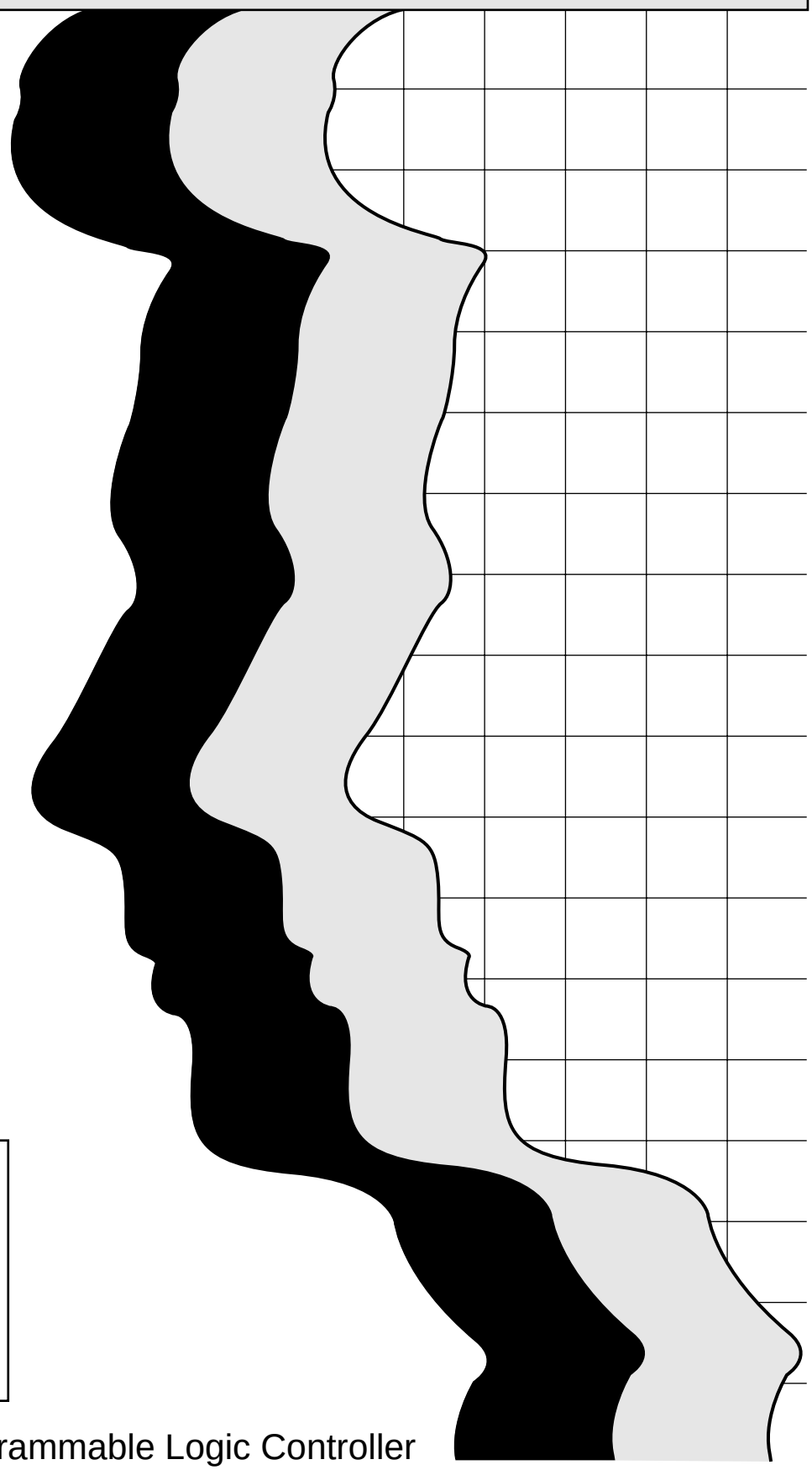
MITSUBISHI

type A0J2 (CPU)

User's Manual



A

MELSEC

Mitsubishi Programmable Logic Controller

INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

CONTENTS

1. GENERAL DESCRIPTION

This manual gives specifications and handling procedures for the A0J2CPU (referred to as "A0J2") and A0J2CPU-DC24 (referred to as "A0J2-DC24") general-purpose programmable controllers.
For information on the A0J2CPU I/O units, extension power supply units and I/O cables, see the A0J2 (I/O unit) User's Manual.

Differences between A0J2 and A0J2-DC24

Item	A0J2	A0J2-DC24
Input power supply	100V/200V AC	24V DC

Table 1.1 Differences between A0J2 and A0J2-DC24

In this manual, the "A0J2CPU" indicates that the CPU used may either be A0J2 or A0J2-DC24.

In the A0J2 system, the number of I/O available can be expanded in the range 28 to 336 points (maximum 480 points when using an extension base unit). With a wall mounting method (thin type), unit thichness is only 41mm (1.61 inch). With a unit-to-unit mounting method, required space is 475cm^2 (19 x 25) (73.6"sq. (7.48 x 9.84)). The system allows controlling of up to 84 I/O.

Included with the A0J2CPU unit, the following components and manuals are included. Please make sure of these items after opening the package.

A0J2CPU Unit	1
4KRAM (furnished to the unit)	1
A6BAT (furnished to the unit)	1
User's manual for A0J2 (CPU unit edition)	1
User's manual for A0J2 (I/O unit edition)	1

2. SPECIFICATIONS

This chapter describes the specifications and performances of the A0J2CPU system.

2.1 General Specifications

General specifications common to each unit for A0J2CPU system are shown in Table 2.1.

<table>
<tr><th>Item</th><th colspan="5">Specifications</th></tr>
<tr><td>Operating ambient temperature</td><td colspan="5">0 to 55°C</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="5">−20 to 75°C</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="5">10 to 90%RH, non-condensing</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="5">10 to 90%RH, non-condensing</td></tr>
<tr><td rowspan="3">Vibration resistance</td><td rowspan="3">Conforms to JIS C 0911</td><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep Count</td></tr>
<tr><td>10 to 55Hz</td><td>−</td><td>0.075mm (0.003inch)</td><td rowspan="2">10 times *(1 octave/minute)</td></tr>
<tr><td>55 to 150Hz</td><td>1g</td><td>−</td></tr>
<tr><td>Shock resistance</td><td colspan="5">Conforms to JIS C 0912 (10g x 3 times in 3 directions)</td></tr>
<tr><td>Noise durability</td><td colspan="5">By noise simulator of 1500Vpp noise voltage,
1μs noise width and 25 to 60Hz noise frequency</td></tr>
<tr><td>Dielectric withstand voltage</td><td colspan="5">500V AC for 1 minute across batch of AC external terminals and ground
500V AC for 1 minute across DC external terminals and ground</td></tr>
<tr><td>Insulation resistance</td><td colspan="5">5MΩ or larger by 500V DC insulation resistance tester across AC external terminals and ground</td></tr>
<tr><td>Grounding</td><td colspan="5">Class 3 grounding; grounding is not required when it is impossible</td></tr>
<tr><td>Operating ambience</td><td colspan="5">Free of corrosive gases. Dust should be minimal.</td></tr>
<tr><td>Cooling method</td><td colspan="5">Self-cooling</td></tr>
</table>

Table 2.1 General Specifications

REMARKS

One octave marked * indicates a change from the initial frequency to double or half frequency. For example, any of the changes from 10Hz to 20Hz, from 20Hz to 40Hz, from 40Hz to 20Hz, and 20Hz to 10Hz are referred to as one octave.

2.2 CPU Unit Performance Specifications

This section describes the performance specifications of the A0J2CPU unit.

2.2.1 Functions and specifications of CPU unit

Table 2.2 shows performances and specifications of the A0J2CPU unit.

Item \ Type		Specifications	
		A0J2	A0J2-DC24
Control method		Stored program, repetitive operation	
I/O control method		Direct system	
Programming language		Language dedicated to sequence control (combined use of relay symbol type, logic symbolic language, and SAP language)	
Instruction	Sequence instruction	21 types	
	Basic instruction	38 types	
	Application instruction	21 types	
Processing speed		Sequence instruction 4.4 to 5.6 μs/step	
Memory capacity and memory type	Memory capacity	Max. 7K steps	
	4KEROM	3K steps	
	4KRAM	3K steps	
	4KROM	3K steps	
	16KRAM	7K steps	
	8KROM	7K steps	
Number of I/O points		336 points (Maximum 480 points when using extension base unit)	
Internal relay (M/L)		M/L0000 to 2047 (2048 points. Setting for M/L to be made with A6GPP or A7PU.)	
Link relay (B)		B000 to B3FF (1024 points. Available for internal relay)	
Timer	Number of points	128 points	
	100ms	T0 to T79 (80 points, 0.1 to 3276.7 sec)	
	10ms	T80 to T119 (40 points, 0.01 to 327.67 sec)	
	Retentive (100ms)	T120 to T127 (8 points, 0.1 to 3276.7 sec)	
Counter		C0 to C127 (128 points, 1 to 32767)	
Data register (D)		D0 to D511 (512 points, 16 bits)	
Annunciator (F)		F0 to F255 (256 points, 1 bit)	
Index register (V, Z)		V, Z (2 points, 16 bits)	
Pointer (P)		P0 to P63 (64 points)	
Special relay (M)		M9000 to M9255 (256 points)	
Special register (D)		D9000 to D9127 (128 points)	
Comment		Can be created with A6GPP (Comment entered into the CPU are only 95 points, F0 to F94.)	
Latch (power failure compensation) function		Available for L, B, T, C, D (Range to be set with A6GPP or A7PU.)	

Table 2.2 CPU Unit Performance Specifications (Continue)

Item \ Type	Specifications	
	A0J2	A0J2-DC24
Remote RUN/STOP function	Can be operated with A6GPP or A7PU.	
Operation mode at error	Operation continued at software instruction error	
STOP to RUN output mode	Operation result at STOP is regenerated.	
Print title entry	Print title cannot be entered into the CPU. However, it can be created with A6GPP.	
Self-diagnostic function	Watch dog timer error monitor, battery error, AC down detection, blown fuse detection, etc.	
Allowable instantaneous power failure period	Within 20ms	*1 Within 1ms
At power on, at power restoration after power failure	Automatic restart when "RUN" switch is set to ON. (Initial start)	
IC-RAM latch device back-up	Battery backup, lithium battery used (5 years of guarantee period)	
Parameter	Latch range to be set with A6GPP or A7PU.	
Microcomputer mode	Other than sequence program area. The content of utility FD is written into the microcomputer area.	
Watch dog time (WDT)	200ms fixed	
Weight (kg)	0.75	

*Allowable lower limit input (power supply input) is 15.6V DC.

Table 2.2 CPU Unit Performance Specifications

2.2.2 Performance specifications of CPU unit built-in power supply

Table 2.3 shows performance specifications of the power supply incorporated in the A0J2CPU unit.

Item \ Type			Performance Specification	
			A0J2	A0J2-DC24
Input	Input power		100 to 120V AC $^{+10\%}_{-15\%}$ (85 to 132V AC) / 200 to 240V AC $^{+10\%}_{-15\%}$ (170 to 264V AC)	24V DC $^{+30\%}_{-35\%}$ (15.6 to 31.2A DC)
	Input current		0.7A or less/0.35A or less	1.5A or less (15.6V DC)/ 1A or less (24V DC)
	Input frequency		50/60Hz±5%	———
	Maximum input apparent power		56VA or less	———
	Input electric power		———	24W or less
	Inrush current		40A, within 5ms	50A (within 2ms)
	Efficiency		65% or more	65% or more
Output	Rated output current	5V DC	2A	2A
		24V DC	0.5A	———
	Over-current protection	5V DC	2.4A	2.4A
		24V DC	0.6A	———
	Output rise time		Within 150ms after power on	Within 150ms after power on
Power supply display			LED display provided	LED display provided

Table 2.3 Performance Specifications of CPU Unit Built-In Power Supply

2.3 Memory Specifications

Table 2.4 shows memory specifications available for the A0J2CPU.

Item \ Type	4KEROM	4KRAM	4KROM	16KRAM	8KROM
Memory specifications	EEPROM (Read/Write) Write disabled during RUN	IC-RAM (Read/Write)	EP-ROM (Read only)	IC-RAM (Read/Write)	EP-ROM (Read only)
Memory capacity	8K bytes	8K bytes	8K bytes	32K bytes	16K bytes
Number of steps	3K steps	3K steps	3K steps	7K steps	7K steps
Structure	28 pin IC package				

Table 2.4 Memory Specifications

2.4 Battery Specification

Table 2.5 shows battery specifications for RAM memory backup and power failure compensation function.

Item / Type	A6BAT
Nominal voltage	3.6V DC
Battery guarantee period	5 years
Total power failure time	4 years at 40°C 330 days at 75°C
Application	IC-RAM memory backup and power failure compensation function
Size mm (inch)	16 (0.63) diameter x 30 (1.18)

Table 2.5 Battery Specifications

3. HANDLING

This chapter explains the handling instructions from unpacking to installation and also the nomenclature and setting of various conditions.

3.1 Handling Instructions

This section explains the handling instructions for the unpacking to installation of PC main unit, memory, battery, etc.

3.1.1 CPU

(1) Since the case, terminal block connector, and pin connector of this PC are made of plastic, do not drop or subject to mechanical shock.

(2) Do not remove the printed circuit board of any unit from its case. Removal may cause board damage.

(3) When wiring, take care to prevent entry of wire offcuts into the unit. If any conductive debris has entered the unit, make sure that it is removed.

(4) Tighten the unit mounting screws and terminal screws in the following ranges.

Screw	Tightening Torque Range (kg-cm)
I/O unit terminal block terminal screw (M3 screw)	5 to 8
I/O unit terminal block mounting screw (M4 screw)	8 to 14
CPU unit terminal block screw (M4 screw) (Power input section)	10 to 14
Unit mounting screw (not required normally) (M4 screw)	8 to 12

3.1.2 Memory chips

(1) To load the memory chip into the socket, securely press the memory chip into the socket and then lock.

(2) Never place the chip on metal, which may allow current flow, or on an object which is charged with static electricity, such as wood, plastic, vinyl, fiber, cable, and paper.

(3) Do not touch the legs of the chip. Also, do not bend the legs.

(4) When mounting the memory, be sure to fit the chip as indicated on the socket. If reversely installed, the chip will be damaged.

(5) If IC-RAM is removed from the socket, memory data will be lost. Therefore, caution should be exercised.

IMPORTANT

Before installing and removing the memory chip to and from the CPU, be sure to turn off the power. If installation or removal is performed during power on, the chip will be damaged.

3.1.3 Battery

(1) Do not short-circuit the battery.

(2) Do not disassemble the battery.

(3) Do not throw the battery into flames.

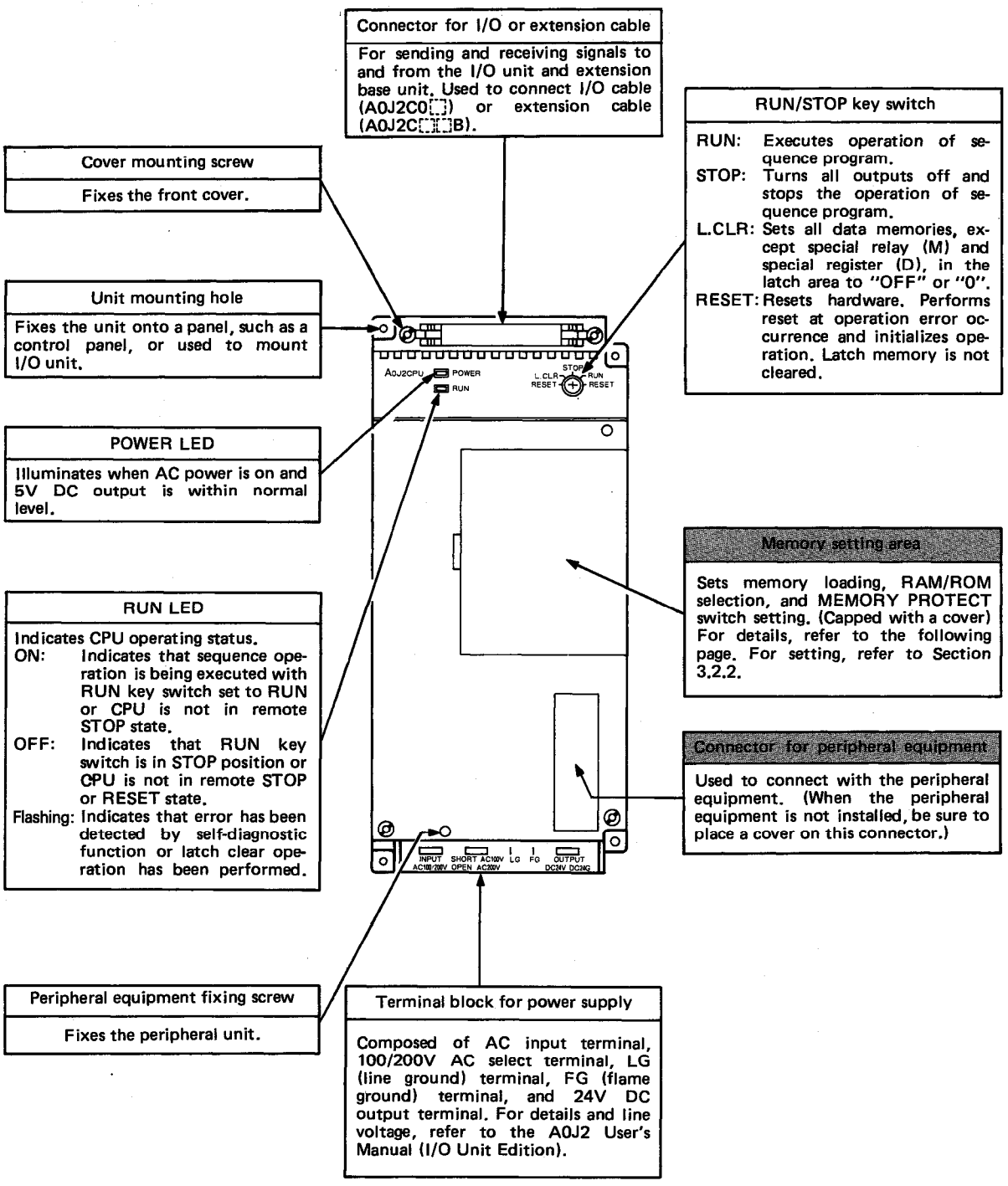
(4) Do not heat the battery.

(5) Do not solder the poles of the battery.

3.2 CPU Unit

This section describes the nomenclature and setting of the A0J2CPU unit.

3.2.1 Nomenclature



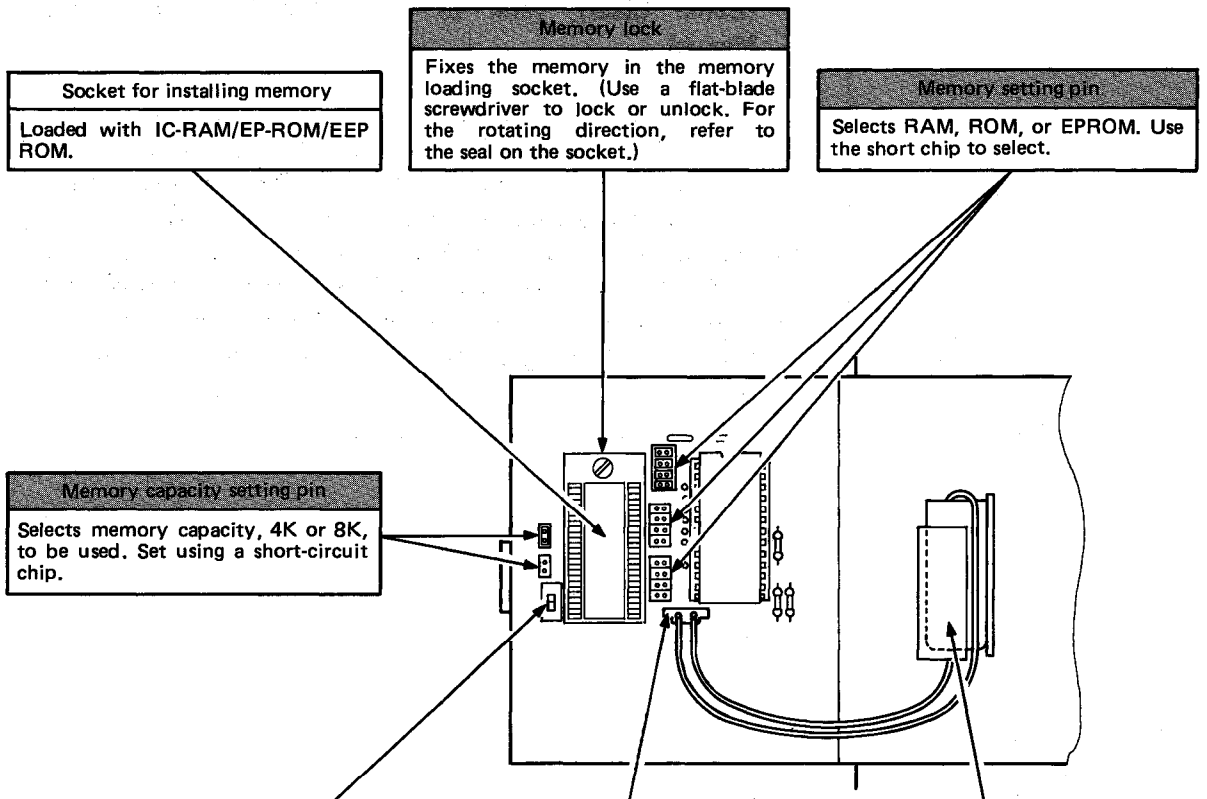
POINT

(1) RUN LED remains on if the annunciator (F) is set.

(2) For the setting of the RUN/STOP switch to "L.CLR" (Latch Clear), refer to the A0J2CPU Programming Manual.

(3) Operation is started when the power is turned on with the RUN/STOP switch set to "RUN" position. When the switch is changed from RUN to STOP, the operation is stopped and all outputs are turned off. In this case, all control information in RUN mode completely remains. If the switch is set again to RUN without resetting, the operation is resumed. Usually, the operation may be started by turning on the power with the switch set to RUN.

Details of Memory Setting Area



Socket for installing memory

Loaded with IC-RAM/EP-ROM/EEP ROM.

Memory lock

Fixes the memory in the memory loading socket. (Use a flat-blade screwdriver to lock or unlock. For the rotating direction, refer to the seal on the socket.)

Memory setting pin

Selects RAM, ROM, or EPROM. Use the short chip to select.

Memory capacity setting pin

Selects memory capacity, 4K or 8K, to be used. Set using a short-circuit chip.

Memory protect setting switch

Enables or disables write to the memory when IC-RAM or EEPROM is installed into the memory loading socket.
M.PRO in [ON] position: disables write
M.PRO in [OFF] position: enables write

Battery lead connector

Connects the lead wire of the battery. (The battery lead is removed before shipment to prevent battery discharge.)

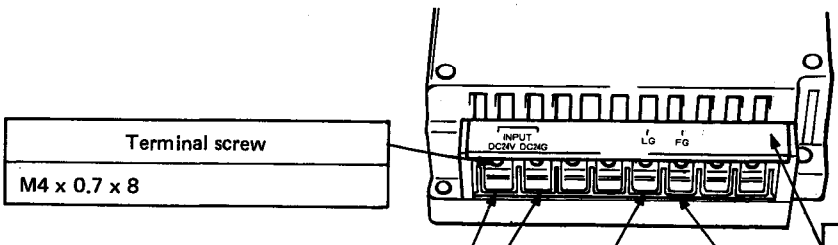
Battery (A6BAT)

Backs up IC-RAM memory and the power failure compensation feature.

* For setting, refer to Section 3.2.2.
It is necessary to set or install the shaded area before test run and adjustments.

Details of Power Supply Terminal Block

A0J2-DC24



Terminal screw

M4 x 0.7 x 8

Terminal cover

Protects the terminal block. Must be kept on the terminal block except during wiring.

Power input terminals

Connect 24V DC power supply.

FG terminal

Connected with shielding pattern on the printed circuit board.

LG terminal

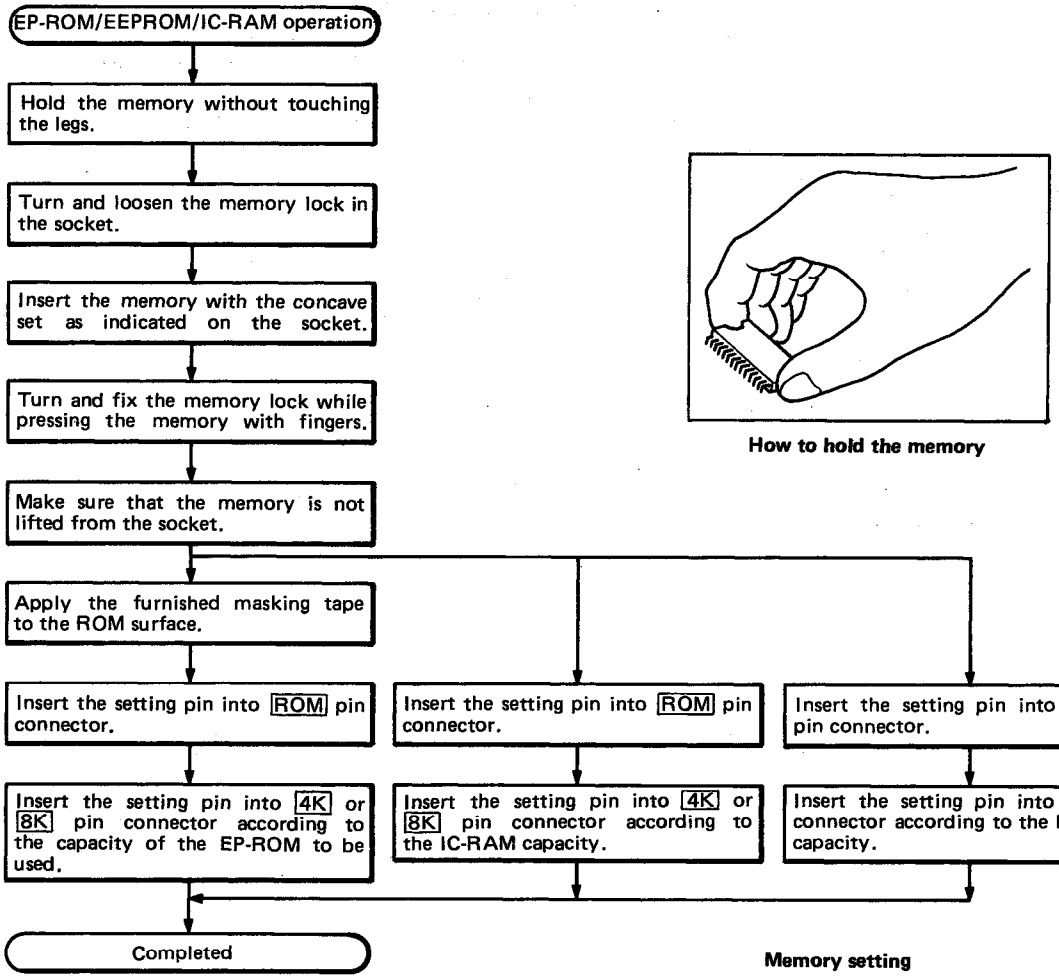
Ground terminal for power filter.

3.2.2 Setting

This section describes the setting of IC-RAM, EP-ROM, and EEP-ROM, the setting of the memory protect switch, and the installation of the battery.

(1) Memory loading and setting

The following flow chart shows how to install the memory into the memory socket and the placement of the setting pin according to the memory type.



How to hold the memory

Memory setting

Memory Type	Pin Connector Setting	
	Memory Capacity Setting	Memory setting (Memory type)
4KROM	4K 8K	ROM RAM EROM
8KROM	4K 8K	ROM RAM EROM
4KRAM	4K 8K	ROM RAM EROM
16KRAM	4K 8K	ROM RAM EROM
4KEROM	4K 8K	ROM RAM EROM

indicates the setting pin inserting position.

POINT

When using 16KRAM, connect a peripheral unit to the CPU and then perform the following memory clear operation.

A6GPP Key operation

PC → TST → [Move cursor to "PC MEMORY ALL CLEAR" position] → GO → Y → GO

..... Set the A0J2 key switch to RESET.

A7PU Key operation

WR → SSN → 0 → STP ± → NOP → K → 3 → 0 → 7 → 1 → STP ±

..... Set the A0J2 key switch to RESET.

After completion of operation with one of the above peripheral units, perform normal write operation.

(2) Setting the memory protect switch

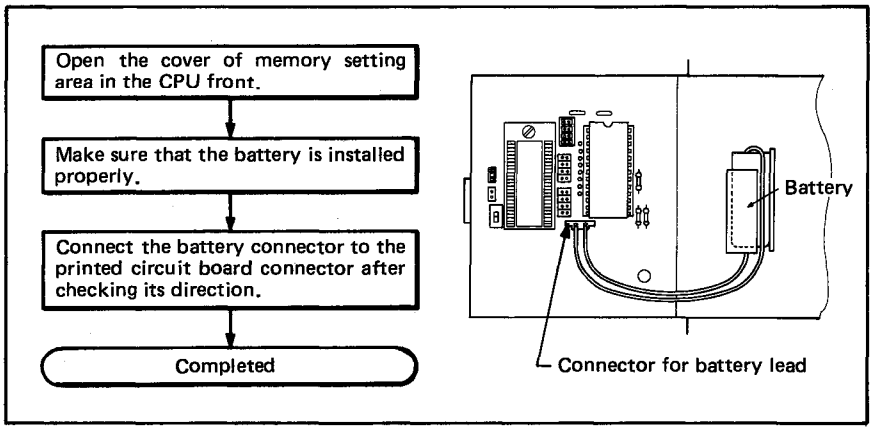
When IC-RAM or EEPROM memory is used, the memory protect switch should be set to the ON position after writing programs in order to avoid the memory contents from being rewritten due to misoperation of the peripheral device (A6GPP or A7PU). Set this switch to OFF before correcting the memory contents.

	Memory Protect Switch Setting	
	To set to ON	To set to OFF
Memory Protect setting switch	ON ⇕ OFF 	ON ⇕ OFF 

Memory Protect Switch Setting

(3) Installing the battery

Since the battery connector is factory-disconnected, connect the connector according to the following procedure when using the RAM memory or power failure compensation function.



REMARKS

Since the battery connector is removed before shipment to prevent discharge during transportation and/or storage, connect the connector when using the battery.

3.2.3 Latch range setting and latch clear

(1) The latch function retains the data of the specified devices (devices in the latch range) if:

(a) The power is switched off.

(b) The PC is reset.

(2) Devices L, B, T, C and D can be latched. Any of the following latch and non-latch ranges may be defined by the peripheral device:

	Non-Latch Range	Latch Range
No latch	M0 to M2047 T0 to T127 C0 to C127 D0 to D511 B0 to B3FF	———
Second-half latch (1/2 latch)	M0 to M1023 T0 to T39/T80 to T99/T120 to T123 C0 to C63 D0 to D255 B0 to B1FF	L1024 to L2047 T40 to T79/T100 to T119/T124 to T127 C64 to C127 D256 to D511 B200 to B3FF
Full latch	———	L0 to L2047 T0 to T127 C0 to C127 D0 to D511 B0 to B3FF

(3) The A0J2 defaults to "1/2 latch."
When the A0J2 is used for the first time, latch clear must be performed or the latch range parameter changed to "no latch." (Without this initialization, normal sequence processing may not be ensured because RAM data of the latched devices is indefinite.)

(a) When the latch function is not used, change the latch range parameter to "no latch" and reset.

(b) When the latch function is used, perform latch clear.

(4) Latch clear procedure

(a) Latch clear initializes the latch and non-latch range data and causes the devices to be as follows:

1) Y, M/L, F, B . . . . .Switched off.
2) Special M (9000 to 9255)
. . . . . .Retained.
3) T, C. . . . . .Contact and coil are switched off.
Present value is set to 0.
4) D, Z, V . . . . . .Contents are reset to 0.
5) Special D (9000 to 9127)
. . . . . .Retained.

(b) Perform latch clear with the RUN key switch in the following procedure:

1) Move the RUN key switch from "STOP" to "L.CLR" three times. The "RUN LED" flickers to indicate that latch clear is ready.

2) Move the RUN key switch from "STOP" to "L.CLR" once again. This completes latch clear.

POINT

If the RUN key switch is set to "RUN" or "RESET" during the latch clear operation, latch clear is canceled and:

The A0J2 is run and continues operation if the switch is set to RUN.
The A0J2 is reset if the switch is set to RESET.

4. CONCEPT AND CAUTIONS FOR A0J2CPU SYSTEM CONFIGURATION

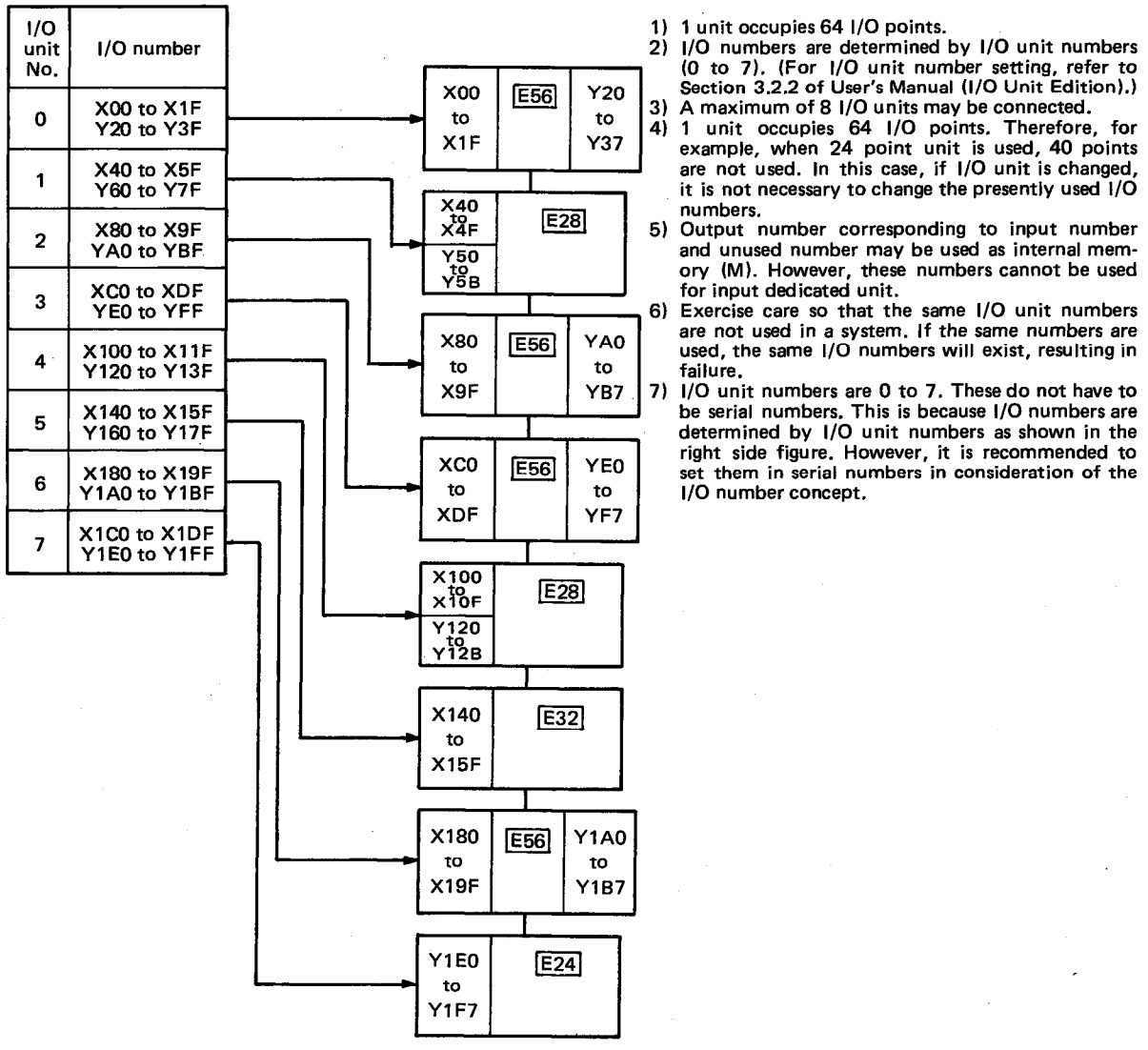
The A0J2CPU system is constructed by connecting I/O units, extension power supply units, or extension base units. This chapter describes the system configuration concept and cautions.

4.1 Assignment and Concept of I/O Numbers

I/O number assignment is one of the system configuration requirements. Wrong assignment results in failure. This section explains the I/O number assignment and concept of A0J2CPU system.

(1) X and Y represent input and output, respectively. I/O numbers are addressed in hexadecimal. (0 to F)
(2) I/O numbers are determined by the I/O unit numbers in each I/O unit. One unit occupies 64 points.
(3) When extension base unit (A65B, A55B) is used, be sure to start I/O numbers with X/Y100. One I/O unit loaded in extension base unit occupies 64 points.

I/O number assignment in A0J2CPU system



1) 1 unit occupies 64 I/O points.
2) I/O numbers are determined by I/O unit numbers (0 to 7). (For I/O unit number setting, refer to Section 3.2.2 of User's Manual (I/O Unit Edition).)
3) A maximum of 8 I/O units may be connected.
4) 1 unit occupies 64 I/O points. Therefore, for example, when 24 point unit is used, 40 points are not used. In this case, if I/O unit is changed, it is not necessary to change the presently used I/O numbers.
5) Output number corresponding to input number and unused number may be used as internal memory (M). However, these numbers cannot be used for input dedicated unit.
6) Exercise care so that the same I/O unit numbers are not used in a system. If the same numbers are used, the same I/O numbers will exist, resulting in failure.
7) I/O unit numbers are 0 to 7. These do not have to be serial numbers. This is because I/O numbers are determined by I/O unit numbers as shown in the right side figure. However, it is recommended to set them in serial numbers in consideration of the I/O number concept.

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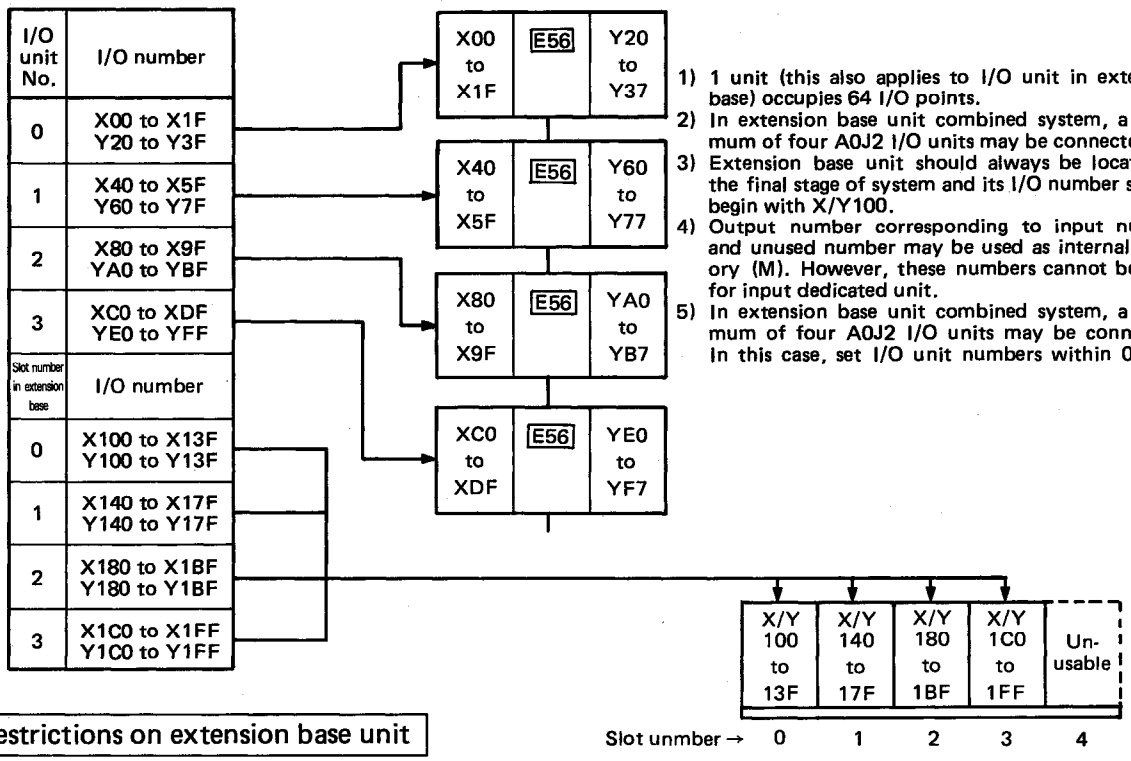
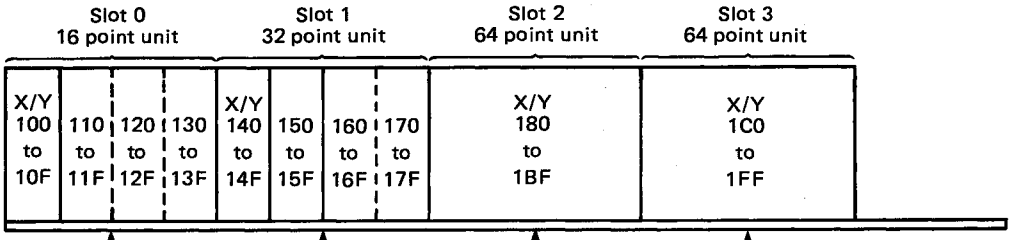
I/O number assignment in extension base unit combined system



1) 1 unit (this also applies to I/O unit in extension base) occupies 64 I/O points.
2) In extension base unit combined system, a maximum of four A0J2 I/O units may be connected.
3) Extension base unit should always be located at the final stage of system and its I/O number should begin with X/Y100.
4) Output number corresponding to input number and unused number may be used as internal memory (M). However, these numbers cannot be used for input dedicated unit.
5) In extension base unit combined system, a maximum of four A0J2 I/O units may be connected. In this case, set I/O unit numbers within 0 to 3.

Restrictions on extension base unit

1) In extension base unit, only slots 0 to 3 are usable.
2) Irrespective of used I/O units, 1 slot occupies 64 points. (Vacant slot also occupies 64 points.)
   Output number corresponding to input unit cannot be used as internal memory (M).
3) When 64 point I/O unit is not used (e.g. 16 or 32 point unit), observe of the following points:



When 64 point unit is used, there is no restriction.

When 32 point unit is used, the latter half 32 points are not used. Actually, however, the first half 32 points and the latter half 32 points overlap with each other and CPU makes access. Therefore, if the latter half I/O numbers are accidentally used in a program, the overlapping first half I/O number area is actually accessed.
For example, 160 overlaps with 140 and 170 with 150.

When 16 point unit is used, the latter 48 points are not used. Actually, however, four 16 point units overlap with each other. For example, if any of 110, 120, and 130 is accessed, 100 is accessed actually. Be sure to use actual I/O numbers in a program. In the example shown on the left, Y100 to 10F are actual I/O numbers.

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4.2 Precautions for Use of Type A0J2PW Extension Power Supply Unit

(1) Determine the use of extension power supply unit by the total internal current consumption of the A0J2CPU unit, I/O units, special function units, and peripheral devices. When using the extension base unit A55B, consider the total current consumption of units in the base unit because 5V DC power is supplied by the A0J2CPU unit's built-in power supply or extension power supply unit.

Unit Type	Rated Output Current (A)	
	5V DC	24V DC
A0J2CPU unit's built-in power supply	2	0.5
A0J2-PW extension power supply unit	2.3	1.5
A0J2-DC24CPU unit's built-in power supply	2	–
A0J2PW-DC24 extension power supply unit	2.5	–

Table 4.1 Current Capacity of Power Supply Unit

Unit Type		Internal Current Consumption (A)		
		5V DC	24V DC	
			Input (7mA/point)	Output
CPU	A0J2CPU	0.3	–	–
	A0J2CPU-DC24	0.3	–	–
Data link unit	A0J2CPUP23	0.52	–	–
	A0J2CPUR23	0.96	–	–
	A0J2P25	0.47	–	–
	A0J2R25	0.89	–	–
Input unit	A0J2-E32A	0.105	–	–
	A0J2-E32D	0.105	0.224	–
	A0J2E-E32D			
Output unit	A0J2-E24R	0.145	–	0.23
	A0J2-E24S	0.4	–	–
	A0J2-E24T	0.145	–	0.069
	A0J2E-E24R			
	A0J2E-E24T			
I/O unit	A0J2-E28AR	0.14	–	0.125
	A0J2-E28AS	0.26	–	–
	A0J2-E28DR	0.13	0.112	0.125
	A0J2-E28DS	0.26	0.112	–
	A0J2-E28DT	0.125	0.112	0.035
	A0J2E-E28DR			
	A0J2E-E28DS			
	A0J2E-E28DT			
	A0J2-E56AR	0.225	–	0.23
	A0J2-E56AS	0.46	–	–
	A0J2-E56DR	0.23	0.224	0.23
	A0J2-E56DS	0.46	0.224	–
	A0J2-E56DT	0.225	0.224	0.069
	A0J2E-E56DR			
	A0J2E-E56DS			
	A0J2E-E56DT			
Peripheral unit	A7PU	0.3	–	–
	A6WU	*0.3(0.8)	–	–

Table 4.2 Current Consumption

*The A6WU is 0.3A in standby state (online) and 0.8A during write (offline).

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The internal current consumption values in Table 4.2 when all points are on.
When the power is supplied from the A0J2CPU's built-in power supply, the total internal current consumption of the entire system should be within the A0J2CPU's built-in power supply capacity range.

CPU's built-in power supply capacity: 5V DC, 2A	>	5V current consumption of CPU	+	5V current consumption of simultaneously "ON" I/O units	+	5V current consumption of peripheral equipment (A7PU)
24V DC, 0.5A	>	Current consumption of 24V DC input simultaneously "ON" points	+	24V DC internal current sonsumption of simultaneously "ON" relay/transistor outputs		

If the total consumption exceeds the CPU's built-in power supply capacity range, use the extension power supply unit (A0J2PW). For the I/O units which is supplied with 5V DC power by the extension unit, set the I/O unit's internal power supply select switch to "EX5V". (For details, refer to the I/O Unit Edition.)

POINT

The allowable current capacity of the 5V DC power supply which can be supplied from the extension power supply unit to the I/O units and extension base unit is 2.3A. If it exceeds 2.3A, use the extension base unit A65B.

(2) Since the 5V DC power is supplied to the I/O units and extension base unit through the I/O cables and extension cables, respectively, the voltage may drop at the cables. Therefore, specified voltage (4.75V DC or more) may not be supplied at the receiving end, causing input/output errors. Calculate the voltage requirement as described below and determine whether or not the A0J2PW is to be used.

1) 5V DC power requirement

(a) 5V DC output voltage range of the power supply unit is 4.9 to 5.2V DC.

(b) The specified voltage at the I/O unit or the extension base unit is 4.75V DC or more.

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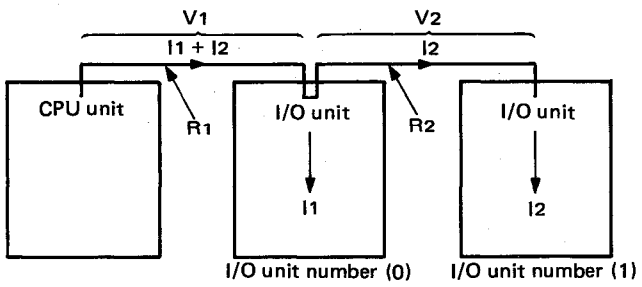
2) Cable resistances

A0J2C01 .....0.047Ω
A0J2C03 .....0.0617Ω
A0J2C06 .....0.0882Ω
A0J2C04B 0.0626Ω
A0J2C10B 0.126Ω

Due to the above requirements 1) and 2), it is necessary to satisfy the specified voltage (4.75V DC or more) of the system at the receiving end when the 5V DC output of the power supply unit is a minimum of 4.9V DC. Voltage calculation at the receiving end is as described below:



V1: Voltage drop at the cable between CPU unit and I/O unit (0)
V2: Voltage drop at the cable between I/O unit (0) and I/O unit (1)
R1: Resistance of the cable between CPU unit and I/O unit (0)
R2: Resistance of the cable between I/O unit (0) and I/O unit (1)
I1: Current consumption of the 5V DC power in I/O unit (0)
I2: Current consumption of the 5V DC power in I/O unit (1)

The voltage drops V1 and V2 are,

$V1=R1(I1+I2)$

$V2=R2I1$

The voltage at the receiving end of I/O unit (1) is,

Receiving end voltage = $4.9-(V1+V2)>4.75$

To satisfy the requirement that the receiving end voltage shall be 4.75V DC or more,

$4.9-4.75 \geqq V1+V2$

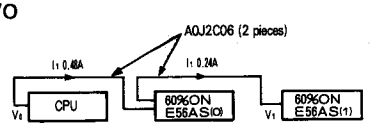
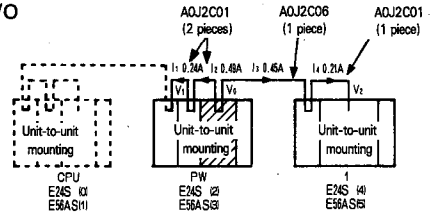
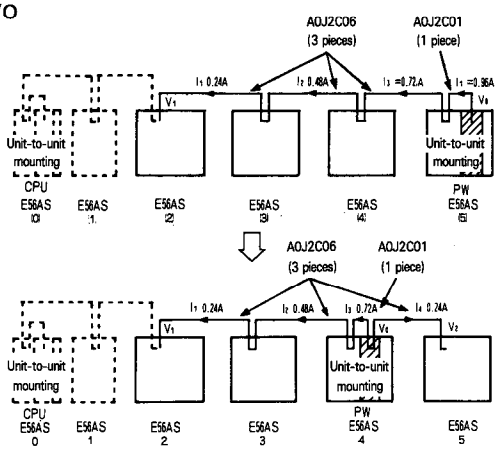
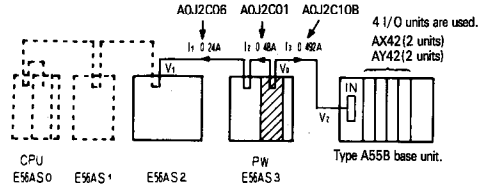
$0.15 \geqq R1(I1+I2)+R2I2$

If this condition is met, extension is allowed up to the I/O unit (1).

Therefore, the number of I/O units to be extended or use of the extension base unit (A55B) can be determined when the following condition is met:

0.15(=4.9–4.75)≧ sum of the voltage drops up to the receiving end

(3) 5V DC power voltage drop calculation example using A0J2 cables

	System Configuration	Voltage Drop	Judgement	Power Select Switch
Example 1	Using CPU's Built-in Power Supply Only 112 I/O 	V_1=A0J2C06Resistance×(I_1+I_2) =0.0882×(0.24+0.48) =0.064(V)	0.15V or less ○	CPU5V position
Example 2	Using Extension Power Supply 240 I/O 	V_1=A0J2C01Resistance×(I_1+I_2) =0.47×(0.24+0.45) =0.033(V) V_2=A0J2C06Resistance×I_3 +A0J2C01Resistance×I_4 =0.0882×0.45+0.047×0.21 =0.05(V)	○	CPU5V position: I/O unit 0, 1 EX5V position: I/O units 2, 3, 4, 5
Example 3	Mounting Extension Power Supply Unit on I/O Unit at Final End 336 I/O 	V_1=A0J2C01Resistance×I_4 +A0J2C06Resistance×(I_1+I_2+I_3) =0.047×0.96 +0.0882×(0.24+0.48+0.72) =0.172(V) When the extension power supply unit is used at the final end, voltage drop at the final end unit supplied with power is large and the requirement of 0.15V or less is not satisfied. Therefore, take the following remedy.	0.15V or more X	CPU5V position: I/O units 0, 1 EX5V position: I/O units 2, 3, 4, 5
		V_1=A0J2C01Resistance×I_3 +A0J2C06Resistance×(I_1+I_2) =0.047×0.72+0.0882×(0.24+0.48) =0.0974(V) V_2=A0J2C06Resistance×I_4 =0.0882×0.24 =0.021(V)	○	
Example 4	Using Extension Base Unit 448 I/O 	V_1=A0J2C06Resistance×I_1 +A0J2C01Resistance×I_2 =0.0882×0.24+0.047×0.48 =0.0437(V) V_2=A0J2C10BResistance×I_3 =0.0126×0.492 =0.062(V)	○	CPU5V position: I/O units 0, 1 EX5V position: I/O units 2, 3

1) I/O unit numbers are indicated in parentheses. I/O unit current consumption has been calculated, assuming that the simultaneous ON ratio is a maximum of 60%.

2) In Examples 2, 3, and 4, the units supplied with 5V DC power from the extension power supply unit are indicated by the full line. The units supplied with the power by the CPU's built-in power supply are shown by the dotted line.

3) Indicated above are voltage drops occurring between the power supply unit and the I/O unit at the final end.

POINT

(1) As shown in Example 3 and 4, the voltage drop of the I/O unit at the final end varies depending on the location of the extension power supply unit and the connection of the cable. Therefore, select the I/O or extension cable or select I/O unit so that the voltage drop may be 0.15V in the system.

(2) Avoid using the extension power supply unit at the final end because the voltage drop value is larger.

5. LOADING AND INSTALLATION

5.1 Unit Mounting

This section explains unit mounting instructions.

5.1.1 Mounting instructions

Explanation is given to the instructions for mounting the PC to a panel, etc.

(1) To improve ventilation or facilitate the replacement of unit, provide 50mm (1.97 inch) or more the clearance around the PC.

(2) Do not mount the base unit vertically or horizontally to allow ventilation.

(3) Ensure that the base unit mounting surface is uniform to prevent strain. It excessive force is applied to the printed circuit boards, this will result in incorrect operation. Therefore, mount the base unit on a flat surface.

(4) Avoid mounting the base unit close to vibration sources, such as large-sized magnetic contactors and no-fuse breakers, install the base unit in another panel or separate the base unit from the vibration source.

(5) Provide a wiring duct as necessary.
However, if the dimensions from the top and bottom of the PC are less than those shown in Fig. 5.1, note the following points:

(a) When the duct is located above the PC, the height of the duct should be 50mm (1.97 inch) or less to allow for sufficient ventilation.
Between the duct and the top of the PC, provide a distance so that the cable may be removed by opening the cable connector fixing lever.
If the lever at the unit top cannot be opened, unit replacement cannot be made.

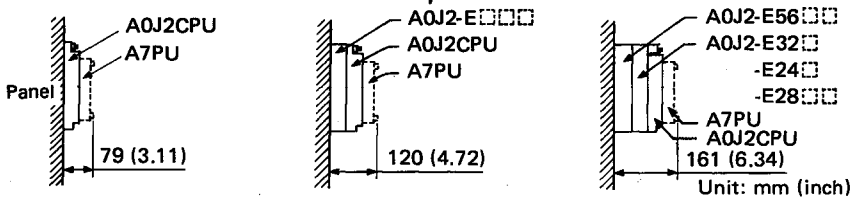
5.1.2 Installation

This section describes the installation of the unit.

(1) For the mounting hole positions of each unit, refer to Appendix 1, Dimensional Outline Drawing.

(2) Fig 5.1 shows dimensions when the A7PU is mounted on the CPU unit. For the dimensions of side-to-side and top-to-bottom arrangements, refer to the Fig. 5.2 and 5.3, respectively.

(3) Fig.5.4 shows dimensions when the extension base unit is installed. If Type A0J2C10B extension cable is used, the unit can also be mounted on the door of the panel.



(1) Mounting A7PU to CPU (2) Mounting A7PU to I/O unit and CPU combination (3) Mounting A7PU to 2 I/O units and CPU combination

Fig. 5.1 Dimensions in Unit-to-Unit Mounting

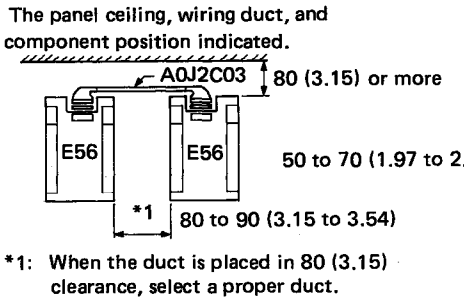


Fig. 5.2 Side-to-Sede Installation

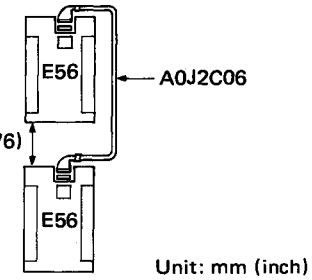
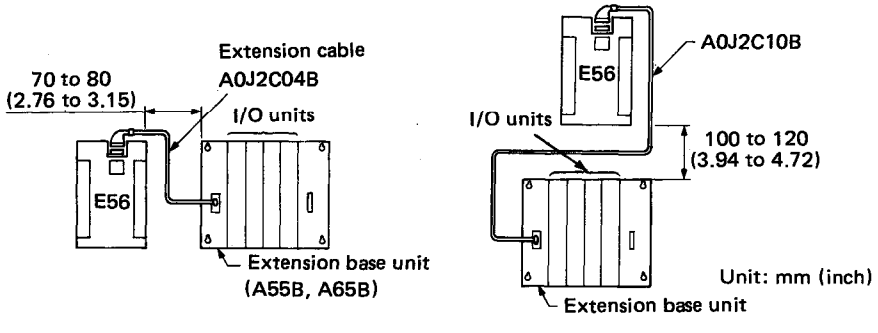


Fig.5.3 Top-to-Bottom Installation



(1) Side-to-side installation (2) Top-to-bottom installation

Fig.5.4 Installation of Extension Base Unit

Fig.5.5 Horizontal Installation (not allowed)

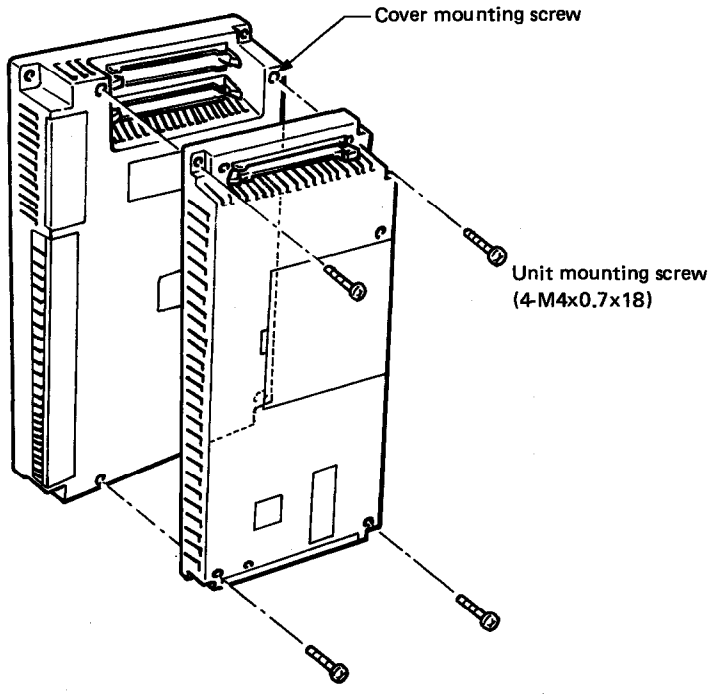
POINT

The distance from the CPU unit front to the external equipment should be 100mm or more.

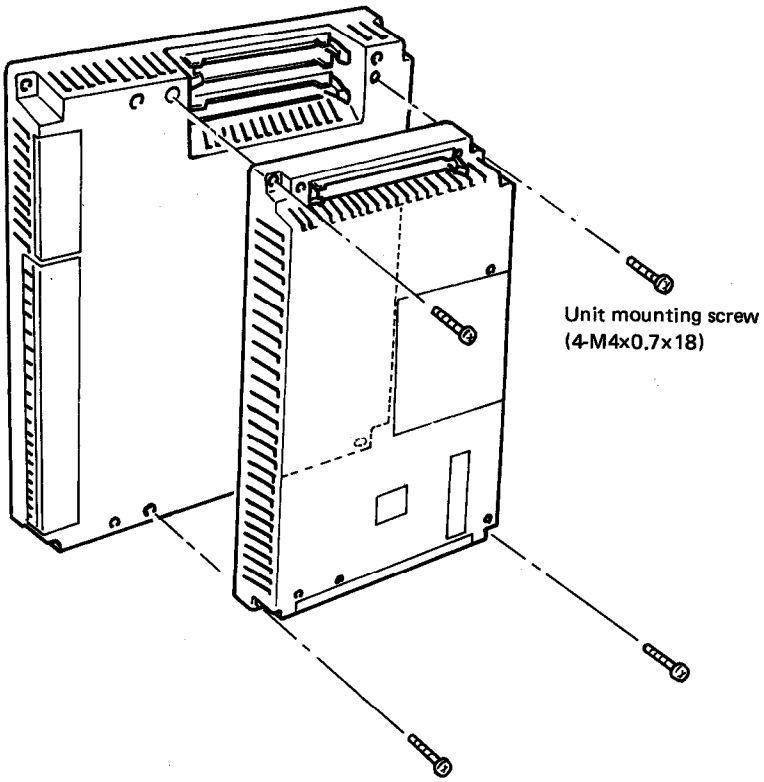
5.1.3 Unit-to-unit mounting method

Install the units as described below.

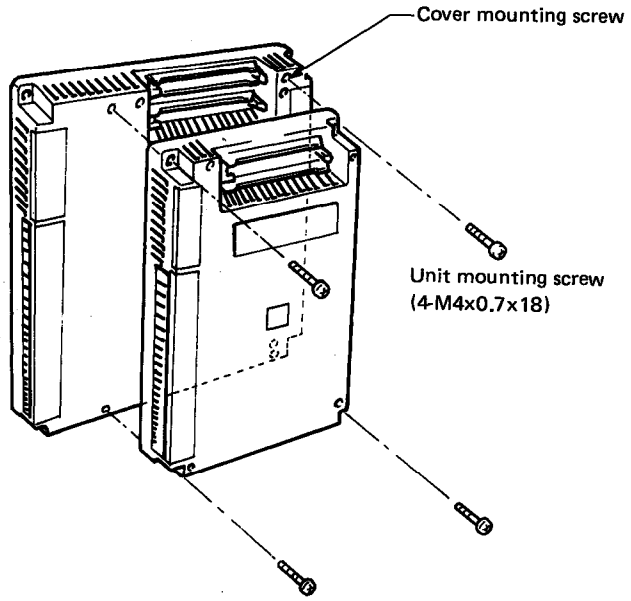
(1) Mounting the CPU unit (or extension power supply unit) to Type E28 □□ I/O unit (or E32 □, E24 □)



(2) Mounting the CPU unit (or extension power supply unit) to Type E56□□ I/O unit

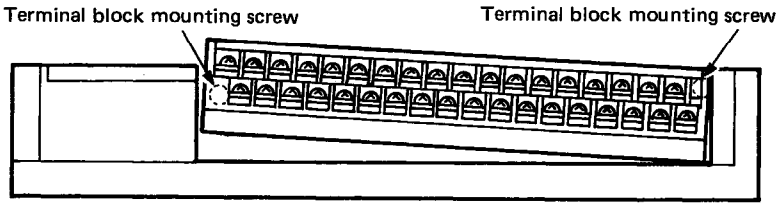


(3) Mounting Type E28[][] I/O unit (or, E32[], E24[]) to the E56[][] I/O unit



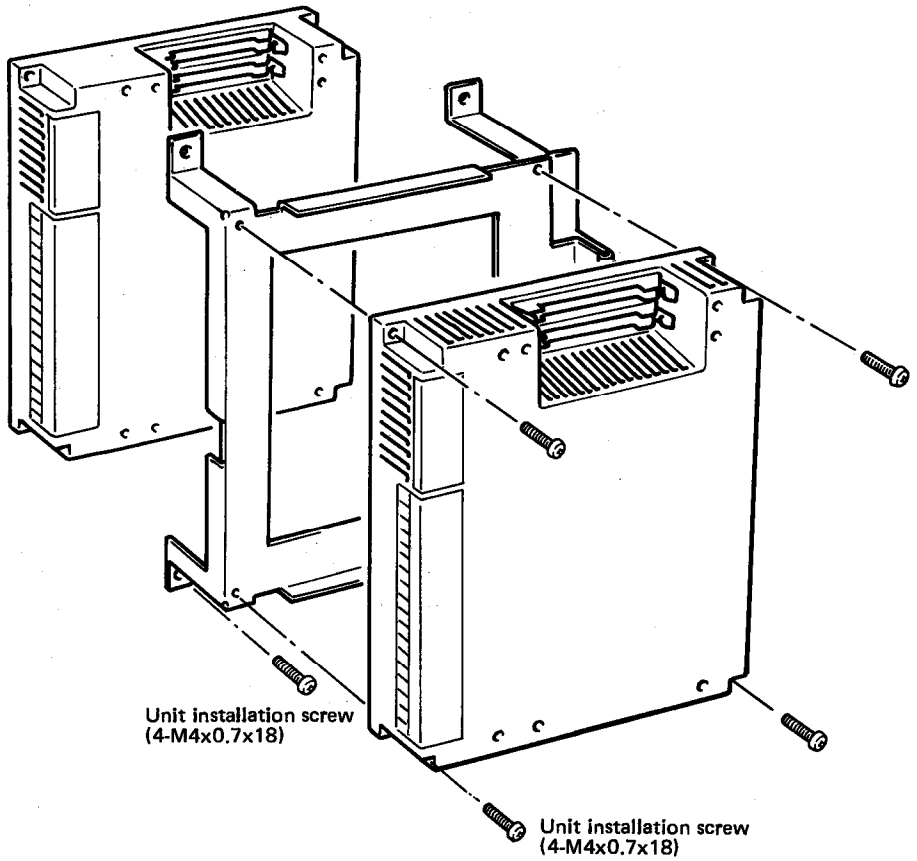
POINT

(1) The terminal block of the I/O unit is fixed by 2 mounting screws. To remove the terminal block, loosen the mounting screws.

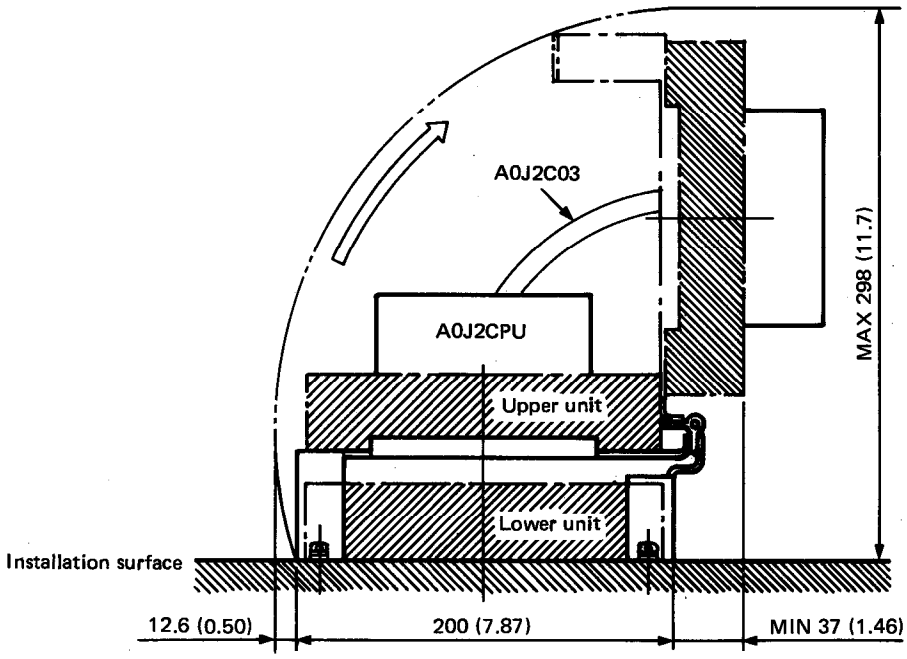


(4) Connecting units using the A0J2-2F bracket

(a) Installation method



(b) Installed unit dimensions



Unit: mm (inch)

5.1.4 Unit-to-unit mounting

This section describes unit-to-unit mounting.

Up to three units can be mounted on the panel. When two or three units are mounted, unit combinations are as follows:

Number of Units: 2 units

Upper (1) unit
Lower (2) unit

Lower (2) unit	Upper (1) unit: CPU	PW	E32□	E28□□	E28□□
E32□	○	○			
E24□	○	○			
E28□□	○	○			
E56□□	○	○	○	○	○

○ indicates that the upper (1) and lower (2) units may be combined.

Number of Units: 3 units

Upper (1) unit
Intermediate (2) unit
E56□□ fixed: Lower (3) unit

Intermediate (2) unit	Upper (1) unit: CPU	PW
E32□	○	○
E24□	○	○
E28□□	○	○

○ indicates that the upper (1), intermediate (2), and lower units may be combined.

5.2 Wiring

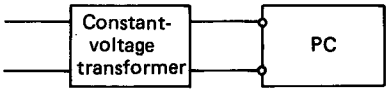
Wiring instructions for the A0J2CPU system.

5.2.1 Wiring instructions

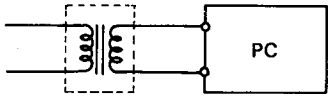
Instructions for wiring the power cable or I/O cables.

(1) Wiring of power source

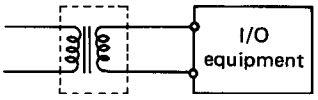
(a) If voltage variations are greater than the specified, connect a constant-voltage transformer. In this case, use a transformer of within 5% output distortion factor.



(b) Use a power supply which generates minimal noise across wire and across PC and ground. When excessive noise is generated, connect an insulating transformer.



Insulating transformer

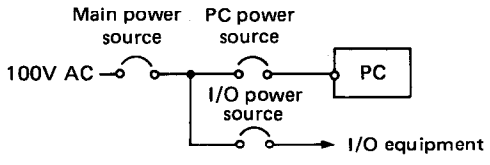


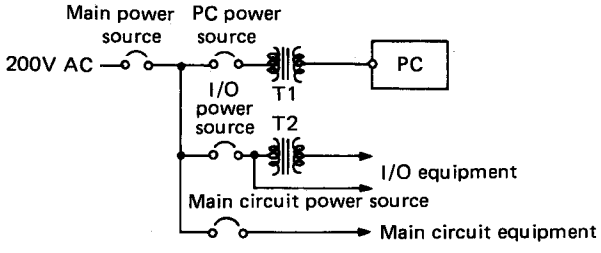
Insulating transformer

(c) When a power transformer or insulating transformer is employed to reduce the voltage from 200V AC to 100V AC, use one with a capacity greater than that indicated in the following table.

Power Supply Unit	Transformer Capacity
A0J2CPU	56VA
A0J2PW	120VA

(d) When wirng, separate the PC power source from those for I/O equipment and power equipment as shown below.



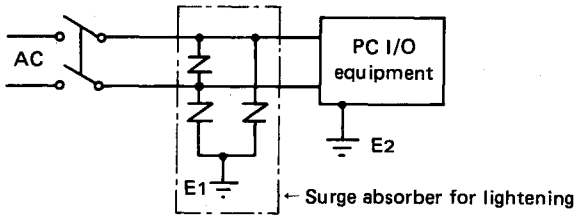


(e) Twist the 100V AC, 200V AC, and 24V DC cables as closely as possible. Connect units with the shortest possible wire lengths.

(f) To minimize voltage drop, use the thickest (max. 2mm^2 (0.0031"sq.)) wires possible for the 100V AC, 200V AC, and 24V DC cables.

(g) Do not bundle the 100V AC and 24V DC cables with main-circuit wires or the I/O signal wires (high-voltage, large-current). Also, do not wire the above indicated cables close to the aforementioned wires. If possible, provide more than 100mm distance between the cables and wires.

(h) As a measure against verylarge surges (e.g. due to lightening), connect a varistor as shown below.



POINT

1. **Ground the surge absorber (E_1) an the PC (E_2) separately from each other.**
2. **Select a surge absorber making allowances for power voltage rises.**

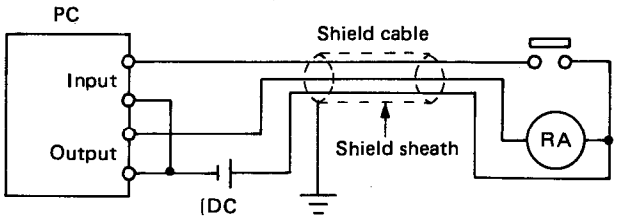
(2) Wiring of I/O equipment

(a) Applicable size of wire to the terminal block connector is 0.75 to 2mm^2 (0.0012 to 0.0032"sq.). However, it is recommended to use wires of 0.75mm^2 (0.0012"sq.) for convenience.

(b) Separate the input and output lines.

(c) I/O signal wires must be at least 100mm (3.93 inch) away from high-voltage and large-current main circuit wires.

(d) When the I/O signal wires cannot be separated from the main circuit wires and power wires, ground on the PC side with batch-shielded cables. Under some conditions it may be preferable to ground on the other side.



(e) If wiring has been done with of piping, ground the piping.

(f) Separate the 24V DC I/O cables from the 100V AC and 200V AC cables.

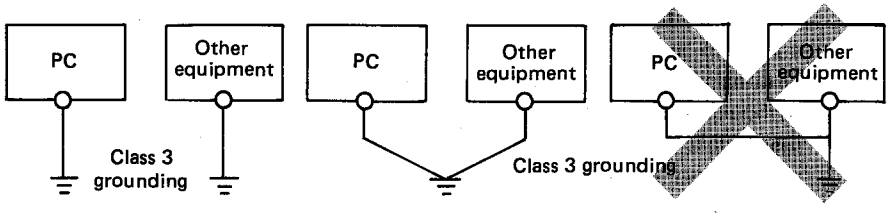
(g) If wiring over 200mm (7.87 inch) or longer distance, trouble can be caused by leakage currents due to line capacity.

(3) Grounding

(a) The A series PC has good noise resistance (see Section 3.1). Therefore, the PC may be used without grounding except when there is excessive noise.
However, follow (b) to (e) described below.

(b) Ground the PC as independently as possible. Class 3 grounding should be used (grounding resistance 100Ω or less).

(c) When independent grounding is impossible, use the joint grounding method as shown in the figure below (2).



(1) Independent grounding .... Best
(2) Joint grounding ... Good
(3) Joint grounding .. Not allowed

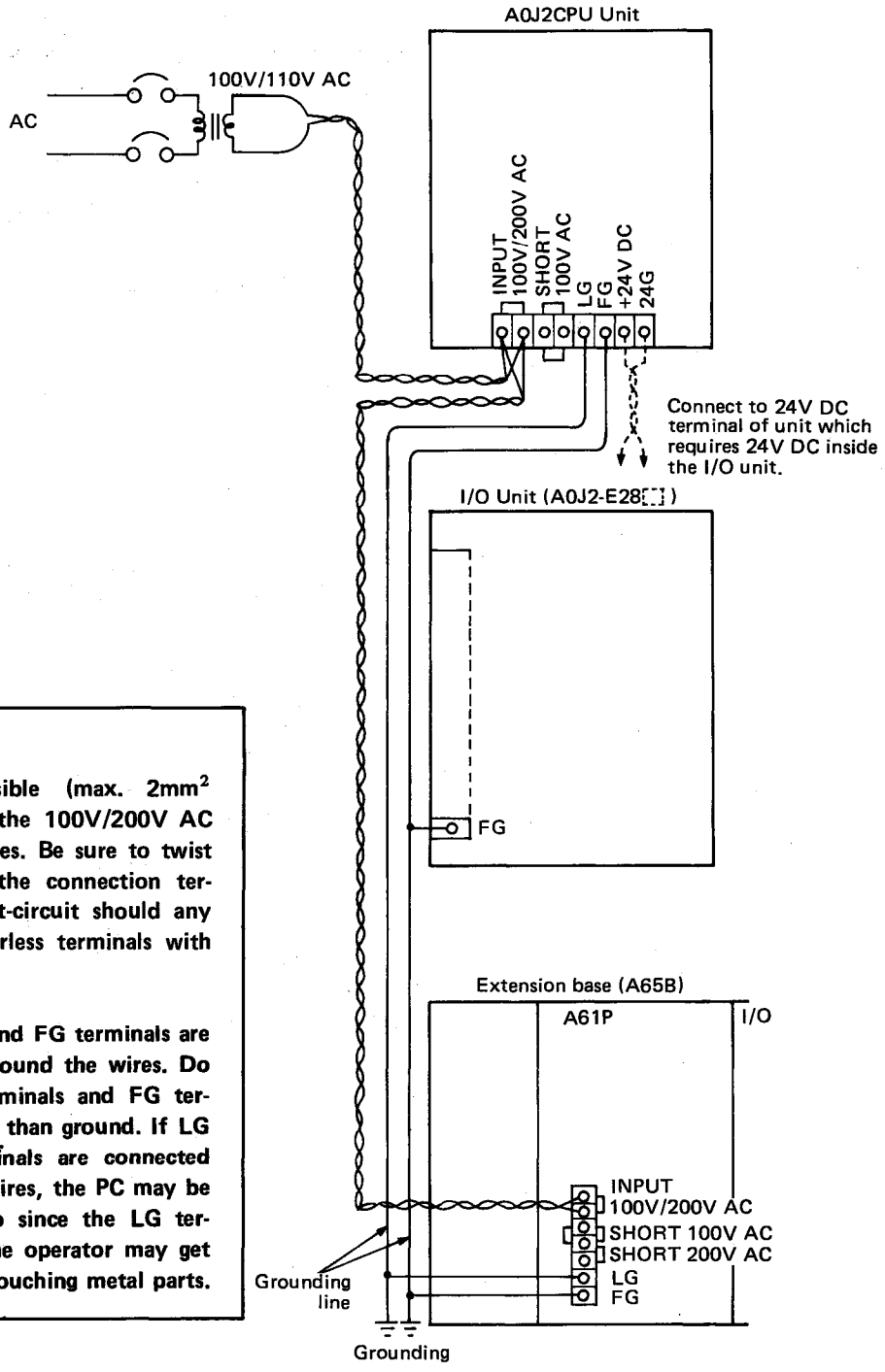
(d) Use 2mm^2 (0.0031"sq.) (AWG #14) or thicker grounding wire. Grounding point should be as near as possible to the PC to minimize the distance of grounding cable.

(e) Should incorrect operation occur due to grounding, disconnect one or both of the LG and FG terminals of base units from the grounding.

5.2.2 Wiring to unit terminals

This section explains the wiring of power lines and grounding lines to the main and extension bases.

(1) A0J2

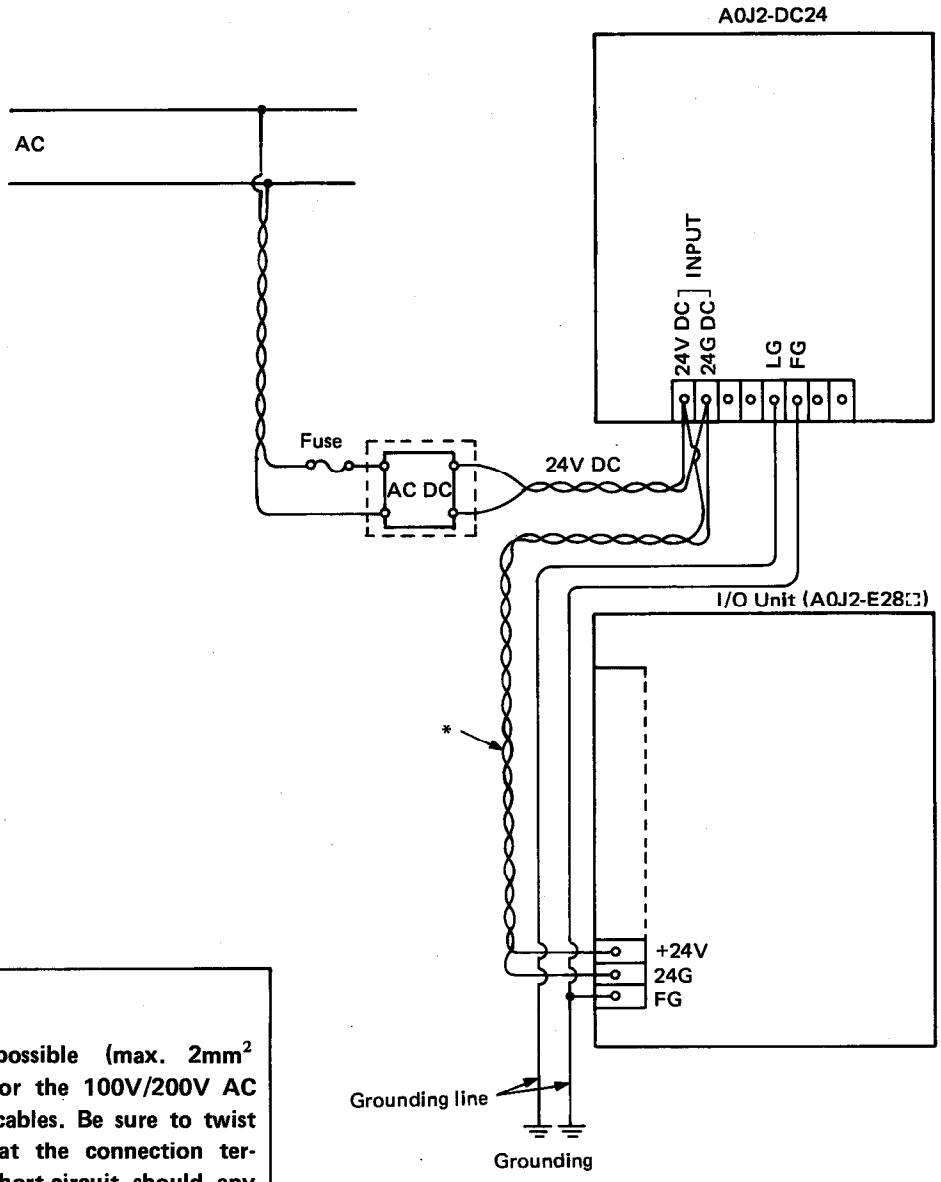


POINT

1. **Use the thickest possible (max. 2mm^2 (0.0031"sq.)) wires for the 100V/200V AC and 24V DC power cables. Be sure to twist these wires starting at the connection terminals. To prevent short-circuit should any screws loosen, use solderless terminals with insulation sleeves.**

2. **When the LG terminals and FG terminals are connected, be sure to ground the wires. Do not connect the LG terminals and FG terminals to anything other than ground. If LG terminals and FG terminals are connected without grounding the wires, the PC may be susceptible to noise, also since the LG terminals have potential, the operator may get an electric shock when touching metal parts.**

(2) A0J2-DC24



POINT

1. Use the thickest possible (max. 2mm^2 (0.0031"sq.)) wires for the 100V/200V AC and 24V DC power cables. Be sure to twist these wires starting at the connection terminals. To prevent short-circuit should any screws loosen, use solderless terminals with insulation sleeves.

2. When the LG terminals and FG terminals are connected, be sure to ground the wires. Do not connect the LG terminals and FG terminals to anything other than ground. If LG terminals and FG terminals are connected without grounding the wires, the PC may be susceptible to noise, also since the LG terminals have potential, the operator may get an electric shock when touching metal parts.

3. * . . .The power supply used to supply 24V DC to both the A0J2-DC24 and I/O unit must satisfy the operating voltage ranges of the A0J2-DC24 and I/O unit.

6. TEST OPERATION AND ADJUSTMENTS

This chapter explains the procedures to be performed before, during, and after the test operation.

6.1 Check Points Before Start of Test Opetation

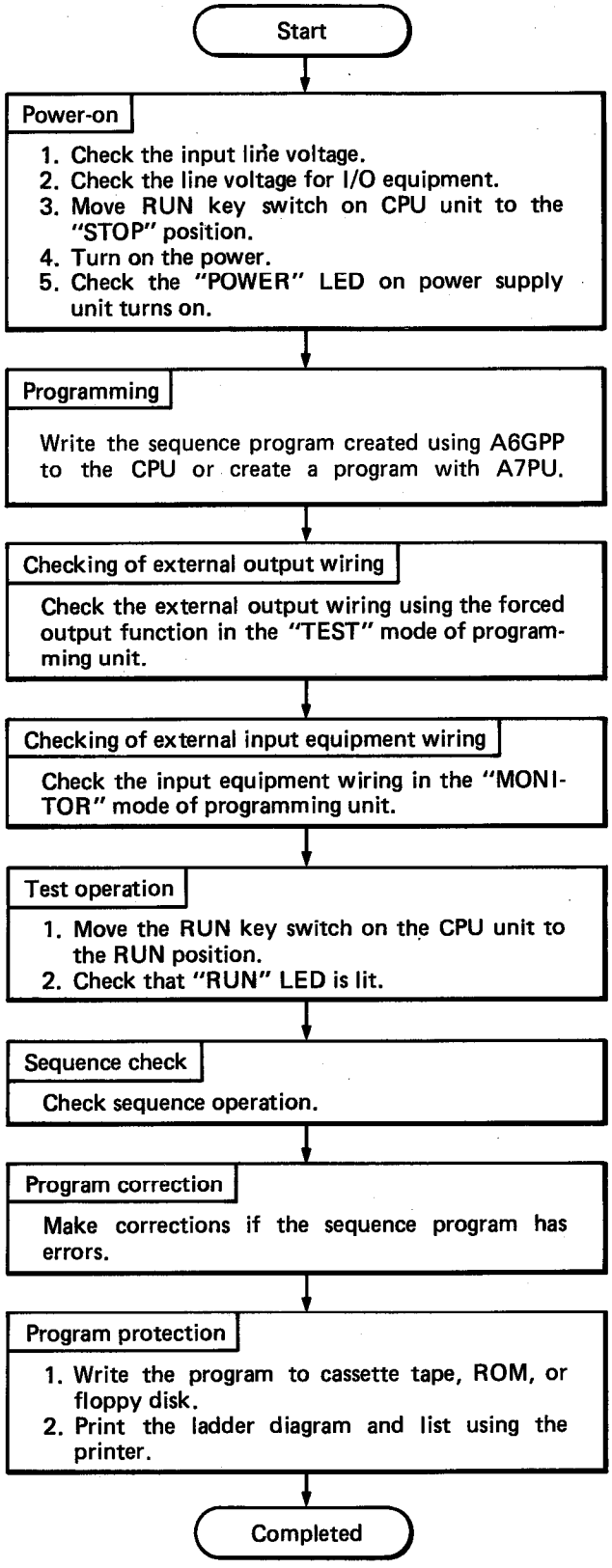
This section explains the points to be checked prior to the test operation of A0J2CPU programmable controller.

Item	Check Point	Description
1	Loading of battery (Inside the memory cassette)	(1) Check whether the connector for battery lead wires, which has been disconnected before shipment, is securely inserted in the pin connector on the printed circuit board. (2) Check that the voltage of battery has not dropped. (Nominal value: 3.6V)
2	Connection of I/O or extension cables	(1) Check that the A0J2CPU unit, I/O unit, and extension base connectors are properly connected with the cable connectors. Are they locked securely? (2) Check that the cable connector positions are proper.
3	I/O unit or extension base stage setting	(1) Make sure that the setting has been performed. (2) Check if the same number has been set.
4	Connection of power and I/O cables	(1) Check the cables connected to each terminal of the terminal block. (2) Check the terminal screws of terminal block for the power supply unit and terminal block for I/O unit. (3) Check the cable size.

Table 6.1 Check Points

6.2 Test Operation and Adjusting Procedure

This section shows the flow chart from after the completion of installation to the test operation of A0J2CPU programmable controller.



7. MAINTENANCE AND INSPECTION

This chapter describes items for daily and periodic maintenance and inspection in order to maintain the A0J2CPU programmable controller in the normal and best conditions.

7.1 Daily Inspection

Table 7.1 shows the inspection items which are to be checked daily.

Number	Check Item		Check Point	Judgement	Corrective Action
1	Base unit mounting conditions		Check for loose mounting screws and cover.	The base unit should be securely mounted.	Retighten screws.
2	Mounting conditions of I/O unit, etc.		Check if the unit is disengaged or the hook is securely engaged.	The hook should be securely engaged and the unit should be positively mounted.	Securely engage the hook.
3	Connecting conditions		Check for loose terminal screws.	Screws should not be loose.	Retighten terminal screws.
			Check distances between solderless terminals.	Proper clearance should be provided between solderless terminals.	Correct.
			Check connectors of extension cable.	Connectors should not be loose.	Retighten connector mounting screws.
4	Main unit indicator lamps	"POWER" LED	Check that the LED is on.	On. (Off indicates an error.)	Refer to Trouble shooting Section of the A0J2CPU Programming Manual.
		"RUN" LED	Check that the LED is on during run.	On. (Off or flashing indicates an error.)	
		Input LED	Check that the LED turns on and off.	On when input is on. Off when input is off. (Display, which is not as mentioned above, indicates an error.)	
		Output LED	Check that the LED turns on and off.	On when output is on. Off when output is off. (Display, which is not as mentioned above, indicates an error.)	

Table 7.1 Daily Inspection

7.2 Periodic Inspection

This section explains the inspection items which are to be checked every six months to one year. If the equipment have been moved or modified or wiring has been changed, also make the inspection.

Number	Check Item		Check Method	Judgement	Corrective Action
1	Ambient environment	Ambient temperature	Measure with thermometer and hygrometer. Measure corrosive gas.	0 to 55°C	When PC is used inside a panel, the temperature in the panel is ambient temperature.
		Ambient humidity		10 to 90%RH	
		Ambience		There should be no corrosive gases.	
2	Line voltage check		Measure voltage across 100/200V AC terminal.	85 to 132V AC 170 to 264V AC	Change supply power. Change transformer tap.
3	Mounting conditions	Looseness, play	Move the unit.	The unit should be mounted securely and positively.	Retighten screws. For CPU, I/O, and power supply units check all connections.
		Ingress of dust or foreign material	Visual check.	There should be no dust or foreign material, in the vicinity of the P.C.	Remove and clean.
4	Connecting conditions	Loose terminal screws			Retighten.
		Distances between solderless terminals	Visual check.	Proper clearance should be provided between solderless terminals.	Correct.
		Loose connector	Visual check.	Connectors should not be loose.	Retighten connector mounting screws.
5	Battery		Ensure that M9006 is off in monitor mode of A7PU or A6GPP.	Preventive maintenance	If battery capacity reduction is not indicated, change the battery when specified service life is exceeded.

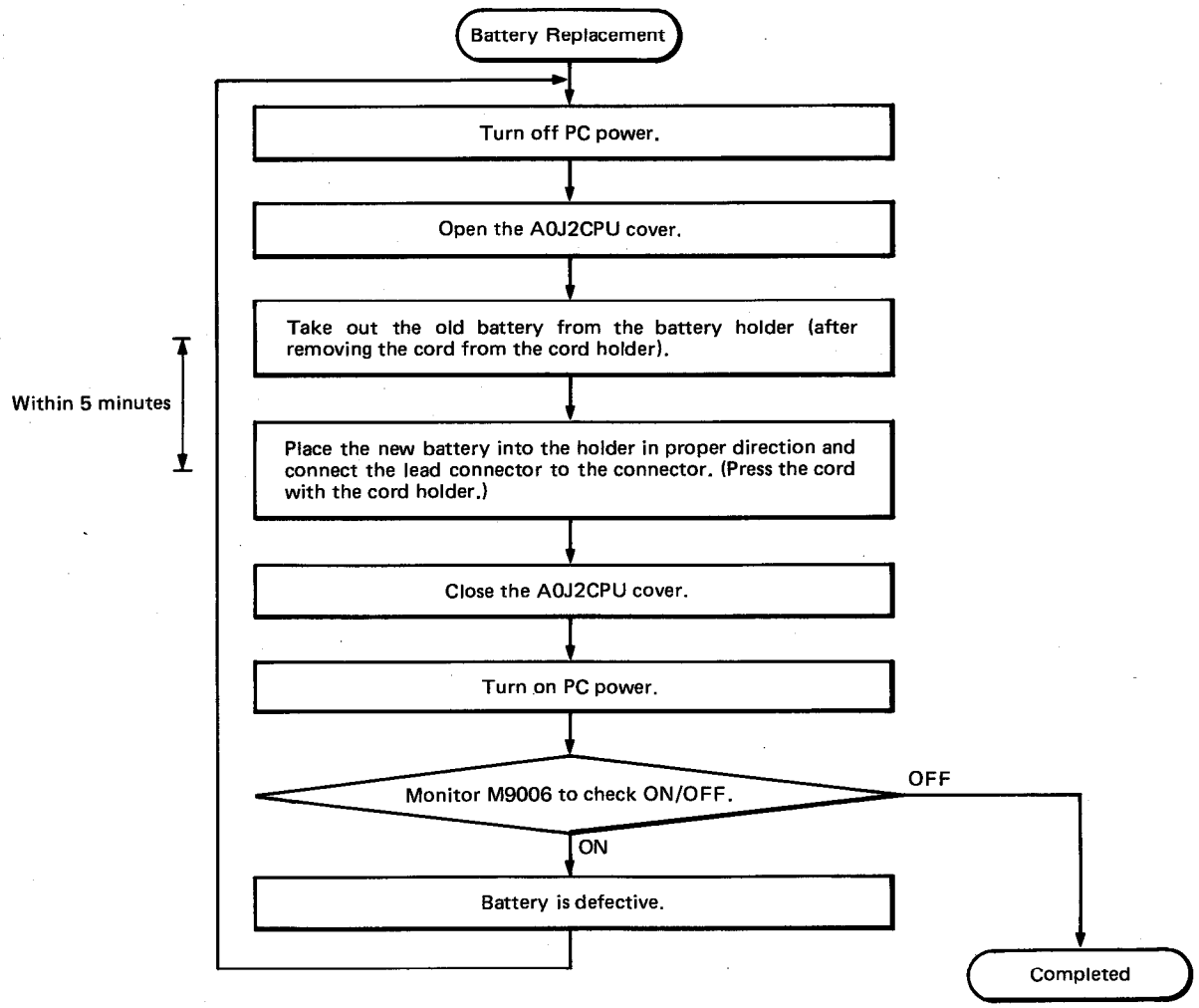
Table 7.2 Periodic Inspection

7.3 Battery Replacement

When the voltage of the backup battery for programs and power failure compensation function drops below the predetermined level, M9006 turns on. The contents of the programs and the latched data are not lost immediately after this special relay turns on (i.e. the contents are kept within 168 hours.). The contents may be lost if you overlook the turning on of the special relay. Therefore, it is recommended to change the battery as soon as possible as the preventive maintenance.

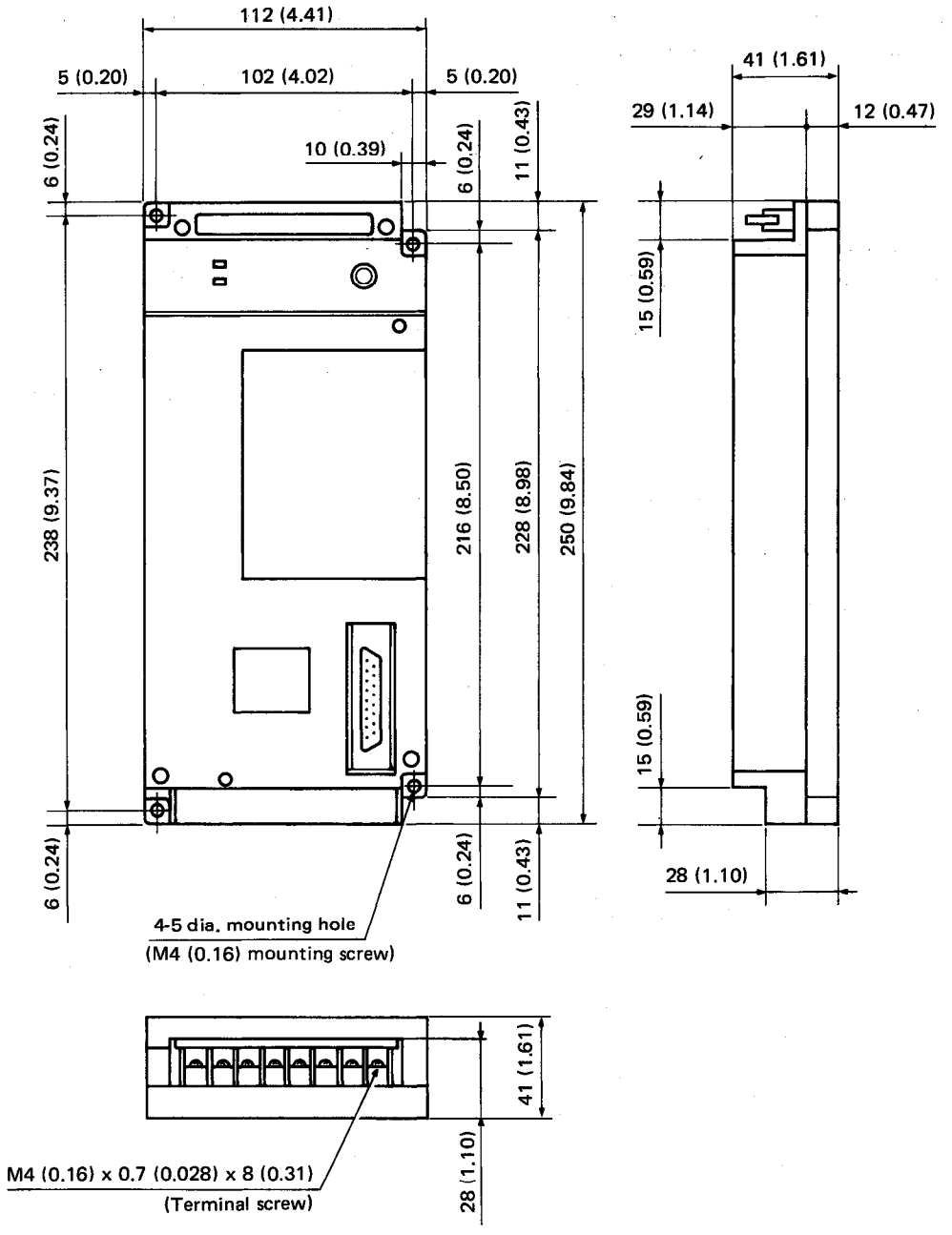
7.4 Battery Replacing Procedure

Replace the battery according to the following procedure when the battery life has expired. The memory is backed up for some time by the capacitor after removing the battery. Change the battery within five minutes. The contents of the memory may be lost if the five minutes period is exceeded. Therefore, replace the battery as soon as possible.



APPENDICES

APPENDIX 1 Dimensional Outline Drawing (A0J2CPU unit)



Unit: mm (inch)

Use M4 (0.16) mounting screws of M4 (0.16) x 0.7 (0.028) x 18 (0.71) mm (inch) size.

IB (NA) 66058-A

IMPORTANT

The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.

(1) Ground human body and work bench.

(2) Do not touch the conductive areas of the printed circuit board and its electrical parts with any non-grounded tools etc.

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

type A0J2 (CPU)

User's Manual

MODEL	A0J2CPU-USERS-E
MODEL CODE	13J601
IB(NA)-66058-D(8812)MEE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : 1-8-12, OFFICE TOWER Z 14F HARUMI CHUO-KU 104-6212,JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5 , HIGASHI-KU, NAGOYA , JAPAN