MITSUBISHI

MOTION CONTROLLER

User's Manual

type A273UHCPU

MITSUBISHI ELECTRIC

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Nov., 1995	IB (NA) 67262-A	First edition
Feb., 1997	IB (NA) 67262-E	Additions Chapter 1, Sections 2.1.2, 2.3.2, 2.7, 2.8.1, 4.3.2, 5.2.1, APPENDIX 1(12), (13), APPENDIX 2, APPENDIX 3, APPENDIX 4 • MR-J2-B Servo Amplifier Added • Section 2.4 "Connecting an External Servo Amplifier Unit" Added • Section 10.4 "Replacing the Servo System CPU" Added Corrections Precautions for Safety 4(5),(8) Chapter 1, Sections 2.1.2, 2.3.2, 2.4.2, 2.5.3 (1)(a), 4.2.1, 5.2.1, 5.4.1, 5.4.3, 5.6.1, 10.5, APPENDIX 1(10), APPENDIX 2.1, APPENDIX 3(1), APPENDIX 4(1), APPENDIX 5.1(2)

INTRODUCTION

Thank you for purchasing the Mitsubishi Motion Controller/Personal Machine Controller. This instruction manual describes the handling and precautions of this unit. Incorrect handling will lead to unforeseen events, so we ask that you please read this manual thoroughly and use the unit correctly. Please make sure that this manual is delivered to the final user of the unit and that it is stored for future reference.

Precautions for Safety

Please read this instruction manual and enclosed documents before starting installation, operation, maintenance or inspections to ensure correct usage. Thoroughly understand the machine, safety information and precautions before starting operation.
The safety precautions are ranked as "Warning" and "Caution" in this instruction manual.

⚠ **WARNING**	When a dangerous situation may occur if handling is mistaken leading to fatal or major injuries.
⚠ **CAUTION**	When a dangerous situation may occur if handling is mistaken leading to medium or minor injuries, or physical damage.

Note that some items described as cautions may lead to major results depending on the situation. In any case, important information that must be observed is described.

For Safe Operations

1. Prevention of electric shocks

⚠ WARNING

- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the control unit and servo amplifier are charged and may lead to electric shocks.
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc. Failing to do so may lead to electric shocks.
- Always ground the control unit, servo amplifier and servomotor with Class 3 grounding. Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the control unit, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the control unit, servo amplifier or servomotor terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the internal power supply, internal grounding or signal wires of the control unit and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

⚠ CAUTION

- Install the control unit, servo amplifier, servomotor and regenerative resistor on inflammable material. Direct installation on flammable material or near flammable material may lead to fires.
- If a fault occurs in the control unit or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fires may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fires.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fires.

3. For injury prevention

⚠ CAUTION

- ⚠ Do not apply a voltage other than that specified in this manual, or the instruction manual for the product you are using on any terminal. Doing so may lead to destruction or damage.
- ⚠ Do not mistake the terminal connections, as this may lead to destruction or damage.
- ⚠ Do not mistake the polarity (+/–), as this may lead to destruction or damage.
- ⚠ The servo amplifier's heat radiating fins, regenerative resistor and servo amplifier, etc., will be hot while the power is ON and for a short time after the power is turned OFF. Do not touch these parts as doing so may lead to burns.
- ⚠ Always turn the power OFF before touching the servomotor shaft or coupled machines, as these parts may lead to injuries.
- ⚠ Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

4. Various precautions

Strictly observe the following precautions.
Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

⚠ CAUTION

- ⚠ Always install a leakage breaker on the control unit and servo amplifier power source.
- ⚠ If installation of a magnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the magnetic contactor.
- ⚠ Install an external emergency stop circuit so that the operation can be stopped immediately and the power shut off.
- ⚠ Use the control unit, servo amplifier, servomotor and regenerative resistor with the combinations listed in this manual, or the instruction manual for the product you are using. Other combinations may lead to fires or faults.
- ⚠ If safety standards (ex., robot safety rules, etc.,) apply to the system using the control unit, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- ⚠ If the operation during a control unit or servo amplifier error and the safety direction operation of the control unit differ, construct a countermeasure circuit externally of the control unit and servo amplifier.
- ⚠ In systems where coasting of the servomotor will be a problem during emergency stop, servo OFF or when the power is shut OFF, use dynamic brakes.
- ⚠ Make sure that the system considers the coasting amount even when using dynamic brakes.
- ⚠ In systems where perpendicular shaft dropping may be a problem during emergency stop, servo OFF or when the power is shut OFF, use both dynamic brakes and magnetic brakes.
- ⚠ The dynamic brakes must be used only during emergency stop and errors where servo OFF occurs. These brakes must not be used for normal braking.
- ⚠ The brakes (magnetic brakes) assembled into the servomotor are for holding applications, and must not be used for normal braking.
- ⚠ Construct the system so that there is a mechanical allowance allowing stopping even if the stroke end limit switch is passed through at the max. speed.
- ⚠ Use wires and cables that have a wire diameter, heat resistance and bending resistance compatible with the system.
- ⚠ Use wires and cables within the length of the range described in this manual, or the instruction manual for the product you are using.

⚠ CAUTION

⚠ The ratings and characteristics of the system parts (other than control unit, servo amplifier, servomotor) must be compatible with the control unit, servo amplifier and servomotor.

⚠ Install a cover on the shaft so that the rotary parts of the servomotor are not touched during operation.

⚠ There may be some cases where holding by the magnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servomotor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Parameter settings and programming

⚠ CAUTION

⚠ Set the parameter values to those that are compatible with the control unit, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.

⚠ The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode, servo amplifier and servo power unit. The protective functions may not function if the settings are incorrect.

⚠ Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

⚠ Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.

⚠ Set the servomotor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.

⚠ Set the servomotor capacity and type (standard, low–inertia, flat, etc.) parameter to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

⚠ Set the servo amplifier capacity and type parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

⚠ Use the program commands for the program with the conditions specified in the instruction manual.

⚠ Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

⚠ Some devices used in the program have fixed applications, so use these with the conditions specified in the instruction manual.

⚠ The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.

⚠ Use the interlock program specified in the special function unit's instruction manual for the program corresponding to the special function unit.

(3) Transportation and installation

⚠ CAUTION

- ⚠ Transport the product with the correct method according to the weight.
- ⚠ Use the servomotor suspension bolts only for the transportation of the servomotor. Do not transport the servomotor with machine installed on it.
- ⚠ Do not stack products past the limit.
- ⚠ When transporting the control unit or servo amplifier, never hold the connected wires or cables.
- ⚠ When transporting the servomotor, never hold the cables, shaft or detector.
- ⚠ When transporting the control unit or servo amplifier, never hold the front case as it may fall off.
- ⚠ When transporting, installing or removing the control unit or servo amplifier, never hold the edges.
- ⚠ Install the unit according to this manual, or the instruction manual for the product you are using in a place where the weight can be withstood.
- ⚠ Do not get on or place heavy objects on the product.
- ⚠ Always observe the installation direction.
- ⚠ Keep the designated clearance between the control unit or servo amplifier and control panel inner surface or the control unit and servo amplifier, control unit or servo amplifier and other devices.
- ⚠ Do not installer operate control units, servo amplifiers or servomotors that are damaged or that have missing parts.
- ⚠ Do not block the intake/outtake ports of the servomotor with cooling fan.
- ⚠ Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the control unit, servo amplifier or servomotor.
- ⚠ The control unit, servo amplifier and servomotor are precision machines, so do not drop or apply strong impacts on them.
- ⚠ Securely fix the control unit and servo amplifier to the machine according to this manual, or the instruction manual for the product you are using. If the fixing is insufficient, these may come off during operation.
- ⚠ Always install the servomotor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.
- ⚠ Store and use the unit in the following environmental conditions.

Environment	Conditions	
	Control Unit/Servo Amplifier	**Servo Motor**
Ambient temperature	0°C to +55°C (With no freezing)	0°C to +40°C (With no freezing)
Ambient humidity	According to each instruction manual.	80%RH or less (With no dew condensation)
Storage temperature	According to each instruction manual.	–20°C to +65°C
Atmosphere	Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist.	
Altitude	1000 m or less above sea level.	
Vibration	According to each instruction manual.	

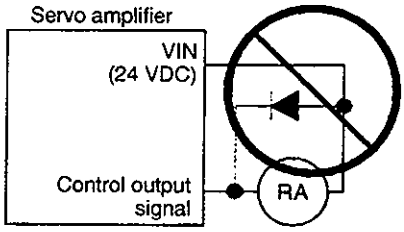
⚠ CAUTION

⚠ When coupling with the synchronization encoder or servomotor shaft end, do not apply impact such as by hitting with a hammer. Doing so may lead to detector damage.
⚠ Do not apply a load larger than the tolerable load onto the servomotor shaft. Doing so may lead to shaft breakage.
⚠ When not using the unit for a long time, disconnect the power line from the control unit or servo amplifier.
⚠ Place the control unit and servo amplifier in static electricity preventing vinyl bags and store.
⚠ When storing for a long time, contact the Service Center or Service Station.

(4) Wiring

⚠ CAUTION

⚠ Correctly and securely wire the wires. Reconfirm the connections for mistakes and the terminal screws for tightness after wiring. Failing to do so may lead to run away of the servomotor.
⚠ After wiring, install the protective covers such as the terminal covers to the original positions.
⚠ Do not install a phase advancing capacitor, surge absorber or radio noise filter (option FR–BIF) on the output side of the servo amplifier.
⚠ Correctly connect the output side (terminals U, V, W). Incorrect connections will lead the servomotor to operate abnormally.
⚠ Do not connect a commercial power supply to the servomotor, as this may lead to trouble.
⚠ Do not mistake the direction of the surge absorbing diode installed on the DC relay for the control signal output of brake signals, etc. Incorrect installation may lead to signals not being output when trouble occurs or the protective functions not functioning.



⚠ Do not connect or disconnect the connection cables between each unit, the encoder cable or sequence expansion cable while the power is ON.
⚠ Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables combing off during operation.
⚠ Do not bundle the power line or cables.

(5) Trial operation and adjustment

⚠ CAUTION

⚠ Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
⚠ Extreme adjustments and changes may lead to unstable operation, so never make them.
⚠ If the absolute positioning system is used, home position return is required after initial start up or after replacement of a controller or absolute positioning compatible motor.

(6) Usage methods

⚠ CAUTION

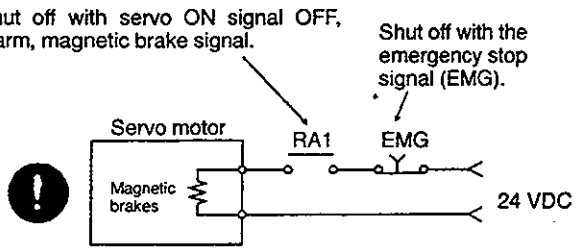
⚠ Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the control unit, servo amplifier or servomotor.
⚠ Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
⚠ The units must be disassembled and repaired by a qualified technician.
⚠ Do not make any modifications to the unit.
⚠ Keep the effect or magnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc. Magnetic obstacles may affect the electronic devices used near the control unit or servo amplifier.
⚠ Use the units with the following conditions.

Item	Conditions
Input power	According to A171SCPU/A273UHCPU specifications
Input frequency	According to A171SCPU/A273UHCPU specifications
Tolerable momentary power failure	According to A171SCPU/A273UHCPU specifications

(7) Remedies for error's

⚠ CAUTION

⚠ If an error occurs in the self diagnosis of the control unit or servo amplifier, confirm the check details according to this manual or the instruction manual, and restore the operation.
⚠ If a dangerous state is predicted in case of a power failure or product failure, use a servomotor with magnetic brakes or install a brake mechanism externally.
⚠ Use a double circuit construction so that the magnetic brake operation circuit can be operated by emergency stop signals set externally.
⚠ If an error occurs, remove the cause, secure the safety and then resume operation.
⚠ The unit may suddenly resume operation after a power failure is restored, so do not go near the machine. (Design the machine so that personal safety can be ensured even if the machine re-starts suddenly.)



(8) Maintenance, inspection and part replacement

⚠ CAUTION

⚠ Perform the daily and periodic inspections according to this manual, or the instruction manual for the product you are using.
⚠ Perform maintenance and inspection after backing up the program and parameters for the control unit and servo amplifier.
⚠ Do not place fingers or hands in the clearance when opening or closing any opening.
⚠ Periodically replace consumable parts such as batteries according to the instruction manual.
⚠ Do not touch the lead sections such as ICs or the connector contacts.
⚠ Do not place the control unit or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
⚠ Do not perform a megger test (insulation resistance measurement) during inspection.

⚠ CAUTION

⚠ When replacing the control unit or servo amplifier, always set the new unit settings correctly.

⚠ To prevent positional displacements after a controller or absolute positioning compatible motor is replaced, use one of the following methods to conduct home position return.

1) PC write the servo data with the peripheral device, turn the power OFF and back ON, then conduct home position return.
2) Use the peripheral device back-up functions to load the data backed up before replacement.

⚠ After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.

⚠ Do not short circuit, charge, overheat, incinerate or disassemble the batteries.

⚠ The electrolytic capacitor will generate gas during a fault, so do not place your face near the control unit or servo amplifier.

⚠ The electrolytic capacitor and fan will deteriorate. Periodically change these to prevent secondary damage from faults. Replacements can be made by the Service Center or Service Station.

(9) Disposal

⚠ CAUTION

⚠ Dispose of this unit as general industrial waste.

⚠ Do not disassemble the control unit, servo amplifier or servomotor parts.

⚠ Dispose of the battery according to local laws and regulations.

(10) General cautions

⚠ CAUTION

⚠ All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to this manual.

⚠ 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.

CONTENTS

1. GENERAL DESCRIPTION

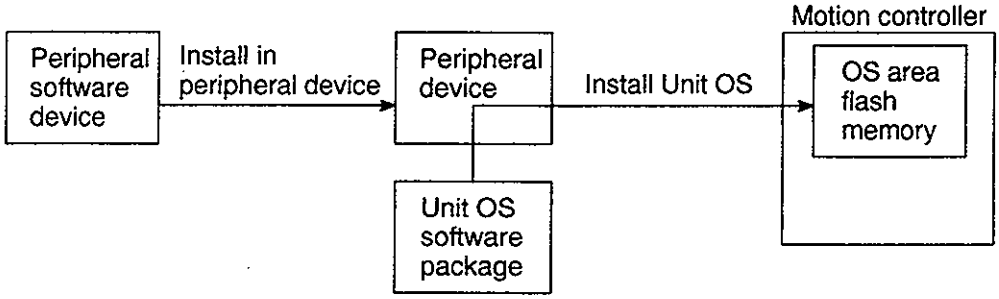
The A273UHCPU Motion Controller integrates the controller functions of sequence control and servo control.

The motion controller can control a maximum of eight axes for the A273UHCPU (8-axis specification) or 32 axes for the A273UH (32-axis specification). It can be configured with the MELSEC-A PC system, the MELSECNET data-link system or the MELSECNET/10 network system. Networking increases line automation, and permits higher speed and flexibility of production systems.
The motion controller operation system (OS) resides in the flash memory, which can be written by peripheral devices. An OS appropriate for the system is installed in the motion controller.

No OS is installed in the motion controller at the time of purchase.
Install one of the following operating systems before using the motion controller.

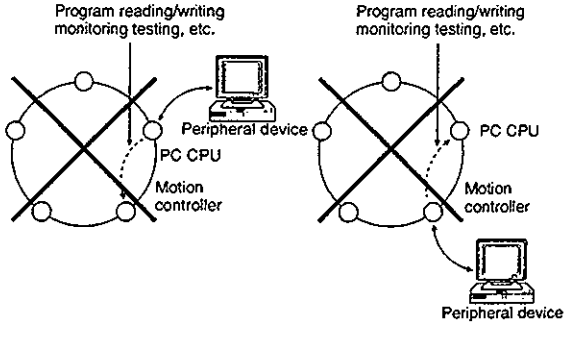
	Unit OS	Controlled Axes		
		Max.	External Servo Amplifiers	AC Motor Drive Modules
A273UHCPU (8-axis specification)	SW2SRX-SV13J SW2SRX-SV22J SW2SRX-SV13K	8	8	8
A273UHCPU (32-axis specification)	SW2SRX-SV13U SW2SRX-SV22U SW2SRX-SV13V	32	32	16

(For details about the installation procedure, refer to Section 10.2. Refer to the Operation Manual of the OS used for details about operation of peripheral devices.)



POINT

Note on accessing other stations in a data link system
Other station access involving the motion controller is not possible.
For example the following are not possible: accessing the motion controller from a peripheral device connected to the PC CPU; accessing the PC CPU from a peripheral device connected to the motion controller; and accessing the motion controller from a personal computer in the network.



1. GENERAL DESCRIPTION

(1) This manual describes the system configuration, equipment in the configuration, unit and module specifications, and handling of hardware for the A273UHCPU (8-/32-axis specification) and the positioning-related units in the motion controller system.
Refer to the Programming Manual of the OS used for details of the motion controller functions.
Refer to the Specifications and Instruction Manual of the servo amplifier used for details about the external servo amplifiers (MR-H-B, MR-J-B, MR-J2-B).

(2) In this manual, A273UHCPU (8-/32-axis specification) is called the "servo system CPU."

(3) Data can be set directly for an external servo amplifier connected to the peripheral devices shown in the table below. However, when the A273UHCPU (8-/32-axis spec.) is turned on, the settings change to the data set in the A273UHCPU.

External servo amplifier	Peripheral device
MR-H-B	Parameter unit
MR-J-B	———
MR-J2-B	Computer

Use a peripheral device connected to the external servo amplifier for monitoring.

(4) To use the functions listed below, use the positioning OS and positioning software package designated in the table.

- High-speed read function
- Cancel servoprogram during execution
- Start function
- Constant-speed control instruction (skip function)
- Constant-speed control instruction (FIN signal wait function)
- Constant-speed control instruction (Circular interpolation function with CPSTART3, CPSTART4)
- High-speed oscillation function
- MR-J2-B servo amplifier control

[Positioning OS]

Model Name	OS Version
SW2SRX-SV13K SW2SRX-SV13V SW2SRX-SV22J SW2SRX-SV22U	U, or above

[Positioning software package]

Model Name	Version
SW2SRX-GSV13PE SW2SRX-GSV22PE	P, or above

1. GENERAL DESCRIPTION

The servo system CPU contains a positioning-control CPU (PCPU) and sequence-control CPU (SCPU), for the following functions:

- PCPU ..... positioning control, home position return, monitoring servo control status
- SCPU ..... sequence control (equivalent to A3UCPU), running servo programs, manual pulse generator operation, etc.

The following peripheral devices and positioning software packages are used to set positioning data and program the servo system CPU.

(1) Peripheral devices

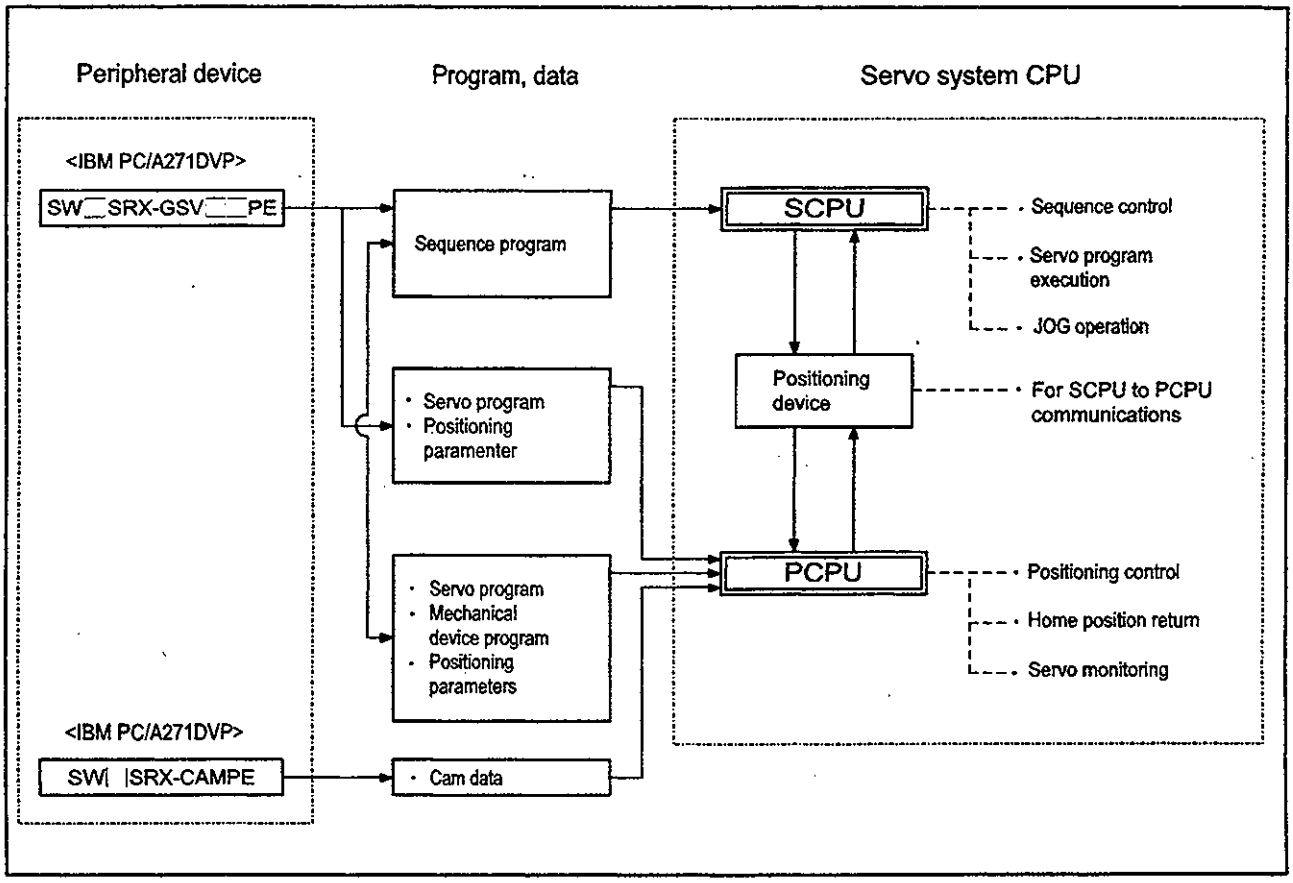
- IBM PC/AT computer running PC-DOS V5.0 or later version ("IBM PC")
- A271DVP man-machine controller ("A271DVP")

IBM PC/AT is a registered trade mark of the IBM Corporation.

(2) Positioning software packages

- IBM PC/AT, A271DVP ..... SW□SRX-GSV□□PE

The diagram below shows the outlines of program and data creation from peripheral devices and servo system CPU processing.



(1) Programs and data written to the servo system CPU are created with a peripheral device running the SW□SRX-GSV□□PE software.

- Designating PC name

  If using A273UHCPU (8-axis specification), designate: A273UH (8-axis specification).
  If using A273UHCPU (32-axis specification), designate: A273UH (32-axis specification).

- The sequence program is stored in the memory cassette mounted in the servo system CPU.

- The servo program, mechanical system program, and positioning parameters are stored in the EEPROM inside the servo system CPU.

(2) The servo system CPU can be monitored and tested with a peripheral device running the SW□SRX-GSV□□PE software.

- On the SCPU side, ladder monitoring, and device ON/OFF status testing and other test can be performed.

- On the PCPU side, the positioning control status can be monitored and servo program execution and jog operation tested.

1. GENERAL DESCRIPTION

1.1 Features

(1) Positioning control of a maximum of eight axes for the A273UHCPU (8-axis specification) or 32 axes for the A273UH (32-axis specification).

The use of AC motor drive modules and/or MR-H-B, MR-J-B servo amplifiers permits control of a maximum of eight axes for the A273UHCPU (8-axis specification) or 32 axes for the A273UHCPU (32-axis specification).

(2) AC motor drive modules mountable on same base as CPU

A maximum of eight A273UHCPU (8-axis specification) or 16 A273UHCPU (32-axis specification) AC motor drive modules can be directly mounted on the main base unit and motion extension base unit, to control 8 or 16 servo motors not exceeding 600 W capacity, respectively.

(3) Control with MR-H-B, MR-J-B, and MR-J2-B servo amplifiers

External MR-H-B, MR-J-B, and MR-J2-B servo amplifiers can be externally connected to control servomotors exceeding 600 W capacity.
Even with no AC motor drive modules mounted, the MR-H-B, MR-J-B, and MR-J2-B servo amplifiers can control a maximum of eight axes for the A273UHCPU (8-axis specification) or 32 axes for the A273UHCPU (32-axis specification). Alternatively, a combination of AC motor drive modules and MR-J2-B servo amplifiers can be used to control a maximum of eight axes for the A273UHCPU (8-axis specification) or 32 axes for the A273UHCPU (32-axis specification).

(4) Internal functions equivalent to Mitsubishi A3UCPU PC

(a) Control of AC motor drive modules and external servo amplifiers with sequence programs

(b) MELSEC-A Series I/O modules can be used mounted on the main base unit and motion extension base unit, but special-function modules cannot be used.
However, installing PC extension base units permits use of both MELSEC-A Series I/O modules and special-function modules.

(5) Use IBM PC/AT or A271DVP as positioning programming tool

Servo control programming, monitoring, and testing are possible using a dedicated software package with IBM PC or A271DVP.

(6) Switchable Operating Systems

The OS can be directly written to internal flash memory by an IBM PC or A271DVP, allowing control with an OS matched to the system.

REMARK

(1) Three types of servo motor control are available. The number of axes controlled by each type of CPU for each control method is shown in the table below.

Control Method	Controlled Axes	
	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)
AC motor drive modules only	8	16
MR-H-B, MR-J-B, and MR-J2-B only	8	32
AC motor drive modules and MR-H-B, MR-J-B, and MR-J2-B	8	32

1. GENERAL DESCRIPTION

1.2 Performance Comparison Between A273UHCPU (8-/32-axis specification) SCPU and A3UCPU

The table below shows the differences between the A273UHCPU (8-/32-axis specification) SCPU and the A3UCPU.

Item			A273UHCPU (8-/32-axis specification) SCPU	A3UCPU
Main base unit			A275B, A278B	A32B, A35B, A38B
Extension base unit		for SCPU	A65B, A68B (A55B, A58B cannot be used)	A65B, A68B, A55B, A58B
		for PCPU	A255B, A268B	—
Power supply module		for control	A61P, A62P, A63P	A61P, A62P, A63P, A65P
		for servo power	A230P	—
Instruction types		sequence instructions	22	22
		basic/application instructions	252	249
		dedicated instructions	204	204
No. I/O points			Total 2048 points for sequence control and positioning control	2048 points for sequence control
Device	Internal relay/latch relays		Total 8192 points for sequence control and positioning control	8192 points for sequence control
	Data registers		Total 8192 points for sequence control and positioning control	8192 points for sequence control
	Special relays	for positioning control	M9073 - M9079	—
	Special registers	for positioning control	D9180 - D9199	—
Data register latching range (from parameter latch range setting)			Only sequence control data registers are latched. Positioning control registers not latched even if set in latching range.	D0 - D8191

POINT

(1) Positioning control internal relays are not latched at power off.
Although the set M, L, and S device symbols set in the parameters are displayed on the peripheral device, devices set as L (latch relay) are not latched in the event of a power interruption.

REMARK

The applications of the A3UCPU DSFRP and DSFLP instructions are different for the A273UHCPU (8-axis specification), as shown below.

Instruction	Application
DSFRP*	Servoprogram start request instruction
DSFLP*	present value change, speed change instruction

* The changes do not apply for the A273UHCPU (32-axis specification). The DSFRP and DSFLP instructions remain as the conventional shift instructions.

2. SYSTEM CONFIGURATION

The following three basic system configurations are possible with the motion controller:

(1) System configuration with ADU ..... Section 2.1

(2) System configuration with external amplifier units ..... Section 2.2

(3) System configuration with both ADU and external amplifier units ... Section 2.3

⚠ CAUTION

⚠ Configure safety circuits external to the controller or servo amplifiers if their abnormal operation could cause axis motion in a direction other than the safe operating direction for the system.

⚠ Ensure that the characteristics of other components used in a system match those of the controllers, servo amplifiers, and servomotors.

⚠ Set the parameters to values appropriate for the controller, servo amplifiers, servomotors, regenerative resistor types, and system application. The protective functions may not work if the parameters are set incorrectly.

2. SYSTEM CONFIGURATION

2.1 System Configuration with AC Motor Drive Modules

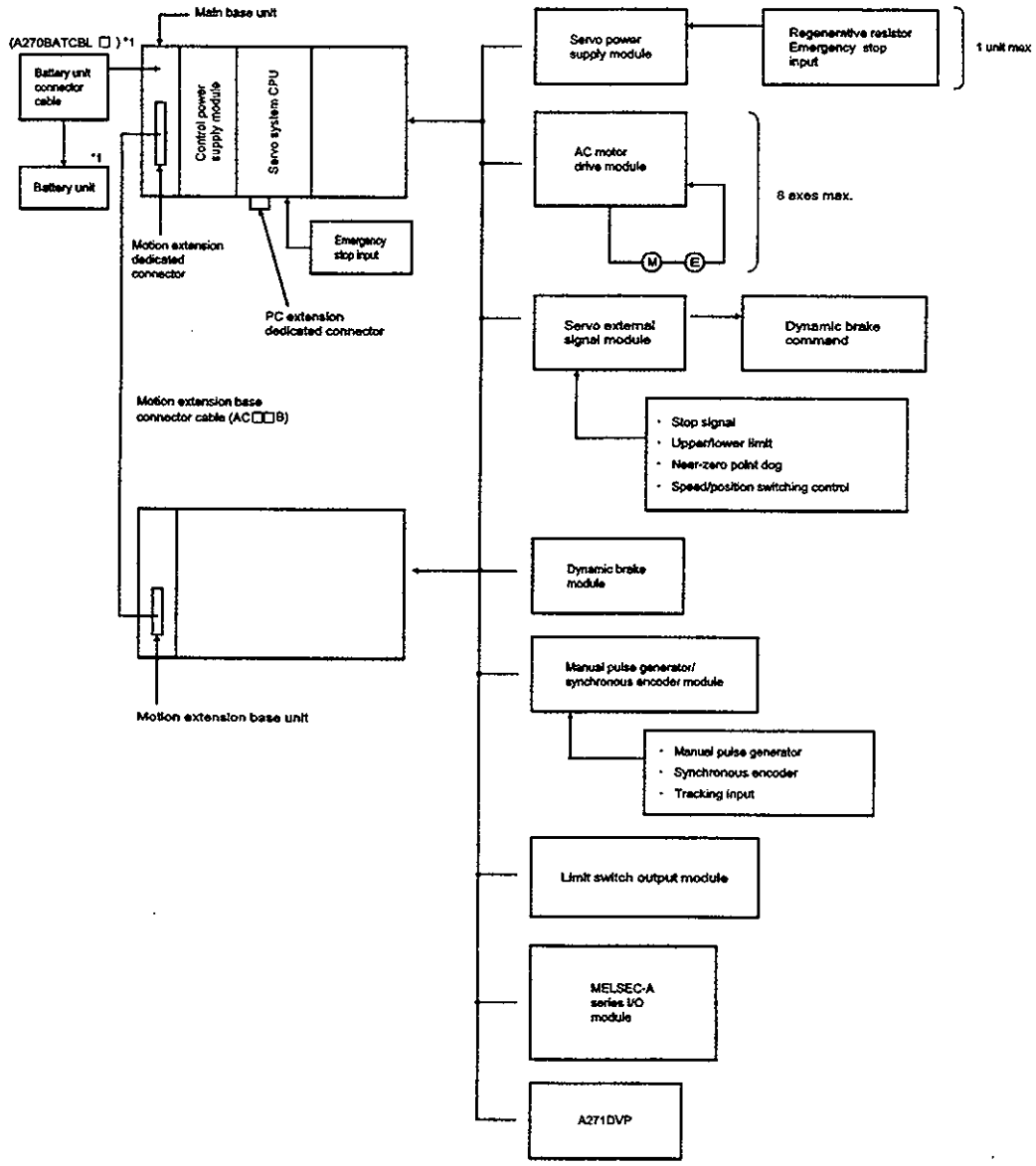
This system controls servomotors not exceeding 600 W capacity with AC motor drive modules (ADUs). The number of controlled axes is as follows:

(A273UHCPU (8-axis specification) ..... 8 axes max.
(A273UHCPU (32-axis specification) ... 16 axes max.

The motion modules, control power supply modules, and I/O modules for MELSEC-A Series PCs can be mounted on the main base unit and motion extension base units.

2.1.1 Overall configuration

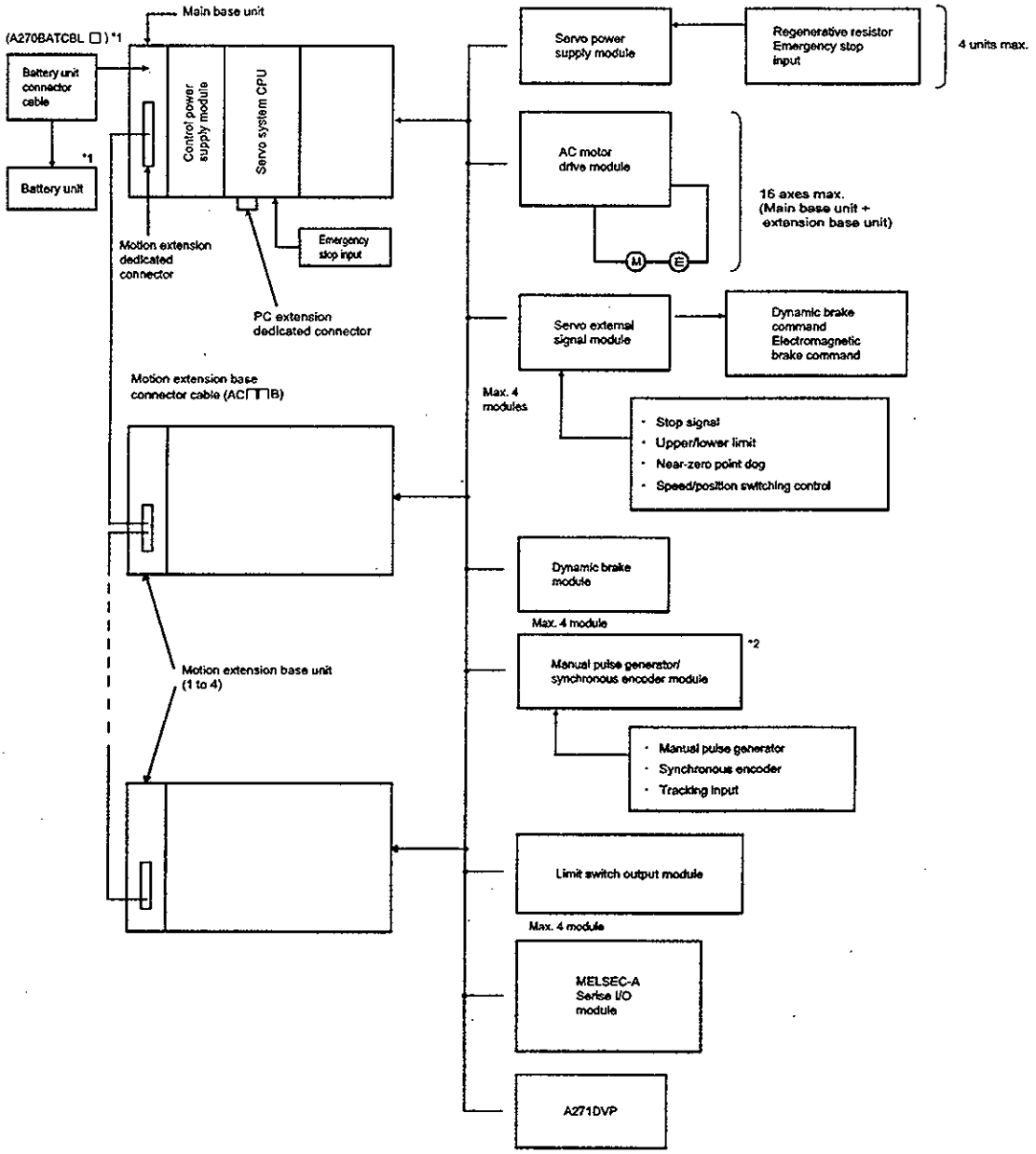
(1) Using A273UHCPU (8-axis specification)



REMARK

(1) *1 : Required if a servomotor with absolute position detector is connected to an ADU or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module. See Section 2.8.

(2) Using A273UHCPU (32-axis specification)



REMARKS

(1) *1 : Required if a servomotor with absolute position detector is connected to an ADU or if a synchronous encoder is connected to a manual pulse generator/synchronous encoder module. See Section 2.8.

(2) *2 : SV22: A maximum of 4 manual pulse generator/synchronous encoder modules can be connected in the VIRTUAL mode. Up to 3 inputs can be used per module for manual pulse generator operation of virtual servos.

2.1.2 Cautions on system configuration

(1) A maximum of 8 servomotors with the A273UHCPU (8-axis specification) or 16 servomotors with the A273UHCPU (32-axis specification) can be controlled using ADUs.

(2) Select the ADUs to match the capacity of the servomotors used, as follows:

ADU Model Name	Applicable Servomotor Capacity
A221AM-20	HA-MH Series: 100 W max. HA-FH Series: 200 W max.
A211AM-20 A222AM-20	600 W max.

(3) The servo system CPU, control power supply module, and the modules listed below can be mounted on the main base unit.
In addition, the modules listed below can be mounted on motion extension base units.
The mounting positions of the following modules on the main base unit and motion extension base units are unrestricted.

(a) ADU
(b) Dynamic brake module
(c) Manual pulse generator/synchronous encoder interface module
(d) Servo external signal modules
(e) Servo power supply modules
(f) MELSEC-A Series I/O modules*

} Refer to Section 2.9 for module model names.

(4) Use a PC extension base unit when a MELSEC-A Series I/O module cannot be mounted on the main base unit or motion extension base unit, or when a MELSEC-A Series special-function module is used. See Section 2.5.

(5) Encoders connected to the ADUs can be individually selected as an incremental encoder or absolute encoder to match each motor.
If an absolute encoder is used, a battery unit must be connected to the main base unit to back up the stored absolute position values. See Section 2.9 for details of battery unit model names.

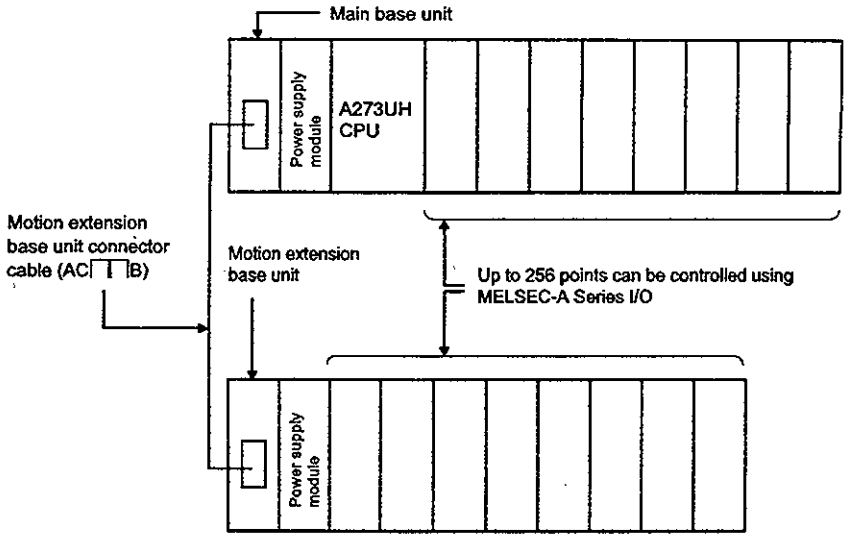
(6) A servo system using ADUs requires two power supplies: a control power supply and a servo power supply.

- Use a MELSEC-A Series PC power supply module (A61P, A62P, or A63P) as the control power supply. See Section 6.3 for information about selecting the control power supply.
- Use an A230P power supply module as the servo power supply. Connect the P and N terminals of the power supply module to the P and N terminals of each ADU with cables.

REMARKS

(1) * : Set the I/O numbers of the I/O modules mounted on the main base unit and motion extension base units using the servo control system settings.
Set I/O numbers greater than the I/O numbers used by the PC extension base unit.

(2)



(7) A230P power supply module contains no internal regenerative resistor.
Connect the optional regenerative resistor specified in Section 5.6.5 to the external regenerative resistor terminals (P and C).
The regenerative resistor is also used for voltage discharge across the P-N terminals when an error occurs or the CPU is reset.

(8) Cautions regarding A230P power supply module configuration when an A273UHCPU (32-axis specification) is used.

A maximum of four servo power supply modules can be used.
Make the following settings using the SW2SRX-GSV□□PE peripheral software package system set-up functions.

(a) Servo power supply module system settings

Use a system number (0 to 3) to set whether an ADU, dynamic brake module, or servo external signal module is connected to the servo power supply.

*System restrictions

No.	Module	Qty	Caution
1	AC motor drive module (A211AM, A221AM, A222AM)	16 modules max. (16 axes max.)	• The total current for all axes at a simultaneous start, calculated by the following equation, must not exceed 30 A (A230P rated output). Total current for all axes (A) = $\Sigma\left(\frac{\text{motor rated current (A)}}{\text{current (A)}} \times \frac{\text{load torque (kgf.cm)}}{\text{rated torque (kgf.cm)}} \times \frac{\text{actual motor speed (r/min)}}{\text{rated motor speed (r/min)}}\right)$ • If the modules control 2 axes, set a system number for each module.
2	Servo external signal module (A278LX)	1 module	• System setting required only if A278LX is set to use motor braking or dynamic braking.
3	Dynamic brake module (A240DY)	As required for number of axes (4 axes/module)	• A278LX is required if A240DY is used. A240DY can be installed externally: it does not need to be mounted on the base. • Set A278LX to use motor braking or dynamic braking.

REMARKS

(1) It is not necessary to mount all modules in a system on the same base.

(2) The external signal (axis number) settings of the servo external signal module is independent of the system setting. It is not necessary to set axis numbers in the same system.

- System control according to system setting
  - Main circuit contactor ON/OFF control to turn servos ON or OFF for all axes. Enable/disable control of dynamic braking. Enable/disable control of motor braking.
  - Main circuit contactor ON/OFF control to input or reset external emergency stops. Enable/disable control of dynamic braking. Enable/disable control of motor braking.
  - Regenerative error checking
  - ADU servo error processing (servos OFF at all axes / servo OFF at error axis)

(b) ADU servo error processing setting

The way an ADU axis servo error is processed can be set independently for each axis.

	Setting	Control Details
1	All system axes off (default)	• If a servo error occurs in any ADU axis, the servo OFF status is established for all axes in the system.
2	Only error axis off	• The servo OFF status is established only for the ADU axis where the servo error occurred. Other axes are unaffected. • However: (1) If one module controls 2 axes, the servo OFF status is established for both axes when a servo error occurs for one axis. (2) The servo OFF status is established for all system axes if any of the following servo errors occurs: Overcurrent (2032) Low voltage (2810) Over-regeneration (2830) Overvoltage (2833) Overheated amplifier power supply (2847)

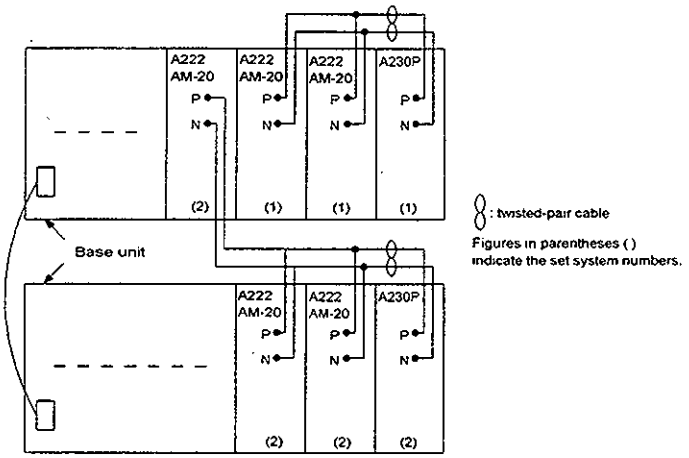
(c) External regenerative resistor setting

Set the model name of the external regenerative resistors connected.
An external regenerative resistance must be connected.

(9) Wiring systems when an A273UHCPU (32-axis specification) is used.
Following the wiring guidelines below if systems are set with different system numbers.

(a) Wiring AC motor drive modules to A230P servo power supply modules

Connect separate cables for each system for the 300 VDC supplies (terminals P, N) from the A230P servo power supply modules to the AC motor drive modules.

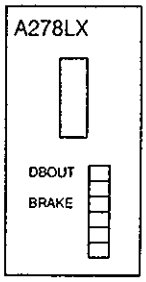


⚠ CAUTION

⚠ Do not connect 300 VDC cables from one system number to a different system number as this may damage the modules or cause the protective functions to fail.

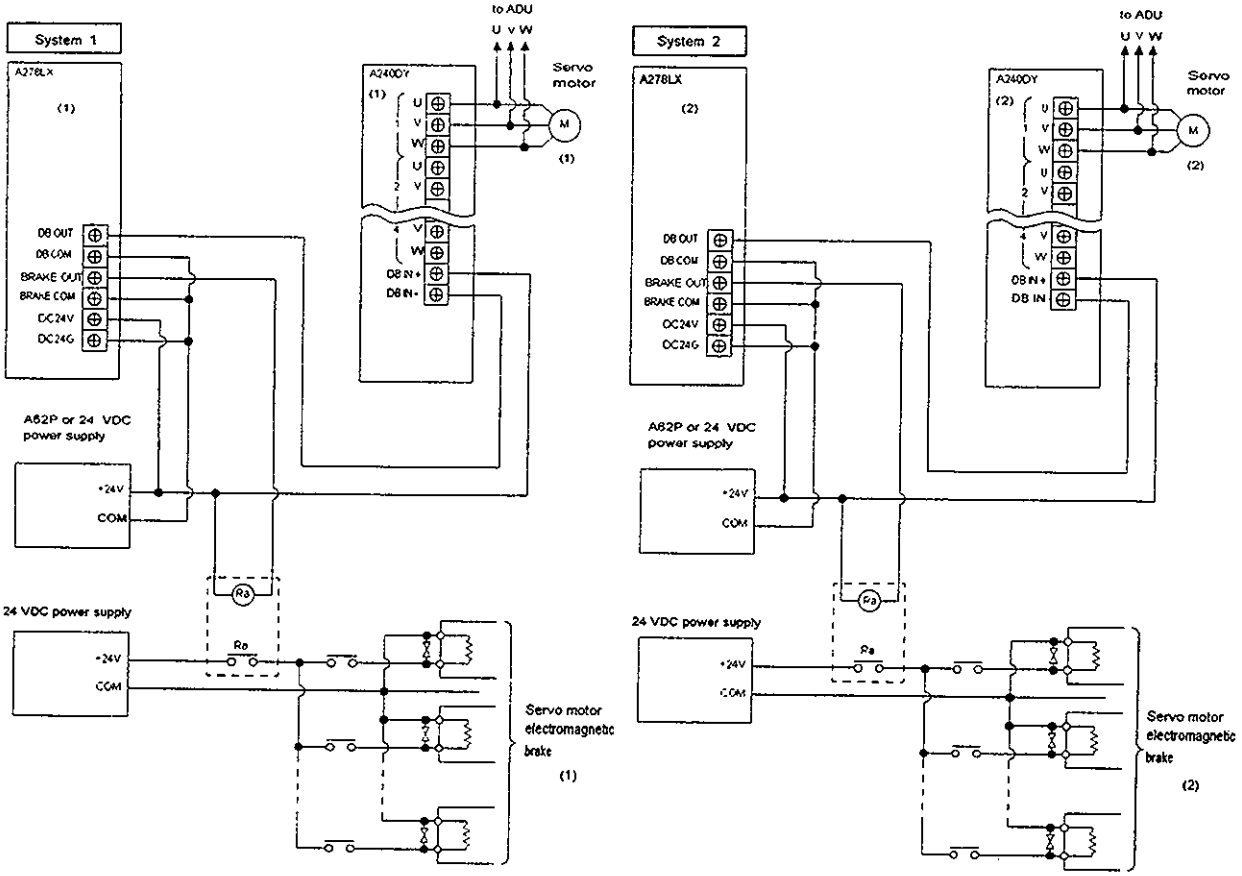
(b) Wiring servo external signal modules (A278LX)

Separate connections are required for each system for dynamic brakes and electromagnetic brakes controlled by dynamic brake and electromagnetic brake control outputs.



DBOUT and BRAKE are connected to the motors and electromagnetic brakes driven by AC motor drive modules with the same system setting.

Wiring Examples



Figures in parentheses ( ) indicate the set system numbers.

2.2 System Configuration with External Amplifier Units

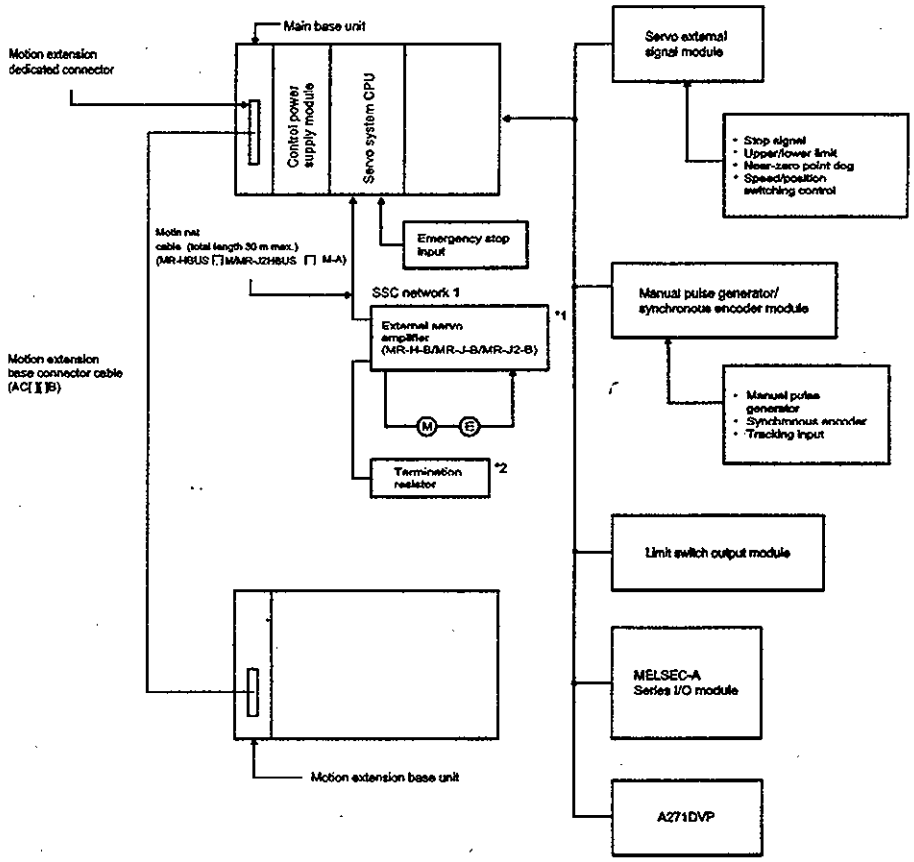
This system controls servomotors with external amplifier units. The number of controlled axes is as follows:

A273UHCPU (8-axis specification) ..... 8 axes max.
A273UHCPU (32-axis specification) ... 32 axes max.

The motion modules, power supply modules, and I/O modules for MELSEC-A Series PCs can be mounted on the main base unit and motion extension base units.

2.2.1 Overall configuration

(1) Using A273UHCPU (8-axis specification)

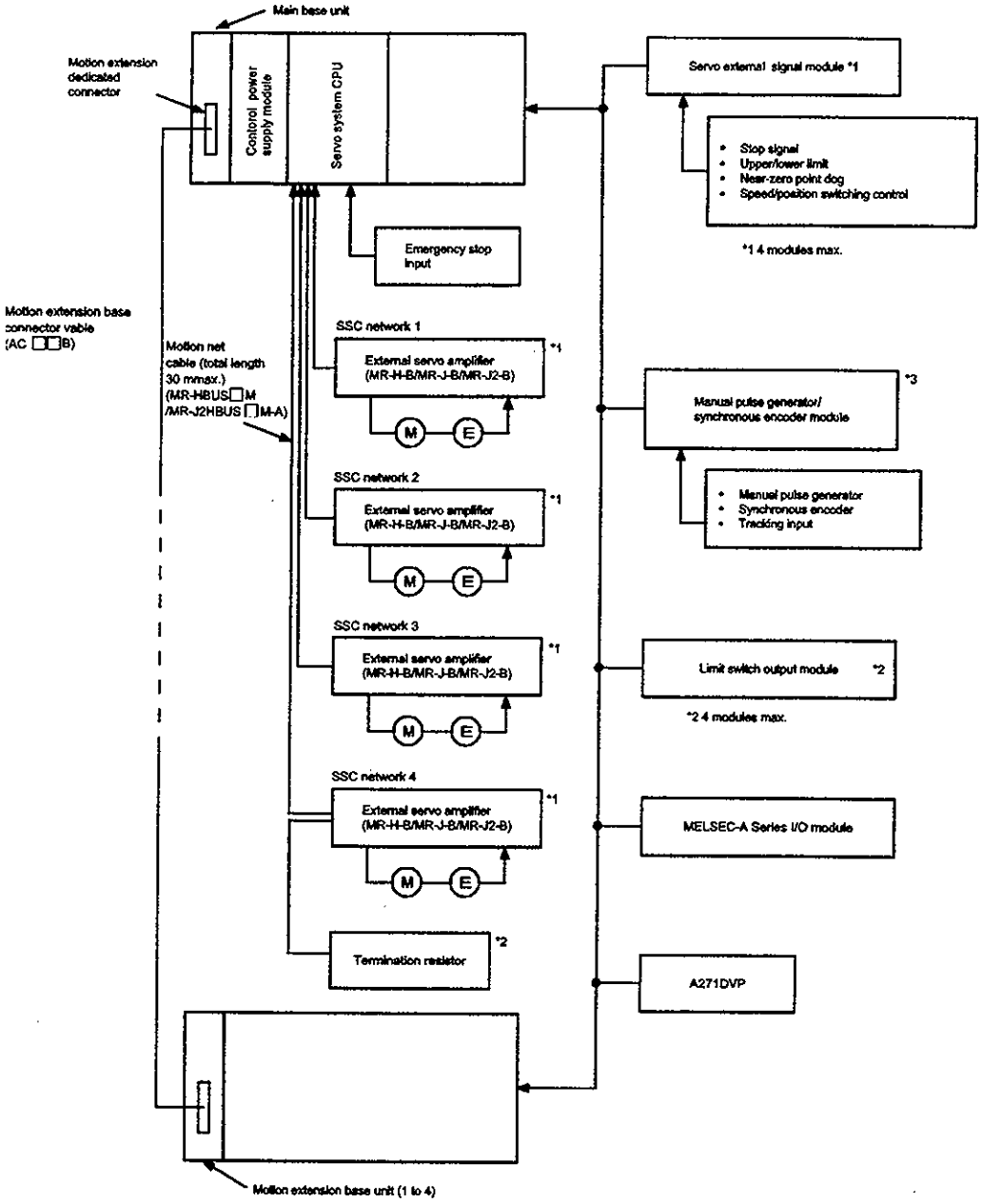


REMARKS

(1) *1 : A maximum of eight axes can be controlled using only external servo amplifiers. Only SSC network 1 can be used. A battery unit is required if a servomotor with absolute position detector is used or if a synchronous encoder is connected to themanual pulse generator/synchronous encoder module. See Section 2.8.

(2) *2 : The termination resistor must be connected after the last external amplifier unit. No termination resistor is required for some servo amplifier types if a servomotor with absolute position detector is used or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module. See Section 2.8.

(2) Using A273UHCPU (32-axis specification)



REMARKS

(1) *1 : A maximum of 32 axes can be controlled using only external servo amplifiers: a maximum of 8 axes for each SSC network.
A battery unit is required if a servomotor with absolute position detector is used or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module. See Section 2.8.

(2) *2 : The termination resistor for the end of the SSC network must be connected after the last external amplifier unit.
No termination resistor is required for some servo amplifier types if a servomotor with absolute position detector is used or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module. See Section 2.8.

(3) *3 : SV22: A maximum of 4 manual pulse generator/synchronous encoder modules can be connected in the VIRTUAL mode. Up to 3 inputs can be used per module for manual pulse generator operation of virtual servos.

2.2.2 Cautions on system configuration

(1) A maximum of 8 servomotors with the A273UHCPU (8-axis specification) or 32 servomotors with the A273UHCPU (32-axis specification) can be controlled using external servo amplifiers.

(2) The servo system CPU, control power supply module, and the modules listed below can be mounted on the main base unit.

In addition, the modules listed below can be mounted on the motion extension base units.

The mounting positions of the following modules on the main base unit and motion extension base units are unrestricted.

(a) Manual pulse generator/synchronous encoder interface module
(b) Servo external signal module
(c) MELSEC-A Series I/O module*

} Refer to Section 2.9 for module model names.

(3) Use a PC extension base unit when a MELSEC-A Series I/O module cannot be mounted on the main base unit or motion extension base unit, or when a MELSEC-A Series special-function module is used. See Section 2.5.

(4) Use a MELSEC-A Series PC power supply module (A61P, A62P, or A63P) as the control power supply for the servo system CPU.

REMARK

(1) * : Set the I/O numbers of the I/O modules mounted on the main base unit and motion extension base units using the servo control system settings. Set I/O numbers greater than the I/O numbers used by the PC extension base unit.

2. SYSTEM CONFIGURATION

2.3 System Configuration with AC Motor Drive Modules and External Amplifier Units

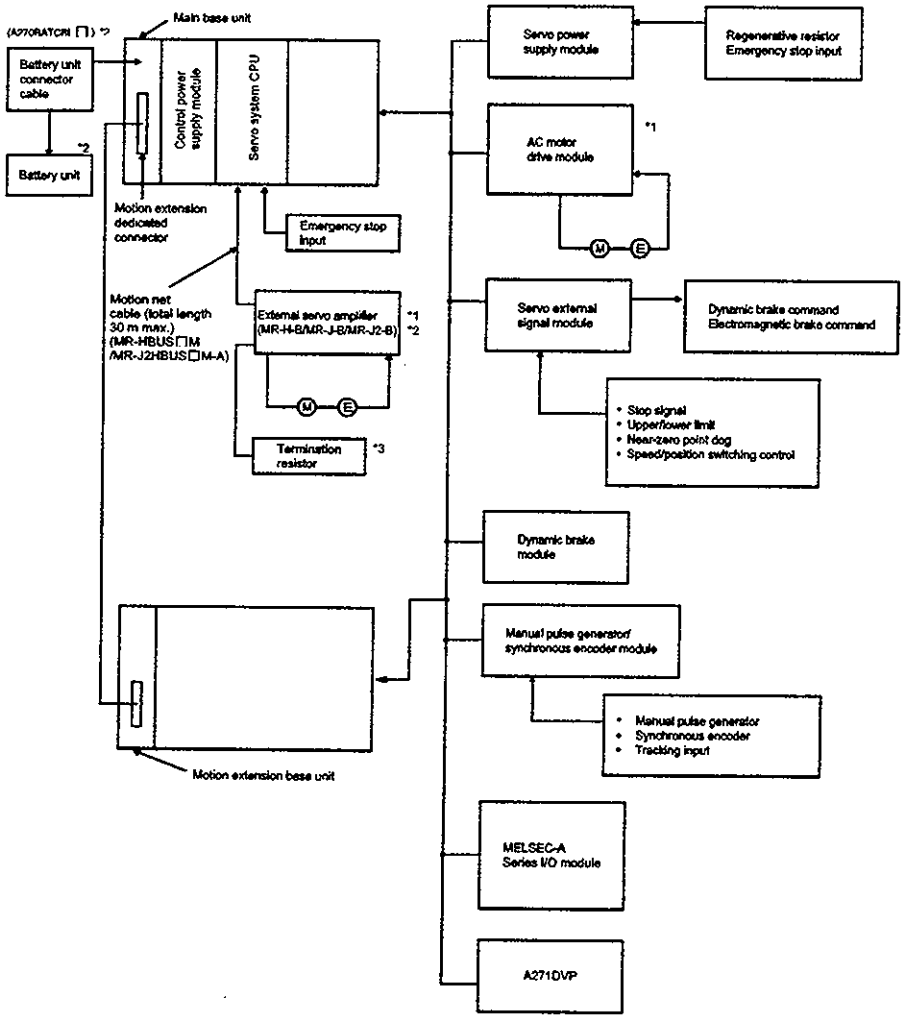
This system controls servomotors with ADUs and external amplifier units.
The number of controlled axes is as follows:

(A273UHCPU (8-axis specification) ..... 8 axes max.
(A273UHCPU (32-axis specification) ... 16 axes max.

The motion modules, power supply module, and I/O modules for MELSEC-A Series PCs can be mounted on the main base unit and motion extension base units.

2.3.1 Overall configuration

(1) Using A273UHCPU (8-axis specification)



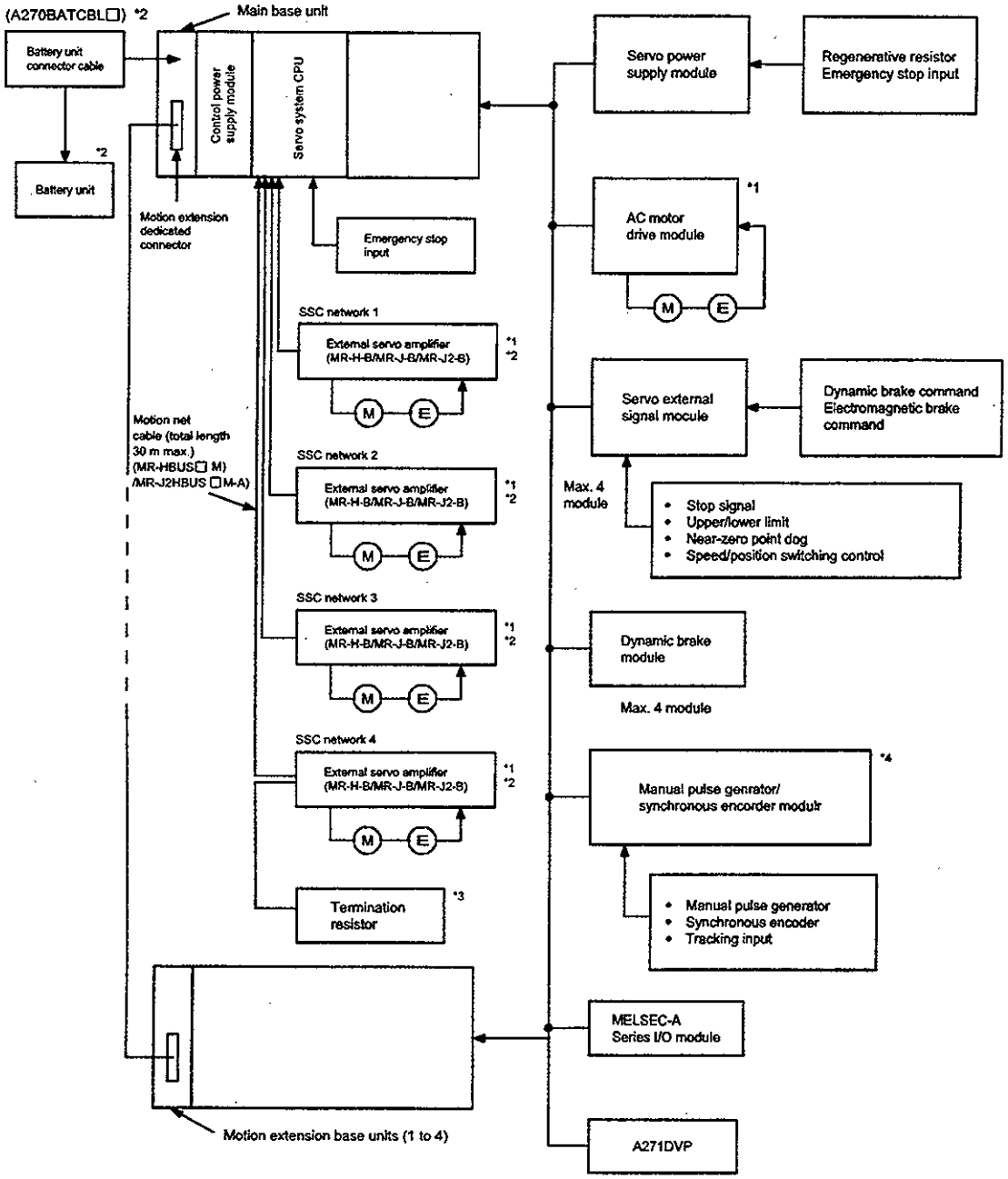
REMARKS

(1) *1 : A maximum of eight axes can be controlled using AC motor drive modules and external servo amplifiers.

(2) *2 : A battery unit is required if a servomotor with absolute position detector is used or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module. See Section 2.8.

(3) *3 : The termination resistor must be connected after the last external amplifier unit. No termination resistor is required for some servo amplifier types if a servomotor with absolute position detector is used or if a manual pulse generator/synchronous encoder is connected. See Section 2.8.

(2) Using A273UHCPU (32-axis specification)



REMARKS

(1) *1 : A maximum of 32 axes can be controlled using AC motor drive modules and external servo amplifiers. A maximum of 16 axes can be controlled using AC motor drive modules, i.e. a maximum of 16 modules. A maximum of 8 axes can be controlled in each SSC network.

(2) *2 : A battery unit is required if a servomotor with absolute position detector is used or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module. See Section 2.8.

(3) *3 : If an SSC network contains MR-H-B/MR-J2-B amplifiers only, a termination resistor must be connected after the last external amplifier unit in the SSC network. No termination resistor is required for some servo amplifier types if a servomotor with absolute position detector is used or if a manual pulse generator/synchronous encoder is connected. See Section 2.8.

(4) *4 : SV22: A maximum of 4 manual pulse generator/synchronous encoder modules can be connected in the VIRTUAL mode. Up to 3 inputs can be used per module for manual pulse generator operation of virtual servos.

2.3.2 Cautions on system configuration

(1) A maximum of 8 servomotors with the A273UHCPU (8-axis specification) or 32 servomotors with the A273UHCPU (32-axis specification) can be controlled using ADUs and external servo amplifiers.

(2) Select the ADUs to match the capacity of the servomotors used, as follows:

ADU Model Name	Applicable Servomotor Capacity
A221AM-20	HA-MH Series: 100 W max. HA-FH Series: 200 W max.
A211AM-20 A222AM-20	600 W max.

(3) The servo system CPU, control power supply module, and the modules listed below can be mounted on the main base unit.

In addition, the modules listed below can be mounted on the motion extension base unit. The mounting positions of the following modules on the main base unit and motion extension base unit are unrestricted.

(a) ADU
(b) Dynamic brake module
(c) Manual pulse generator/synchronous encoder interface module
(d) Servo external signal module
(e) Servo power supply module
(f) MELSEC-A Series I/O module*
(g) A271DVP

} Refer to Section 2.9 for module model names.

(4) Use a PC extension base unit when a MELSEC-A Series I/O module cannot be mounted on the main base unit or motion extension base unit, or when a MELSEC-A Series special function module is used. See Section 2.5.

(5) Encoders connected to the ADUs can be individually selected as an incremental encoder or absolute encoder to match each motor.

If an absolute encoder is used, a battery unit must be connected to the main base unit to back up the stored absolute position values. See Section 2.9 for details of battery unit model names.

(6) A servo system using ADUs requires two power supplies: a control power supply and a servo power supply.

(a) Use a MELSEC-A Series PC power supply module (A61P, A62P, or A63P) as the control power supply. See Section 6.3 for information about selecting the control power supply.

(b) Use an A230P power supply module as the servo power supply.
Connect the P and N terminals of the power supply module to the P and N terminals of each ADU with cables.

(7) A230P power supply module contains no internal regenerative resistor.
Connect the optional regenerative resistor specified in Section 5.6.5 to the external regenerative resistor terminals (P and C).
The regenerative resistor is also used for voltage discharge across the P-N terminals when an error occurs or the CPU is reset.

(8) A maximum of four servo power supply modules can be used with an A273UHCPU (32-axis specification).

Servo power supply module system settings are required if a servo power supply module, ADU, servo external signal module (A278LX) or dynamic brake module (A240DY) is used with the A273UHCPU (32-axis specification). See Section 2.1.2(8) for details.

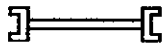
REMARK

(1) * : Set the I/O numbers of the I/O modules mounted on the main base unit and motion extension base unit using the servo control system settings.
Set I/O numbers greater than the I/O numbers used by the PC extension base unit.

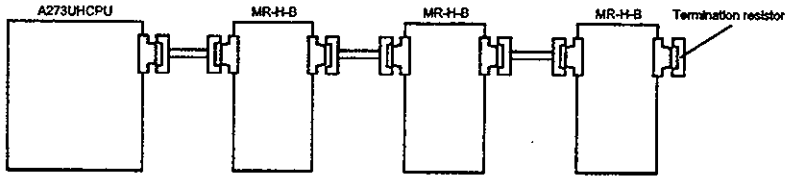
2.4 Connecting an External Servo Amplifier Unit

This section describes how to connect an external servo amplifier unit.
The connected motion net cable and termination resistor differ according to the type of external servo amplifier. Refer to the examples below when connecting the external servo amplifier unit.

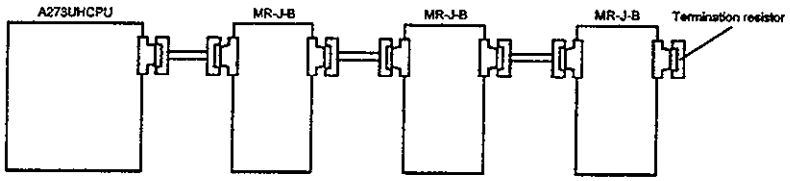
The model name for each motion net cable and termination resistor shown in the diagrams is given in the table below.

Name	Model Name	Symbol in Diagram	Description
Motion Net Cable	MR-HBUS□M		To connect A273UHCPU to MR-H-B/MR-J-B, and MR-H-B /MR-J-B to MR-H-B/MR-J-B
	MR-J2HBUS□M		To connect MR-J2-B to MR-J2-B
	MR-J2HBUS□M-A		To connect A273UHCPU to MR-J2-B, and MR-H-B/MR-J-B to MR-J2-B
Termination Resistor	MR-TM		For MR-H-B/MR-J-B
	MR-A-TM		For MR-J2-B

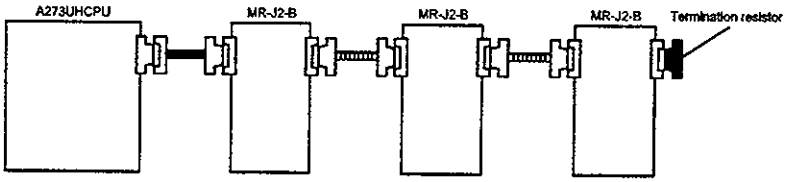
(1) MR-H-B Configuration



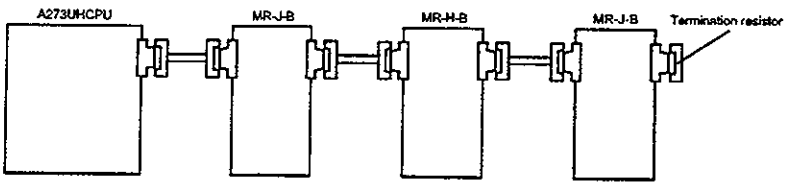
(2) MR-J-B Configuration



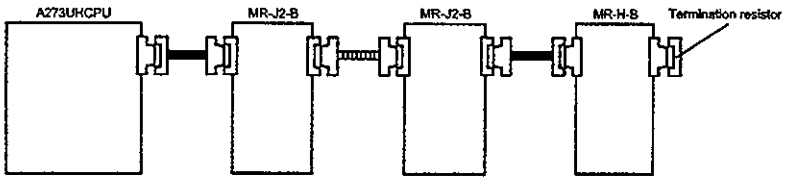
(3) MR-J2-B Configuration

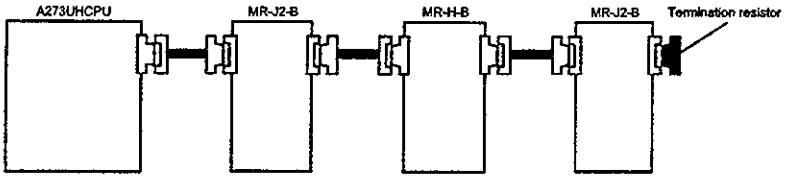


(4) MR-H-B and MR-J-B Configuration

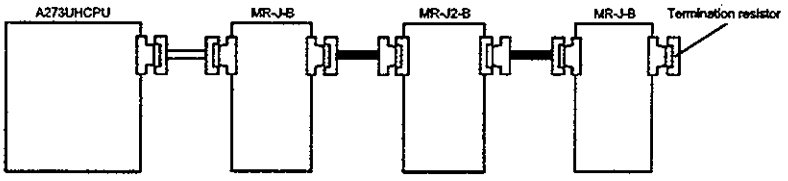


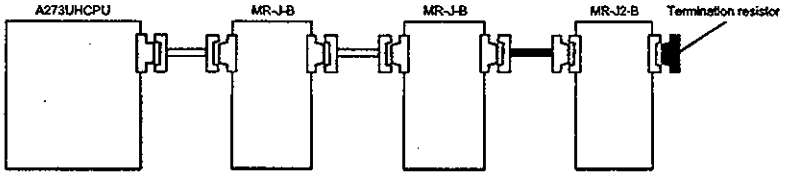
(5) MR-J2-B and MR-H-B Configuration





(6) MR-J-B and MR-J2-B Configuration

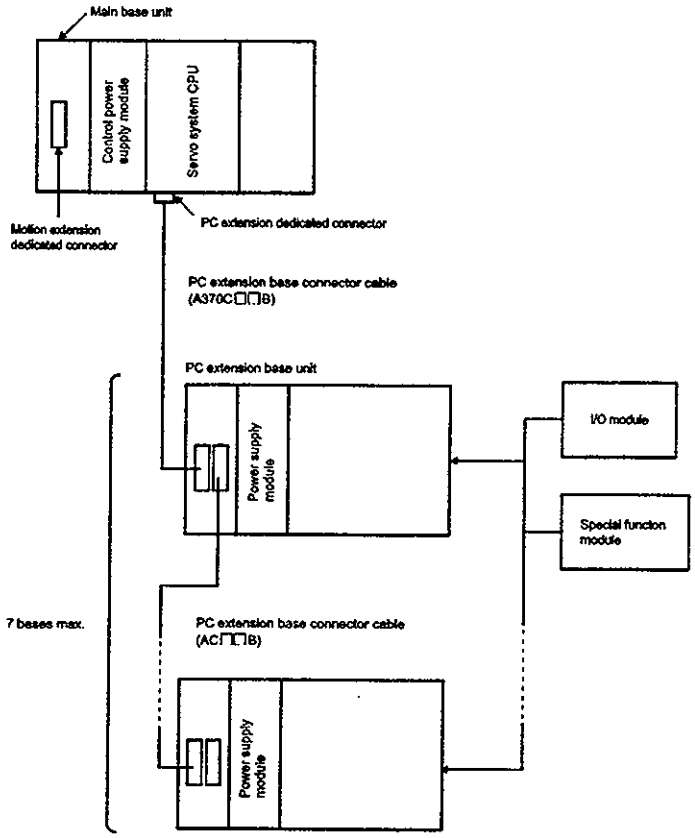




2.5 System Configuration with PC Extension Base Unit Connected

A PC extension base unit can be connected to the servo system CPU.
The PC extension base unit can be connected to the system configurations described in Sections 2.1 to 2.3.

2.5.1 Overall configuration



2.5.2 Cautions on system configuration

(1) The following extension base units can be used as the PC extension base unit:

• A62B, A65B, A68B ..... A maximum of seven units can be connected.

An extension base unit not requiring a power supply module cannot be used.

(2) The extension stages of the PC extension base unit can be set from stage 1 to stage 7.

(3) The first I/O number for extension stage 1 is as follows:

(a) Using A273UHCPU (8-axis specification)

If the servo system CPU OS model name is SV13, the I/O numbers start from X/Y100. The 1792 points from X/Y100 to X/Y7FF can be used.
If the servo system CPU OS model name is SV22, the I/O numbers start from X/Y180. The 1664 points from X/Y180 to X/Y7FF can be used.
The 128 points from X/Y100 to X/Y17F can be designated for use by the user in the REAL mode by setting 32 points/vacant slot for slots 0 to 7 during I/O allocation from a peripheral device.

(b) Using A273UHCPU (32-axis specification)

The I/O numbers start from X/Y80. The 1920 points from X/Y80 to X/Y7FF can be used.
However, the first I/O number can be set to X/Y0 by I/O allocation, permitting use of the 2048 device points from X/Y0 to X/Y7FF.

(4) Any MELSEC-A Series I/O module or special function module can be mounted and used on the PC extension base unit.

Sequence control by an A273UHCPU (8-/32-axis specification) is identical to sequence control by a MELSEC-A Series A3UCPU, except for the differences described in Section 1.2.
If a special function module is used, all references to "A3UCPU" in the manuals for special function modules also include "A273UHCPU (8-/32-axis specification)".

(5) Using A77GOT-S5 or A870GOT graphic operation terminal

For a bus connection, at least one vacant slot (32 vacant points) is required on the extension base unit.
Bus connection is also possible if a vacant extension stage exists but the I/O numbers must be allocated before the motion main base or motion extension base I/O numbers.

⚠ CAUTION

⚠ The total length of the extension cables must not exceed 6.6 m.

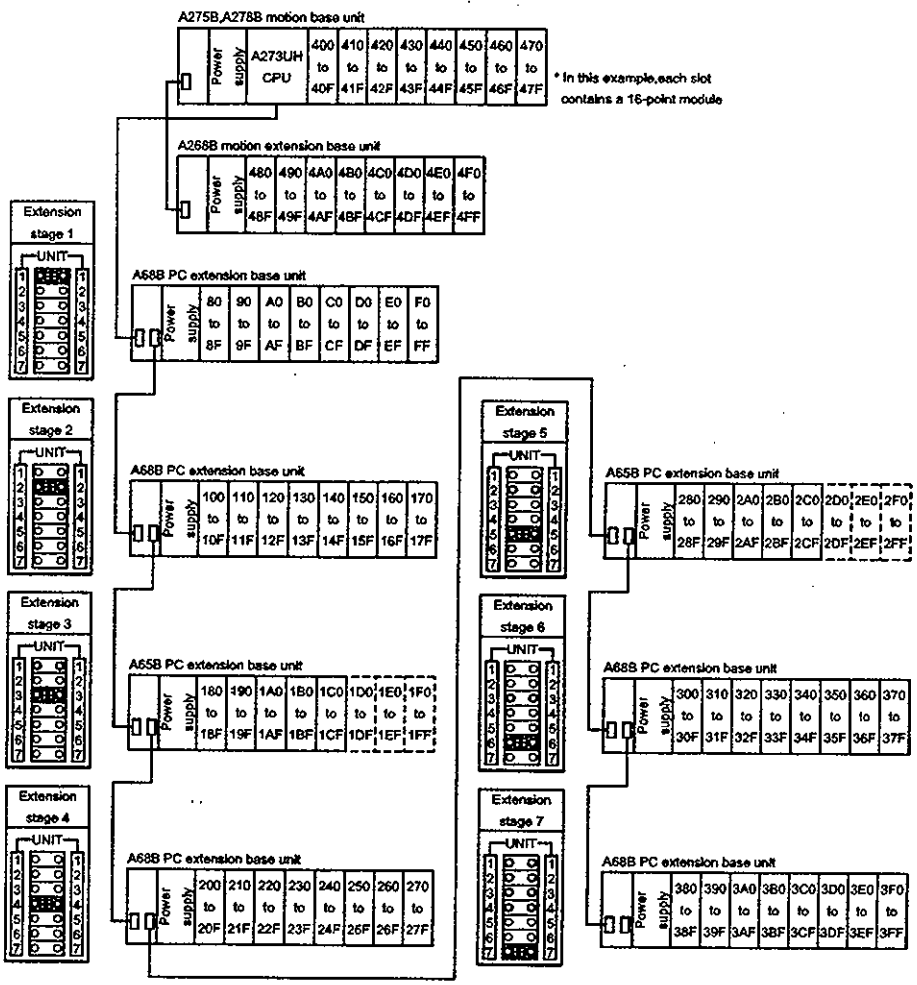
REMARK

(1) See Section 2.5.3 and Chapter 7 for details about the PC extension base unit.

2.5.3 Basic system configuration with I/O modules mounted

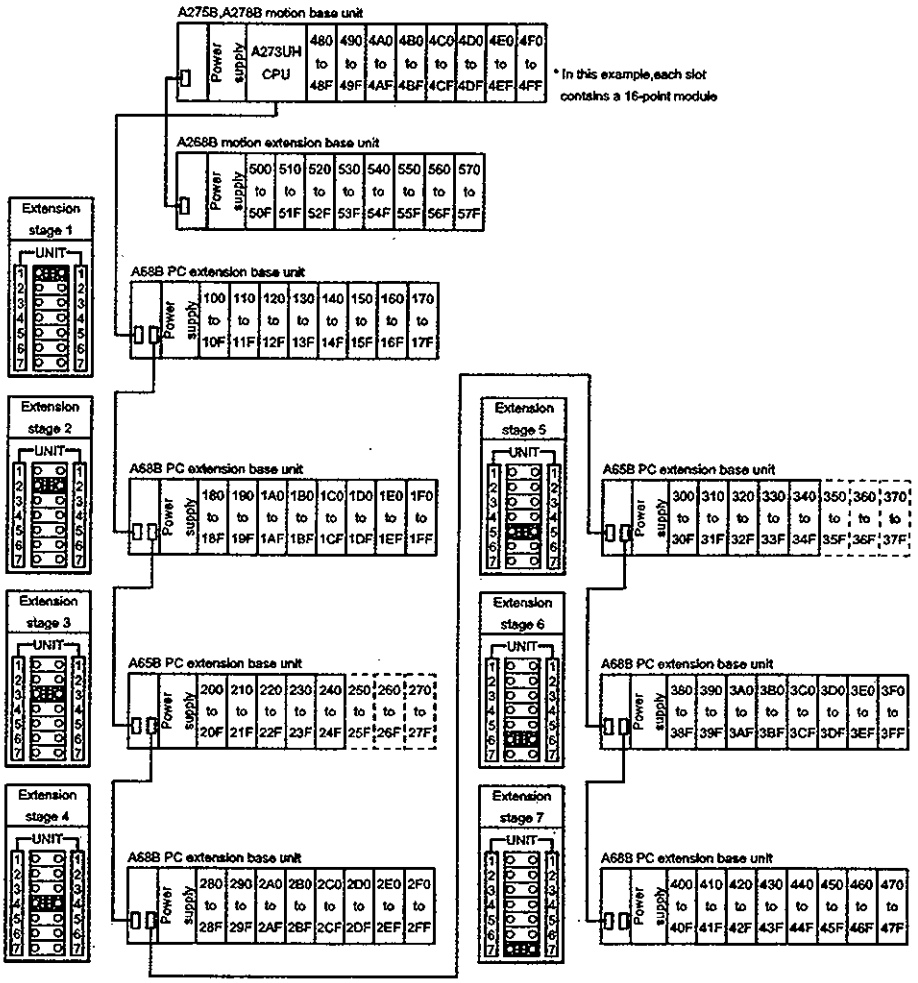
(1) Overall configuration

(a) A273UHCPU (32-axis specification)



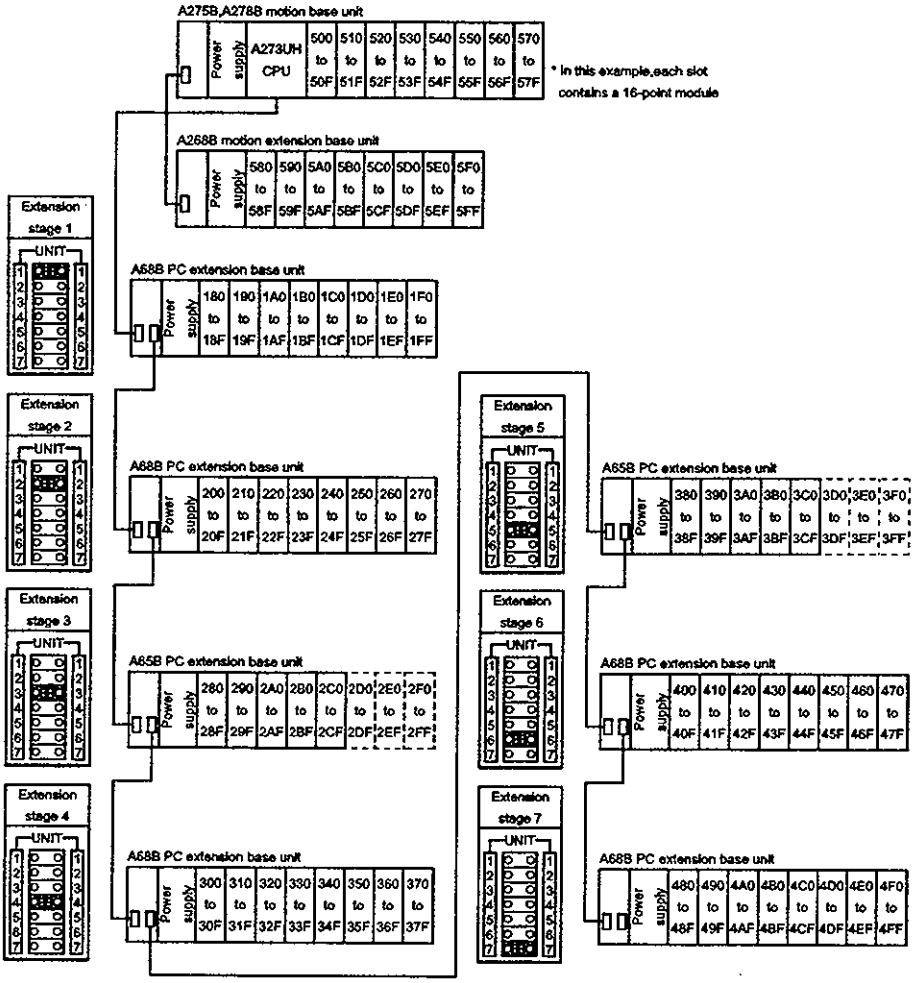
Max. extension stages	PC extension stages: 7; motion extension stages: 4
Max. I/Os	2048 points
Restrictions	(1) Only the following types of extension base units can be used: A62B, A65B, A68B (with control power supply). (2) The total length of the extension cables must not exceed 6.6 m. (3) A maximum total of 256 I/O points can be controlled with MELSEC-A Series I/O modules mounted on the motion main base unit and motion extension base units. (4) Special function modules cannot be mounted on the motion main base unit or motion extension base units. (5) The refresh lag when I/O modules are used on the motion main base unit and motion extension base unit is as follows. • Normal : approx. 20 to 30 ms • Max. : approx. 100 ms (for constant speed control instruction execution of all axes)
I/O number allocation	(1) The I/O numbers are allocated after the I/O numbers of the PC extension base unit. Allocate the I/O numbers of the I/O modules mounted on the motion main base unit and motion extension base unit greater than the I/O numbers of the PC extension base unit. Allocate I/O numbers using system set-up from a peripheral device. The PC extension base unit allocation is conducted automatically by the servo system CPU. (2) The first I/O number is X/Y80. (3) See Section 2.5.3(3) for information on I/O allocation using a peripheral device.

(b) A273UHCPU (8-axis specification) - SV13



Max. extension stages	PC extension stages: 7; motion extension stages: 1
Max. I/Os	1792 points
Restrictions	(1) Only the following types of extension base units can be used: A62B, A65B, A68B (with control power supply). (2) The total length of the extension cables must not exceed 6.6 m. (3) A maximum total of 256 I/O points can be controlled with MELSEC-A Series I/O modules mounted on the motion main base unit and motion extension base units. (4) Special function modules cannot be mounted on the motion main base unit or motion extension base unit. (5) The refresh lag when I/O modules are used on the motion main base unit and motion extension base units is as follows. • Normal : approx. 20 to 30 ms • Max. : approx. 100 ms (for constant speed control instruction execution of all axes)
I/O number allocation	(1) The I/O numbers are allocated after the I/O numbers of the PC extension base unit. Allocate the I/O numbers of the I/O modules mounted on the motion main base unit and motion extension base unit greater than the I/O numbers of the PC extension base unit. Allocate I/O numbers using system set-up from a peripheral device. The PC extension base unit allocation is conducted automatically by the servo system CPU. (2) The first I/O number is X/Y100. (3) See Section 2.5.3(3) for information on I/O allocation using a peripheral device.

(c) A273UHCPU (8-axis specification) - SV22



Max. extension stages	PC extension stages: 7; motion extension stages: 1
Max. I/Os	1644 points
Restrictions	(1) Only the following types of extension base units can be used: A62B, A65B, A68B (with control power supply). (2) The total length of the extension cables must not exceed 6.6 m. (3) A maximum total of 256 I/O points can be controlled with MELSEC-A Series I/O modules mounted on the motion main base unit and motion extension base unit. (4) Special function modules cannot be mounted on the motion main base unit or motion extension base unit. (5) The refresh lag when I/O modules are used in the motion main base unit and motion extension base unit is as follows. • Normal : approx. 20 to 30 ms • Max. : approx. 100 ms (for constant speed control instruction execution of all axes)
I/O number allocation	(1) The I/O numbers are allocated after the I/O numbers of the PC extension base unit. Allocate the I/O numbers of the I/O modules mounted on the motion main base unit and motion extension base unit greater than the I/O numbers of the PC extension base unit. Allocate I/O numbers using system set-up from a peripheral device. The PC extension base unit allocation is conducted automatically by the servo system CPU. (2) The first I/O number is X/Y180. (3) See Section 2.5.3(3) for information on I/O allocation using a peripheral device.

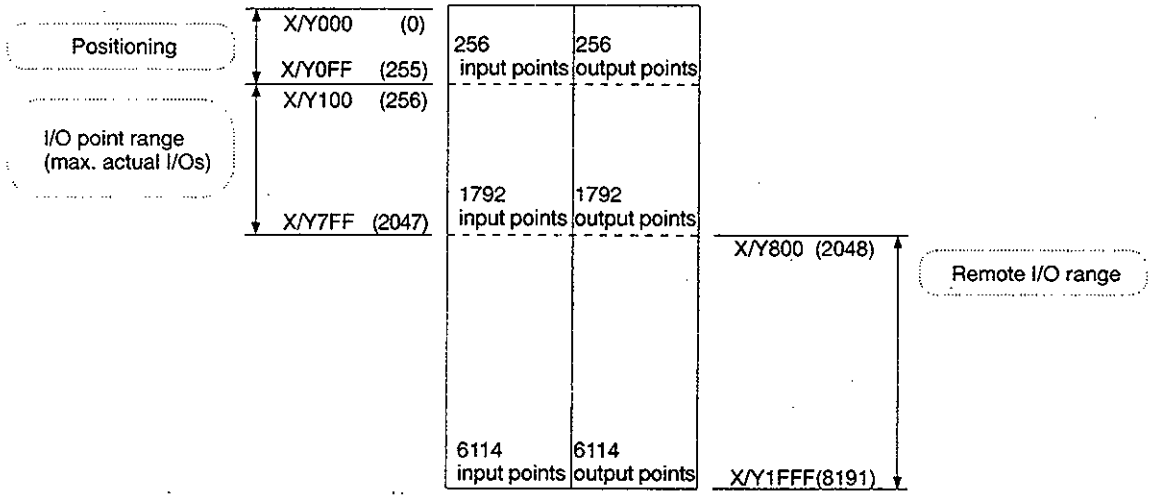
(2) I/O device allocation

(a) The servo system CPU has 8192 input (X) points and 8192 output (Y) device points, from X/Y0 to X/Y1FFF. Of these, the 2048 points from X/Y0 to X/Y7FF can be used for I/O modules and special function modules mounted on the base units. In addition, the devices from the last device used by the I/O modules and special function modules up to X/Y1FFF can be used as remote I/Os handled as internal relays by the sequence program.

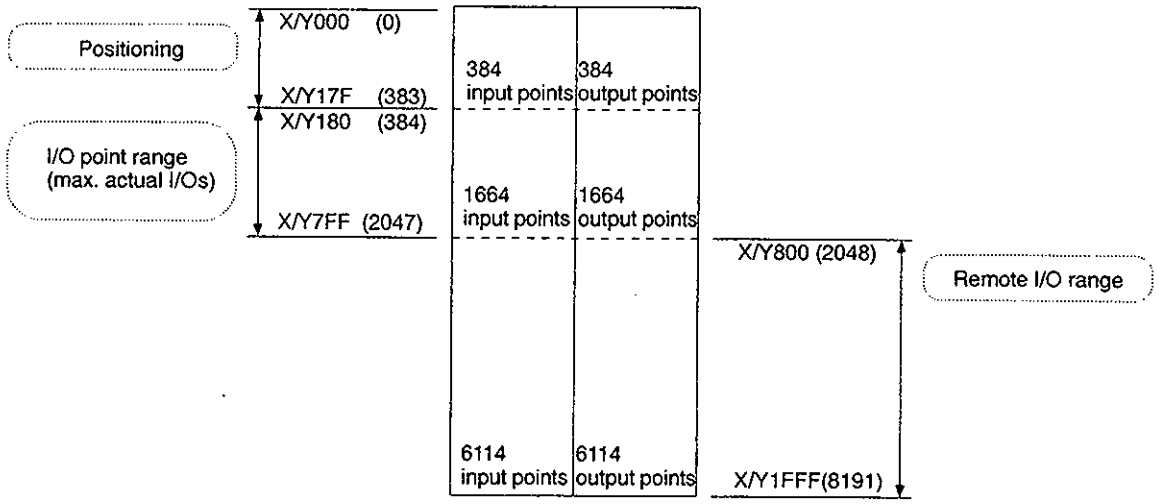
When an A273UHCPU (8-axis specification) is used, the positioning OS occupies either 256 points or 384 points from the first device, so the I/O modules and special function modules use the remainder of the first 2048 points.

(b) The I/O device allocation ranges are shown below.

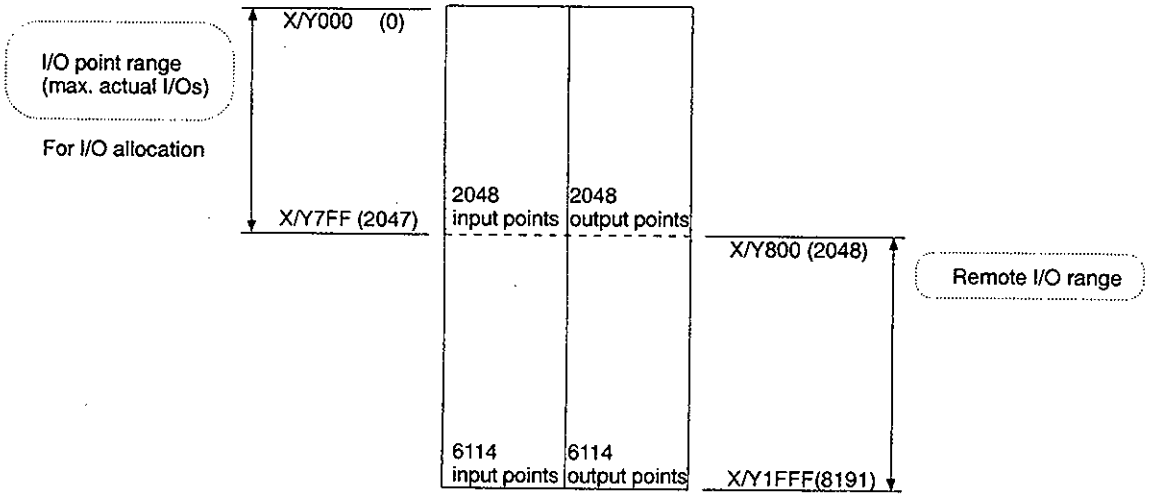
1) A273UHCPU (8-axis specification) - SV13



2) A273UHCPU (8-axis specification) - SV22



3) A273UHCPU (32-axis specification)



For an A273UHCPU (32-axis specification), the default value of the first I/O device number is X/Y80, so that 1920 I/O devices from X/Y80 to X/Y7FF can be used. However, by allocating the first I/O device number as X/Y0, the 2048 devices from X/Y0 to X/Y7FF can be made available.

POINTS

(1) If some of the actual I/O points are not used, the unused I/O points can be used as remote I/Os.

(2) To make sequence programs and I/O numbers easier to understand, use of I/O points from the start of the remote I/O range is recommended when using MELSECNET/MINI-S3.

(3) I/O allocation

(a) No I/O allocation by peripheral device

1) The servo system CPU automatically applies I/O numbers to the I/O modules mounted on the PC extension base units in the sequence that the extension base extension stage numbers were set, but independently of the order in which the extension cables were attached.

The first I/O number differs according to the CPU and OS used, as follows.
A273UHCPU (8-axis specification) - SV13 .. first I/O number is X/Y100
A273UHCPU (8-axis specification) - SV22 .. first I/O number is X/Y180
A273UHCPU (32-axis specification) ..... first I/O number is X/Y80

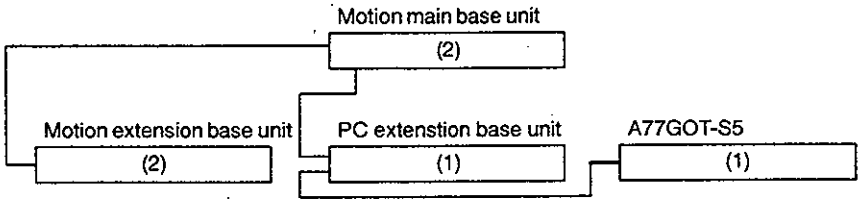
2) I/O numbers are allocated on the assumption that each PC extension base unit has 8 slots. Therefore, in a case where all base units except the last stage is a 5-slot base unit, I/O points for 3 additional slots are allocated (48 I/O points) before the I/O numbers of the next PC extension base unit start.

3) Vacant slots in a PC extension base unit are allocated 16 points.

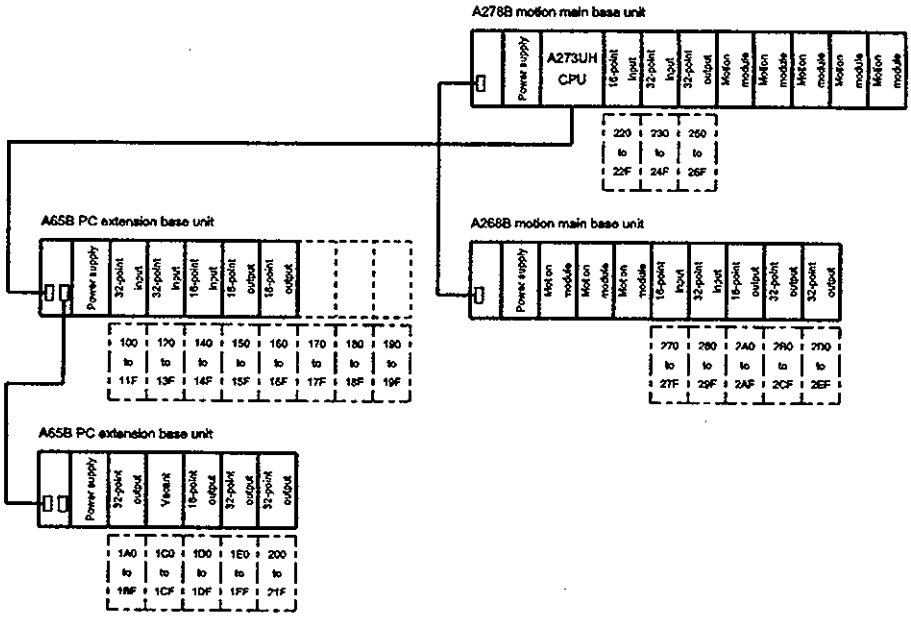
4) If extension stage settings are skipped, 16 points per slot are allocated for 8 slots in each of the skipped extension stages.

5) The I/O numbers are set for the motion main base unit and motion extension base units using system set-up with a peripheral device, and are made greater than the I/O numbers of the PC extension base unit in the allocations. However, if no PC extension base unit is used but PC I/O modules are used with a motion main base unit and motion extension base unit, the I/O numbers can be used from the first number. However, provision should be made in the I/O number allocations for the future addition of a PC extension base unit.

6) Always allocate I/O numbers in the sequence: (1)PC extension base unit, A77GOT-S5 (bus connection) and (2) motion main base unit and motion extension base units. However, I/O numbers can be allocated freely between motion main base unit and motion extension base units because no sequence is specified for I/O number allocation.



Allocation example for 8-axis specification, SV13



(b) I/O allocation by peripheral device (including I/O allocation using MELSECNET(II) remote I/O)

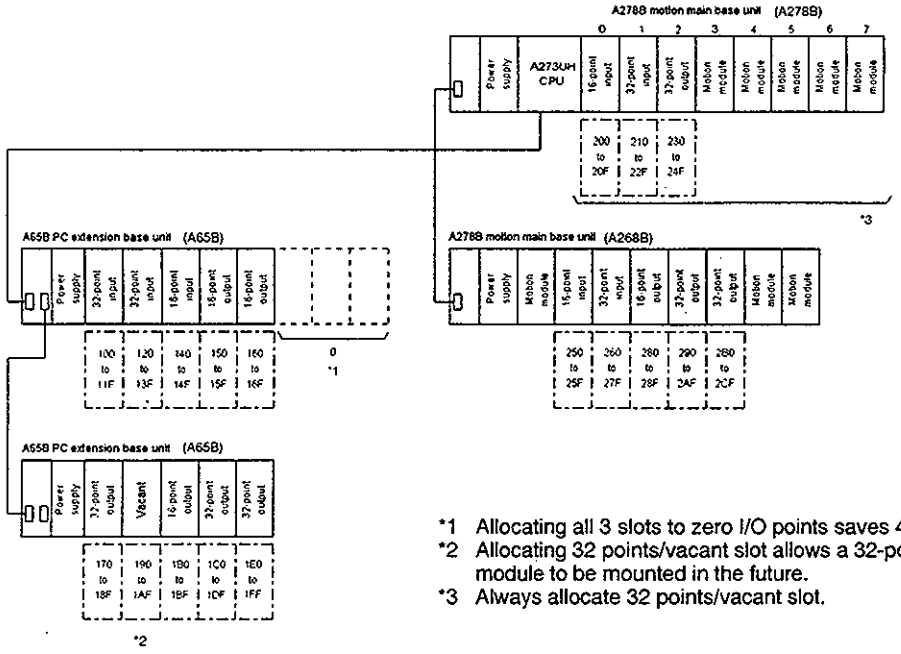
1) I/O allocation with a peripheral device offers the following functions.

- Use designated instructions for special function modules
  Registering the model name of a special function module at I/O allocation allows the special function module designated instructions to be used.
- Reduction in I/O points occupied by vacant slots
  The number of I/O points occupied by vacant slots can be reduced by allocating zero I/O points to vacant slots. This can save 48 I/O points if a A65B PC extension base unit is used, for example.
- 32, 48, or 64 I/O points can be reserved for future system expansion.
  The I/O addresses for each I/O module do not need to be changed if the appropriate number of I/O points is reserved, making the addition or modification of sequence programs easy.

2) When allocating I/Os from a peripheral device, the A275B or A278B motion base unit must be allocated to match the OS, as shown in the table.

OS		I/O Allocation	First I/O Number
8-axis specification	SV13	Allocate slots 0 to 7 as 32 points/vacant slot	X/Y 100
	SV22, REAL mode	Allocate slots 0 to 7 as 32 points/vacant slot	X/Y 100
	SV22, VIRTUAL mode	Allocate slots 0 to 7 as 48 points/vacant slot	X/Y 180
32-axis specification		Allocate slots 0 to 7 as 0 points/vacant slot	X/Y0

Allocation example for 8-axis specification, SV13

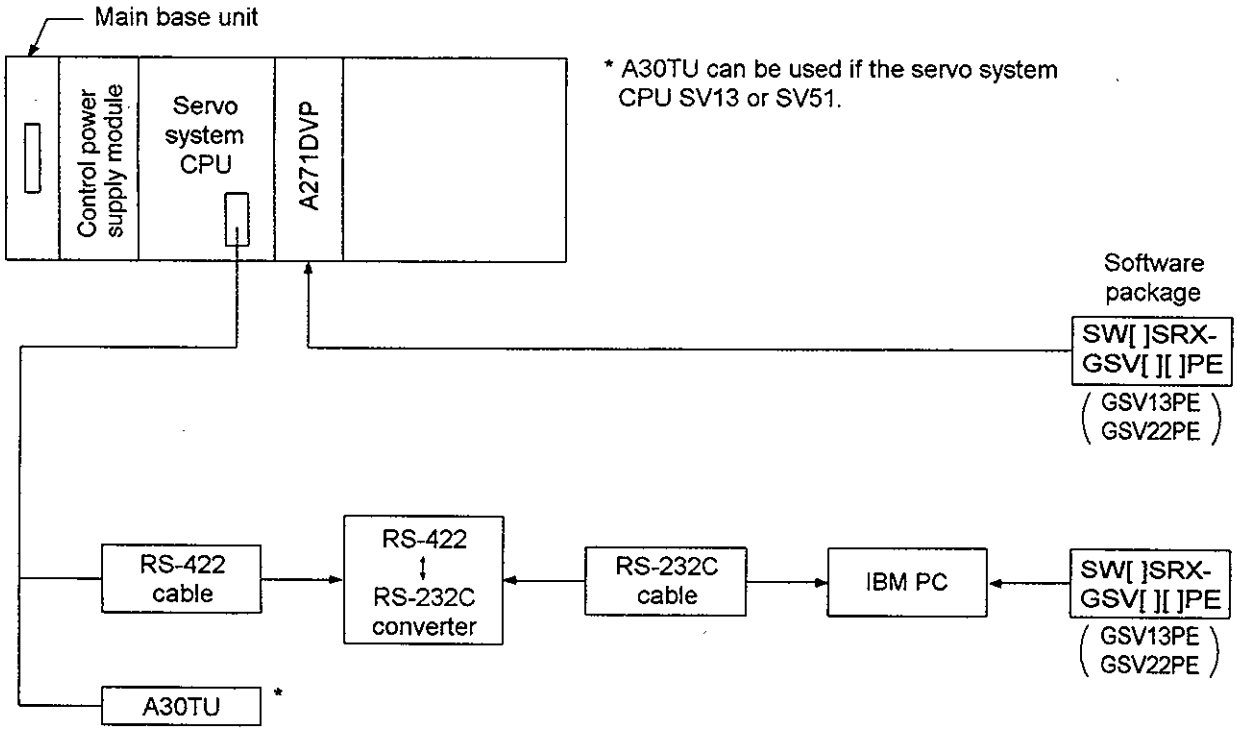


*1 Allocating all 3 slots to zero I/O points saves 48 points.
*2 Allocating 32 points/vacant slot allows a 32-point I/O module to be mounted in the future.
*3 Always allocate 32 points/vacant slot.

2.6 System with Peripheral Device Connected

A peripheral device can be connected to the servo system CPU.

2.6.1 Overall configuration



2.6.2 Cautions on system configuration

(1) Use a software package compatible with the OS model name stored in the servo system CPU.

(2) Each software package allows the creation of PCPU positioning data and programs, and SCPU sequence programs.

(3) A RS-422 ↔ RS-232C converter and RS-422 and RS-232C cables are required to use an IBM PC computer.
Refer to the software package programming manual for details.

(4) Bus communications are possible between the servo system CPU and A271DVP, if used. Observe the cautions below when bus communications are used between the A271DVP and servo system CPU.

(a) Bus communications are possible between one servo system CPU and up to two A271DVPs. If 3 or more A271DVPs are used, bus communications are possible with the two modules nearest slot 0 on the main base unit.

(b) The following software packages support bus communications with two A271DVPs.

No.	A271DVP 1	A271DVP 2	○ : Supported, ×: Not Supported
1	Digital oscilloscope (SW2DVP-DOSCP)	Digital oscilloscope (SW2DVP-DOSCP)	○
2	Digital oscilloscope (SW2DVP-DOSCP)	Peripheral device software (SW2SRX-GSV□□PE)	○
3	Peripheral device software (SW2SRX-GSV□□PE)	Peripheral device software (SW2SRX-GSV□□PE)	× (On-line functions)

REMARKS

(1) Mounting an A271DVP in a slot set as an unused slot during system set-up with the peripheral device software package (SW2SRX-GSV□□PE) permits bus communications with two modules.

(2) Mounting an A271DVP in a slot for which a different module was set during system set-up with the peripheral device software package (SW2SRX-GSV□□PE) causes a "lay error" but permits bus communications with two modules.

2.7 MELSECNET(II) Data Link System and MELSECNET/10 Network System

Refer to the following manuals for details about networking with the servo system CPU.

MELSECNET(II), MELSECNET/B Data Link System Reference Manual .... IB-66350 MELSECNET/10 Network System Reference Manual (PC to PC network) .. IB-66440

The servo system CPU network is configured by mounting MELSECNET/10 network modules and MELSECNET(II) data link modules on the base unit.
Up to four network modules or two data link modules can be mounted. For a combination of network modules and data link modules, a maximum of four modules can be mounted, including no more than two data link modules.

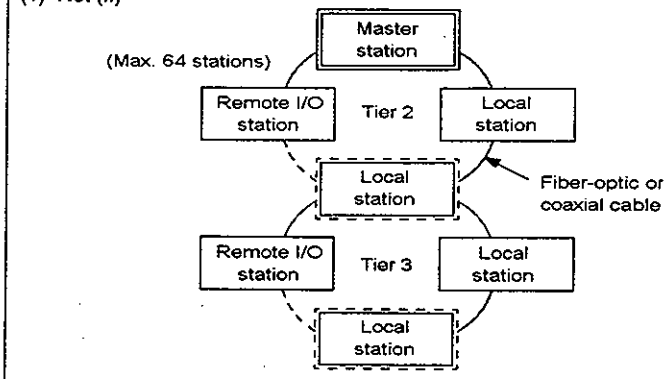
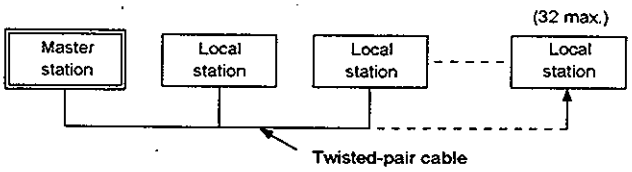
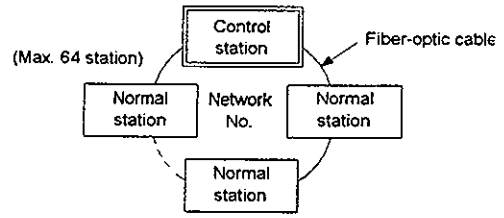
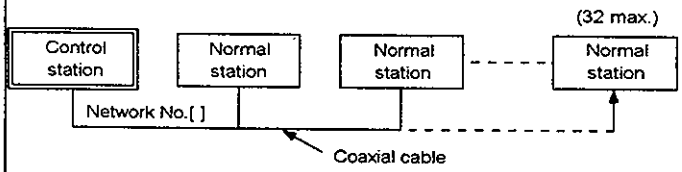
Item	Configuration	Description
MELSECNET(II), MELSECNET/B	(1) Net (II)  (2) Net/B  	(1) NET (II) is configured by connecting local stations and remote I/O stations to a single master station to form a 2-tier or 3-tier system. (2) Net/B is configured by connecting local stations to a master station. Net/B can be configured as a Net (II) 3-tier system. (3) Link control is conducted by the master station. (The link stops when the master station is down.)
MELSECNET/10 (all stations AnUCPU or A273UHCPU)	(1) Fiber-optic loop network  (2) Coaxial bus network  	(1) NET/10 is configured by connecting normal stations to a single control station. If the A273UHCPU is made a control station, only a PC-to-PC network can be used with GSV□□P. (Remote I/O stations cannot be connected.) (2) Other networks can be configured by mounting up to four network modules at the control station or normal stations. (3) Link control is conducted by the control station when the network starts up after all stations are turned on. A normal station acts as a sub-control station to continue link control if the control station goes down after system start-up. However, if the overall system is shut down (by turning off the power, for example), link control will be established at the next system start-up only if the control system is normal.

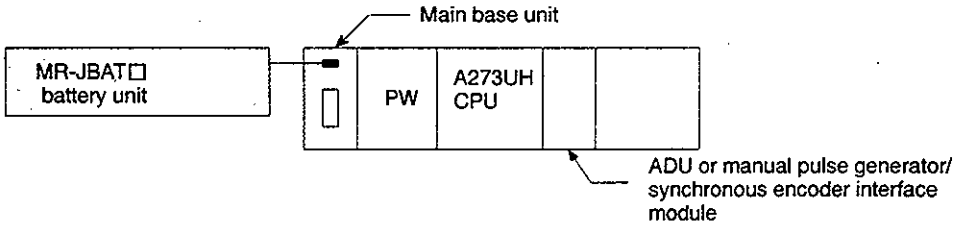
Fig. 2.1 Basics of MELSECNET (II) and MELSECNET/10

2.8 Connecting the Battery for an Absolute Positioning System

A battery unit is required if a servomotor with absolute position detector is used or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module.

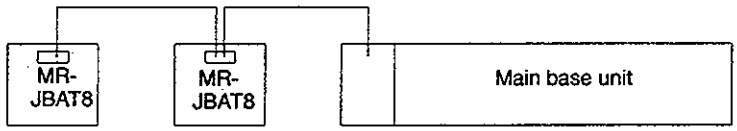
A MR-JBAT□battery unit is required when using an AC motor drive module, a manual pulse generator/synchronous encoder interface, or a MR-J-B servo amplifier. A MR-BAT/A6BAT battery is required for use with a MR-H-B/MR-J2-B servo amplifier.
Follow the appropriate procedure from (1) to (7) below to connect the battery.

(1) Using ADU or manual pulse generator/synchronous encoder interface
Connect a MR-JBAT□ battery unit to the battery unit connector at the left of the main base unit.

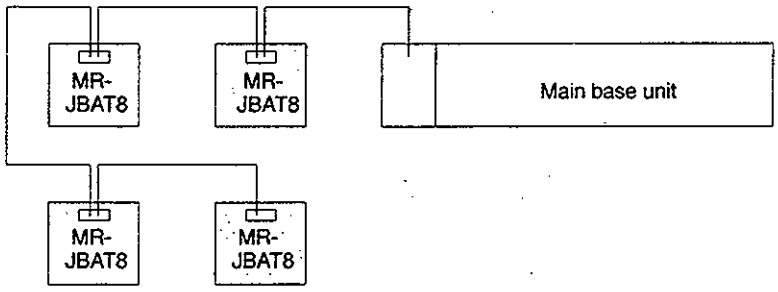


The battery unit connected to the main base unit supplies power to an ADU or manual pulse generator/synchronous encoder interface module mounted on the main base unit or motion extension base unit.
Connect multiple battery units as shown below if the total number of ABS motor axes controlled by the ADU or the number of ABS synchronous encoder axes connected to the manual pulse generator/synchronous encoder interface module exceeds eight axes when an A273UHCPU (32-axis specification) is used.

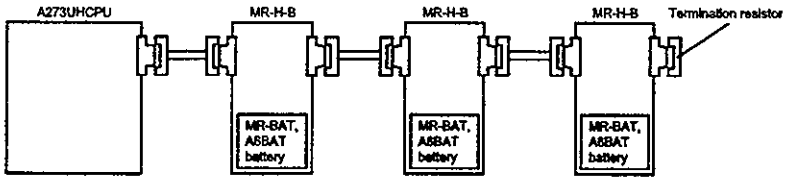
16 axes max., cable: A270BATCBLJ16



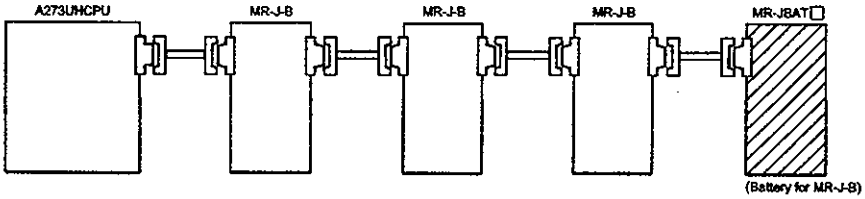
32 axes max., cable: A270BATCBLJ32



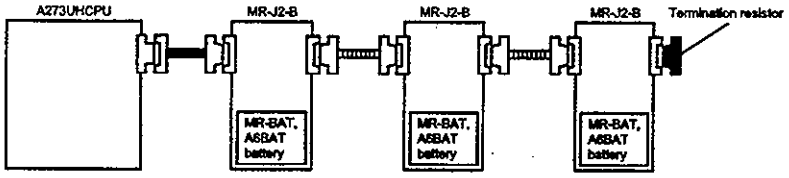
(2) MR-H-B Configuration



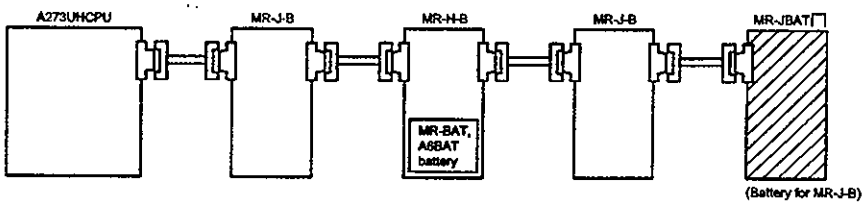
(3) MR-J-B Configuration



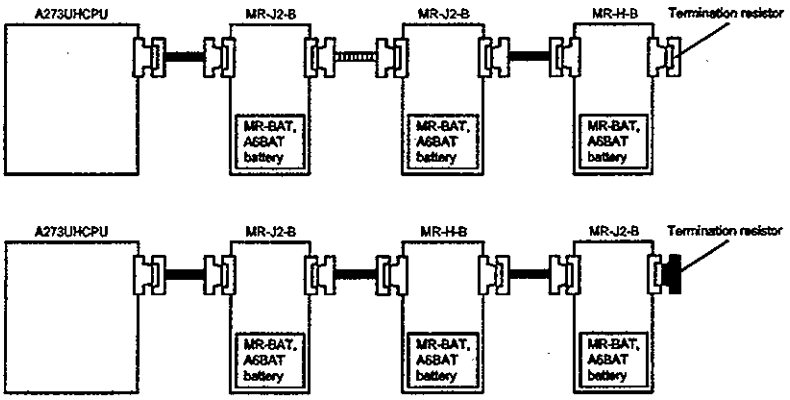
(4) MR-J2-B Configuration



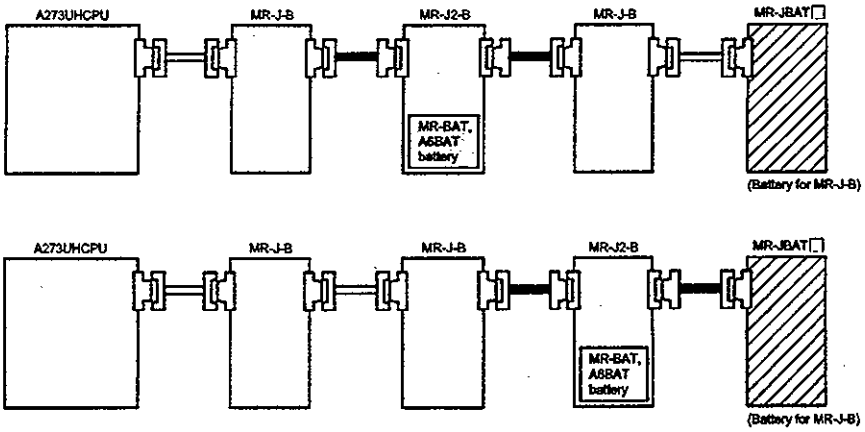
(5) MR-H-B and MR-J-B Configuration



(6) MR-J2-B and MR-H-B Configuration



(7) MR-J-B and MR-J2-B Configuration



2.9 Table of Equipment and Peripheral Devices in Servo System CPU Configuration

2.9.1 Servo system CPU component devices

Table 2.1 Servo System CPU Component Devices

Part Name		Model Name	Description
CPU	CPU module	A273UHCPU	• CPU without data link functions • Sequence memory capacity: 60 kstep (main: 30 kstep max., sub: 30 kstep max.) • I/O points for sequence control: 2048 • Positioning program memory capacity: 64 kbyte
Base units	Main base unit	A275B A278B	• To mount 5 modules • To mount 8 modules (for mounting control power supply) } For motion modules, I/O modules for MELSEC-A Series
	Motion extension base unit	A255B A268B	• To mount 5 modules (no control power supply required) • To mount 8 modules (for mounting control power supply) } For motion modules, I/O modules for MELSEC-A Series
	PC extension base unit	A62B A65B A68B	• To mount 2 modules • To mount 5 modules • To mount 8 modules (for mounting control power supply) } For motion modules, I/O modules for MELSEC-A Series
Memory	Memory cassette	A3NMCA-0	No IC RAM
		A3NMCA-2	RAM capacity: 16 kbyte
		A3NMCA-4	RAM capacity: 32 kbyte
		A3NMCA-8	RAM capacity: 64 kbyte
		A3NMCA-16	RAM capacity: 128 kbyte
		A3NMCA-24	RAM capacity: 192 kbyte
		A3NMCA-40	RAM capacity: 320 kbyte
		A3NMCA-56	RAM capacity: 448 kbyte
		A3NMCA-96	RAM capacity: 768 kbyte
	IC RAM memory	4KRAM	4 kstep, mounted in A3NMCA-0
	EPROM memory	4KROM	For 4 kstep memory cassette
		8KROM	For 8 kstep memory cassette
		16KROM	For 16 kstep memory cassette

POINTS

(1) The RAM capacity of the A3NMCA-16 memory cassette is 128 kbyte, but the capacity available for parameter settings is 96 kbyte. See Section 8.1.1 for details.

(2) The RAM capacity of the A3NMCA-24, 40, 56 and the A3AMCA-96 memory cassettes is 192, 320, 448, 768 kbyte, respectively, but the capacity available for parameter settings is 144 kbyte. See Section 8.1.1 for details.

Table 2.1 Servo System CPU Component Devices

Part Name		Model Name	Description
Power supply modules	Servo power supply	A230P	240 to 342 VDC, 30 A output
	Control power supply	A61P	Input: 100 VAC, output : 5 VDC, 8 A
		A62P	Input: 100 VAC, output : 5 VDC, 5 A 24 VDC, 0.8 A
		A63P	Input: 24 VDC, output : 5 VDC, 8 A
		A65P	Input: 100 VAC, output : 5 VDC, 2 A 24 VDC, 1.2 A } (used only with PC extension base unit)
Motion modules	AC motor drive module	A221AM-20	2-axis control with 100 W max. (HA-MH Series) or 200 W max. (HA-FH Series) servomotor (occupies 1 slot)
		A211AM-20	1-axis control with 600 W max. servomotor (occupies 1 slot)
		A222AM-20	2-axis control with 600 W max. servomotors (occupies 2 slots)
	Dynamic brake module	A240DY	For 4-axis dynamic braking
	Servo external signal module	A278LX	From external inputs (upper/lower limit, stop, near-zero point dog, speed/position switching), outputs dynamic brake commands and mechanical brake commands
	Manual pulse generator/ synchronous encoder interface module	A273EX	• Manual pulse generator and synchronous encoder interface with three inputs • Three tracking inputs
	Man-machine control module	A271DVP	DOS/V computer
Cables	Motion net cable	MR-HBUS□M	• Cable to connect A273UHCPU to MR-H-B/MR-J-B, and MR-H-B/MR-J-B to MR-H-B/MR-J-B • Cable length: 0.5 m (1.64 ft), 5 m (16.4 ft) (total length 30 m (98.4 ft) max.)
		MR-J2HBUS□M	• Cable to connect MR-J2-B to MR-J2-B • Cable length: 0.5 m (1.64 ft), 1 m (3.28 ft), 5 m (16.4 ft) (total length 30 m (98.4 ft) max.)
		MR-J2HBUS□M-A	• Cable to connect A273UHCPU to MR-J2-B, and MR-H-B/MR-J-B to MR-J2-B • Cable length: 0.5 m (1.64 ft), 1 m (3.28 ft), 5 m (16.4 ft) (total length 30 m (98.4 ft) max.)
	Encoder cable	MR-HCBL□M	• Cable to connect a HA-MH/FH Series servomotor to ADU/MR-H-B, MR-J-B • Cable length: 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft)
		MR-HSCBL□M	• Cable to connect a HA-SH/LH/UH series servomotor to a servo amplifier. • Cable length: 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft)
		MR-JCCBL□M-L	• Cable to connect a HC-MF/HA-FF Series servomotor to MR-J2-B (standard cable) • Cable length: 2 m (6.56 ft), 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft)
		MR-JCCBL□M-H	• Cable to connect a HC-MF/HA-FF Series servomotor to MR-J2-B (high bending-life cable) • Cable length: 2 m (6.56 ft), 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft)
		MR-JHSCBL□M-H	• Cable to connect a HC-SF Series servomotor to MR-J2-B (high bending-life cable) • Cable length: 2 m (6.56 ft), 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft)
	Motion extension cable	AC06B	Cable to connect main base unit to motion extension base unit (A255B/A268B): 0.6 m (1.97 ft)
		AC12B	Cable to connect main base unit to motion extension base unit (A255B/A268B): 1.2 m (3.94 ft)
		AC30B	Cable to connect main base unit to motion extension base unit (A255B/A268B): 3.0 m (9.84 ft)
	PC extension cable	A370C12B	Cable to connect A273UHCPU to PC extension base unit: 1.2 m (3.94 ft)
		A370C25B	Cable to connect A273UHCPU to PC extension base unit: 2.5 m (8.2 ft)
		AC06B	Cable to connect two PC extension base units: 0.6 m (1.97 ft)
		AC12B	Cable to connect two PC extension base units: 1.2 m (3.94 ft)
		AC30B	Cable to connect two PC extension base units: 3.0 m (9.84 ft)

Others	Battery unit	MR-JBAT4	Absolute-position back-up battery for 4 axes max.
		MR-JBAT8	Absolute-position back-up battery for 8 axes max.
	Battery unit connector cable	A270BATCBL A270BATCBLJ16 A270BATCBLJ32	Cable to connect the battery unit to the main base unit
	Regenerative resistor	MR-RB064	External regenerative resistor, 60 W, 13 Ω } Connect to A230P P and C terminals
		MR-RB10	External regenerative resistor, 100 W, 13 Ω
		ME-RB30	External regenerative resistor, 300 W, 13 Ω
	Termination resistor	MR-TM	MR-H-B/MR-J-B connector
		MR-A-TM	MR-J2-B connector

POINTS

(1) I/O modules for MELSEC-A series PCs can be mounted on the main base unit and motion extension base units.

(2) I/O modules for MELSEC-A series PCs and special function modules can be mounted on PC extension base units.

3. GENERAL SPECIFICATIONS

Specifications common to motion controllers are listed in the table below.

Item	Specification				
Operating ambient temperature	0 to 55℃				
Storage ambient temperature	−20 to −75℃				
Operating ambient humidity	10% to 90% RH, no condensation				
Storage ambient humidity	10% to 90% RH, no condensation				
Vibration resistance	Conforms to JIS C 0911 *2	Frequency	Acceleration	Amplitude	Sweep Count
		10 to 55 Hz	—	0.075 mm (0.003 inch)	10 (1 octave/minute) *1
		55 to 150 Hz	9.8 m/s^2 (1 g)		
Shock resistance	Conforms to JIS C 0912 (98 m/s^2 (10 g), 3 directions, 3 times)				
Noise resistance	Noise voltage: 1500 V p.p, noise amplitude: 1 μs, noise frequency: 25 to 60 Hz, with a noise simulator				
Withstand voltage	1500 VAC, one minute, between AC external terminals and ground 500 VAC, one minute, between DC external terminals and ground (24 VDC terminal) 1500 VAC, one minute, between DC external terminals and ground (across PN terminals)				
Insulation resistance	5 MΩ or larger by 500 VDC insulation resistance tester across AC external terminals and ground 500 VAC between all Class 3 grounding AC terminals and ground				
Grounding	Class 3 grounding				
Operating environment	No corrosive gas, low dust				
Cooling method	Forced cooling of servo power supply modules and AC motor drive modules. Other modules self-cooling.				

REMARKS

(1) *1 : One octave marked * indicates a change from the initial frequency to double or half frequency. For example, any of the changes from 10 Hz to 20 Hz, from 20 Hz to 40 Hz, from 40 Hz to 20 Hz, and 20 Hz to 10 Hz are referred to as one octave.

(2) *2 : JIS Japanese Industrial Standards

⚠ WARNING

⚠ Class 3 grounding should be used. The motion controller should not share a common ground with any other equipment. The ground terminal is located on the power supply module terminal block. See Section 5.6.

⚠ CAUTION

⚠ The motion controller must be stored and operated under the conditions listed in the table of specifications above.

⚠ Disconnect the power cables from the motion controller if it is to remain unused for a long period of time.

⚠ Insert a controller or servo amplifier into the static-proof vinyl bag for storage.

⚠ Consult the service center or service station before storing equipment for a long period of time.

4. CPU MODULE

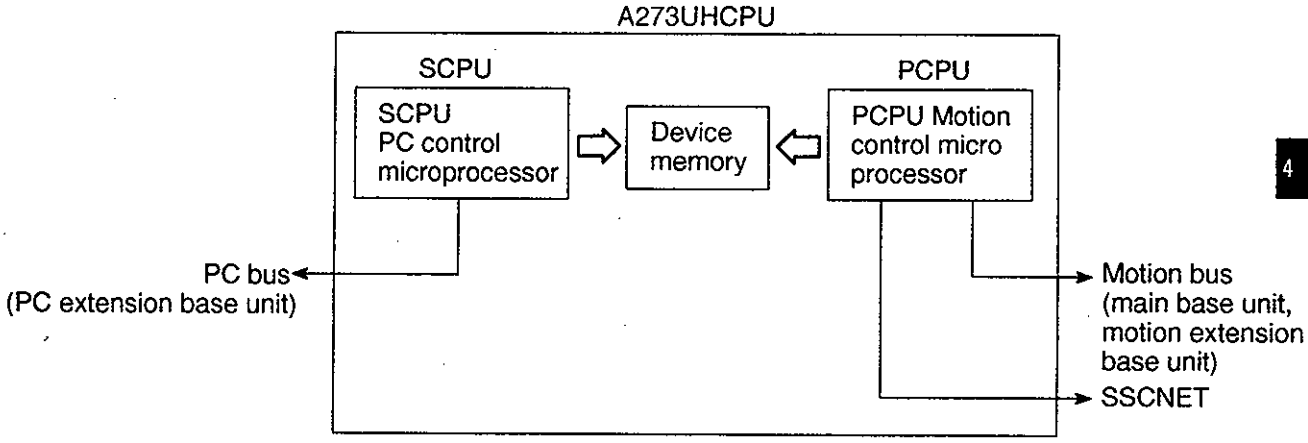
The servo system CPU contains a positioning-control CPU (PCPU) and sequence-control CPU (SCPU), for the following functions:

- PCPU ..... positioning control, home position return, monitoring servo control status
- SCPU ..... sequence control (equivalent to A3UCPU), running servo programs, enabling and disabling manual pulse generator operation, jog operation

This section describes servo system CPU performance, functions, descriptions and settings of parts, and I/O interface specifications.
Refer to the following manuals for details about servo system CPU performance and functions.

- PCPU performance and functions ..... Motion Controller Programming Manual
- SCPU performance and functions ..... ACPU Programming Manual (Fundamentals)

CPU Block Configuration Diagram



4.1 Performance

4.1.1 PCPU performance specifications

The PCPU performance specifications differ according to the model name of the OS installed in the servo system CPU. Refer to the Motion Controller Programming Manual for the OS installed in the servo system CPU.

4.1.2 SCPU performance specifications

The SCPU performance specifications are listed in Table 4.1.

Table 4.1 SCPU Performance Specifications

Item / Model Name		A273UHCPU			
		SV13		SV22	
		32-Axis Specification	8-Axis Specification	32-Axis Specification	8-Axis Specification
Control method		Repeated operation (using stored programs)			
I/O control method		Refresh method (partial direct I/O with instructions)			
Programming language		Sequence control dedicated language (relay symbol language, logic symbol language, MELSAP-II (SFC))			
Number of instructions (type)	Sequence instructions	22			
	Basic, application instructions	252			
	Dedicated instructions	204			
Processing speed (sequence instruction) (μsec/step)		0.15			
Number of I/O points		2048	1792	2048	1664
Number of I/O device points		8192	7936	8192	7808
Watchdog timer (WDT) (ms)		200			
Memory capacity		Capacity of mounted memory cassette (1024 Kbyte max.)			
Program capacity		Main sequence 30 k max.; sub-sequence 30 k max.			
Number of internal relay (M) points		6352	8144	4704	8128
Internal relay (M) designated positioning devices		M2000 - M3839	M2000 - M2047	M2000 - M5487	M1984 - M2047
Number of latch relay (L) points		1048 (L1000~2047)			
Number of step relay (S) points		0 (none at initial status)			
Number of link relay (B) points		8192 (B0 - 1FF)			
Timers (T)	Number of points	2048 (256 at initial status)			
	Specifications	100 ms timer : time setting 0.1 to 3276.7 s (T0 to T199) } 10 ms timer : time setting 0.01 to 327.67 s (T200 to T255) 100 ms timer : time setting 0.1 to 3276.7 s (none at initial status) Expansion timer : time setting by word devices (D, W, R) (T256 to T2047) } set with parameters			
Counter (C)	Number of points	1024 (256 at initial status)			
	Specifications	Normal counter : setting range 1 to 32767 (C0 to C255) Interrupt counter : can be set from C244 to C255 (none at initial status) Expansion counter : setting by word devices (D, W, R) (C256 to C1023) } set with parameters			
Number of data register (D) points		7392	7968	6632	7838
Data register (D) designated positioning devices		D0 - D799	D800 - D1023	D0 - D1559	D670 - D1023
Number of link register (W) points		8192 (W0 - 1FFF)			
Number of annunciator (F) points		2048 (F0 - 2047)			
Number of file register (R) points		8192 (R0 - 8191)			
Number of accumulator (A) points		2 (A0, A1)			
Number of index register (V, Z) points		14 (V, V1 - V6, Z, Z1 - Z6)			
Number of pointer (P) points		256 (P0 - 255)			
Number of interrupt pointer (I) points		32 (I0 - 31)			
Number of special-function relay (M) points		256 (M9000 - 9255)			
Number of special-function register (D) points		256 (D9000 - 9255)			
Comments (points)		4032 max. (set in 64-point units)			
Expansion comments (points)		3968 max. (set in 64-point units)			
Output mode selection at RUN after STOP		Select from: re-output of operating status at stop/output after operation started			
Self-diagnosis function		Watchdog error monitoring (watchdog timer 200 ms fixed) Error monitoring for memory, CPU, I/O, battery, etc.			
Operating mode on error occurrence		Select stop/continue			
Start at RUN		Initial start (auto-boot when CPU switch set to RUN at power on/recovery after power-failure)			
Latch (hold at power interruption) range		L1000 to L2047 (default) Latch range can be set for L, B, T, C, D, W.			
Remote RUN/PAUSE contacts		One RUN/PAUSE contact can be set from X0 to X1FFF			
Printer title registration		Yes. Up to 128 characters.			
Entry code registration		Yes.			
I/O allocation		Registration of number of occupied I/O points and module model name			
Step operation		Run/stop sequence program operation			
Interrupt processing		Interrupt program operation by interrupt or scheduled interrupt signal			
Data link		MELSECNET/10, MELSECNET(II)			
5 VDC Internal current consumption (A)		1.5			
External dimensions mm (inch)		250 (9.84)(H) X 79.5 (3.13)(W) X 134 (5.28)(D)			
Weight kg (lb)		1 (2.2)			

4.2 Tables of Functions

The following table lists the functions of the servo system CPU (PCPU, SCPU).

4.2.1 PCPU functions

The PCPU functions are summarized in Table 4.2.
Some of the functions in Table 4.2 may be unavailable, depending on the OS installed in the servo system CPU. Refer to the Motion Controller Programming Manual for the OS installed in the servo system CPU.

Table 4.2 Table of PCPU Functions

Function		Description
Positioning	Positioning	• Constant-speed positioning control (permits circular interpolation, linear interpolation) • Permits absolute data, incremental methods
	Fixed-pitch feed	• Permits unlimited repetition of positioning control through a set travel value.
	Speed control	• Permits control at the designated speed from a single start command until a stop command is input.
	Speed/position switching control	• Initially speed control after a single start command; position control by the set travel value after an external speed/position switching signal (CHANGE) is input. • During speed control, the set travel value can be changed and restarting is possible after a halt.
	Speed-switching Control	• After a single start command, positioning is executed while switching to the set speeds at the preset speed-switching points.
	Constant-speed Control	• After a single start command, positioning control is conducted using the designated positioning method (any random setting of circular and linear interpolation) at constant speed to the preset pass point. • Control repetition is possible using the repeat instructions (FOR/NEXT).
	Position Follow-up Control	• Positioning control to an address set with the designated word device. • The address can be changed during positioning.
High-speed Oscillation		• Positioning for reciprocating motion in a sinusoidal motion for a designated axis.
Jog Operation		• Jog operation is possible while the JOG start signal is ON. • Simultaneous start of jog operations is possible. A273UHCPU (8-axis specification) ... select forward/reverse for each of 8 axes max. A273UHCPU (32-axis specification) .. select forward/reverse for each of 32 axes max.
Manual pulse generator		• Positioning according to the number of pulses input from the manual pulse generator. • Manual pulse generator operation is possible for 3 axes max. independently or simultaneously.

Table 4.2 Table of PCPU Functions (Continued)

Function		Description
Home position return		• On the home position return start command, home position return is conducted and the home position address is updated to the present value of the actual stop position. • The home position return method can be selected from the near-zero point dog, count, or data set methods.
Simultaneous start		• Permits the simultaneous start of any three programs max. for positioning control, home position return, etc.
Control change	Speed change	• Permits speed change during positioning control or jog operation. Speed control is not permitted for circular interpolation control or during home position return.
	Travel value change	• During speed/position switching control, permits change of the set travel value for the positioning control conducted after input of the speed/position switching signal (CHANGE) during speed control.
	Present value change	• Permits change of the present address during a stop.
M code		• Permits output of the M codes (0 to 255) for positioning control. • M codes can be set for each speed-switching point for speed-switching control. • M codes can be set for each pass point for constant-speed control.
Backlash compensation function		• Permits compensation for backlash each time operation starts. • The backlash compensation amount is set from a peripheral device.
Electronic gear		• Permits error compensation between command values and actual travel values. • Valid for all operations.
Torque Limit Function		• The torque limit value for all positioning and jog operations can be set by a servo program (between 0% and 300%).
Limit switch output		• Limit switch outputs are possible at certain actual present value addresses, according to preset data. • Ten ON/OFF switching points max. can be set per axis. • Eight output points are permitted per axis. • Output permitted to a MELSEC-A Series AY42 output module.
Test mode operation		• Peripheral device test mode permits teaching and starting of operations. • Addresses taught during jog or manual pulse generator operation can be written to a designated servo program. • Test mode permitted during PC RUN and STOP statuses.
Absolute position detection		• Compatibility with absolute-position systems by using servomotors with absolute position detectors.
Feed forward control		• The feed forward gain value can be set in the servo parameters to improve the servo follow-up.
S-curve acceleration/deceleration		Permits setting of acceleration and deceleration curves using a sine curve.

4.2.2 SCPU functions

Table 4.3 Table of SCPU Functions

Function	Description
Constant scan	• Sets a constant time for one scan of a sequence program. • Set the scan time in 10 ms increments between 10 ms and 190 ms.
Latch (status retention at power interruption)	• The contents of devices set as latch devices are held when a power interruption over 20 ms or CPU reset occurs, and when the power is turned off. • Devices L, B, T, C, D, W can be set as latch devices. • Latch data is stored in the CPU and is backed up by the memory cassette battery.
MELSECNET/MINI-S3 automatic refresh	• Conducts automatic I/O refresh communications with the batch refresh communications areas in a maximum of eight AJ71PT32-S3s. • Automatic refresh is conducted after the end processing. • Programming with direct device allocations eliminates FROM and TO instructions for I/Os in sequence programs.
Remote RUN/STOP	• Conducts remote STOP/RUN PC control from external inputs, peripheral devices, and computers when the servo system CPU switch is set to RUN (keyswitch: RUN).
PAUSE	• Stops the servo system CPU operation and holds the output (Y) ON/OFF statuses. (All outputs (Y) turn OFF if operation is stopped using STOP.) • Conducts remote PAUSE/RUN control of the servo system CPU from external inputs and peripheral devices when the servo system CPU switch is set to RUN (keyswitch: RUN).
Status latch	• The contents of devices set as status latch devices are written to the status latch extension file registers in the memory cassette when the status latch conditions are met. (Stored data can be cleared by the latch clear operation.) • The status latch conditions can be selected as execution by SLT instruction in a sequence program or execution when values match in set condition devices.
Sampling trace	• The device operating status of the devices set as sampling trace devices is sampled the number of times set per scan or per unit time, and the results are stored in the sampling trace extension file registers in the memory cassette. (Stored data can be cleared by the latch clear operation.) • The sampling trace is started by the sequence program STRA instruction.

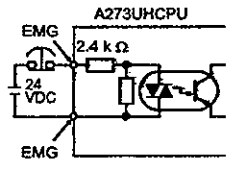
Table 4.3 Table of SCPU Functions (Continued)

Function	Description
Step operation	• Runs a sequence program according to setting (1) to (5) below and then stops operation. (1) Execute one instruction (2) Execute one ladder block (3) Execute according to time between steps and loop rotations (4) Execute according to loop rotations and brake points (5) Execute when device values match
Clock	• Executes the servo system CPU built-in clock operations. • Clock data... year, month, day, hour, minute, second, day of week • If the clock data read request signal (M9028) is ON, the clock data elements are read and stored in D9025 to D9028 after the PC operation end processing. • The clock data is backed up by the memory cassette battery.
I/O module replacement while on-line	• I/O modules can be removed or mounted during servo system CPU operation without causing an error. Special function modules cannot be removed or mounted while on-line.
Indicator order of priority	• With the exception of fatal error displays, the display order for the default display items displayed by the LED ERROR indicators and LED display can be changed or cancelled. Only the order of errors displayed by the SCPU can be changed.
Self-diagnosis function	• To prevent malfunctioning, CPU operation is stopped and an error is displayed if an error related to a self-diagnosis item occurs when the CPU power is turned on or during RUN operation. • An error code corresponding to the self-diagnosis item is stored. • The error message is displayed on the indicators on the servo system CPU front panel.

4.2.3 Emergency stop input terminal specifications

The emergency stop input terminal specifications are listed in Table. 4.4.

Table 4.4 Table of Emergency Stop Input Terminal Specifications

Item	Specifications	Wiring Example
Supply voltage	4.75 VDC to 26.4 VDC	
ON voltage/current (emergency stop cancel) OFF voltage/current (emergency stop)	3.5 V min. 1.2 mA min. 1.5 V max. 0.3 mA max.	
Response time	OFF to ON 1 ms max. ON to OFF 2 ms max.	

4.3 Handling

This section describes handling precautions between opening the packaging and installation, and describes the names and settings of parts.

4.3.1 Handling precautions

This section describes handling precautions between opening the packaging and installation.

(1) Ensure the tightening torques of the module mounting screws and emergency stop input terminals are within the following ranges.

Screw Name		Tightening Torque Range N·cm (kg·cm) [lb·inch]
Module mounting screw	(M4)	78 - 118 (8 - 12) [6.93 - 10.48]
Emergency stop input terminal screw	(M4)	98 - 137 (10 - 14) [8.66 - 12.12]

(2) When mounting a module on a base unit, push it fully in place until the hook engages in the base unit. To remove a module, push the hook to fully release it from the base unit before pulling out the module. See Section 9.5 for details.

⚠ CAUTION

⚠ The CPU module casing, memory casette, terminal connectors, and pin connectors are made of resin. Take care not to drop the module or subject it to severe shock.

⚠ Do not remove the printed circuit boards from the module casing. This will cause faults.

⚠ Ensure no wiring waste or other foreign matter enters the top of the module.
Remove any foreign matter that does enter the module.

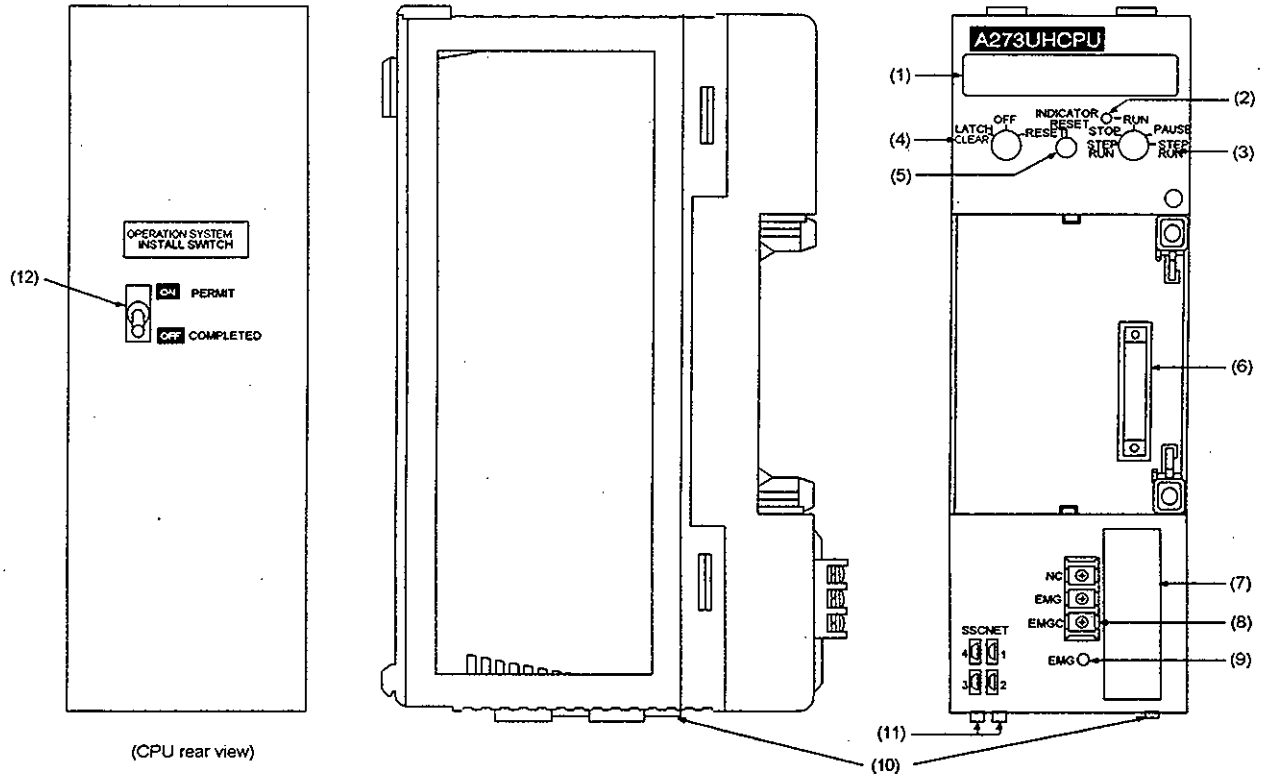
⚠ Ensure that module mounting screws and emergency stop terminal screws are tightened within the prescribed torque ranges.

⚠ When mounting a module on a base unit, push it fully in place until the hook engages with the base unit.
To remove a module, push the hook to fully release it from the base unit before pulling out the module.
See Section 9.5 for details.

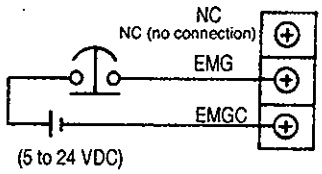
4.3.2 Names and settings of parts

The names and settings of unit parts are described below.

(1) Names of parts



No.	Name	Application
1	LED display	16-character display. Displays comments for self-diagnosis errors, and comments generated with OUT F, and SET F.
2	RUN indicator	Indicates the CPU operating status. Lit: Operating with key switch set to RUN or STEP RUN. Not lit: Stopped with key switch set to STOP, PAUSE or STEP RUN. Flashing: Self-diagnosis function detected an error. (If parameter for operating mode on error occurrence is set to stop.)
3	RUN/STOP key switch	RUN/STOP: Starts or stops sequence program execution. PAUSE: Stops the sequence program execution and holds the output ON/OFF statuses. STEP RUN: Step execution of the sequence program.
4	Reset key switch	RESET: H/W reset, operation error reset, and initialization. LATCH CLEAR: Sets all data in the latch areas specified by parameters to OFF or 0. Only valid when RUN/STOP key switch is set to STOP.
5	Indicator reset switch	Clears the current indictor display and displays the next data, if any.

No.	Name	Application
6	Memory cassette connector	Connector to connect memory cassette to CPU.
7	RS-422 connector	Connector to connect a peripheral device. Normally covered by a cover.
8	Emergency stop input terminals (5 VDC to 24 VDC)	Terminals for emergency stop signal input. 
9	Emergency stop indicator	Lights during an emergency stop.
10	Extension base connector	Connector to connect PC extension base unit.
11	Motion network connector	Connector to connect to the servo amplifier serial bus (for MR-H-B, MR-J-B, MR-J2-B). Four connectors, each can be connected to eight servo amplifiers. Maximum total cable length is 30 m (98.43 ft) per connector.
12	Install switch	Switch used to install a new OS from a peripheral device. ON: Turn ON to install a new OS. OFF: Turn OFF for normal CPU operation. See the operating manual for each motion controller software package for details about the installation procedure.

4.3.3 Precautions regarding memory cassette selection

To use software cams with the SV22 OS software mechanical support language, select memory cassette A3NMCA-24 or higher specification to allow storage of software cam data in the extension registers.

5. MOTION MODULES

Motion modules are the following modules, which are required for positioning control by the servo system CPU.

Item	Model Name	Function	No. of Permitted Modules/Axes	
			A273UHCPU (32-axis Specification)	A273UHCPU (8-axis Specification)
AC motor drive module	A2□□AM-20	• Module to connect to servomotors. • Can drive servomotors up to 600 W capacity.	16 axes	8 axes
Dynamic brake module	A240DY	• Module to rapidly stop servo motors at power interruption or emergency stop. • Connected to servomotors.	Required number of modules (can be separately located)	
Servo external signal module	A278LX	• Inputs external signals required for positioning control (upper/lower limit, stop signals) and outputs dynamic brake commands and mechanical brake commands	4	1
Manual pulse generator/synchronous encoder interface module	A273EX	• Receives manual pulse generator, synchronous encoder, and tracking inputs.	4	1
Servo power supply module	A230P	• Supplies power to AC motor drive modules and conducts emergency stops.	4	1
Battery unit	MR-JBAT□	• A battery unit is required if a servomotor with absolute position detector is connected to an AC motor drive module or if a synchronous encoder is connected to the manual pulse generator/synchronous encoder module.		

5. MOTION MODULES

5.1 Handling Precautions

This section describes handling precautions between opening the packaging and installation.

(1) Ensure the tightening torques of the module mounting screws and emergency stop input terminals are within the following ranges.

Screw Name		Tightening Torque Range N·cm (kg·cm) [lb·inch]
Module mounting screw	(M4)	118 - 157 (12 - 16) [10.48 - 13.9]
Emergency stop input terminal screw	(M4)	78 - 118 (8 - 12) [6.93 - 10.48]

(2) When mounting a module on a base, equally tighten the upper and lower mounting screws to a torque within the prescribed tightening range.
To remove a module, fully release the module mounting screws before pulling out the module. See Section 9.5 for details.

⚠ CAUTION

⚠ Module casings, terminal connectors, and pin connectors are made of resin. Take care not to drop modules or subject them to severe shock.

⚠ Do not remove the printed circuit boards from the module casing. This will cause faults.

⚠ Ensure no wiring waste or other foreign matter enters the top of the module.
Remove any foreign matter that does enter the module.

⚠ When mounting a module on a base unit, equally tighten the upper and lower mounting screws to a torque within the prescribed tightening range.
To remove a module, fully release the module mounting screws before pulling out the module. See Section 9.5 for details.

5.2 AC Motor Drive Modules

An A2□□AM-20 AC motor drive module can drive one or two servomotors.
The following servomotors can be connected: HA-MH, HA-FH, HA-SH, HA-LH, HA-UH.
Select the ADU (AC motor drive module) to match the servomotor capacity.

This section describes ADU specifications, names of parts, and wiring methods.

5.2.1 Specifications

The ADU specifications are shown in Table 5.1.

Table 5.1 Table of ADU Specifications

Model Name	A221AM-20	A211AM-20	A222AM-20
No. of controlled axes/modules	2	1	2
No. of I/O slots occupied	1	1	2
Max. motor capacity	200 W (50 - 200 W)	600 W (50 - 600 W)	600 W (50 - 600 W)
Rated output current (per axis)	2 A	4 A	
Max. output current (per axis)	6 A	12 A	
Applicable motors	HA-MH/HA-FH/ SH/ LH/ UH Series		
Amplifier unit power supply	300 VDC supplied by A230P servo power supply module through external wiring. Control power supply (5 VDC) supplied via base unit.		
Cooling method	Forced cooling by ADU internal fan		
5 VDC internal current consumption (A)	0.6 A		
Weight kg (lb)	0.9 (1.98)	0.8 (1.76)	1.1 (2.42)
External dimensions mm (inch)	250 (9.84) (H) × 3.75 (1.48) (W) × 136 (5.35) (D)		250 (9.84) (H) × 75.5 (2.97) (W) × 136 (5.35) (D)

POINTS

(1) If A211AM-20 or A222AM-20 is used, match the motor power wiring terminals and encoder cable connector positions to the numbers on the module.

(2) See Appendix 2 for combinations of AC motor drive modules and servomotors.

⚠ CAUTION

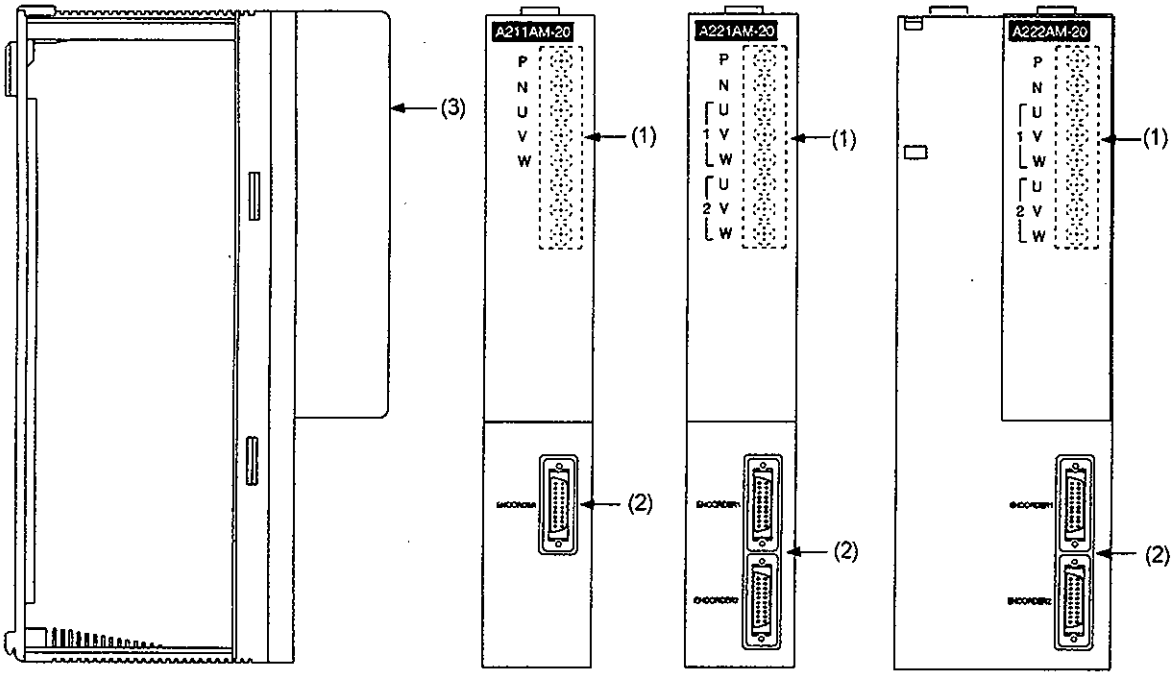
⚠ Make sure parameter settings are correct. Incorrect settings can cause destruction of, or damage to, the system and injury to personnel.

⚠ Correctly connect the wiring to an A211AM-20 or A222AM-20 module. Incorrect wiring connections can cause destruction of, or damage to, the system and injury to personnel.

⚠ Choose correct combinations of AC motor drive module and servomotor. Incorrect combinations can cause destruction of, or damage to, the system and injury to personnel.

⚠ The permitted speed of the absolute position encoder at power failure is 500 rpm. To prevent positional displacements, the home position return operation must be carried out if the power failure occurred when the servomotor axis speed exceeded 500 rpm due to external loads.

5.2.2 Names of parts



No.	Name	Application
1	Terminal block	U, V, W: servomotor connector terminals P, N: connect to A230P servo power supply module P, N terminals
2	Encoder connector	Incremental encoder ..... MR-H-compatible RS-422 serial interface Absolute-data encoder ... • MR-H-compatible RS-422 serial interface • Battery power supplied from the base unit battery connector via the base unit and ADU. Encoder power supply ... 5 VDC supplied from ADU
3	Terminal block cover	Terminal block protective cover Attach this cover for safety after connecting wiring to P, N, U, V, W.

5.2.3 Wiring

This section describes how to connect servomotors to an ADU and outlines precautions for servomotor control.

(1) Connect the encoder cable of a servomotor connected to the output terminals (U, V, W) of an ADU to the appropriate encoder connector on the same ADU.

(2) Complete all wiring before supplying power to the module.

(3) Refer to the diagram on the following page for details of wiring connections.

⚠ WARNING

⚠ To avoid electric shocks, turn off the power, wait at least ten minutes, then check the voltage with a tester before starting wiring or inspections.

⚠ CAUTION

⚠ The U, V, W phases of the ADU output terminals must match the phases of the servomotor input terminals.

⚠ Do not connect wiring to the module while power is turned on.

⚠ For safety, attach the supplied terminal cover after wiring is complete.

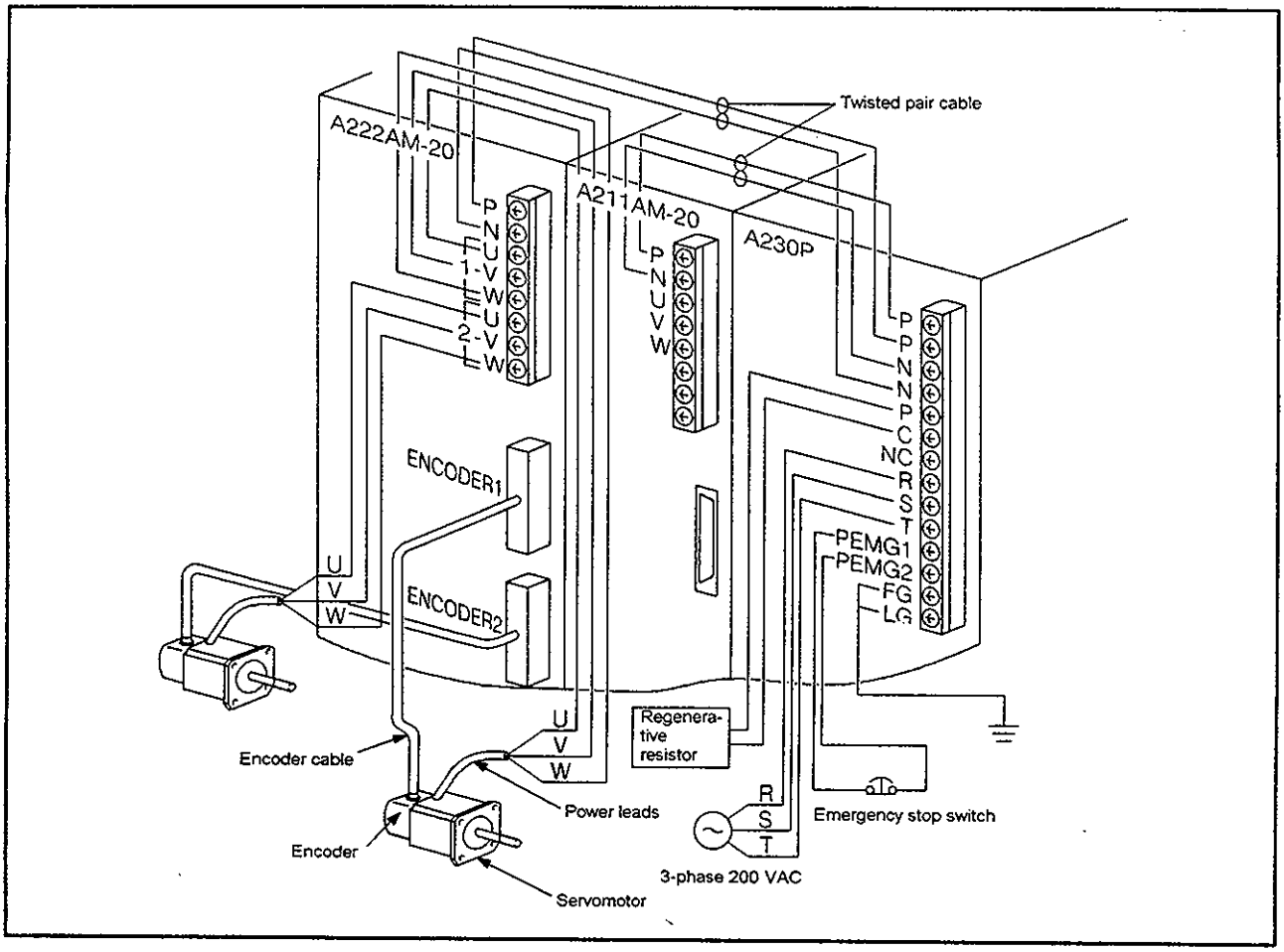
⚠ Ensure all wires are connected correctly. When wiring is complete, re-check that all connections are correct and terminal screws are fully tightened. Incorrect wiring connections can cause servomotors to run out of control.

⚠ Do not directly connect the commercial power supply to a servomotor. This can damage the servomotor.

⚠ Ensure that cable connector locking screws and locking mechanisms are fully tightened. The cable may become disconnected during operation if not fully locked.

⚠ Do not bundle power cables with other cables.

⚠ When using a A273UHCPU (32-axis specification), do not connect 300 VDC (P, N) cables with different system numbers (set at system set-up). This can cause damage or malfunction of the system.


Twisted pair cable
A222AM-20
A211AM-20
A230P
P
N
U
1-V
W
U
2-V
W
P
N
U
V
W
P
P
N
N
P
C
NC
R
S
T
PEMG1
PEMG2
FG
LG
ENCODER1
ENCODER2
U
V
W
U
V
W
Regenera-
tive
resistor
Encoder cable
Power leads
Encoder
Servomotor
R
S
T
3-phase 200 VAC
Emergency stop switch

5.3 Dynamic Brake Module

The A240DY dynamic brake module (hereafter referred to as "A240DY") rapidly stops a servomotor connected to an ADU in the event of a power interruption or emergency stop.
This section describes A240DY specifications, names of parts, and wiring methods.

5.3.1 Specifications

The A240DY specifications are shown in Table 5.2.

Table 5.2 Table of A240DY Specifications

Item	Specification
Number of controlled motors (axes)	4 axes (U, V, W for each axis)
Power supply	External power supply (24 VDC, 190 mA)
Operation commands	Connected to A278LX dynamic output
Operation	Applies dynamic braking simultaneously to all axes
Applicable motors	Any motor which can be driven by ADU
External dimensions mm (inch)	250 (9.84) (H) × 37.5 (1.48) (W) × 136 (5.35) (D)
Weight kg (lb)	0.9 (1.98)

⚠ CAUTION

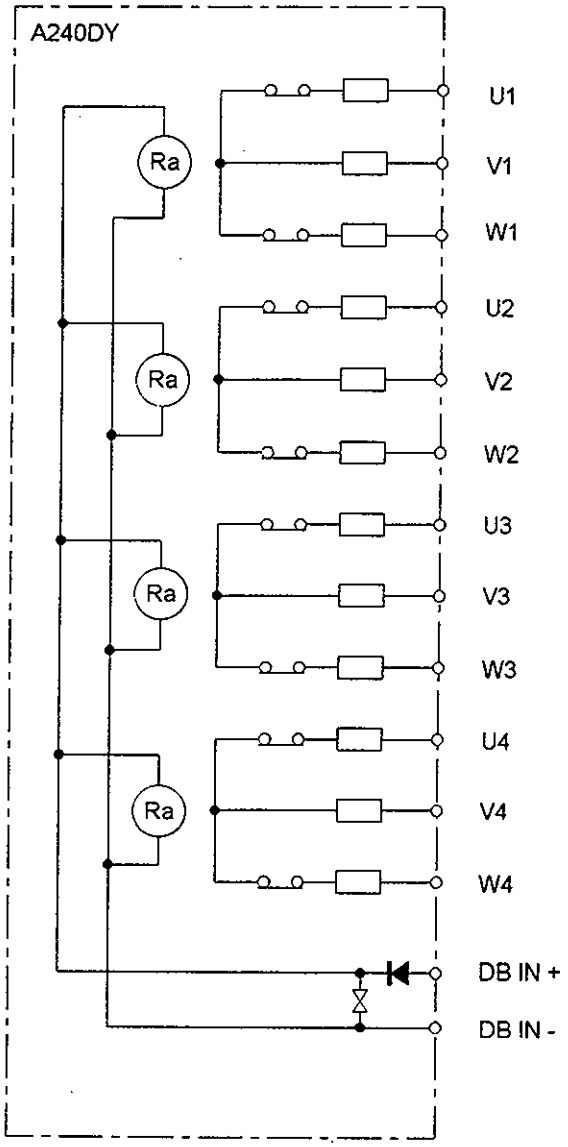
⚠ Use servomotors with a capacity of 600 W max. with the A240DY. It is not suitable for servomotors over 600 W capacity.

⚠ Use the dynamic brake module to stop servomotors when an emergency error or other error occurs to turn off the servomotors. Do not use it to stop the servomotors during normal operation as this will dramatically reduce the life of the module.

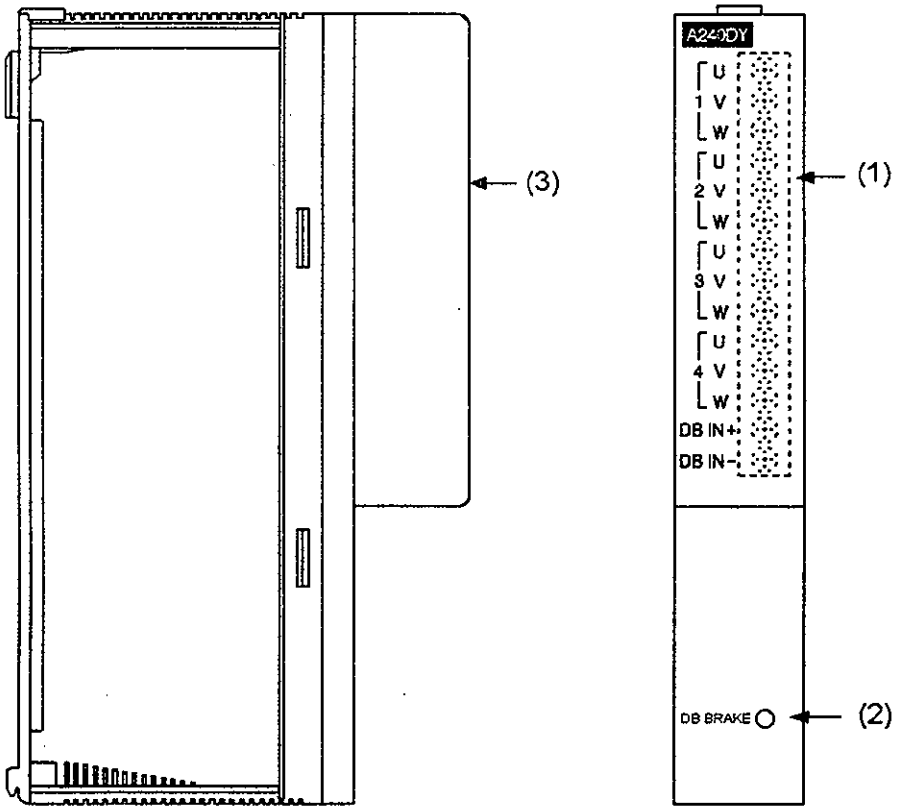
POINT

(1) See Appendix 3 for information on the dynamic brake characteristics.

A block diagram of the A240DY is shown below.



5.3.2 Names of parts



No.	Name	Application
1	Terminal block	U, V, W: Servomotor connector terminals (300 VDC) DB IN +: DB IN −:) Connect to A278LX DBOUT/DBCOM
2	DB BRAKE indicator	Off: Dynamic brake on Dynamic braking is applied to all axes due to an emergency stop input. Lit: Dynamic brake off
3	Terminal block cover	Terminal block protective cover Attach this cover for safety after connecting U, V, W, DB IN +, DB IN − wiring.

5.3.3 Wiring

(1) Connection to ADU

This section explains how to connect A240DY to servomotors and describes important points to ensure optimum A240DY performance and increase system reliability.

(a) Complete all wiring before supplying power to the module.

(b) Refer to the diagram on the following page for details of wiring connections.

⚠ WARNING

⚠ To avoid electric shocks, turn off the power, wait at least ten minutes, then check the voltage with a tester before starting wiring or inspections.

⚠ CAUTION

⚠ The U, V, W phases of the ADU and A240DY output terminals must match the phases of the servomotor input terminals.

⚠ Do not connect wiring to the module while power is turned on.

⚠ For safety, attach the supplied terminal cover after wiring is complete.

⚠ Connect the DBOUT on A278LX to the A240DY.

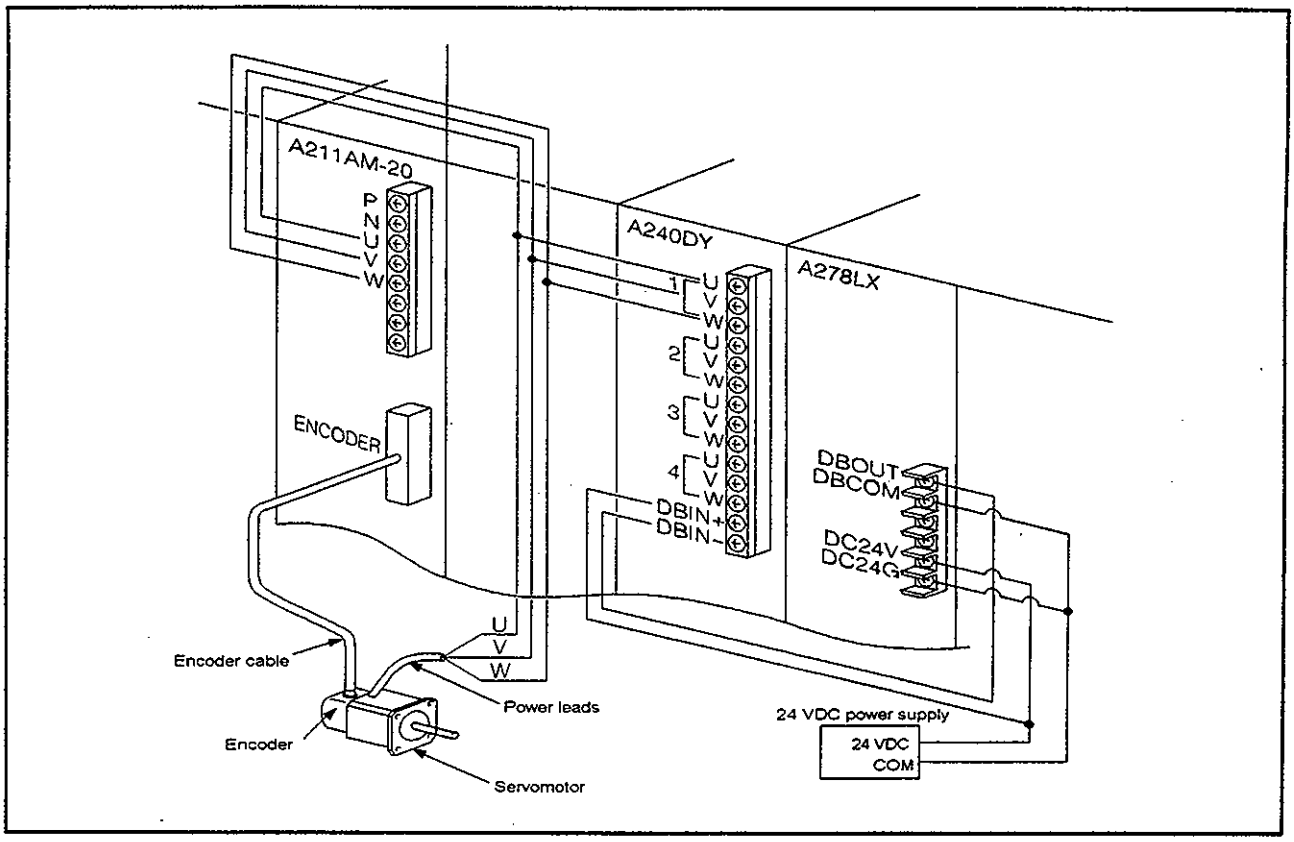
⚠ To use dynamic braking, use system set-up to set dynamic braking ON before establishing the servo ON status. Incorrect settings can damage the module.

⚠ Ensure all wires are connected correctly. When wiring is complete, re-check that all connections are correct and terminal screws are fully tightened. Incorrect wiring connections can cause servomotors to run out of control.

⚠ Do not directly connect the commercial power supply to a servomotor. This can damage the servomotor.

⚠ Ensure that cable connector locking screws and locking mechanisms are fully tightened. The cable may become disconnected during operation if not fully locked.

⚠ Do not bundle power cables with other cables.


A211AM-20
P
N
U
V
W
ENCODER
A240DY
A278LX
1
2
3
4
U
V
W
DBIN+
DBIN-
DBOUT
DBCOM
DC24V
DC24G
Encoder cable
Encoder
Power leads
Servomotor
24 VDC power supply
24 VDC
COM

5.4 Servo External Signal Module

The A278LX servo external signal module (hereafter referred to as "A278LX") inputs the external signals listed below required for positioning control and outputs dynamic brake commands and electromagnetic brake commands.

- Upper limit switch (FLS)
- Lower limit switch (RLS)
- Stop signal (STOP)
- Near-zero point dog (DOG)
- Speed/position switching signal (CHANGE)

This section describes A278LX specifications, names of parts, and wiring methods.

5.4.1 Specifications

The A278LX specifications and connector pin allocations are described here.

(1) Specifications

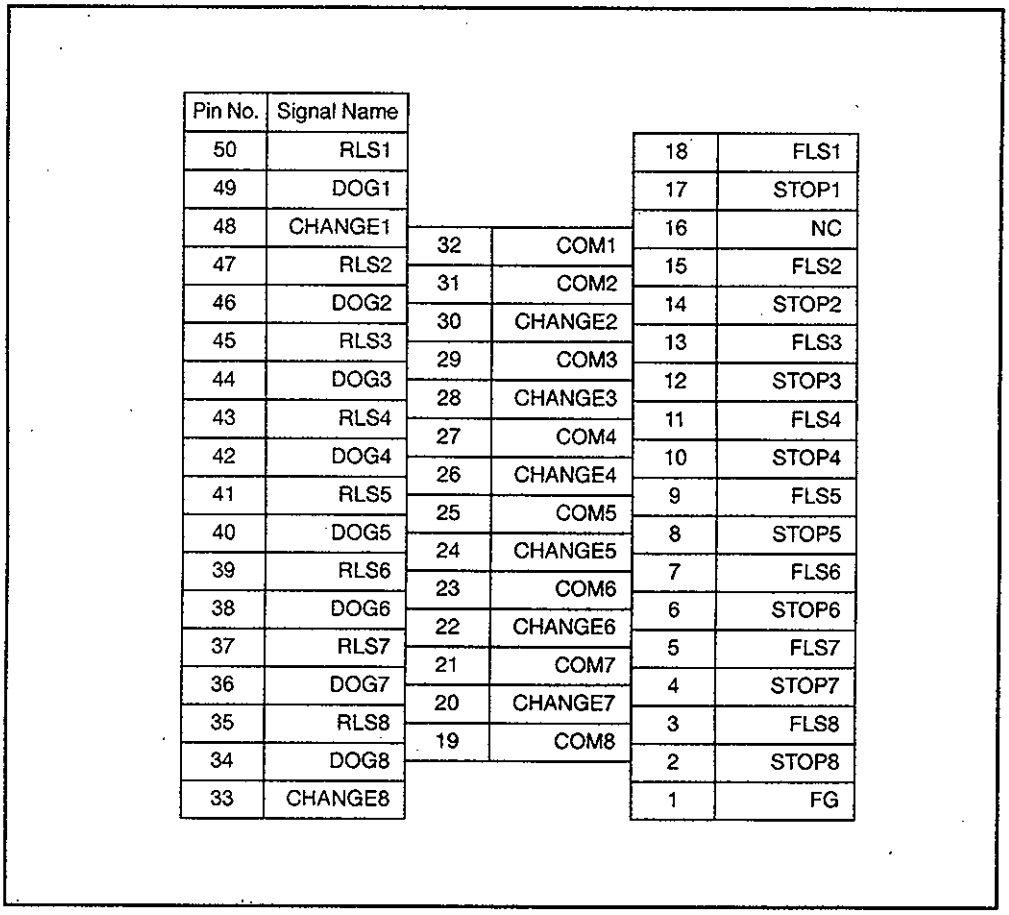
The specifications of the A278LX are shown in Table 5.3 below.

Table 5.3 Table of A278LX Specifications

Item		Specification
Upper limit switch Lower limit switch STOP input Near-zero point dog Speed/position switching signal	No. of inputs	8 points each (for 8 axes)
	Supply voltage	4.75 VDC to 26.4 VDC
	ON voltage/current	3.5 V min. 1.2 mA min.
	OFF voltage/current	1.5 V max. 0.3 mA max.
	Response time	OFF to ON 1 ms max. ON to OFF 2 ms max.
24 VDC supply detect input (doubles as supply to electromagnetic and dynamic brake command output relays)	No. of inputs	1 point each
	Supply voltage	20.4 VDC to 28.8 VDC
	ON voltage/current	20.4 min. 1.2 mA min.
	OFF voltage/current	13.5 V max. 0.3 mA max.
	Response time	OFF to ON 10 ms max. ON to OFF 20 ms max.
Dynamic brake/electromagnetic brake command outputs	Number of outputs	1 point each
	Output type	Relay output (with varistor)
	Isolation method	Photocoupler
	Rated load voltage	24 VDC
	Max. load current (per point)	2 A
	Response time	OFF to ON 10 ms max. ON to OFF 20 ms max.
External dimensions mm (inch)		250 (9.84) (H)×37.5 (1.48) (W)×119 (4.69) (D)
Weight kg (lb)		0.4 (0.88)
5 VDC internal current consumption (A)		0.1

(2) Connector pin allocations (CTRL connector)

(a) The pin allocation looking at the A278LX from the front is shown in Fig. 5.1.



Pin No.	Signal Name
50	RLS1
49	DOG1
48	CHANGE1
47	RLS2
46	DOG2
45	RLS3
44	DOG3
43	RLS4
42	DOG4
41	RLS5
40	DOG5
39	RLS6
38	DOG6
37	RLS7
36	DOG7
35	RLS8
34	DOG8
33	CHANGE8

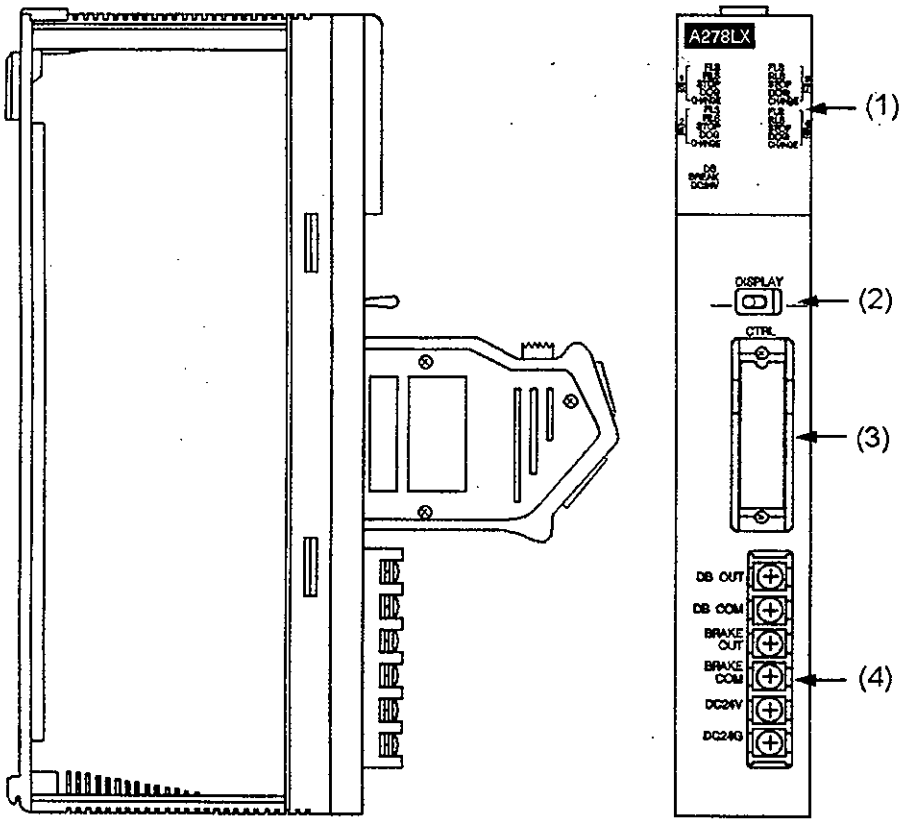
32	COM1
31	COM2
30	CHANGE2
29	COM3
28	CHANGE3
27	COM4
26	CHANGE4
25	COM5
24	CHANGE5
23	COM6
22	CHANGE6
21	COM7
20	CHANGE7
19	COM8

18	FLS1
17	STOP1
16	NC
15	FLS2
14	STOP2
13	FLS3
12	STOP3
11	FLS4
10	STOP4
9	FLS5
8	STOP5
7	FLS6
6	STOP6
5	FLS7
4	STOP7
3	FLS8
2	STOP8
1	FG

Fig. 5.1 CTRL Connector Pin Allocation

(b) Applicable connector ..... MR-50NS9MG, manufactured by Honda Communications Industries.
Standard accessory.

5.4.2 Names of parts

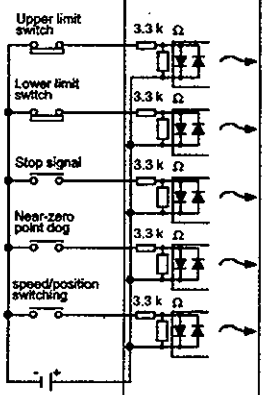


No.	Name	Application
1	Indicators	Display the input status from external equipment and errors detected by the self-diagnosis function. FLS 1 to 8 : Displays upper limit input RLS 1 to 8 : Displays lower limit input STOP 1 to 8 : Displays STOP signal input DOG 1 to 8 : Displays near-zero point dog input CHANGE 1 to 8 : Displays CHANGE signal input DB : Displays dynamic brake command output BRAKE : Displays electromagnetic brake command output DC24V : Displays 24 VDC power supply
2	Display selector switch	Selects display of the input statuses of signal 1 to 4 or signal 5 to 8 from external equipment. H-HALF : Signal 5 to 8 L-HALF : Signal 1 to 4
3	CTRL connector	Input connectors for FLS, RLS, STOP, DOG, CHANGE signals.
4	Control terminal block	Terminal block for dynamic brake and electromagnetic brake command outputs and 24 VDC input. See Section 5.4.4. DB OUT, DB COM) Dynamic brake command output BRAKE OUT, BRAKE COM) Electromagnetic brake command output DV24V, DC24G) 24 VDC input

5.4.3 Interface with external equipment (CTRL connector)

The interface between A278LX and external equipment is shown in Table 5.4.

Table 5.4 Interface between A278LX and External Equipment

Input or Output	Signal Name	Pin Number CTRL Connector Signal 1	Signal 2	Signal 3	Signal 4	Signal 5	Signal 6	Signal 7	Signal 8	Wiring Example	Internal Circuit	Specification	Description
Input	Upper limit switch (FLS)	18	15	13	11	9	7	5	3			• Supply voltage Use 5 VDC to 24 VDC, 4.75 VDC to 26.4 VDC stabilized power supplies. • HIGH level 3.5 V DC min. 1.2 mA min. • LOW level 1.5 V DC max. 0.3 mA max.	Stroke upper limit detected signal
	Lower limit switch (RLS)	50	47	45	43	41	39	37	35				Stroke lower limit detected signal
	Stop signal (STOP)	17	14	12	10	8	6	4	2				External stop signal for speed control and position control
	Near-zero point dog (DOG)	49	46	44	42	40	38	36	34				Near-point dog detected during home position return
	Speed/ position switching signal (CHANGE)	48	30	28	26	24	22	20	33				Signal to switch from speed control to position control during speed/position switching control
	Power supply	32	31	29	27	25	23	21	19				Common terminal for FLS, RLS, STP, DOG, CHANGE

(1) Wiring precautions

This section explains how to connect A278LX to external equipment and describes important points to ensure optimum A278LX performance and increase system reliability.

(a) Applicable connector

CTRL end ... MR-50NS9MG, manufactured by Honda Communications Industries. Standard accessory.

⚠ CAUTION

⚠ Connect the A278LX to external equipment using a shielded cable. To reduce electromagnetic interference, do not position the cable close to, or bundle it with, power or main circuit cables. A clearance of at least 200 mm (0.66 inch) to other cables is required.

⚠ Connect the shield wire of the shielded cable to the FG terminal of the external equipment.

⚠ Make sure parameter settings are correct. Incorrect settings can cause the malfunction of stroke-limit and other protective functions of the module, lack of brake output, and damage to the module.

POINTS

(1) Using A273UHCPU (8-axis specification)
Signals 1 to 8 are allocated to axes 1 to 8 by the system settings.
Each signal can be individually set as used or not used.

(2) Using A273UHCPU (32-axis specification)
Signals 1 to 8 from 4 modules max. are allocated to axes 1 to 32 by the system settings.
Each signal can be individually set as used or not used.

(2) Connecting cables to connectors

This section describes how to connect cables to connectors.

Connect cable

- Disassemble the connector plug
  (1) Loosen and remove bolts.
  (2) Open the cover.

- - - - • Take care not to lose the nuts and bolts when disassembling the connector.

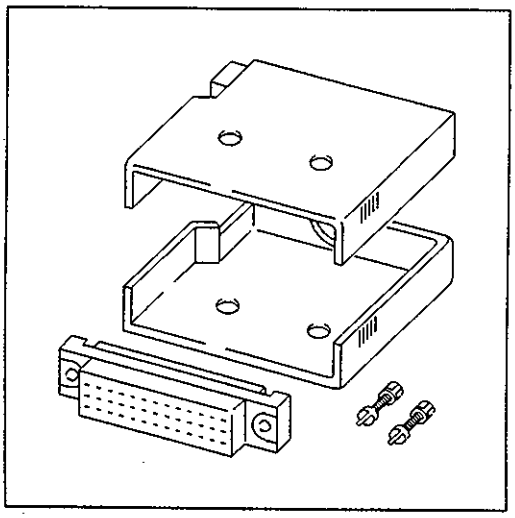
- Connect the wires
  (1) Use 0.3 mm^2 max. wires. Thicker wires will not pass through the cable clamp.
  (2) Check the pin allocation and solder the wires into position.

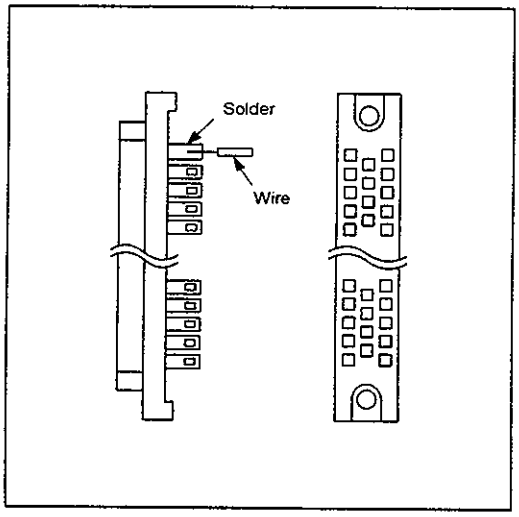
- - - - • The pin allocation differs for each connector plug. Carefully check the pin number allocation of the connector.
• During soldering, ensure that no terminals are shorted by bare wires or solder bridges. Use insulating tubes to avoid short circuits.

- Assemble the connector plug
  (1) Bundle the wires and pass them through the cable clamp.
  (2) Insert the fixing bolts in the connector unit and attach one half of the cover to it.
  (3) Attach the other half of the cover.
  (4) Tighten the bolts.

- - - - • If the number of wires is too small to be clamped by the cable clamp, put a tube round the wires so that the cable clamp can clamp them effectively.

End



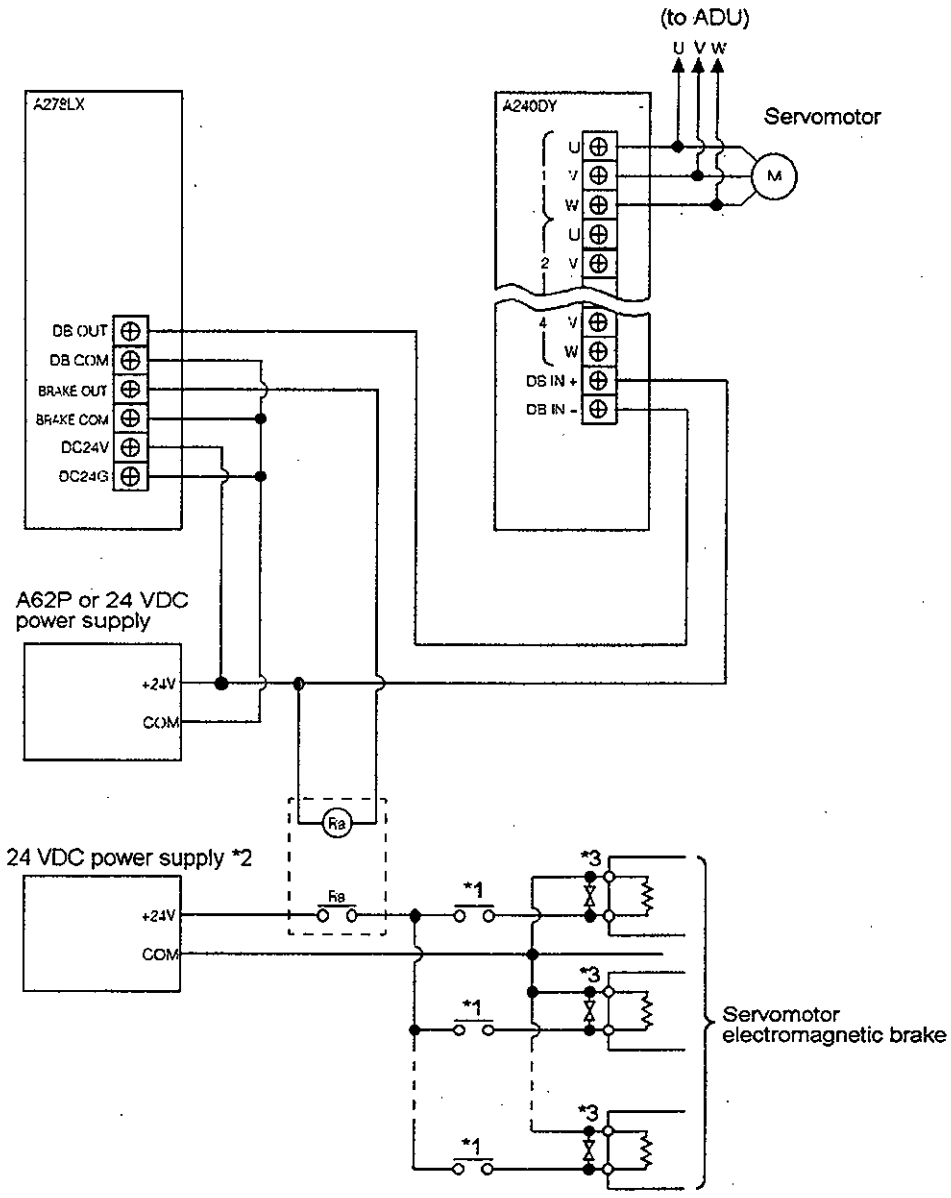


⚠ CAUTION

⚠ Ensure all connections are correct. The servomotor may malfunction if the connections are incorrect.

5.4.4 Wiring the control terminal block (for dynamic brake and electromagnetic brake)

(1) Wiring the control terminal block



REMARKS

(1) *1 : For brake control of individual servomotors. Use MELSEC-A Series output modules.

(2) *2 : ZKF-30W (24 VDC, 0.9 A) or ZKF-50W (24 VDC, 1.8 A) power supply for electromagnetic brake excitation.

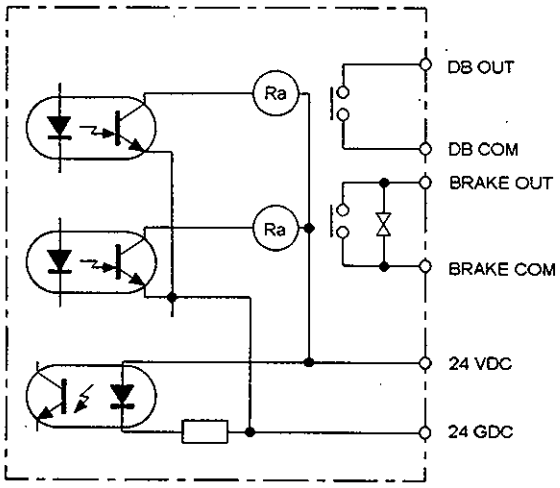
(3) *3 : A surge absorber is required when switching on and off the DC side of the electromagnetic brake power supply. Use a Matsushita FRZ-C10DK221 surge absorber.

⚠ CAUTION

⚠ If a A273UHCPU (32-axis specification) is used, each dynamic brake and electromagnetic brake system set with the system settings for control by the dynamic brake and electromagnetic brake outputs must be wired independently.

(2) Block diagram of the control terminal block

A278LX control terminal block



5.5 Manual Pulse Generator/Synchronous Encoder Interface Module

The A273EX manual pulse generator/synchronous encoder interface module (hereafter referred to as "A273EX") allows manual pulse generator operation for positioning control and inputs signals from the synchronous encoder.

This section describes A273EX specifications, names of parts, and interfaces with external equipment.

5.5.1 Specifications

The A273EX specifications and connector pin allocations are described here.

(1) Specifications

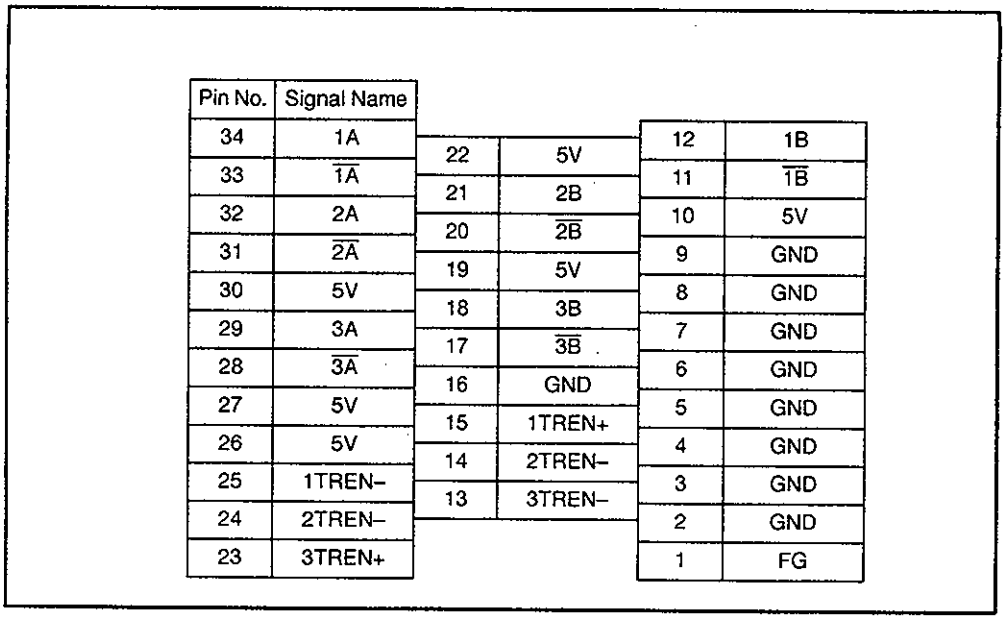
The specifications of the A273EX are shown in Table 5.5 below.

Table 5.5 Table of A273EX Specifications

Item		Specification
Tracking inputs	No. of inputs	3
	Supply voltage	4.75 VDC to 26.4 VDC
	ON voltage/current	3.5 V min. 1.2 mA min.
	OFF voltage/current	1.5 V max. 0.3 mA max.
	Response time	OFF to ON 1 ms max. ON to OFF 2 ms max.
Manual pulse generator/synchronous encoder input	No. of inputs	3
	Applicable types:	Voltage output type (5 VDC) Differential output type (26LS31, or equivalent) Set with DIP switches on side of module.
	Supply voltage (from A273EX to manual pulse generator)	5 VDC
	HIGH level	3.0 V to 5.25 VDC
	LOW level	0 V to 1.0 VDC
	Input frequency:	I - 100 kpps max.
Serial synchronous encoder input	No. of inputs	3
	Applicable types:	MR-HENC
	Supply voltage (from battery unit)	5 VDC
External dimensions mm (inch)		250(9.84)(H)×37.5(1.48)(W)×111(4.37)(D)
Weight kg (lb)		0.4 (0.88)
5 VDC internal current consumption (A)		0.7 (including manual pulse generator and synchronous encoder)

(2) Connector pin allocations

(a) The pin allocation looking at the A273EX from the front is shown in Fig. 5.2.



Pin No.	Signal Name
34	1A
33	$\overline{1A}$
32	2A
31	$\overline{2A}$
30	5V
29	3A
28	$\overline{3A}$
27	5V
26	5V
25	1TREN–
24	2TREN–
23	3TREN+

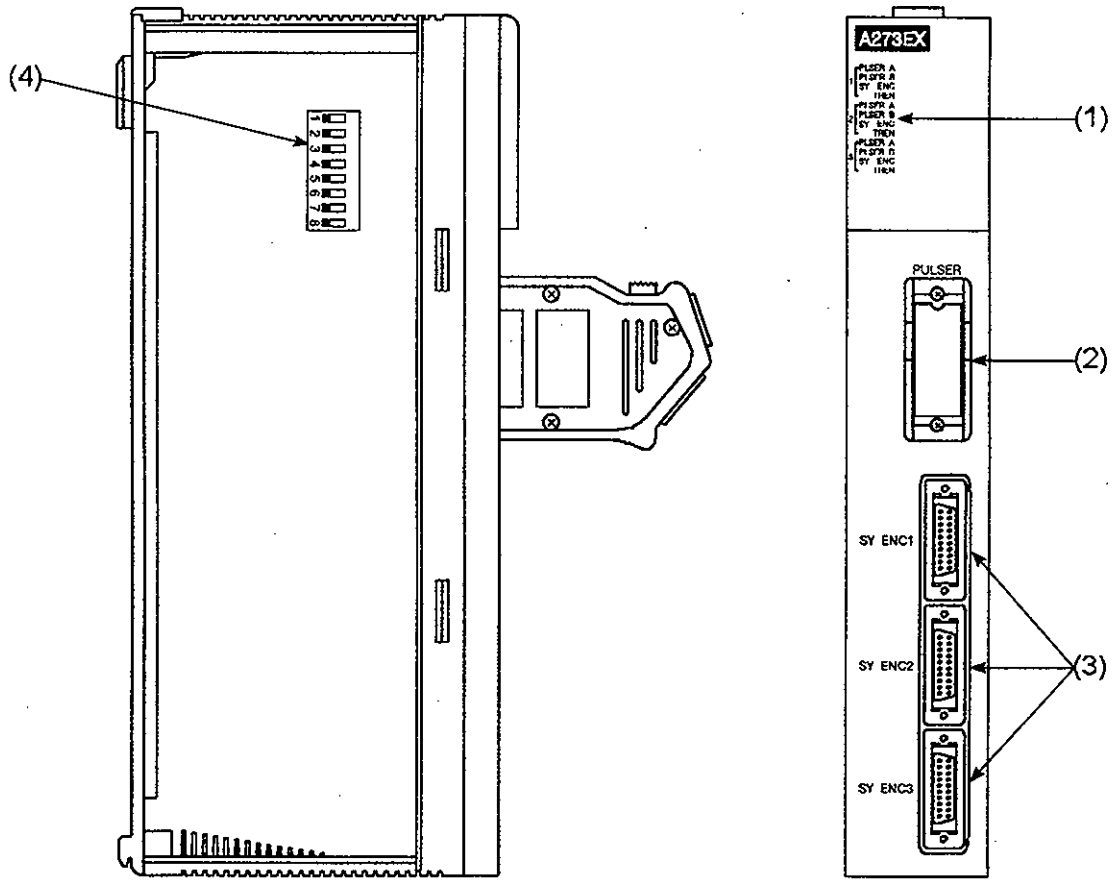
22	5V
21	2B
20	$\overline{2B}$
19	5V
18	3B
17	$\overline{3B}$
16	GND
15	1TREN+
14	2TREN–
13	3TREN–

12	1B
11	$\overline{1B}$
10	5V
9	GND
8	GND
7	GND
6	GND
5	GND
4	GND
3	GND
2	GND
1	FG

Fig. 5.2 Manual Pulse Generator Connector Pin Allocation

(b) Applicable connector ..... MR-50NS9MG, manufactured by Honda Communications Industries.
Standard accessory.

5.5.2 Names of parts



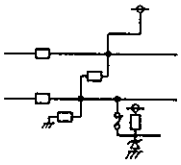
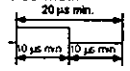
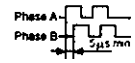
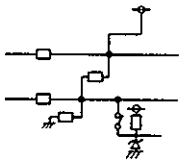
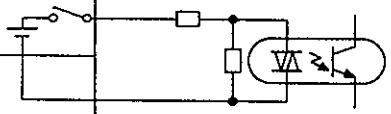
No.	Name	Application
1	Indicators 1 PULSER A / PULSER B / SY ENC / TREN 2 PULSER A / PULSER B / SY ENC / TREN 3 PULSER A / PULSER B / SY ENC / TREN	Display the input status from external equipment and errors detected by the self-diagnosis function. PULSERA 1 - 3, PULSERB 1 - 3: ON/OFF status of manual pulse generator phases A and B SYENC 1 - 3: Synchronous encoder/tracking input display TREN: Tracking enable display
2	Manual pulse generator connector	Connector for the manual pulse generator.
3	Connector	Input connectors for serial synchronous encoders (MR-HENC) 1 to 3. Connector cable: MR-HSCBL
4	Manual pulse generator setting switch	Set according to the connected encoder type. Switches 7, 8 are unused, set OFF.

Encoder No.	Switch No.	Encoder Type	
		Open-Collector Output	Differential Output
P1	1	ON	OFF
	2	ON	OFF
P2	3	ON	OFF
	4	ON	OFF
P3	5	ON	OFF
	6	ON	OFF

5.5.3 Interface with external equipment

The interface between A273EX and external equipment is shown in Table 5.6.

Table 5.6 Interface between A273EX and External Equipment

Input or Output	Signal Name		CTRL Connector P1	CTRL Connector P2	CTRL Connector P3	Wiring Example	Internal Circuit	Specification	Description
Input	Manual pulse generator, phase A	A+	34	32	29	A+		• Rated supply voltage 5.5 VDC max. • HIGH level 3 VDC min. 3 mA • LOW level 1 VDC max. 0.3 mA	To connect manual pulse generator phases A, B • Pulse width  Duty ratio: 50% • Rise time, fall time: .... 1 ms max. • Phase difference  1 If the A phase is advanced with respect to the B phase, the positioning addresses increase. 2 If the B phase is advanced with respect to the A phase, the positioning addresses decrease.
		A–	33	31	28	*1A–			
	Manual pulse generator, phase B	B+	12	21	18	A+			
		B–	11	20	17	*1A–			
	Tracking enable	+	15	14	23				Input tracking enable signal • Generate interrupts for servo system CPU • Start counter operation
		–	25	24	13				
	Power supply	5V	22	30	27				
			10	19	26				
		GND	9	6	16				
			8	5	3				
			7	4	2				

*1 : Connection for a balanced output type

(1) Wiring precautions

This section explains how to connect A273EX to external equipment and describes important points to ensure optimum A273EX performance and increase system reliability.

(a) Applicable connector
Manual pulse generator end .. MR-50NS9MG, manufactured by Honda Communications Industries.
Standard accessory.

⚠ CAUTION

⚠ Connect the A273EX to external equipment using a shielded cable. To reduce electromagnetic interference, do not position the cable close to, or bundle it with, power or main circuit cables. A clearance of at least 200 mm (7.87 in.) to other cables is required.

⚠ Connect the shield wire of the shielded cable to the FG terminal of the A273EX external device.

⚠ Make sure parameter settings are correct. Incorrect settings can cause malfunctions.

(2) Connecting cables to connectors

This section describes how to connect cables to connectors.

Connect cable

↓

- Disassemble the connector plug
  (1) Loosen and remove bolts.
  (2) Open the cover.

- - - - • Take care not to lose the nuts and bolts when disassembling the connector.

↓

- Connect the wires
  (1) Use 0.3 mm^2 max. wires. Thicker wires will not pass through the cable clamp.
  (2) Check the pin allocation and solder the wires into position.

- - - - • The pin allocation differs for each connector plug. Carefully check the pin number allocation of the connector.
• During soldering, ensure that no terminals are shorted by bare wires or solder bridges. Use insulating tubes to avoid short circuits.

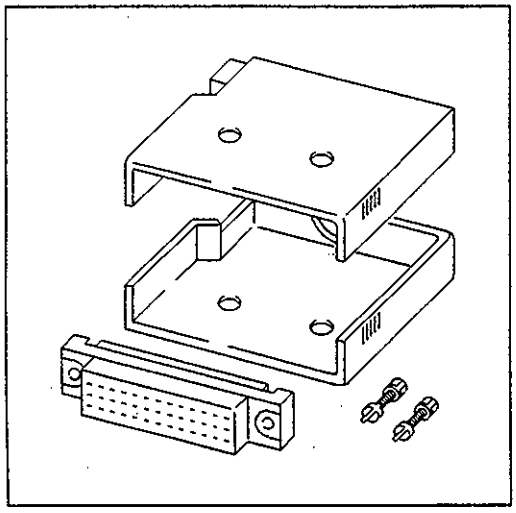
↓

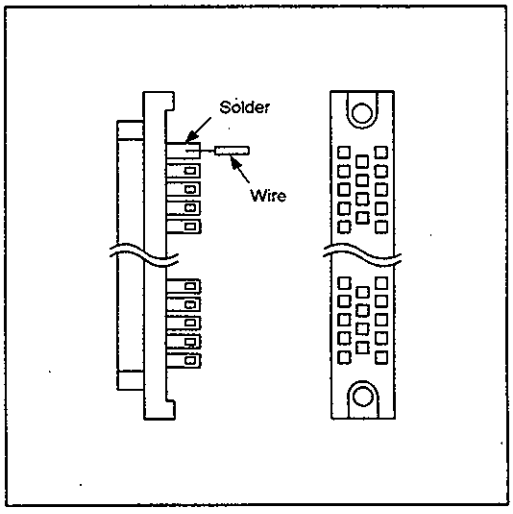
- Assemble the connector plug
  (1) Bundle the wires and pass them through the cable clamp.
  (2) Insert the fixing bolts in the connector unit and attach one half of the cover to it.
  (3) Attach the other half of the cover.
  (4) Tighten the bolts.

- - - - • If the number of wires is too small to be clamped by the cable clamp, put a tube round the wires so that the cable clamp can clamp them effectively.

↓

End



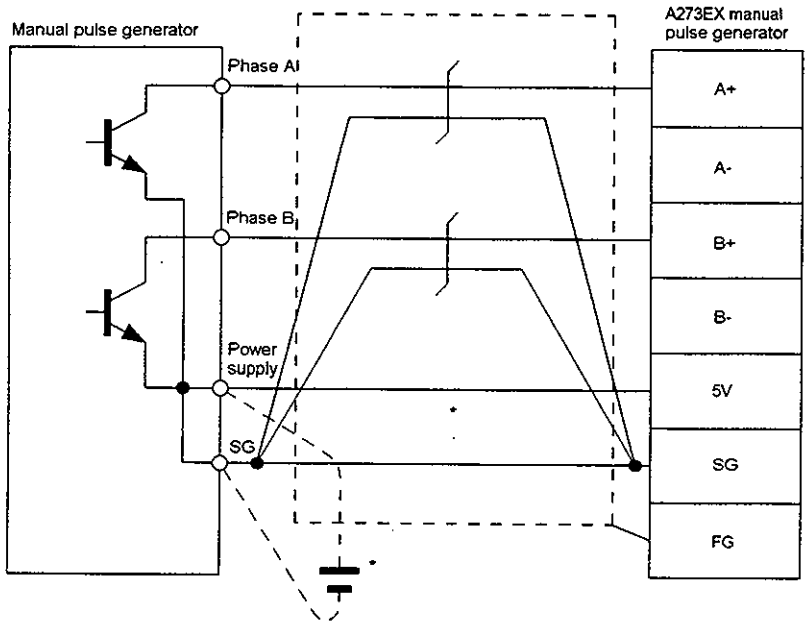


⚠ CAUTION

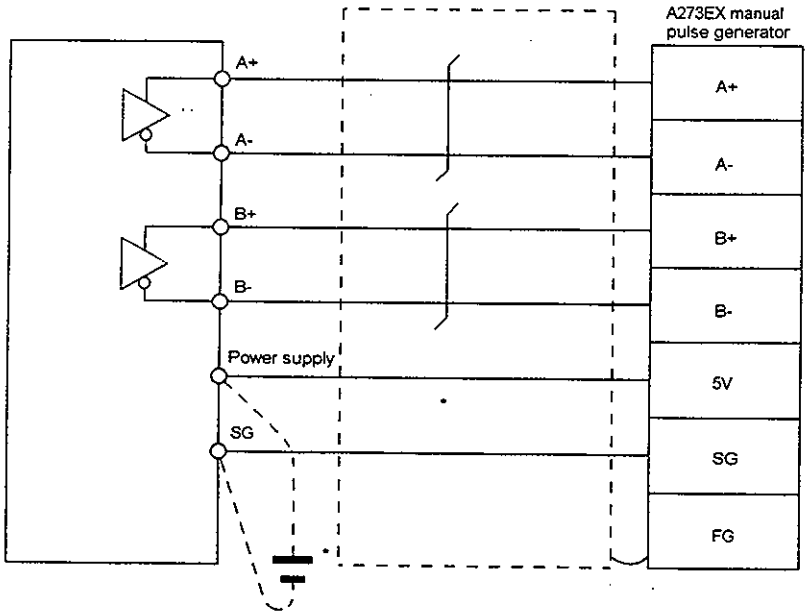
⚠ Ensure all connections are correct. The servomotor may malfunction if the connections are incorrect.

5.5.4 Manual pulse generator wiring example

(1) Voltage-output, open-collector type



(2) Balanced-output type



⚠ CAUTION

⚠ * : The 5 VDC power supply from the module must not be connected if a separate power supply is used as the manual pulse generator power supply.

⚠ * : If a separate power supply is used as the manual pulse generator power supply, use a 5 V stabilized power supply. Any other power supply may cause a failure.

5.6 Servo Power Supply Module

The A230P power supply module (hereafter referred to as "A230P") is the power supply to drive the servomotors.
This section describes A230P specifications, names of parts, and wiring methods.

5.6.1 Specifications

The A230P specifications are shown in Table 5.7.

Table 5.7 A230P Specifications

Item	Specification
Supply voltage, frequency	3-phase, 200 VAC, 50 Hz; 200 VAC, 60 Hz; 220 VAC, 60 Hz
Permissible voltage fluctuation	170 VAC to 242 VAC
Permissible frequency fluctuation	± 3Hz
Rated output	240 VDC to 343 VDC 30 A
Power supply capacity	10 KVA (at max. load)
I/O terminals	(1) 300 VDC output (2) External regenerative resistor terminals (3) 200 VAC power supply input (4) Emergency stop input terminals (5) Ground terminals
External regenerative resistor	13.3Ω
No. of slots occupied	2
5 VDC internal current consumption (A)	0.1
Weight kg (lb)	1.4 (3.08)
External dimensions mm (inch)	250 (9.84) (H) × 75.5 (2.97) (W) × 136 (5.35) (D)

POINT

The regenerative resistor is also used for voltage discharge across the P-N terminals when an error occurs or the CPU is reset.

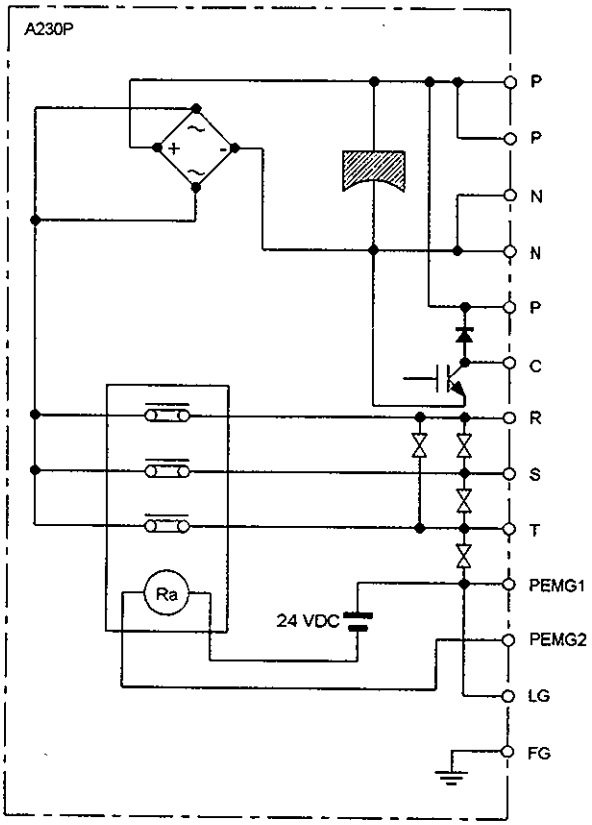
⚠ CAUTION

⚠ The rated current output of this power supply module to drive servomotors is 30 A. To prevent damage to the power supply module, use the formula below to select servomotors, speed, and torque such that the total current for all axes does not exceed 30 A.

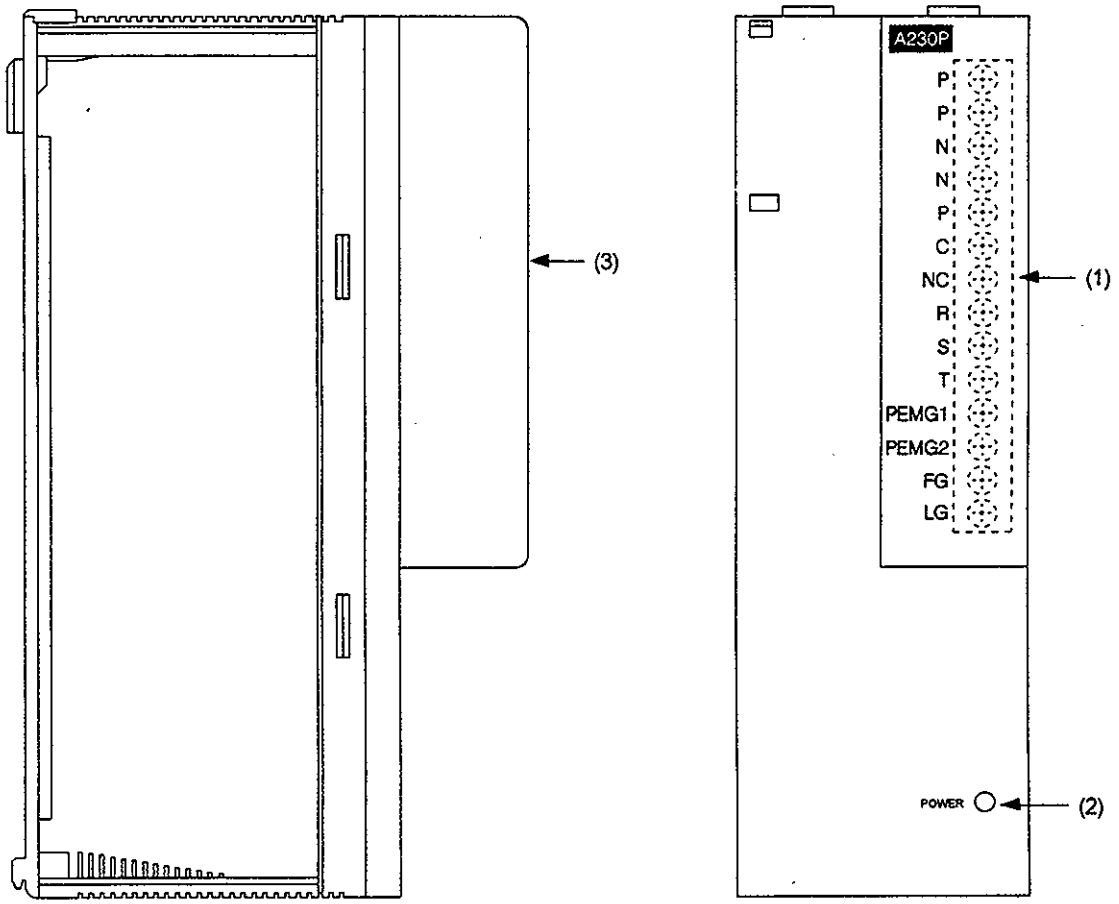
$$\text{Total current for all axes (A)} = \Sigma \left[\text{motor rated current (A)} \times \frac{\text{load torque (kg·cm)}}{\text{rated torque (kg·cm)}} \times \frac{\text{operation speed (r/min.)}}{\text{rated speed (r/min.)}}\right]$$

⚠ Use under the conditions defined in Table 5.7.

(1) A230P block diagram



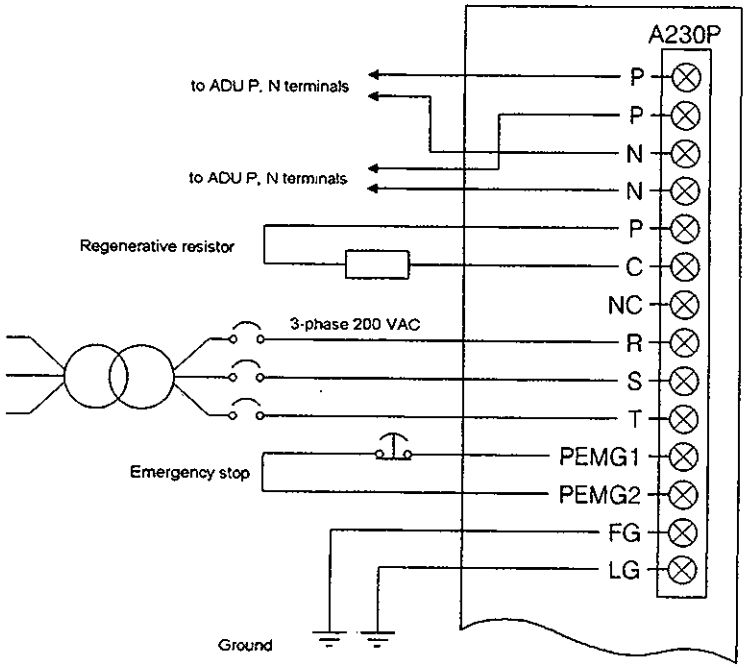
5.6.2 Names of parts



No.	Name	Application
1	Terminal block	P, N: Connect to ADU P, N terminals. (300 VDC output) P,C: Regenerative optional connector terminals NC: Not used R, S, T: Power supply terminals. Connect to 3-phase 200 VAC 50/60 Hz power supply PEMG1: / PEMG2:) Emergency stop input FG, LG: Ground terminals. Use designated ground, if possible. Class 3 grounding
2	Power indicator	Lights to indicate the power is on.
3	Terminal block cover	Terminal block protective cover Attach this cover for safety after connecting wiring to P.N, P.C, R.S.T, PEMG1, PEMG2, FG, LG.

5.6.3 Wiring

This section describes the A230P wiring.



5.6.4 Wiring precautions

Refer to Section 2.9 for information on which regenerative resistors can be connected.

⚠ WARNING

- ⚠ The power supply module has a lot of live parts. Always attach the terminal block cover after connecting the wiring. To avoid shocks, do not touch this module after the power is turned on.
- ⚠ A capacitor maintains a residual voltage across terminals P-N after the power supply is turned off. To avoid shocks, wait sufficient time after turning off the power or discharge the residual voltage before touching the wiring.

⚠ CAUTION

- ⚠ If a A273UHCPU (32-axis specification) is used, 300 VDC cables between P, N terminals on the A230P servo power supply module and the AC motor drive modules must be wired independently for each system set with the system settings. Otherwise, failure or malfunction may occur.
- ⚠ No output occurs from the P, N terminals unless an emergency stop switch is connected between terminals PEMG1 and PEMG2. An external emergency stop circuit must be connected.
- ⚠ Mount the regenerative resistor on a non-flammable material. Fire may result if the regenerative resistor is mounted on or near a flammable material.
- ⚠ If a regenerative resistor is used, ensure that an alarm signal cuts off the power supply, otherwise damage to the regenerative transistor, overheating of the regenerative resistor, or even fire may result.
- ⚠ To prevent fires, take heat countermeasures such as using non-flammable wiring inside the control box where the regenerative resistor is located.

5.6.5 Precautions on using the power supply module

(1) Selecting a Power Supply Module

Ensure that the total current for all axes is 30 A max., as described in Section 5.6.1.

(2) Selecting a Regenerative Resistor

(a) It is important to select the regenerative resistor such that the regenerative power during operation does not exceed the permissible heat generation in continuous regenerative status, when operation speed is frequently changed or vertical feed is carried out, for example. Determine the regenerative power of the motors for all axes, and select the regenerative resistor according to this regenerative power.

Regenerative Resistor Name	Regenerative Power (W)	Resistance (Ω)
MR-RB064	60	13
MR-RB10	100	13
MR-RB30	300	13

(b) An example calculation of regenerative resistor heat generation is shown below.

$$Pr = \frac{-Er}{tf}$$

Where,

Pr: regenerative power (W)
Er: total regenerative energy per operation period (Joule)
tf : operation period (sec)

For vertical feed with an operation pattern as shown in Fig. 5.3, the torque and energy in each operation region can be calculated as shown in Table 5.8. The total regenerative energy is the sum of the negative ⊖ regenerative energies (Er) in each region. (Negative ⊖ energies are regenerative, positive energies ⊕ are powering.)

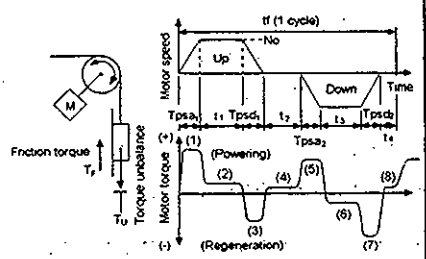


Fig. 5.3 Operation Pattern for Vertical Feed

Table 5.8 Equations to Calculate Torque and Energy in Each Region

Operation Region	Torque Applied To Motor (kg·cm)	Energy E (Joule)
(1)	$T_1 = \frac{(GD_L^2 + GD_M^2) \cdot No}{37500} \cdot \frac{1}{Tpsa_1} + T_U + T_F$	$E_1 = \frac{0.01027}{2} \cdot No \cdot T_1 \cdot TPsa_1$
(2)	$T_2 = T_U + T_F$	$E_2 = 0.01027 \cdot No \cdot T_2 \cdot t_1$
(3)	$T_3 = \frac{(GD_L^2 + GD_M^2) \cdot No}{37500} \cdot \frac{1}{Tpsd_1} + T_U + T_F$	$E_3 = \frac{0.01027}{2} \cdot No \cdot T_3 \cdot TPsd_1$
(4), (8)	$T_4 = T_U$	$E_4 \geq 0$ (No regeneration)
(5)	$T_5 = \frac{(GD_L^2 + GD_M^2) \cdot No}{37500} \cdot \frac{1}{Tpsa_2} - T_U + T_F$	$E_5 = \frac{0.01027}{2} \cdot No \cdot T_5 \cdot TPsa_2$
(6)	$T_6 = -T_U + T_F$	$E_6 = 0.01027 \cdot No \cdot T_6 \cdot t_3$
(7)	$T_7 = \frac{(GD_L^2 + GD_M^2) \cdot No}{37500} \cdot \frac{1}{Tpsd_2} - T_U + T_F$	$E_7 = \frac{0.01027}{2} \cdot No \cdot T_7 \cdot TPsd_2$
Regenerative energy Er		Total of negative energies in regions 1 to 8

⚠ CAUTION

⚠ Ensure that the regenerative resistor name and capacity parameter settings are appropriate for the operation mode, servo amplifier, and servo power supply module. Incorrect settings can cause the malfunction of the protective functions.

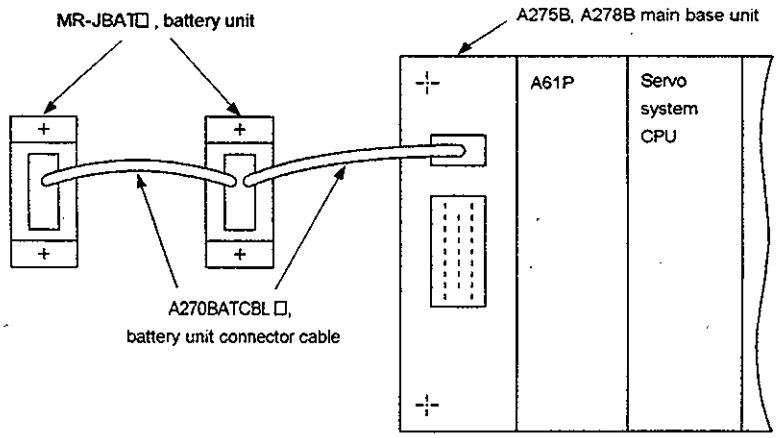
⚠ Mount the regenerative resistor on a non-flammable material. Fire may result if the regenerative resistor is mounted on or near a flammable material.

⚠ If a regenerative resistor is used, ensure that an alarm signal cuts off the power supply, otherwise damage to the regenerative transistor, overheating of the regenerative resistor, or even fire may result.

⚠ To prevent fires, take heat countermeasures such as using non-flammable wiring inside the control box where the regenerative resistor is located.

5.7 Battery Unit and Connector Cable

If an absolute encoder is used, an MR-JBAT□ battery unit must be connected to back up the stored absolute position values.
Use the A270BATCBL□ battery unit connector cable to connect a MR-JBAT□ to the main base unit or to another MR-JBAT□.



This section describes MR-JBAT□ and A270BATCBL□ specifications and names of parts.

5.7.1 Specifications

(1) MR-JBAT□ Specifications

This section describes the MR-JBAT□ specifications.

Table 5.9 MR-JBAT□ Specifications

	MR-JBAT4	MR-JBAT8
No. of axes with battery back-up	4 axes max.	8 axes max.
External dimensions mm (inch)	160 (6.3)(H)×30 (1.18)(W)×100 (3.94)(D)	
Weight kg (lb)	0.53 (1.17)	0.58 (1.28)

(2) A270BATCBL□ Specifications

This section describes the A270BATCBL□ specifications.

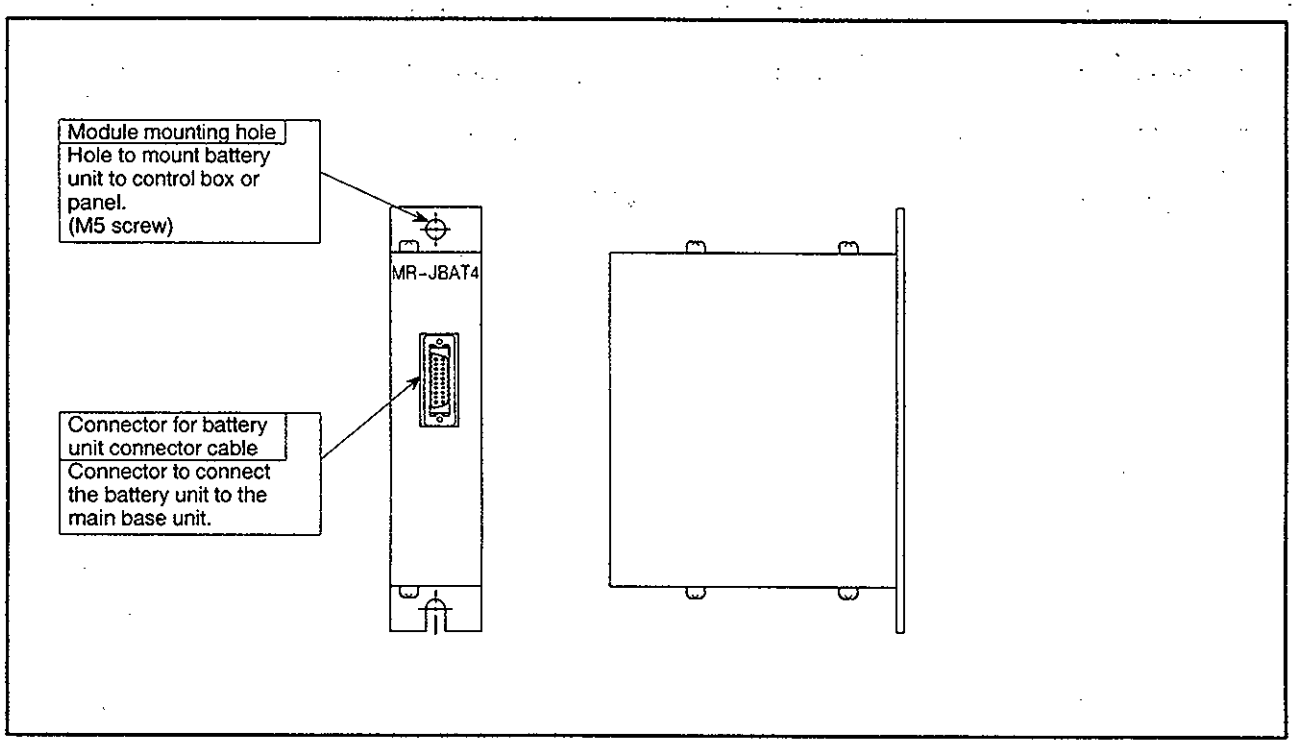
Table 5.10 A270BATCBL□ Specifications

	A270BATCBL	A270BATCBLJ16	A270BATCBLJ32
Cable length m (inch)	0.25 (9.84)		
Weight kg (lb)	0.05 (0.11)		
Application	Connecting MR-JBAT□ to main base unit	Connecting a MR-JBAT8 to the main base unit or to another MR-JBAT8	Connecting a MR-JBAT8 to the main base unit or to another MR-JBAT8
No. connected battery units	1	2	4

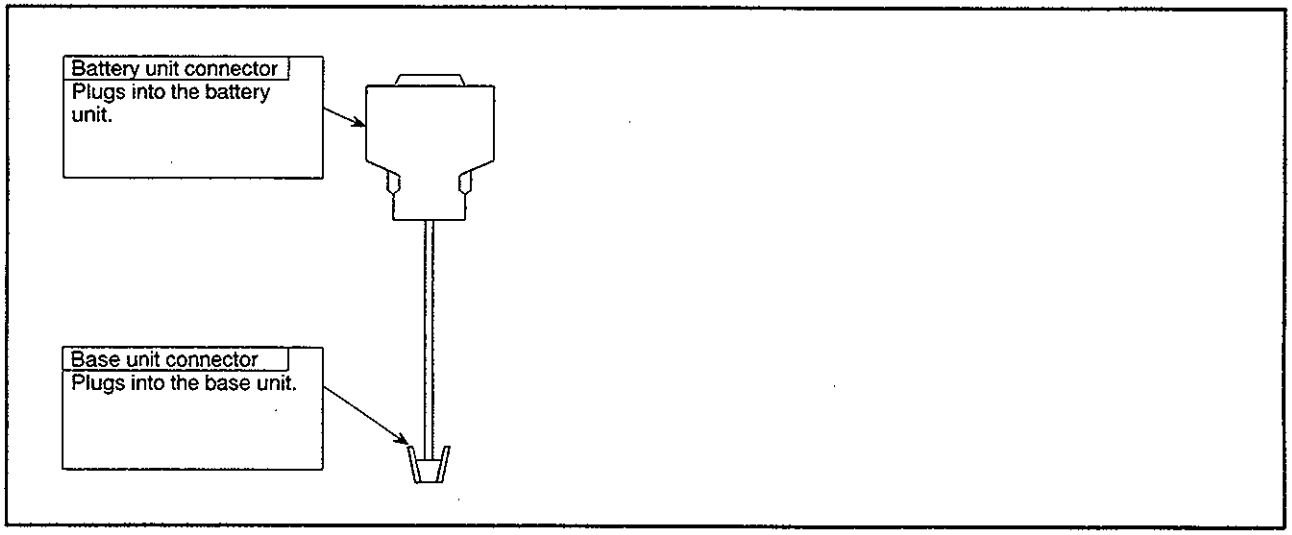
⚠ CAUTION
⚠ Ensure polarity is correct. Incorrect polarity can cause destruction of, or damage to, the system.
⚠ Regularly replace consumables, such as batteries, as described in the instruction manuals.
⚠ Do not short, recharge, overheat, burn, or disassemble batteries.
⚠ Dispose of batteries according to government regulations.

5.7.2 Names of parts

(1) Battery unit



(2) Battery unit connector cable



6. CONTROL POWER SUPPLY MODULE

This section describes control power supply module specifications and selection.

6.1 Mountable Power Supply Modules

The model names of the power supply modules which can be mounted on the main base unit, motion extension units, and PC extension base units are shown in the table below.

Power Supply Module Model Name / Base Unit	A61P	A62P	A63P	A65P
Main base unit	○			×
Motion extension base unit	○			×
PC extension base unit	○			○

○ can be mounted × cannot be mounted

6.2 Specifications of Power Supply Modules

The specifications of the power supply modules are shown in Table 6.1 .

Table 6.1 Table of Power Supply Module Specifications

Item		Specifications			
		A61P	A62P	A63P	A65P
Mounting position in base		Power supply module mounting slot			
Input power supply		100 - 120 VAC $^{+10\%}_{-15\%}$ (85 - 132 VAC)		24 VDC $^{+30\%}_{-35\%}$ (15.6 - 31.2 VDC)	100 - 120 VAC $^{+10\%}_{-15\%}$ (AC 85 - 132 VAC)
		200 - 240 VAC $^{+10\%}_{-15\%}$ (170 - 264 VAC)			200 - 240 VAC $^{+10\%}_{-15\%}$ (170 - 264 VAC)
Input frequency		50/60 Hz ± 5%		–	50/60 Hz ± 5%
Max. apparent input power		110 VA		65 W	110 VA
Inrush current		20A 8 ms max.		100A 1 ms max.	20A 8 ms max.
Rated output current	5 VDC	8 A	5 A	8 A	2 A
	24 VDC	–	0.8 A	–	1.5 A
	+15 VDC	–			
	−15 VDC	–			
*1 Overcurrent protection	5 VDC	8.8 A min	5.5 A min	8.5 A min	2.2 A min
	24 VDC	–	1.2 A min	–	2.3 A min
	+15 VDC	–			
	−15 VDC	–			
*2 Overvoltage protection	5 VDC	5.5 - 6.5 V	5.5 - 6.5 V	5.5 - 6.5 V	5.5 - 6.5 V
	24 VDC	–			
Efficiency		65% min.			
Power indicator		LED indicator			
Terminal screw size		M4×0.7×6			
Applicable power cable size		0.75 - 2 mm^2			
Applicable solderless terminal		V 1.25 - 4, V 1.25 - YS 4A, V 2 - S 4, V 2 - YS 4A			
Applicable tightening torque		118N (12kg · cm)			
External dimensions mm (inch)		250 (9.84)×55 (2.17)×121 (4.76)			
Weight kg (lb)		0.98 (2.16)	0.94 (2.07)	0.8 (1.76)	0.94 (2.07)
*3 Permissible momentary power interruption time		20 ms max.		1 ms max.	20 ms max.

6. CONTROL POWER SUPPLY MODULE

POINTS

*1 : Overcurrent protection

(a) When current in excess of the specifications flows through the 5 VDC or 24 VDC circuits, the overcurrent protection device breaks the circuit and stops the system.
A drop in voltage will extinguish or dim the power supply module indicator display.

(b) After overcurrent protection operates, start up the system after eliminating the cause, such as insufficient current capacity or short circuit. The system will execute an initial start when the current returns to the normal level.

*2 : Overvoltage protection

When a 5.5 - 6.5 V overvoltage is applied to a 5 VDC circuit, the overvoltage protection device breaks the circuit and stops the system. The power supply module indicator display switches off. To restart the system, switch the input power supply off, and then turn it back on. The system will execute an initial start.
If the system does not start up, and the indicator display remains off, the power supply module must be changed.

*3 : Permissible momentary power interruption time

This shows the permissible momentary power interruption time for the extension base power supply modules, and is determined according to the type of power supply module used. The permissible momentary power interruption time for systems using the A63P is the time taken after the stabilized primary power supply supplying 24 VDC to the A63P turns off until the 24 VDC falls below the prescribed current (15.6 VDC).

6.3 Selecting the Power Supply Module

The power supply module is selected according to the total current consumption of the I/O module and special function module peripheral devices, which is supplied by the power supply module.
See the corresponding manuals for information about the 5 VDC current consumption of the I/O modules, special function modules, and peripheral devices.

The current consumption of the motion module is shown in the table below.

Product Name	Model Name	Current Consumption (A)	
		5 VDC	24 VDC
CPU module	A273UHCPU	1.5	–
AC motor drive module	AM221AM-20 A211AM-20 AM222AM-20	0.6	–
Servo power supply module	A230P	0.1	–
Dynamic brake module	A240DY	–	0.19
Servo external signal module	A278LX	0.1	–
Manual pulse generator/synchronous encoder interface module	A273EX	0.7	–

6. CONTROL POWER SUPPLY MODULE

6.4 Fuse Specifications

This section describes the fuse specifications for the control power supply module and the output module.

Table 6.2 Table of Fuse Specifications

Item / Model Name	GTH4	SM6.3A	MF51NM8	HP-32	HP-70K	MP-20	MP-32	MP-50
Application	A61P, A62P, A65P power supply module	A63P power supply module	AY11E, AY13E output module	AY23 output module	AY22 output module	AY50, AY80 output module	AY60 output module	AY60E output module
Shape	glass tube	glass tube	glass tube	plug-in	plug-in	plug-in	plug-in	plug-in
Rated current	4A	6.3A	8A	3.2A	7A	2A	3.2A	5A
External dimensions mm (inch)	φ6 (0.24)× 32 (1.26)	φ6 (0.24)× 32 (1.26)	φ5.2 (0.2)× 20 (0.79)	30.3 (1.19)× 8 (0.31)× 20 (0.79)	30.3 (1.19)× 8 (0.31)× 20 (0.79)	17.2 (0.68)× 5.5 (0.22)× 19 (0.75)	17.2 (0.68)× 5.5 (0.22)× 19 (0.75)	17.2 (0.68)× 5.5 (0.22)× 19 (0.75)

⚠ CAUTION

⚠ Only use a designated model name fuse. Non-designated model name fuses can cause malfunctioning of the system.

6.5 Handling Precautions

This section describes handling precautions for control power supply modules between opening the packaging and mounting.

(1) Tighten the module mounting screws (which are unnecessary under normal conditions of use), terminal screws, etc. within the ranges specified in the table below.

Screw Name		Tightening Torque Range (N·cm (kg·cm)) [lb·inch]
Power supply module terminal block terminal screw	(M3)	49 - 78 (5 - 8) [4.33 - 6.93]
Power supply module terminal block terminal screw	(M4)	98 - 137 (10 - 14) [8.71 - 12.19]
Module mounting screw	(M4)	78 - 118 (8 - 12) [6.93 - 10.4]

(2) When mounting the module in the base unit, lock the hook on the module into the base unit by pushing firmly. When unfastening the module, push the hook so that the hook is totally unfastened from the base unit before pulling the module toward you (see 9.5 for more details).

6. CONTROL POWER SUPPLY MODULE

⚠ CAUTION

⚠ The power supply module casing, terminal connectors, and pin connectors are made of resin. Take care not to drop the module or subject it to severe shock.

⚠ Do not remove the printed circuit boards from the module casing. This will cause faults.

⚠ Ensure no wiring waste or other foreign matter enters the top of the module. Remove any foreign matter that does enter the module.

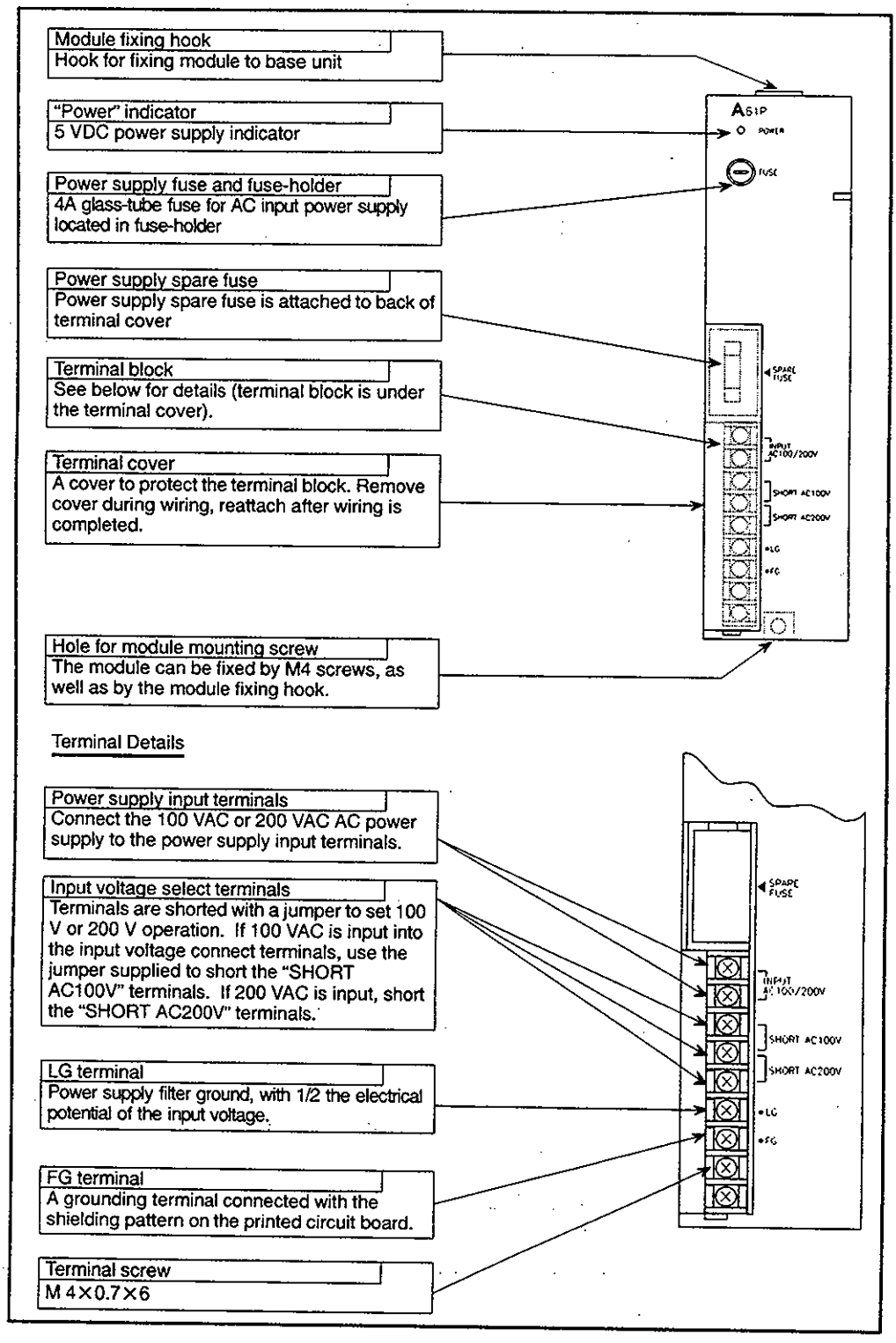
⚠ Tighten the module mounting screws (which are unnecessary under normal conditions of use), terminal screws, etc. within the torque range for tightening.

⚠ When mounting the module in the base unit, lock the hook on the module into the base unit by pushing firmly. When unfastening the module, push the hook so that the hook is totally unfastened from the base unit before pulling the module toward you (see 9.5 (2) for more details).

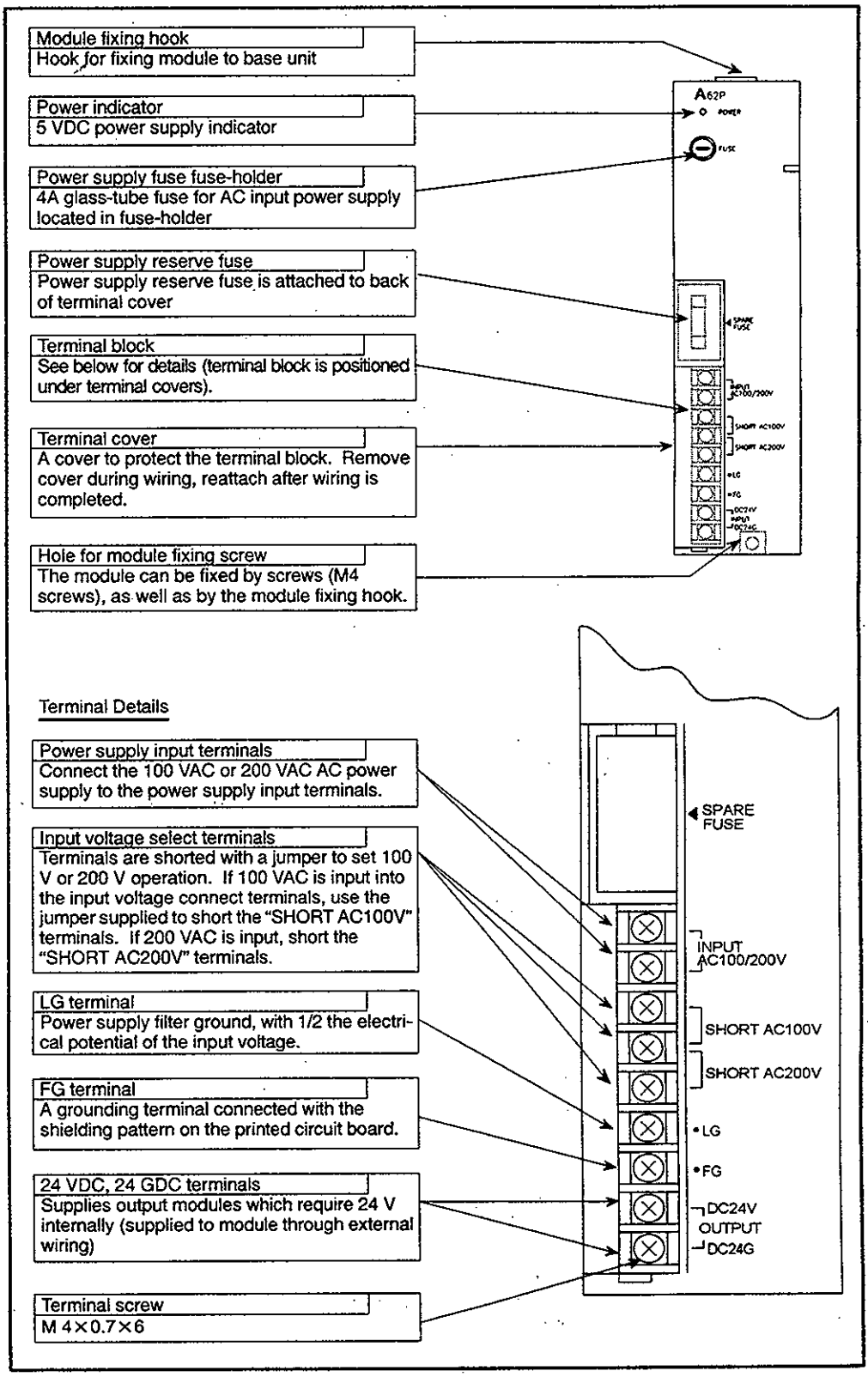
6.6 Names and Settings of Parts

This section describes the name of each part in the control power supply module.

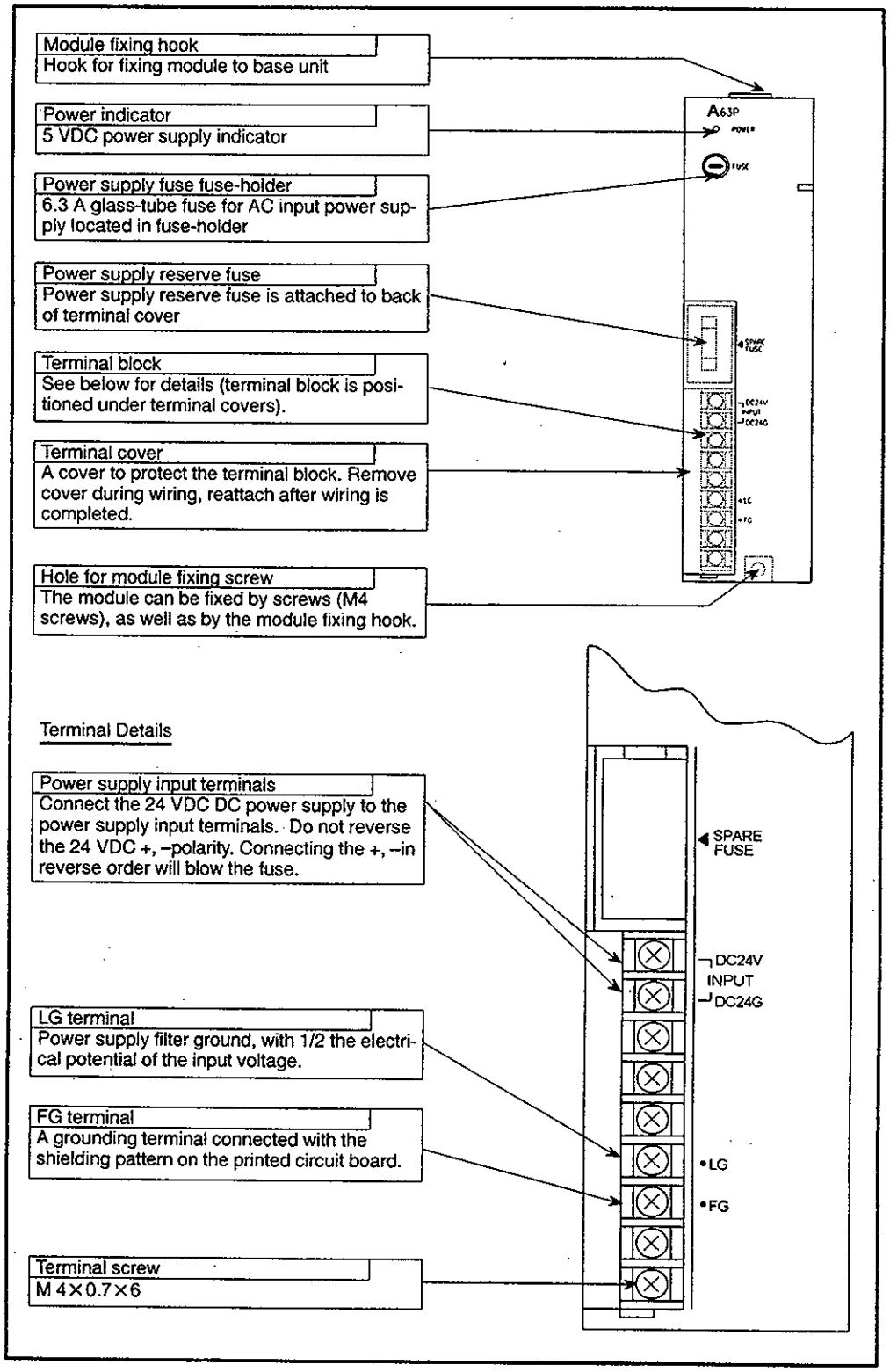
(1) Names of parts in the A61P module



(2) Names of parts in the A62P and A65P modules



(3) Names of parts in the A63P module



(4) Setting supply voltage

Insert the jumper to short the terminals which correspond to the voltage supplied to the A61P, A62P or A65P power supply module. This section describes this setting method.

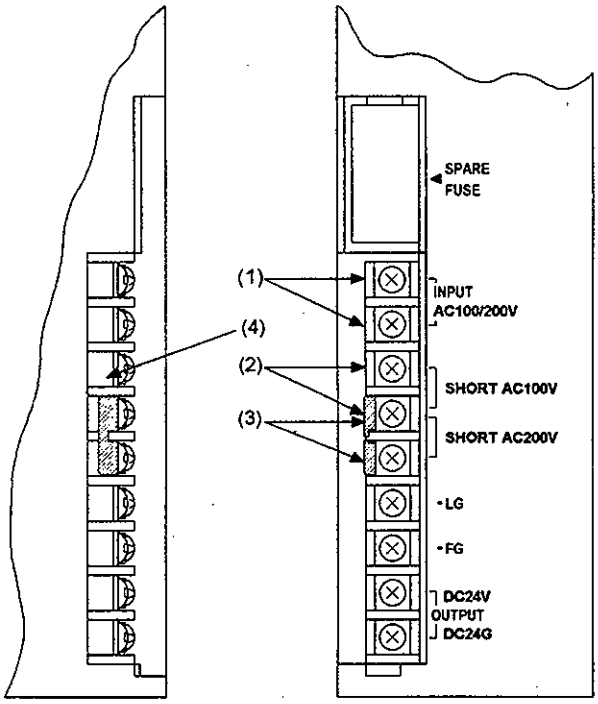
Remove terminal cover from power supply module.

↓

Remove the terminal screws from either (2) or (3), whichever matches the voltage supplied at the input terminals (1)
(2): If the supply voltage is 100 VAC
(3): If the supply voltage is 200 VAC

↓

Fix the attached jumper (4) with the terminal screws. Install the jumper as shown in the diagram to the right. (Diagram shows situation when supply voltage is 200 VAC).



⚠ CAUTION

⚠ Care must be taken with the supply voltage or setting.
Incorrect setting or voltage can cause destruction of, or damage to, the system, as shown in the table below.

	Supply Voltage	
	100 VAC	**200 VAC**
Set to 100 VAC (jumper attached to (2))	–	Destroys the power supply module (no abnormality in the extension base unit)
Set to 200 VAC (jumper attached to (3))	No abnormality in the module, but extension base unit does not operate	–
No setting (jumper not attached)	No abnormality in the module, but extension base unit does not operate	

7. BASE UNIT AND EXTENSION CABLE

7.1 Specifications

This section describes the specifications of the base units (main base unit and extension base units) and extension cables which can be used with the motion controller.

7.1.1 Base unit specifications

The specifications of the base units which can be used with the motion controller are shown in Table 7.1.

Table 7.1 Table of Base Unit Specifications

	Main Base Unit		Motion Extension Base Unit		PC Extension Base Unit		
	A275B	A278B	A255B	A268B	A62B	A65B	A68B
Max. mountable No. of modules	5	8	5	8	2	5	8
Mounting hole size	ø6 dia. slot/ ø6 dia. mounting hole (M5)		ø6 dia. slot (M5)		ø6 dia. slot (M5)		
Pitch of mounting hole mm (inch)	362 (14.25) × 200 (7.87)	460 (18.11) × 200 (7.87)	277 (10.9) × 200 (7.87)	446 (17.56) × 200 (7.87)	218 (8.58) × 200 (7.87)	332 (13.07) × 200 (7.87)	446 (17.56) × 200 (7.87)
External dimensions mm (inch)	382 (15.04)	480 (18.9)	297 (11.69)	466 (18.35)	238 (9.37)	352 (13.86)	466 (18.35)
	250 (9.84)		250 (9.84)		250 (9.84)		
	29 (1.14)		29 (1.14)		29 (1.14)		
Weight kg (lb)	1.5 (3.3)	1.9 (4.19)	1.2 (2.64)	1.9 (4.19)	1.1 (2.42)	1.4 (3.08)	1.9 (4.19)

7.1.2 Specifications of extension cable

The specifications for extension cables which can be used with the motion controller are shown in Table 7.2.

Table 7.2 Table of Extension Cable Specifications

Item \ Model Name	A370C12B	A370C25B	AC06B	AC12B	AC30B
Cable length m (ft.)	1.2 (3.94)	2.5 (8.2)	0.6 (1.97)	1.2 (3.94)	3.0 (9.84)
Resistance of 5 VDC supply line (Ω at 55°C)	0.028	0.045	0.019	0.028	0.052
Application	Connecting servo system CPU to A62B, A65B, A68B		• Connecting main base unit to motion extension base unit • Connecting two PC extension base units		
Weight kg (lb)	0.52 (1.15)	0.95 (2.09)	0.34 (0.75)	0.52 (1.15)	1.06 (2.33)

POINTS

(1) The motion controller cannot be connected to the A55B or A58B extension base units.

(2) The total length of the extension cables must not exceed 6.6 m (21.65 ft.).

7. BASE UNIT AND EXTENSION CABLE

7.2 Handling

This section describes the cautions on handling from unpacking to mounting, the names of parts, and setting the stage numbers for the extension base units.

7.2.1 Handling precautions

This section describes the cautions on handling from unpacking to mounting the base unit.

(1) Tighten the unit mounting screws within the range indicated below.

Screw Name		Tightening Torque Range N·cm (kg·cm) [lb·inch]
Unit mounting screw	(M4)	78 - 118 (8 - 12) [6.93 - 10.4]

⚠ CAUTION

⚠ The base unit casing, terminal connectors, and pin connectors are made of resin. Take care not to drop the unit or subject it to severe shock.

⚠ Do not remove the printed circuit boards from the unit casing. This will cause faults.

⚠ Ensure no wiring waste or other foreign matter enters the top of the unit. Remove any foreign matter that does enter the unit.

⚠ Tighten the unit mounting screws within the torque range for tightening.

⚠ Do not install or detach the base unit while power is supplied to it.

⚠ Do not mount or remove a module in the base unit while power is supplied to it.

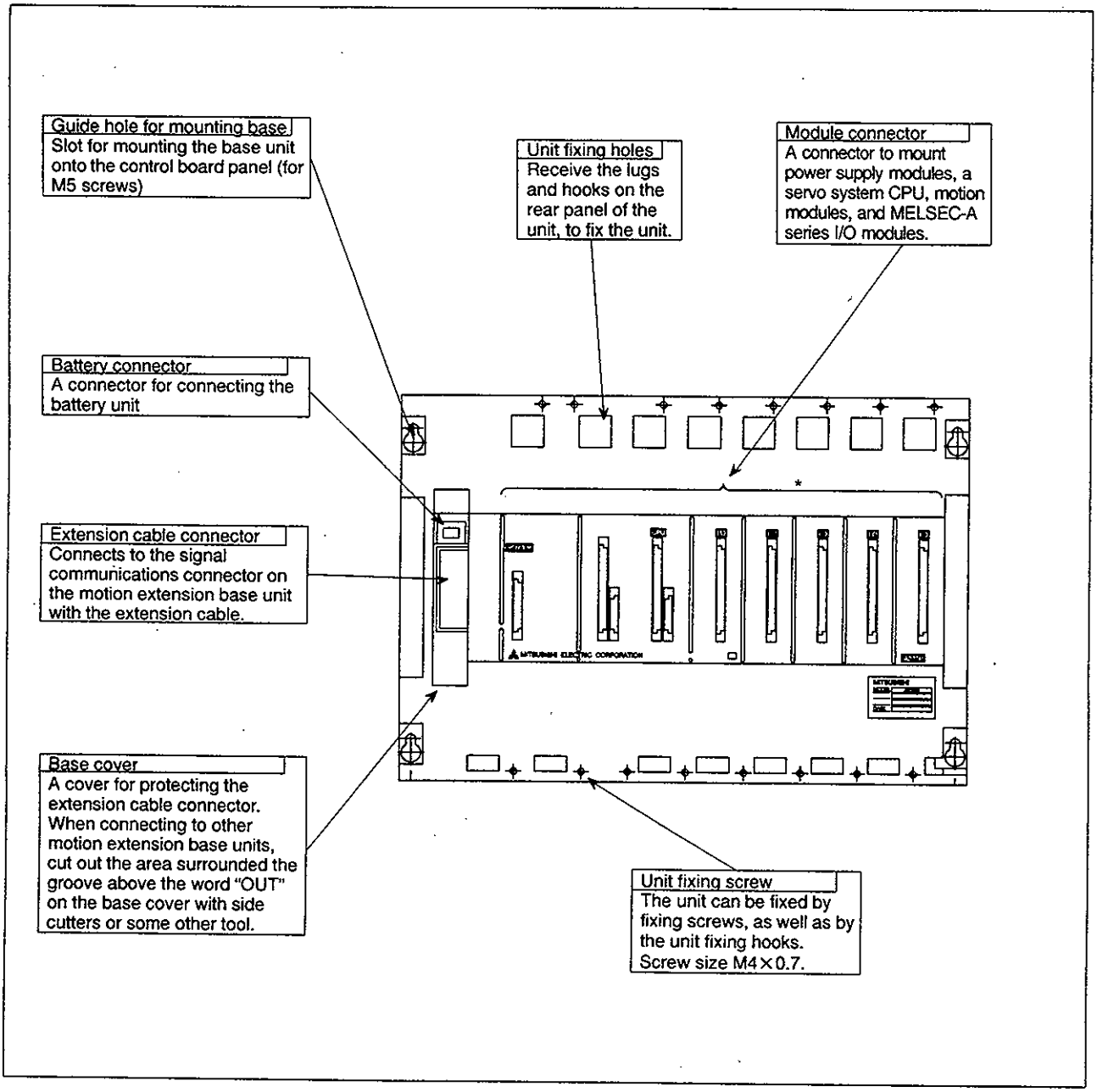
⚠ Install the unit in a location which can support its weight. Follow the instructions in this manual.

⚠ Do not stand on the unit, or rest heavy objects on the unit.

⚠ The unit must be installed in the correct orientation.

7.2.2 Names of parts

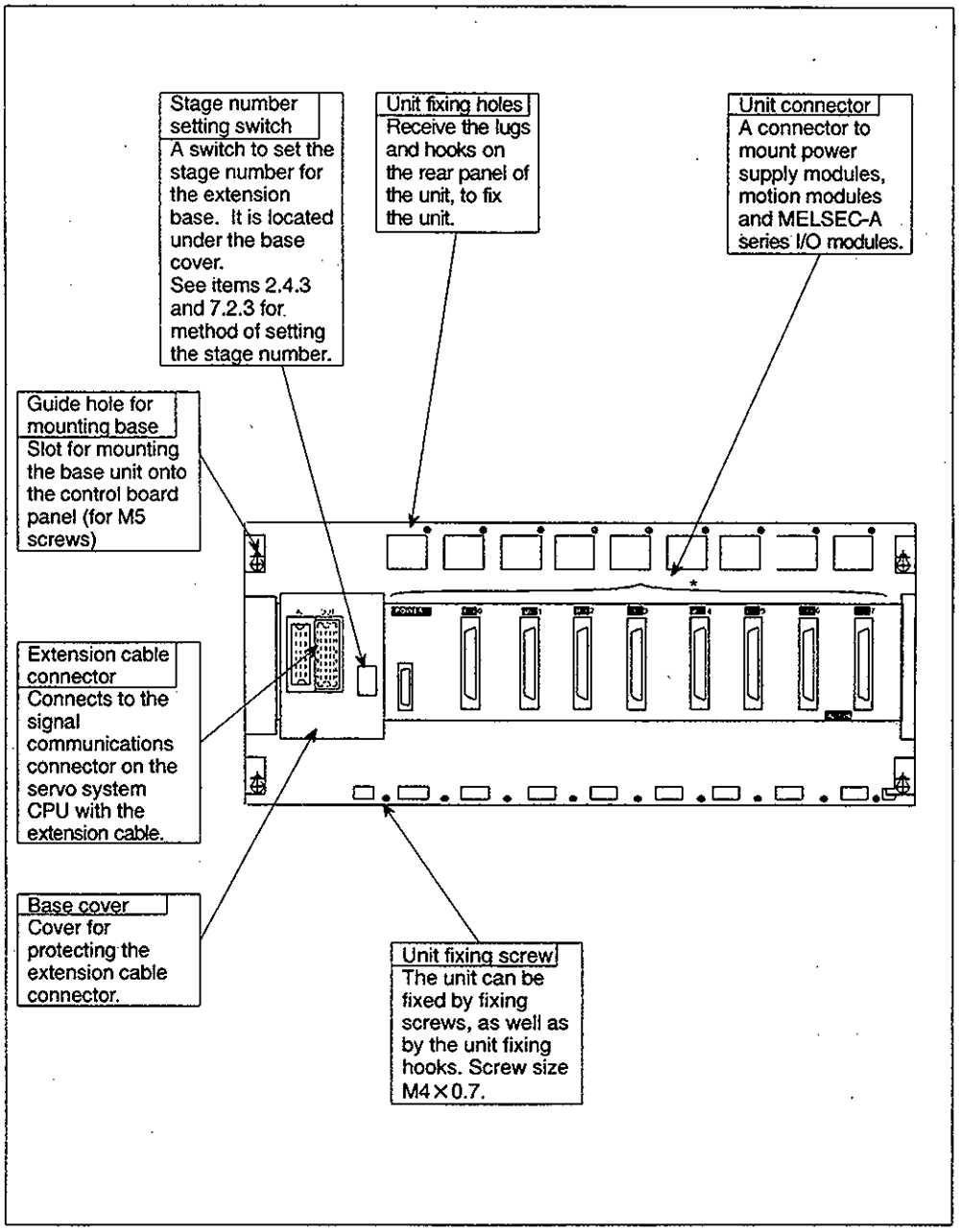
(1) Main base unit (A275B, A278B)



⚠ CAUTION

⚠ Install the supplied blind cap or blank cover (AG60) to prevent dust penetrating the empty connector spaces. Failure to do so can cause malfunctioning.*

(2) Motion extension base unit (A268B)



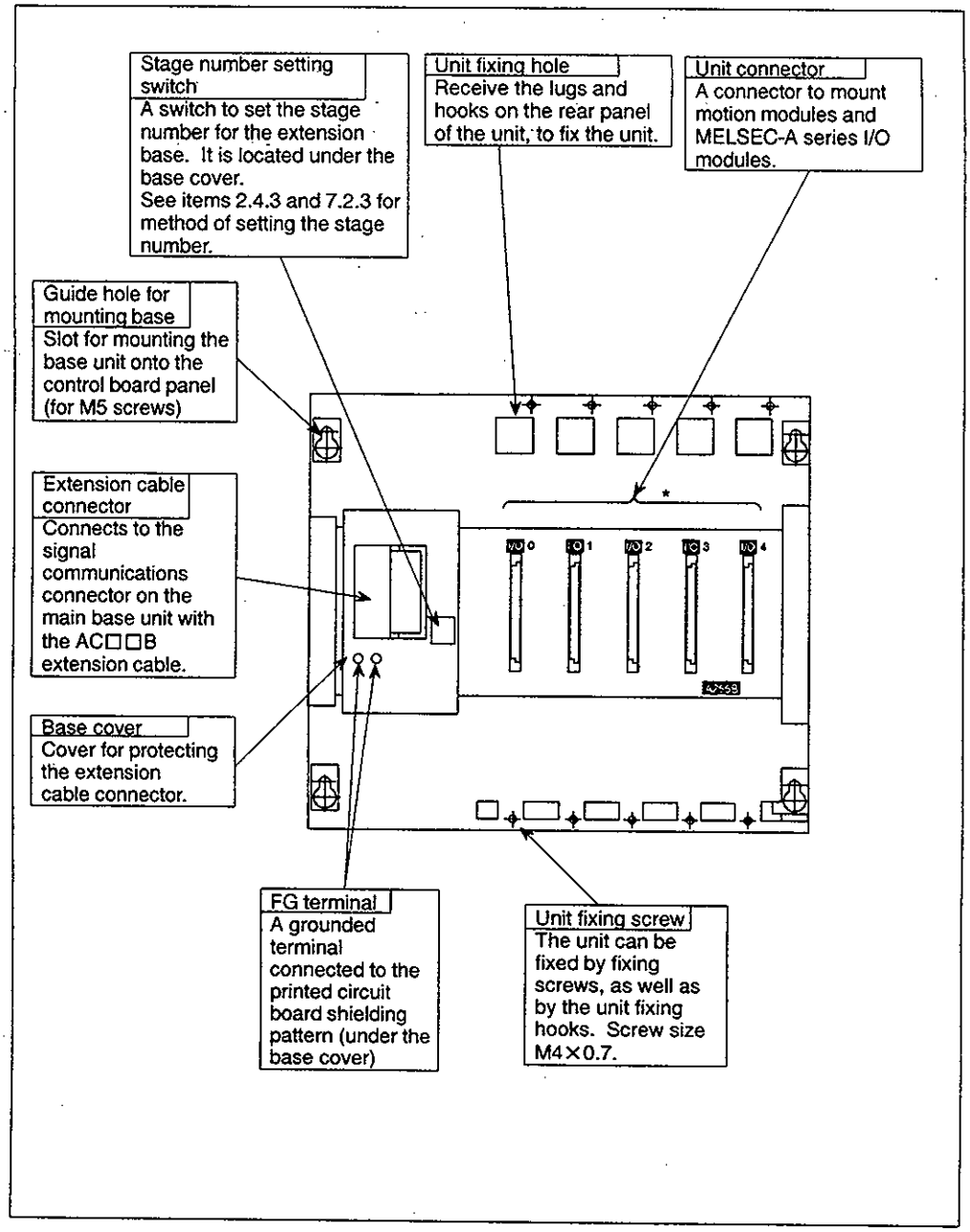
REMARK

The stage number setting switch must be set prior to installing and operating the base.

⚠ CAUTION

⚠ Install the supplied blind cap or blank cover (AG60) to prevent dust penetrating the empty connector spaces. Failure to do so can cause malfunctioning.*

(3) Motion extension base unit (A255B)



REMARK

The stage number setting switch must be set prior to installing and operating the base.

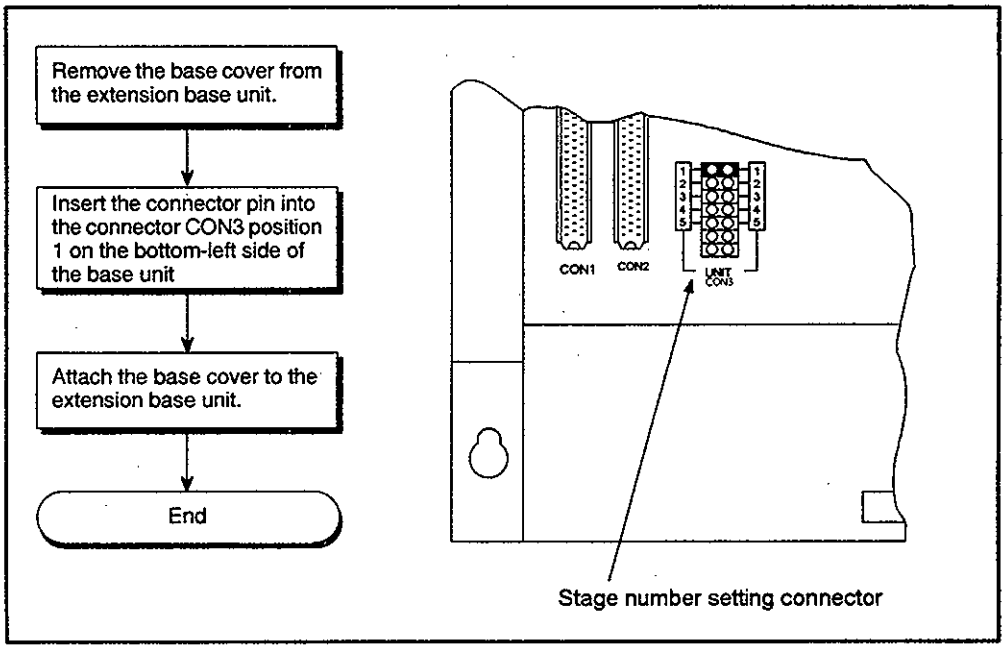
⚠ CAUTION

⚠ Install the supplied blind cap or blank cover (AG60) to prevent dust penetrating the empty connector spaces. Failure to do so can cause malfunctioning.*

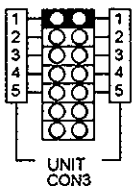
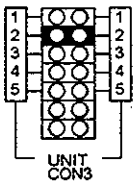
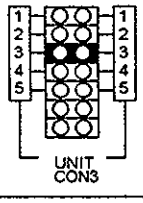
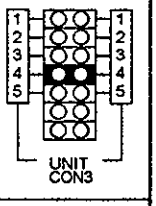
7.2.3 Setting the stage number of extension base units

(1) Motion extension base unit

If a motion extension base unit is connected to the servo system CPU extension connector, the extension stage number must be set for the motion extension base unit. The method of setting the extension stage number is shown below.



Setting Main Base Unit Stage Number

		Extension Stage Number Setting			
		Stage 1	Stage 2	Stage 3	Stage 4
Connector setting					
Permitted settings	8-axis specification	OK	NG		
	32-axis specification	OK			

⚠ CAUTION

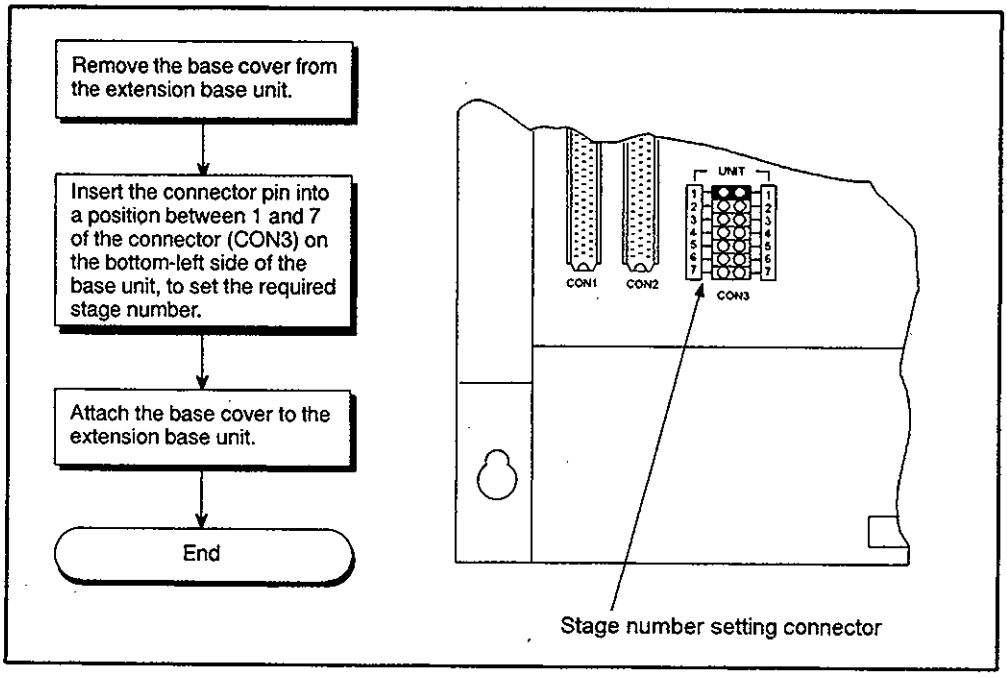
⚠ The stage number setting connector (CON3) cannot be set to stages 2 to 7 for A273UHCPU (8-axis specification.) or stages 5 to 7 for A273UHCPU (32-axis specification.).

⚠ The I/O number of an I/O module mounted on the motion extension base unit is set using system set-up from a peripheral device. Set the I/O number larger than I/O numbers used in the PC extension base unit.

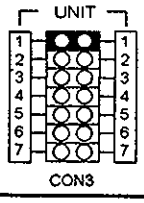
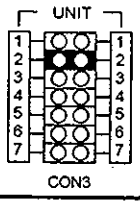
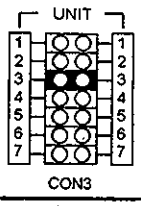
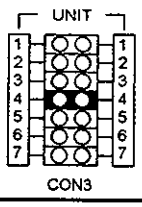
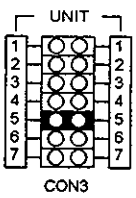
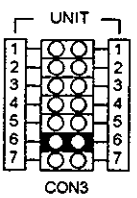
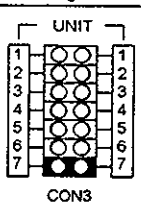
⚠ Having two or more settings for the same base unit, setting the same stage number for more than one extension base unit, or not setting the stage numbers, can cause output errors.

(2) PC extension base unit

If a PC extension base unit is connected to the servo system CPU extension connector, the extension stage number must be set for each PC extension base unit. The method of setting the extension stage number is shown below.



Setting Main Base Unit Stage Number

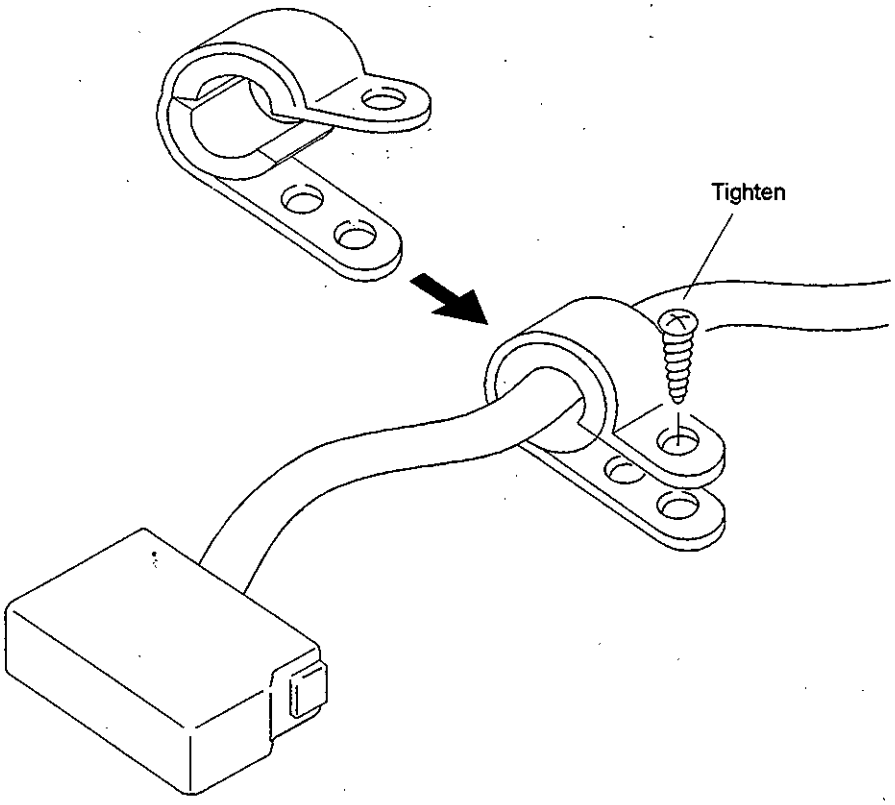
	Extension Stage Number Setting						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Connector setting							

⚠ CAUTION

⚠ Having two or more settings for the same base, setting the same stage number for more than one extension base unit, or not setting the stage numbers, can cause output errors.

7.2.4 Attaching the motion extension base noise filter

If a motion extension base unit is used, the extension base unit noise filter must be attached. Install the noise filter correctly, as incorrect installation may impair operation. The diagram below shows the method of attaching the noise filter.
Open out the noise filter and pass the cable through it, as shown in the diagram. Tighten the nylon clamp with an M4 screw.



⚠ CAUTION
⚠ Failure to correctly attach the noise filter can cause faulty operation.

8. MEMORY AND MEMORY CASSETTES

8.1 Specifications

This section describes the specifications of the memory, memory cassettes, and batteries.

8.1.1 Memory cassette specifications

The specifications of the memory cassettes used are shown in the following table.

Table 8.1 Memory Cassette Specifications

Item \ Model Name	A3NMCA-0	A3NMCA-2	A3NMCA-4	A3NMCA-8	A3NMCA-16	A3NMCA-24	A3NMCA-40	A3NMCA-56	A3AMCA-96
*RAM memory capacity (parameter setting capacity)	None	16 kbyte (16 kbyte)	32 kbyte (32 kbyte)	64 kbyte (64 kbyte)	128 kbyt (96 kbyte)	192 kbyte (144 kbyte)	320 kbyte (144 kbyte)	448 kbyte (144 kbyte)	768 kbyte (144 kbyte)
No. of ROM mounting sockets	2 (28 pins)								
Mountable ROM model name	4KROM, 8KROM, 16KROM								
Mountable RAM model name	4KRAM	Cannot be mounted							
External dimensions mm (inch)	110 (4.33) × 79.5 (3.13) × 33 (1.3)								
Weight Kg (lb)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.15 (0.33)	0.15 (0.33)	0.14 (0.31)

* The RAM memory capacity refers to the capacity of RAM memory soldered to the memory cassette printed circuit board. The parameter setting area refers to the area to store parameters, main programs, subprograms, and comments set with the parameters. See Section 8.2.4 for information on the types and order of stored data.

8.1.2 Memory specifications

The specifications of the ROM and RAM used in the memory cassettes are shown in the following table.

Table 8.2 Memory Specifications

Item \ Model Name	4KRAM	4KROM	8KROM	16KROM
Memory specification	IC-RAM (reading and writing)	EPROM (read only)		
Memory capacity	8 kbyte	8 kbyte	16 kbyte	32 kbyte
Construction	28-pin IC package	28-pin IC package	28-pin IC package	28-pin IC package
Others	Two memory chips of the same type must be mounted in the two mounting sockets.			

8.1.3 Battery specifications

The specifications of the battery for RAM back-up and power interruption backup functions are shown in the table below.

Table 8.3 Battery Specifications

Item \ Model Name	A6BAT
Nominal voltage	3.6 VDC
Battery warranty period	5 years
Total power interruption time	Differs in the following ranges according to memory cassette (see Section 11.3 for details) A3NMCA-0: 4100 hours A3NMCA-56: 450 hours
Applications	RAM back-up and power interruption backup functions
External dimensions mm (inch)	ϕ 16 (0.63) × 30 (1.18)

8.2 Handling

This section describes handling precautions between opening the packaging and installation, and describes the names, settings, and mounting of parts.

8.2.1 Handling precautions

This section describes handling precautions for memory cassettes and batteries between opening the packaging and installation.

(1) Memory and memory cassettes

(a) When mounting a memory cassette in a module, push it fully into the connector.

(b) When mounting a memory chip in a socket, push it fully in place until it locks. After mounting the memory chip, check that it is pushed fully in.

⚠ CAUTION

⚠ The memory cassette and pin connectors are made of resin. Take care not to drop the memory cassette or subject it to severe shock.

⚠ Do not remove the printed circuit boards from the memory cassette. This will cause faults.

⚠ Ensure no wiring waste or other foreign matter enters the top of the module. Remove any foreign matter that does enter the module.

⚠ When mounting a memory cassette in a module, push it fully into the connector.

⚠ When mounting a memory chip in a socket, push it fully in place until it locks. After mounting the memory chip, check that it is pushed fully in.

⚠ Do not place a memory cassette on a metal surface which can cause electrical leakage, or on a material which accumulates static electricity, such as wood, plastic, vinyl, fabric, electric wiring or paper.

⚠ Do bend memory chip leads or touch them by hand. This can damage the memory.

⚠ Insert memory chips as indicated on the socket.
Inserting a memory chip incorrectly can damage it.

⚠ Do not touch the memory cassette CPU connector by hand.
This can cause defective contact with the connector.

⚠ Turn off the power supply of the equipment (CPU, IBM PC, or A271DVP) before inserting or removing a memory cassette.
Inserting or removing a memory cassette while the power is connected can damage the memory cassette hardware.

⚠ Do not short a battery.

⚠ Do not disassemble a battery.

⚠ Do not burn a battery.

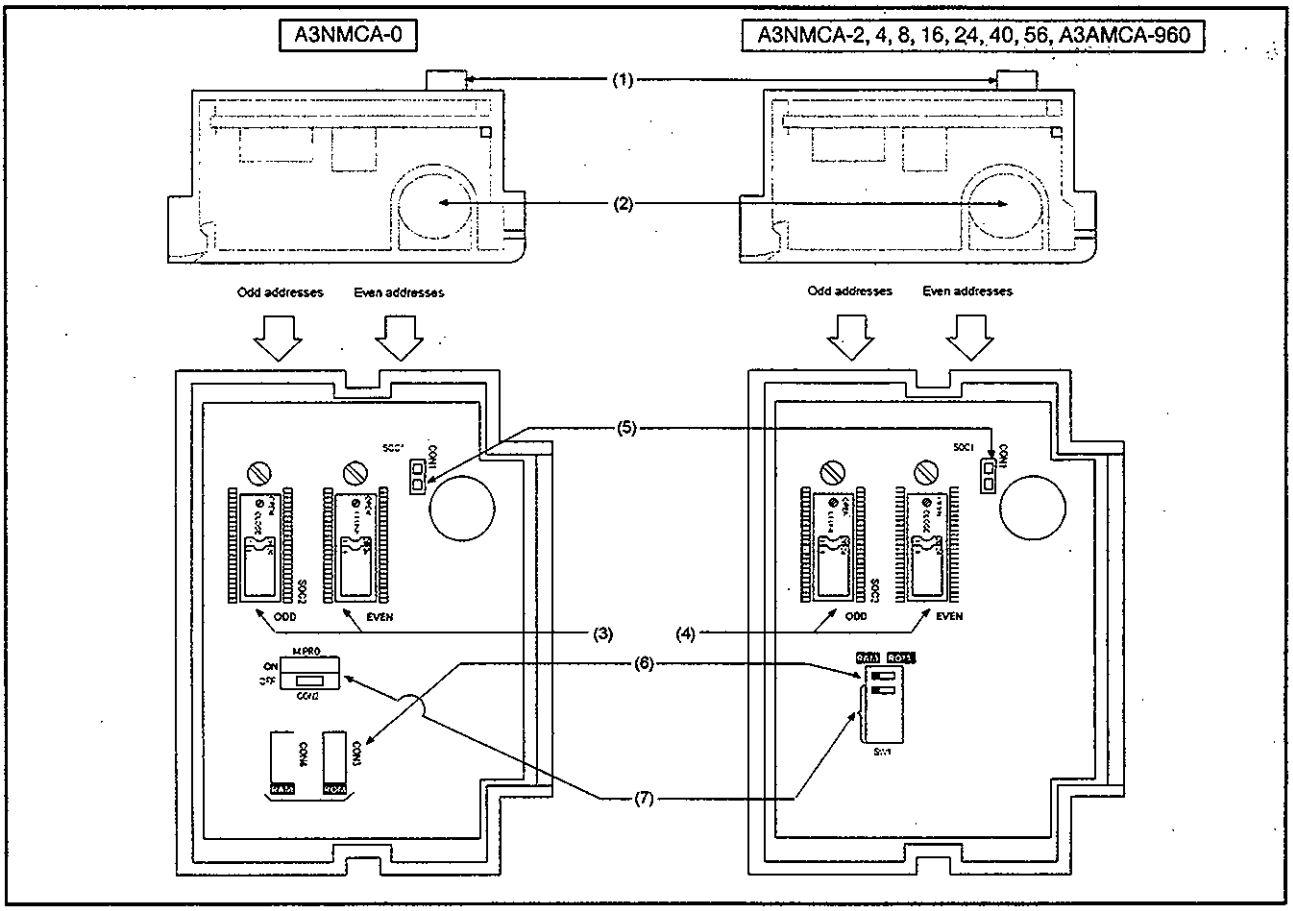
⚠ Do not overheat a battery.

⚠ Do not solder the battery terminals.

8. MEMORY AND MEMORY CASSETTES

8.2.2 Names of parts

This section describes the names of the memory cassette parts.



No.	Name	Description	Comment
1	CPU connector	Connector to connect the memory cassette to the CPU.	
2	Battery (A6BAT)	Battery for RAM back-up and power interruption backup functions	
3	Program memory sockets	Mounting sockets for IC-RAM or EPROM. Two memory chips of the same type must be mounted in the two mounting sockets SOC 1 and SOC 2. Mount memory with even addresses in SOC 1 and memory with odd addresses in SOC 2.	*
4		Mounting sockets for EPROM. Two memory chips of the same type must be mounted in the two mounting sockets SOC 1 and SOC 2. Mount memory with even addresses in SOC 1 and memory with odd addresses in SOC 2.	*
5	Battery lead connectors	Connect the battery leads to connector CON1. To reduce battery consumption, the leads are not connected to the connector when the memory cassette is shipped.	*
6	Memory setting switch	Switch between memory RAM and ROM.	*
7	Memory protection switch	Protects the contents of the IC-RAM memory. Writing and editing the memory is disabled when the protection is set ON.	*

* Must be set or mounted before writing programs.

8.2.3 Mounting and removing memory chips

This section describes the method of mounting or removing memory chips from a memory cassette.

(1) Holding the memory chip

Hold the memory chip as shown in the diagram to mount it correctly. Do not touch the leads by hand or static electricity may destroy the memory or defective contact may result from bent pins.

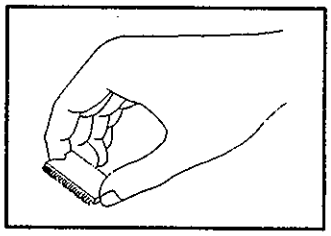


Fig. 8.1 Holding the Memory Chip

(2) Mounting direction

Make sure that the memory chip is inserted correctly or it may be destroyed when the power is turned on.
The mounting direction is marked on the memory socket. Correctly align the EPROM notch or IC-RAM notch or dotted line when mounting the memory chip.

⚠ CAUTION

⚠ Make sure that the memory chip is inserted correctly or it may be destroyed when the power is turned on.

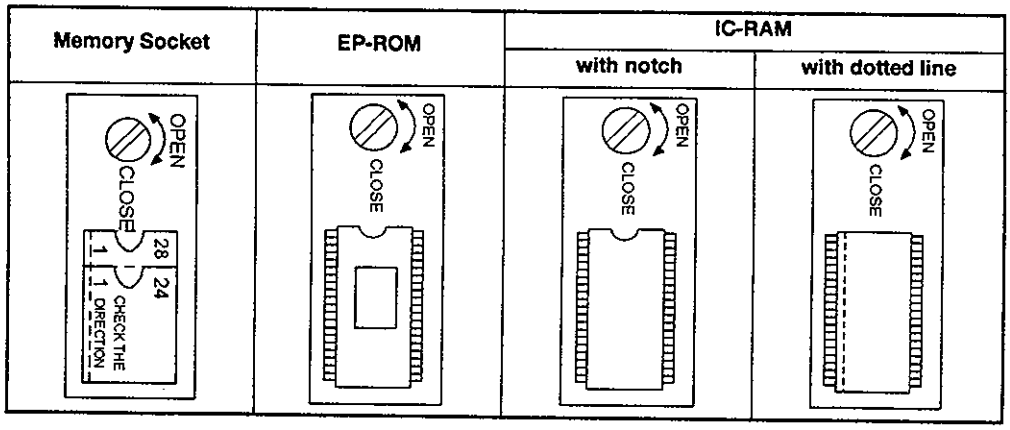
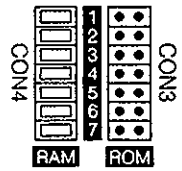
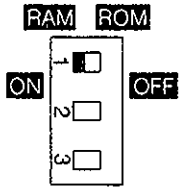
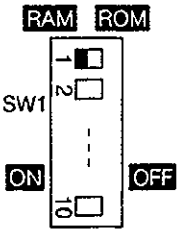


Fig. 8.2 Memory Mounting Direction

(3) Memory settings

Set the jumpers and switches to match the RAM and ROM used.

<table>
<tr>
<td rowspan="2">Memory setting</td>
<td>RAM</td>
<td>A3NMCA-0
 
</td>
<td>A3NMCA-2, 4
 
</td>
<td>A3NMCA-8, 16, 24, 40, 56
A3AMCA-96
 
</td>
<td rowspan="2">(1) Set RAM or ROM before mounting the corresponding memory.
(2) For A3NMCA-0, insert the jumpers in CON3 or CON4 to select the memory.
CON3 . . ROM
CON4 . . RAM
(3) For A3NMCA-2 to -56 or A3AMCA-96, set the switches to select the memory.

REMARK

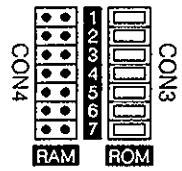
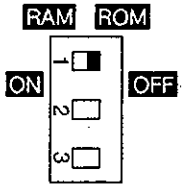
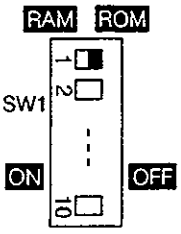
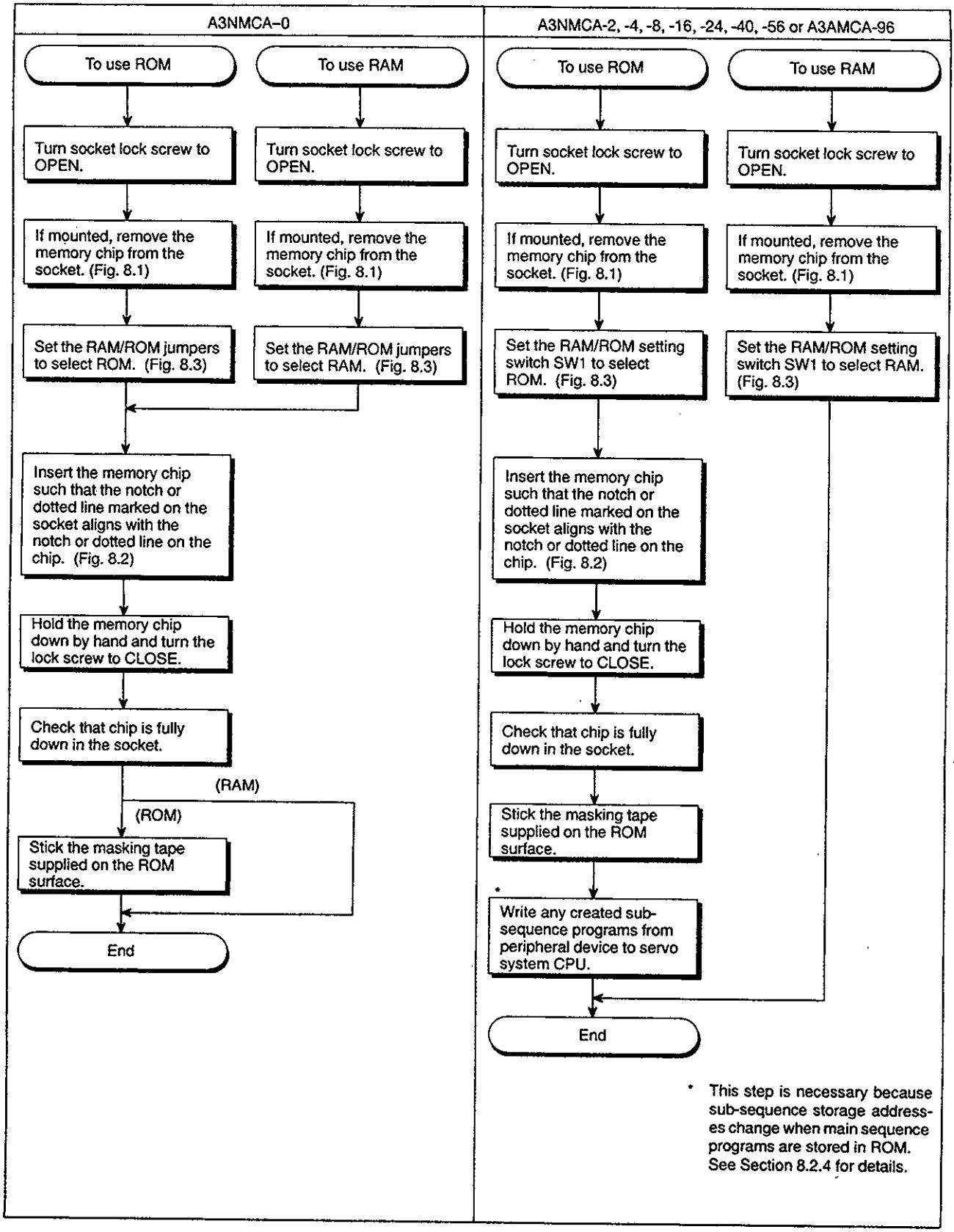
RAM is selected when the memory cassette is shipped from the factory.</td>
</tr>
<tr>
<td>ROM</td>
<td> 
</td>
<td> 
</td>
<td> 
</td>
</tr>
</table>

Fig. 8.3 Memory Settings

(4) Memory mounting procedure

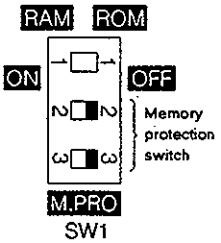
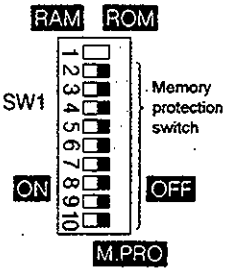
Mount the memory correctly by following the procedure described below.



8.2.4 Memory protection switch settings

The memory protection switch is provided to prevent inadvertently writing data to the memory cassette due to incorrect operation of a peripheral device.
It prevents overwriting or deleting of previously created programs.
Set the memory protection switch to the OFF position before modifying the memory cassette contents.

(1) The switch setting differs according to the model name of the memory cassette, as shown in the diagram. The memory protection switch is set OFF on shipment from the factory.

A3NMCA-0	A3NMCA-2, 4	A3NMCA-8, 16, 24, 40, 56 A3AMCA-96
		

(2) The memory ranges protected by the switch settings are shown in the table below.

Memory Protection Range (Bytes)	Switch	Applicable Memory Cassette
0 - 16K	• A3NMCA-0 jumper set to ON. • A3NMCA-2, to -56 switch 2 of DIP SW1 set to ON	Applicable to A3NMCA-0 A3NMCA-2 / Applicable to A3NMCA-4 / Applicable to A3NMCA-8 / Applicable to A3NMCA-16 / Applicable to A3NMCA-24 / Applicable to A3NMCA-40 / Applicable to A3NMCA-56 / Applicable to A3NMCA-96
16K - 32K	Switch 3, SW1 ON	
32K - 48K	Switch 4, SW1 ON	
48K - 64K	Switch 5, SW1 ON	
64K - 80K	Switch 6, SW1 ON	
80K - 96K	Switch 7, SW1 ON	
96K - 112K	Switch 8, SW1 ON	
112K - 128K	Switch 9, SW1 ON	
128K - 144K		
144K - 192K	Switch 10, SW1 ON	
192K - 320K		
320K - 448K		
448K - 768K		

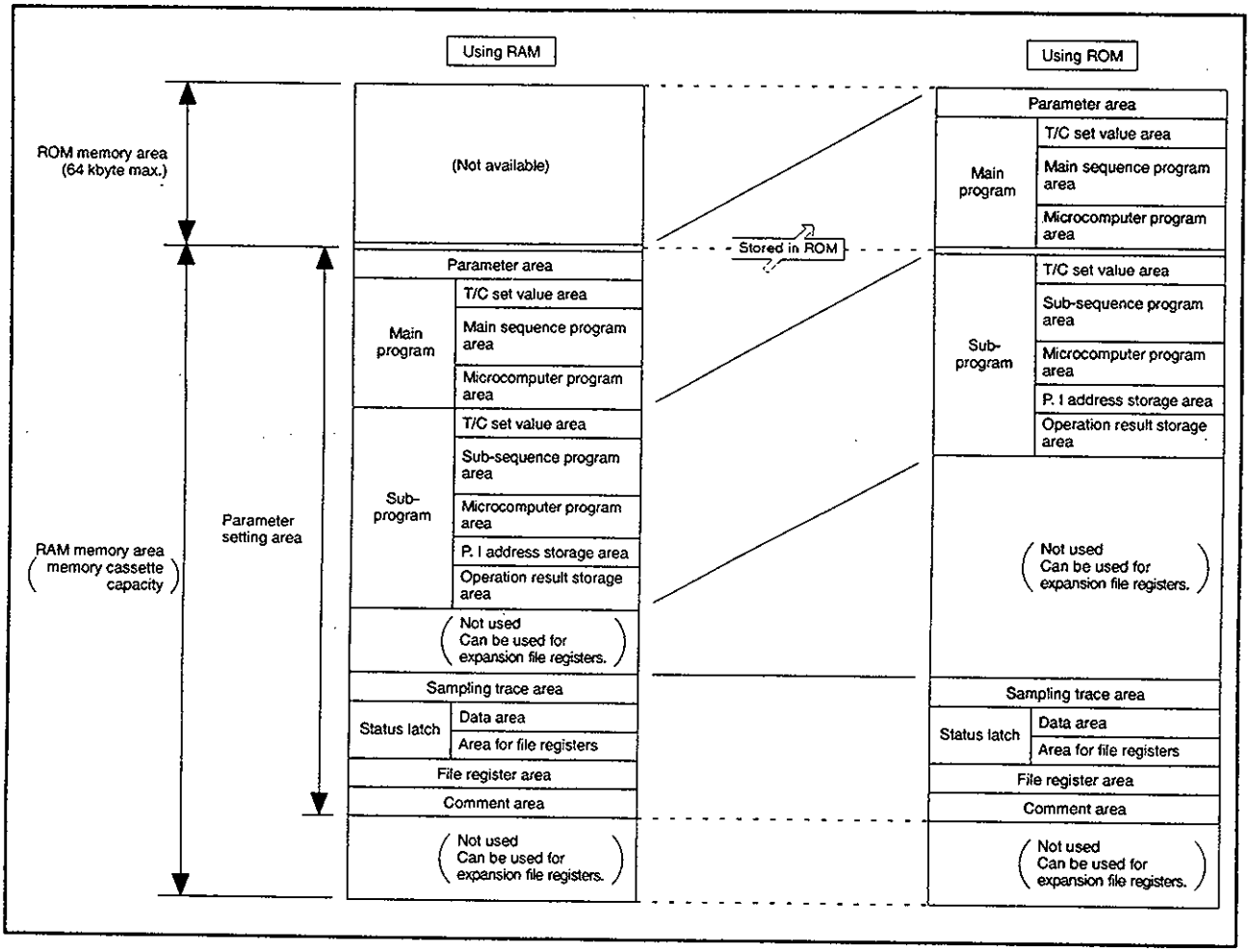
(3) Check the memory cassette areas for storing programs and data before setting memory protection.
The sequence of memory cassette storage is shown in the diagram below.
The type of data stored is determined by the parameter settings.

(a) Using RAM

- From the start address of the parameter setting capacity, data is stored in the sequence: parameters, main programs, and subprograms.
- From the end address of the parameter setting capacity, data is stored in the sequence: comments, file registers, status latches, and sampling trace.

(b) Using ROM

- Parameters and main programs are stored in ROM memory.
- Sub-programs are stored from the start address of the parameter setting capacity.
- From the end address of the parameter setting capacity, data is stored in the sequence: comments, file registers, status latches, and sampling trace.



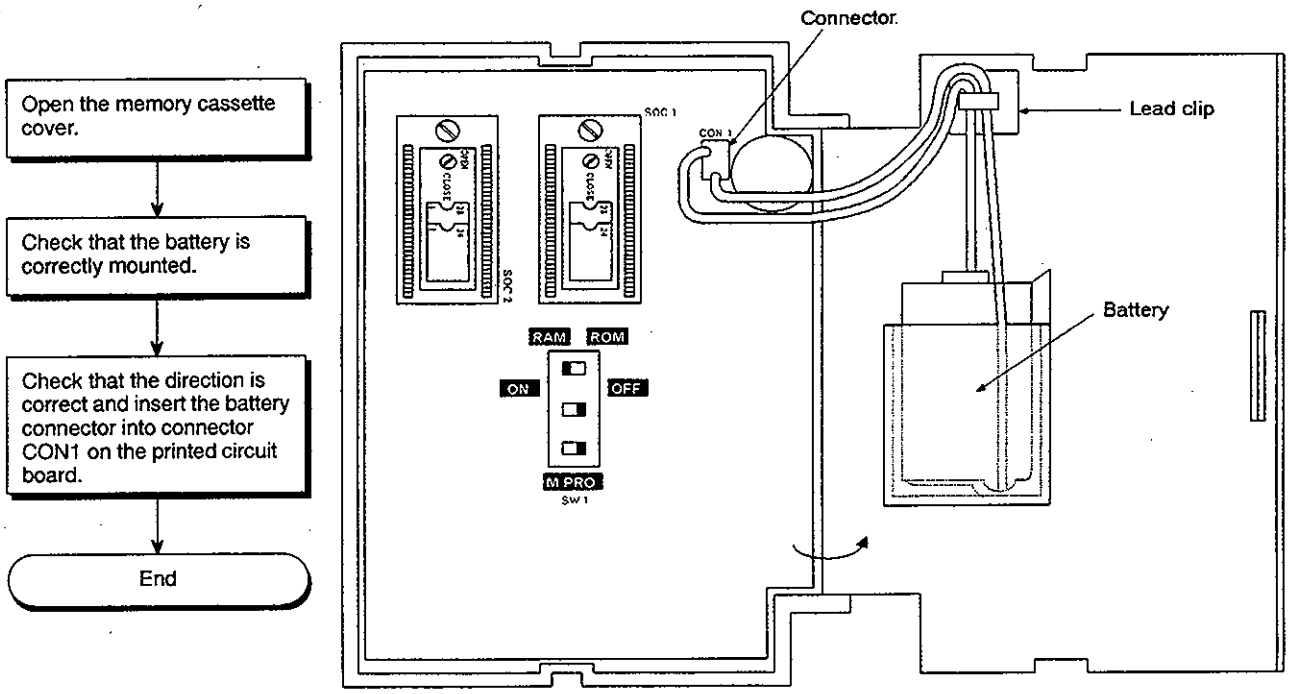
POINT

(1) Do not apply memory protection before running sampling trace or status latch. The results cannot be stored if the memory is protected.

8.2.5 Battery Installation

The battery leads are not connected when the memory cassette is shipped.

Connect the leads to the connector as described below before using RAM or power interruption backup functions.



REMARK

To reduce battery consumption during distribution and storage, the leads are not connected to the connector when the memory cassette is shipped.

MEMO

9. MOUNTING AND LOCATION SELECTION

To ensure optimum performance and increase system reliability, this section describes methods and precautions relating to mounting and selecting a location for units.

9.1 Fail-safe Circuits and Important Precautions

9.1.1 Concept behind fail-safe circuits

The difference in the lag time and rise time of the servo system CPU power supply and external process power supply (particularly DC) can cause a temporary abnormal process output when the servo system CPU is turned on or off.
For example, if the external process power supply is connected to a DC output module before the power to the servo system CPU is turned on, the DC output module can issue an abnormal output when the servo system CPU is turned on. Therefore, a circuit is required to ensure that the servo system CPU turns on first.
Malfunctions are also possible if a fault occurs in the external power supply or if the servo system CPU fails.
Therefore, circuits to prevent these abnormal outputs from reaching the overall system and failsafe circuits (including emergency stop circuits, protective circuits, and interlock circuits) to prevent damage to machines due to abnormal operation must be provided external to the servo system CPU.
Examples of suitable system circuit designs are shown on the following pages.

⚠ CAUTION

⚠ Provide appropriate circuits external to the servo system CPU to prevent cases where danger may result from abnormal operation of the overall system in the event of a power supply fault or servo system CPU failure.

⚠ Mount each controller, servo amplifier, servomotor, and regenerative resistor on a non-flammable material. Fire may result if they are mounted on or near a flammable material.

⚠ Take measures to cut off the servo amplifier power supply if the controller or servo amplifier fails. Large currents continuing to flow can cause fires.

⚠ If a regenerative resistor is used, ensure that an alarm signal cuts off the power supply, otherwise damage to the regenerative transistor, overheating of the regenerative resistor, or even fire may result.

⚠ To prevent fires, take flameproofing measures inside the control box where the servo amplifier and regenerative resistor are located and use non-flammable wiring.

⚠ Do not apply a voltage to terminals which exceeds the voltage prescribed in this manual or the instruction manuals for other products used. Incorrect voltage can cause destruction of, or damage to, the equipment.

⚠ Correct the terminals correctly. Incorrect connection can cause destruction of, or damage to, the equipment.

⚠ Ensure polarity is correct. Incorrect polarity can cause destruction of, or damage to, the equipment.

⚠ The servo amplifier cooling fins, regenerative resistor, and servomotors become hot during operation and can remain hot for some time after the power is turned off. Do not touch these parts or burn injuries may result.

⚠ To avoid injury, turn off the power before touching servomotor shafts or machinery connected to them.

⚠ To avoid injury, do not approach machinery during trial or teaching operation.

9. MOUNTING AND LOCATION SELECTION

⚠ CAUTION

⚠ Connect a leak breaker to the controller and servo amplifier power supply.

⚠ Provide an electromagnetic contactor for servo amplifiers and other equipment for which the instruction manual prescribes an electromagnetic contactor to cut off the power in the event of an error.

⚠ Provide an external emergency stop circuit to instantaneously stop operation and cut off power.

⚠ Use controllers, servo amplifiers, servomotors, and regenerative resistors in combinations prescribed in this manual and the instruction manuals for other products used. Incorrect combinations can cause damage to the system or fire.

⚠ If used in systems for which safety standards apply (such as robot systems), all controllers, servo amplifiers, and servomotors must meet the prescribed safety standards.

⚠ Configure safety circuits external to the controller or servo amplifiers if their abnormal operation could cause axis motion in a direction other than the safe operating direction for the system.

⚠ Use dynamic braking on servomotors if free running after an emergency stop, servo OFF, or a power cut is a problem.

⚠ Consider the overrun distances of the system, even if dynamic braking is used.

⚠ Use both dynamic braking and electromagnetic braking on servomotors if vertical falling of axes after an emergency stop, servo OFF, or a power cut is a problem.

⚠ Use the dynamic brake module to stop servomotors when an emergency error or other error occurs to turn off the servomotors. Do not use it to stop the servomotors during normal operation.

⚠ The electromagnetic brake incorporated in a servomotor is intended for holding only. Do not use it during normal operation.

⚠ Design systems with sufficient mechanical allowance for a safe stop if an axis passes the stroke-end limit switch at maximum speed.

⚠ Select cables for the system with appropriate diameter, heat resistance, and bending resistance.

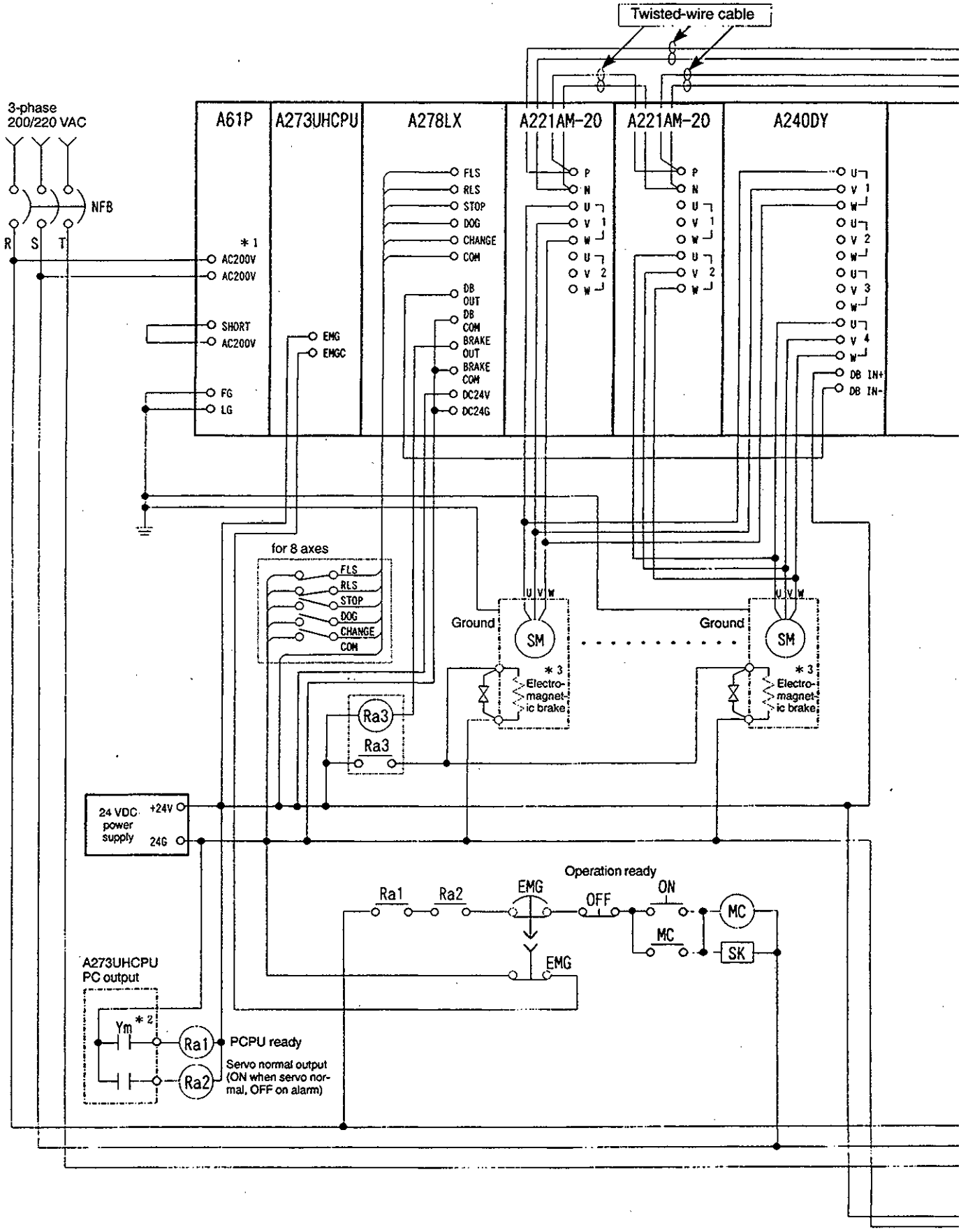
⚠ Use wires and cables with lengths in the range prescribed in this manual and the instruction manuals for other products used.

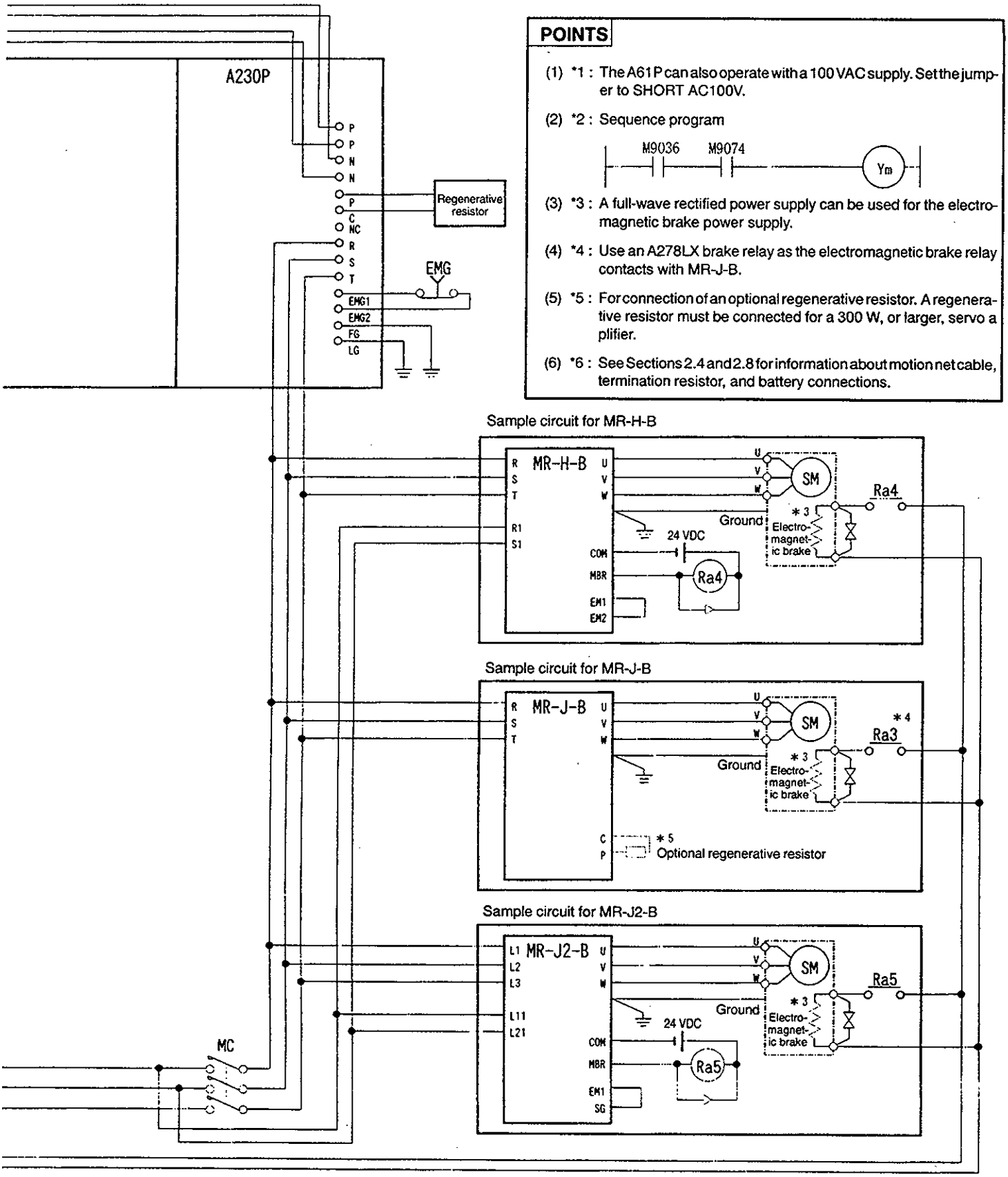
⚠ Ensure that the characteristics of other components used in a system match those of the controllers, servo amplifiers, and servomotors.

⚠ Attach covers to prevent servomotor rotating parts being touched during operation.

⚠ The electromagnetic brake may not be able to hold an axis due to age or machine construction (if a servomotor is linked via a timing belt to a ball screw, for example). As a safety measure, provide a stopping device on the machine.

(1) Sample system circuit design for motion control





POINTS

(1) *1 : The A61P can also operate with a 100 VAC supply. Set the jumper to SHORT AC100V.

(2) *2 : Sequence program

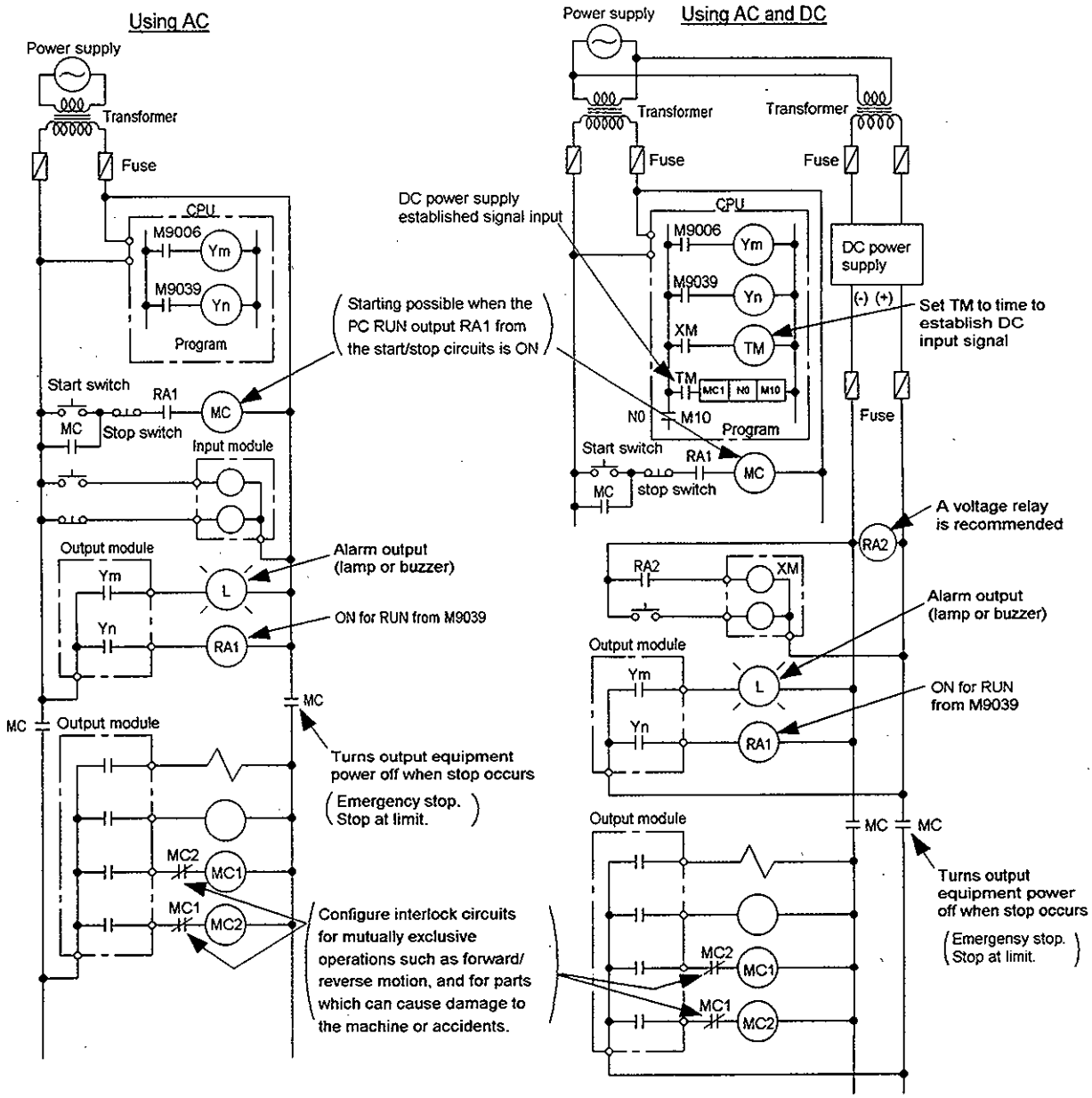
(3) *3 : A full-wave rectified power supply can be used for the electromagnetic brake power supply.

(4) *4 : Use an A278LX brake relay as the electromagnetic brake relay contacts with MR-J-B.

(5) *5 : For connection of an optional regenerative resistor. A regenerative resistor must be connected for a 300 W, or larger, servo amplifier.

(6) *6 : See Sections 2.4 and 2.8 for information about motion net cable, termination resistor, and battery connections.

(2) Example system circuit design for PC I/Os



Procedure to start up the power supply.

AC

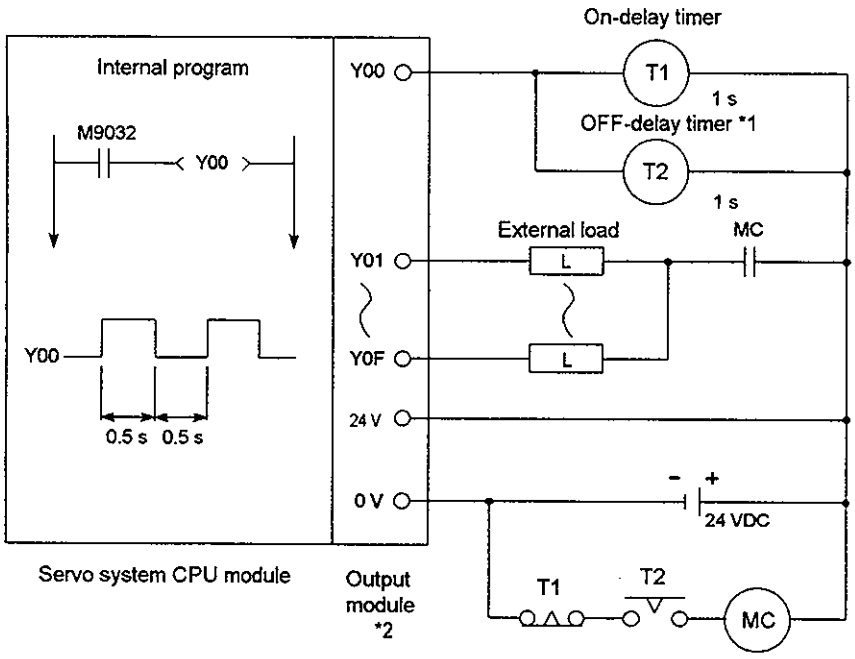
(1) Turn on the power supply.
(2) Set the CPU to RUN.
(3) Turn on the start switch.
(4) Output equipment driven by program when the electromagnetic contactor (MC) turns on.

AC and DC

(1) Turn on the power supply.
(2) Set the CPU to RUN.
(3) Turn on RA2 when DC power supply is established.
(4) Turn on timer (TM) when the DC power supply is 100% established. (Set TM set value to the time from RA2 turning ON until the DC power supply is 100% established. The set time should be approximately 0.5 s.)
(5) Turn on the start switch.
(6) Output equipment driven by program when the electromagnetic contactor (MC) turns on. The program timer (TM) is not required if RA2 is a voltage relay.

(3) Failsafe measures for servo system CPU failure

Failure of the servo system CPU or memory is detected by the self-diagnosis functions, but some abnormalities in the I/O control components cannot be detected by the servo system CPU.
Some failures can result in situations such as all points turning on or off, where normal operation and safety of the controlled object cannot be assured.
The manufactures makes every effort to ensure perfect quality control.
However, external failsafe circuits should be provided to prevent accidents or damage to machines in the event that a failure does occur in the servo system CPU.
An example of a failsafe circuit is shown in the diagram below.



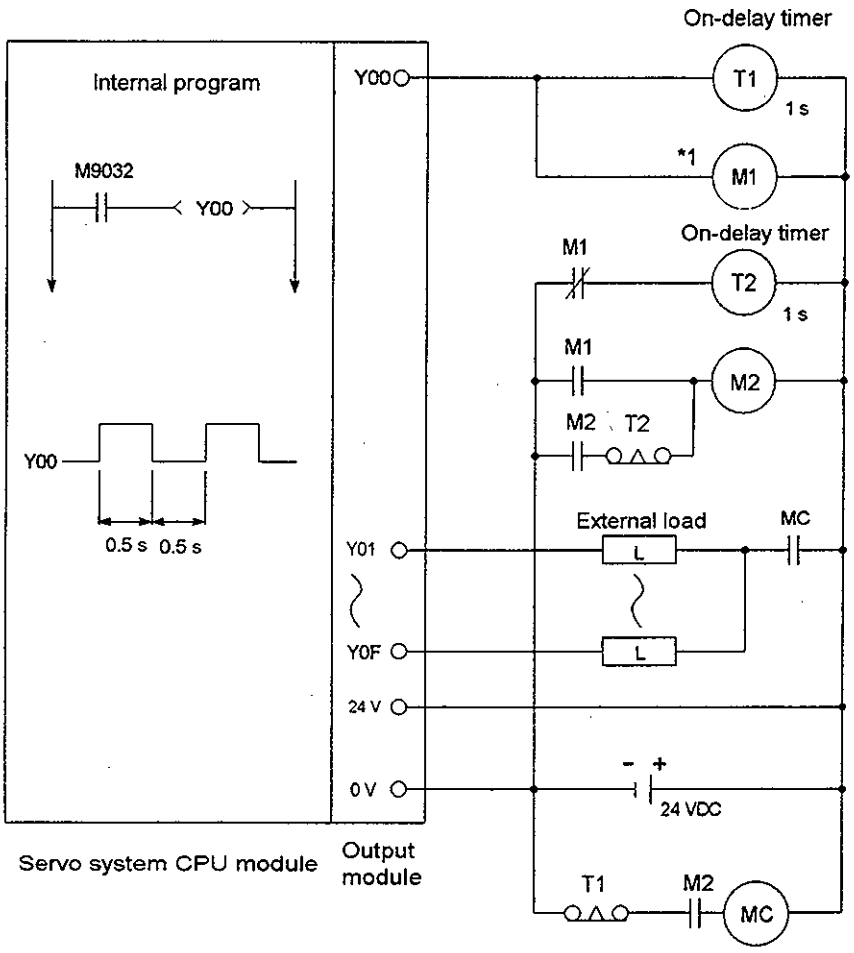
*1 Failsafe measures can be taken using an on-delay timer, as shown on the following page, if an off-delay timer (particularly a miniature timer) cannot be obtained.

⚠ CAUTION

⚠ *2 Use a non-contact output module for Y00, as it turns ON/OFF at 0.5 s intervals. A transistor is shown in the example above. Using a contact module for Y00 can cause failures.

9. MOUNTING AND LOCATION SELECTION

A failsafe circuit using only on-delay timers is shown below.



*1 Relay M1 should be a solid-state relay.

⚠ CAUTION

⚠ Some servo system CPU failures can result in situations such as all points turning on or off, where normal operation and safety of the controlled object cannot be assured. External failsafe circuits should be provided to prevent accidents or damage to machines in the event that a failure does occur in the servo system CPU.

9.1.2 Precautions with positioning systems using AC motor drive modules

Precautions when wiring the A2□□AM-20

(1) Note the following points when wiring servomotors to an A2□□AM-20 (ADU).

(a) Complete all wiring operations before supplying power to the power supply module.

(b) Refer to Appendix 2 for servomotors which can be used with A2□□AM-20.

⚠ CAUTION

⚠ Do not carry out wiring while power is supplied to the power supply module.

⚠ The U, V, W phases of the A2□□AM-20 output terminals must match the phases of the servomotor input terminals. The motor direction cannot be switched if the phases are incorrectly connected.

Emergency stop method and follow-up processing

(1) The A2□□AM-20 emergency stop can be applied by opening the servo system CPU emergency stop circuit (EMG) to apply a simultaneous stop to all A2□□ AM-20 and MR-H-B, MR-J-B axes.

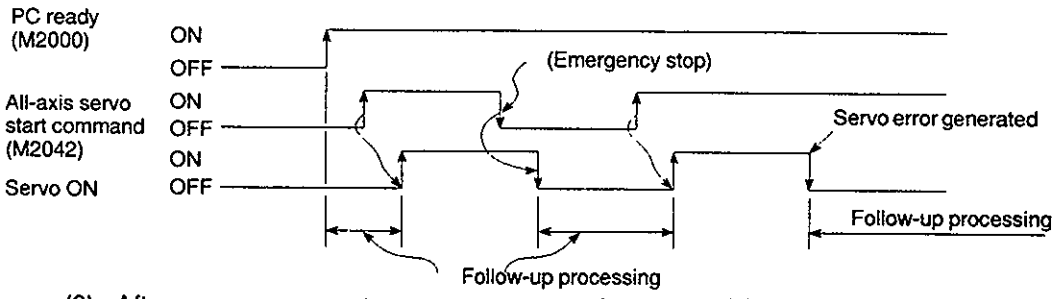
(2) The machine movement during an emergency stop or in servo OFF status is monitored and the present values modified accordingly, so that positioning continues at servo ON without rotation of the motor by the number of rotations in the deviation counter. This is called follow-up processing and is conducted according to the following conditions:

(a) When servo system CPU PC ready (M2000) signal is ON.

(b) When servo turned off for one or all axes by the sequence program.

(c) When a stop is applied by the servo system CPU emergency stop circuit (EMG). (No follow-up processing after stop by MR-H-B/MR-J-B/MR-J2-B emergency stop circuit.)

The follow-up processing timing is shown in the following timing chart.



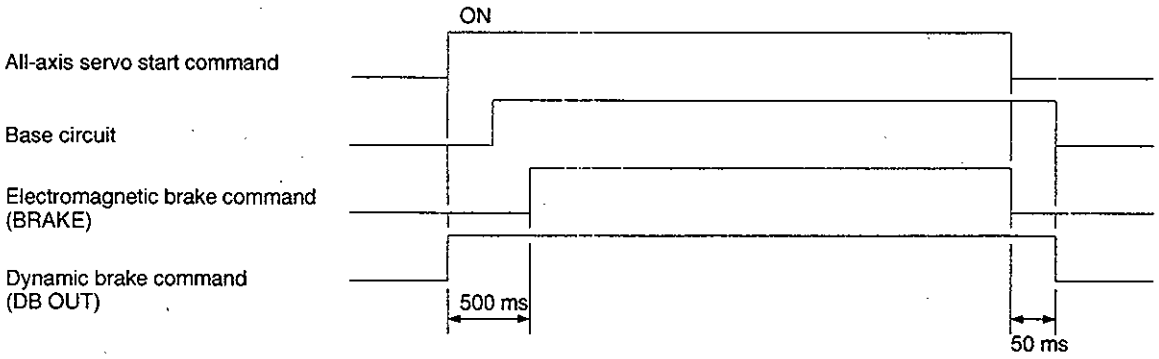
(3) After an emergency stop occurs, remove the cause of the emergency stop and re-set the emergency stop (EMG circuit ON) to establish the servo ON status.

POINT

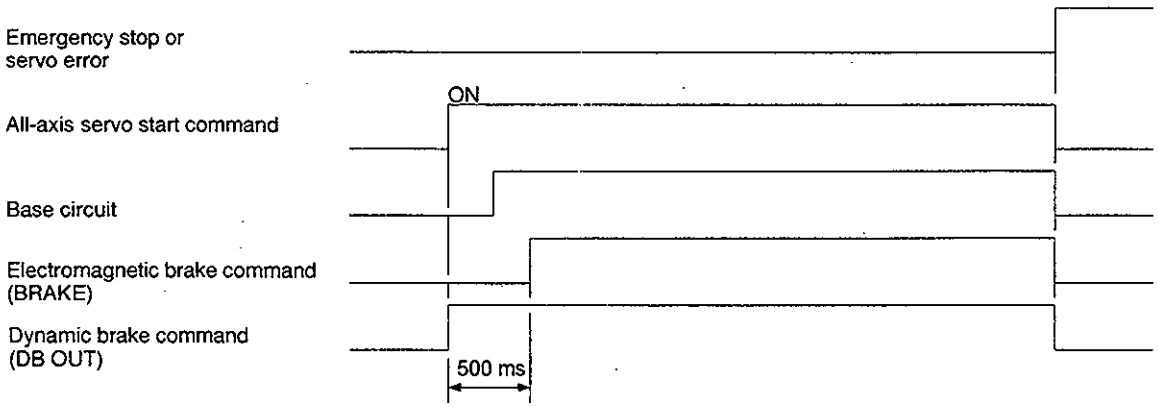
After an emergency stop, an error occurs if the emergency stop is reset within the rapid stop deceleration time set by the parameters.

Timing of Electromagnetic Brake and Dynamic Brake Outputs using A278LX

(1) When all-axis servo start command (M2042) turns on or off



(2) Emergency stop or ADU axis servo error

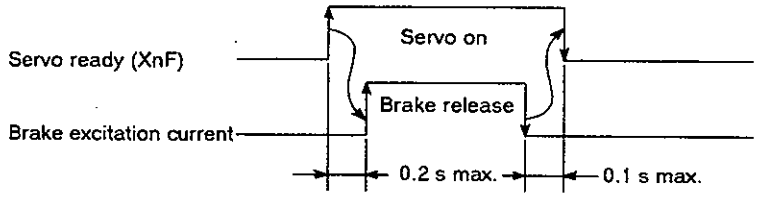


9.1.3 Precautions with positioning systems using MR-H-B, MR-J-B or MR-J2-B servo amplifiers

Wiring Connections when a Motor with Electromagnetic Brake and A273UHCPU (8-axis specification) are Used

(1) A motor with electromagnetic brake is rapidly stopped using dynamic braking when a power interruption occurs. Therefore, even if the electromagnetic brake is used, the overrun distances are not especially short.
As a double safety precaution, the overrun distance when the dynamic brake does not work should be determined.

(a) Set up the signals as shown below to use braking to prevent vertical axes falling. The diagram below shows signals to prevent axes falling during initialization: they are not intended to protect the motor.



(2) Operation circuit for motor with electromagnetic brake

The electromagnetic brake is applied when the electromagnetic brake terminals of the motor are turned OFF. See Section 9.1.1 for details about the wiring required for electromagnetic brake operation by the motion control system.

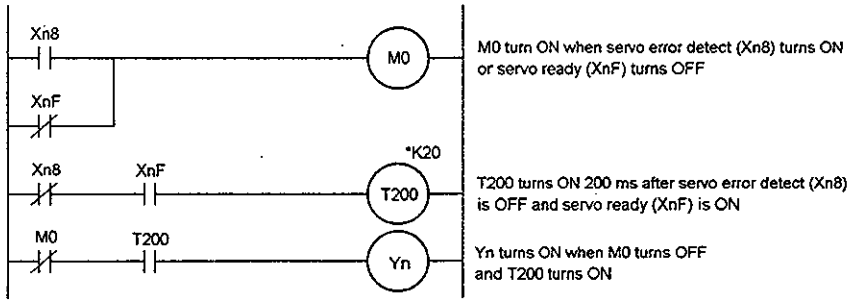
REMARK

See Appendix 4 for information on electromagnetic brake characteristics.

Electromagnetic Brake Operation Sequence Program for Servo System CPU (A273UHCPU (8-axis specification))

Write the servo system CPU sequence program to turn off the electromagnetic brake output when the servo error detect (Xn8) turns ON or servo ready (XnF) turns OFF. Also, turn on the electromagnetic brake output 200 ms after the normal servo status is detected (Xn8 OFF and XnF ON).

(A273UHCPU)



Xn8 : Servo error detect
XnF : Servo ready
M0 : Flag detecting a servo error or servo ready OFF
T200 : Timer to measure 200 ms after servo status becomes normal
Yn : Electromagnetic brake operation instruction

POINT

* ... T200 is a 10 ms timer. Errors of $^{-2\ \text{scan}}_{+1\ \text{scan}}$ may occur with some sequence program scan times.
Release the electromagnetic brake and adjust the set value such that no servo error occurs.

Emergency Stop Methods

(1) An emergency stop can be applied to stop all A2□□AM-20 and the separate servo amplifier (MR-H-B, MR-J-B or MR-J2-B) axes by opening the servo system CPU emergency stop circuit (EMG).
After an emergency stop occurs, eliminate the cause of the emergency stop and reset the emergency stop (EMG circuit ON) to turn on servos. The servo error detect (Xn8) signal does not turn ON after an emergency stop using the A273UHCPU (8-axis specification).

(2) Do not use the emergency stop terminals at the separate servo amplifier side. In cases where an independent emergency stop circuit is also required at the separate servo amplifier side, shut off the power to the separate servo amplifier by using an external circuit.

9.2 Location Environment

Avoid locating the motion control system in environments subject to:

(1) Ambient temperature outside range 0℃ to 55℃

(2) Ambient humidity outside the range 10% to 90% RH

(3) Condensation resulting from sudden temperature changes

(4) Corrosive or inflammable gas

(5) Large amounts of conducting dust or iron filings, oil mist, salt, organic solvents

(6) Direct sunlight

(7) Strong electrical or magnetic fields

(8) Direct vibrations or shocks on the equipment.

⚠ CAUTION

⚠ The storage conditions are listed in the table below.

Environment	Conditions
Ambient temperature	0℃ to 55℃
Ambient humidity	10% to 90% RH
Atmosphere	No condensation resulting from sudden temperature changes No corrosive or inflammable gas Low levels of conducting dust or iron filings, oil mist, salt, organic solvents Not subject to direct sunlight No strong electrical or magnetic fields No direct vibrations or shocks on the equipment.

9.3 Calculating Heat Generated by a Motion Controller

If a motion controller is installed in an enclosure, the temperature inside the enclosure must be restricted to the operation ambient temperature of 55℃.
The average power consumption (heat generation) of the equipment and instruments in the enclosure must be known to design the heat dissipation of the enclosure.
This section describes how to calculate the motion controller power losses and average power consumption.

Heat Generation of Modules Mounted on the Motion Main Base Unit and Motion Extension Base Units

If both the motion main base unit and motion extension base units are installed in an enclosure, use the equations below to determine the heat generated by each mounted module, and use the sum of these values to calculate the temperature rise in the enclosure.

The following equation approximately calculates the temperature in the enclosure:

$$T = \frac{W_T}{UA} \quad [℃]$$

where:

W_T : main base unit power losses (W) + power consumption of the overall motion extension base unit system (W)
A : internal surface area of the enclosure (m^2)
U : if a fan is used to make enclosure temperature uniform 6
if air is not circulated inside the enclosure 4

⚠ CAUTION

⚠ If the enclosure temperature rises above the prescribed range, a heat exchanger should be attached to the enclosure to lower the temperature.
Ventilation of the enclosure with a fan can result in dust problems with the motion controller because of the dust which is introduced with the ambient air.

Power Losses in Servo Power Supply Module and ADUs

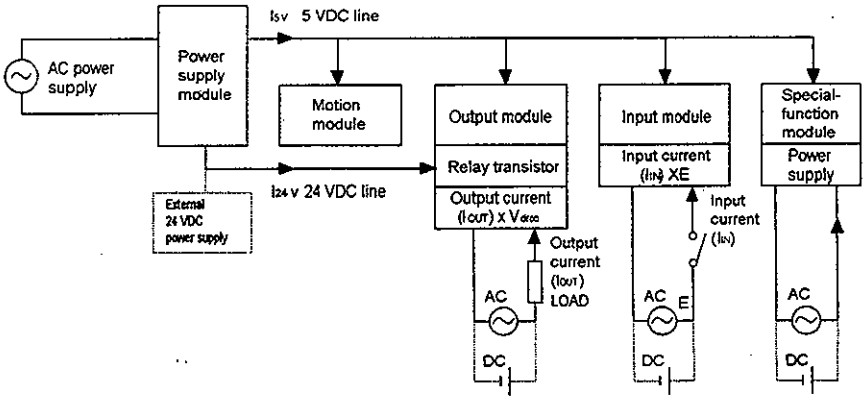
The power losses (heat generation) in ADUs and servo power supply modules at rated output are shown in Table 9.1.
ADU power losses are the total power losses of all mounted ADUs.

Table 9.1 Servo Power Supply Module and ADU Power Losses

Module	Power Supply Module	ADU		
	A230P	A211AM-20	A221AM-20	A222AM-20
Loss (W)	70	11	11	22

Calculating Average Power Consumption

The major parts consuming power in a motion extension base unit are shown in the block diagram below.



(1) Power consumption of power supply module

The power conversion efficiency of a power supply module is approximately 70%, with the remaining 30% consumed in heat generation. Therefore, the heat generation is 3/7 of the output power, calculated by the following equation:

$$W_{PW} = \frac{3}{7} \{ (I_{5V} \times 5) + (I_{24V} \times 24) \} \quad (W)$$

where:

I_{5V} : I_{5V} is the current consumption of the 5 VDC logic circuits of each module
I_{24V} : I_{24V} is the 24 VDC average current consumption of the output module internal power supply (current consumption of simultaneously ON points)
... This does not apply to modules with an external 24 VDC supply but no 24 VDC output.

(2) Total power consumption of 5 VDC logic circuits of all modules

The power supply module power consumption is the 5VDC output circuit power of the module.

$$W_{5V} = I_{5V} \times 5 \quad (W)$$

(3) 24 VDC average power consumption (power consumption of simultaneously ON points)

The total power consumption of a power supply module is the average power of the 24 VDC output circuits of the module.

$$W_{24V} = I_{24V} \times 24 \quad (W)$$

(4) Average power consumption from voltage drop in output circuits of the output modules (power consumption of simultaneously ON points)

$$W_{out} = I_{out} \times V_{drop} \times (\text{no. of output points}) \times (\text{simultaneously ON ratio}) \quad (W)$$

where:

I_{out} : I_{out} is the output current (actual operation current) (A)
V_{drop} : V_{drop} is the voltage drop of each output module (V)

(5) Average power consumption from voltage drop in input circuits of the input modules (power consumption of simultaneously ON points)

$$W_{in} = I_{in} \times E \times (\text{no. of input points}) \times (\text{simultaneously ON ratio}) \quad (W)$$

where:

I_{in} : I_{in} is the input current (RMS value for AC) (A)
E : E is the input voltage (actual operation voltage) (V)

(6) Power consumption of special-function module power supply circuits

$$W_S = (I_{5V} \times 5) + (I_{24V} \times 24) + (I_{100V} \times 100) \quad (W)$$

The total power consumptions of all the blocks described above is the power consumption of the entire PC system.

$$W = W_{PW} + W_{5V} + W_{24V} + W_{out} + W_{in} + W_S \quad (W)$$

Use the overall power consumption calculated for the extension base unit to calculate heat generation and temperature rise inside the enclosure.

9.4 Installing the Base Units

This section describes precautions relating to the installation of the main base unit and extension base units.

9.4.1 Precautions on installation

This section describes the precautions related to mounting a motion controller in an enclosure.

(1) To improve ventilation and make it easy to replace modules, leave a space of at least 100 mm (3.94 in) between the top of the modules and any other object.

(2) Provide a wiring duct, if required.

Consider the following points if the dimensions from the top or bottom of the motion controller are less than those shown in Fig. 9.1 in Section 9.4.2.

(a) If the duct is above the motion controller, limit the duct height to 50 mm max. to improve ventilation.
Leave sufficient clearance above the motion controller to allow module replacement.

(b) If the duct is below the motion controller, ensure it allows maintenance of the support motion network and PC extension cables and take the minimum bending radius of the cables into consideration.

⚠ CAUTION

⚠ Due to ventilation problems, do not install the base units vertically or horizontally (as shown in Fig. 9.4 and 9.5).

⚠ Install the base units on a flat surface. Unevenness or warping of the surface can apply undue force to printed circuit boards and lead to malfunctions.

⚠ Avoid installing the base units close to a vibration source, such as a large electromagnetic contactor or no-fuse breaker. Mount them on a separate panel or at a safe distance.

⚠ To limit the effects of reflected noise and heat, leave at least 100 mm (3.94 in) clearance to instruments mounted in front of the motion controller (on the rear of the door).
Similarly, leave at least 50 mm (1.97 in) clearance between instruments and the left and right sides of the base units.

9.4.2 Installation

(1) The mounting positions of the main base unit and extension base unit are shown below.

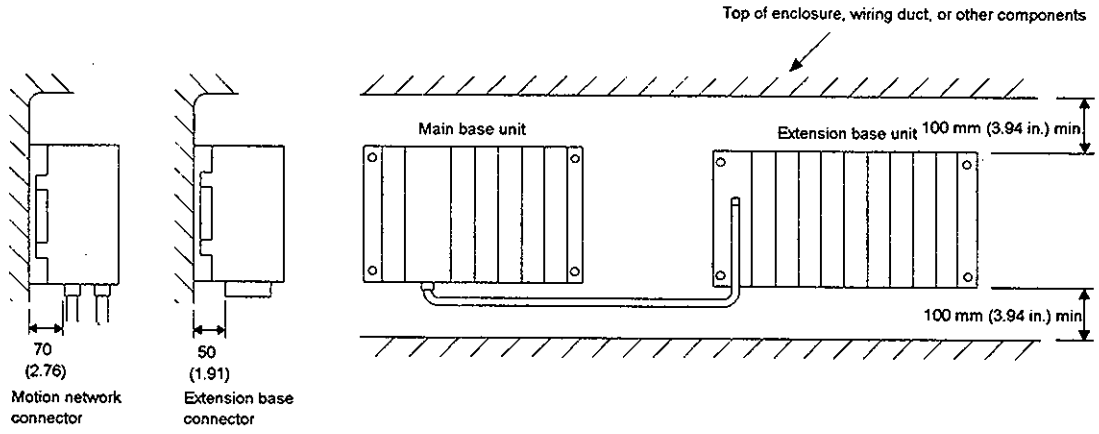
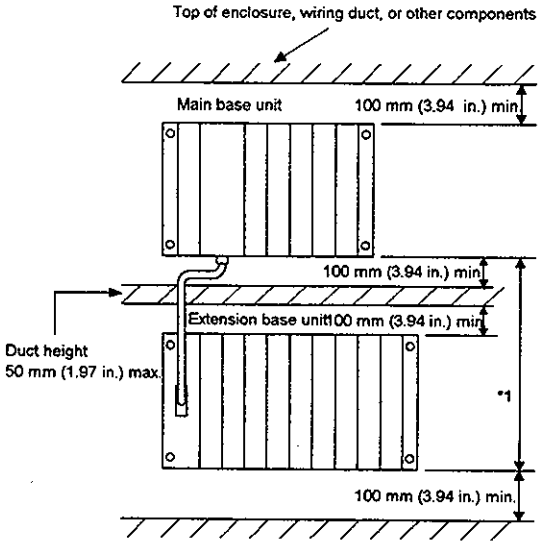


Fig. 9.1 Parallel Installation



*1 Extension Cable Lengths
A370C12B cable ... 620 mm (24.4 in.) max.
A370C25B cable ... 1920 mm (75.6 in.) max.

Fig. 9.2 Serial Installation

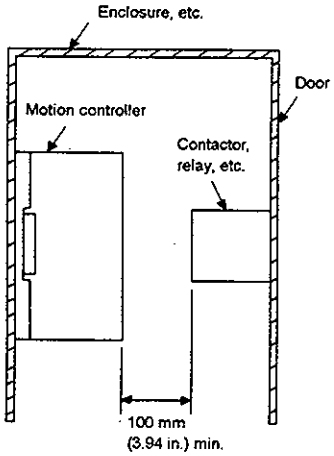


Fig. 9.3 Clearance to Instruments in Front of Motion Controller

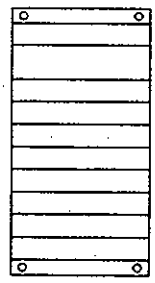


Fig. 9.4 Vertical Installation (Not Permitted)

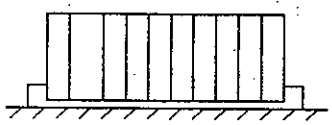


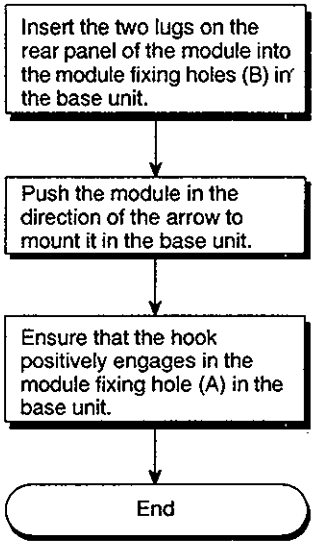
Fig. 9.5 Horizontal Installation (Not Permitted)

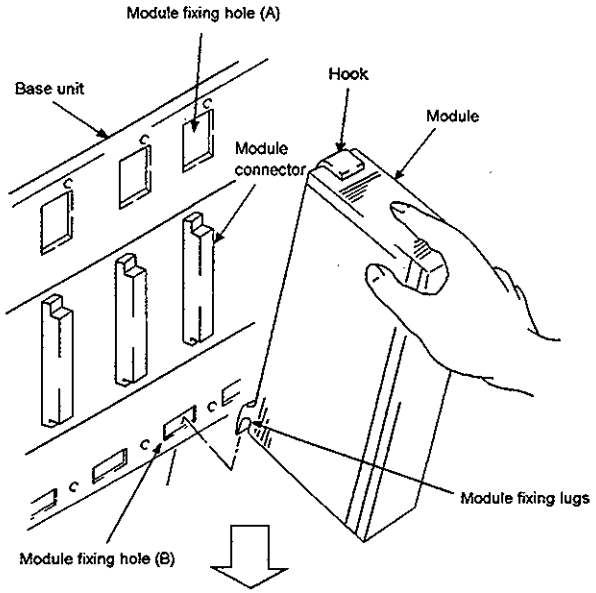
9.5 Mounting and Removing Modules

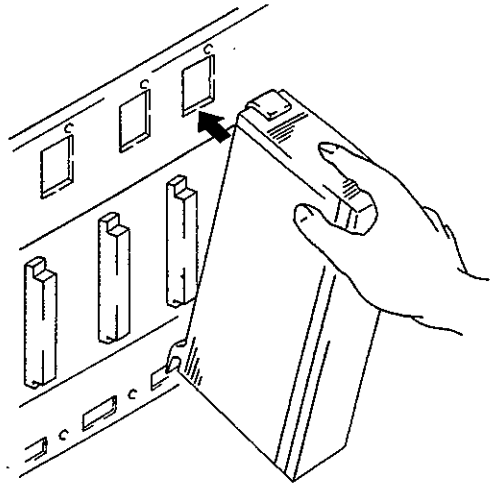
This section describes how to mount and remove power supply modules, servo system CPUs, motion modules, I/O modules, special function modules in the base units.

(1) Mounting modules

Follow the procedure below to mount a module in the base unit.



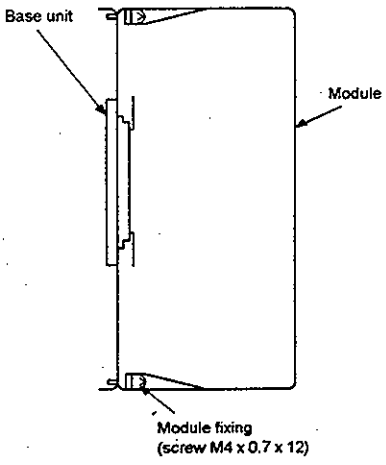




⚠ CAUTION

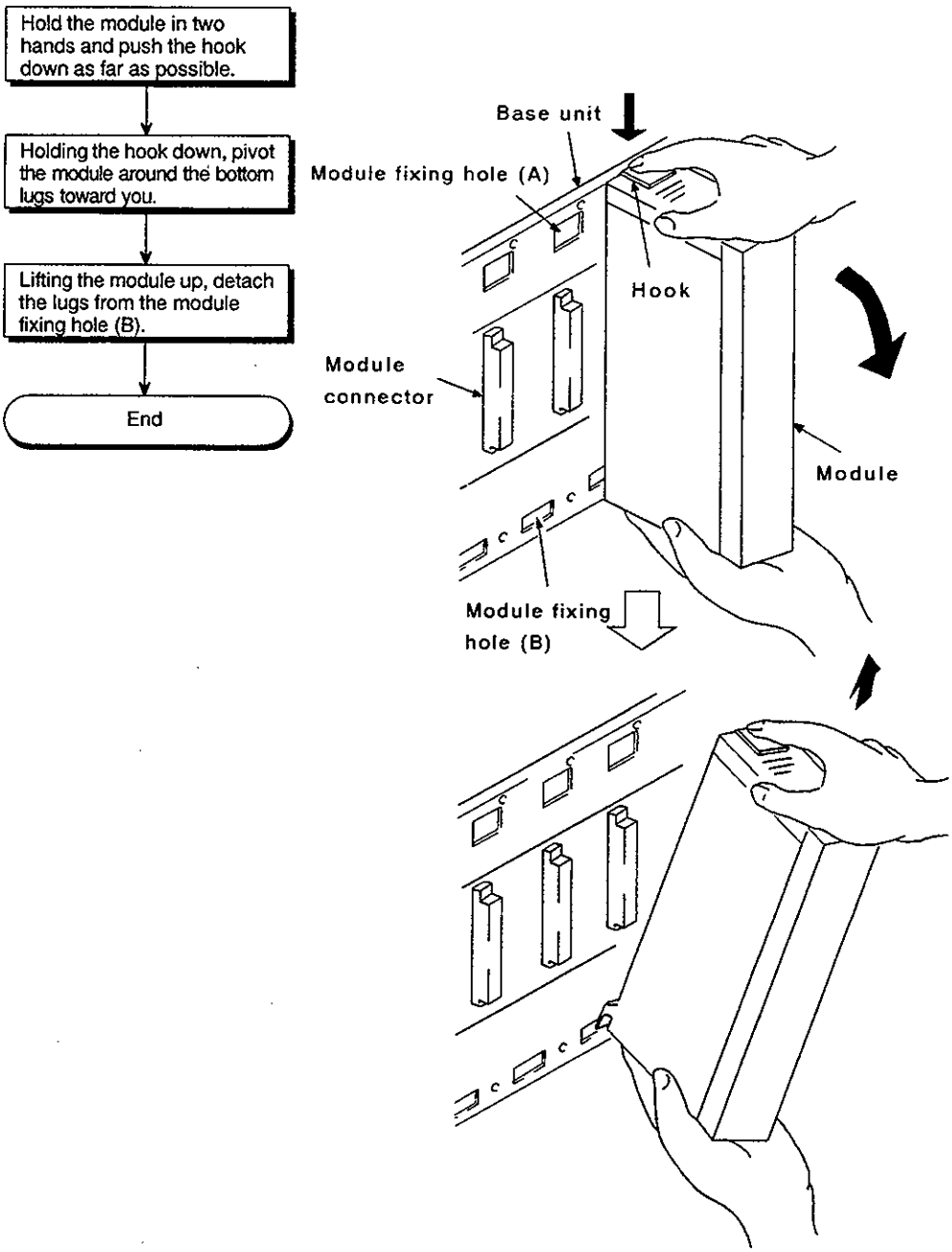
⚠ The lugs must be inserted in module fixing hole (B) when a module is mounted. Forcibly fixing a module in place without inserting the lugs in the hole will bend the module connector pins and cause other damage.

⚠ Screw the modules to the base unit, to prevent them falling off due to shocks and vibrations during operation. Use M4 x 0.7 x 12 screws. The user is to provide the screws. The screw positions are shown in the diagram to the right.



(2) Removing modules

Follow the procedure below to remove a module from the base unit.

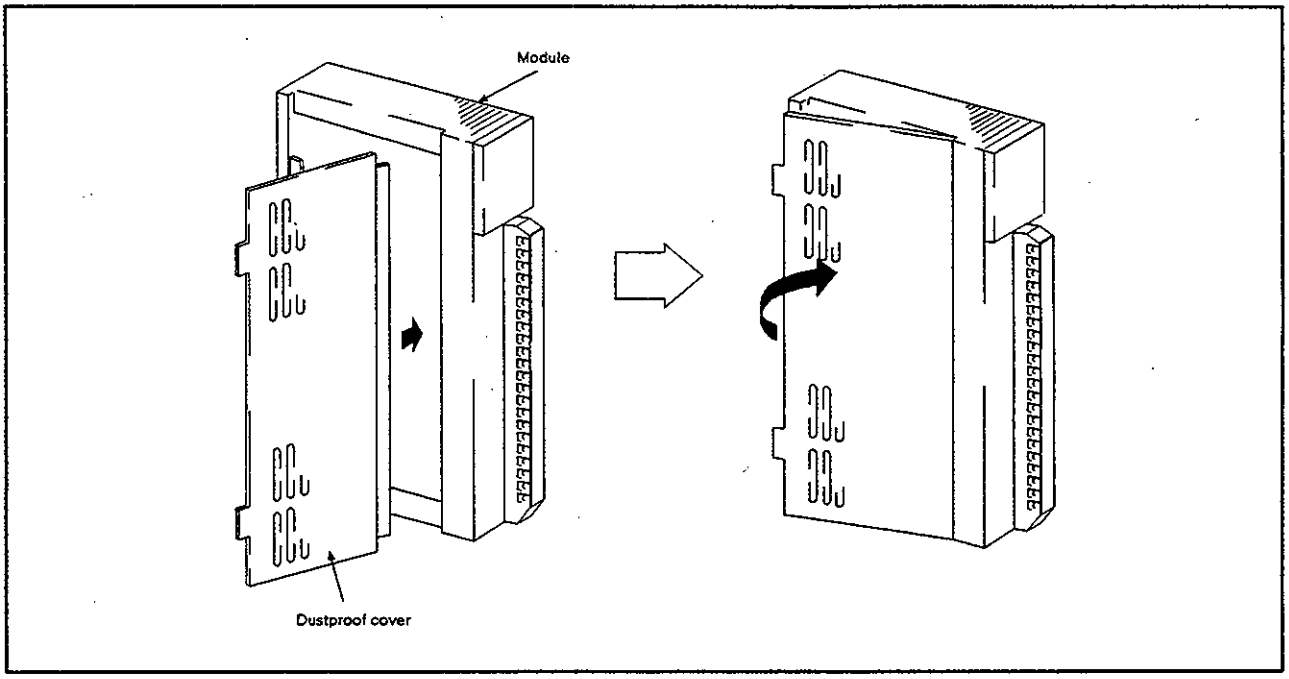


⚠ CAUTION

⚠ When removing a module, the hook must be released from the module fixing hole (A) before attempting to remove the lugs from module fixing hole (B).
Forcing out a module may damage the hook and lugs.

9.6 Attaching the Dustproof Cover

When an A255B is used, the dustproof cover supplied with the base unit must be attached to the left side, to prevent dust and foreign matter entering the module. The cover must be attached, otherwise dust and foreign matter entering the module could cause it to fail. The method of attaching the cover is shown below.



As shown in the diagram, attach the dustproof cover by first inserting it in the direction of the terminals and then pushing it against the side of the module.

⚠ CAUTION

⚠ A dustproof cover must be attached. Dust and foreign matter entering the module can cause it to fail.

9.7 Wiring

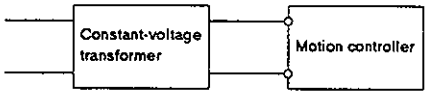
This section explains important information about wiring the system.

9.7.1 Wiring precautions

Precautions about wiring the power supply and I/O cables.

(1) Wiring the power supply

(a) Connect a constant-voltage transformer if the power supply voltage fluctuations exceed the prescribed value.



(b) Use a power supply with low noise between cables and with respect to earth. Connect an insulating transformer if high levels of noise exist.

⚠ CAUTION

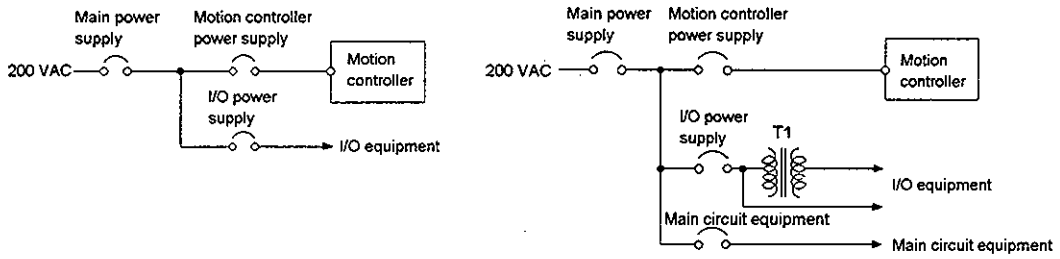
⚠ When selecting power transformers and insulating transformers with 200 VAC secondary voltage, refer to the table below for the minimum transformer capacity required.

Power Supply Module Model Name	Transformer Capacity*
A230P	10KVA×n
A61P	110VA×n
A62P	110VA×n
A65P	110VA×n
A66P	95VA×n
A68P	95VA×n

n : the number of power supply modules used

* : table lists the transformer capacity at maximum output

(c) Connect wiring to the motion controller power supply separate from the wiring to I/O equipment and power equipment.

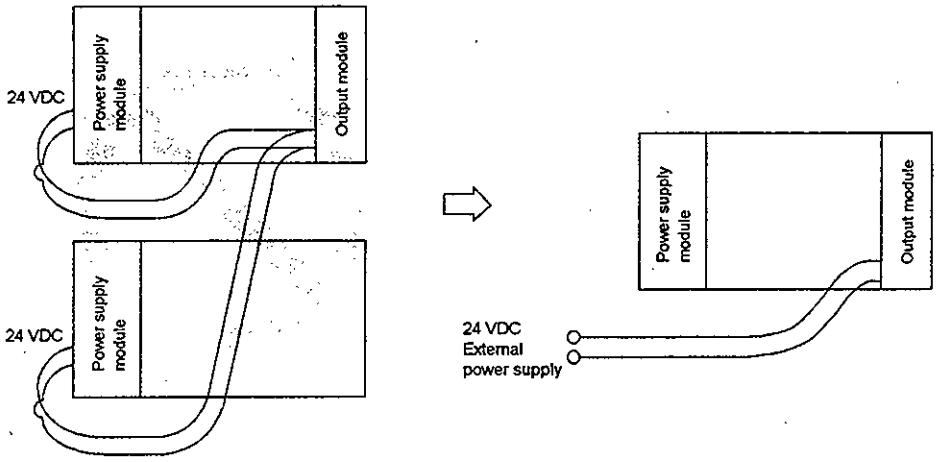


REMARK

As a safety precaution for on-line replacement of I/O modules mounted in the PC extension base unit, connect the power supply wiring for each module and piece of equipment through a cut-off switch.

(d) Precautions when Using the A62P, A65P Power Supply Module 24 VDC Output

Do not connect 24 VDC outputs from multiple power supply modules in parallel to supply a single I/O module. The power supply modules will be damaged if the outputs are connected in parallel.
If the 24 VDC output capacity of a single power supply module is insufficient, supply power from an external 24 VDC power supply.



(e) Twist 100 VAC, 200 VAC, and 24 VDC wires together as tightly as possible. Connect modules together over the minimum distance.

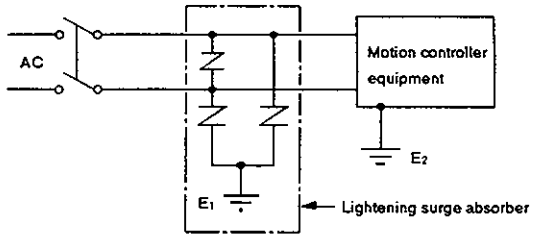
(f) To minimize the voltage drop, use the thickest 100 VAC, 200 VAC, and 24 VDC wires possible.

⚠ CAUTION

⚠ Do not connect 24 VDC outputs from multiple power supply modules in parallel to supply a single I/O module. This can damage or destroy the power supply modules.

⚠ Do not position the 200 VAC or 24 VDC cables close to, or bundle them with, power-circuit (high-voltage, high-current) cables or I/O signal cables. A clearance of at least 200 mm (7.87 in) to other cables is required.

(g) As a measure against lightening surges, connect a lightening surge absorber, as shown in the diagram below.



⚠ CAUTION

⚠ Use separate grounds for the lightening surge absorber ground (E_1) and motion controller ground (E_2).

⚠ Select the lightening surge absorber such that the maximum rise in supply voltage does not exceed the surge absorber maximum permitted circuit voltage.

(2) Wiring the motion modules

See Chapter 5 for information on wiring the motion modules.

(3) Wiring the I/O equipment

(a) Wires between 0.75 mm^2 and 2 mm^2 can be connected to the terminal block, but 0.75 mm^2 wires are recommended.

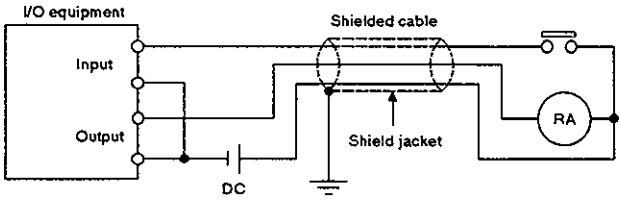
(b) If wires pass through a conduit, the conduit must be grounded.

⚠ CAUTION

⚠ Connect input and output wires along different routes.

⚠ Leave at least 200 mm (7.87 in) clearance between I/O wires and high-voltage, high-current main-circuit cables.

⚠ If the I/O wires cannot be kept separate from the main-circuit or power cables, use shielded cable for all of them and ground the shield at the I/O equipment end. However, if appropriate, ground the other end of the shield



⚠ Keep 24 VDC I/O wires separate from 100 VAC and 200 VAC wires.

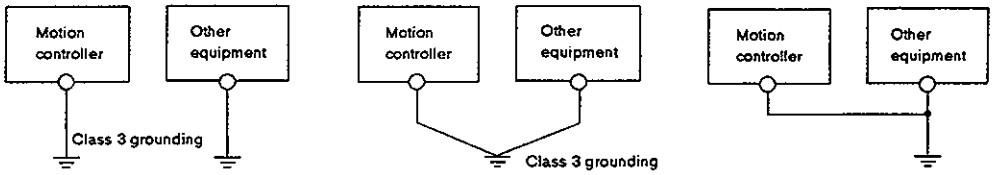
⚠ The leakage current over long-distance wiring connections exceeding 200 m (656.17 ft.) can lead to problems. See Section 12.3 for appropriate countermeasures.

(4) Grounding

(a) Connect the ground wiring as described in steps (b) to (d).

(b) Use a separate ground, if possible. Ground resistance 100 Ω, or less.

(c) If a separate ground is not possible, connect to ground as shown in (2) below.



(1) Separate ground connections ····· optimum (2) Common ground connection ····· acceptable (3) Common ground connection ····· not permitted

(d) Grounding cables to be 2 mm^2 min.

Grounding point to be as close as possible to the motion controller and the distance to the grounding point as short as possible.

⚠ WARNING

⚠ Ground resistance to be 100 Ω max. Do not share a common ground with other equipment.

9. MOUNTING AND LOCATION SELECTION

9.8 Serial Synchronous Encoder

Precautions on using a MR-HENC serial synchronous encoder.

9.8.1 Installation precautions

(1) If the serial synchronous encoder is linked to a chain, timing belt, or gears, the machine rotating shaft should be supported by a separate bearing and connected to MR-HENC through a coupling. Take care that excessive force (greater than the permitted shaft load) is not applied to the encoder.

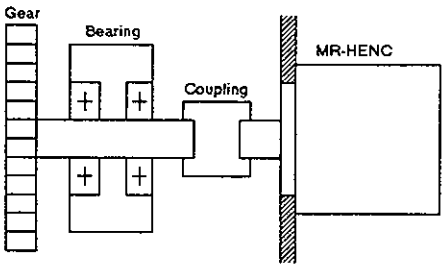


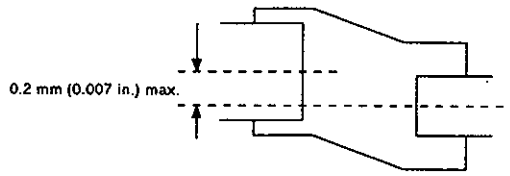
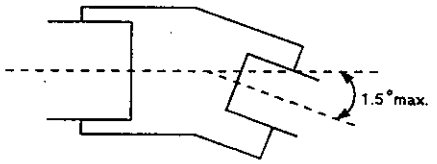
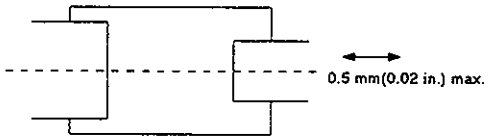
Table 9.2 Permitted Shaft Loads

	Radial Direction	Thrust Direction
Permitted shaft load kg (lb)	10 (22.03) max.	5 (11.01) max.

Fig. 9.6 Example of Encoder Linked to a Gear

(2) Large errors in eccentricity and angle of deviation during mounting can apply an excessive force to the MR-HENC shaft, which can cause a deterioration in performance and an extreme reduction in encoder life.
Minimize loads applied to the shaft such that they lie within the permitted shaft load range. The permitted shaft loads are shown in Fig. 9.2 for the recommended coupling type.

Table 9.3 Permitted Values for Coupling Mounting Errors

Eccentricity	
Angle of deviation	
Axial displacement	

Recommended coupling: Mini coupling manufactured by Eagle Industries, Co. Ltd.

Model Name	Machine Shaft Diameter mm (in.)
EFCS38B120×150Z	12 (0.47)
EFCS38B080×150Z	8 (0.31)

⚠ CAUTION

⚠ The MR-HENC contains a glass disk and precision mechanism. Take care when handling it. The encoder performance may deteriorate if it is dropped or subjected to shocks or vibrations exceeding the prescribed limits.

⚠ Do not connect the encoder directly to the rotating machine shaft. Always connect the encoder through a flexible coupling.

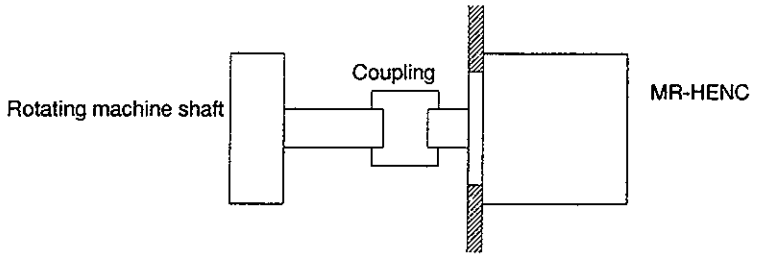


Fig. 9.7 Connecting the Encoder to a Machine Shaft

⚠ Never hit the end of the MR-HENC coupling shaft with a hammer when connecting the coupling to it. The large loads applied to MR-HENC will damage it.

9.8.2 Wiring precautions

(1) Connect MR-HENC with shielded twisted-wire pair cable.

(2) Do not extend the cable to more than 30 m (98.43 ft) in length. Keep the cable length as short as possible to reduce induced noise.

⚠ CAUTION

⚠ Always turn off the power before connecting the wiring. The output circuits may be damaged if an output signal wire touches the power supply or another output signal wire when the power is turned on.

⚠ Ensure that all wires are connected correctly. Incorrect connection can destroy the internal circuits.

⚠ Position AC cables, power cables and high-voltage cables separately. If they are together, the induced noise can cause malfunctioning or damage to equipment.

10. TRIAL OPERATION

This section describes the operations required before, during, and after trial operation.

⚠ CAUTION

⚠ Check and adjust the programs and parameters before starting trial operation. Errors in the programs or parameters may cause the machine to make unpredicted movements.

⚠ Never make very large adjustments as this can make operation unstable.

10.1 Checklist before Trial Operation

Check the points in Table 10.1 before starting trial operation of the motion control system.

Table 10.1 Checklist before Trial Operation

Model Name	Check Item	Reference
CPU module	(1) Is memory cassette correctly mounted in CPU module?	Section 8.2.1
	(2) Does memory cassette capacity match used memory capacity?	Section 4.3.3, Section 8.1.1
	(3) RAM/ROM settings correct?	Section 8.2.3
	(4) Is EPROM or IC-RAM correctly mounted in the socket? (If A3NMCA-0 or EP-ROM is used.)	
	(5) Are two EPROM/IC-RAM of the same type mounted?	Section 8.1.2
	(6) Is memory protection switch ON?	Section 8.2.4
	(7) Is the memory cassette battery (A6BAT) lead connector fully inserted into the PCB pin connector.	Section 8.2.5
	(8) Is the battery voltage normal? (Nominal value: 3.16 V)	Section 11.3
	(9) Is OS model name displayed at power on?	Programming/ Operating Manual of OS used.
	(10) Is OS model name correct?	
	(11) Is emergency stop wiring connected?	Chapter 9
A230P power supply module	(1) Is correct power supply module mounted on the base unit?	Section 5.6
	(2) Are supply voltage and power supply module rated voltage correct?	
	(3) Are FG and LG wired correctly?	Section 5.6, Section 9.1.1
	(4) Are terminal screws correctly tightened?	Section 5.1
	(5) Are cable sizes correct?	–
	(6) Is emergency stop connected?	Section 5.6.3
	(7) Is regenerative resistor required?	
A2□□AM-20 AC motor drive module	(1) Are servomotors and encoders correctly connected?	Section 5.1, Section 5.2
	(2) Are the correct cables connected to the terminals (U, V, W, P, N) of the terminal block?	
	(3) Are terminal screws correctly tightened?	
	(4) Are cable sizes correct?	–
	(5) Are the correct servomotor and module capacities selected?	Section 5.2
A273EX manual pulse generator/synchronous encoder interface module	(1) Is the manual pulse generator setting switch correctly set?	Section 5.5.2
	(2) Is interface with external equipment correct?	Section 5.5.3

10. TRIAL OPERATION

Model Name	Check Item	Reference
A240DY dynamic brake module	(1) Are the correct cables connected to the terminals (U, V, W, power supply) of the terminal block?	Section 5.1, Section 5.3.3
	(2) Are terminal screws correctly tightened?	
Servo external signal module	(1) Is the CTRL connector wired correctly?	Section 5.4.3
	(2) Are the dynamic brake command output, electromagnetic brake command output, and 24 VDC wiring OK?	Section 5.4.4
Main base unit	(1) Is the main base unit model name correct? (A27□B)	Section 7.1.1
	(2) Are the mounted module model names correct?	Section 2.9
	(3) Are the modules correctly mounted?	Section 9.5
	(4) If servomotors with absolute position detector are used, is the battery unit connected?	Section 2.9
Control power supply module	(1) Is the model name of the power supply module mounted in the base correct?	Section 6.1
	(2) Are fuses all OK?	Section 6.4
	(3) Are supply voltage and power supply module voltage setting correct? (Except A63P)	Section 6.6
	(4) Is power supply cable polarity correct? (A63P only)	
	(5) Are FG and LG wired correctly?	Section 6.6, Section 9.1.1
	(6) Are terminal screws correctly tightened?	Section 6.2, Section 6.5
	(7) Are cable sizes correct?	Section 6.2
I/O module	(1) Do cables connected to each terminal of the terminal block match the signal names?	Building-block Type I/O Module Users' Manual
	(2) Are terminal screws correctly tightened?	
	(3) Are cable sizes correct?	
	(4) Is external power supply correctly connected? (24 VDC, ±15 VDC, etc.)	
Special function module (PC extension base unit)	(1) Are the setting switches correctly set?	User's Manual of the special function module used.
	(2) Do cables connected to each terminal of the terminal block match the signal names?	
	(3) Are terminal screws correctly tightened?	
	(4) Are cable sizes correct?	
	(5) Is external power supply correctly connected? (24 VDC, ±15 VDC, etc.)	
AG62 dummy module (PC extension base unit)	(1) Is point-setting switch correctly set?	Building-block Type I/O Module Users' Manual
PC extension base unit	(1) Is extension base unit model name correct? Only A62B, A65B, A68B are connect able to servo system CPU.	Section 7.1.1
	(2) Are the mounted module model names correct?	Section 2.9
	(3) Check that the total I/O module and special function module I/O points does not exceed the servo system CPU I/O points.	Section 2.5, Section 4.1
	(4) Extension stage number (a) Set correctly? (b) No stage number duplicated? (c) No multiple settings made for a single base?	Section 2.5, Section 7.2.3
	(5) Are the modules correctly mounted?	Section 9.5
	(6) Is extension stage 1 connected to servo system CPU connector?	Section 2.5
Motion extension base unit	(1) Is extension base unit model name correct? Only A255B, A268B can be connected.	Section 7.1.1
	(2) Are the mounted module model names correct?	Section 2.9
	(3) Is the total number of servomotors controlled by ADUs and axes controlled by MR-H-B, MR-J-B, or MR-J2-B servo amplifiers 8 or less?	Section 2.3
	(4) Are the modules correctly mounted?	Section 9.5
	(5) Is connector at left-side of main base unit connected?	Section 2.2
	(6) Is extension stage setting switch set to 1?	Section 2.5, Section 7.2.3

10. TRIAL OPERATION

Model Name	Check Item	Reference
Extension cable	(1) Is the extension cable connector correctly inserted in base unit connector?	Section 7.1.2
	(2) Is the extension cable connector position correct?	Section 7.2.2
	(3) Does the total length of the extension cables exceed 6.6 m (21.65 ft.)?	Section 2.5

10. TRIAL OPERATION

⚠ WARNING

- Do not open the front casing or terminal cover during operation or when power is connected. This can cause electric shocks.
- Do not operate with the front case or terminal cover open. This can cause electric shocks from exposed high-voltage terminals or charged parts.
- Do not operate switches when your hands are wet. This can cause electric shocks.
- Do not scratch, apply undue strain to, place heavy weights on, or trap, cables. This can cause electric shocks.
- Do not touch controller, servo-amplifier, or servomotor terminal blocks while power is turned on. This can cause electric shocks.
- Do not touch the controller or servo amplifier internal power supply, internal ground, or signal wires. This can cause electric shocks.

⚠ CAUTION

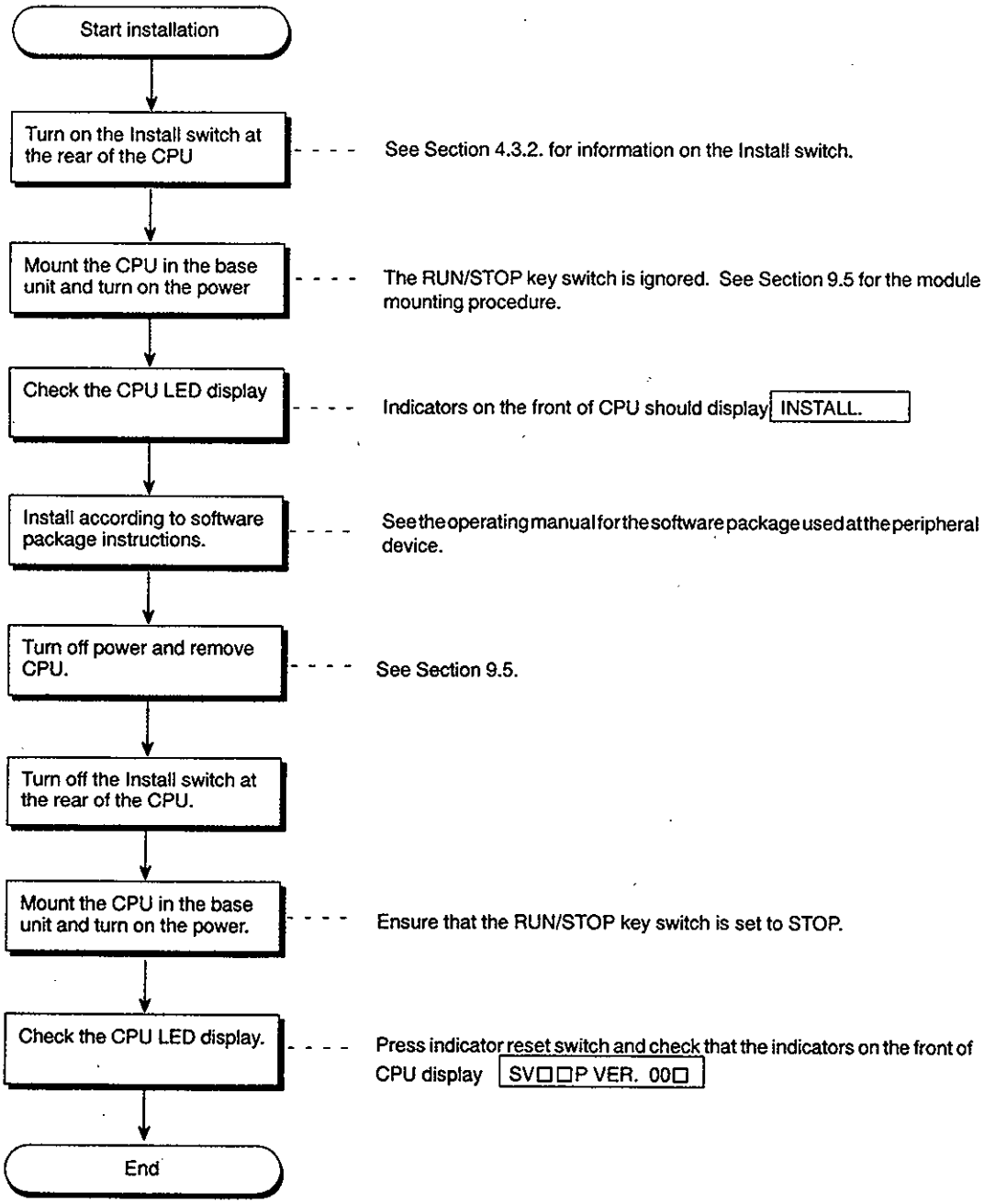
- The machine may make unpredicted movements after a servo amplifier or servomotor is first turned on. To prevent accidents, check the operation of each individual motor.
- Start up servos according to the servo start-up procedure described below.
- The servo amplifier cooling fins, regenerative resistor, and servomotors become hot during operation and can remain hot for some time after the power is turned off. Do not touch these parts or burn injuries may result.
- To avoid injury, turn off the power before touching servomotor shafts or machinery connected to them.
- To avoid injury, do not approach machinery during trial or teaching operation.

10.2 Operating System Installation Procedure

The servo system CPU can use peripheral devices and software packages to modify the operating system (OS).

This modification of the OS is called "installation".

The installation procedure is shown below.



POINT

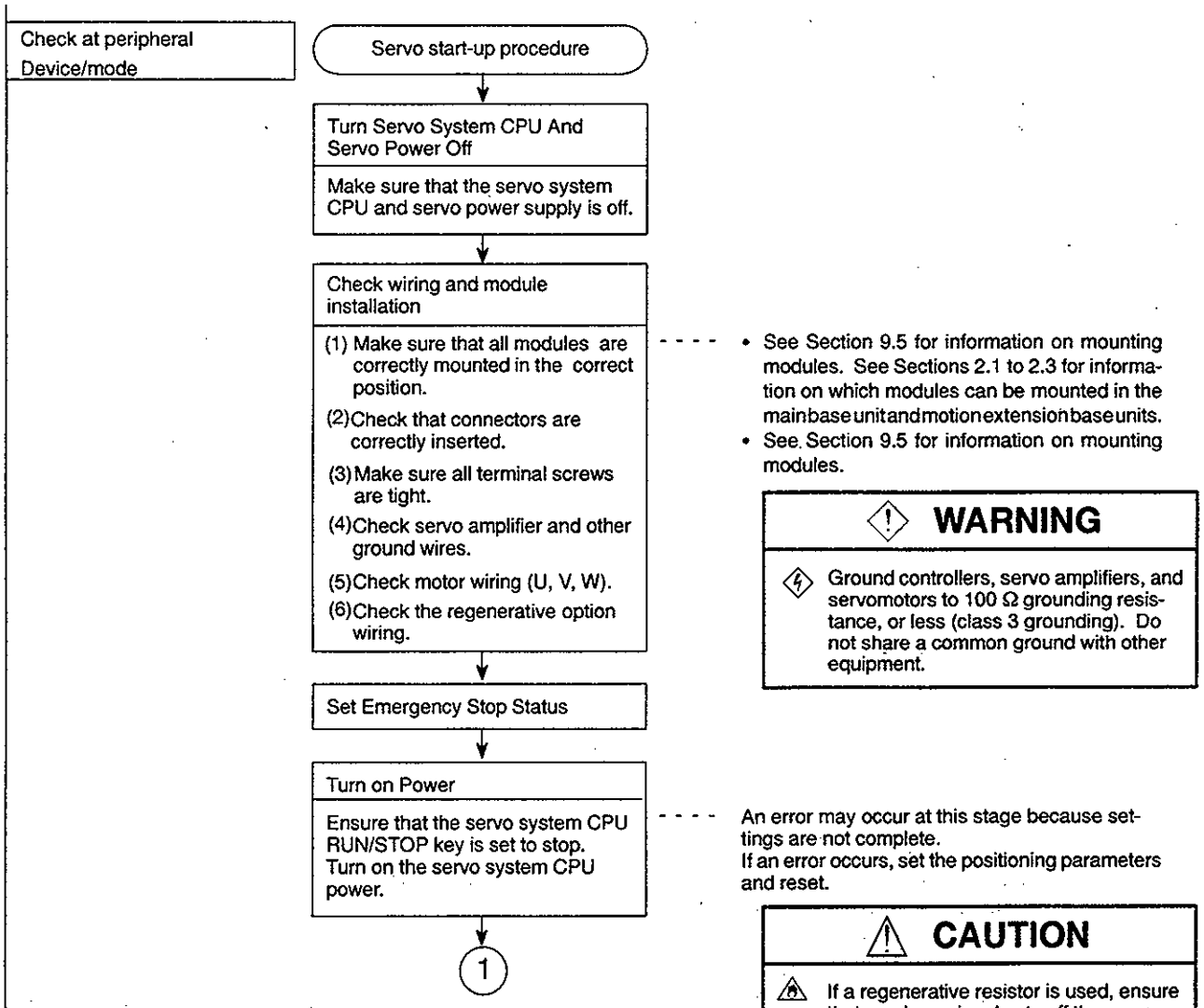
After installation, do not forget to turn off the Install switch at the rear of the CPU.

10.3 Servo Start-up

The servo start-up procedure using the servo system CPU and peripheral device is described below.

POINT

(1) Make note of the motor model name before the motor is installed on a machine.
The motor name plate may be invisible after the motor is installed.



- See Section 9.5 for information on mounting modules. See Sections 2.1 to 2.3 for information on which modules can be mounted in the main base unit and motion extension base units.
- See Section 9.5 for information on mounting modules.

WARNING

Ground controllers, servo amplifiers, and servomotors to 100 Ω grounding resistance, or less (class 3 grounding). Do not share a common ground with other equipment.

An error may occur at this stage because settings are not complete.
If an error occurs, set the positioning parameters and reset.

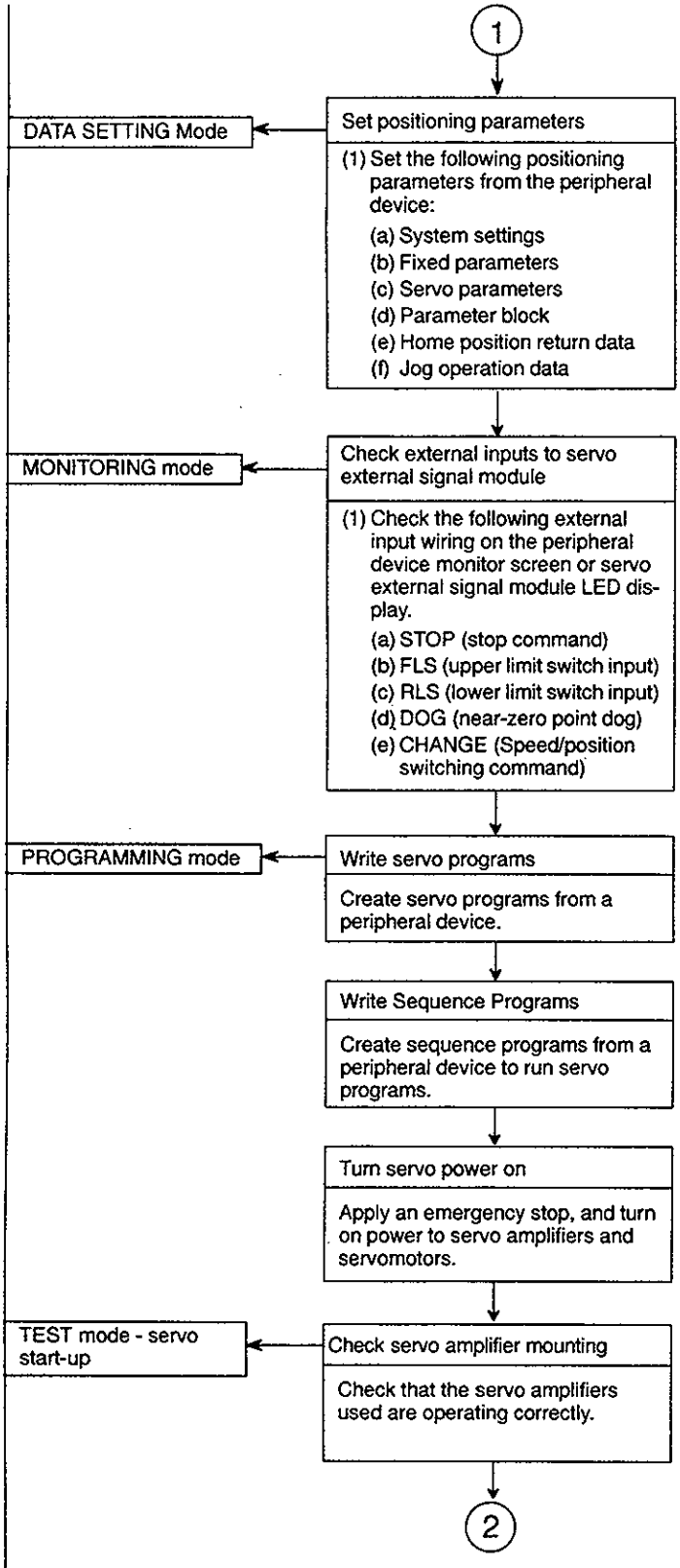
CAUTION

If a regenerative resistor is used, ensure that an alarm signal cuts off the power supply, otherwise damage to the regenerative transistor, overheating of the regenerative resistor, or even fire may result.

To prevent fires, take flameproofing measures inside the control box where the servo amplifier and regenerative resistor are located and use non-flammable wiring.

Do not connect a phase-advancer capacitor, surge absorber, or radio noise filter (FR-BIF option) to the servo amplifier output.

Ensure output terminals U, V, W, are correctly connected. Abnormal servomotor operation may result if the terminals are incorrectly connected.



⚠ CAUTION

⚠ Set parameter values to match the controllers, servo amplifiers, servomotors, and regenerative resistor models used. Protective functions may not operate correctly if the parameters are set incorrectly.

⚠ WARNING

⚠ Even if the power is turned off, do not open the front casing or terminal covers, except to connect wiring or conduct scheduled inspections. Charged components in the controller or servo amplifier can cause electric shocks.

⚠ To avoid electric shocks, turn off the power, wait at least ten minutes, then check the voltage with a tester before starting wiring or inspections.

⚠ Install controllers, servo amplifiers, and servomotors before connecting wiring. Otherwise, electric shocks or injury can result.

The following peripheral devices can be used (See Section 2.5)
IBM PC, A271DVP, started using SW□SRX-GSV□□PE.

⚠ CAUTION

⚠ Connect a leak breaker to the controller and servo amplifier power supply.

⚠ Provide an external emergency stop circuit to instantaneously stop operation and cut off power.

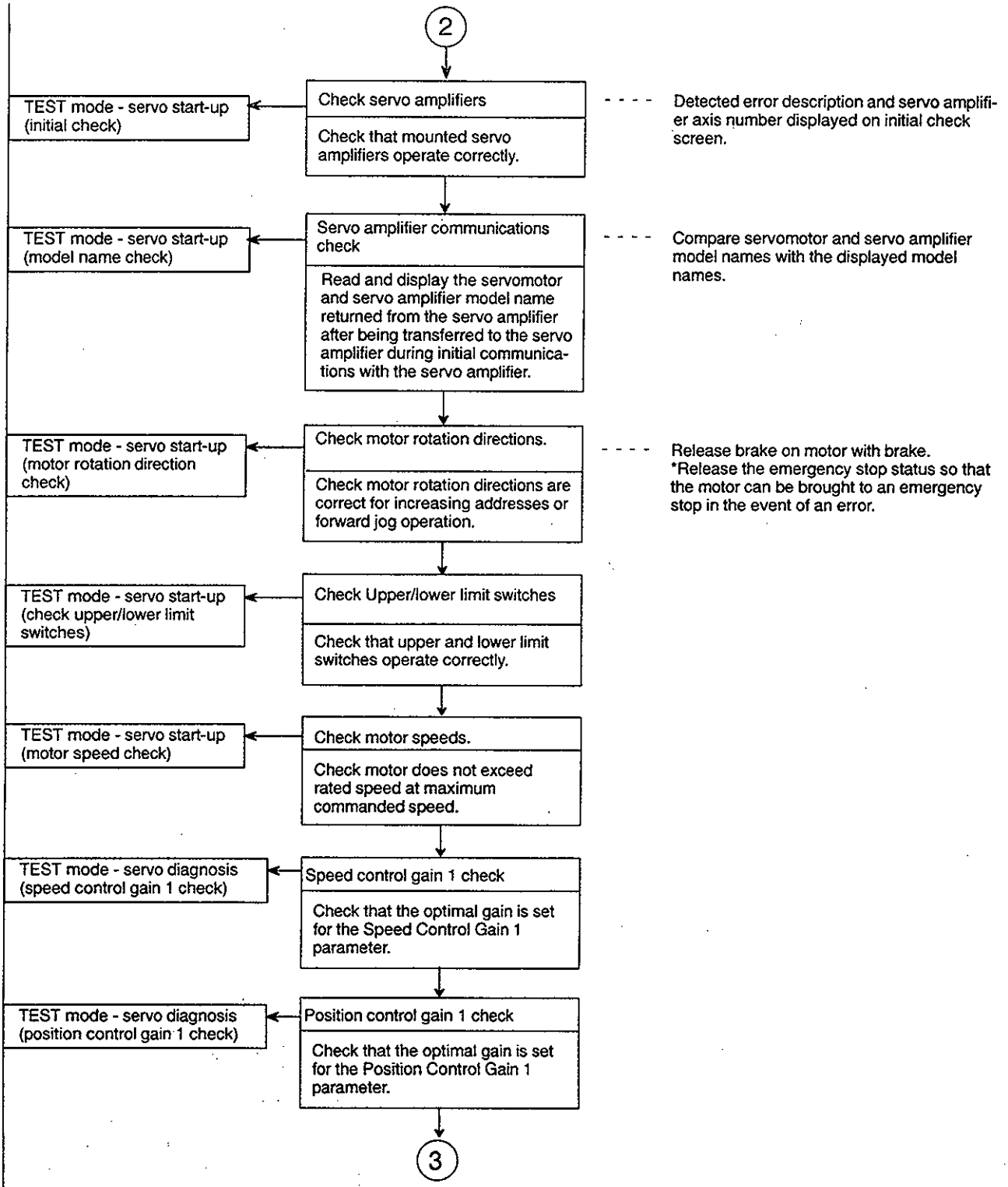
⚠ Follow the conditions prescribed in this manual and the product instruction manuals when programming using the program commands.

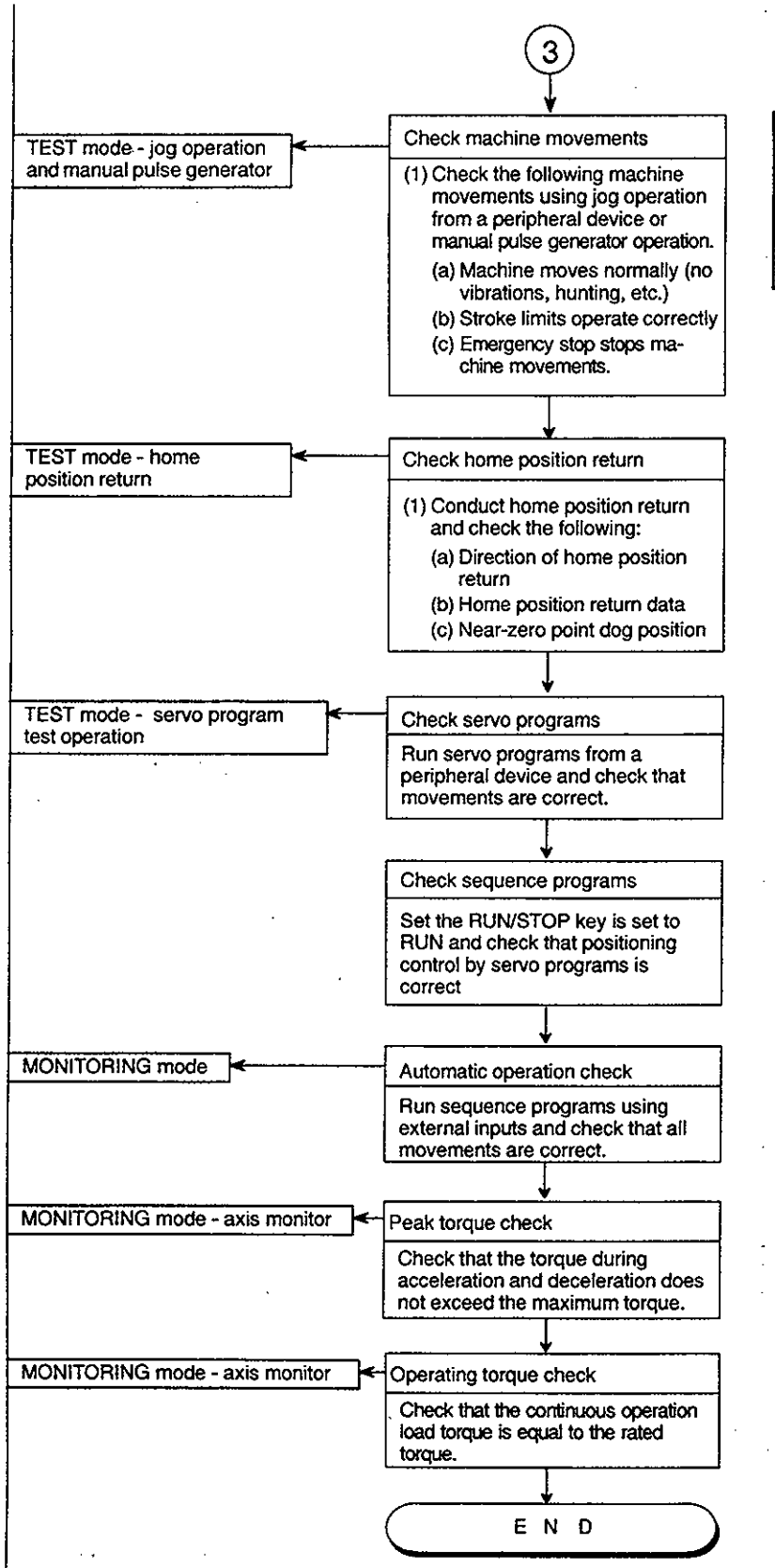
⚠ When programming, follow the conditions prescribed in this manual regarding devices which have a fixed application.

⚠ CAUTION

⚠ If used in systems for which safety standards apply (such as robot systems), all controllers, servo amplifiers, and servomotors must meet the prescribed safety standards.

⚠ Configure safety circuits external to the controller or servo amplifiers if their abnormal operation could cause axis motion in a direction other than the safe operating direction for the system.


2
Check servo amplifiers
Check that mounted servo amplifiers operate correctly.
TEST mode - servo start-up (initial check)
Detected error description and servo amplifier axis number displayed on initial check screen.
Servo amplifier communications check
Read and display the servomotor and servo amplifier model name returned from the servo amplifier after being transferred to the servo amplifier during initial communications with the servo amplifier.
TEST mode - servo start-up (model name check)
Compare servomotor and servo amplifier model names with the displayed model names.
Check motor rotation directions.
Check motor rotation directions are correct for increasing addresses or forward jog operation.
TEST mode - servo start-up (motor rotation direction check)
Release brake on motor with brake.
*Release the emergency stop status so that the motor can be brought to an emergency stop in the event of an error.
Check Upper/lower limit switches
Check that upper and lower limit switches operate correctly.
TEST mode - servo start-up (check upper/lower limit switches)
Check motor speeds.
Check motor does not exceed rated speed at maximum commanded speed.
TEST mode - servo start-up (motor speed check)
Speed control gain 1 check
Check that the optimal gain is set for the Speed Control Gain 1 parameter.
TEST mode - servo diagnosis (speed control gain 1 check)
Position control gain 1 check
Check that the optimal gain is set for the Position Control Gain 1 parameter.
TEST mode - servo diagnosis (position control gain 1 check)
3



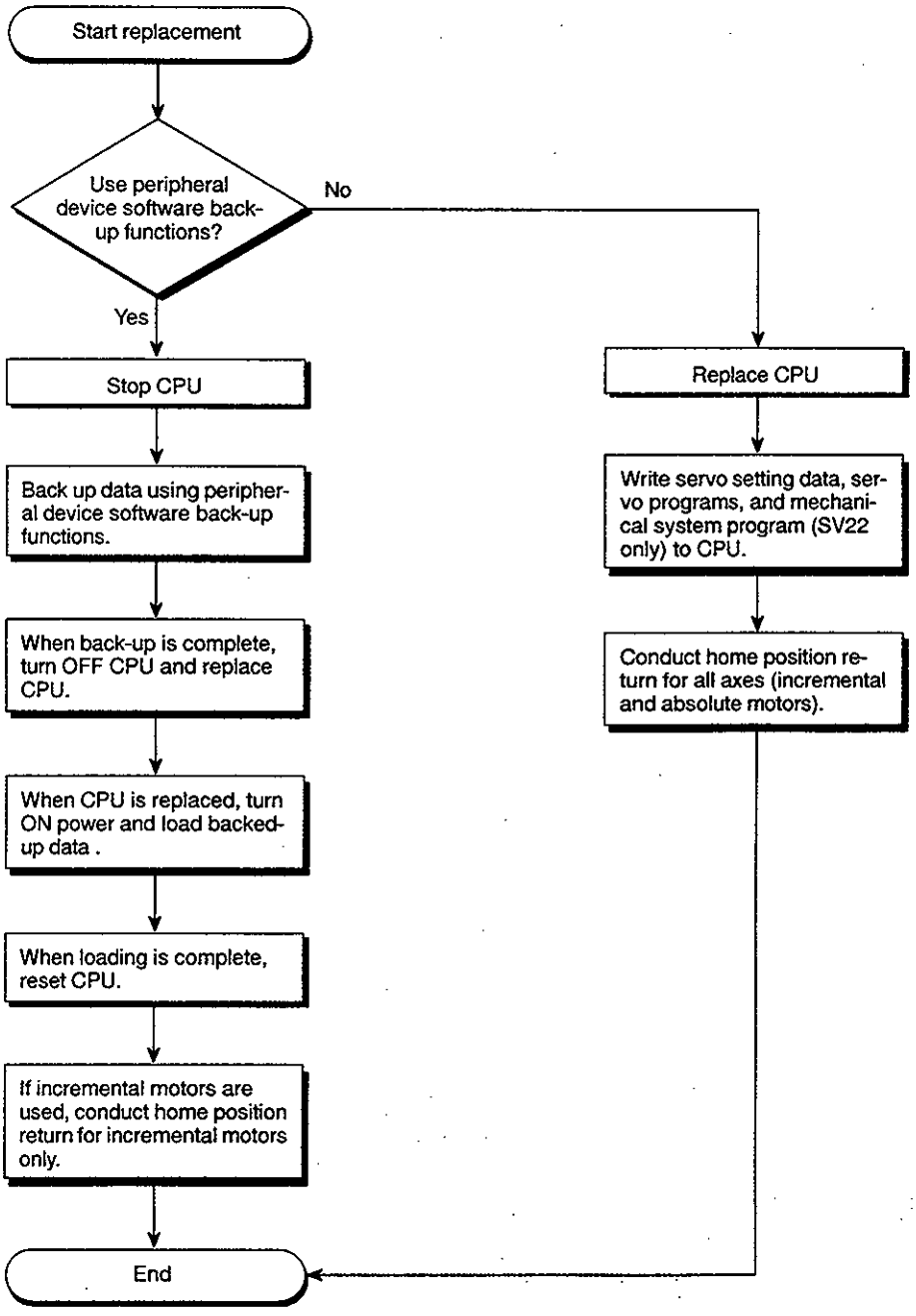
⚠ CAUTION

⚠ Design systems with sufficient mechanical allowance for a safe stop if an axis passes the stroke-end limit switch at maximum speed.

10.4 Replacing the Servo System CPU

The operations after the servo system CPU is replaced are much easier if data is backed up using the peripheral device back-up functions before replacing the servo system CPU.

The servo system CPU replacement procedure is shown below.



POINT

By using the peripheral device software back-up functions, absolute motor operation can be restarted from the position before CPU replacement.

10.5 Setting Axis Numbers

The servo system CPU can control a total of 8 axes (A273UHCPU (8-axis specification)) or 32 axes (A273UHCPU (32-axis specification)) using ADUs and MR-H-B, MR-J-B, or MR-J2-B.

The axis number sets which axis is used with each ADU mounted in a main base unit or motion extension base unit and each MR-H-B, MR-J-B, or MR-J2-B connected to the servo system CPU.

(1) Using A273UHCPU (8-axis specification)

Axis numbers between 1 and 8. No duplication.

ADU and MR-H-B, MR-J-B, and MR-J2-B axis numbers are set in the peripheral device system set-up. (See the operating manual of the software package for details about the axis number setting procedure.) The set position of the axis selector switch (CS1) on the MR-H-B, MR-J-B, and MR-J2-B units is determined by the peripheral device system settings.

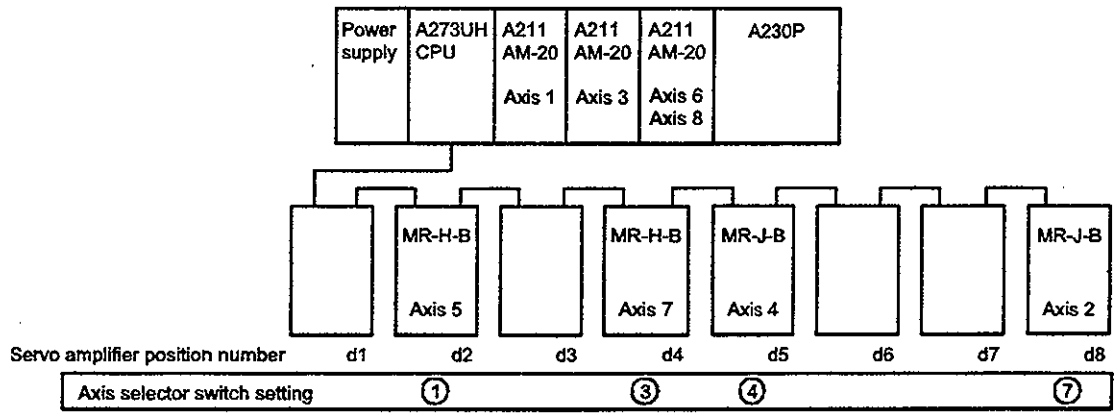
Set the axis selector switch (CS1) to a value one less than the position number (d1 to d8) set with the peripheral device system set-up (that is: Axis No. - 1). The axis number set in the system set-up is ignored. The axis selector switch (CS1) settings are shown in the table below.

Selector Switch Number		Description		
		MR-H-B	MR-J-B	MR-J2-B
SSC network 1	0	Axis 1		
	1	Axis 2		
	2	Axis 3		
	3	Axis 4		
	4	Axis 5		
	5	Axis 6		
	6	Axis 7		
	7	Axis 8		
	8	Not used		
	9	Not used		
	A	Not used		
	B	Not used		
	C	Not used		
	D	Not used		
	E	Not used		
	F	Test operation *1	Not used.	Test operation*2

*1 If MB-H-B is used with a parameter unit, set the selector switch to "F" during test operation. (See the MR-H-B instruction manual for details.)

*2 "F" to run test operation for MR-J2-B using a personal computer. (See the MR-J2-B instruction manual for details.)

Axis Selector Switch Setting Example



(2) Using A273UHCPU (32-axis specification)

Axis numbers between 1 and 32. No duplication.
Set the MR-H-B, MR-J-B, or MR-J2-B axis selector switch (CS1) as shown in the table below. A maximum of eight axes can be set with MR-H-B, MR-J-B, or MR-J2-B for each of the SSC networks (1 to 4) when using the A273UHCPU (32-axis specification). Set each switch between 0 and 7. Axis switch settings must not be duplicated within a single network.

The table below shows the relationship between the axis selector switch setting and the MR-H-B, MR-J-B, and MR-J2-B position numbers in the peripheral device system set-up.

Selector Switch Number		Description			Selector Switch Number		Description		
		MR-H-B	MR-J-B	MR-J2-B			MR-H-B	MR-J-B	MR-J2-B
SSC network 1	0	d1			SSC network 3*	0	d1		
	1	d2				1	d2		
	2	d3				2	d3		
	3	d4				3	d4		
	4	d5				4	d5		
	5	d6				5	d6		
	6	d7				6	d7		
	7	d8				7	d8		
SSC network 2*	0	d1			SSC network 4*	0	d1		
	1	d2				1	d2		
	2	d3				2	d3		
	3	d4				3	d4		
	4	d5				4	d5		
	5	d6				5	d6		
	6	d7				6	d7		
	7	d8				7	d8		

* Applies to A273UHCPU (32-axis specification) only.

Use peripheral device system set-up to set the axis numbers.

Set ADU axis numbers to axis numbers not used by MR-H-B, MR-J-B, or MR-J2-B.

10.6 Servo Diagnosis

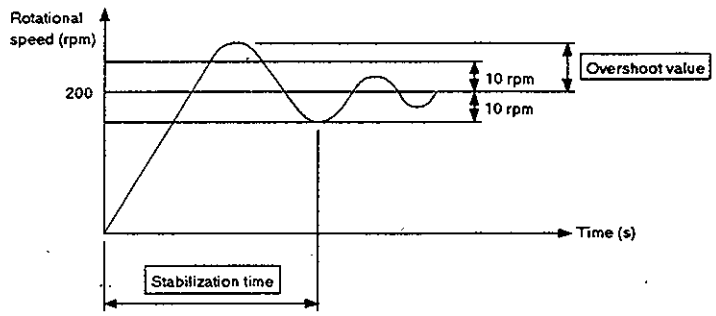
Servo diagnosis is a check from a peripheral device that the speed control gain and position control gain set by the peripheral device are the optimal values for the type of servomotor connected.

⚠ CAUTION

⚠ Never make very large adjustments as this can make operation unstable.

(1) Checking speed control gain 1

(a) The speed control gain 1 check involves using the servo system CPU to rotate the motor 1.6 revolutions at the commanded speed (200 rpm) and determining the servomotor response and stability from the stabilization time (response time) and overshoot value.



1) Overshoot value is calculated from the following formula:

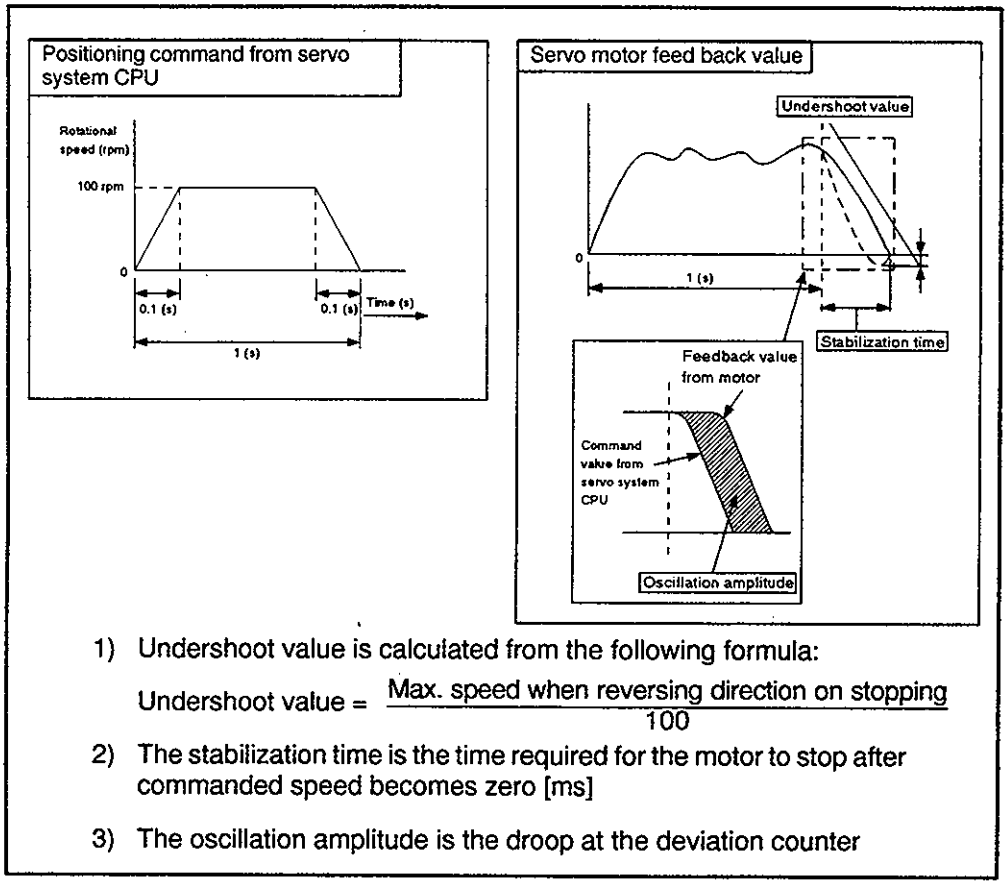
$$\text{Overshoot value} = \frac{\text{Rotational speed} - 200}{200} \times 100\ (\%)$$

2) The stabilization time is the time required for the speed to reach 200 rpm ± 10 rpm.

Fig. 10.1 Speed Control Gain 1 Check

(2) Checking position control gain 1

The position control gain 1 check involves diagnosis of the servomotor response and stability based on the feedback undershoot value, stabilization time (response time), and oscillation amplitude (droop at the deviation counter] in response to positioning commands from the servo system CPU.



1) Undershoot value is calculated from the following formula:

$$\text{Undershoot value} = \frac{\text{Max. speed when reversing direction on stopping}}{100}$$

2) The stabilization time is the time required for the motor to stop after commanded speed becomes zero [ms]

3) The oscillation amplitude is the droop at the deviation counter

Fig. 10.2 Position Control Gain 1 Check

11. INSPECTION AND MAINTENANCE

This section describes the daily and scheduled inspections required to maintain the motion controller in optimum condition.

⚠ WARNING

- Do not open the front casing or terminal cover during operation or when power is connected. This can cause electric shocks.
- Do not operate with the front case or terminal cover open. This can cause electric shocks from exposed high-voltage terminals or charged parts.
- Even if the power is turned off, do not open the front casing or terminal covers, except to connect wiring or conduct scheduled inspections. Charged components in the controller or servo amplifier can cause electric shocks.
- To avoid electric shocks, turn off the power, wait at least ten minutes, then check the voltage with a tester before starting wiring or inspections.
- Ground controllers, servo amplifiers, and servomotors to class 3 grounding resistance, or less. Do not share a common ground with other equipment.
- All wiring and inspections to be conducted by a trained technician.
- Install controllers, servo amplifiers, and servomotors before connecting wiring. Otherwise, electric shocks or injury can result.
- Do not operate switches when your hands are wet. This can cause electric shocks.
- Do not scratch, apply undue strain to, place heavy weights on, or trap cables. This can cause electric shocks.
- Do not touch controller, servo-amplifier, or servomotor terminal blocks while power is turned on. This can cause electric shocks.
- Do not touch the controller or servo amplifier internal power supply, internal ground, or signal wires. This can cause electric shocks.

11. INSPECTION AND MAINTENANCE

⚠ CAUTION

⚠ Conduct inspections and maintenance as described in this manual and the product instruction manuals.

⚠ Back up all controller, servo-amplifier, and servomotor programs and parameters before starting inspections and maintenance.

⚠ Take care not to trap hands or fingers when opening or closing doors and covers.

⚠ Regularly replace batteries and other consumables, as prescribed in this manual and the product instruction manuals.

⚠ Do not touch IC leads or connector contacts.

⚠ Do not place a memory cassette on a metal surface which can cause electrical leakage, or on a material which accumulates static electricity, such as wood, plastic, vinyl, fabric, electric wiring or paper.

⚠ Do not use a megger tester (insulation-resistance measurement instrument) for inspections.

⚠ When replacing a controller or servo amplifier, make sure the new unit is correctly set-up.

⚠ After inspections and maintenance are complete, check that the absolute-position detection function is working correctly.

⚠ Do not short, recharge, overheat, burn, or disassemble batteries.

⚠ Electrolytic capacitors produce a gas when they fail. Do not put your face near a controller or servo amplifier.

⚠ Electrolytic capacitors and fans are subject to deterioration. Replace these items regularly to prevent secondary fire damage after a failure occurs. Contact our service center or service station for information about replacing these parts.

11. INSPECTION AND MAINTENANCE

11.1 Daily Inspections

The inspections listed in the table below should be conducted every day.

Table 11.1 Daily Inspections

No.	Item		Description	Evaluation Standard	Remedy
1	Base unit installation		All screws tight and covers in position.	Must be firmly installed.	Tighten loose screws.
2	Module mounting		Modules correctly mounted in base unit.	Fully and correctly mounted.	Tighten loose screws.
3	Connections		Terminal screws tight	No loose screws	Tighten loose screws
			Spacing between solderless terminals.	Correct spacing is maintained.	Adjust spacing.
			Extension cable connectors	Connectors fully tightened	Tighten connector screws
4	Indicators	POWER indicator	Check that indicator lights	Indicator lights (otherwise abnormal)	See Section 12.2.2.
		RUN indicator	Lights in RUN status	Indicator lights (otherwise abnormal)	See Section 12.2.3 or 12.2.4.
		INPUT indicator	Check that indicator lights and goes out.	Indicator lights when input is ON and goes out when input is OFF (otherwise abnormal)	See Section 12.2.5.
		OUTPUT indicator	Check that indicator lights and goes out.	Indicator lights when output is ON and goes out when output is OFF (otherwise abnormal).	See Section 12.2.5.

REMARK

If it is necessary to replace an I/O module mounted in a PC extension base unit during motion controller operation, see information related to the on-line replacement of I/O modules in the ACPU Programming Manual (Fundamentals) (IB-66249).

11. INSPECTION AND MAINTENANCE

11.2 Scheduled Inspections

The inspections listed in the table below should be conducted once or twice every 6 to 12 months. They should also be conducted after equipment is moved or upgraded, and if the wiring is changed.

Table 11.2 Scheduled Inspections

No.	Item		Description	Evaluation standard	Remedy
1	Ambient environment	Ambient temperature	Measuretemperature and humidity. Measure corrosive gases.	0°C to 55°C	If system is in an enclosure, measure temperature and humidity inside the enclosure.
		Ambient humidity		10% to 90% RH	
		Atmosphere		No corrosive gases	
2	Supply voltage		Measure voltage across 100 VAC/200 VAC terminals.	85 VAC to 132 VAC	Change power supply
				170 VAC to 264 VAC	
3	Installation	Looseness	Move modules and check	Firmly installed	Tighten screws. If CPU, I/O, or power supply module is loose, fasten with screws.
		Dirt, foreign matter	Visual	To be none	Remove, clean
4	Connections	Terminal screws tight	Turn with a screwdriver	No loose screws	Tighten loose screws
		Spacing between solderless terminals.	Visual	Correct spacing is maintained.	Adjust spacing.
		Loose connectors	Visual	Connectors fully tightened	Tighten connector screws
5	Memory cassette battery		In Monitor mode, check from peripheral device that M9006 and M9007 are OFF.	Preventative maintenance	Replace battery if life is exceeded, even if no voltage drop occurs.
6	Battery unit		Check that servo error codes do not include 2025 and 2103.	Preventative maintenance	Replace battery if voltage is low.
7	Fuses		Check fuses are not blown.	Preventative maintenance	Replace fuses regularly, even if not blown. Rush currents can cause deterioration.
8	Fan		Check for noise and vibration when operating.	No large noise, vibration	Replace the fan.

11.3 Replacing the Battery

M9006 and M9007 turn ON if the voltage drops from the battery which backs up programs and provides power interruption protection functions. Program back-up and power interruption protection functions are not lost immediately the M9006 and M9007 special-function relays turn ON, but memory contents may be lost if this special-function status is overlooked.
After M9006 and M9007 turn ON, replace the battery within the total power interruption time shown in Table 11.3 below.
This section gives replacement guidelines and describes the replacement method.

11.3.1 Battery life

(1) The battery life differs according to the memory capacity. The relationship between battery life and memory capacity is shown in Table 11.3.

Table 11.3 Battery Life

Battery Life / Memory Cassette Model Name	Battery Life (Total Power Interruption Time) (Hr)		
	Guaranteed Time (MIN)	Actual Time (TYP)	After M9006, M9007 Turn ON
A3NMCA-0	4100	10250	168
A3NMCA-2	4100	10250	168
A3NMCA-4	3410	8525	168
A3NMCA-8	3410	8525	168
A3NMCA-16	2600	6500	168
A3NMCA-24	2140	5350	168
A3NMCA-40	1400	3500	168
A3NMCA-56	450	1125	168
A3NMCA-96	1860	9495	168

* Actual times are average values. Guaranteed times are minimum values.

Preventative Maintenance Guidelines

(a) Replace battery every 4 or 5 years, even if total power interruption time is less than the value in the table.

(b) Replace the battery if the total power interruption time exceeds the guaranteed time shown in the table and M9006 is ON.

(2) The following table shows the life of the battery to back up absolute data, which is connected to the left side of the main base unit.

Item	MR-JBAT4	MR-JBAT8
Battery back-up time	10,000 hours	
Battery life	5 years	
Battery voltage	3.6 V	

Preventative Maintenance Guidelines

(a) Replace battery every 4 or 5 years, even if total power interruption time is less than the value in the table.

(b) Replace the battery when a battery low error 2025 (at power ON) or 2103 (during operation) occurs, even if total power interruption time is less than the value in the table.

11.3.2 Replacing a memory cassette battery

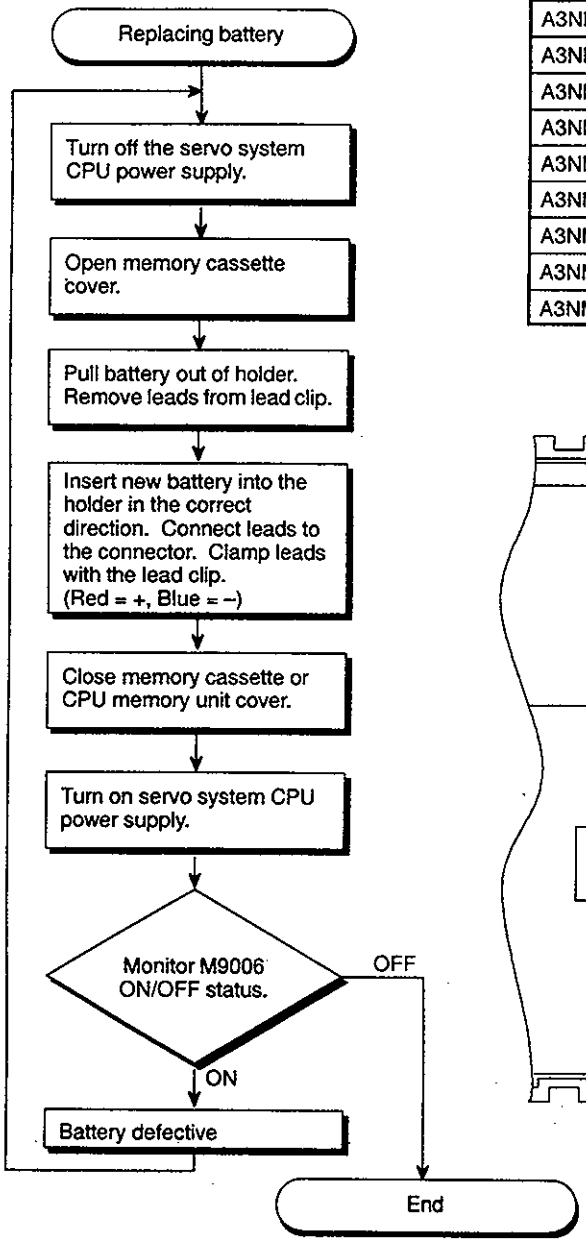
Follow the procedure below to replace a battery when its life expires. After the battery is disconnected, a capacitor maintains memory back-up for a short time. Complete the battery change operation within the time specified in Table 11.4.

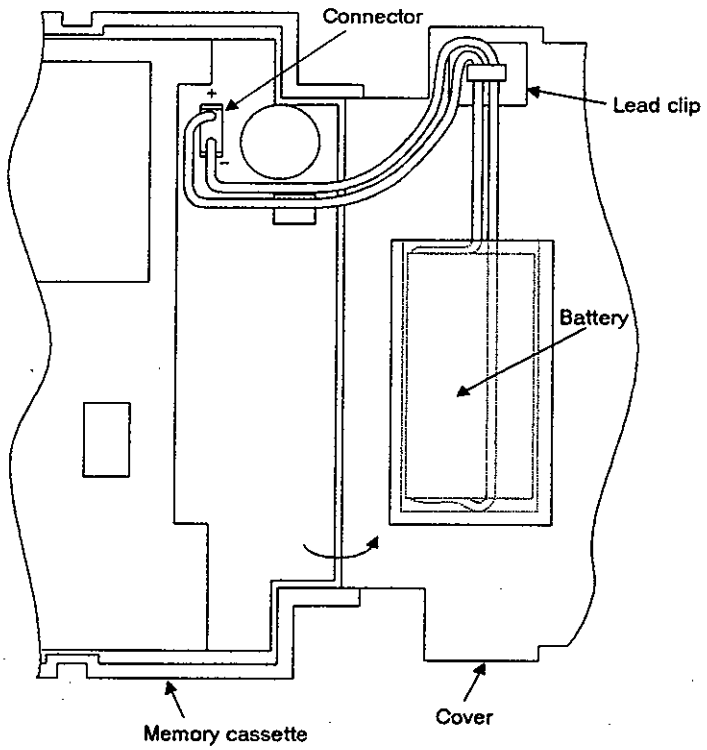
⚠ CAUTION

⚠ Dispose of batteries according to local government regulations.

Table 11.4 Capacitor Back-up Time

Memory Cassette Model Name	Capacitor Back-up Time (min.)	
	Guaranteed Time (MIN)	Actual Time (TYP)
A3NMCA-0	24	60
A3NMCA-2	24	60
A3NMCA-4	20	50
A3NMCA-8	20	50
A3NMCA-16	15	37
A3NMCA-24	12	30
A3NMCA-40	8	20
A3NMCA-56	6	15
A3NMCA-96	3	15

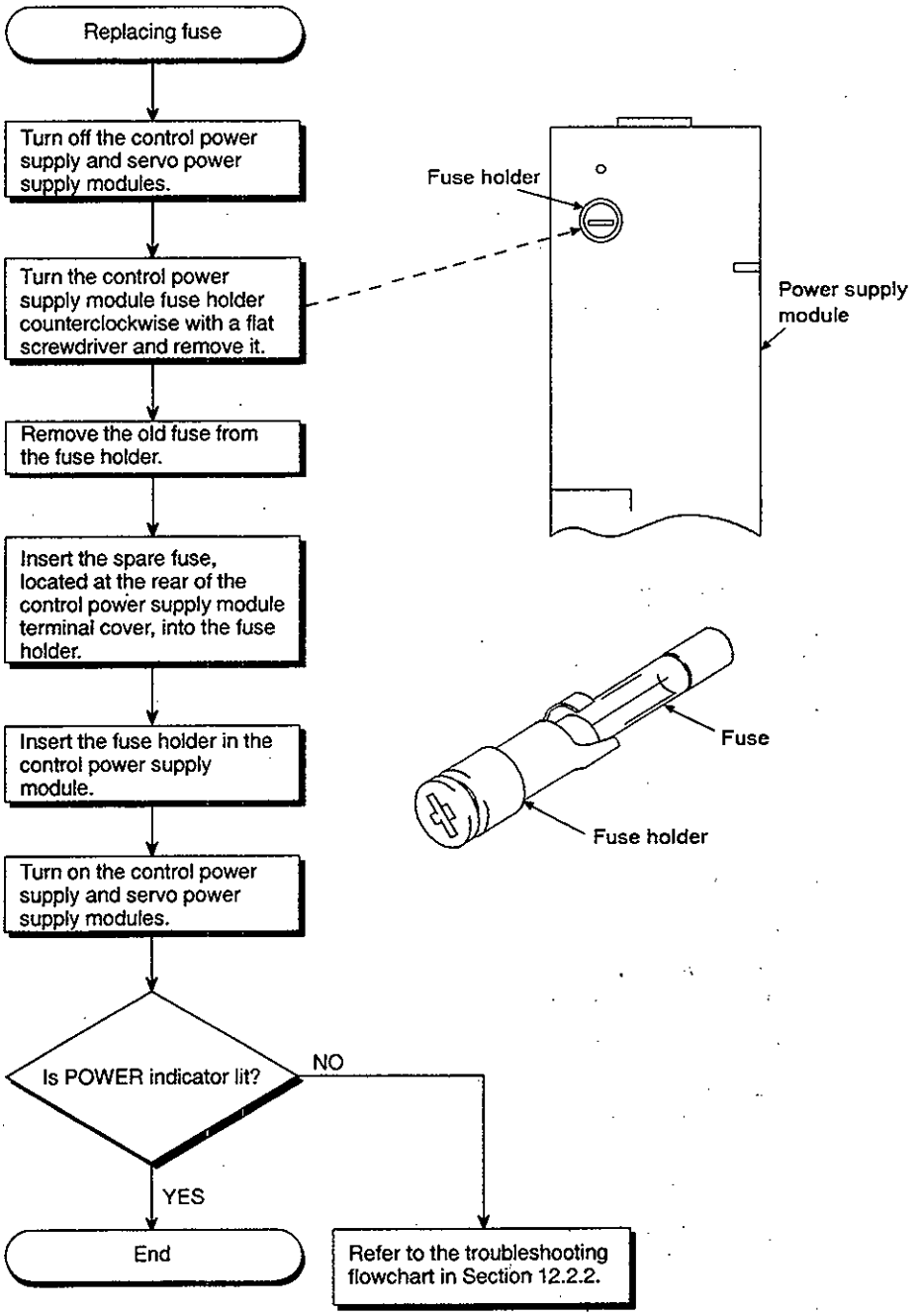




11.4 Replacing Fuses

Regular replacement of fuses is recommended, even if they are not blown. Rush currents can cause fuses to deteriorate.

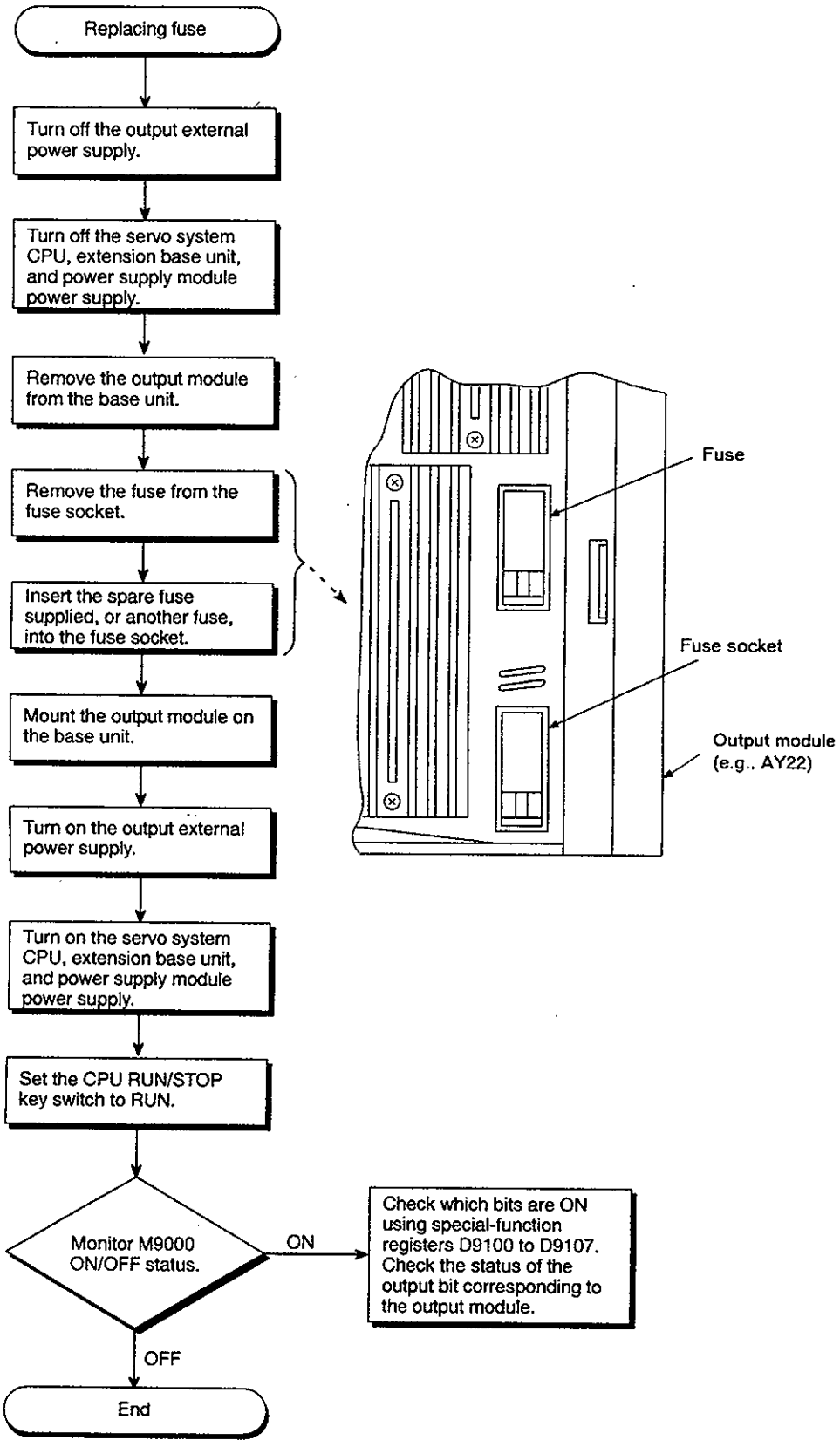
11.4.1 Replacing a control power supply module fuse



⚠ CAUTION

⚠ Make sure the fuse matches the type of power supply module. An incorrect fuse can cause failures.

11.4.2 Replacing a MELSEC-A series output module fuse



12. TROUBLESHOOTING

This section describes the errors which could occur when using the system and what to do about them.

12.1 Basics of Troubleshooting

A high-reliability system requires not only the use of very reliable equipment but also the ability to quickly restart the system if an error does occur.
Restarting a system after an error occurs requires the cause of the error to be quickly determined and remedied.
The three basic points for conducting troubleshooting operations are listed below.

(1) Visual checks

Check the following:

(a) machine movements (when stopped and operating);

(b) if power is connected;

(c) I/O equipment status;

(d) wiring status (I/O wires, cables, etc.);

(e) indictor display statuses (POWER, RUN, I/O indicators, etc.);

(f) switch setting status (extension base, power interruption backup, etc.).
Check items (a) to (f) then connect a peripheral device and check the motion controller status and program contents.

(2) Problem check

Conduct the following operations and check how the problem changes:

(a) Set the RUN/STOP switch to STOP.

(b) Reset with the Reset key switch.

(c) Turn power on and off.

(3) Narrow down the range

From the results of (1) and (2), determine whether the problem is:

(a) in motion controller, or external;

(b) in I/O module, or elsewhere;

(c) in a sequence program.

12. TROUBLESHOOTING

⚠ WARNING

- Do not open the front casing or terminal cover during operation or when power is connected. This can cause electric shocks.
- Do not operate with the front case or terminal cover open. This can cause electric shocks from exposed high-voltage terminals or charged parts.
- Even if the power is turned off, do not open the front casing or terminal covers, except to connect wiring or conduct scheduled inspections. Charged components in the controller or servo amplifier can cause electric shocks.
- To avoid electric shocks, turn off the power, wait at least ten minutes, then check the voltage with a tester before starting wiring or inspections.
- Ground controllers, servo amplifiers, and servomotors to class 3 grounding resistance, or less. Do not share a common ground with other equipment.
- All wiring and inspections to be conducted by a trained technician.
- Install controllers, servo amplifiers, and servomotors before connecting wiring. Otherwise, electric shocks or injury can result.
- Do not operate switches when your hands are wet.
- Do not damage, apply undue strain to, place heavy weights on, or trap cables. This can cause electric shocks.
- Do not touch controller, servo-amplifier, or servomotor terminal blocks while power is turned on. This can cause electric shocks.
- Do not touch the controller or servo amplifier internal power supply, internal ground, or signal wires. This can cause electric shocks.

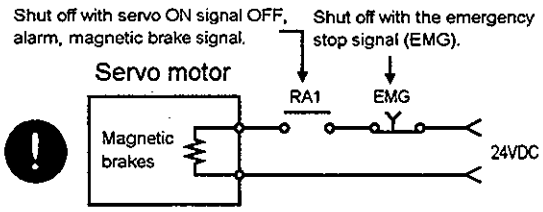
12. TROUBLESHOOTING

⚠ CAUTION

⚠ After a controller or servo amplifier self-diagnosis error occurs, conduct checks and repair work as described in this manual and the product instruction manuals.

⚠ Use servomotors with electromagnetic brake mechanisms or attach an external brake mechanism in situations which could be dangerous in the event of a power interruption or product failure.

⚠ Duplicate circuits, such that an external emergency stop signal also causes the electromagnetic brake circuit to operate.



⚠ Eliminate the cause of the alarm and make safety checks before restarting operation.

⚠ The machine should not be approached after a momentary power interruption is reset, as the machine could suddenly start operating again. Design the machine to ensure safety when operation restarts.

⚠ Check and adjust the programs and parameters before starting machine operation. Errors in the programs or parameters may cause the machine to make unpredicted movements.

⚠ Never make very large adjustments as this can make operation unstable.

⚠ Do not apply a voltage to terminals which exceeds the voltage prescribed in this manual or the instruction manuals for other products used. Incorrect voltage can cause destruction of, or damage to, the equipment.

⚠ Correct the terminals correctly. Incorrect connection can cause destruction of, or damage to, the equipment.

⚠ Ensure polarity is correct. Incorrect polarity can cause destruction of, or damage to, the equipment.

⚠ The servo amplifier cooling fins, regenerative resistor, and servomotors become hot during operation and can remain hot for some time after the power is turned off. Do not touch these parts or burn injuries may result.

⚠ To avoid injury, turn off the power before touching servomotor shafts or machinery connected to them.

⚠ To avoid injury, do not approach machinery during trial or teaching operation.

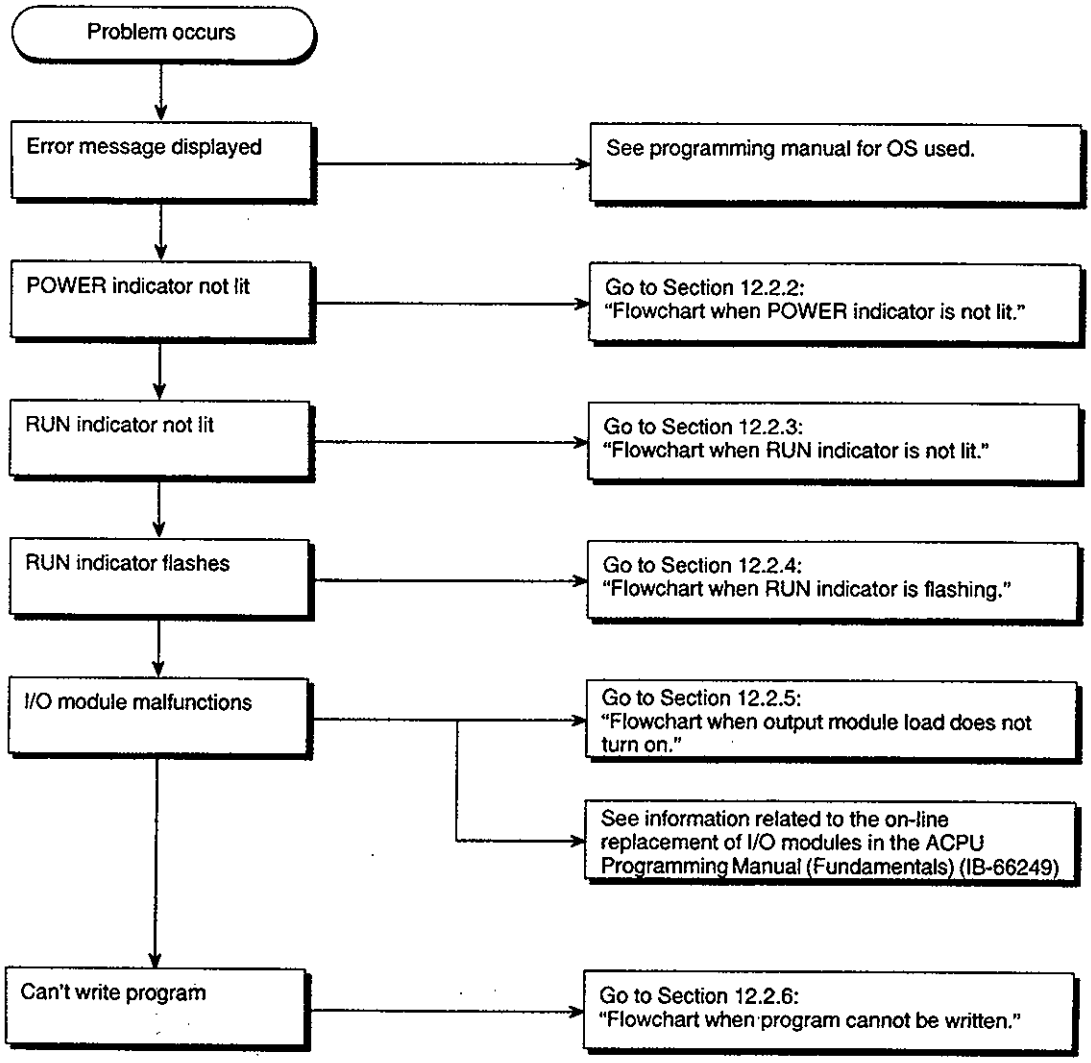
12.2 Troubleshooting

(1) The flowcharts below explain how to remedy problems with the servo system CPU SCPU or modules mounted on an extension base unit.

(2) For information about error codes and remedies related to the servo system CPU PCPU and SCFU, see the motion controller maintenance manual and the programming manuals for the software packages.

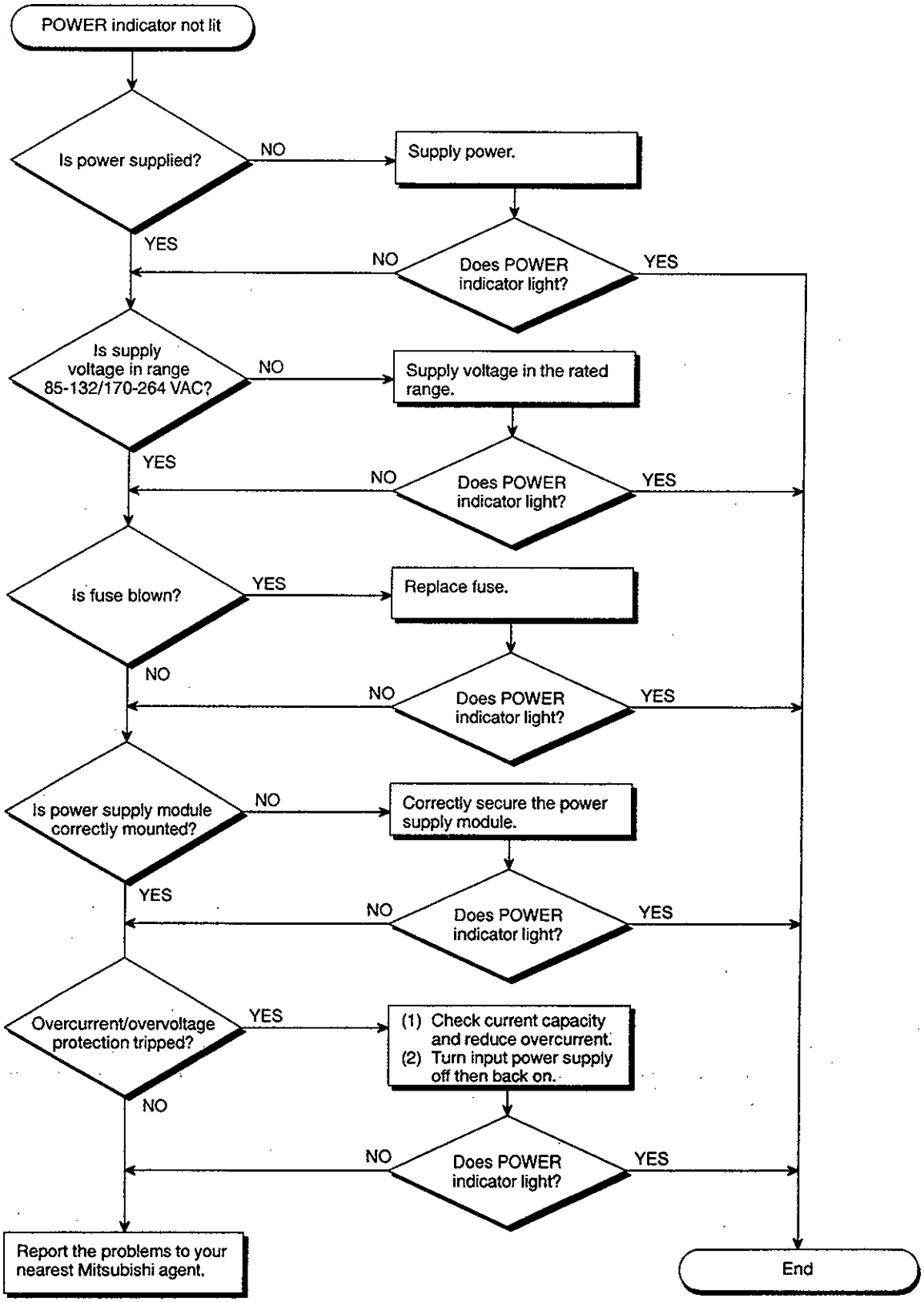
12.2.1 Troubleshooting flow chart

Problems are classified according to the symptoms in the flowchart below.



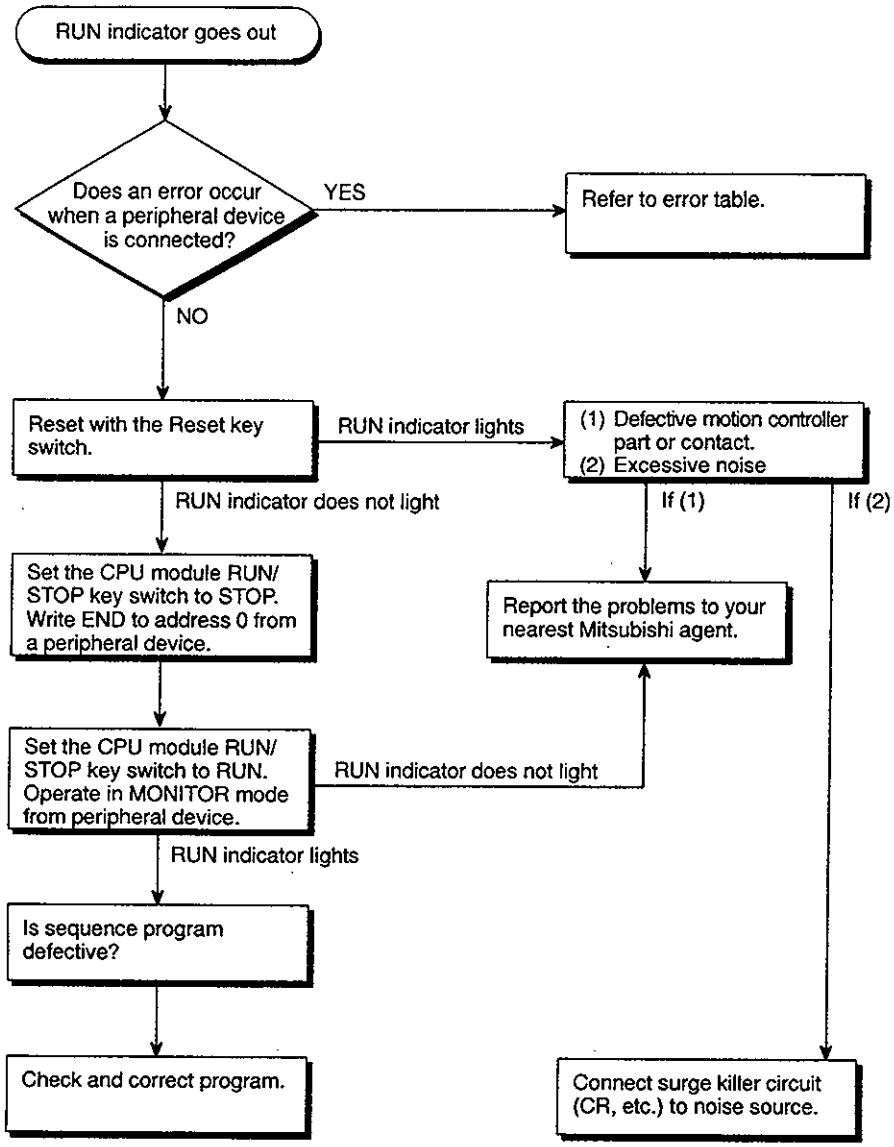
12.2.2 Flowchart when POWER indicator is not lit

Follow the flowchart below if the POWER indicator does not light when the power is turned on or goes out during operation.



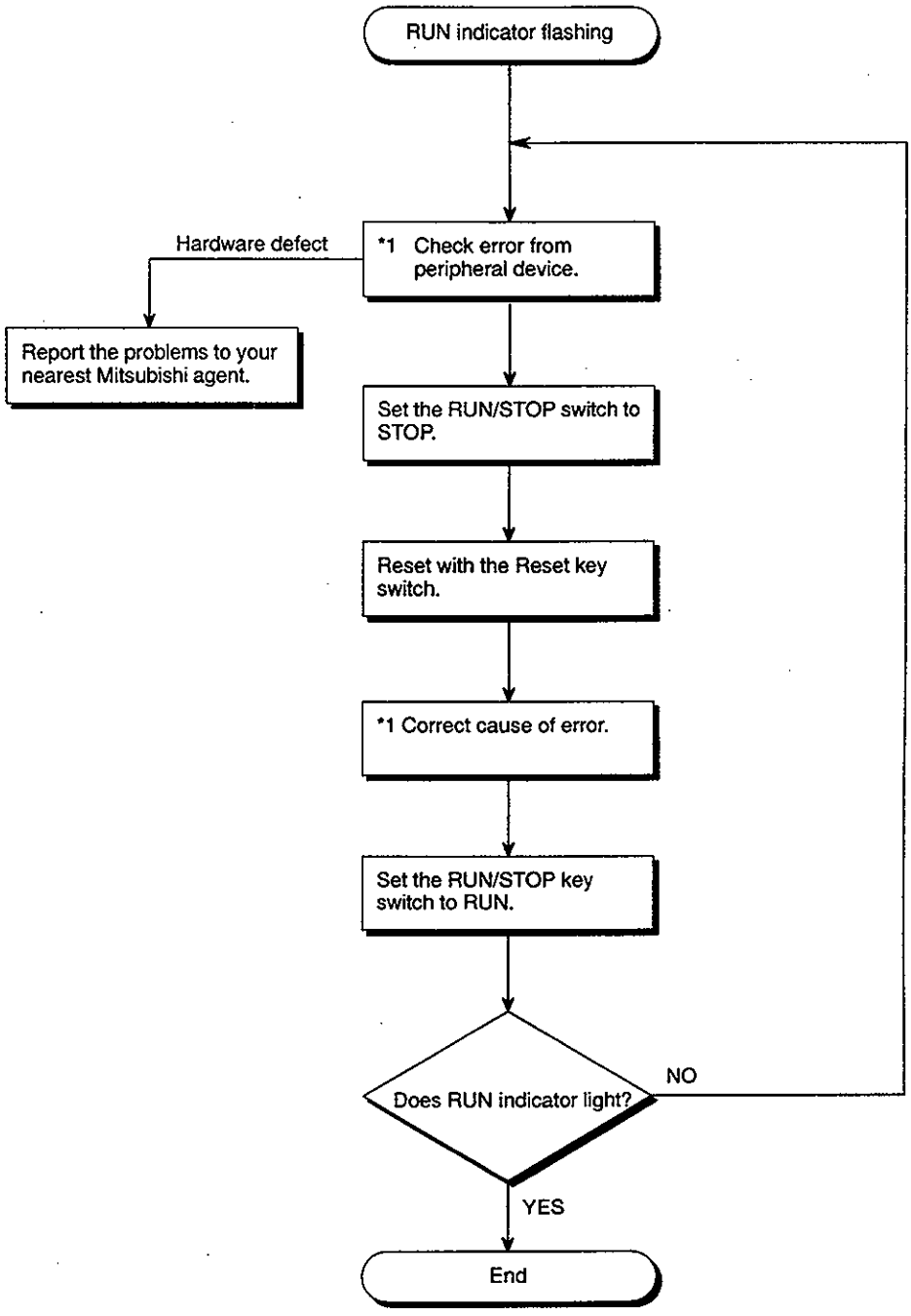
12.2.3 Flowchart when run indicator is not lit

Follow the flowchart below if the RUN indicator goes out during operation.



12.2.4 Flowchart when run indicator is flashing

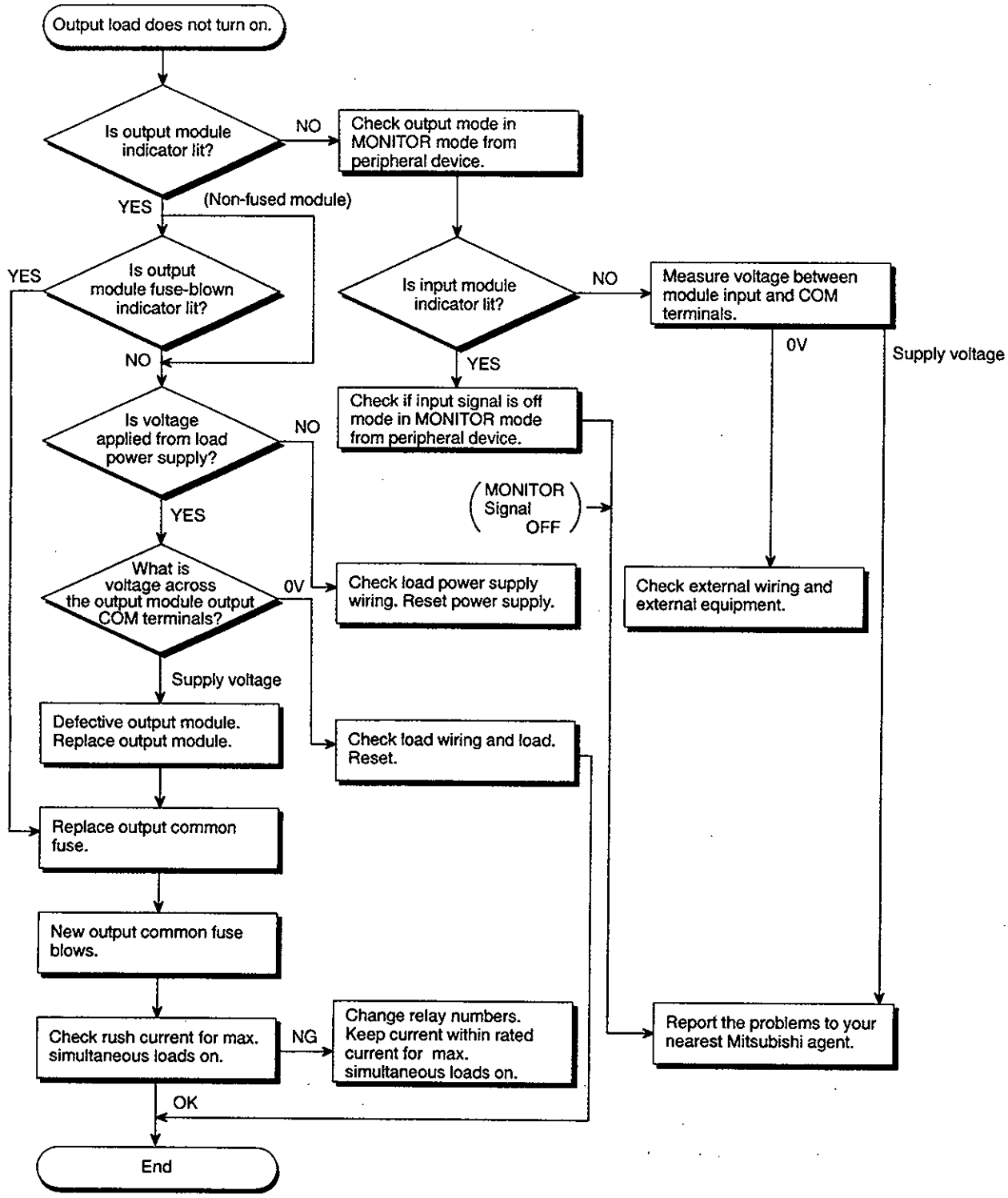
Follow the flowchart below if the RUN indicator flashes when the power is turned on or goes out during operation.



*1 See the motion controller maintenance manual and the programming manuals for the software packages.

12.2.5 Flowchart when output module load does not turn on

Follow the flowchart below if the output module loads do not turn on during operation.

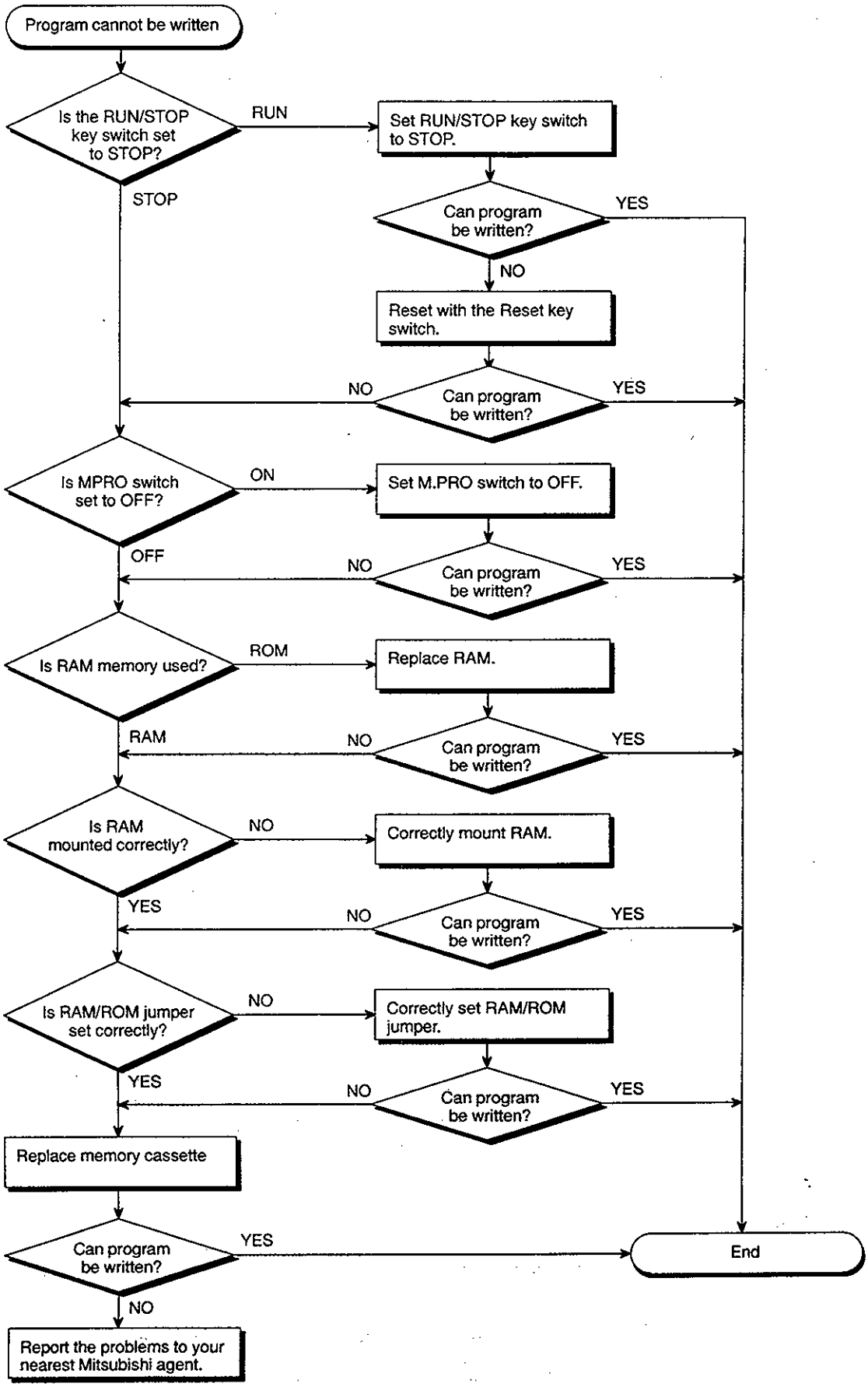


POINT

If the input signal or load does not turn off, refer to Section 12.3 "Possible Problems with I/O Modules."

12.2.6 Flowchart when program cannot be written

Follow the flowchart below if programs or other data cannot be written to the CPU.



12. TROUBLESHOOTING

12.3 Possible Problems with I/O Modules

This section describes possible problems with input and output circuits, and what to do about them.

12.3.1 Troubleshooting input circuits

Table 12.1 describes problems and remedies for input circuits.

Table 12.1 Troubleshooting Input Circuits

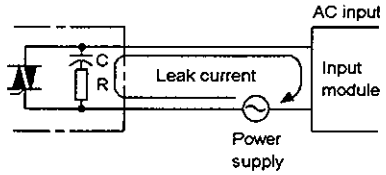
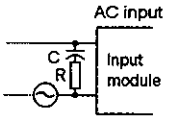
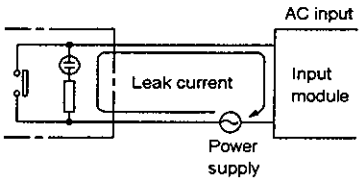
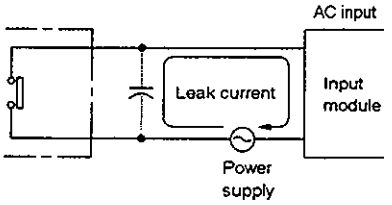
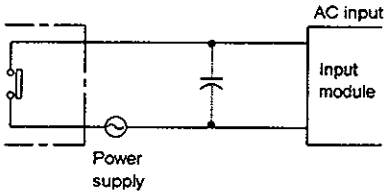
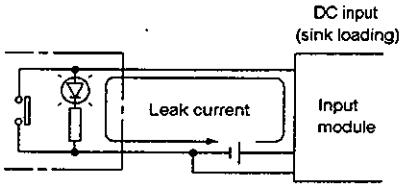
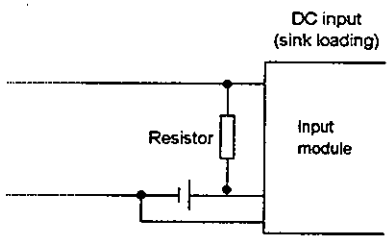
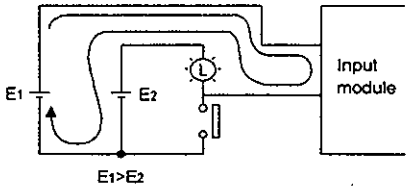
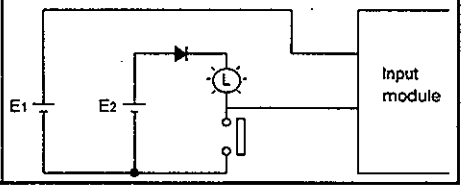
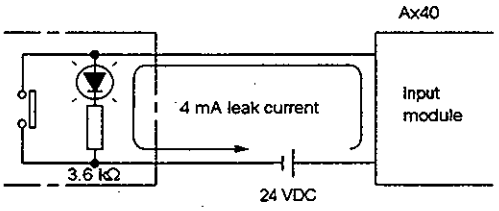
	Symptom	Cause	Remedy
1	Input signal does not turn OFF	• Current leakage through input switch. (Contactless switch used, etc.) 	• Connect an appropriate resistor to lower the voltage between the input module terminals below the OFF voltage.  CR constant: 0.1 to 0.47 μF+ 47 to 120Ω (1/2 W) recommended
2	Input signal does not turn OFF	• Driven using a limit switch with neon lamp. 	• See Problem 1, above. • Alternatively, provide a separate, independent display circuit.
3	Input signal does not turn OFF	• Leak current due to line capacity of wiring. Line capacity (C) of twisted-wire pair is approx. 100 PF/m. 	• See Problem 1, above. • However, this problem does not arise when the power supply is on the input equipment side. 
4	Input signal does not turn OFF	• Driven using a limit switch with LED indicator. 	• Connect an appropriate resistor to lower the voltage between the input module and common terminals below the OFF voltage, as shown below.  * The method of calculating the resistor to connect is shown below.

Table 12.1. Troubleshooting Input Circuits (Continued)

	Symptom	Cause	Remedy
5	Input signal does not turn OFF	• Twin power supplies cause undesirable currents. 	• Use a single power supply. • Connect a diode to prevent undesirable currents, as shown in the diagram. 

Resistor Resistance Calculation for Problem 4

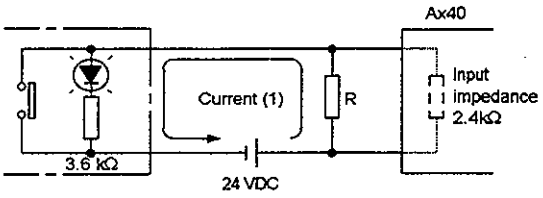


Limit switch with LED indicator is connected to AX40, causing 4 mA leak current.

- Voltage between module terminal and common terminal (V_{TB}) is given by:

$V_{TB} = 4\ [mA] \times 2.4\ [k\Omega] = 9.6\ [V]$ (voltage drop due to LED ignored)

The circuit does not turn OFF because this voltage exceeds the OFF voltage of 6 V. Therefore, the connection of a resistor is required, as shown below.



- Resistance Calculation
The voltage between terminals should not exceed 6 V. For a terminal voltage of 6 V, the corresponding current (I) is:

$(24 - 6)\ [V] \div 3.6\ [k\Omega] = 5mA$

Therefore, the connected resistor must provide a current (I) of 5 mA minimum.

- The resistor resistance is given by:

$6\ [V] \div R > 5 - 2.5\ [mA]$
$6\ [V] \div 2.5\ [mA] > R$
$2.4\ [k\Omega] > R$

If a 2 kΩ resistor is used, the resistor power capacity (W) is given by:

$W = (\text{Applied voltage})^2 / R$ OR $W = (\text{Max. current})^2 \times R$

The terminal voltage (X) of resistor (R) is:

$$\frac{2.4 \times 2}{2.4 + 2}\ (k\Omega) : \frac{2.4 \times 2}{2.4 + 2} + 3.6\ (k\Omega) = X \quad : \quad 24\ [V]$$

$$X = 5.58\ [V]$$

Therefore, the power capacity (W) of resistor (R) is:

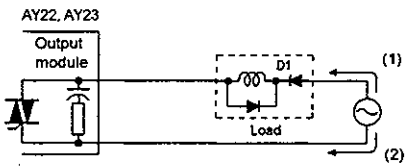
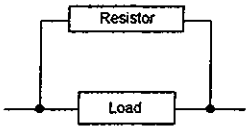
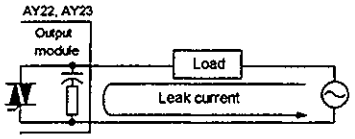
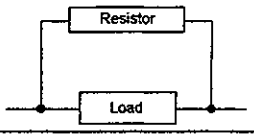
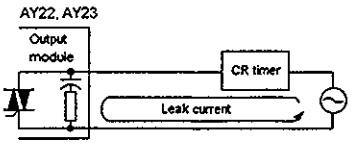
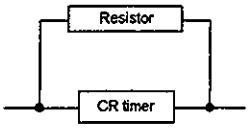
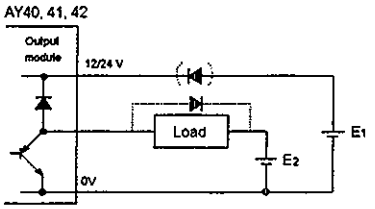
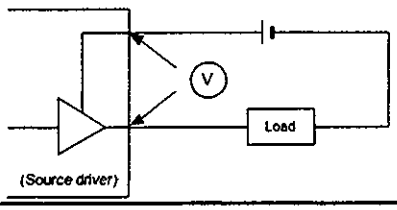
$$W = (5.58\ [V])^2 / 2\ [k\Omega] = 0.015\ [W]$$

- In practice, a resistor power capacity between 0.5 to 1 (W) is selected, which is 3 to 5 times the actual power consumption.
  To conclude, connect a 2 (kΩ)/0.5 to 1 (W) resistor between a problem terminal and COM.

12.3.2 Troubleshooting output circuits

Table 12.2 describes problems and remedies for output circuits.

Table 12.2 Troubleshooting Output Circuits

	Symptom	Cause	Remedy
1	Overvoltage applied to load when output turns OFF	• If load is internally half-wave rectified (some solenoids are like this)  • With polarity (1), C is charged. With polarity (2), the C charge voltage plus the power supply voltage is applied across D1. Max.voltage is approx. 2.2 E	• Connect a resistor between several kΩ to several hundred kΩ across the load. This method causes no problems with output terminals but can lead to deterioration or burn-out of load internal diodes. 
2	Load does not turn OFF (Triac output)	• Leak current due to internal surge killer. 	• Connect a resistor across the load. If long wiring exists between the output card and the load, leak currents also arise due to wiring capacity. 
3	Time period fluctuates when load is a CR timer (Triac output)		• Drive a relay and use the relay contacts to drive the CR timer. See note attached to Problem 1, as some timers are half-wave rectified internally.  Calculate resistor constants from load.
4	Load does not turn OFF (DC version)	• Twin power supplies cause undesirable currents.  • Undesirable currents result if $E_1 < E_2$.	• Use a single power supply. • Connect a diode to prevent undesirable currents, as shown in the diagram. If the load is a resistor, connect a diode across the load to absorb reverse voltages (see broken lines in diagram).
5	Load does not operate correctly (due to external short, etc.) AY60EP AY80EP AY81EP AY82EP	• Defective load or incorrect wiring. Check as shown in "Remedy" column to the right.	• Check external load operation. • Check voltage across the terminals shown below when output (Y) is ON. An output voltage over 3 V could indicate shorting in the external load. Check the external load and wiring. 

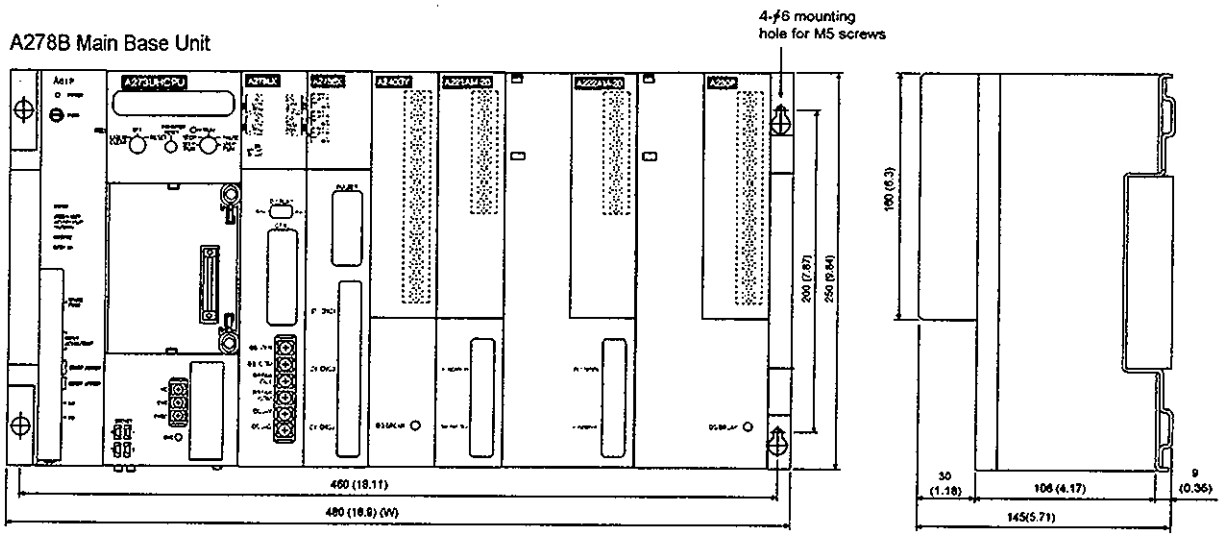
APPENDICES

APPENDIX 1 MOTION CONTROLLER EXTERNAL DIMENSION DIAGRAMS

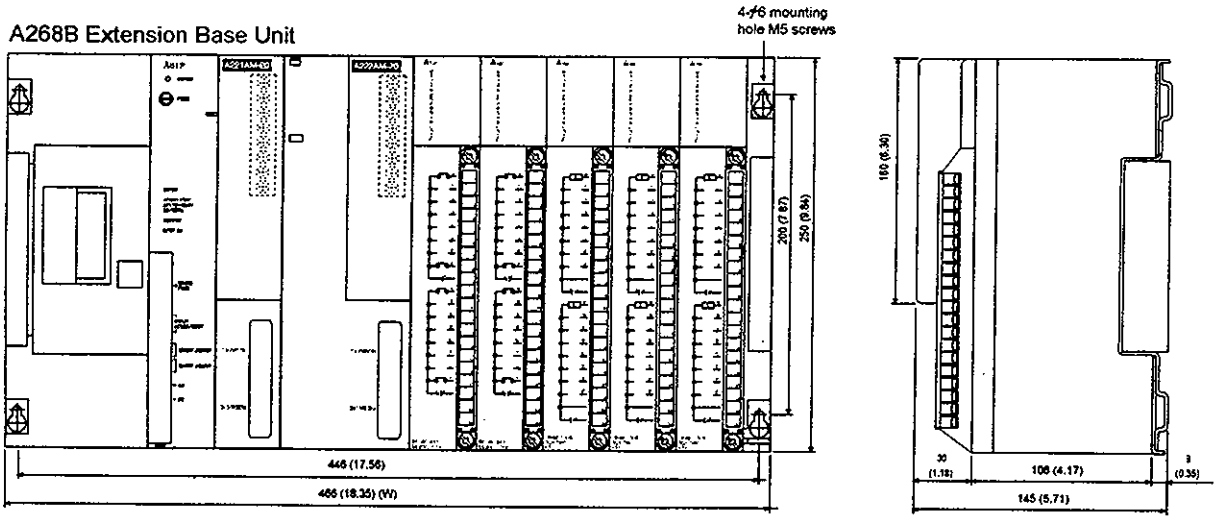
These diagrams show the dimensions of the base units with modules mounted in them and the external dimensions of each module.

(1) External dimensions of the base units with modules mounted

A278B Main Base Unit



A268B Extension Base Unit

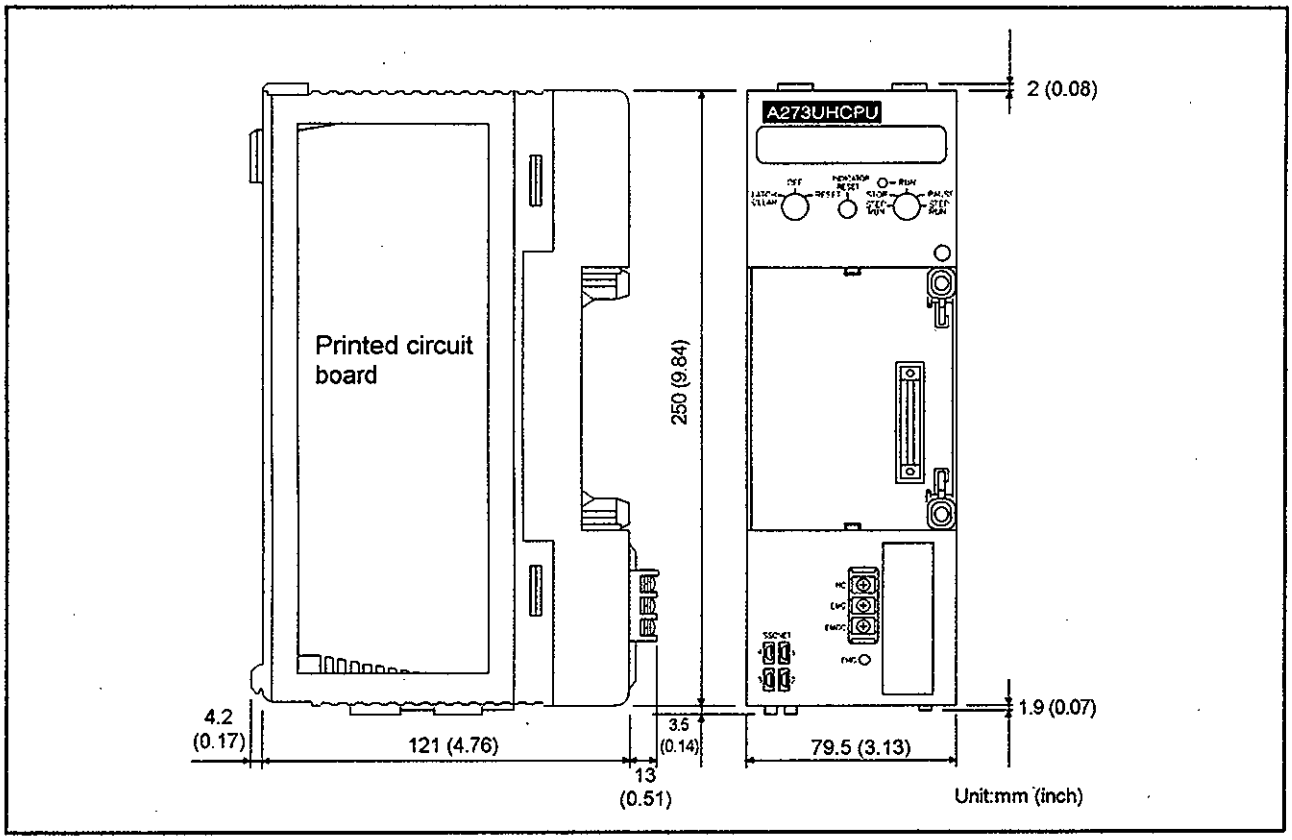


Unit:mm (inch)

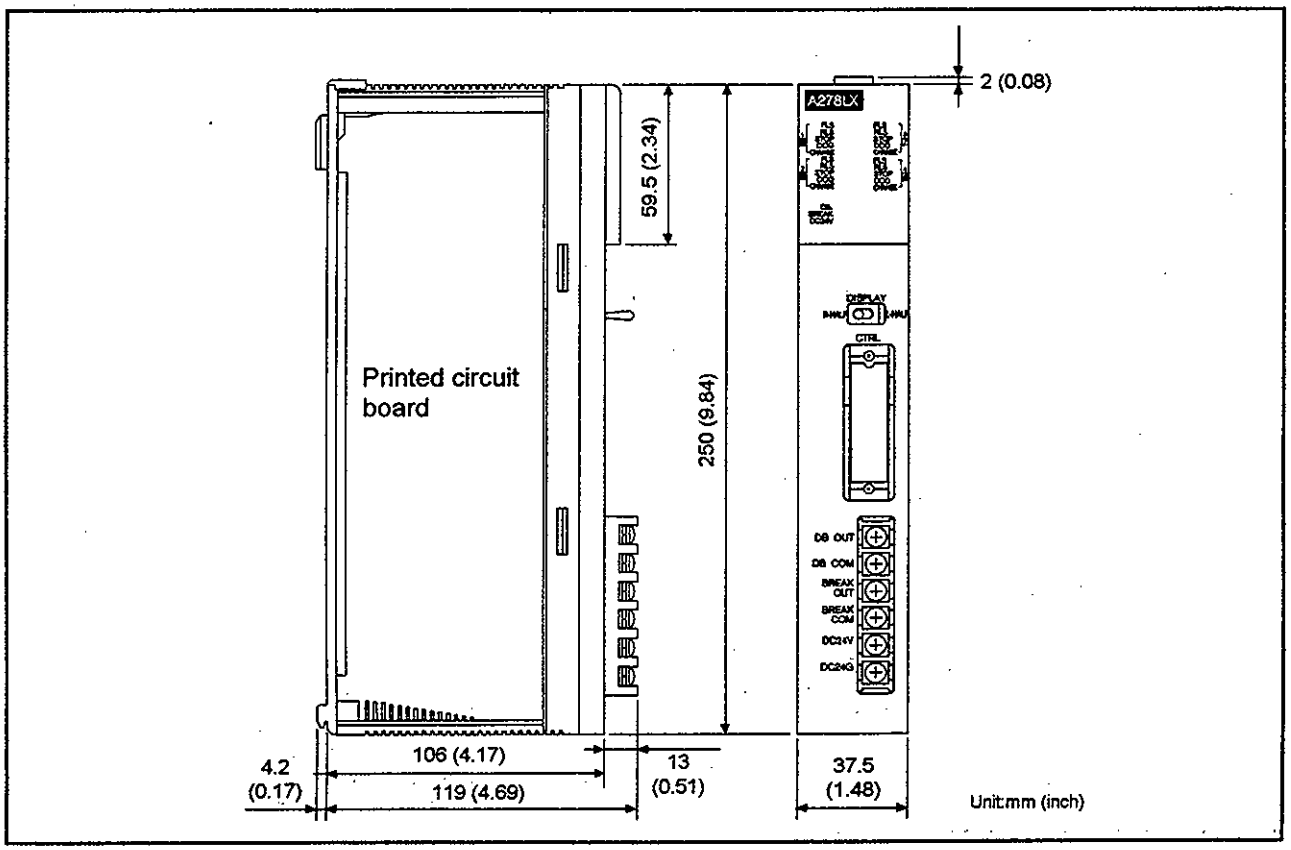
Width Dimension (W)

Main Base Unit		Motor Extension Base Unit		PC Extension Base Unit		
A275B	A278B	A255B	A268B	A62B	A65B	A65B
382 (15.04)	480 (18.9)	297 (11.69)	466 (18.35)	238 (9.37)	352 (13.86)	466 (18.35)

(2) A273UHCPU motion controller

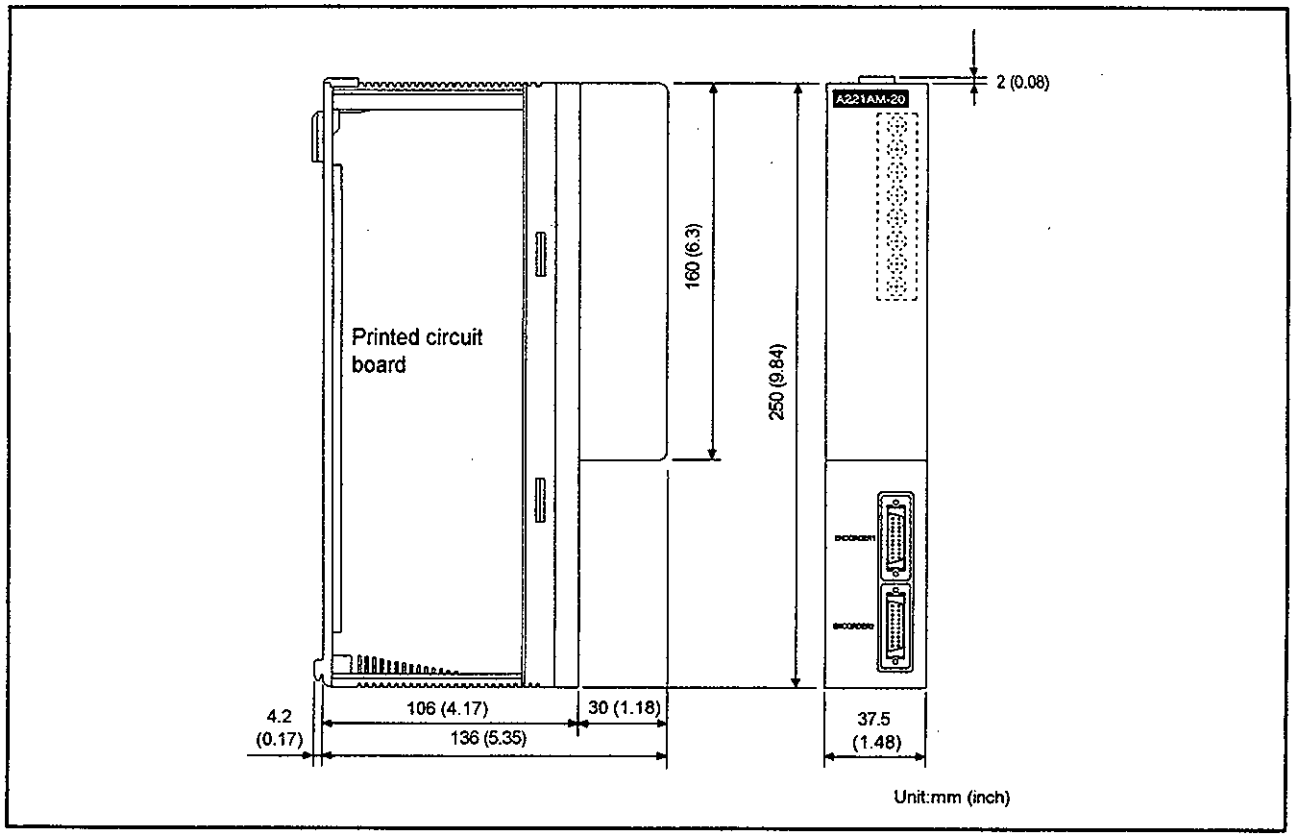


(3) A211AM-20 AC motor drive module

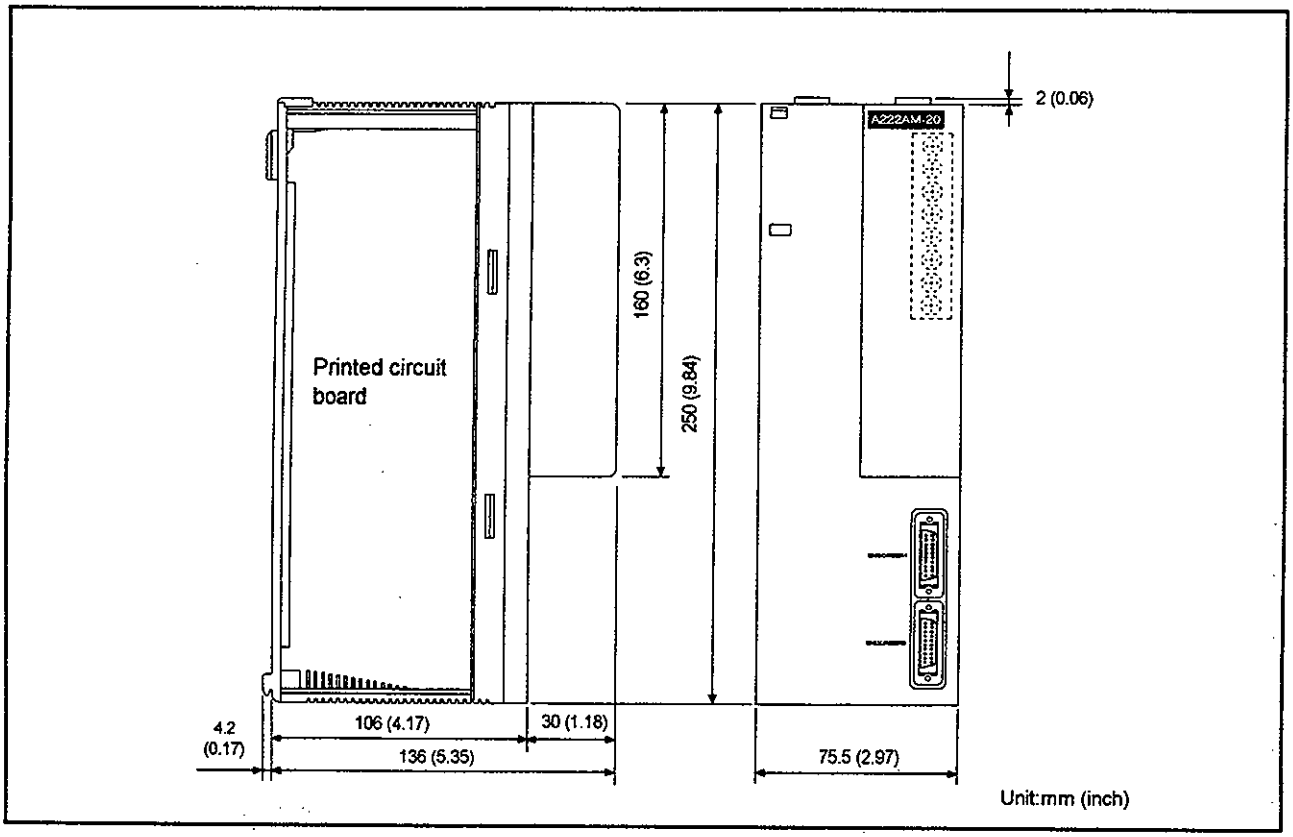


APP

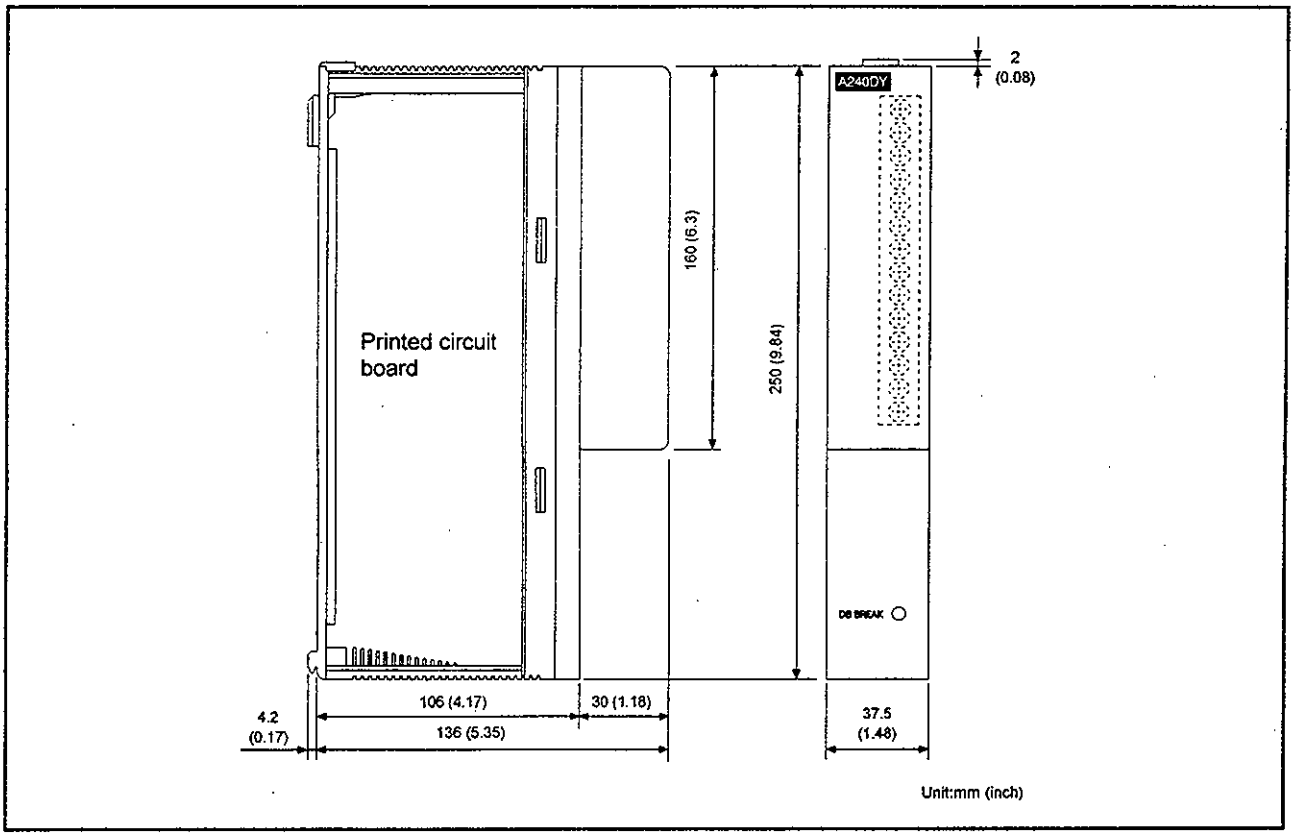
(4) A221AM-20 AC motor drive module



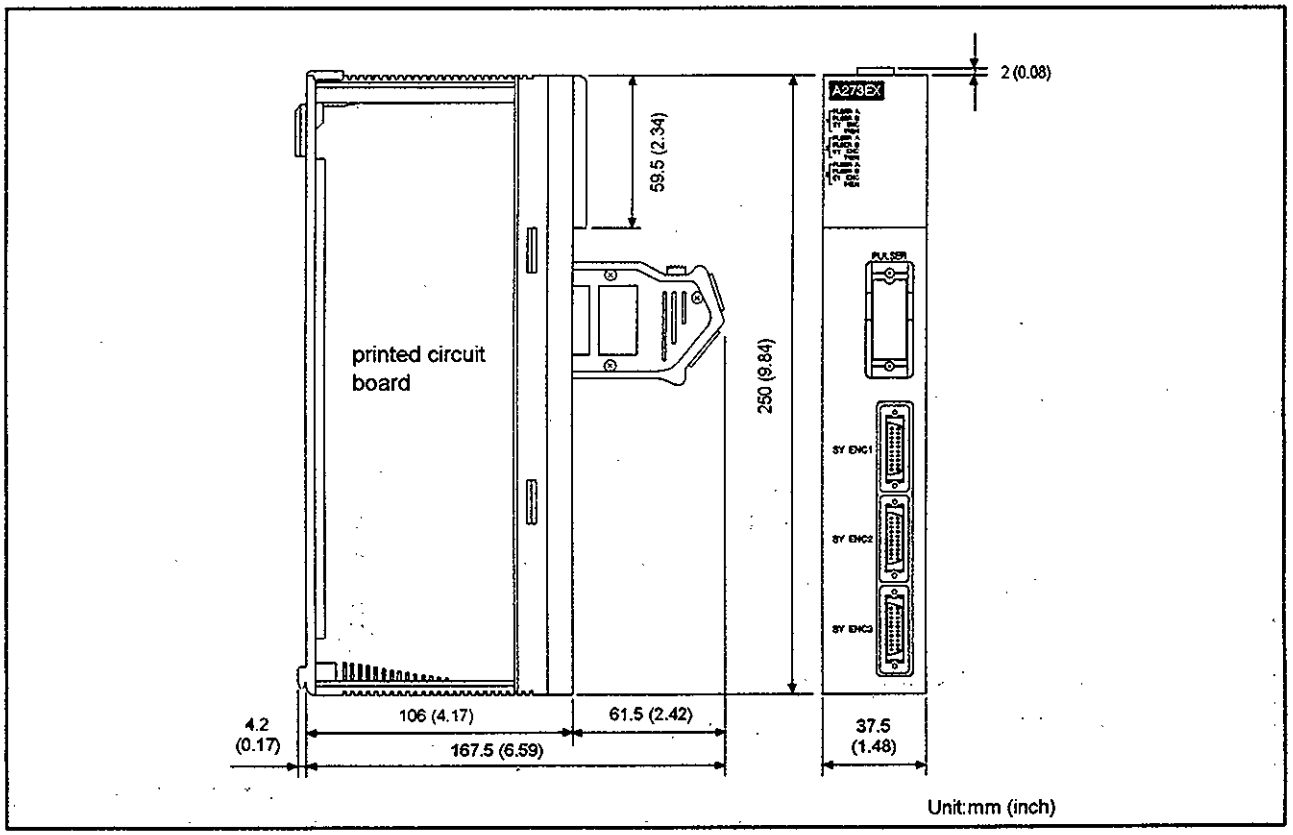
(5) A222AM-20 AC motor drive module



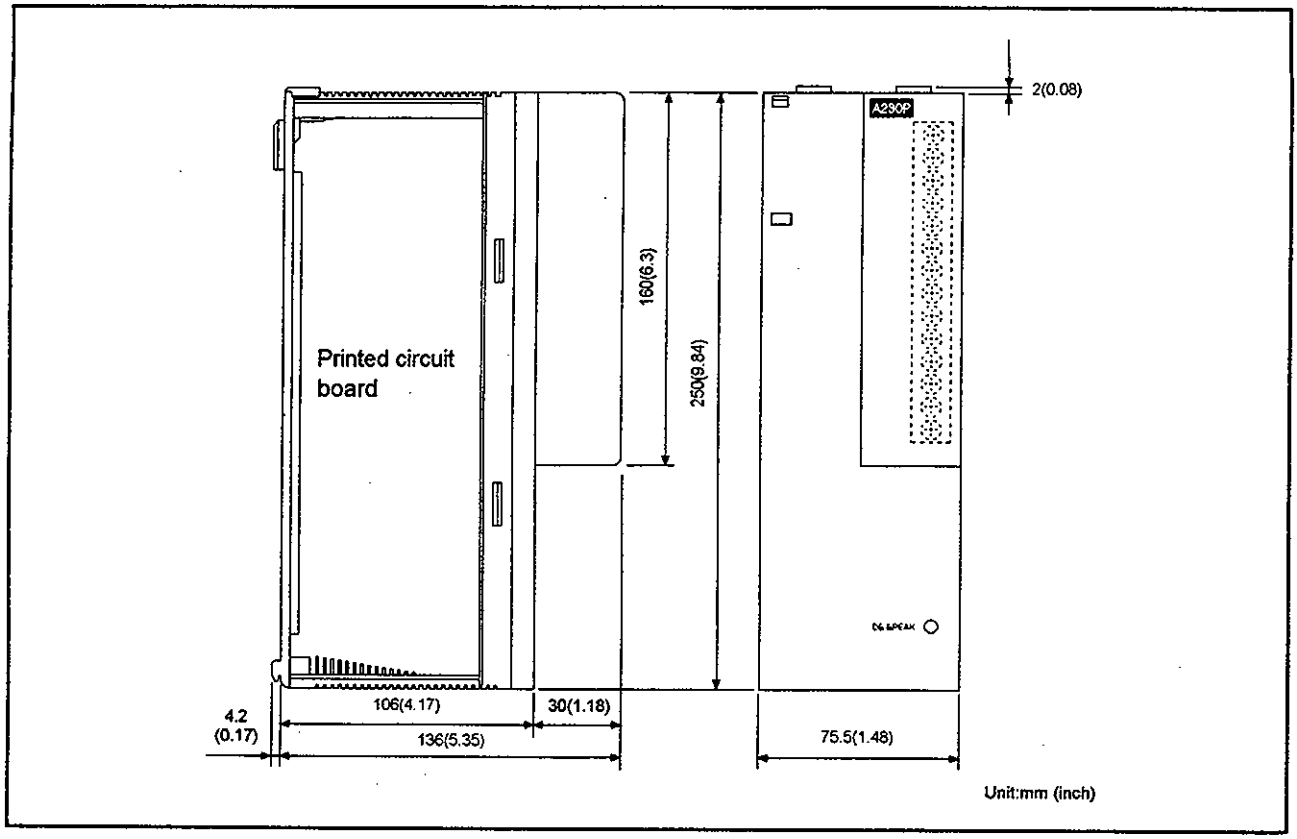
(6) A240DY dynamic brake module



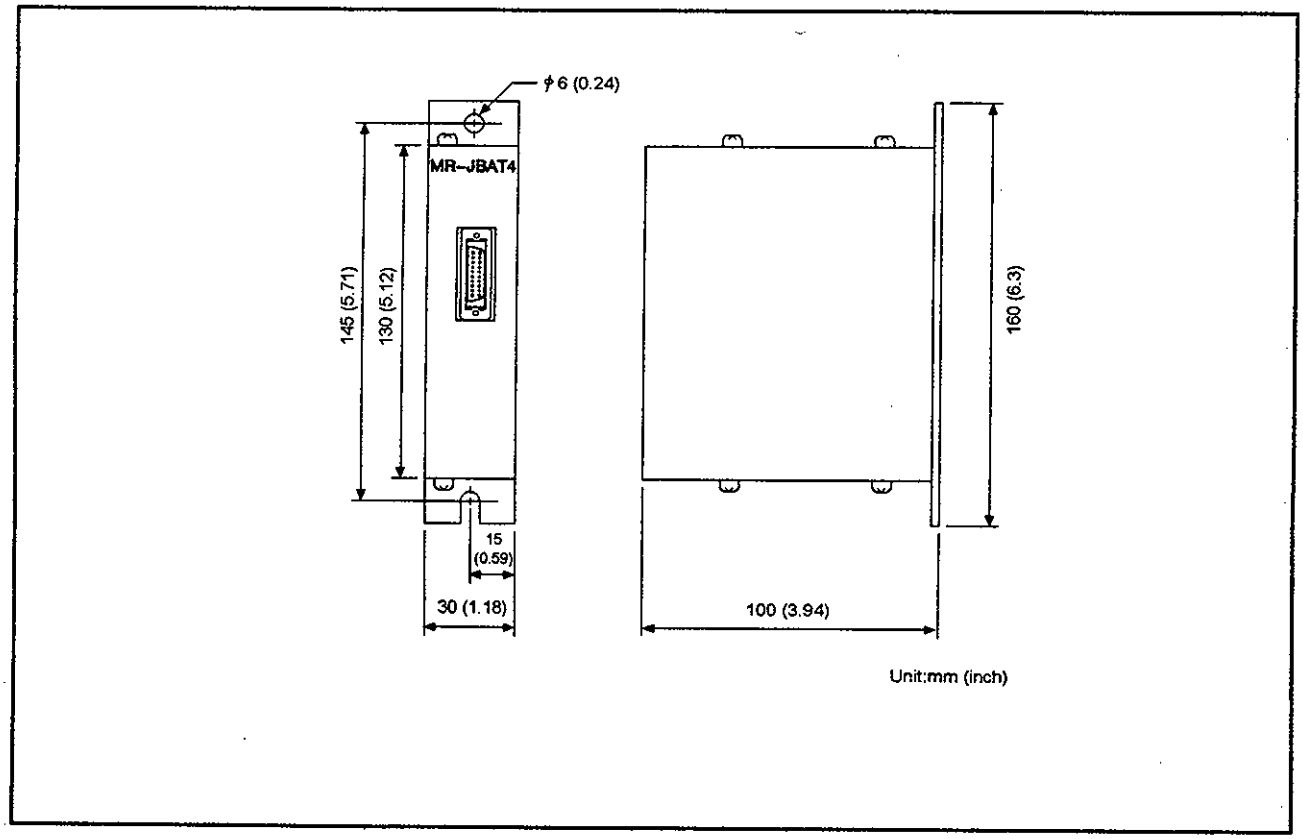
(7) A273EX manual pulse generator/synchronous encoder interface module



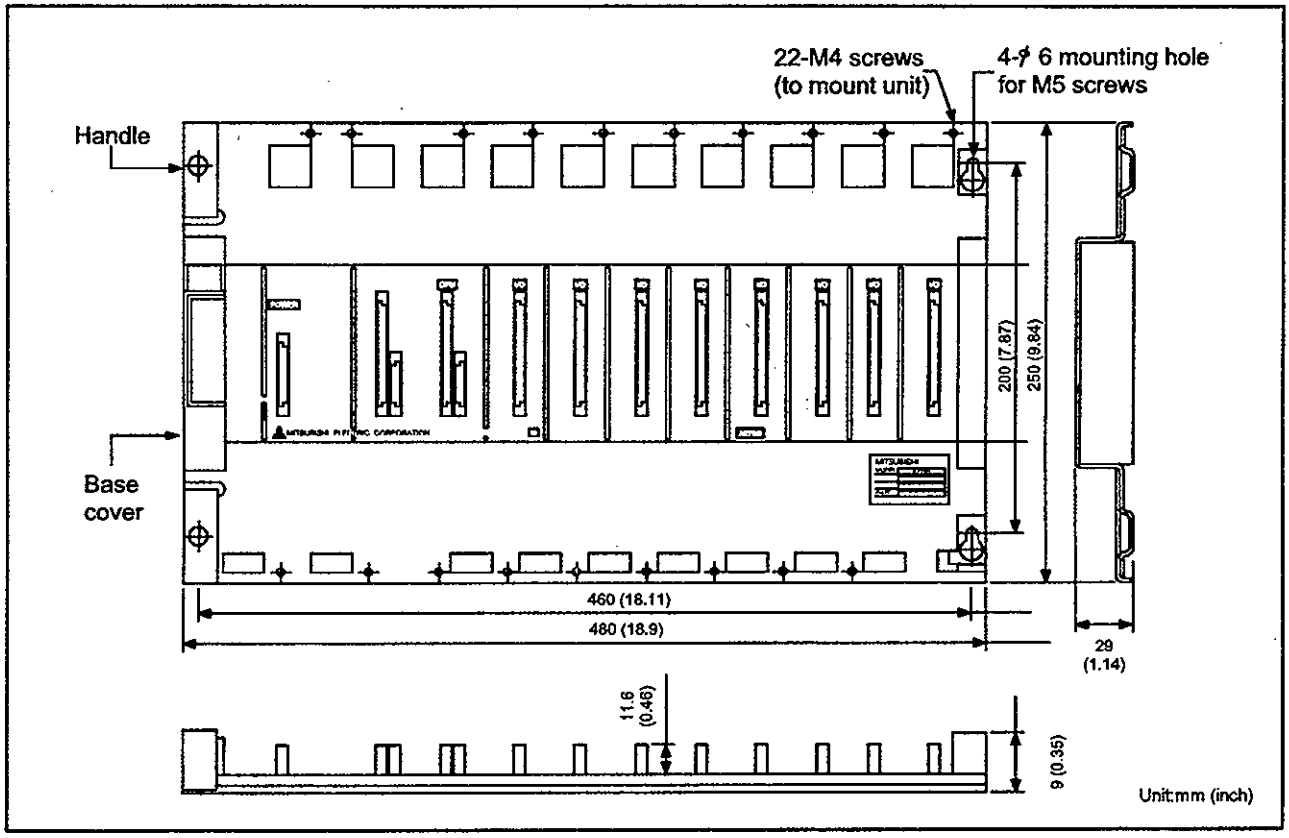
(8) A230P servo power supply module



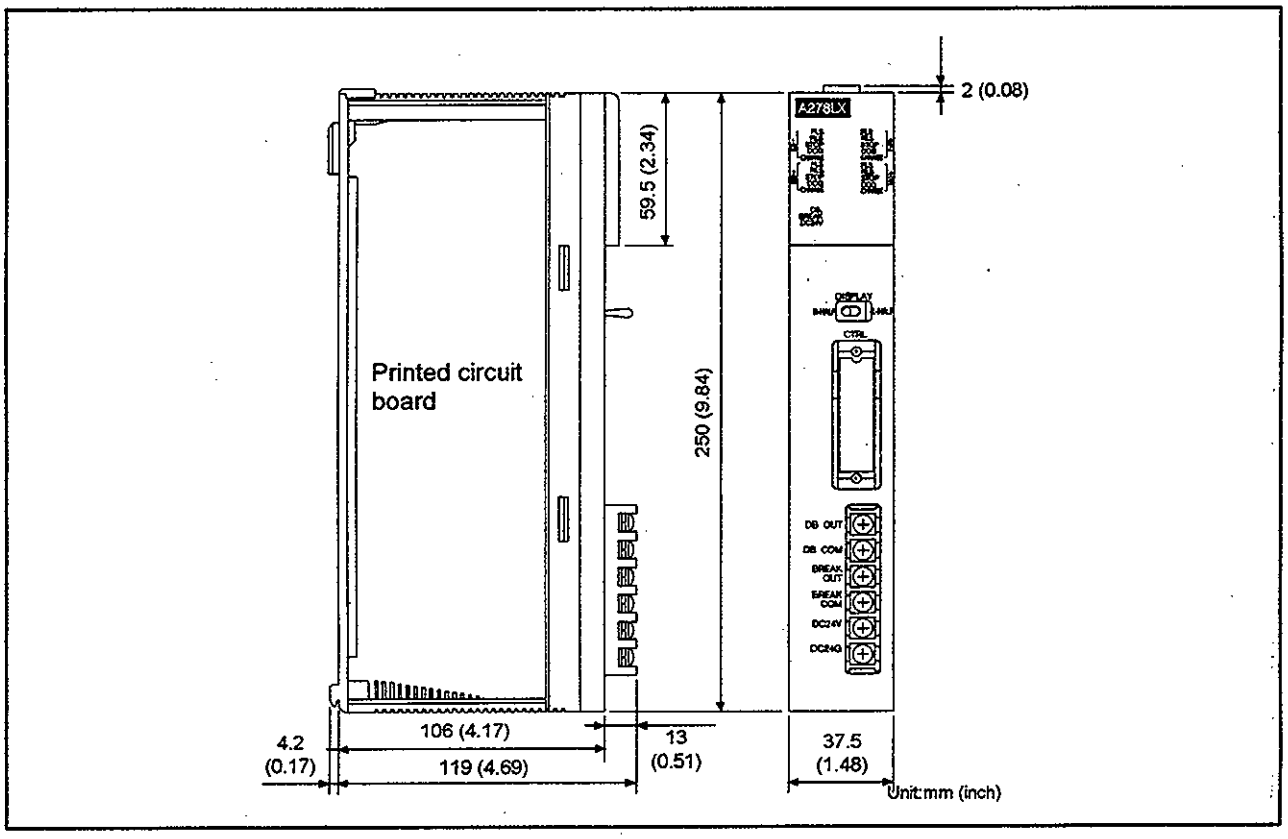
(9) MR-JBAT4 battery unit



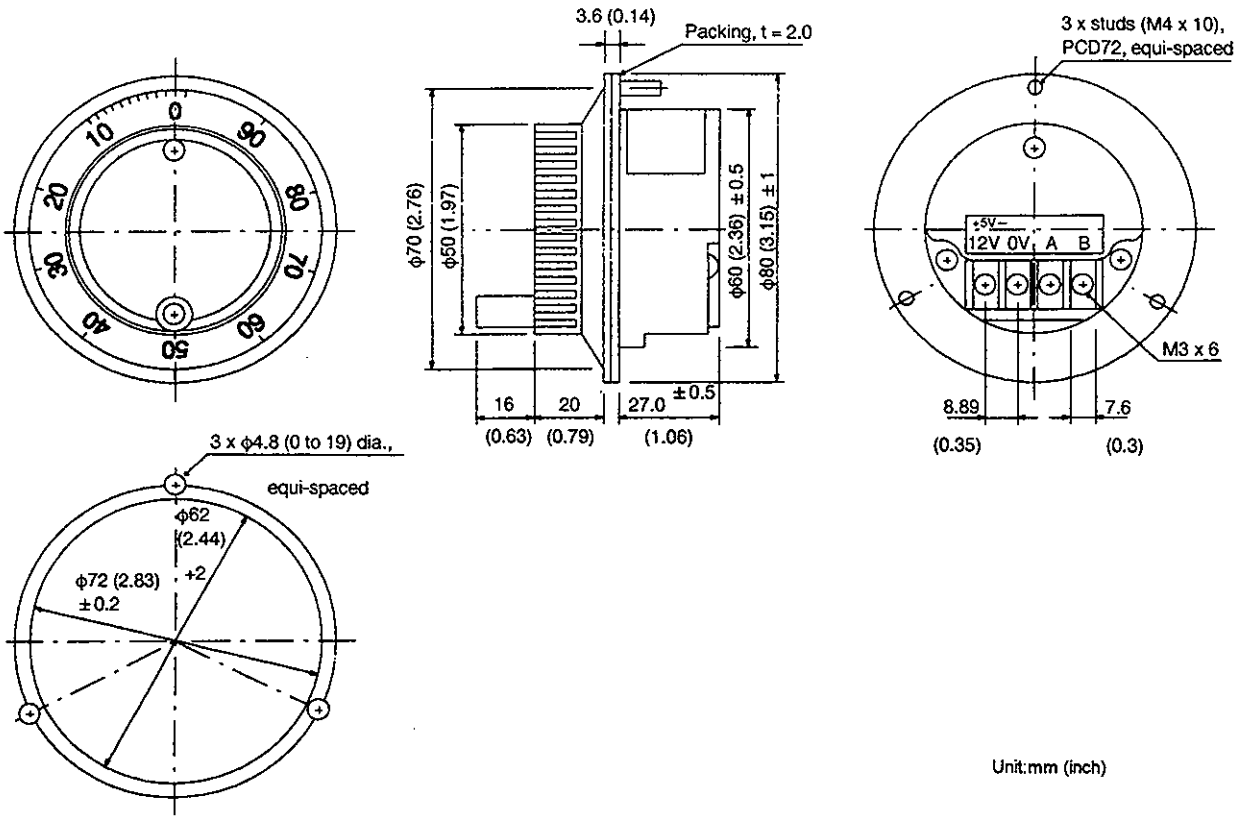
(10) A278B main base unit



(11) A278LX servo external signal module



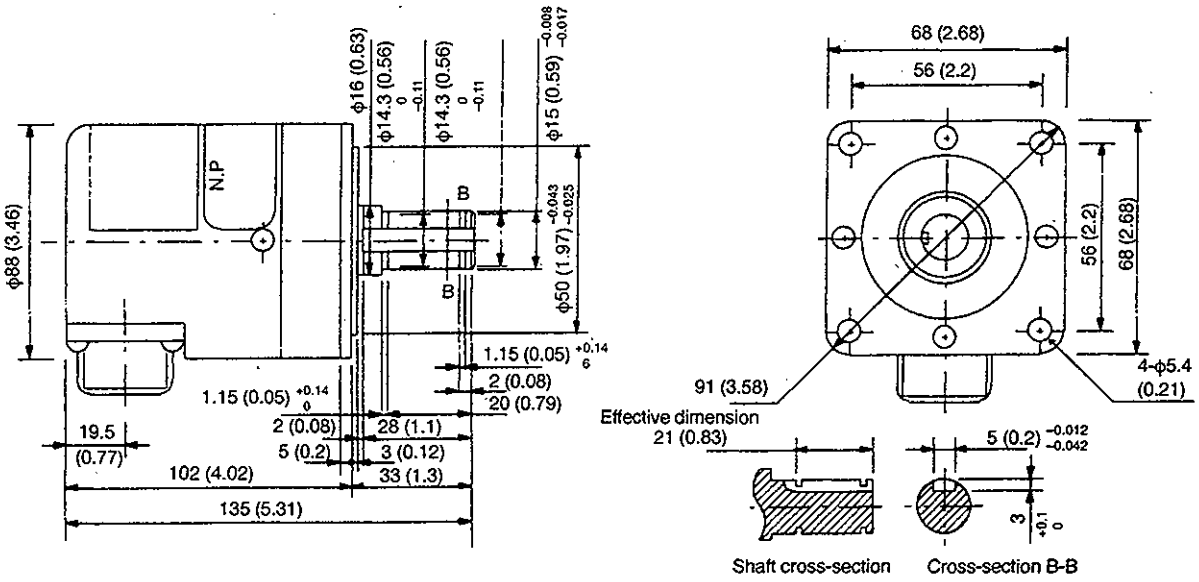
(12) Manual pulse generator specifications



Unit:mm (inch)

Item	Specification
Model name	MR-HDP01
Pulse resolution	25 pulse/rev (100 pulse/rev after magnification by 4)
Output method	Open-collector output, output current = 20 mA max.
Supply voltage	4.5 to 13.2 VDC
Current consumption	60 mA
Life	1,000,000 revolutions min., at 200 rpm.
Permitted axial loads	Radial load: 2 kg max. (4.41 lb)
	Thrust load: 1 kg max. (2.2 lb)
Operating temperature	−10 to 60 °C
Weight kg (lb)	0.4 (0.88)
Max. rotational speed	Instantaneous: 600 rpm max.; normal: 200 rpm
Pulse signal format	2 signals: A phase, B phase, 90 phase difference

(13) Serial synchronous encoder specifications



Keyway Dimensional Diagram

Unit: mm (inch)

Item	Specification
Model name	MR-HENC
Resolution	16384 pulse/rev
Transmission method	Serial communications (connected to A273EX)
Direction of increasing addresses	Counterclockwise (viewed from end of shaft)
Protective construction	IP52 (dust-proof, oil-proof)
Permitted speed	7030 rpm (electrical response: 4300 rpm)
Permitted axial loads	Radial load: 10 kg max. (22.03 lb)
	Thrust load: 5 kg max. (11.01 lb)
Runout at input shaft tip	0.02 mm (0.00079 inch) max., 15 mm (0.59 inch) from tip
Recommended coupling	Bellows coupling
Permitted angular acceleration	40000 rad/s^2
Operating temperature	–5 to 55 °C
Weight kg (lb)	1.5 (3.3)
Connecting cables	MR-HSCBL[ ]M, where [ ] is replaced by the cable length: 5 m (19.69 inch), 10 m (39.37 inch), 20 m (78.74 inch), 30 m (118.11 inch)
Communications method	Differential driver/receiver conforming to RS422
Transmission distance	50 m (196.85 inch) max.

POINT

When fitting an encoder to the machine, use a coupling.

APPENDIX 2 COMBINATIONS OF AC MOTOR DRIVE MODULES, SERVO AMPLIFIERS, AND SERVOMOTORS

2.1 Combinations of AC Motor Drive Modules/MR-H-B/MR-J-B with Servomotors

(1) Table of AC motor drive modules/MR-H-B/MR-J-B combinations

Servomotor \ Servo Amplifier		A273UHCPU (8-/32-axis Specification) Built-in Servo Amplifier			MR-J-B Separate Servo Amplifier						MR-H-B Separate Servo Amplifier												Motor Capacity (kW)	Motor Rated Current (A)
		A221AM-20	A211AM-20	A222AM-20	MR-J-10B	MR-J-20B	MR-J-40B	MR-J-60B	MR-J-100B	MR-J-200B	MR-H-10B	MR-H-20B	MR-H-40B	MR-H-60B	MR-H-100B	MR-H-200B	MR-H-350B	MR-H-500B	MR-H-700B	MR-H-11KB	MR-H-15KB	MR-H-22KB		
HA-MH Low-capacity 3000 rpm Series	HA-MH053	○	○	○	○							○											0.05	1.2
	HA-MH13	○	○	○	○							○											0.1	1.2
	HA-MH23					○							○										0.2	1.7
	HA-MH43						○							○									0.4	2.8
	HA-MH73								○						○								0.75	5.3
HA-FH Low-capacity 3000 rpm Series	HA-FH053	○	○	○	○						○												0.05	0.6
	HA-FH13	○	○	○	○						○												0.1	1.1
	HA-FH23	○	○	○		○						○											0.2	1.3
	HA-FH33		○	○			○						○										0.3	1.9
	HA-FH43		○	○			○						○										0.4	2.5
	HA-FH63		○	○				○						○									0.6	3.6
HA-SH Medium-capacity 1000 rpm Series	HA-SH81								○						○								0.85	4.5
	HA-SH121									○						○							1.2	6
	HA-SH201									○						○							2.0	9.5
	HA-SH301																○						3.0	14
HA-SH Medium-capacity 2000 rpm Series	HA-SH52		○	○					○					○									0.5	3
	HA-SH102								○						○								1.0	5.5
	HA-SH152									○						○							1.5	8
	HA-SH202									○						○							2.0	10
	HA-SH352																○						3.5	16
	HA-SH502																	○					5.0	24
	HA-SH702																		○				7.0	37
HA-SH Medium-capacity 3000 rpm Series	HA-SH53		○	○					○					○									0.5	3
	HA-SH103								○						○								1.0	5
	HA-SH153									○						○							1.5	8
	HA-SH203									○						○							2.0	9
	HA-SH353																○						3.5	16

Servomotor		Servo Amplifier: A273UHCPU (8-/32-axis Specification) Built-in Servo Amplifier			MR-J-B Separate Servo Amplifier						MR-H-B Separate Servo Amplifier												Motor Capacity (kW)	Motor Rated Current (A)
		A221AM-20	A211AM-20	A222AM-20	MR-J-10B	MR-J-20B	MR-J-40B	MR-J-60B	MR-J-100B	MR-J-200B	MR-H-10B	MR-H-20B	MR-H-40B	MR-H-60B	MR-H-100B	MR-H-200B	MR-H-350B	MR-H-500B	MR-H-700B	MR-H-11KB	MR-H-15KB	MR-H-22KB		
HA-LH Low-inertia 2000 rpm Series	HA-LH52		○	○										○									0.5	3.5
	HA-LH102															○							1.0	7
	HA-LH152															○							1.5	9.4
	HA-LH202																○						2.0	14
	HA-LH302																	○					3.0	18
	HA-LH502																	○					5.0	28
	HA-LH702																		○				7.0	37
	HA-LH11K2																			○			11.0	68
	HA-LH15K2																				○		15.0	87
	HA-LH22K2																					○	22.0	126
HA-UH Flat 2000 rpm Series	HA-UH32		○	○									○										0.3	2.7
	HA-UH52		○	○										○									0.5	3.4
	HA-UH102															○							1.0	7.4
	HA-UH152															○							1.5	10
	HA-UH222																○						2.2	14
	HA-UH352																	○					3.5	20
	HA-UH452																	○					4.5	27

Selection Method for AC Motor Drive Modules and Servo Amplifiers

The motion controller can control a maximum of eight servomotor axes (A273UHCPU (8-axis specification)) or 32 servomotor axes (A273UHCPU (32-axis specification)). Combinations of ADU, MR-H-B, MR-J-B, and MR-J2-B can be used.

(a) A maximum of eight axes using A273UHCPU (8-axis specification) or 16 axes using A273UHCPU (32-axis specification) can be controlled using only AC motor drive modules. Use AC motor drive modules where possible to keep the system compact.
The AC motor drive modules work from a single A230P servo power supply module.
Select the AC motor drive modules in accordance with the number of motors and load torques, using the following equation.

1) The total current for all axes at a simultaneous start, calculated by the following equation, must not exceed 30 A.

$$\text{Total current for all axes (A)} = \Sigma\left(\text{motor rated current (A)} \times \frac{\text{load torque (kg·cm)}}{\text{rated torque (kg·cm)}} \times \frac{\text{operation speed motor (r/min.)}}{\text{rated speed motor (r/min.)}}\right)$$

2) If the total current for any axis exceeds 30 A, use a MR-H-B, MR-J-B, or MR-J2-B servo amplifier.

(b) Use a MR-H-B, MR-J-B, or MR-J2-B servo amplifier for large-capacity servomotors which cannot be driven by an AC motor drive module.

(2) Table of servomotors

(a) Low-capacity 3000 rpm series

Motor Rated Output			(kw)	0.05		0.1		0.2		0.3		0.4		0.6		0.75	
			Electromagnetic Brake	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
HA-MH 3000 rpm Series				○	○	○	○	○	○			○	○			○	○
	With high-precision reduction gears	Gear ratio	1/5	○	○	○	○	○	○			○	○			○	○
			1/9	○	○	○	○	○	○			○	○			○	○
			1/20	○	○	○	○	○	○			○	○			○	○
			1/29	○	○	○	○	○	○			○	○			○	○
HA-FH 3000 rpm Series				○	○	○	○	○	○	○	○	○	○	○	○		
	With general-purpose industrial reduction gears	Gear ratio	1/5	○	○	○	○	○	○	○	○	○	○	○	○		
			1/10	○	○	○	○	○	○	○	○	○	○	○	○		
			1/30	○	○	○	○	○	○	○	○	○	○	○	○		

(b) Medium-/high-capacity series

Motor Rated Output			(kw)	0.3		0.5		0.85		1.0		1.2		1.5		2.0		2.2		3.0		3.5		4.5		5.0		7.0		11	15	22
			Electromagnetic Brake	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No
HA-SH Medium-capacity 1000 rpm Series								○	○			○	○			○	○			○	○											
HA-SH Medium-capacity 2000 rpm Series						○	○			○	○			○	○	○	○					○	○			○	○	○	○			
	With general-purpose industrial reduction gears	Gear ratio	1/6			○	○			○	○			○	○	○	○					○	○									
			1/8																							○	○					
			1/11			○	○			○	○			○	○	○	○					○	○			○	○	○	○			
			1/17			○	○			○	○			○	○	○	○					○	○			○	○	○	○			
			1/29			○	○			○	○			○	○	○	○					○	○			○	○	○	○			
			1/35			○	○			○	○			○	○	○	○					○	○			○	○	○	○			
			1/43			○	○			○	○			○	○	○	○					○	○			○	○	○	○			
			1/59			○	○			○	○			○	○	○	○					○	○									
	With high-precision reduction gears	Gear ratio	1/5			○	○			○	○			○	○	○	○					○	○			○	○	○	○			
			1/9			○	○			○	○			○	○	○	○					○	○			○	○					
			1/20			○	○			○	○			○	○	○	○					○	○									
			1/29			○	○			○	○			○	○	○	○															
			1/45			○	○			○	○			○	○	○	○															
HA-SH Medium-capacity 3000 rpm Series						○	○			○	○			○	○	○	○					○	○									
HA-LH Low-inertia 2000 rpm Series						○				○				○		○				○						○		○		○	○	○
	With high-precision reduction gears	Gear ratio	1/5			○				○				○		○				○												
			1/9			○				○				○		○				○												
			1/20			○				○				○		○				○												
			1/29			○				○				○		○																
			1/45			○				○				○		○																
HA-UH Flat 2000 rpm Series				○	○	○	○			○	○			○	○			○	○			○	○	○	○							

(3) Absolute-position detector

The following servomotors with absolute-position detectors can also be used.

HA-SH-Y	Encoder resolution: 16384 pulse/rev.
HA-LH-Y	
HA-UH-Y	
HA-FH-Y	Encoder resolution: 8192 pulse/rev.
HA-MH-Y	

2.2 Combinations of MR-J2-B and Servomotors

(1) Table of MR-J2-B combinations

Servo Amplifier / Servomotors		MR-J2-B Separate Servo Amplifier						Motor Capacity (KW)	Motor Rated Current (A)
		MR-J2-10B	MR-J2-20B	MR-J2-40B	MR-J2-60B	MR-J2-70B	MR-J2-100B		
HC-MF Low capacity 3000 rpm Series	HC-MF053	○						0.05	0.85
	HC-MF13	○						0.1	0.85
	HC-MF23		○					0.2	1.5
	HC-MF43			○				0.4	2.8
	HC-MF73					○		0.75	5.1
HA-FF Low capacity 3000 rpm Series	HA-FF053	○						0.05	0.6
	HA-FF13	○						0.1	1.1
	HA-FF23		○					0.2	1.3
	HA-FF33			○				0.3	1.9
	HA-FF43			○				0.4	2.5
	HA-FF63				○			0.6	3.6
HC-SF Medium capacity 2000 rpm Series	HC-SF52				○			0.5	3.2
	HC-SF102						○	1.0	6

(2) Table of servomotors

(a) Low-capacity 3000 rpm Series

Motor Rated Output				(kw)	0.05		0.1		0.2		0.3		0.4		0.6		0.75	
				Electromagnetic Brake	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
HC-MF 3000 rpm Series					○	○	○	○	○	○			○	○			○	○
	With general-purpose industrial reduction gears	Gear ratio	1/5		○	○	○	○	○	○			○	○			○	○
			1/12		○	○	○	○	○	○			○	○			○	○
			1/20		○	○	○	○	○	○			○	○			○	○
	With high-precision reduction gears	Gear ratio	1/5		○	○	○	○	○	○			○	○			○	○
			1/9		○	○	○	○	○	○			○	○			○	○
			1/20		○	○	○	○	○	○			○	○			○	○
			1/29		○	○	○	○	○	○			○	○			○	○
HA-FF 3000 rpm Series					○	○	○	○	○	○	○	○	○	○	○	○		
	With general-purpose industrial reduction gears	Gear ratio	1/5		○	○	○	○	○	○	○	○	○	○	○	○		
			1/10		○	○	○	○	○	○	○	○	○	○	○	○		
			1/30		*1 ○	*1 ○	*1 ○	*1 ○	○	○	○	○	○	○	○	○		
	With high-precision reduction gears	Gear ratio	1/5		○	○	○	○	○	○	○	○	○	○	○	○		
			1/9										○	○	○	○		
			1/10		○	○	○	○	○	○	○	○						
			1/15		○	○	○	○	○	○								
			1/20						○	○	○	○	○	○	○	○		
			1/25		○	○	○	○										
			1/29						○	○	○	○	○	○	○	○		
			1/45				○	○	○	○	○	○	○	○	○	○		

*1: HA-FF053 and HA-FF13 are reverse-direction motors.

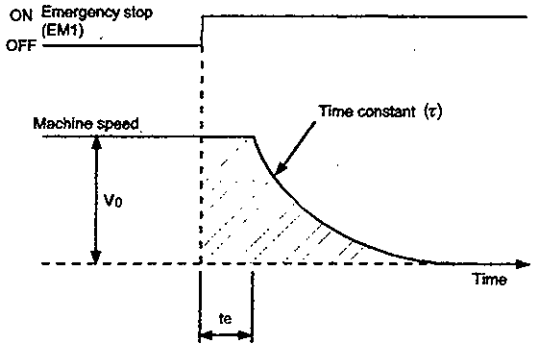
(b) Medium-capacity Series

Motor Rated Output		(kw)		0.5		1.0		1.5		2.0		3.5	
		Electromagnetic Brake		No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
HC-SF 2000 rpm Series				O	O	O	O	O	O	O	O	O	O
	With general-purpose industrial reduction gears	Gear ratio	1/6	O	O	O	O	O	O	O	O	O	O
			1/11	O	O	O	O	O	O	O	O	O	O
			1/17	O	O	O	O	O	O	O	O	O	O
			1/29	O	O	O	O	O	O	O	O	O	O
			1/35	O	O	O	O	O	O	O	O	O	O
			1/43	O	O	O	O	O	O	O	O	O	O
			1/59	O	O	O	O	O	O	O	O	O	O
	With high-precision reduction gears	Gear ratio	1/5	O	O	O	O	O	O	O	O	O	O
			1/9	O	O	O	O	O	O	O	O	O	O
			1/20	O	O	O	O	O	O	O	O	O	O
			1/29	O	O	O	O	O	O	O	O	O	O
			1/45	O	O	O	O	O	O	O	O	O	O

APPENDIX 3 DYNAMIC BRAKE CHARACTERISTICS

(1) HA-MH/FH/SH/LH/UH Series Motors

The dynamic brake operates to rapidly stop the servomotor when a power interruption or emergency stop occurs. The machine decelerates and stops according to the pattern shown in Fig. 1.
The area under the curve (shaded) in Fig. 1 represents the overrun distance (Lmax) when the dynamic brake is applied, and this can be estimated using Equation 3.1 below. The effect of the load torque is significant near the stop position, and if the load torque is large, the axis may stop before the calculated position.
The brake time constant (τ) is dependent on the motor speed at emergency stop, according to the relationship shown in Fig. 2-4.



$$Lmax = \frac{V_0}{60}\left\{ te + \tau\left(1 + \frac{J_L}{J_M}\right)\right\} \quad \text{..... (Equation 3.1)}$$

Where:

Lmax	:	Overrun distance	[mm]
V_0	:	Machine rapid traverse speed	[mm/min]
J_M	:	Servomotor moment of inertia	[kg·cm^2]
J_L	:	Servomotor axis-converted load moment of inertia	[kg·cm^2]
τ	:	Brake time constant (see Figs. 2, 3, 4, Table 1)	[sec]
te	:	Control circuit delay (see diagram) (Internal relay delay is approx. 30 ms.)	[sec]

Fig. APP.1 Dynamic Brake Braking Diagram

Table APP.1 Dynamic Time Constants

Model Name	Brake Time Constant τ (sec)	Model Name	Brake Time Constant τ (sec)
HA-MH053	0.02	HA-FH053	0.02
HA-MH13	0.03	HA-FH13	0.02
HA-MH23	0.04	HA-FH23	0.05
HA-MH43	0.06	HA-FH33	0.07
HA-MH73	0.05	HA-FH43	0.09
		HA-FH63	0.02

[Dynamic Brake Permitted Load GD^2]

Applying the dynamic brake at load GD2 exceeding the load shown in the following table can cause the brake resistor in the servo amplifier to burn out.

Amplifier Model Name	GD_L/GD_M
MR-H10B - MR-H100B	30
MR-H200B	15
MR-H350B - MR-H700B	10
MR-H11KB - MR-H22KB	30

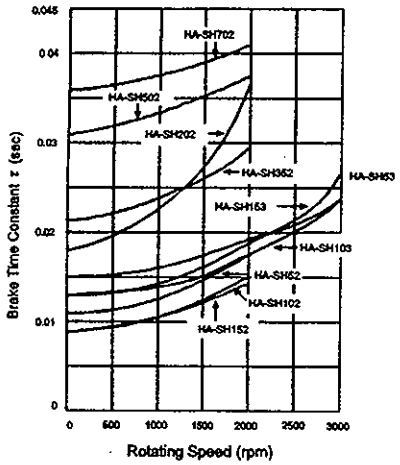


Fig. APP.2 Dynamic Brake Time Constant (HA-SH)

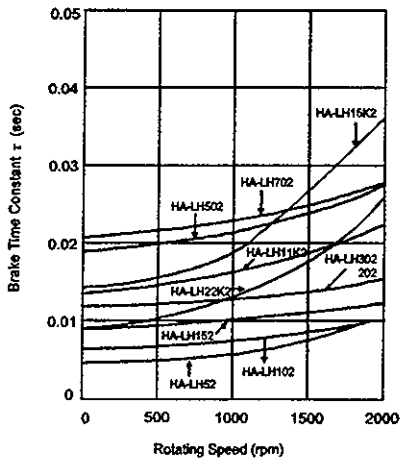


Fig. APP.3 Dynamic Brake Time Constant (HA-LH)

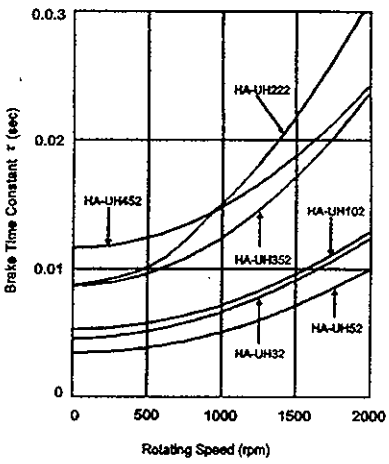
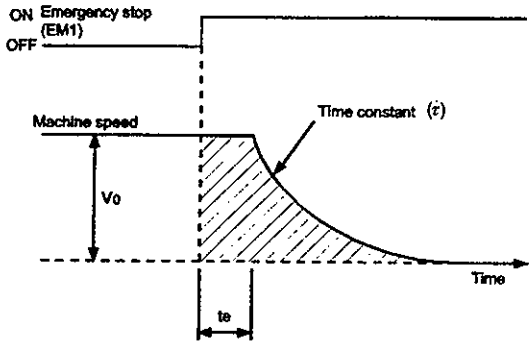


Fig. APP.4 Dynamic Brake Time Constant (HA-UH)

(2) HC-MF/HA-FF/HC-SF Series motors

The dynamic brake operates to rapidly stop the servomotor when a power interruption or emergency stop occurs. The machine decelerates and stops according to the pattern shown in Fig. APP.5. The area under the curve (shaded) in Fig. APP.5 represents the overrun distance (Lmax) when the dynamic brake is applied, and this can be estimated using Equation 3.2 below. The effect of the load torque is significant near the stop position, and if the load torque is large, the axis may stop before the calculated position. The brake time constant (τ) is dependent on the motor speed at emergency stop, according to the relationship shown in Fig. APP.6 and APP.7.



$$Lmax = \frac{V_0}{60}\left\{ te + \tau\left(1 + \frac{J_L}{J_M}\right)\right\} \quad \text{..... (Equation 3.2)}$$

Where:

Lmax	:	Overrun distance	[mm]
V_0	:	Machine rapid traverse speed	[mm/min]
J_M	:	Servomotor moment of inertia	[kg·cm^2]
J_L	:	Servomotor axis-converted load moment of inertia	[kg·cm^2]
τ	:	Brake time constant (see Figs. 6, and APP. 7, Table APP. 2)	[sec]
te	:	Control circuit delay (see diagram) (Internal relay delay is approx. 30 ms.)	

Fig. APP.5 Dynamic Brake Braking Diagram

Table APP.2 Dynamic Time Constants

Model Name	Brake Time Constant τ (sec)
HA-FF053·13	0.02
HA-FF23	0.05
HA-MF33	0.07
HA-MF43	0.09
HA-MF63	0.12

[Dynamic Brake Permitted Load GD^2]

Applying the dynamic brake at load GD^2 exceeding the load shown in the following table can cause the brake resistor in the servo amplifier to burn out.

Amplifier Model Name	GD_L/GD_M
MR-J210B – MR-J2-350B	30

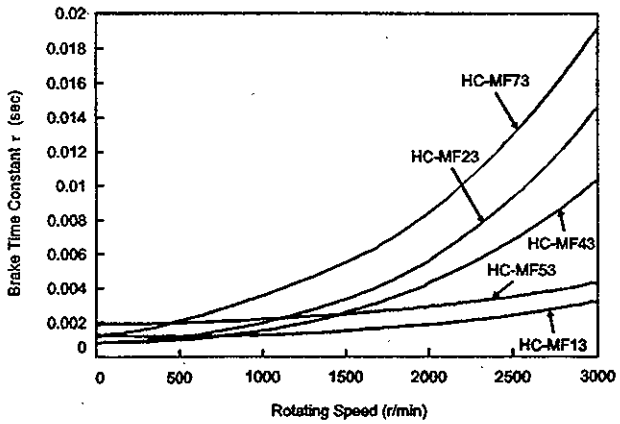


Fig. APP.6 Dynamic Brake Time Constant (HC-MF)

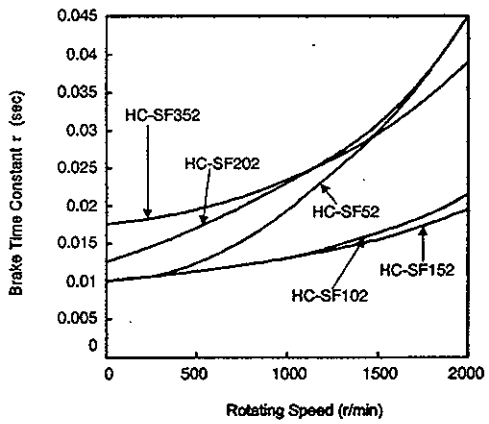


Fig. APP.7 Dynamic Brake Time Constant (HC-SF)

APPENDIX 4 ELECTROMAGNETIC BRAKE CHARACTERISTICS

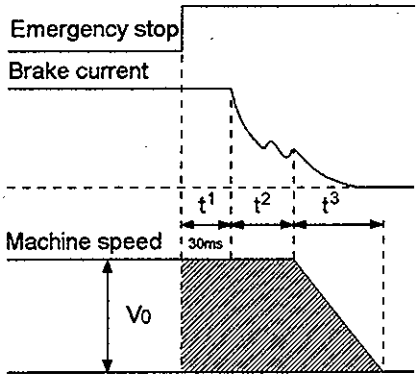
This appendix describes the characteristics of the electromagnetic brakes used for servomotors fitted with electromagnetic brakes. Use both dynamic braking and electromagnetic braking on servomotors if vertical falling of axes after an emergency stop, servo OFF, or a power cut is a problem.

(1) HA-MH/FH/SH/UH Series motor

Item		HA-MH Series Motor			HA-FH Series Motor			HA-SH Series Motor		HA-UH Series Motor			
		HA-MH053 HA-MH13	HA-MH23 HA-MH43	HA-MH73	HA-FH053 HA-FH13	HA-FH23 HA-FH33	HA-FH43 HA-FH63	HA-SH52 - 152 HA-SH53 - 153 HA-SH81	HA-SH202 - 702 HA-SH203 - 353 HA-SH121,201, 301	HA-UH32 HA-UH52	HA-UH102 HA-UH152	HA-UH222 HA-UH352	HA-UH452
Model name		Spring safety brake											
Rated voltage		24 VDC											
Rated current (A)	Cool (20°C)	0.27	0.38	0.51	0.22	0.31	0.46	0.63	1.04	0.56	0.63	0.73	0.80
	Hot (95°C)	0.21	0.29	0.39	0.17	0.24	0.36	0.49	0.80	0.43	0.49	0.56	0.62
Excitation coil resistance (Ω)	Cool (20°C)	90	63	47	111	78	52	38	23	43	38	33	30
	Hot (95°C)	117	82	61	144	101	67	49	30	56	49	43	39
Capacity (W)		6.4	9.1	12.3	7	7.4	11	15	25	14	15	17	19
Attraction current (A)		0.12	0.15	0.22	0.15	0.2	0.3	0.25	0.4	0.25	0.25	0.30	0.35
Fall current (A)		0.04	0.06	0.07	0.06	0.06	0.1	0.14	0.2	0.14	0.14	0.14	0.16
Static-friction torque	(N·m)	0.32	1.3	2.4	0.39	1.18	2.3	7.84	29.4	4.0	8.0	17.0	22.0
	(kgf·cm)	3.2	13	24	4	12	23.5	80	300	41	82	173	224
Moment of inertia	J ($kg \cdot cm^2$)	0.0031	0.04	0.2	0.02	0.13	0.34	0.68	4.25	0.33	0.68	1.0	1.0
	GD^2 ($kgf \cdot cm^2$)	0.012	0.16	0.8	0.07	0.53	1.4	2.7	17	1.36	2.8	4.1	4.1
Release delay time (s)		0.03	0.03	0.04	0.03	0.03	0.03	0.07	0.10	0.07	0.07	0.10	0.13
Braking delay time (s)	AC type	0.08	0.10	0.12	0.08	0.10	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	DC type	0.01	0.02	0.02	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Permitted braking work (kg·m) {kgf·m}	Per application	5.6 {0.6}	22 {2.2}	64 {6.5}	3.9 {0.4}	18 {1.8}	46 {4.7}	390 {40}	4400 {450}	190 {20}	390 {40}	390 {40}	390 {40}
	Per hour	56 {6}	220 {22}	640 {65}	39 {4.0}	189 {18}	460 {47}	3900 {400}	44000 {4500}	1900 {200}	3900 {400}	3900 {400}	3900 {400}
Brake play on motor shaft (deg·)		0·19-2·2	0.12-1.01	0.088-1.01	0.3 - 3.5	0.2 - 2.0	0.2 - 1.3	0.2 - 0.6		0.2 - 0.6			
Weight kg (lb)		0.2 (0.44)	0.4 (0.88)	0.6 (1.32)	0.3 (0.66)	0.6 (1.32)	0.8 (1.76)	2 (4.41)	6 (13.22)	0.8 (1.76)	1.2 (2.64)	2.1 (4.63)	2.3 (5.07)
Brake life		20,000 applications at 4 N·m per application	20,000 applications at 15 N·m per application	20,000 applications at 32 N·m per application	30,000 applications at 4 N·m per application	30,000 applications at 18 N·m per application	30,000 applications at 47 N·m per application	20,000 applications at 200 N·m per application	20,000 applications at 2,000 N·m per application	20,000 applications at 100 N·m per application	20,000 applications at 200 N·m per application		

Overrun Distance

Use the optional dynamic brake to rapidly stop a motor when an emergency stop occurs. The overrun distance is not significantly reduced by applying both the dynamic brake and electromagnetic brake. If the dynamic brake fails and does not operate, the axis stops according to the pattern shown in the figure below. The area under the curve (shaded) represents the overrun distance (Lmax) when the brake is applied, and this can be estimated using the following equation.



Overrun Distance at Emergency Stop

$$Lmax = \frac{V_0}{60} \times (t_1 + t_2 + \frac{t_3}{2}) \quad [mm]$$

Where:

L_{max}	:	Max. Overrun distance	[mm]
V_0	:	Machine rapid traverse speed	[mm/min]
t_1	:	Switch delay time	[s]
t_2	:	Brake delay time (Note)	[s]
t_3	:	Braking time	[s]

$$t_3 = \frac{(J_L + J_M) \times N_0}{9.55 \times 10^4 \ (T_L + 0.8T_B)}$$

J_L	:	Servomotor axis-converted load moment of inertia	[kg·cm^2]
J_M	:	Servomotor moment of inertia	[kg·cm^2]
N_0	:	Motor rotational speed during rapid traverse	[rpm]
T_L	:	Motor shaft-converted torque	[N·cm]
T_B	:	Brake static-friction torque (Note)	[N·cm]

Note : Values for t_2 and T_B from Table on APPENDIX 4 (1).
J_L is the sum of the machine and electromagnetic brake moments of inertia (see Appendix 4 (1)).

(2) HC-MF/HA-FF Series motor

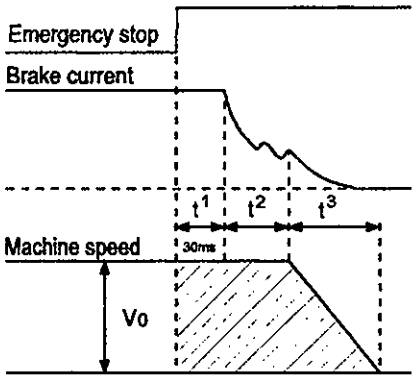
Item		HC-MF Series Motor			HA-FF Series Motor		
		HC-MF053 HC-MF13	HC-MF23 HC-MF43	HC-MF73	HA-FF053 HA-FF13	HA-FF23 HA-FF33	HA-FF43 HA-FF63
Model name		Spring safety brake					
Rated voltage		24 VDC					
Rated current at 20℃ (A)		0.26	0.33	0.42	0.22	0.31	0.46
Excitation coil resistance at 20℃ (Ω)		91	73	57	111	78	52
Capacity (W)		6.3	7.9	10	7	7.4	11
Attraction current (A)		0.18	0.16	0.2	0.15	0.2	0.3
Fall current (A)		0.06	0.07	0.12	0.06	0.06	0.1
Static-friction torque	(N·m)	0.32	1.3	2.4	0.39	1.18	2.3
	(kgf·cm)	3.2	13	2.4	4	12	23.5
Moment of inertia	J (kg·cm^2)	0.0031	0.04	0.2	0.02	0.13	0.34
	GD^2 (kgf·cm^2)	0.0124	0.16	0.8	0.07	0.53	1.4
Release delay time (s)		0.03	0.03	0.03	0.03	0.03	0.03
Braking delay time (s)	AC type	0.08	0.1	0.12	0.08	0.1	0.12
	DC type	0.01	0.02	0.03	0.01	0.03	0.03
Permitted braking work (kg·m) {kgf·m}	Per application	5.6 {0.6}	22 {2.2}	64 {6.5}	3.9 {0.4}	18 {1.8}	46 {4.7}
	Per hour	56 {6}	220 {22}	640 {65}	39 {4.0}	180 {18}	460 {47}
Brake play on motor shaft (deg.)		0.19- 2.5	0.12- 1.2	0.1- 0.9	0.3 - 3.5	0.2 - 2.0	0.2 - 1.3
Brake life		20,000 applications at 4 N·m per application	20,000 applications at 15 N·m per application	20,000 applications at 32 N·m per application	30,000 applications at 4 N·m per application	30,000 applications at 18 N·m per application	30,000 applications at 47 N·m per application

(3) HC-SF Series motor

Item			HC-SF Series Motor HC-SF52B to HC-SF152B
Model name			Spring safety brake
Rated voltage			24 VDC
Rated current at 20℃ (A)			0.8
Excitation coil resistance at 20℃ (Ω)			29
Capacity (W)			19
Attraction current (A)			0.2
Fall current (A)			0.08
Static-friction torque	(N·m)		8.3
	(kgf·cm)		85
	(oz·in)		1175
Moment of inertia	J (kg·cm^2)		2.0
	GD^2 (kgf·cm^2)		8.0
	WK^2 (oz·in^2)		10.9
Release delay time (s)			0.04
Braking delay time (s)	AC type		0.12
	DC type		0.03
Permitted braking work	Per application	(N·m)	400
		(kgf·cm)	4082
		(oz·in)	56648
	Per hour	(N·m)	4000
		(kgf·cm)	40816
		(oz·in)	566476
Brake play on motor shaft (deg.)			0.2 to 0.6
Brake life	Number of times		20000
	Per application	(N·m)	200
		(kgf·cm)	2041
		(oz·in)	28324

Overrun Distance

Use the optional dynamic brake to rapidly stop a motor when an emergency stop occurs. The overrun distance is not significantly reduced by applying both the dynamic brake and electromagnetic brake. If the dynamic brake fails and does not operate, the axis stops according to the pattern shown in the figure below. The area under the curve (shaded) represents the overrun distance (Lmax) when the brake is applied, and this can be estimated using the following equation.



Overrun Distance at Emergency Stop

$$Lmax = \frac{V_0}{60} \times (t_1 + t_2 + \frac{t_3}{2})$$

Where:

L_{max}	:	Overrun distance	[mm]
V_0	:	Machine rapid traverse speed	[mm/min]
t_1	:	Switch delay time	[s]
t_2	:	Brake delay time (Note)	[s]
t_3	:	Braking time	[s]

$$t_3 = \frac{(J_L + J_M) \times N_0}{9.55 \times 10^4 \ (T_L + 0.8T_B)}$$

J_L	:	Servomotor axis-converted load moment of inertia	[kg·cm^2]
J_M	:	Servomotor moment of inertia	[kg·cm^2]
N_o	:	Motor rotational speed during rapid traverse	[rpm]
T_L	:	Motor shaft-converted torque	[N·m]
T_B	:	Brake static-friction torque (Note)	[N·m]

Note: Values for t_2 and T_B from table of characteristics in APPENDIX 4 (2).
J_L is the sum of the machine and electromagnetic brake moments of inertia (from APPENDIX 4 (2)).

APPENDIX 5 Connecting Cables

This appendix shows the connections of the motion network cables and encoder cables.

5.1 Motion Net Cables

(1) MR-HBUS□M

(a) Cable

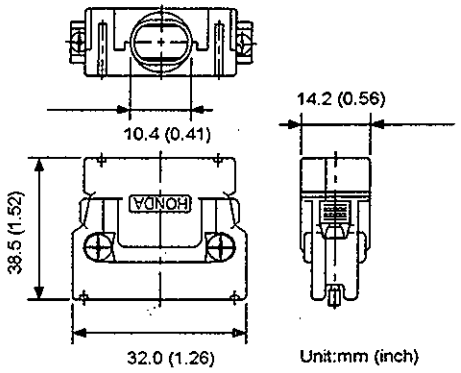
Use the following twisted pair cables, or equivalent, for the motion net cables.

Model Name	Size mm (in.)	External Diameter mm (in.)	Wire Characteristics		Color
			Construction (wires/mm)	Resistance (Ω/km)	
A14B2343	6 pairs×0.2 (0.0079)	7.9 (0.311)	40/0.08	105 max.	Black

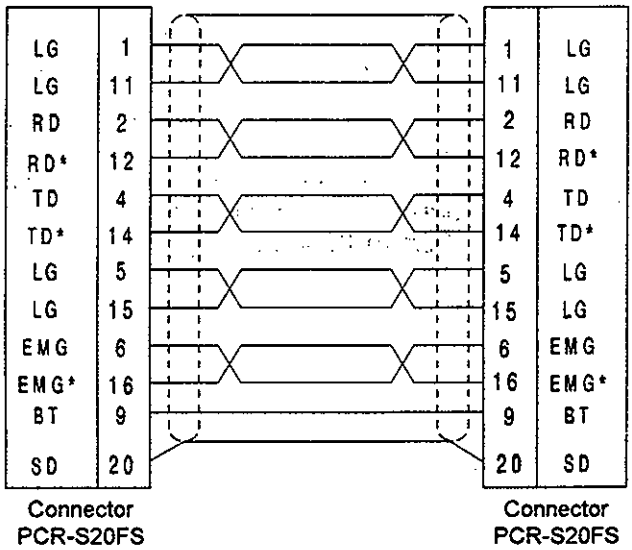
Manufactured by Junkosha. Purchase through Toa Denki Kogyo.

(b) Connectors

Use PCR-S20FS (with PCR-LS20LA1 casing) connectors manufactured by Honda Tsushin Kogyo.



(c) Connections



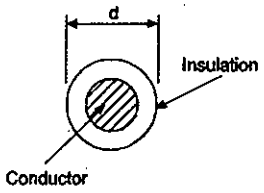
(2) MR-J2HBUS□M-A/MR-J2HBUS□M

(a) Cable

Use the following twisted pair cables, or equivalent, for the motion net cables.

Core Size (mm^2) × pair	External Diameter of Insulation d (mm) (Note)	Recommended Power Cable	Color
0.2 × 7	0.9 – 1.27	UL20276 AWG28 10pair	Black

Note: see diagram below for dimension d.



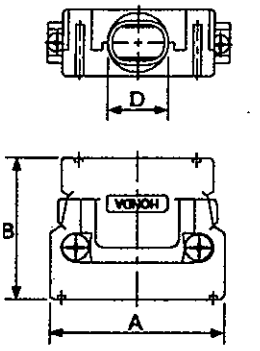
Cross-section through Core

(b) Connectors

Use the following connectors.

1) MR-J2HBUS□M-A

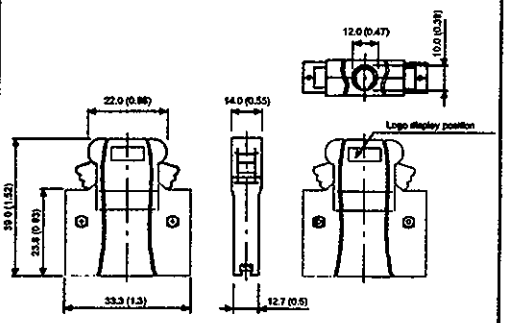
Connector at motion controller end (manufactured by Honda Tsushin Kogyo)



No. of pins	Casing	A	B	C	D	Connector
20	PCR-LS20LA1	32.00 (1.26)	38.50 (1.52)	14.2 (0.56)	10.4 (0.41)	PCR-S20FS

Unit : mm (inch)

Connector at amplifier end (manufactured by Sumitomo 3M) CN3A

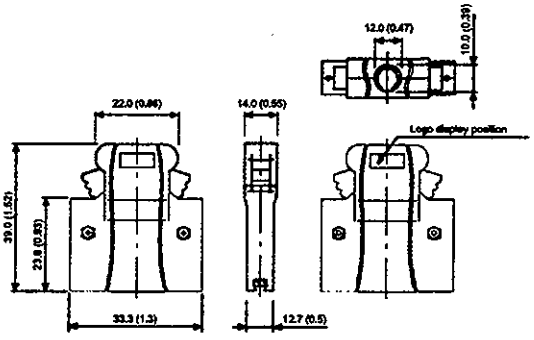


Casing	Connector
10320-3210-000	10120-6000EL

Unit : mm (inch)

2) MR-J2HBUS□M

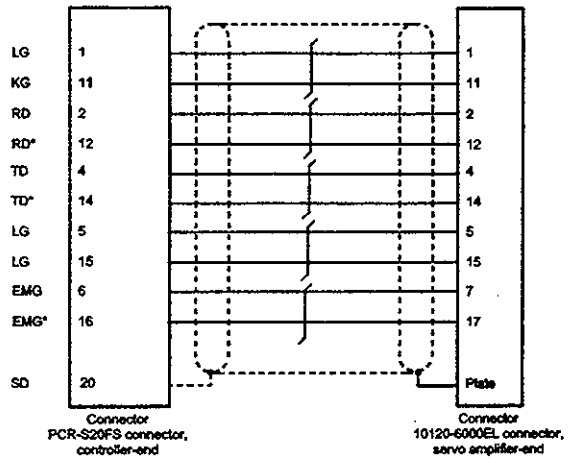
Use connector 10120-6000EL manufactured by Sumitomo 3M, with casing 10320-3210-000.



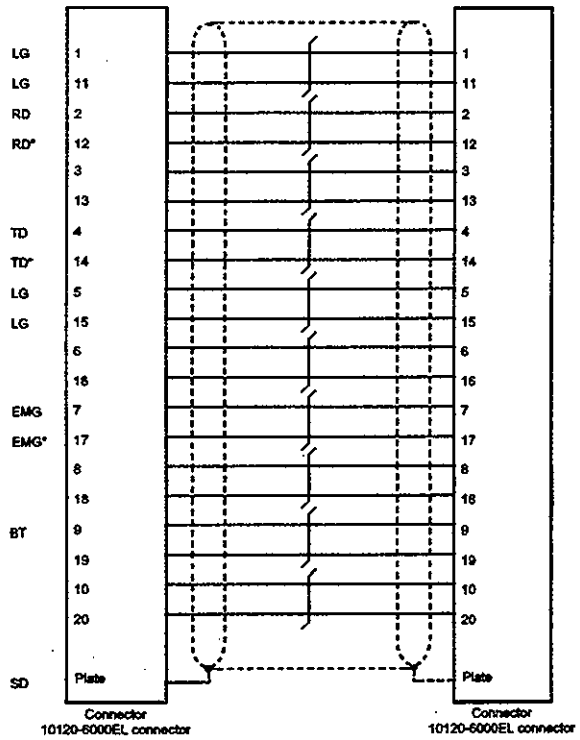
Unit : mm (inch)

(c) Connections

1) MR-J2HBUS□M-A



2) MR-J2HBUS□M



5.2 Encoder Cables

(1) MR-HCBL□M/MR-HSCBL□M

(a) Cable

Use the following twisted pair cables, or equivalent, for the encoder cables.

1) 4-pair shielded cable for detectors (use with MR-HCBL5M, MR-HSCBL5M)

Model Name	Size mm (in.)	External Diameter mm (in.)	Wire Characteristics		Color
			Construction (wires/mm)	Resistance (Ω/km)	
A14B2339	4 pairs×0.2 (0.0079)	7.2 (0.283)	40/0.08	105 max.	Black

2) 6-pair shielded cable (use with MR-HCBL10M to MR-HCBL30M MR-HSCBL10M to MR-HSCBL30M MR-HBUS□M to MR-HBUS□M)

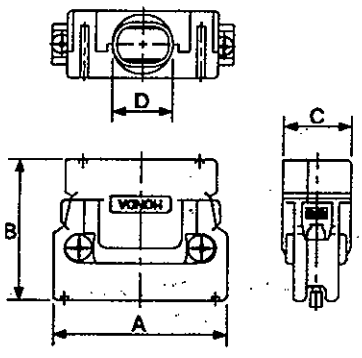
Model Name	Size mm (in.)	External Diameter mm (in.)	Wire Characteristics		Color
			Construction (wires/mm)	Resistance (Ω/km)	
A14B2343	6 pairs×0.2 (0.0079)	7.9 (0.311)	40/0.08	105 max.	Black

Manufactured by Junkosha. Purchase through Toa Denki Kogyo.

(b) Connectors

Use the following connectors.

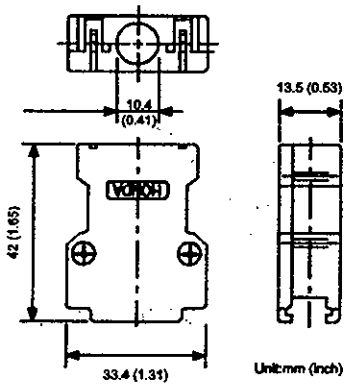
Amplifier-end Connector CN2, CN1A, CN1B Manufactured by Honda Tsushin Kogyo



No. of pins	Casing	A	B	C	D	Connector
20	PCR-LS20LA1	32.00 (1.26)	38.50 (1.52)	14.2 (0.56)	10.4 (0.41)	PCR-S20FS

Unit : mm (inch)

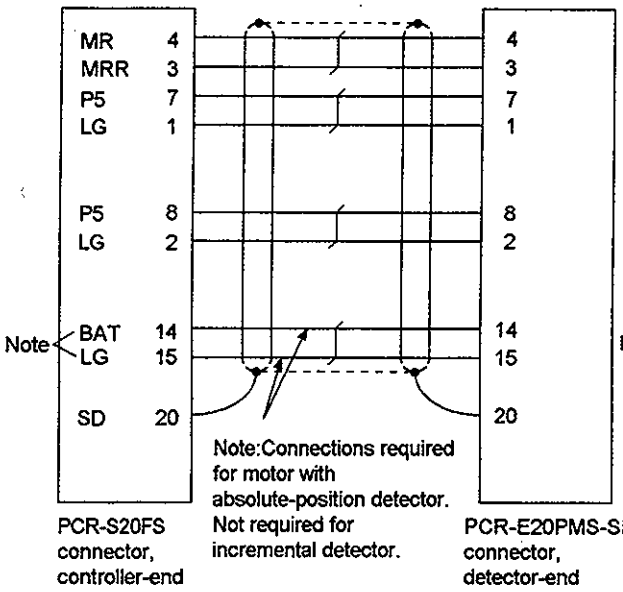
Detector-end Connector Manufactured by Honda Tsushin Kogyo for HA-FH.



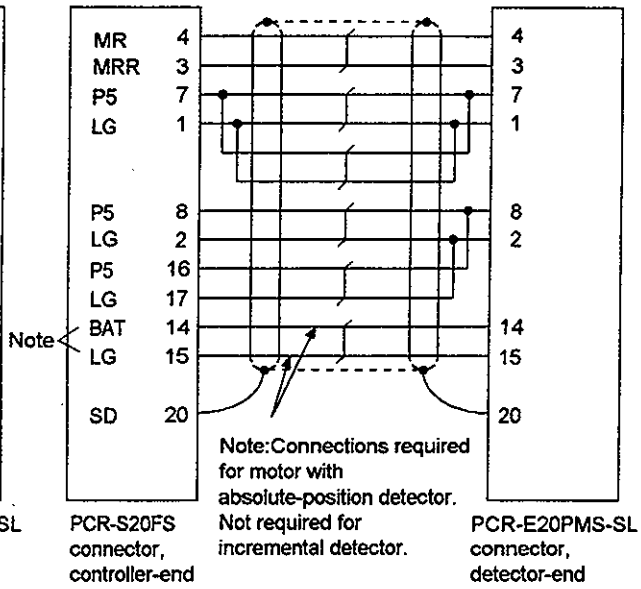
No. of pins	Casing	Connector
20	PCR-S20PMLA2	PCR-E20PMRS-SL

(c) Connections

1) MR-HCBL□M (for HA-FH Series motors)

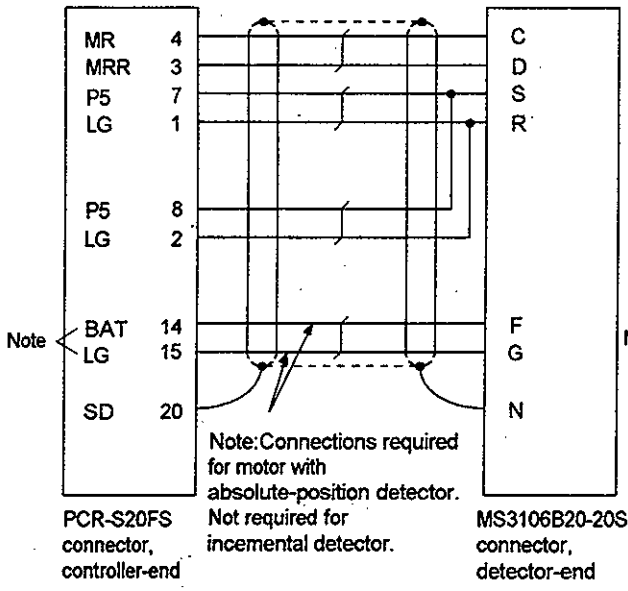


MR-HCBL5M (10 m (32.8 ft) max.)

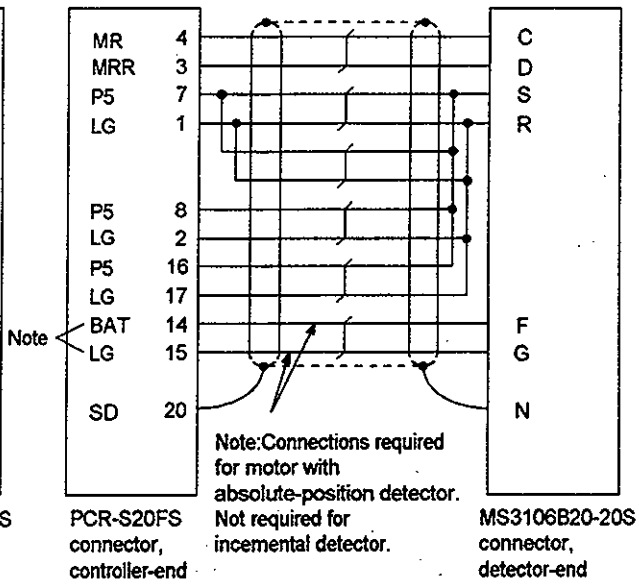


MR-HCBL10M to MR-HCBL30M
(connections10 m (32.8 ft) to 50 m (164.01 ft))

2) MR-HCSBL□M (for HA-SH/LH/UH series motors)



MR-HSCBL5M (10 m (32.8 ft) max.)



MR-HSCBL10M to MR-HSCBL30M
(connections 10 m (32.8 ft) to 50 m (164.01 ft))

(2) MR-JCCBL□M/MR-JHSCBL□M

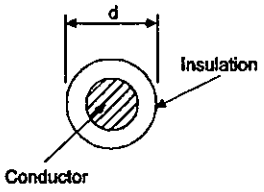
(a) Cable

Use the following twisted pair cables, or equivalent, for the encoder cables.

1) Standard cables (use with MR-JCCBL□M-L)

Core Size (mm^2) × pair	External Diameter of Insulation d (mm) (Note)	Recommended Power Cable	Color
0.2 × 7	0.9 – 1.27	UL20276 AWG28 7pair	Black
0.3 × 7		UL20276 AWG24 7pair	

Note: see diagram below for dimension d.



Cross-section through Core

2) High Bending-life cables
(use with MR-JCCBL□M-H, MR-JHSCBL□M-H)

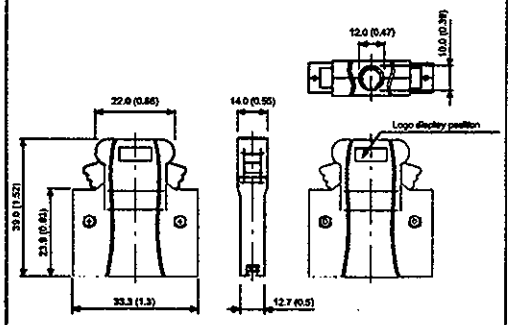
Core Size (mm^2) × pair	Core characteristics (per core)		Recommended Power Cable	Color
	Structure (wires/mm)	Resistance (Ω/km)		
0.2 × 6	40/0.08	105 or less	A14B2343	Black

Manufactured by Junkosha. Purchase through Toa Denki Kogyo.

(b) Connectors

Use the following connectors.

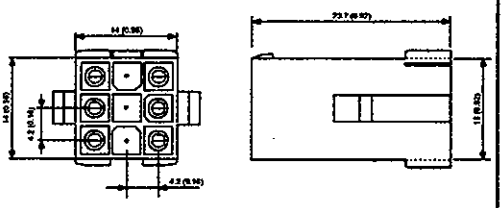
Connector at amplifier end (manufactured by Sumitomo 3M) CN3A



Unit : mm (inch)

Casing	Connector
10320-52F0-008	10120-3000VE

Relay connector at detector end (manufactured by AMP (Japan)-ltd.) for HC-MF/HA-FF



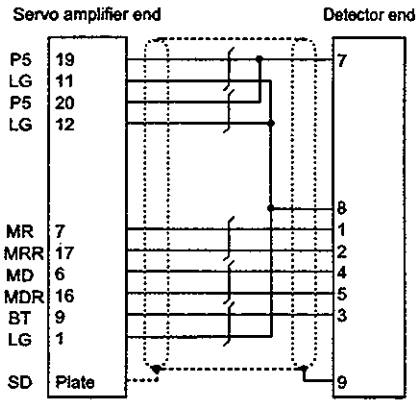
Unit : mm (inch)

House	Connector Pin	Crimping Tool
1-72161-9	170359-1	755330-1

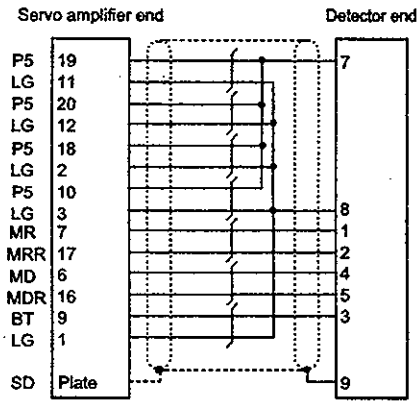
(c) Connections

1) MR-JCCBL□M (for HC-MF/HA-FF Series motors)

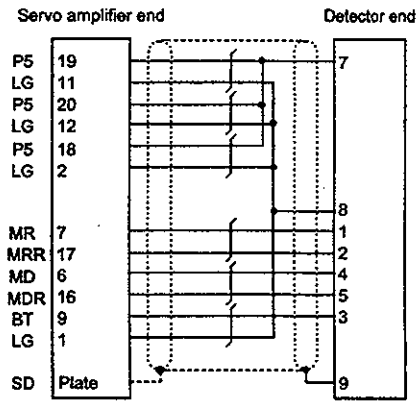
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L
MR-JCCBL10M-H
MR-JCCBL20M-H
MR-JCCBL30M-H

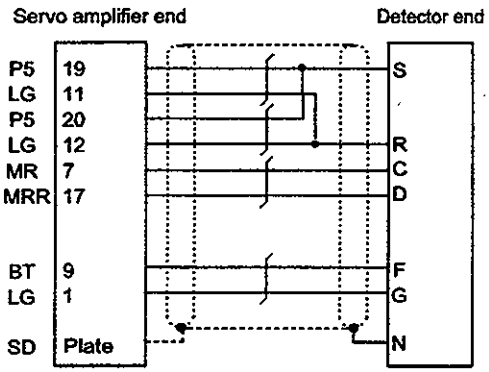


MR-JCCBL20M-L
MR-JCCBL30M-L



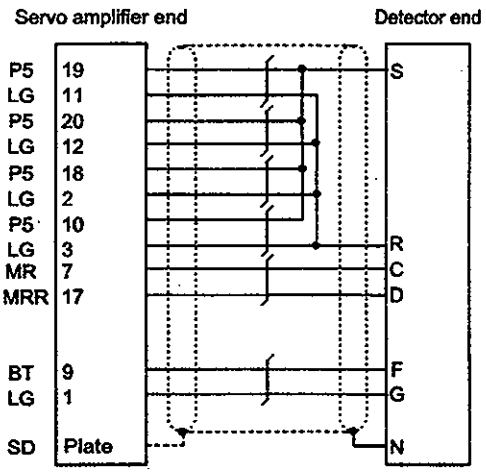
2) MR-JHSCBL□M (for HC-SF Series motors)

MR-JHSCBL2M-H
MR-JHSCBL5M-H



(10 m (32.8 ft) Max.)

MR-JHSCBL10M-H
MR-JHSCBL20M-H
MR-JHSCBL30M-H



(10 m (32.8 ft) to 50 m (164.01 ft))

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-8310 TELEX : J24532 CABLE MELCO TOKYO
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