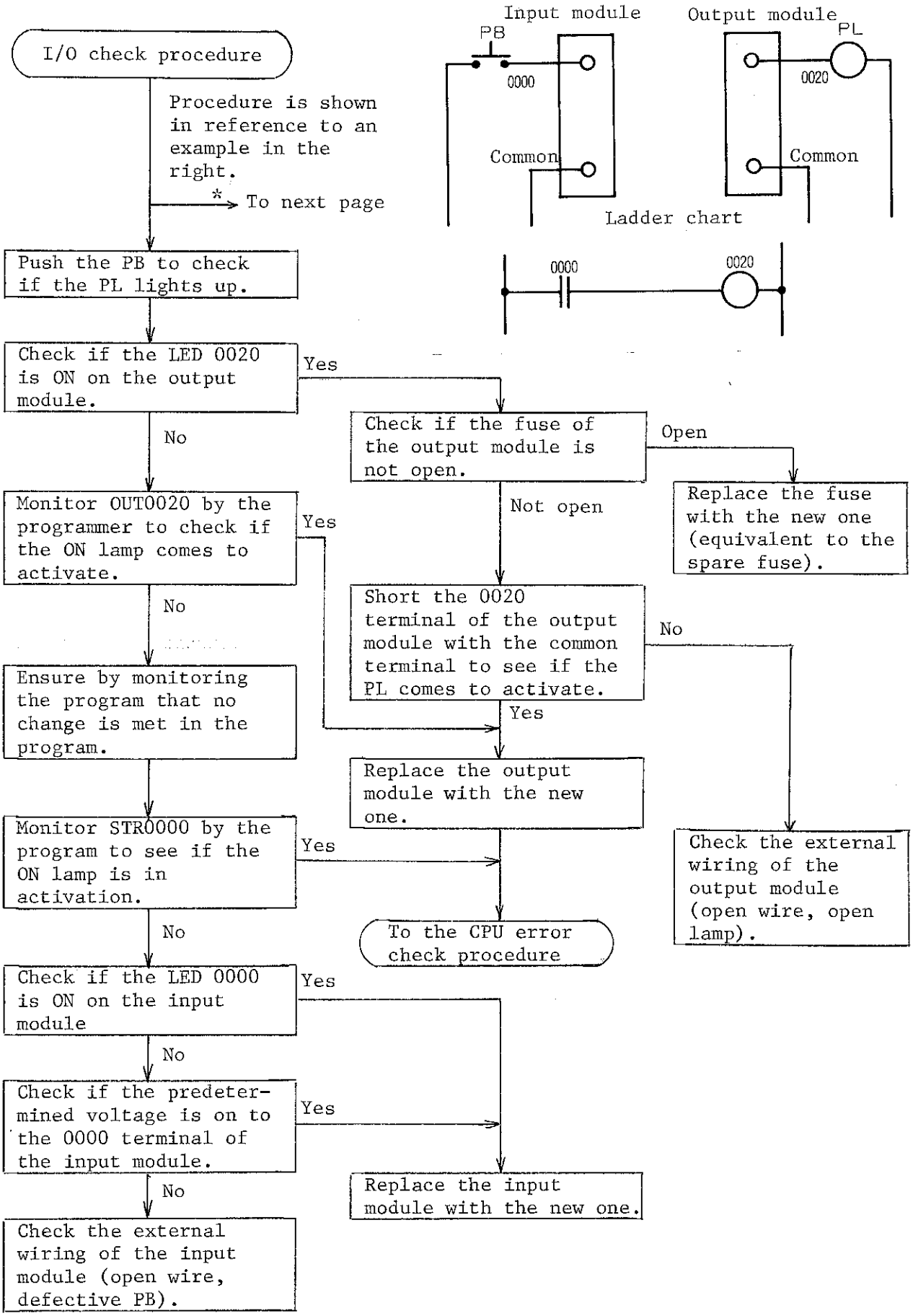


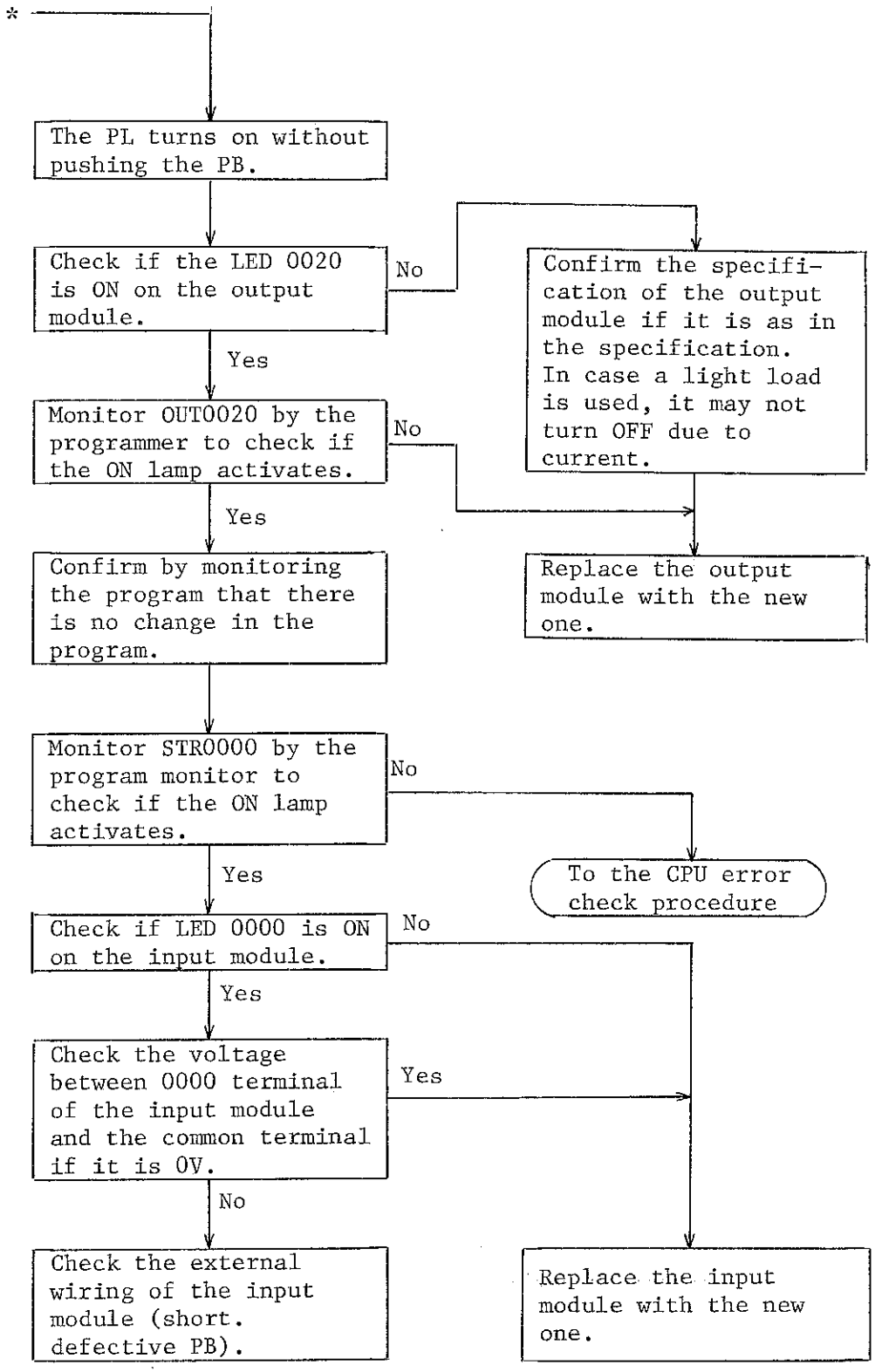


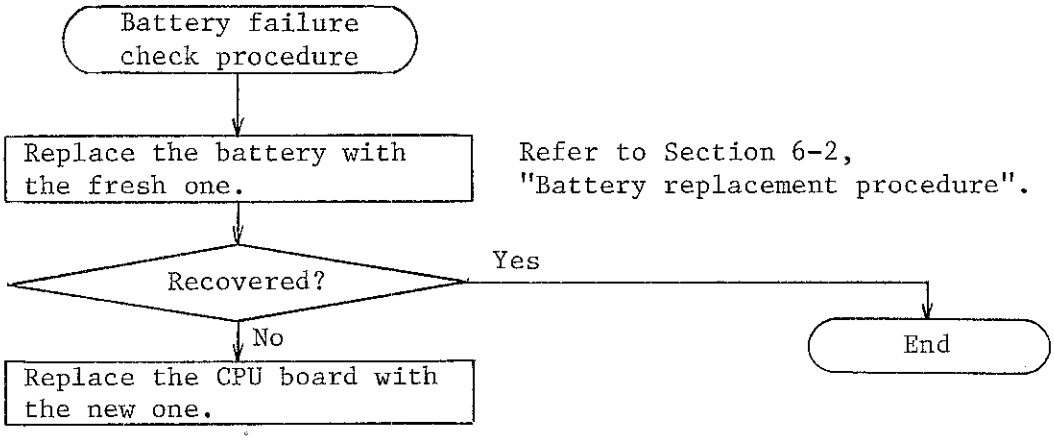


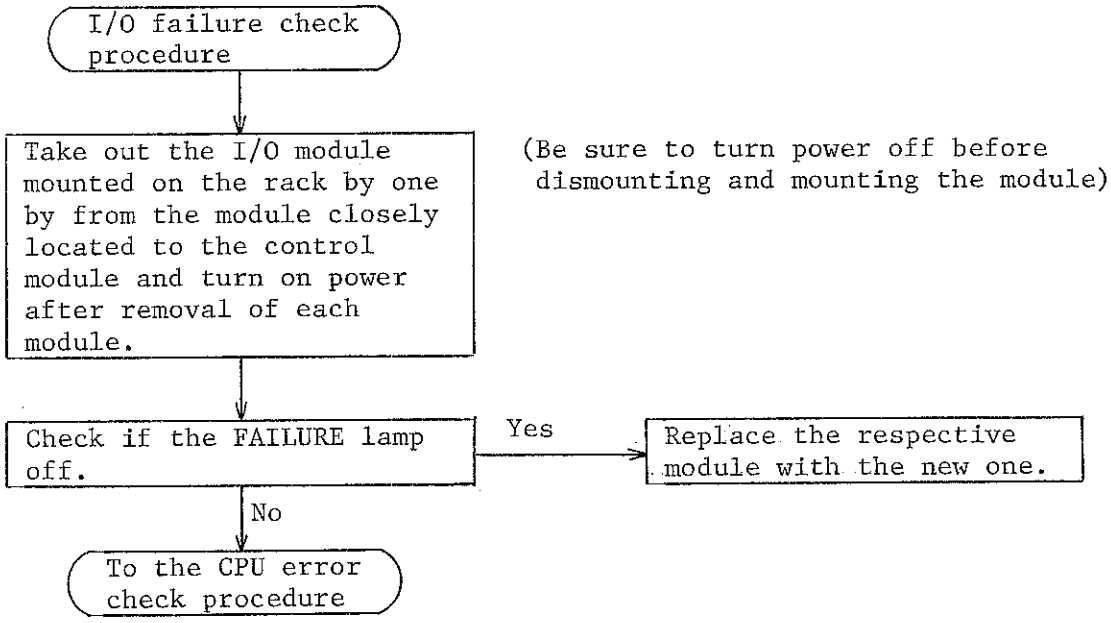
Shut power off prior to changing of the source power select switch.

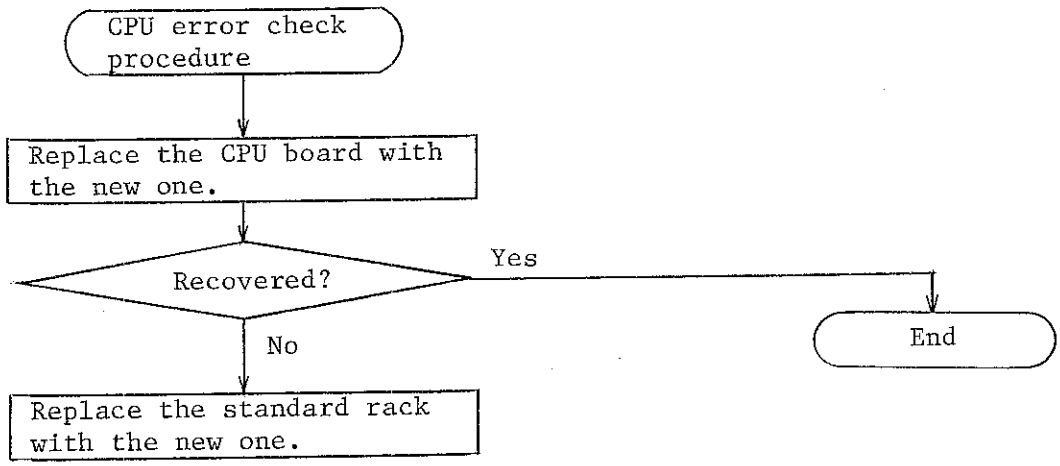

Halt output check procedure
Check if the RUN lamp of the CPU board is ON.
No
To the main check procedure
Yes
Short the halt output terminal of the control module.
Recovered?
No
Yes
Check the external wiring of the control module.
Check if the 250VAC, 1A, fuse of the control module is not open.
Yes
No
Replace the fuse with the new one (250VAC, 1A).
No
Recovered?
Yes
End
To the CPU error check procedure

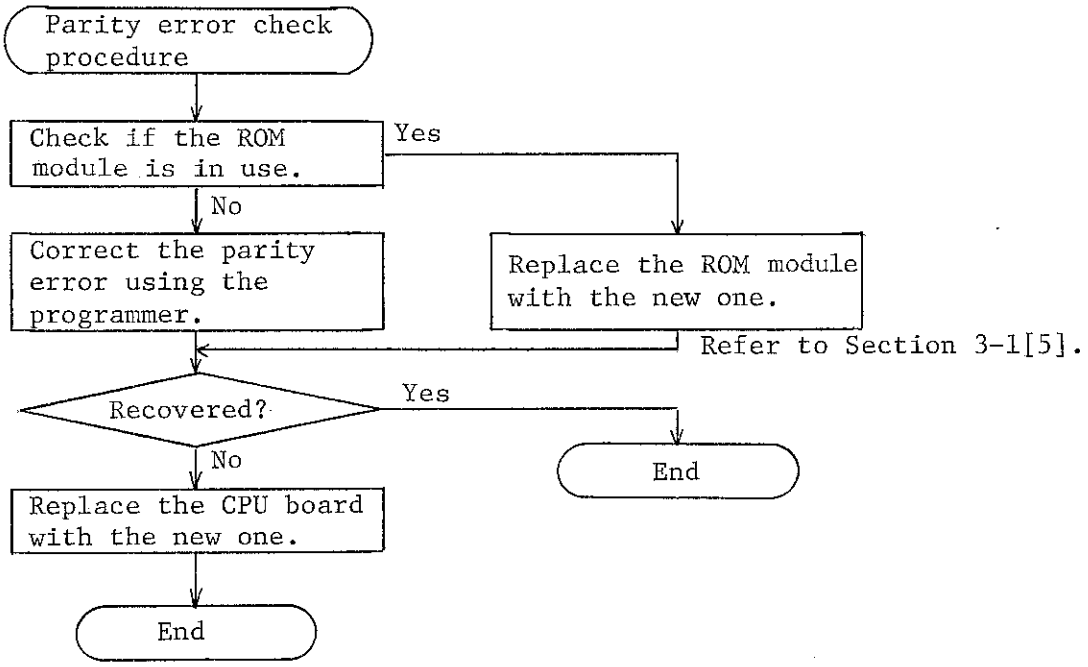

I/O check procedure
Procedure is shown in reference to an example in the right.
* To next page
Input module
PB
0000
Common
Output module
PL
0020
Common
Ladder chart
0000
0020
Push the PB to check if the PL lights up.
Check if the LED 0020 is ON on the output module.
Yes
No
Check if the fuse of the output module is not open.
Open
Replace the fuse with the new one (equivalent to the spare fuse).
Not open
Monitor OUT0020 by the programmer to check if the ON lamp comes to activate.
Yes
No
Short the 0020 terminal of the output module with the common terminal to see if the PL comes to activate.
No
Yes
Ensure by monitoring the program that no change is met in the program.
Replace the output module with the new one.
Monitor STR0000 by the program to see if the ON lamp is in activation.
Yes
No
Check the external wiring of the output module (open wire, open lamp).
To the CPU error check procedure
Check if the LED 0000 is ON on the input module
Yes
No
Check if the predetermined voltage is on to the 0000 terminal of the input module.
Yes
No
Replace the input module with the new one.
Check the external wiring of the input module (open wire, defective PB).

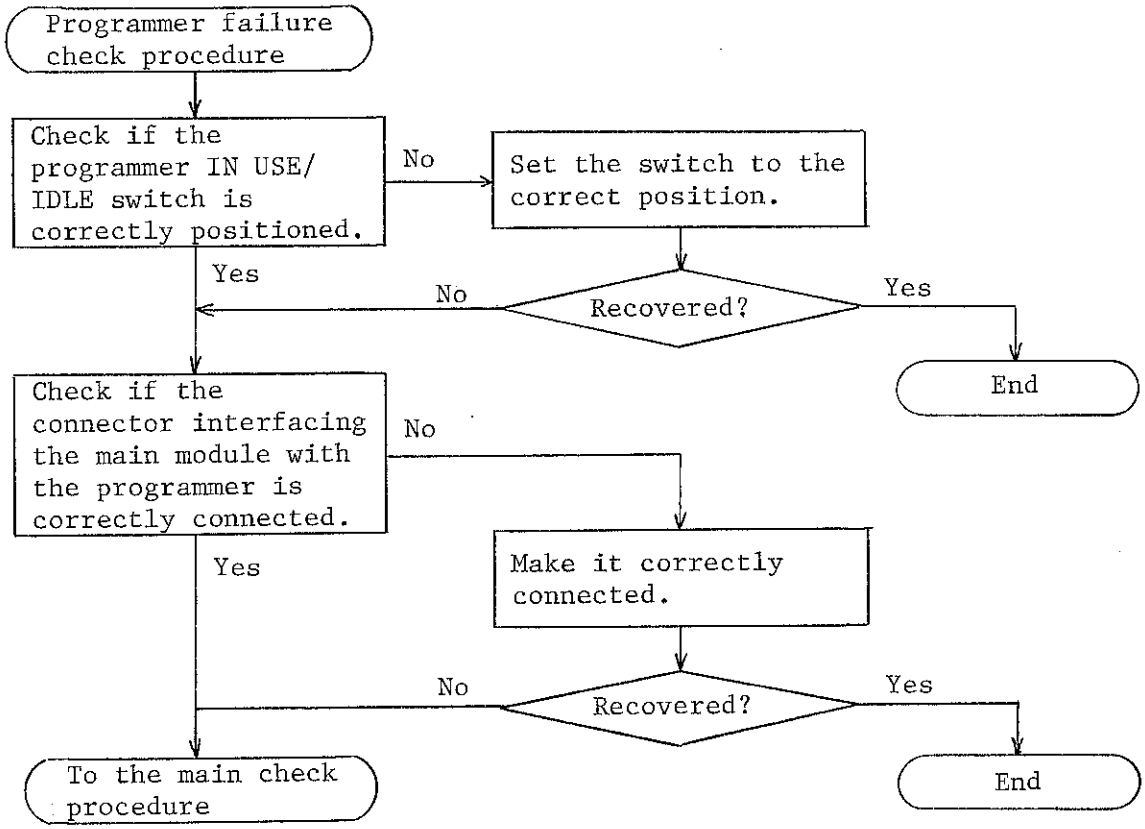

*
The PL turns on without pushing the PB.
Check if the LED 0020 is ON on the output module.
No
Confirm the specification of the output module if it is as in the specification. In case a light load is used, it may not turn OFF due to current.
Yes
Monitor OUT0020 by the programmer to check if the ON lamp activates.
No
Yes
Confirm by monitoring the program that there is no change in the program.
Replace the output module with the new one.
Monitor STR0000 by the program monitor to check if the ON lamp activates.
No
Yes
To the CPU error check procedure
Check if LED 0000 is ON on the input module.
No
Yes
Check the voltage between 0000 terminal of the input module and the common terminal if it is 0V.
Yes
No
Check the external wiring of the input module (short. defective PB).
Replace the input module with the new one.

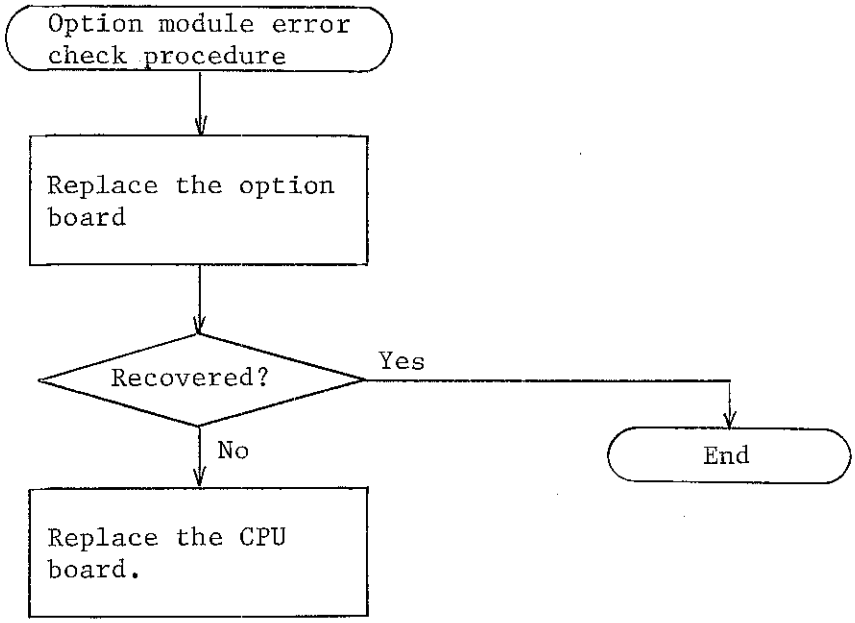

Battery failure check procedure
Replace the battery with the fresh one.
Refer to Section 6-2, "Battery replacement procedure".
Recovered?
Yes
No
End
Replace the CPU board with the new one.


I/O failure check procedure
Take out the I/O module mounted on the rack by one by from the module closely located to the control module and turn on power after removal of each module.
(Be sure to turn power off before dismounting and mounting the module)
Check if the FAILURE lamp off.
Yes
Replace the respective module with the new one.
No
To the CPU error check procedure


CPU error check procedure
Replace the CPU board with the new one.
Recovered?
Yes
No
End
Replace the standard rack with the new one.


Parity error check procedure
Check if the ROM module is in use.
Yes
No
Correct the parity error using the programmer.
Replace the ROM module with the new one.
Refer to Section 3-1[5].
Recovered?
Yes
No
End
Replace the CPU board with the new one.
End


Programmer failure check procedure
Check if the programmer IN USE/ IDLE switch is correctly positioned.
No
Set the switch to the correct position.
Yes
No
Recovered?
Yes
End
Check if the connector interfacing the main module with the programmer is correctly connected.
No
Yes
Make it correctly connected.
No
Recovered?
Yes
To the main check procedure
End


Option module error check procedure
Replace the option board
Recovered?
Yes
No
End
Replace the CPU board.