MITSUBISHI

MOTION CONTROLLER

User's Manual

type A171SCPU

MITSUBISHI ELECTRIC

REVISIONS

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

Print Date	*Manual Number	Revision
Mar., 1996	IB (NA) 67276-A	First edition
Feb., 1997	IB (NA) 67276-F	Additions • Servo amplifiers (MR-J2-200B, MR-J2-350B) • HC-SF series motors • MR-J2-B added to servo amplifiers • A178B-S1 added to main base units • Section 2.1.2 (method for connecting separate servo amplifier units) • Appendix 2 (combinations of servo amplifiers and servo motors) • Appendix 3 (dynamic brake characteristics) • Appendix 4 (electromagnetic brake characteristics) • Appendix 5 (connecting cables) Partial addition • For Safe Operations (4. Various precautions (7)) Partial revisions • 2.2.3, 7.2.3, 13 (2) (6), Appendix 4.1, Appendix 6, Appendix 7 Deletions • Appendix 1 (table of special relays and special registers) • Appendix 2 (specifications of servo amplifiers and servo motors)

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 the instruction manual 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 the instruction manual. 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.

⚠ CAUTION
⚠ Use wires and cables within the length of the range described in the instruction manual. ⚠ 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 the instruction manual 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 install or 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 the instruction manual. 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	**Servomotor**
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	1000m 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.

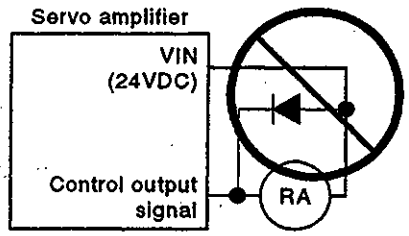
⚠ After wiring, install the protective covers such as the terminal covers to the original positions.

⚠ 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.

⚠ When using the absolute position system function, on starting up, and when the controller or absolute value motor has been replaced, always perform a home position return.

(6) Usage methods

⚠ CAUTION

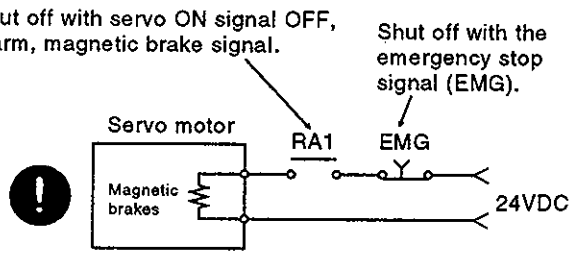
- ⚠ Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the control unit, servo amplifier or servomotor.
- ⚠ Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- ⚠ The 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 the separate instruction manual.
Input frequency	According to the separate instruction manual.
Tolerable momentary power failure	According to the separate instruction manual.

(7) Remedies for errors

⚠ CAUTION

- ⚠ If an error occurs in the self diagnosis of the control unit or servo amplifier, confirm the check details according to 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 restarts suddenly.)



(8) Maintenance, inspection and part replacement

⚠ CAUTION

- ⚠ Perform the daily and periodic inspections according to the instruction manual.
- ⚠ 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.

⚠ CAUTION

⚠ 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.

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

⚠ When the controller or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.

1) After writing the servo data to the PC using peripheral device software, switch on the power again, then perform a home position return operation.
2) Using the backup function of the peripheral device software, 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 the instruction 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. INTRODUCTION

A Motion Controller is a positioning control system which integrates the controller functions of sequence control and servo control.
A motion controller can control a maximum of four axes using an A171SCPU.
Configuration with the MELSECNET (II) data-link system allows networking, for increased line automation and higher speed and flexibility of production systems.
Install one of the following operating systems (OS) before using the A171SCPU.
See section 11.4 for details about the installation procedure.

Positioning OS

- SW[ ]SRX-SV[ ][ ][ ]

This manual describes the system configuration, equipment in the configuration, module specifications, and handling of hardware for the A171SCPU and the positioning-related units/modules in the motion controller system.

Related manuals

Refer to the manuals listed in the table below for information on items not covered in this manual.

Manual Title	Manual No.	Description
Motion Controller (SV[ ][ ]) Programming Manual	——	• Describes the signals, parameters, and programs for positioning control and the positioning movements.
SW[ ]SRX-GSV[ ][ ]PE Operating Manual	——	• Describes positioning program creation, monitoring, testing, and operation using peripheral devices.
MITSUBISHI Motion Controller AC Servo MELSERVO-H-B Specifications and Instruction Manual	IB 67217	• Describes servo amplifier handling and error displays.
MITSUBISHI Motion Controller AC Servo MELSERVO-J-B Specifications and Instruction Manual	IB 67218	
ACPU Programming Manual (Fundamentals)	IB 66249	• Describes the PC functions and performance.

POINTS

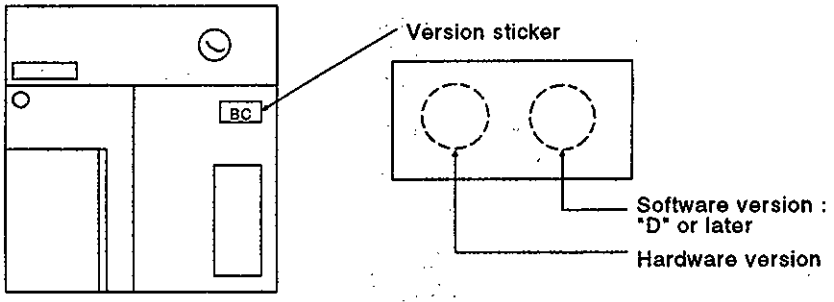
(1) Data setting for separate servo amplifiers is possible by directly connecting the peripheral devices indicated below, but the setting contents are those set at the A171SCPU when the power to the A171SCPU is turned on.

Separate Servo Amplifier	Used Peripheral Device
MR-H-B	Parameter unit
ME-J-B	———
MR-J2-B	Personal computer

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

(2) To use the functions indicated below, use the A171SCPU and the positioning OS and positioning software also indicated below.
- High-speed reading function
- Cancel/start of executed servo program
- 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
- Control with MR-J2-B servo amplifier

When using SV13 or SV22, use an A171SCPU that has "D" or later as the software version indication on the front of the module. (Use with "C" and earlier versions is not possible.)



[Positioning OS]

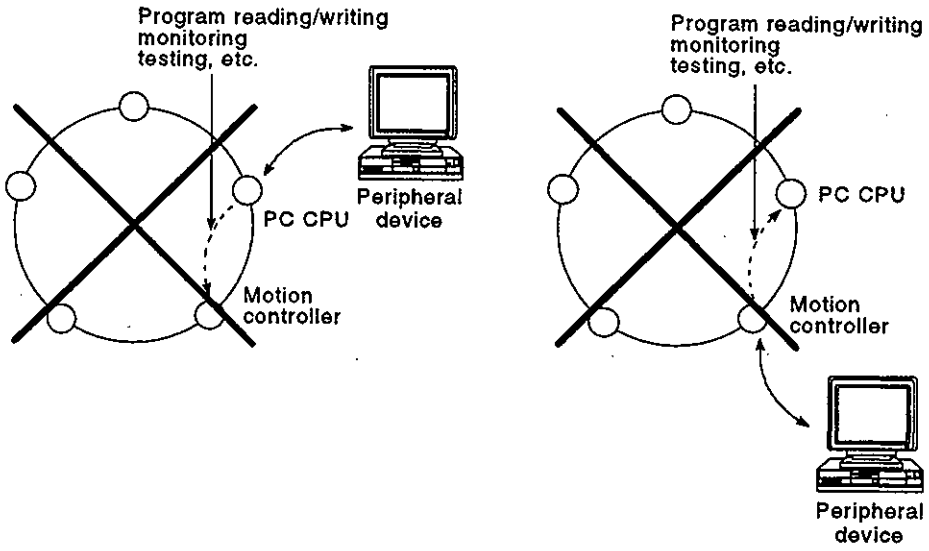
Model Name	OS Ver.
SW0SRX-SV13M SW0SRX-SV22L	U or later

[Positioning software package]

Model Name	OS Ver.
SW2SRX-GSV13PE SW2SRX-GSV22PE	P or later

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.



REMARK

Refer to the manuals for each unit and module for information on the peripheral devices for creating sequence programs, programming manuals, and special-function modules.
Refer to the programming manual for the OS used for information on creating motion programs, and refer to the relevant operating manual for information on using the peripheral software packages.

The following abbreviations are used in this manual.

Description	Abbreviation
A171SCPU Module	A171SCPU
MR-H-B, MR-J-B, MR-J2-B servo amplifiers	MR-H-B, MR-J-B, MR-J2-B
A171SENC manual pulse generator/synchronous encoder interface unit/module	A171SENC

The A171SCPU contains a positioning-control CPU (PCPU) and sequence-control CPU (SCPU), for the following functions:

- PCPU.... positioning control with a servo program or motion program, home position return, monitoring servo amplifier control status
- SCPU.... sequence control (equivalent to A1SCPU), running servo programs or motion programs, enabling and disabling manual pulse generator operation, jog operation

The following peripheral devices and positioning software packages are used to set positioning data and program the A171SCPU.

(1) Peripheral devices

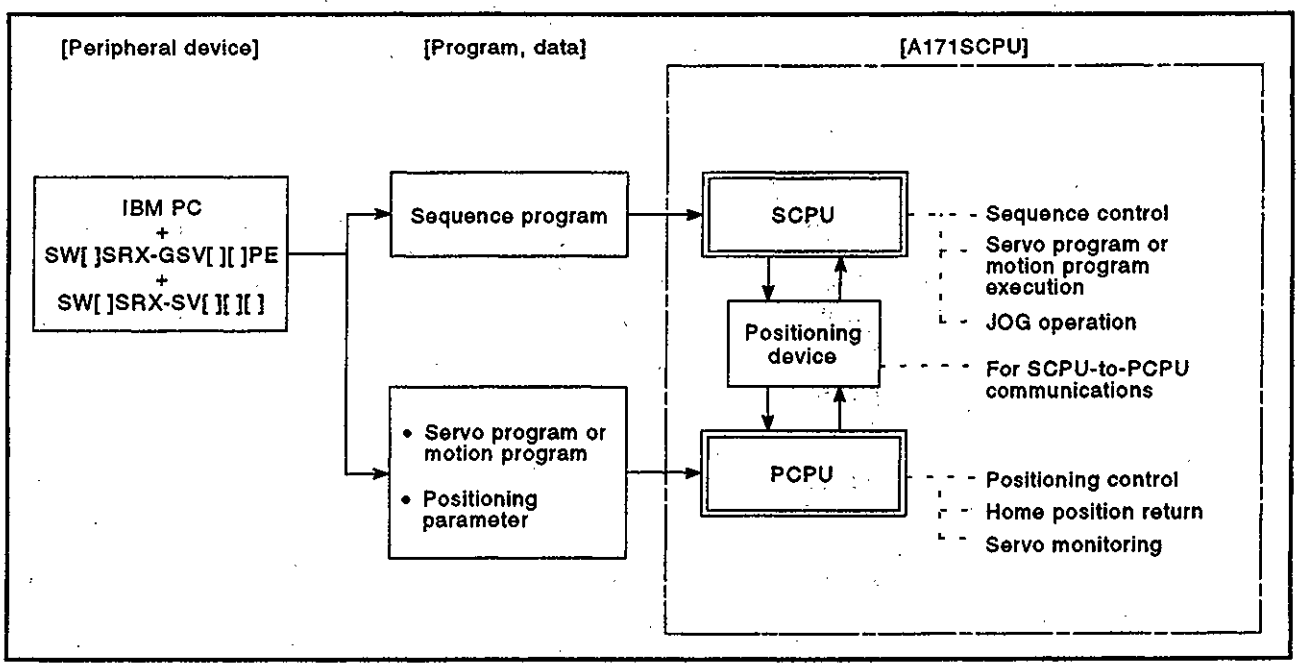
- IBM PC/AT computer running PC-DOS V5.0, or higher ("IBM PC")

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

(2) Positioning software packages

- SW[ ]SRX-GSV[ ][ ]PE

The diagram below shows the outlines of programing, data creation, and A171SCPU processing using a peripheral device and positioning software package.

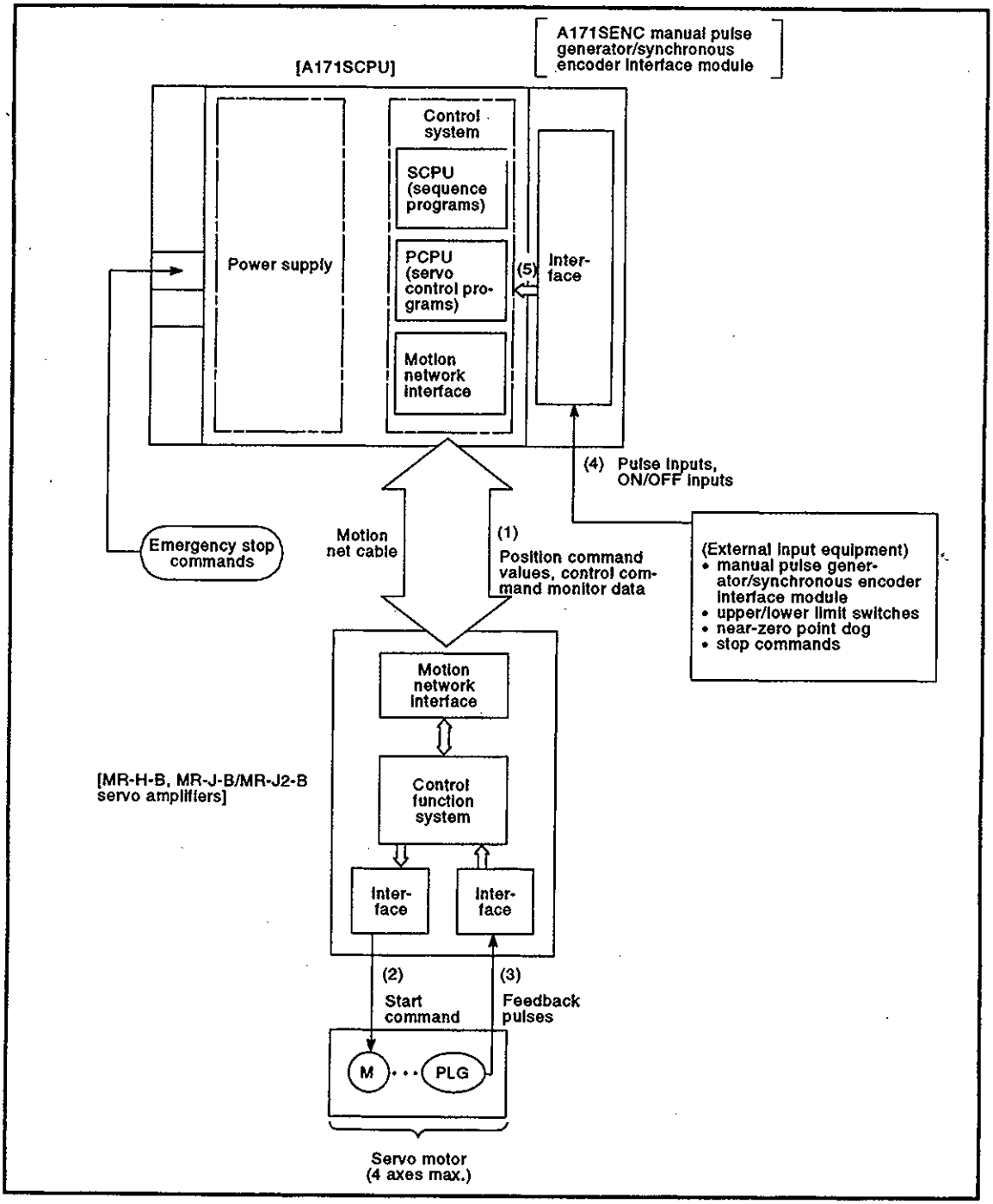


- Sequence programs written to the SCPU, servo programs or motion programs written to the PCPU, and positioning parameters are created by running the appropriate positioning software package on the peripheral device.
- A peripheral device running the appropriate positioning software package can be used to monitor the A171SCPU operating status, execute a servo program or motion program, or to test JOG operation.

1. INTRODUCTION

1.1 Positioning Control Outline

This section describes the operation outlines and reading of the external inputs before the servomotors are started.



(1) Operation outline

(a) Starting servomotors

(1), (2), and (3) above start 4 servomotors maximum using A171SCPU and servo amplifier

(b) Control from external input equipment using manual pulse generator/synchronous encoder interface module

(4) and (5) above read external inputs and control the A171SCPU.

(c) Servomotor emergency stop

To apply an emergency stop to all servomotor axes, wire the emergency stop commands to the emergency stop terminals at the left of the base unit.

1.2 Features

(1) Simultaneous or independent control of a maximum of four axes.
Up to four axes can be controlled simultaneously or independently with servo amplifiers.

(2) Compact shape
Compact size, with external dimensions of CPU and 2 option modules mounted in the main base unit (A172B): 220 mm (8.66 in) x 130 mm (5.12 in) x 110 mm (4.33 in).

(3) Internal functions equivalent to MITSUBISHI A1SCPU

(a) Common sequence commands
MELSEC-A series sequence programs (commands) can be used.

(b) A1SCPU I/O modules and special-function modules can be used.
A1S I/O modules and special-function modules can be used mounted in a main base unit or extension base unit.

(4) Use IBM PC as positioning peripheral device.
Servo control programming, monitoring, and testing are possible using a dedicated software package with an IBM PC.

(5) Switchable operating systems
The OS can be directly written to internal flash memory by an IBM PC, allowing control with an OS matched to the system.

1.3 Performance Comparison between A171SCPU (SCPU) and A1SCPU

The table below shows the differences between the SCPU in the A171SCPU and A1SCPU.

<table>
<tr><th colspan="3">Item</th><th colspan="2">A171SCPU (SCPU)</th><th>A1SCPU</th></tr>
<tr><td colspan="3">Main base unit</td><td colspan="2">A172B, A178B, A178B-S1</td><td>A1S32B, A1S33B, A1S35B, A1S38B</td></tr>
<tr><td colspan="3">Extension base unit</td><td colspan="2">A1S65B, A1S68B</td><td>A1S65B, A1S68B, A1S52B, A1S55B, A1S58B</td></tr>
<tr><td colspan="3" rowspan="2">Power supply unit</td><td>Main base unit</td><td>built-in A171SCPU</td><td rowspan="2">A1S61P, A1S62P, A1S63P</td></tr>
<tr><td>Extension base unit</td><td>A1S61P, A1S62P</td></tr>
<tr><td colspan="2" rowspan="3">Instruction types</td><td>sequence instructions</td><td colspan="2">22</td><td>22</td></tr>
<tr><td>basic/application instructions</td><td colspan="2">131</td><td>131</td></tr>
<tr><td>dedicated instructions</td><td colspan="2">104</td><td>104</td></tr>
<tr><td colspan="3">Number of I/O points</td><td colspan="2">Total 256 points for sequence control and positioning control</td><td>256 points for sequence control</td></tr>
<tr><td rowspan="4">Devices</td><td colspan="2">Internal relay/latch relays</td><td colspan="2">Total 2048 points for sequence control and positioning control</td><td>2048 points for sequence control</td></tr>
<tr><td colspan="2">Data registers</td><td colspan="2">Total 1024 points for sequence control and positioning control</td><td>1024 points for sequence control</td></tr>
<tr><td>Special relays</td><td>for positioning control</td><td colspan="2">M9073 to M9079</td><td>——</td></tr>
<tr><td>Special registers</td><td>for positioning control</td><td colspan="2">D9180 to D9199</td><td>——</td></tr>
<tr><td colspan="3">Data register latching range (from parameter latch range setting)</td><td colspan="2">D0 to D599
(Only sequence control data registers are latched. Positioning control registers not latched if set in latching range.)</td><td>D0 to D1023</td></tr>
</table>

* All other specifications identical to A1SCPU.

POINT

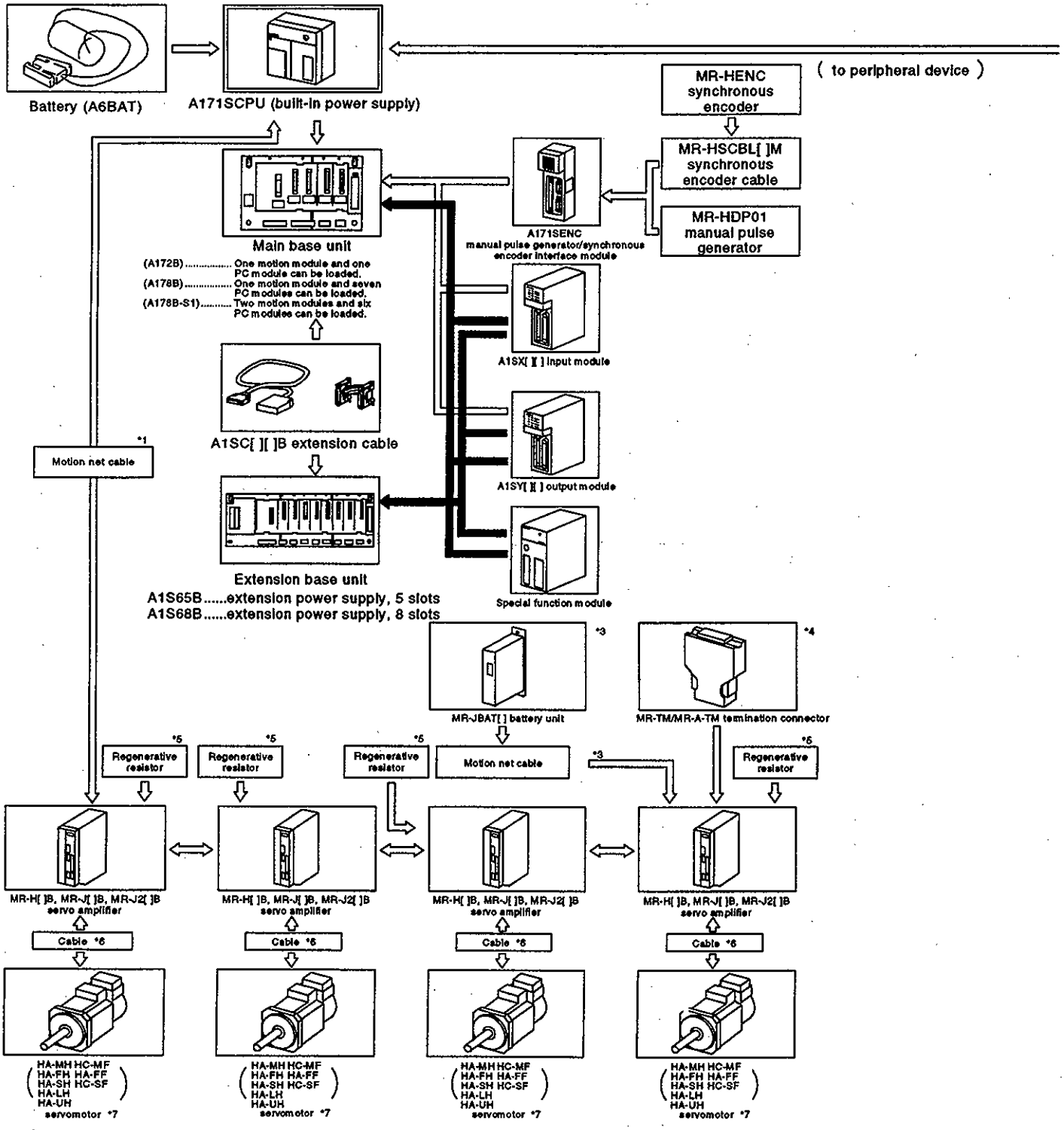
(1) Positioning control internal relays operate as M devices (internal relays) in a sequence program.
Although the set M, L, and S device symbols set in the parameters are displayed on the peripheral device, devices set as L (latch relay) are not held in the event of a power interruption.

2. SYSTEM CONFIGURATION

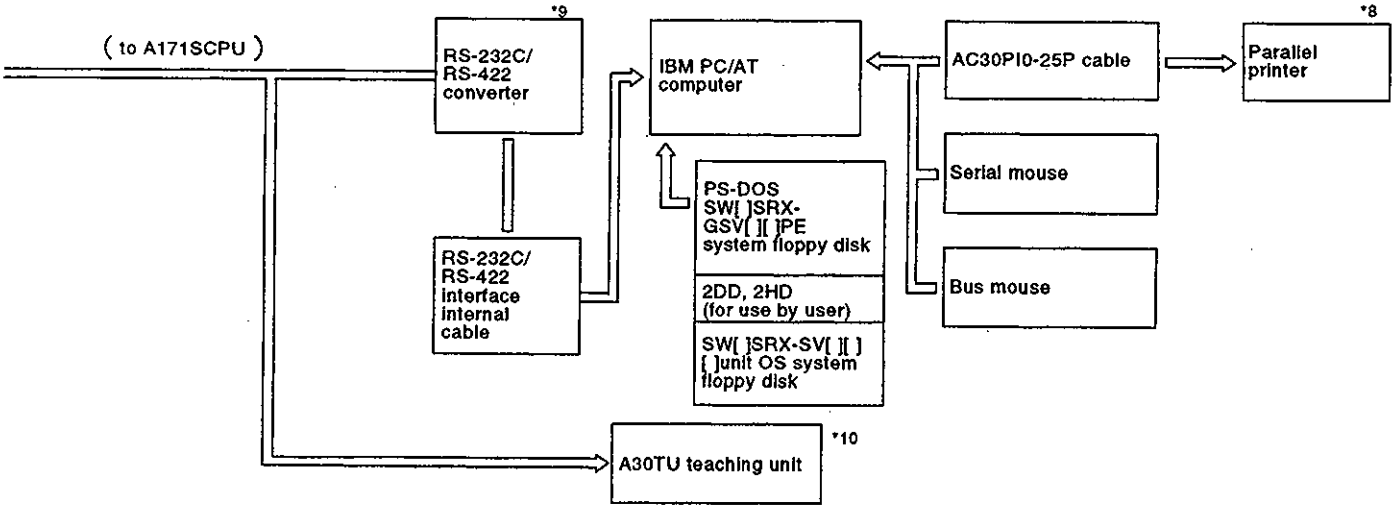
This section describes the system configuration, the cautions on the system configuration, and the equipment.

2.1 Overall Configuration

The configuration of devices in an A171SCPU stand alone system, and the configuration of peripheral devices, are shown below.



2. SYSTEM CONFIGURATION



POINTS

(1) Cable for connection between A171SCPU and servo amplifier (*1)
Use one of the following cables depending on the type of servo amplifier.

MR-H-B/MR-J-B connecting cable	MR-HBUS[ ]M
MR-J2-B connecting cable	MR-J2HBUS[ ]M-A

(2) Motion net cable for connection between servo amplifiers (*2)
Use one of the following cables depending on the type of servo amplifier.

Cable for connection between MR-H-B/MR-J-B and MR-H-B/MR-J-B	MR-HBUS[ ]M
Cable for connection between MR-H-B/MR-J-B and MR-J2-B	MR-J2HBUS[ ]M-A
Cable for connection between MR-J2-Bs	MR-J2HBUS[ ]M

(3) Connection of the battery unit (*3)
- When using MR-J-B and performing absolute position detection control, connect a battery unit to the last servo amplifier. Make the connection to the last servo amplifier with the appropriate motion net cable among the following.

Cable for connecting MR-H-B/MR-J-B	MR-HBUS[ ]M
Cable for connecting MR-J2-B	MR-J2HBUS[ ]M-A

- When a battery unit is connected, there is no need to connect a termination connector.

(4) Connection of termination connector (*4)
Connect a termination connector to the last servo amplifier.
Use the appropriate termination connector, depending on the model of the last servo amplifier:

Termination connector for MR-H-B/MR-J-B	MR-TM
Termination connector for MR-J2-B	MR-A-TM

(5) Connecting the regenerative resistor (*5)
- Connect an external regenerative resistor when using MR-J40B to MR-J200B (Cables supplied by the user.)
- When using an external regenerative resistor with MR-J40B or a higher model, disconnect the servo amplifier internal resistor.

(6) Cable for connection between the servo motor and servo amplifier (*6)
- The following encoder cables are available as accessories.

Encoder cable for HA-MH/FH series motor	MR-HCBL[ ]M
Encoder cable for HA-SH/LH/UH series motor	MR-HSCBL[ ]M
Encoder cable for HC-MF/HA-FF series motor	MR-JCCBL[ ]M-H
	MR-JCCBL[ ]M-L
Encoder cable for HC-SF series motor	MR-JHSCBL[ ]M-H
	MR-JHSCBL[ ]M-L

- If you prepare the cable yourself, use the following encoder connector sets.

Encoder connector set for HA-MH/FH series motor	MR-HCNS
Encoder connector set for HA-SH/LH/UH series motor	MR-JSCNS
Encoder connector set for HC-MF/HA-FF series motor	MR-J2CNM
Encoder connector set for HC-SF series motor	MR-J2CNS

POINTS

(7) Servo motor (*7)
It is possible to use both incremental method and absolute data method servo motors in combination.

(8) Parallel printer (*8)
Refer to the operating manual of the peripheral software package for information on the types of printer which can be used.

(9) Connection using an IBM PC (*9)
Connect the IBM PC to the A171SCPU using the DAFX-CAB interface internal cable.

(10) Teaching unit (*10)
Whether or not the teaching unit can be used depends on the operating system registered in the A171SCPU.
Refer to the programming manual for the OS used.

⚠ 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.

2.1.1 Cautions on system configuration

This section describes the hardware and software packages which can be used with the A171SCPU.

(1) Hardware

(a) I/O modules
Only dedicated A1S I/O modules can be used (see Section 2.3).

(b) Special function modules

1) Only dedicated A1S special function modules can be used (see Section 2.3).

2) A maximum of two of the following special function module models can be mounted with a single A171SCPU:

• A1SJ71C24(R2/R4/PRF)

(2) Software packages
Set one of the following model names when starting up the peripheral software package.

• A1S, A171S

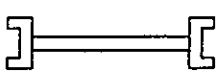
POINT

(1) It is possible to key in more than 256 I/O points (X/Y, FF) when setting the A171SCPU model name, but this should be avoided as the A171SCPU cannot use more than 256 points.

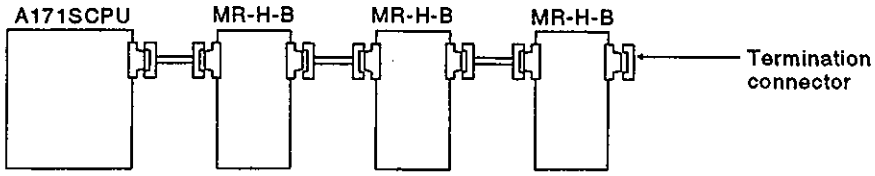
2.1.2 Method for connecting separate servo amplifier units

The method for connecting separate servo amplifier units is described here. Since the motion net cable and termination connector that can be connected differ depending on the model of separate servo amplifier unit, refer to the connection examples given below.

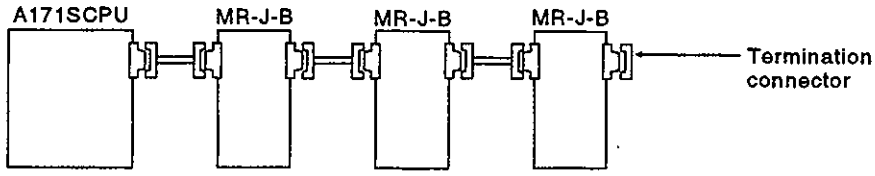
The various models of motion net cables and termination connectors are depicted in the connection examples as indicated in the table below.

Name	Model Name	Depiction in Connection Example	Details
Motion net cable	MR-HBUS[ ]M		For connecting A171SCPU and MR-H-B/MR-J-B, and MR-H-B/MR-J-B and MR-H-B/MR-J-B.
	MR-J2HBUS[ ]M		For connecting MR-J2-B and MR-J2-B.
	MR-J2HBUS[ ]M-A		For connecting A171SCPU and MR-J2-B, and MR-H-B/MR-J-B and MR-J2-B.
Termination connector	MR-TM		For MR-H-B/MR-J-B.
	MR-A-TM		For MR-J2-B.

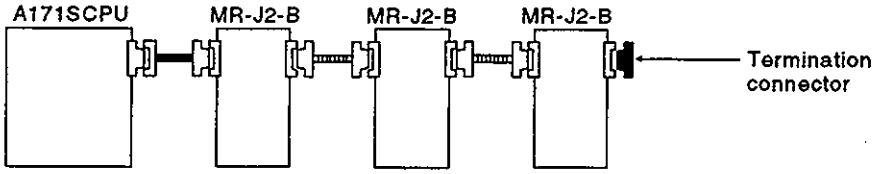
(1) MR-H-B configuration



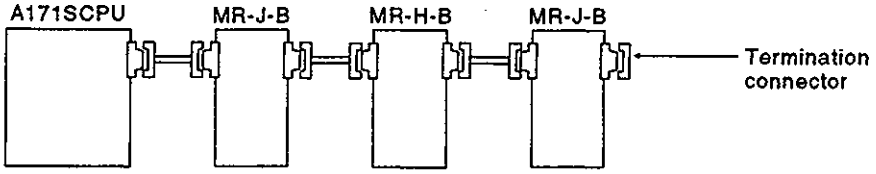
(2) MR-J-B configuration



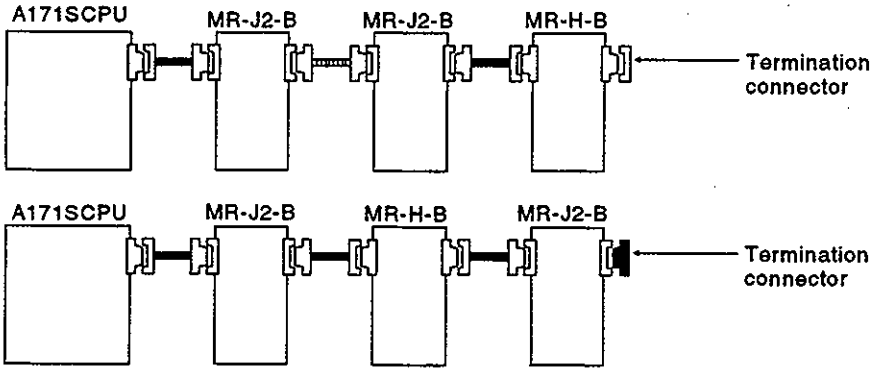
(3) MR-J2-B configuration



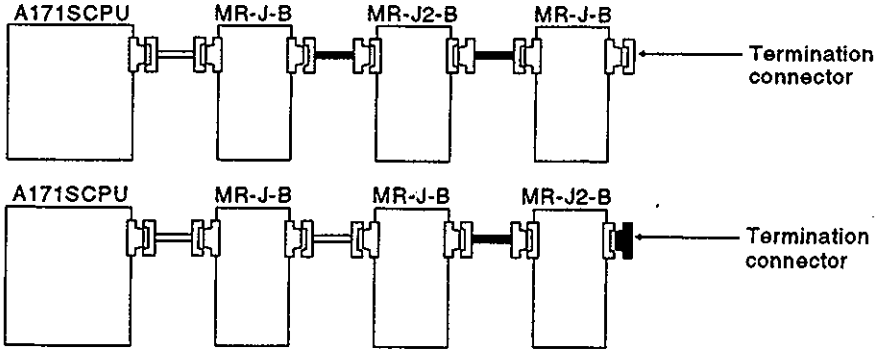
(4) MR-H-B + MR-J-B configuration



(5) MR-J2-B + MR-H-B configuration



(6) MR-J-B + MR-J2-B configuration



2.2 Basic Configuration

The motion controller can be used in the following basic configurations.

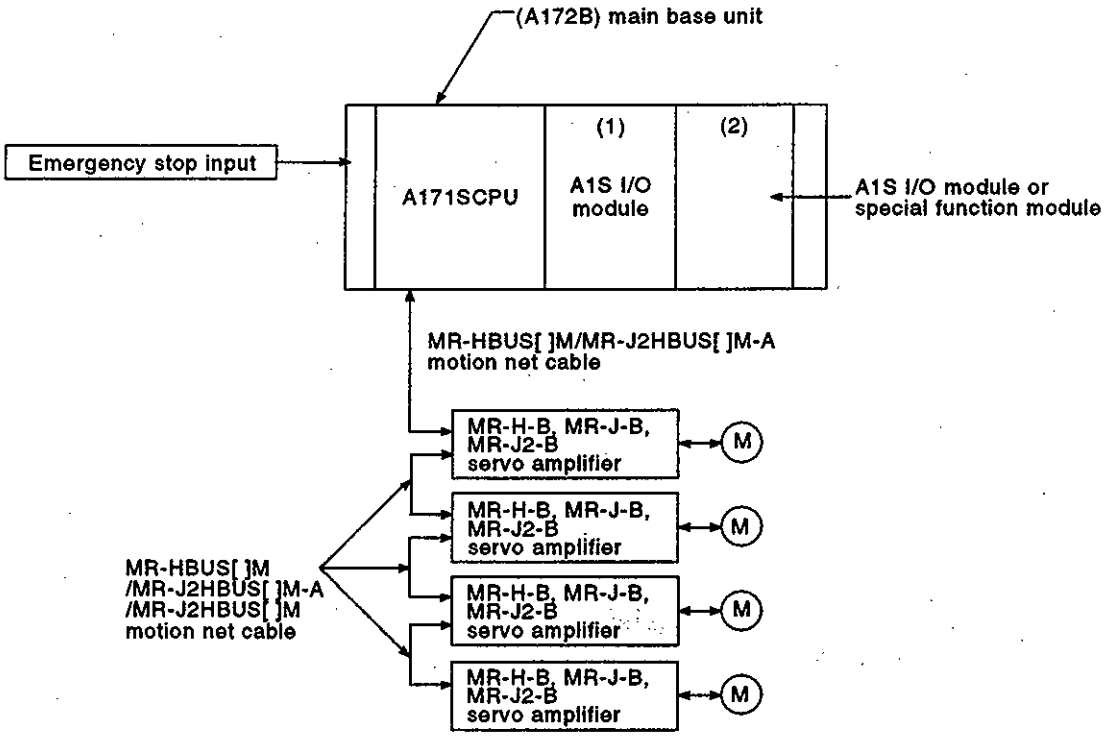
- Main base unit only (using I/O or special function modules)
- Main base unit only (using manual pulse generator/synchronous encoder interface module)
- Using extension base.

2.2.1 Main base unit + I/O or special function modules

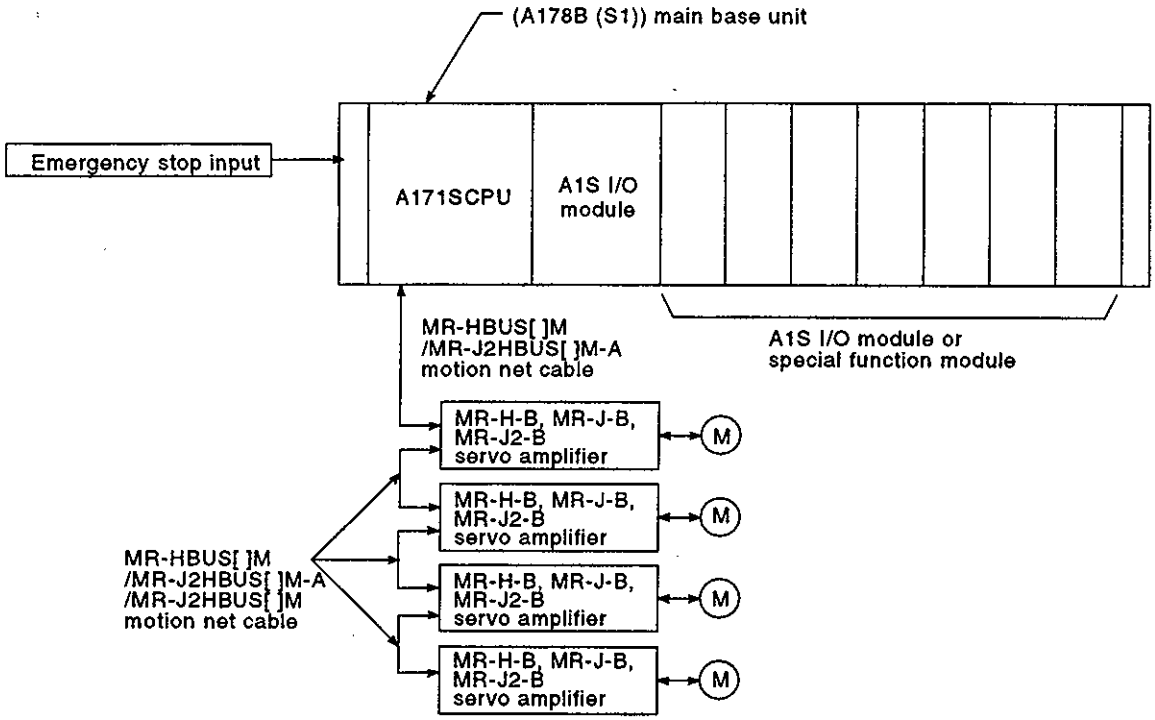
A maximum of four axes can be controlled using MR-H-B/MR-J-B/ MR-J2-Bs, and a maximum of 64 I/O points are available.

(1) Overall configuration

(a) Using A172B



(b) Using A178B (S1)



(2) Cautions

(a) MR-H-B, MR-J-B, and MR-J2-B can be used in combination.

(b) A171SCPU is connected to servo amplifiers with the motion net cables indicated below.

For connecting MR-H-B/MR-J-B	MR-HBUS[ ]M
For connecting MR-J2-B	MR-J2HBUS[ ]M-A

Make connections between servo amplifiers with the motion net cables indicated below.

For connection between MR-H-B/MR-J-B and MR-H-B/MR-J-B	MR-HBUS[ ]M
For connection between MR-H-B/MR-J-B and MR-J2-B	MRJ2HBUS[ ]M-A
For connection between MR-J2-B and MR-J2-B	MR-J2HBUS[ ]M

The total length of motion net cable used to make connections between the A171SCPU and servo amplifier, and between servo amplifiers, should not exceed 30 meters.
Fit the following termination connector to the last connection of the connected servo amplifiers.

For MR-H-B/MR-J-B	MR-TM
For MR-J2-B	MR-A-TM

When using MR-J-B and performing absolute position detection, connect a battery unit to the last connection of the motion network. Connect the battery unit with the motion net cable indicated below.

MR-H-B/MR-J-B	MR-HBUS[ ]M
MR-J2-B	MR-J2HBUS[ ]M-A

When a battery unit is connected, no termination connector is required.

(c) A1S input and output modules with 16, 32, or 64 I/O points can be used.

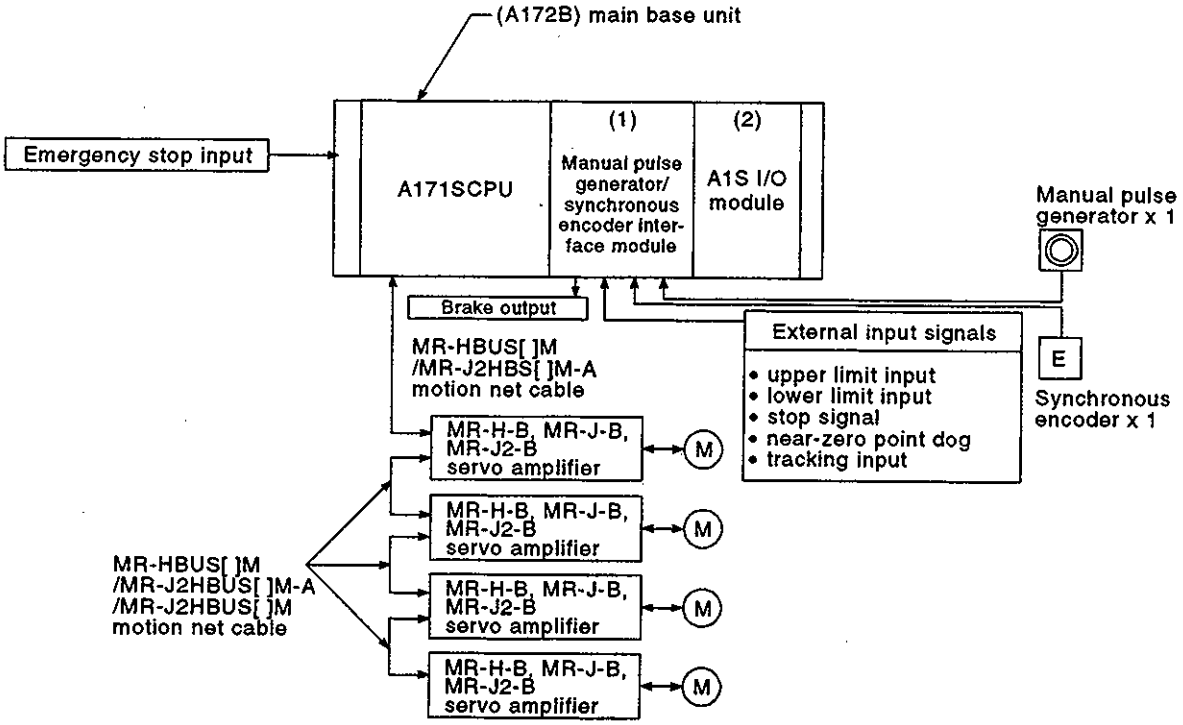
(d) The first I/O slot (or the first and second slots when using A178B-S1) can only be accessed from the motion controller.

2.2.2 Main base unit + manual pulse generator/synchronous encoder interface module

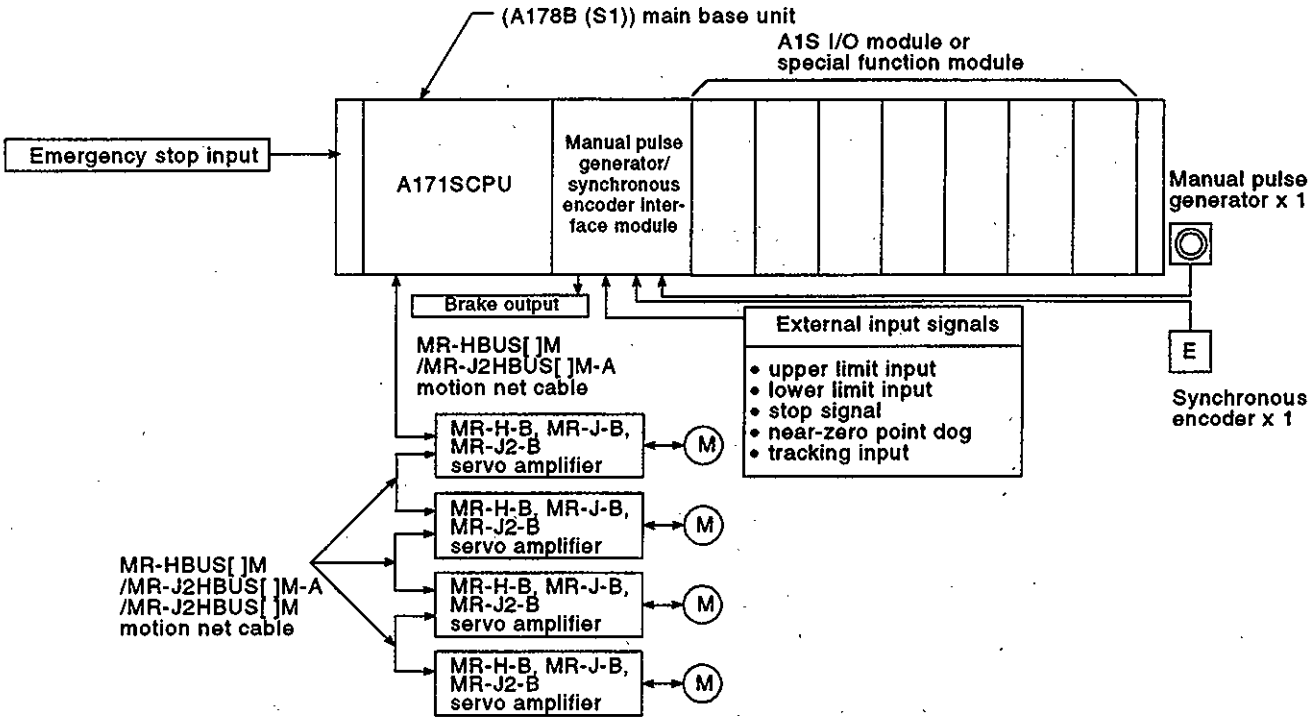
A maximum of four axes can be controlled using MR-H-B/MR-J-B/MR-J2-Bs, and a maximum of 64 I/O points are available.
The system can be applied the controlled system to suit the pulses input from the manual pulse generator, external inputs, synchronous encoder inputs, and brake output signals.

(1) Overall configuration

(a) Using A172B



(b) Using A178B (S1)



(2) Cautions

(a) When an A178B-S1 is used, two pulse generator/synchronous encoder interface modules can be loaded.

(b) Mount the manual pulse generator/synchronous encoder interface module in I/O slot 1. (or if using A178B-S1, in I/O slot 1 or 2.)

(c) A combination of MR-H-B, MR-J-B and MR-J2-B can be used.

(d) Connect an A171SCPU and servo amplifier with the motion net cable indicated below.

For connecting MR-H-B/MR-J-B	MR-HBUS[ ]M
For connecting MR-J2-B	MR-J2HBUS[ ]M-A

Use the motion net cables indicated below for connections between servo amplifiers.

Between MR-H-B/MR-J-B and MR-H-B/MR-J-B	MR-HBUS[ ]M
Between MR-H-B/MR-J-B and MR-J2-B	MR-J2HBUS[ ]M-A
Between MR-J2-B and MR-J2-B	MR-J2HBUS[ ]M

The total length of motion net cable used to make connections between the A171SCPU and servo amplifiers, and between servo amplifiers, should not exceed 30 meters.

Fit the following termination connector to the last connection of the connected servo amplifiers.

For MR-H-B/MR-J-B	MR-TM
For MR-J2-B	MR-A-TM

When using MR-J-B and performing absolute position detection, connect a battery unit to the last connection of the motion network. Connect the battery unit with the motion net cable indicated below.

MR-H-B/MR-J-B	MR-HBUS[ ]M
MR-J2-B	MR-J2HBUS[ ]M-A

When a battery unit is connected, no termination connector is required.

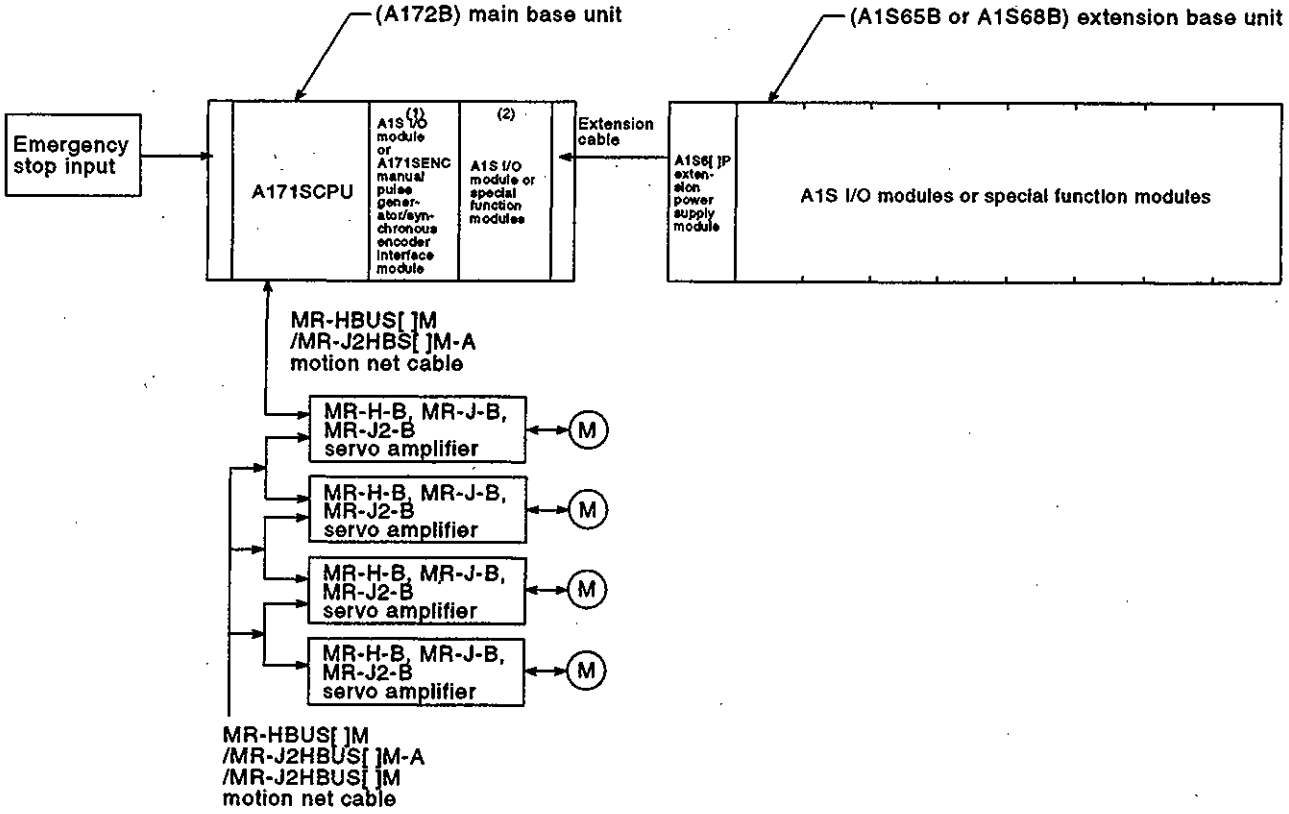
(e) A1S input and output modules with 16, 32, or 64 I/O points can be used.

2.2.3 Extension base unit

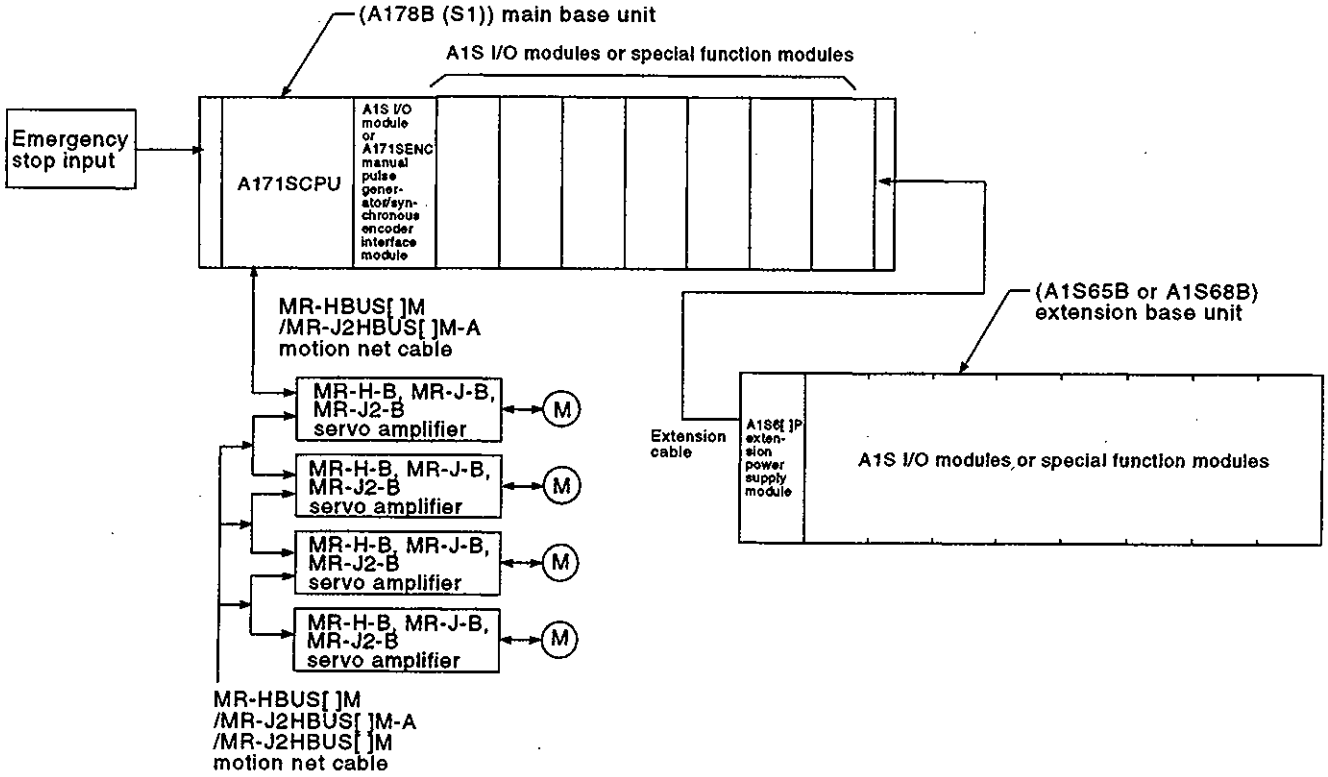
A maximum of four axes can be controlled using MR-H-B, MR-J-B and MR-J2-B. Using an extension base unit makes a maximum of 256 I/O points available.
Use an extension base unit to use a large number of I/O points or to use special function modules.

(1) Overall configuration

(a) Using A172B



(b) Using A178B (S1)



(2) Cautions

(a) Extension base units are available with five or eight I/O slots. Select the extension base unit according to the number of A1S I/O modules and special function modules used.

(b) If a manual pulse generator/synchronous encoder interface module is used, mount it in I/O slot 1 (or if using A178B-S1, in I/O slot 1 or 2.).

(c) Mount the extension power supply module in the power slot of the extension base unit.
Select the extension power supply module according to the total current consumption of the I/O modules and special function modules to which current is supplied.
See Section 2.3 for the current consumption at 5 VDC of the I/O modules and special function modules.

(d) A combination of MR-H-B, MR-J-B and MR-J2-B can be used.

(e) Connect an A171SCPU and servo amplifier with the motion net cables indicated below.

For connecting MR-H-B/MR-J-B	MR-HBUS[ ]M
For connecting MR-J2-B	MR-J2HBUS[ ]M-A

Use the motion net cables indicated below for connections between servo amplifiers.

Between MR-H-B/MR-J-B and MR-H-B/MR-J-B	MRHBUS[ ]M
Between MR-H-B/MR-J-B and MR-J2-B	MR-J2HBUS[ ]M-A
Between MR-J2-B and MR-J2-B	MR-J2HBUS[ ]M

The total length of motion net cable used to make connections between the A171SCPU and servo amplifier, and between servo amplifiers, should not exceed 30 meters.

Fit the following termination connector at the last connection of the connected servo amplifiers.

For MR-H-B/MR-J-B	MR-TM
For MR-J2-B	MR-A-TM

When using MR-J-B, to perform absolute position detection, connect a battery unit to the last connection of the motion network. Connect the battery unit with the motion net cable indicated below.

MR-H-B/MR-J-B	MR-HBUS[ ]M
MR-J2-B	MR-J2HBUS[ ]M-A

When a battery unit is connected, no termination connector is required.

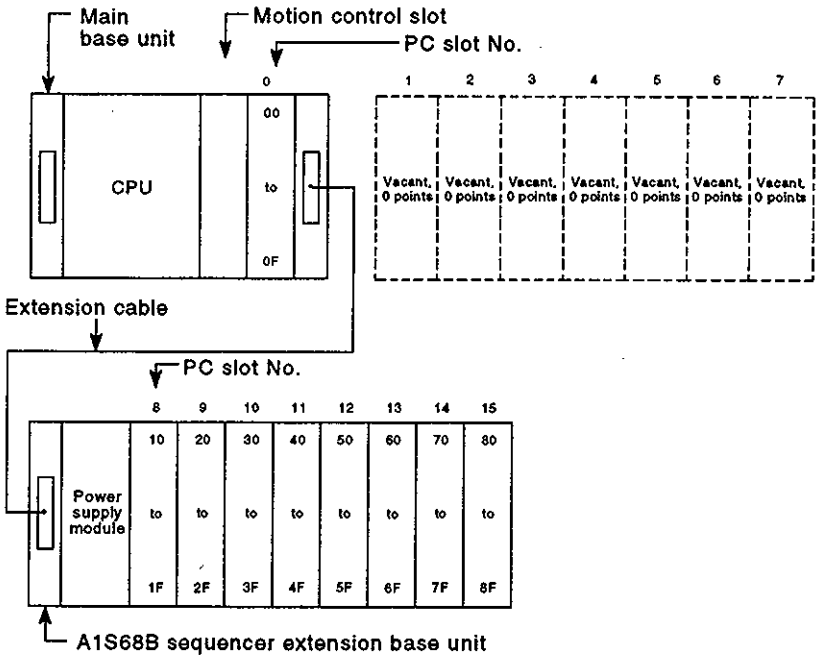
(f) A1S input and output modules with 16, 32, or 64 I/O points can be used.

(g) The first I/O slot (or the first and second slots when using A178B-S1) can only be accessed from the motion controller.

POINTS

(1) The number of I/Os and the I/O number allocations when an extension base unit is used are shown below.

In this example, each slot contains a module with 16 points.



* The I/O numbers in the example above assume that slot numbers 1 to 7 were designated as vacant slots with 0 points in I/O allocation.
If I/O allocation is not performed, slot number 1 to 7 are set as vacant slots occupying 16 points, and in this case the extension base I/O numbers start from 80H.

Max. extension stages	1 extension stage
Max. mountable I/O modules	10 modules
Max. I/O points	256 points
Main base unit model name	A172B, A178B, A178B-S1
Extension base unit model name	A1S65B, A1S68B
Extension cable model name	A1SC03B, A1SC12B, A1SC30B, A1SC01B (for right-side mounting)
Cautions	(1)Only one extension base unit stage can be used. (Two extension unit stage not usable) (2)Length of extension cable not to exceed 3 m (9.84 ft.).
I/O number allocation (with no I/O allocation)	(1)The I/O numbers are allocated to the main base unit then to the extension base unit. For the I/O numbers of I/O modules mounted in the motion side slots of the main base unit, allocate numbers later than the I/O numbers used for the PC side slots of the main base and extension base units. Make the I/O number allocations for the PC side slots at the main base unit first, then at extension base units. (2)The first I/O number of the extension base unit is determined from the number of I/O points of the I/O modules mounted in the main base unit. (3)If automatic I/O allocation is performed, add 16 points for each vacant slot. (4)I/O allocation can be used to change items (2) and (3) above. For details, see the ACPU Programming Manual (Fundamentals).

POINTS

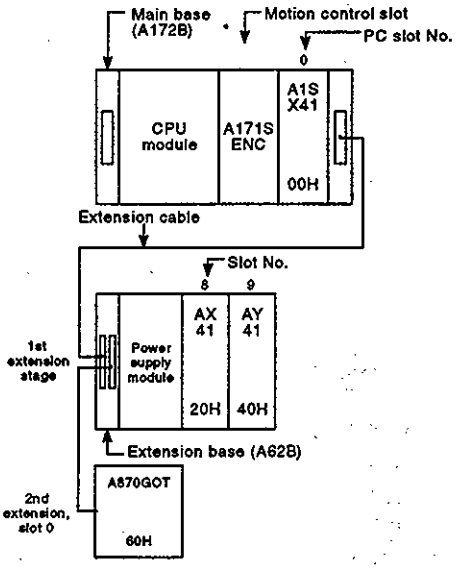
(2) The I/O number allocations when an A870GOT is connected to the extension base unit are as follows.

<FOR SV13>

1. I/O allocations

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
X32	S0	S0	S0	S0	S0	S0	S0	X32	Y32	S0	S0	S0	S0	S0	S0
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
F32															

The I/O numbers when the I/O allocations above are made are shown below.



2. If automatic I/O allocation is performed with the module condigurarion shown below, the A870GOT I/O number will be:
   (32 points + 16 points × 7) + (32 points × 2 + 16 points × 6) = 304 (130H)
   and since this exceeds 256 points, a GOT communication error will occur.
   In this case, make the following GOT settings:
   number of extension
   stages = 1, I/O slot = slot 2.

Notes

1. Mark sure that the total number of I/O points including the 32 points for the A870GOT does not exceed the total number of points of the A171SCPU (256 points).
2. Other modules cannot be mounted at a slot set for an A870GOT.
3. In I/O allocation, set "F" (32-point special function module) for the GOT.

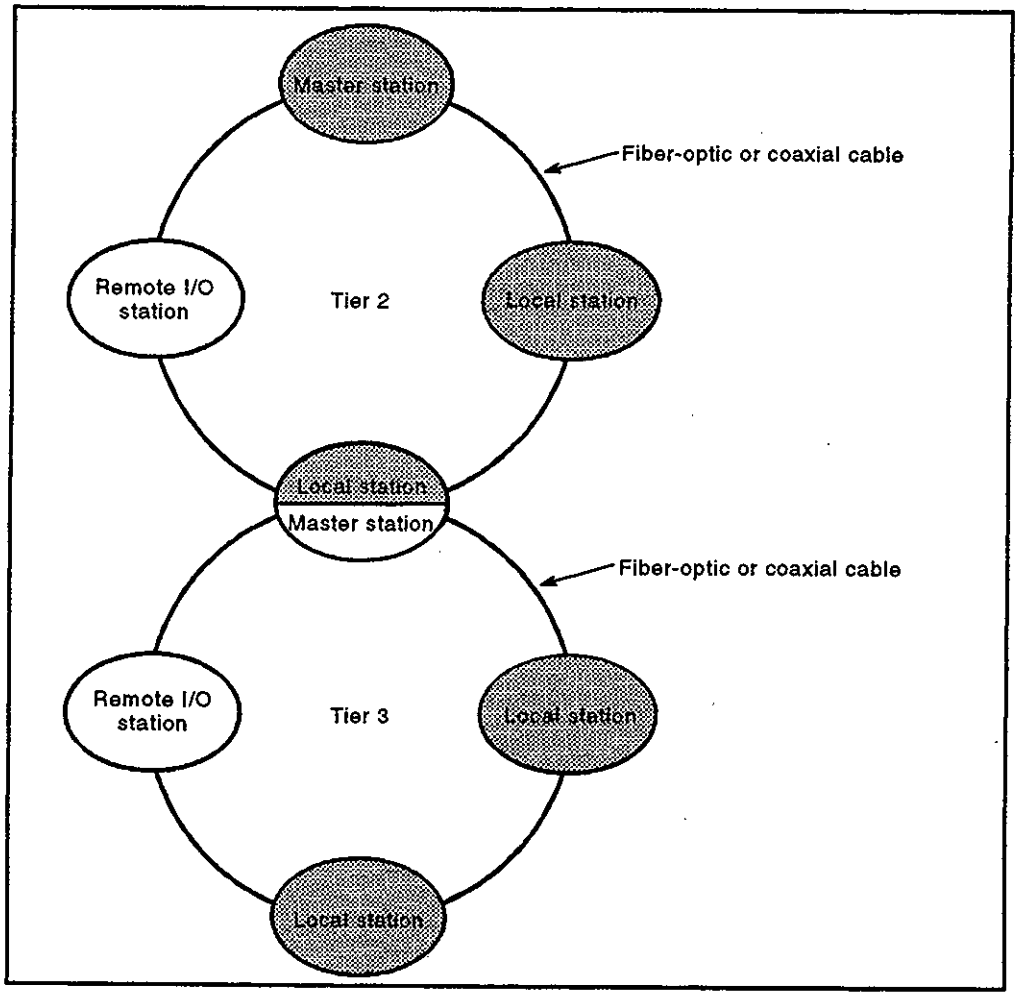
⚠ CAUTION

⚠ The total length of the extension cables must not exceed 3 m.

2.2.4 MELSECNET data link system

A MELSECNET(II) data link system can be configured using A1SJ71AP21/R21 for fiber-optic/coaxial cable data links.

(1) Overall configuration
The A1SJ71AP21/R21 can be used as master and local stations (marked ⬭), as shown in the diagram below.



(2) Cautions on system configuration
The system configuration of A1SJ71AP21/R21 used as master and local stations is the same as described in Sections 2.2.1 to 2.2.3.

2.3 Equipment in System

This section lists the units/modules and peripheral devices which can be used in the A171SCPU system.

(1) Table of motion modules

Part Name	Model Name	Description	Occupied Points (Type of I/O Module Allocated)	Current Consumption		Remarks
				5 VDC (A)	24 VDC (A)	
CPU module	A171SCPU	See performance specifications in Chapter 4. (256 I/O points, 32 kbyte memory capacity)	—	0.90	—	Built-in RAM
Main base unit	A172B	One motion module and one PC module can be loaded.	—	—	—	One extension connector at right as accessory
	A178B	One motion module and seven PC modules can be loaded.	—	—	—	One extension connector at right as accessory
	A178B-S1	Two motion modules and six PC modules can be loaded.	—	—	—	One extension connector at right as accessory
Manual pulse generator/ synchronous encoder interface module	A171SENC	66 points I/O signals (DOG, OT+, OT-, STOP: 4 points each, Tracking 1 point) Manual pulse generator interface Synchronous encoder interface	—	0.50	—	
Manual pulse generator	MR-HDP01	4.5 VDC to 13.2 VDC, 100 pulse/rev at magnification of 4.	—	0.06	—	
Synchronous encoder	MR-HENC	Resolution: 16384 pulse/rev, permitted rotational speed: 7030 rpm (electrical response 4300 rpm)	—	0.15	—	
Synchronous encoder cable	MR-HSCBL[ ]M	Synchronous encoder to A171SENC connector cables: 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft). (Same cables as encoder cables for HA-SH series motors.)	—	—	—	

(2) Table of PC CPU modules

Part Name	Model Name	Description		Occupied Points (Type of I/O Module Allocated)	Current Consumption		Remarks
					5 VDC (A)	24 VDC (A)	
Power supply module	A1S61P	5 VDC, 5 A	Input, 100/200 VAC	—	—	—	Mount in power slot of extension base unit.
	A1S62P	5 VDC, 3A/24 VDC 0.6 A					
	A1S63P	5 VDC, 5 A Input 24 VDC					
Input modules	A1SX10	16-point, 100 VAC input module		16 (16-point input)	0.05	—	
	A1SX20	16-point, 200 VAC input module		16 (16-point input)	0.05	—	
	A1SX30	16-point, 12/24 VDC,12/24 VAC input module		16 (16-point input)	0.05	—	
	A1SX40	16-point, 12/24 VDC input module		16 (16-point input)	0.05	—	
	A1SX40-S1	16-point, 24 VDC input module		16 (16-point input)	0.05	—	
	A1SX40-S2	16-point, 24 VDC input module		16 (16-point input)	0.05	—	
	A1SX41	32-point, 12/24 VDC input module		32 (32-point input)	0.08	—	
	A1SX41-S2	32-point, 24 VDC input module		32 (32-point input)	0.08	—	
	A1SX42	64-point, 12/24 VDC input module		64 (64-point input)	0.09	—	
	A1S42-S2	64-point, 24 VDC input module		64 (64-point input)	0.09	—	
	A1SX71	32-point, 5/12 VDC input module		32 (32-point input)	0.075	—	
	A1SX80	16-point, 12/24 VDC sink/source input module		16 (16-point input)	0.05	—	
	A1SX80-S1	16-point, 24 VDC sink/source input module		16 (16-point input)	0.05	—	
	A1SX80-S2	16-point, 24 VDC sink/source input module		16 (16-point input)	0.05	—	
	A1SX81	32-point, 12/24 VDC sink/source input module		32 (32-point input)	0.08	—	
	A1SX81-S2	32-point, 24 VDC sink/source input module		32 (32-point input)	0.08	—	

Part Name	Model Name	Description	Occupied Points (Type of I/O Module Allocated)	Current Consumption		Remarks
				5 VDC (A)	24 VDC (A)	
Output modules	A1SY10	16-point, relay contact output module (2A)	16 (16-point output)	0.12	0.09	
	A1SY18A	8-point, relay contact output module (2A), for independent contacts	16 (16-point output)	0.24	0.075	
	A1SY22	16-point, triac output module (0.6 A)	16 (16-point output)	0.27	(200 VAC) 0.004	
	A1SY28A	8-point, triac output module (1 A), all points independent	16 (16-point output)	0.11	—	
	A1SY40	16-point, 12/24 VDC transistor output module (0.1 A), sink type	16 (16-point output)	0.27	0.016	
	A1SY41	32-point, 12/24 VDC transistor output module (0.1 A), sink type	32 (32-point output)	0.50	0.016	
	A1SY42	64-point, 12/24 VDC transistor output module (0.1 A), sink type	64 (64-point output)	0.93	0.016	
	A1SY50	16-point, 12/24 VDC transistor output module (0.5 A), sink type	16 (16-point output)	0.12	0.12	
	A1SY60	16-point, 24 VDC transistor output module (2 A), sink type	16 (16-point output)	0.12	0.015	
	A1SY60E	16-point, 12 VDC transistor output module (1 A), source type	16 (16-point output)	0.20	0.01	
	A1SY68A	8-point, 5/12/24/48 VDC transistor output module, sink/source type, all points independent	16 (16-point output)	0.13	—	
	A1SY71	32-point, 5/12 VDC transistor output module (0.016 A), sink type	32 (32-point output)	0.40	0.15	
	A1SY80	16-point, 12/24 VDC transistor output module (0.8 A), source type	16 (16-point output)	0.12	0.04	
	A1SY81	32-point, 12/24 VDC transistor output module (0.1 A), source type	32 (32-point output)	0.50	0.016	
Input/ output compos- ite mod- ules	A1SH42	32-point, 12/24 VDC input module 32-point 12/24 VDC transistor output module (0.1 A), sink type	32 (32-point output)	0.50	0.008	
Dynamic input module	A1S42X	16-/32-/48-/64-point, 12/24 VDC dynamic input module	Set no. points (input with) set no. points	0.08	—	
Dynamic output module	A1S42Y	16-/32-/48-/64-point, 12/24 VDC dynamic output module	Set no. points (output with) set no. points	0.10	0.008	
Blank cover	A1SG60	Protects unused slots from dust.	16 (vacant)	—	—	
Dummy module	A1SG62	16-/32-/48-/64-point selectable module	—	—	—	

2. SYSTEM CONFIGURATION

Part Name	Model Name	Description	Occupied Points (Type of I/O Module Allocated)	Current Consumption		Remarks
				5 VDC (A)	24 VDC (A)	
40-pin connector	A6C0N1	Soldered type	—	—	—	
	A6C0N2	Solderless type				
	A6C0N3	Pressure displacement type				
37-pin D-sub connector	A6C0N1E	Soldered type	—	—	—	
	A6C0N2E	Solderless type				
	A6C0N3E	Pressure-displacement type				
Pulse catcher module	A1SP60	Input module for pulses with short ON duration (0.5 ms min.), 16 input points	16 (16-point output)	0.055	—	
Analog timer module	A1ST60	Modules allow timer set value to be adjusted with variable resistor from 0.1 to 1.0 s, 1 to 10 s, 10 to 60 s, or 60 to 600 s. Analog timer 8 points	16 (16-point output)	0.055	—	
Interrupt module	A1SI61	Interrupt module to designate interrupt program execution. 16 interrupt input points.	32 (32-point special function)	0.057	—	
High-speed counter module	A1SD61	32-bit signed binary, 50 kbps, 1 channel	32 (32-point special function)	0.35	—	
A/D conversion module	A1S64AD	4-20 mA/0-10 V, analog, 4 channel	32 (32-point special function)	0.4	—	
Tempera-ture/ digital conversion module	A1S62RD3	For Pt100 (3-wire type) connection, temperature input, 2 channel	32 (32-point special function)	0.54	—	
	A1S62RD4	For Pt100 (4-wire type) connection, temperature input, 2 channel	32 (32-point special function)	0.44	—	
D/A conversion module	A1S62DA	4-20 mA/0-10 V, analog output, 2 channel	32 (32-point special function)	0.8	—	
Computer link module	A1SJ71C24 -R2	Computer link functions, RS-232C, 1 channel	32 (32-point special function)	0.1	—	
	A1SJ71C24 -PRF	Computer link functions and printing functions, RS-232C, 1 channel	32 (32-point special function)	0.1	—	
	A1SJ71C24 -R4	Computer link functions and multi-drop link functions, RS-422/RS-485, 1 channel	32 (32-point special function)	0.1	—	

2. SYSTEM CONFIGURATION

Part Name	Model Name	Description	Occupied Points (Type of I/O Module Allocated)	Current Consumption		Remarks
				5 VDC (A)	24 VDC (A)	
Positioning module	A1SD70	For 1-axis positioning control, speed control, speed-position control. Analog voltage output (0 V to ±10 V).	48 (first half : 16 vacant points, second half : 32-point special function)	0.3	—	
	A1SD71-S2	For positioning control, speed control. 2-axis pulse train output (independent, simultaneous 2-axis, linear interpolation).	48 (first half : 16 vacant points, second half : 32-point special function)	0.8	—	
	A1SD71-S7	For positioning control. 2-axis pulse train output (independent, simultaneous 2-axis, linear interpolation).	48 (first half : 16 vacant points, second half : 32-point special function)	0.8	—	
Analog I/O module	A1S63ADA	Analog input, 2 channel Analog output, 1 channel	32 (32-point special function)	0.8	—	
MELSECNET (II) data link module	A1SJ71AP21	For MELSECNET (II) optical data link system master and local stations.	32 (32-point special function)	0.33	—	
	A1SJ71AR21	For MELSECNET (II) co-axial data link system master and local stations.	32 (32-point special function)	0.8	—	
MELSECNET/B data link module	A1SJ71T21B	For MELSECNET/B data link system master and local stations.	32 (32-point special function)	0.66	—	
MELSECNET/MINI-S3 master module	A1SJ71PT-32-S3	For 64 max. MELSECNET/MINI-S3 master stations, 512 total remote I/O points, remote terminal control	32 dedicated I/O mode (32-point special function) 48 extension mode (48-point special function)	0.35	—	
Extension base unit	A1S65B	To mount 5 I/O modules	—	—	—	Requires power supply module
	A1S68B	To mount 8 I/O modules				
Extension cables	A1SC01B	Flat cable, length 55 mm (2.17 in)	—	—	—	For extension to right
	A1SC03B	Length 330 mm (13 in)	—	—	—	Extension base unit connector cable
	A1SC12B	Length 1200 mm (47.2 in)				
	A1SC30B	Length 3000 mm (118.1 in)				
Battery	A6BAT	IC-RAM memory back-up	—	—	—	

Part Name	Model Name	Description	Applicable Model Name
Connector/terminal block conversion module	A6TBXY36	For sink-type input modules, sink-type output modules (standard type)	A1SX41(S2), A1SX42(S2), A1SY41, A1SY42, A1SH42
	A6TBXY54	For sink-type input modules, sink-type output modules (2-wire type)	AX42(S1), AY42(S1/S3/S4), AH42
	A6TBX70	For sink-type input modules (3-wire type)	A1SX41(S2), A1SX42(S2), A1SH42, AX42(S1), AH42
	A6TBX36-E	For source-type input modules (standard type)	A1SX81(S2), AX82
	A6TBY36-E	For source-type output modules (standard type)	A1SY81, AY82EP
	A6TBX54-E	For source-type input modules (2-wire type)	A1SX81(S2), AX82
	A6TBY54-E	For source-type output modules (2-wire type)	A1SY81, AY82EP
	A6TBX70-E	Cables for connector/terminal block conversion modules (3-wire type)	A1SX81(S2), AX82
Connector/terminal block conversion module cables	AC05TB	0.5 m (1.64 ft) cable for source modules	A6TBXY36 A6TBXY54 A6TBX70
	AC10TB	1 m (3.28 ft) cable for source modules	
	AC20TB	2 m (6.56 ft) cable for source modules	
	AC30TB	3 m (9.84 ft) cable for source modules	
	AC50TB	5 m (16.4 ft) cable for source modules	
	AC05TB-E	0.5 m (1.64 ft) cable for source modules	A6TBX36-E A6TBY36-E A6TBX54-E A6TBY54-E A6TBX70-E
	AC10TB-E	1 m (3.28 ft) cable for source modules	
	AC20TB-E	2 m (6.56 ft) cable for source modules	
	AC30TB-E	3 m (9.84 ft) cable for source modules	
	AC50TB-E	5 m (16.4 ft) cable for source modules	

(3) Table of servo amplifiers modules

(a) MR-H-B/MR-J-B

Part Name		Model Name	Description
MR-J-B series servo amplifiers	Servo amplifier	MR-J10B	For motor output capacity 50 W, 100 W
		MR-J20B	For motor output capacity 200 W
		MR-J40B	For motor output capacity 300 W, 400 W
		MR-J60B	For motor output capacity 600 W
		MR-J100B	For motor output capacity 500 W, 850 W, 1 kW
		MR-J200B	For motor output capacity 1.2 kW, 1.5 kW, 2 kW
	Battery unit	MR-JBAT4	Absolute position detection back-up battery, 4 axes max.
		MR-JBAT8	Absolute position detection back-up battery, 8 axes max.
	Battery unit connector cable	MR-HBUS[ ]M	To connect MR-J-B series servo amplifier to battery unit
MR-H-B series servo amplifiers	Servo amplifier	MR-H10B	For motor output capacity 50 W, 100 W
		MR-H20B	For motor output capacity 200 W
		MR-H40B	For motor output capacity 300 W, 400 W
		MR-H60B	For motor output capacity 500 W, 600 W
		MR-H100B	For motor output capacity 850 W, 1 kW
		MR-H200B	For motor output capacity 1 kW (low inertia), 1 kW (flat) 1.2 kW, 1.5 kW, 2 kW
		MR-H350B	For motor output capacity 2 kW (low inertia), 2.2 kW (flat), 3 kW, 3.5 kW
		MR-H500B	For motor output capacity 3 kW (low inertia), 3.5 kW (flat), 4.5 kW, 5 kW
		MR-H700B	For motor output capacity 7 kW
		MR-H11KB	For motor output capacity 11 kW - with 4 regenerative resistors (GRZG400-2Ω)
		MR-H15KB	For motor output capacity 15 kW - with 5 regenerative resistors (GRZG400-1Ω)
		MR-H22KB	For motor output capacity 22 kW - with 5 regenerative resistors (GRZG400-0.8Ω)
	Battery unit	MR-BAT	Absolute position detection back-up battery

2. SYSTEM CONFIGURATION

Part Name		Model Name	Description
MR-H-B, MR-J-B common equipment	Termination connector	MR-TM	Mounted to last MR-H-B/MR-J-B in motion network
	Termination resistor	MR-RB013	10 W external regenerative resistor
		MR-RB033	30 W external regenerative resistor
		MR-RB064	60 W external regenerative resistor
		MR-RB064X2	100 W external regenerative resistor (2 connected in series)
MR-H-B, MR-J-B common equipment	Termination resistor	MR-RB30	300 W external regenerative resistor
		MR-RB31	300 W external regenerative resistor
		MR-RB32	300 W external regenerative resistor
		MR-RB34	300 W external regenerative resistor
		MR-RB50	500 W external regenerative resistor
		MR-RB51	500 W external regenerative resistor
		MR-RB54	500 W external regenerative resistor
		MR-H11KB standard accessory	600 W regenerative power, 8Ω resistance (2Ω x 4) (800 W if fan-cooled)
		MR-H15KB standard accessory	600 W regenerative power, 5Ω resistance (1Ω x 5) (1300 W if fan-cooled)
		MR-H22KB standard accessory	600 W regenerative power, 4Ω resistance (0.8Ω x 5) (1300 W if fan-cooled)
		FR-BU	Brake module FR-BU15/30/55K
		FR-RC	Power regenerative converter
	Motion net cable	MR-HBUS[ ]M	Cable to connect A171SCPU to MR-H-B or MR-J-B, MR-H-B, MR-J-B to MR-H-B, MR-J-B. 5 m (16.4 ft), 5 m (16.4 ft), total 30 m (98.4 ft max.).
	Detector cable for HA-MH/FH series motor	MR-HCBL[ ]M	Cable to connect HA-MH/FH series motor to MR-H-B, MR-J-B. 5 m (16.4 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft).
	Detector cable for HA-SH/LH/UH series motor	MR-HSCBL[ ]M	Cable to connect HA-SH series motor to MR-J-B, or HA-SH/LH/UH series motor to MR-H-B. 0.5 m (1.64 ft), 10 m (32.8 ft), 20 m (65.6 ft), 30 m (98.4 ft).
	Connector set for HA-FH series motor detector	MR-HCNS	Amplifier connector, relay connector set
	Connector set for HA-SH/LH/UH series motor detector	MR-JSCNS	Amplifier connector, detector connector set

*Long detector cables and cables without connectors are also available.

(b) MR-J2-B

Part Name		Model Name	Description
MR-J2-B series servo amplifiers	Servo amplifier	MR-J2-10B	For motor output capacity 50 W, 100 W
		MR-J2-20B	For motor output capacity 200 W
		MR-J2-40B	For motor output capacity 300 W, 400 W
		MR-J2-60B	For motor output capacity 500 W, 600 W
		MR-J2-70B	For motor output capacity 750 W
		MR-J2-100B	For motor output capacity 1 kW
		MR-J2-200B	For motor output capacity 1.5 kW, 2 kW
		MR-J2-350B	For motor output capacity 3.5 kW
	Battery unit	MR-BAT	Absolute position detection backup battery
	Termination connector	MR-A-TM	Mounted to last MR-J2-B in motion network
	Regenerative resistor	MR-RB032	External regenerative resistor, 30 W
		MR-RB12	External regenerative resistor, 100 W
		MR-RB32	External regenerative resistor, 300 W
	Motion net cable	MR-J2HBUS[ ]M-A	Cables for connections between A171SCPU and MR-J2-B, MR-H-B/MR-J-B and MR-J2-B, and MR-J2-B and battery for MR-J-B 0.5 m, 1 m, 5 m
		MR-J2HBUS[ ]M	Cables for connection between MR-J2-B and MR-J2-B 0.5 m, 1 m, 5 m
	Encoder cables for HC-MF /HA-FF series motors*	MR-JCCBL[ ]M-L	Cable for connection between HC-MF/HA-FF series motor and MR-J2-B (standard cable) 2 m, 5 m, 10 m, 20 m, 30 m
		MR-JCCBL[ ]M-H	Cable for connection between HC-MF/HA-FF series motor and MR-J2-B (high bending life cable) 2 m, 5 m, 10 m, 20 m, 30 m
	Encoder cables for HC-SF series motors*	MR-JHSCBL[ ]M-H	Cable for connection between HC-SF series motor and MR-J2-B (high bending life cable) 2 m, 5 m, 10 m, 20 m, 30 m
	Connector set for HC-MF /HA-FF series motor detector	MR-J2CNM	Amplifier connector, relay connector set
	Connector set for HC-SF series motor detector	MR-J2CNS	Amplifier connector, relay connector set

*Avoid using short cables with relays, since this can lead to position displacement.

(4) Peripheral devices

Model Name		Remarks	
IBM PC AT personal computer		• IBM PC computer • PS-DOS..... Operating system software package, V5.0, or higher • SW[ ]SRX-GSV[ ][ ]PE.... GPP and servo function start-up floppy disk • 2DD, 2HD ..... User floppy disks • AC30R2..... RS-232C cable, length 3 m (9.84 ft.)	
RS422 cable	AC30R4 AC300R4	Length 3 m (9.84 ft) Length 30 m (98.4 ft)	Cable to connect CPU to A64G0T-LT21B/A77G0T
RS-232C-RS422 converter	DCNV-RS24 DCNV-RS24L DCNV-RS42R	RS-232C-RS422 converter for connecting IBM PC to A171SCPU. Connection to IBM PC requires D232LM-CAB connector conversion cable.	
RS-232C-RS422 interface internal cable	DAFX-CAB	RS-232C-RS422 interface cable for connecting IBM PC to A171SCPU. Connection to IBM PC requires D232LM-CAB connector conversion cable.	
Graphic operation terminal	A64GOT-LT21B	• A64GOT body • A6GT-KP..... keyboard panel	
	A77GOT	• A77GOT body • A7GT-TK..... ten-key panel	
	A87GOT	• A870GOT body	
Printer	Parallel (ESC/P-compatible)	• To print out programs. • Compatible with ESC/P24-84 (or higher).	
Parallel interface cable	AC30PIO-25P	• Cable to connect IBM PC to parallel printer. • Length 3 m (9.84 ft)	
Teaching unit	A30TU	• Connects to the CPU to teach addresses and programs. • Cable length 5 m (16.4 ft)	

3. GENERAL SPECIFICATIONS

Table 3.1 shows the common motion controller specifications.

Table 3.1 Generation Specifications

<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Operating ambient temperature</td><td colspan="5">0 to 55°C</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="5">-20 to 75°C</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="5">10% to 90%RH, no condensation</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="5">10% to 90%RH, no condensation</td></tr>
<tr><td rowspan="3">Vibration resistance</td><td rowspan="3">Conforms to JIS C 0911*2</td><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Number of Sweeps</td></tr>
<tr><td>10 to 55Hz</td><td>———</td><td>0.075mm (0.003 in)</td><td rowspan="2">10 (1 octave/minute)*1</td></tr>
<tr><td>55 to 150Hz</td><td>9.8m/s^2(1g)</td><td>———</td></tr>
<tr><td>Shock resistance</td><td colspan="5">Conforms to JIS C 0912 (9.8m/s^2 (10 g), 3 directions, 3 times)</td></tr>
<tr><td>Noise resistance</td><td colspan="5">Noise voltage: 1500Vpp, noise amplitude: 1 μs, noise frequency: 25 to 60 Hz, with a noise simulator</td></tr>
<tr><td>Withstand voltage</td><td colspan="5">1500 VAC, one minute, between all external AC terminals and ground
500 VAC, one minute, between all external DC terminals and ground</td></tr>
<tr><td>Insulation resistance</td><td colspan="5">5 Ω min., at 500 VDC between all external AC terminals and ground</td></tr>
<tr><td>Ground</td><td colspan="5">Grounding with 100 Ω max. resistance. Connect to panel if grounding impossible.</td></tr>
<tr><td>Operating environment</td><td colspan="5">No corrosive gas, low dust</td></tr>
<tr><td>Cooling method</td><td colspan="5">Natural cooling.</td></tr>
</table>

REMARKS

*1 An "octave" refers to an increase or decrease in frequency by a factor of two. For example, the following are all octaves: 10 Hz to 20 Hz, 20 Hz to 40 Hz, 40 Hz to 20 Hz, and 20 Hz to 10 Hz.
See Section 10 "MOUNTING AND LOCATION SELECTION."

*2 JIS: Japan Industrial Standards

3. GENERAL SPECIFICATIONS

⚠ 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 motion controller module terminal block. See Section 6.1.

⚠ 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. A171SCPU

This section describes the A171SCPU performance, functions, names and settings of parts, and I/O interface specifications.

4.1 Performance

4.1.1 PCPU performance specifications

The PCPU performance specifications differ according to the OS model installed in the A171SCPU. Refer to the Programming Manual for the OS installed in the A171SCPU.

4.1.2 SCPU performance specifications

The SCPU performance specifications are listed in Table 4.1.
As the SCPU performance specifications differ according to the operating system used, refer to the appropriate OS Programming Manual for details.

Table 4.1 Table of SCPU Performance Specifications

Item	SCPU Performance, Specification
Control method	Repeated operation (using stored programs)
I/O control method	Refresh method/direct method (selectable)
Programming language	Sequence control dedicated language (relay symbol language, logic symbol language, MELSAP-II)
Number of instructions (type)	Sequence instructions : 22 Basic instructions : 131 Application instructions : 104
Processing speed (sequence instructions)	Direct method : 1.0 to 2.3 μs/step Refresh method : 1.0 μs/step
No. I/O points	Total 256 for motion control and sequence control
Watchdog timer	10 to 2000ms
*1 Memory capacity	32 kbyte (32 kbyte internal RAM)
Program capacity	Main sequence program + main microcomputer program = 8 ksteps max. Of this, the main microcomputer program can be set to 7 ksteps (14 kbyte). (No sub-sequence programs)
Internal relays (M)	1000 points (M0 to M999)
Latch relays (L)	1048 points (L1000 to 2047)
Step relays (S)	0 (none at initial status)
Link relays (B)	1024 points (B0 to 3FF)
	(M, S, L total 2048 points for motion control and sequence control (set with parameters))
Timers (T)	256 points 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] set with parameters
Counters (C)	256 points Normal counter: setting range 1 to 32767 (C0 to C255) } Interrupt program counter: setting range 1 to 32767 (none at initial status) └→ Counter used in interrupt programs] set with parameters
Data registers (D)	Total 1024 points (D0 to D1023) for motion control and sequence control
Link registers (W)	1024 points (W0 to W3FF)
Annunciators (F)	256 points (F0 to 255)
File registers (R)	4096 points max. (R0 to R4095)
Accumulators (A)	2 points (A0, A1)
Index registers (V, Z)	2 points (V, Z)
Pointers (P)	256 points (P0 to 255)

Table 4.1 Table of SCPU Performance Specifications (cont.)

Item	SCPU Performance, Specification
Interrupt pointers (I)	32 points (I0 to 31)
Special-function relays (M)	256 points (M9000 to 9255)
Special-function registers (D)	256 points (D9000 to 9255)
*2 Comments (points)	1600 max. (set in 64-point units)
Self-diagnosis function	Watchdog error monitoring, memory error detection, CPU error detection, I/O error detection, battery error detection, etc.
Operating mode on error	Select stop/continue
Output mode selection when switching from STOP to RUN	Select re-output operation status before STOP or output after operation execution.
Permitted stop time	20ms
Current consumption (5 VDC)	0.9A
Weight	0.86(1.89)

*1 The 32 kbyte memory capacity is the total memory used for parameters, timer and counter set values, program capacity, file registers, comments (points), sampling trace, and status latch. The memory capacity of 32 kbytes is fixed and cannot be expanded.
*2 The A171SCPU can store up to 1600 comment points, but the GPP functions allow 4032 comments to be created.

4.2 Functions

4.2.1 PCPU functions

The PCPU functions differ according to the OS model installed in the A171SCPU. Refer to the Programming Manual for the OS installed in the A171SCPU.

4.2.2 SCPU functions

The SCPU functions are summarized in Table 4.2.
Refer to the A1SCPU user's manual for details of the SCPU functions.

Table 4.2 Table of SCPU Functions

Function	Description
Constant scan	• Sets a constant time for one scan of a sequence program which is independent of the sequence program scan time. • Set the constant scan time between 10 ms and 2000 ms.
Latch (hold on power interruption)	• The contents of devices set as latch devices are retained when a reset or a power interruption over 20 ms occurs or if the power is turned off. • Devices L, B, T, C, D, W can be set as latch devices.
Remote RUN/STOP	• Conducts remote STOP/RUN PC control from external inputs or peripheral devices when the RUN/STOP switch is set to RUN.

PAUSE	• Stops the operation and holds the output (Y) ON/OFF statuses.
	• The PAUSE status can be set by two methods:
	  • with the remote PAUSE contacts
	  • from a peripheral device.

Status latch	• The contents of all devices are written to the A171SCPU status latch extension file registers when the status latch conditions are met. • The statuses of the devices stored in the status latch area can be monitored from a pripheral device
Sampling trace	• The operating status of the designated devices is sampled at the set interval, and the results are stored in the A171SCPU sampling trace area. • The statuses of the devices stored in the sampling trace area can be monitored from a peripheral device
Off-line switch	• Separates the devices (Y, M, L, S, F, B) used by the out instruction from the sequence program operations.
Error indicator order or priority	• Sets order in which the indicators light and go out when an error occurs.
Clock	• Executes the CPU module internal clock operations. • Clock data is: year, month, day, hour, minute, second, day of week • The clock data can be read to D9025 to D9028.

REMARK

The A171SCPU does not support step operation, PAUSE control with the RUN/STOP switch, or I/O module on-line replacement.

4.3 Handling Precautions

This section describes handling precautions for A171SCPU and batteries between opening the packaging and installation.

(1) Ensure that module mounting screws and terminal screws are tightened within the prescribed torque ranges.

Screw Name	Tightening Torque Range N.cm [kg.cm](lb.inches)
Module mounting screw (M4)	70 to 118 [8 to 12] (6.93 to 10.39)
Terminal block, terminal screw (M3.5)	59 to 88 [6 to 9] (5.2 to 7.79)

⚠ CAUTION

⚠ The CPU 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.

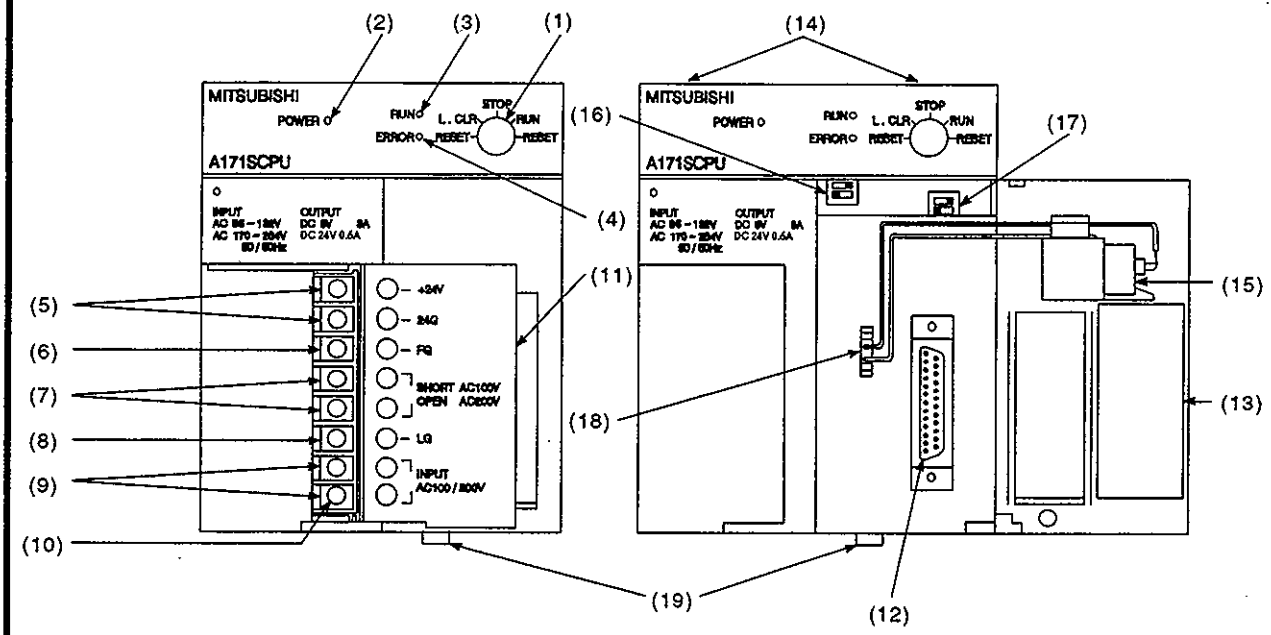
⚠ Ensure that module mounting screws and emergency stop terminal screws are tightened within the prescribed torque ranges.

⚠ 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 10.5 for details.

4.4 Names and Settings of A171SCPU Parts

This section describes the names and settings of A171SCPU parts and the switch settings required to use the A171SCPU.

4.4.1 Names of A171SCPU parts



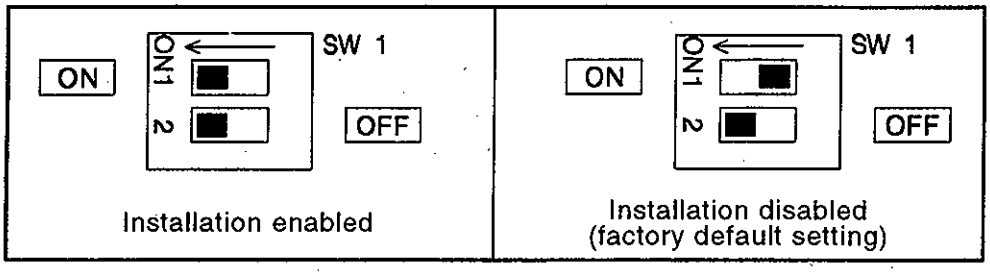
No.	Name	Application
(1)	RUN/STOP key switch	• RUN/STOP : Starts or stops sequence program execution. • RESET : Resets the hardware. Applies a reset after an operation error occurs and initializes the operations. • LATCH CLEAR (L.CLR) : Clears the latch area data set with the parameters (to OFF or 0). (LATCH CLEAR also clears data outside the latch area.)
(2)	POWER indicator	• Display indicator for 5 VDC power supply.

No.	Name	Application
(3)	RUN indicator	• Lit : Sequence program operating with key switch set to RUN. (The indicator remains lit if an operation error occurs in the servo program (see 13.3.).) • Not lit : The RUN indicator is not lit in the following cases: • No 100/200 VAC power supplied to the A171SCPU. • RUN/STOP key switch is set to STOP. • A remote STOP is applied. • A remote PAUSE is applied. • Flashing: The RUN indicator flashes in the following cases: • Self-diagnosis function detected an error which stops sequence program operation. • A latch clear operation is conducted.
(4)	ERROR indicator	• Lit : Self-diagnosis function detected an error. (However, the indicator does not light if it is set not to light for the error detected in the order of priority settings.) • Not lit : Normal, or error detected by CHK instruction. • Flashing: Sequence program annunciator (F) is on.
(5)	24VDC, 24GDC terminals	• Supplies output modules which require 24 VDC internally (supplied through external wiring).
(6)	FG terminal	• A grounding terminal connected with the shielding pattern on the printed circuit board.
(7)	Input voltage select terminals	• Terminals to select 100 VAC or 200 VAC operation with a jumper. Short the terminals with the jumper supplied if 100 VAC is input, or leave the terminals open if 200 VAC is supplied.
(8)	LG terminal	• Ground for power supply filter, with 1/2 the electrical potential of the input voltage.
(9)	Power supply input terminals	• Connect the 100 VAC or 200 VAC AC power supply to the power supply input terminals.
(10)	Terminal screws	• M 3.5 x 7
(11)	Terminal cover	• A cover to protect the terminal block.
(12)	RS-422 connector	• Connector to read, write, monitor, or test main programs with a peripheral device. • Covered by a cover when unconnected to a peripheral device.
(13)	Covers	• Open the protective cover for the printed circuit board, RS-422 connector, or battery to carry out the following operations: • Set DIP switches. • Connect the battery connectors. • Replace the battery.
(14)	Module fixing screws	• Screws to fix the module to the base unit.
(15)	Battery	• Back-up battery for programs, devices in the latch range, and file registers. (See Section 9.1 for the battery mounting procedure.)
(16)	DIP switch 1	• Installation switch This switch is used to change the installed A171SCPU operating system with a peripheral device. (See Section 4.4.2 for details about the switch settings.) ON : Turn ON to install an operating system. OFF : Turn OFF to enable CPU operation when OS installation is complete • See Section 11.5 for information on the installation procedure.

No.	Name	Application
(17)	DIP switch 302	• This switch selects the I/O control method and enables or disables memory protection. (See Sections 4.4.3 and 4.4.4 for details about the switch settings.)
(18)	Battery connector	• A connector for connecting the battery unit
(19)	Motion network connector	• Connects to MR-H-B, MR-J-B or MR-J2-B.

4.4.2 Install switch settings

This switch must be set to install an operating system (OS) in the A171SCPU.
The switch SW1-1 is set OFF to disable OS installation when the module is shipped from the factory. To install an OS, turn ON switch SW1-1 before turning on the power. After installation is complete, turn OFF switch SW1-1 then turn the power off and back on again.
Open the cover on the front of the servo system CPU to operate the install DIP switch.



POINTS

(1) Turn off the power supply before setting the install switch.

(2) After using this switch, check the switch status before turning on the power supply.

⚠ CAUTIONS

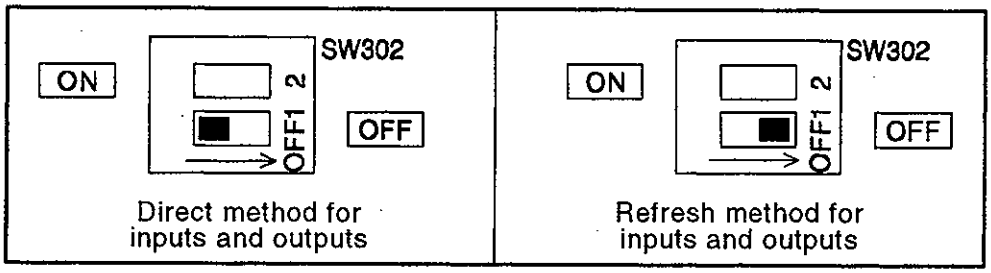
⚠ Switch SW1-2 is for use by the manufacturer only.

Leave this switch set ON.

Operation cannot be guaranteed if this switch is set OFF.

4.4.3 I/O control selector switch settings

Two methods of I/O control are available, the direct method and the refresh method.
Select the I/O control method with DIP switch 302-1.
The switch SW302-1 is set OFF when the module is shipped from the factory to select the refresh I/O control method for inputs and outputs.



POINTS

(1) Turn off the power supply before setting the I/O control selector switch.

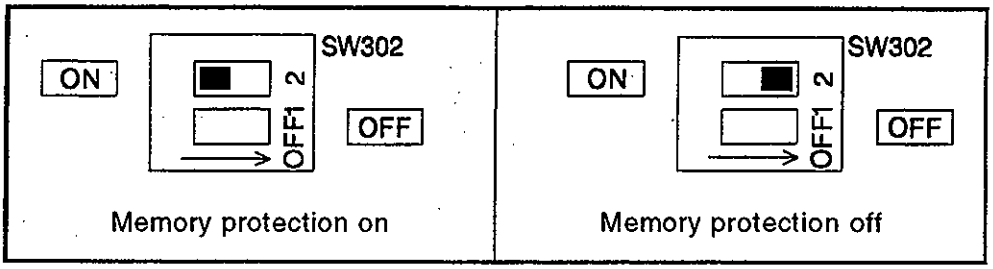
(2) After using this switch, check the switch status before turning on the power supply.

(3) A BIN value corresponding to the selected I/O control method is input in special-function register D9014 and can be monitored from a peripheral device.

- Direct method for inputs and outputs.....0
- Refresh method for inputs and outputs 3

4.4.4 Memory protect switch settings

The memory protection switch is provided to prevent inadvertently writing data to RAM due to incorrect operation of a peripheral device.
Set memory protection ON or OFF with DIP switch SW302-2.
The protected area of memory is the first 20 kbytes of the 32-kbyte user area.
It prevents overwriting or deleting of previously created programs.
Set the memory protection switch to the OFF position before modifying the RAM memory contents.
The memory protect switch SW302-2 is set OFF to turn off memory protection when the module is shipped from the factory.



POINT

(1) Turn off memory protection when running sampling trace or status latch.
The results cannot be stored in memory is memory protection is on.

5. MANUAL PULSE GENERATOR/SYNCHRONOUS ENCODER INTERFACE MODULE

A171SENC receives external signals required for positioning control (motion control signals and tracking inputs), manual pulse generator inputs, and synchronous encoder inputs.
This section describes the A171SENC specifications and part names, and its interfaces with external equipment.

⚠ CAUTION

⚠ The casings and pin connectors of manual pulse generator/synchronous encoder interface modules 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 10.5 for details.

5. MANUAL PULSE GENERATOR/SYNCHRONOUS ENCODER INTERFACE MODULE

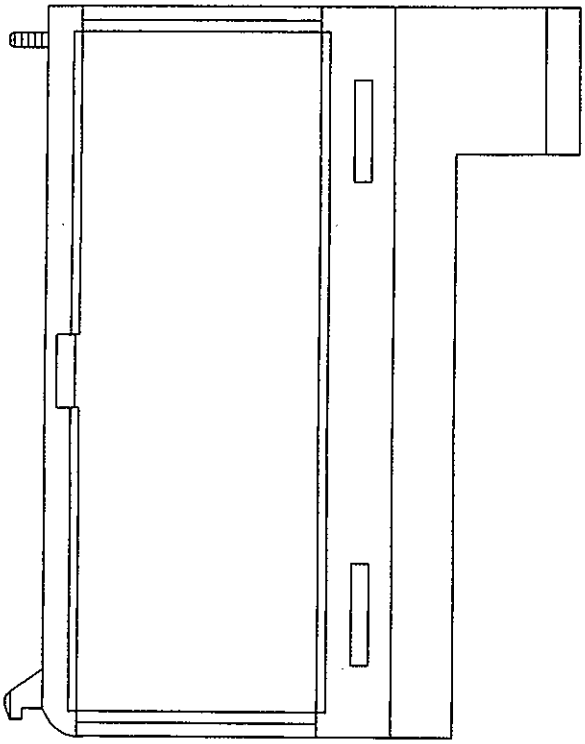
5.1 Specifications

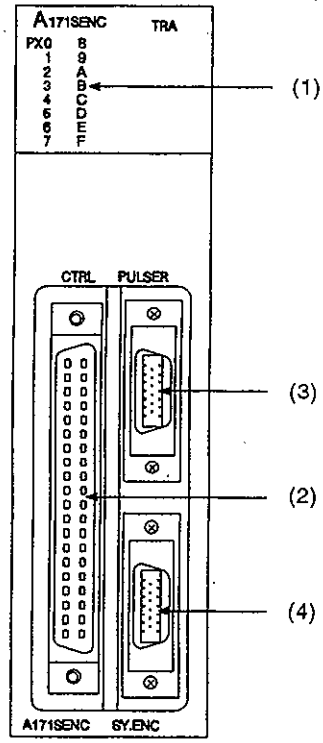
The A171SENC specifications are shown in Table 5.1.

Table 5.1 A171SENC Specifications

Item		Specification
Motion control signal input, tracking input	No. inputs	Motion control signals : 16 points (4 points each for upper limit switch, lower limit switch, STOP input, near-zero point input) Tracking : 1 point Total : 17 points
	Rated input voltage	5/24 VDC
	Rated input current	5 VDC: 2 mA 24 VDC: 8 mA
	Operating voltage range	4.5 VDC to 26.4 VDC
	ON voltage/current	3.8 VDC min./1.0 mA min.
	OFF voltage/current	1.2 VDC max./0.2 mA max.
	Response time	OFF→ON: 1.5 ms max. ON→OFF: 3 ms max.
Brake output	No. outputs	1 point
	Rated load voltage	24 VDC
	Operating load voltage range	21.6 VDC to 30 VDC (peak voltage 30 VDC)
	Maximum load current	0.1 A (max. rush current: 0.4 A, 10 ms max.)
	Response time	OFF→ON: 2 ms max. ON→OFF: 2 ms max.
Manual pulse generator input	No. of modules	1
	H voltage	3.0 V to 5.25 V
	L voltage	0 V to 1.0 V
	Inputtable frequency	10 kpps max.
	Applicable types	Voltage-output type (5 VDC), recommended product: MR-HDP01 Differential-output type: 26LS31, or equivalent Select by connector wiring.
Synchronous encoder input	No. of modules	1
	Applicable types	MR-HENC
	Position detection method	Absolute
	Resolution	16384 pulse/rev.

5.2 Description of Parts





No.	Description	Application
(1)	Indicators	Display the input status from external equipment and errors detected by self-diagnosis. **LED** / **Description** PX0 to PXF: Indicators to display the motion control signal input status of each axis. TRA: Input start signal from synchronous encoder.
(2)	CTRL connector	Connector for motion control signal input and tracking signal input of each axis.
(3)	PULSER connector	Manual pulse generator input connector.
(4)	SY.ENC connector	Synchronous encoder input connector.

5.3 CTRL Connector

(1) CTRL connector pin allocation
The A171SENC CTRL connector pin allocation seen from the front is shown below.

CTRL connector

Pin No.	Signal Name	Pin No.	Signal Name
A1	BRK.COM	B1	COM
A2	BRK	B2	COM
A3	Vacant	B3	Vacant
A4	Vacant	B4	TRA
A5	Not for use by user	B5	PXF
A6		B6	PXE
A7		B7	PXD
A8		B8	PXC
A9		B9	PXB
A10		B10	PXA
A11		B11	PX9
A12		B12	PX8
A13		B13	PX7
A14		B14	PX6
A15		B15	PX5
A16		B16	PX4
A17		B17	PX3
A18		B18	PX2
A19		B19	PX1
A20		B20	PX0

External input signal name SV13/22

DOG/CHANGE	4	STOP	4
STOP		DOG	
RLS		RLS	
FLS		FLS	
DOG/CHANGE	3	STOP	3
STOP		DOG	
RLS		RLS	
FLS		FLS	
DOG/CHANGE	2	STOP	2
STOP		DOG	
RLS		RLS	
FLS		FLS	
DOG/CHANGE	1	STOP	1
STOP		DOG	
RLS		RLS	
FLS		FLS	

Applicable connector model name..... FCN-361J040-A0 connector (manufactured by Fujitsu)
FCN-360C040-B connector cover
} Standard accessories

(2) Interface with external equipment
The interface between the CTRL connector and external equipment is shown in Table 5.2.

Table 5.2 Interface between CTRL Connector and External Equipment

Input or Output	Signal Name	Pin Number (CTRL Connector)				Wiring Example	Internal Circuit	Specification	Description
Input	PX0, PX4, PX8, PXC	B20	B16	B12	B8	Motion control signal	3.3kΩ	• Supply voltage 5 to 24 VDC (4.5 to 26.4 VDC, stabilized power supply) • HIGH level 3.8 VDC min./1.0 mA min. • LOW level 1.2 VDC max./0.2 mA max.	Motion control signal
	PX1, PX5, PX9, PXD	B19	B15	B11	B7	Motion control signal	3.3kΩ		
	PX2, PX6, PXA, PXE	B18	B14	B10	B6	Motion control signal	3.3kΩ		
	PX3, PX7, PXB, PXF	B17	B13	B9	B5	Motion control signal	3.3kΩ		
	Tracking enable	B4				TRA signal	3.3kΩ		Tracking enable signal input. • Generates interrupts to A171SCPU. • Starts counter operation.
	Power	B1 B2				5 VDC to 24 VDC			Common terminals for motion control signals and TRA.
Output	Brake	A1 A2				24 VDC		Rated load voltage 24 VDC (21.6 to 30 VDC), 0.1 mA max.	Brake signal output

5.4 PULSER Connector

(1) PULSER connector pin allocation
The A171SENC PULSER connector pin allocation, seen from the front, is shown below.

PULSER connector

	Pin No.	Signal Name	Pin No.	Signal Name	
	1	SG	11	SG	
	2	Vacant	12	Vacant	
	3	HZ1	13	Vacant	
*2	4	HA1	14	HB1	*2
	5	SG	15	SG	
	6	P5	16	P5	
*3	7	HA2P	17	HA2N	*3
	8	HB2P	18	HB2N	
	9	HZ2P	19	HZ2N	
	10	Vacant	20	HPSEL	*1

Applicable connector model names

10120-3000VE connector

10120-52F0-008 connector cover

(Manufactured by Sumitomo 3M)

*1 Inputs from manual pulse generator switched by HPSEL. Unconnected selects voltage-output type, HPSEL=SG selects differential-output type.

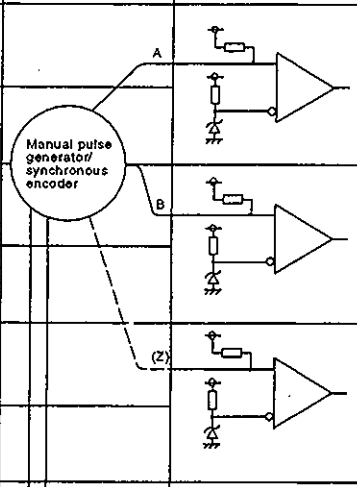
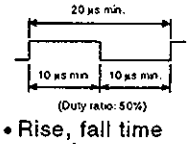
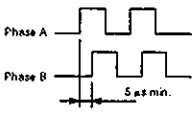
*2, *3 Connect the manual pulse generator connector cable wires according to the output type of the manual pulse generator, as described below.

*2 Voltage-output type
Connect the A-phase signal to Pin 4 (HA1) and the B-phase signal to Pin 14 (HB1).

*3 Differential-output type
Connect the A-phase signal to Pin 7 (HA2P) and the A-phase inverse signal to Pin 17 (HA2N), the B-phase signal to Pin 8 (HB2P) and the B-phase inverse signal to Pin 18 (HB2N).

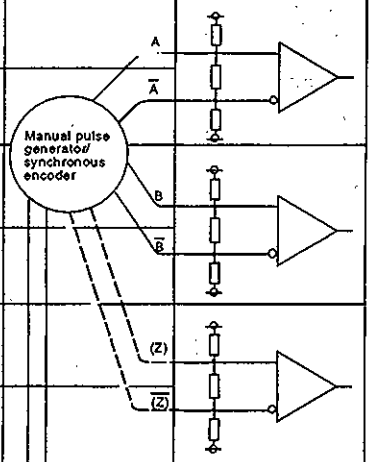
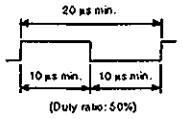
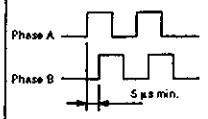
(2) Interface with external equipment
The interface between the PULSER connector and external equipment is shown in Tables 5.3 and 5.4.

Table 5.3 Interface between PULSER Connector and Voltage-output Manual Pulse Generator/Synchronous Encoder

Input or Output	Signal Name		Pin No. PULSER Connector Voltage-Output Type	Wiring Example	Internal Circuit	Specification	Description
Input	Manual pulse generator, phase A	A+	4			• Rated input voltage 5.5 VDC max. • HIGH level 3 VDC to 5.25 VDC/3 mA • LOW level 1 VDC max./ 0.3 mA	To connect manual pulse generator phases A, B • Pulse width  • Rise, fall time .... 1µs max. • Phase difference  (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
	Manual pulse generator, phase A	A-					
	Manual pulse generator, phase B	B+	14				
	Manual pulse generator, phase B	B-					
	*1 Manual pulse generator, phase Z	Z+	3				
	*1 Manual pulse generator, phase Z	Z-					
	P5		6 16				
	SG		1 5 11 15				

*1 Do not connect for manual pulse generator operation.
Connect for synchronous encoder operation only.

Table 5.4 Interface between PULSER Connector and Differential-Output Manual Pulse Generator/Synchronous Encoder

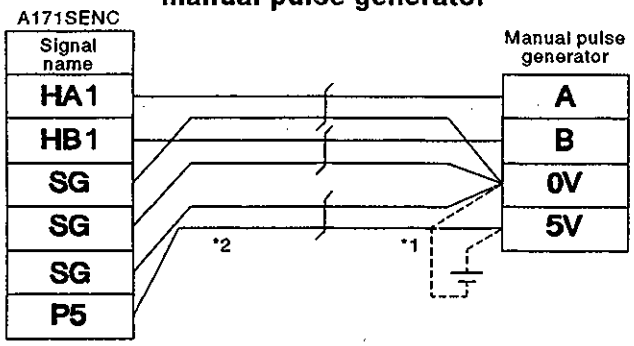
Input or Output	Signal Name		Pin No. PULSER Connector Voltage-Output Type	Wiring Example	Internal Circuit	Specification	Description
Input	Manual pulse generator, phase A	A+	7			• Rated input voltage 5.5 VDC max. • HIGH level 3 VDC to 5.25 VDC/3 mA • LOW level 1 VDC max./ 0.3 mA	To connect manual pulse generator phases A, B • Pulse width  • Rise, fall time .... 1µs max. • Phase difference  (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
		A-	17				
	Manual pulse generator, phase B	B+	8				
		B-	18				
	*1 Manual pulse generator, phase Z	Z+	9				
		Z-	19				
	P5		6 16				
	SG		1 5 11 15				

*1 Do not connect for manual pulse generator operation. Connect for synchronous encoder operation only.

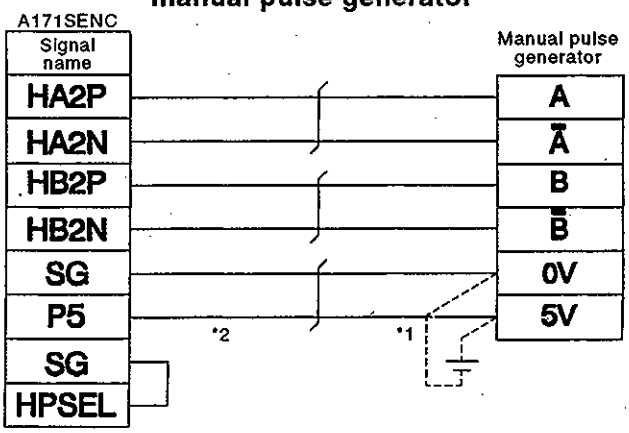
(3) Connection examples

Examples of connections of the PULSER connector to external equipment are shown below.

Connection of voltage-output manual pulse generator



Connection of differential-output manual pulse generator



⚠ CAUTION
⚠ *1 : The 5 VDC power supply from the A171SENC must not be connected if a separate power supply is used as the manual pulse generator power supply.
⚠ *1 : 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.
⚠ *2 : Total connector cable length not to exceed 30 m (98.4 ft.)

5.5 Connection to MR-HENC Serial Absolute-Value Synchronous Encoder

(1) SY.ENC connector pin allocation
The A171SENC SY.ENC connector pin allocation seen from the front is shown below.

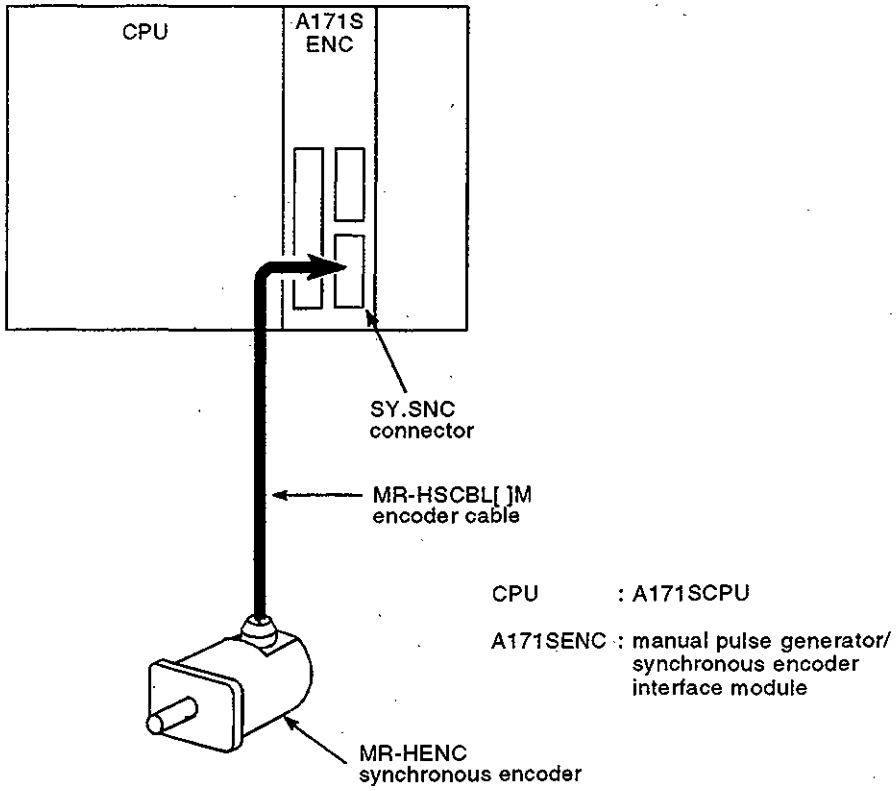
SY.ENC connector

Pin No.	Signal Name	Pin No.	Signal Name
10	Vacant	20	SD
9	Vacant	19	Vacant
8	P5	18	Vacant
7	P5	17	SG
6	Vacant	16	P5
5	Vacant	15	SG
4	MR	14	BAT
3	MRR	13	MDR
2	SG	12	MD
1	SG	11	Vacant

(2) Interface with external equipment
The interface between the SY.ENC connector and external equipment is described below.

(a) Wiring precautions

1) Tighten the screws after connecting the connector.



5. MANUAL PULSE GENERATOR/SYNCHRONOUS ENCODER INTERFACE MODULE

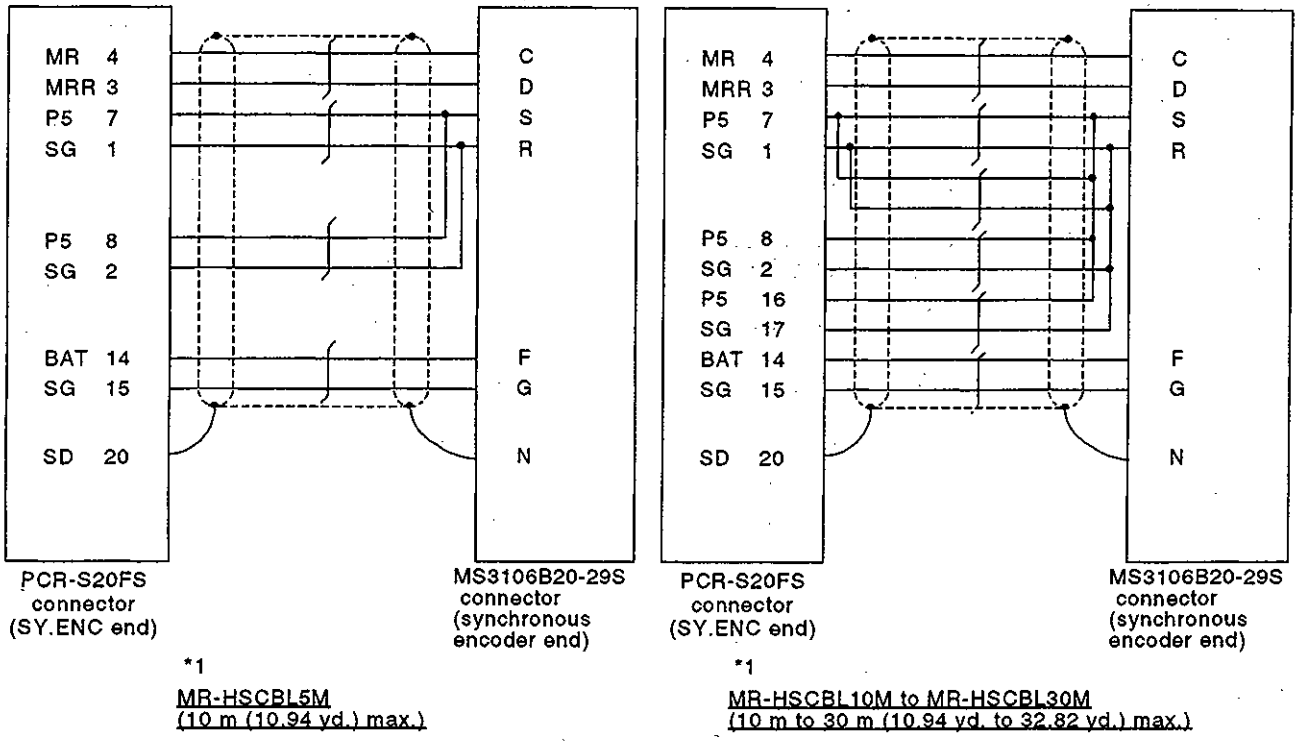
⚠ CAUTION

⚠ Connect the SY.ENC connector 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.

(b) Details of encoder cable connections



*1 : Encoder cables are the same as HA-SH/HA-LH series motor cables.

(c) Interface of SY.ENC connector to external equipment

Table 5.5 Interface between SY.ENC Connector and External Equipment

Input or Output	Signal Name	Pin No. SY.ENC Connector	Wiring Example	Internal Circuit	Specification	Description
Input	MR	4	Serial synchronous encoder		• Transmission method: serial communications • Position detection method: absolute	
	MRR	3				
	P5	7 8 16 *1				
	SG	1 2 15 17 *1				
	BAT	14				
	SD	20				

*1 : Connect when using MR-HSCBL10M to MR-HSCBL30M.

6. A171SCPU INTERNAL POWER SUPPLY

6.1 A171SCPU Internal Power Supply

The A171SCPU incorporates an internal servomotor drive power supply and motion module control power supply. This section describes the specifications of the A171SCPU internal power supply.

6.1.1 Specifications

The specifications of the A171SCPU internal power supply are shown in Table 6.1.

Table 6.1 Power Supply Specifications

Item		Specifications
Mounting position in base		A171SCPU mounting slot
Input power supply		100-120 VAC $^{+10\%}_{-15\%}$ (85 to 132 VAC)
		200-240 VAC $^{+10\%}_{-15\%}$ (170 to 264 VAC)
Input frequency		50/60 Hz ±3 Hz
Max. apparent input power		105 VA
Rush current		20 A 8 ms max.
Rated output current	5 VDC	3 A
	24 VDC ±10%	0.6 A
*1 Overcurrent protection	5 VDC	3.3 A min.
	24 VDC	0.66 A min.
*2 Overvoltage protection	5 VDC	5.5 to 6.5 V
	24 VDC	———
Efficiency		65% min.
Power indicator		LED indicator
Terminal screw size		M3.5 x 7
Applicable power cable size		0.3 to 2 mm^2
Applicable solderless terminal		1.25-3.5 V1.25-YS3A 2-3.5 2-YS3A V1.25-M3 V2-YS3A V2-S3 V2-YS3A
Applicable tightening torque		59 to 88N (6 to 9 kg•cm)
External dimensions mm(inch)		130 x 110 x 110 (5.12 x 4.33 x 4.33)
Weight kg(lb)		0.55 (1.21)
Permissible instantaneous power interruption time		20 ms max.

6. A171SCPU INTERNAL POWER SUPPLY

POINTS

*1 : Overcurrent protection

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 A171SCPU indicator display.
After overcurrent protection operates, start up the system after eliminating the cause, such as insufficient current capacity or short circuit.
The system initial start commences when the current returns to the normal level.

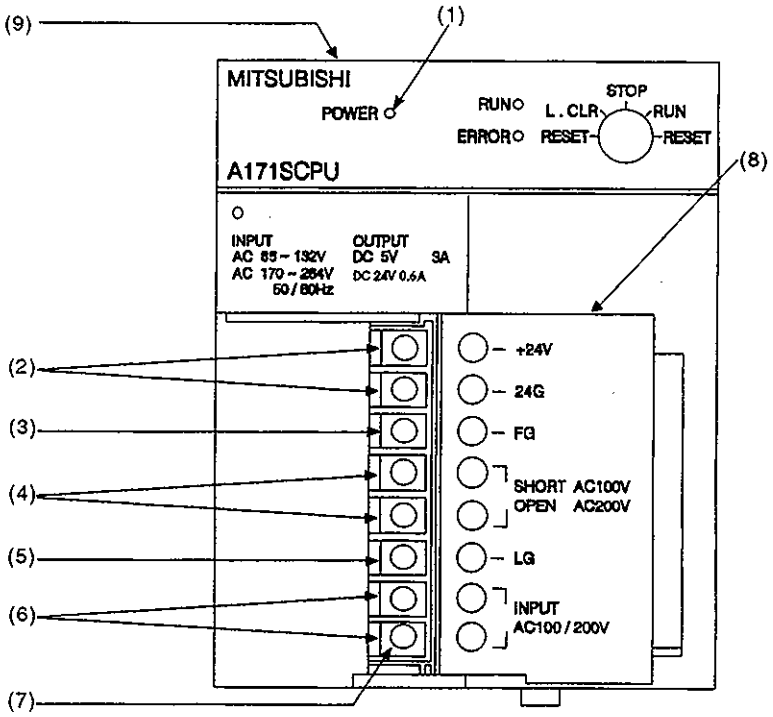
*2 : Overvoltage protection

When an overvoltage of 5.5 V to 6.5 V is applied to a 5 VDC circuit, the overvoltage protection device breaks the circuit and stops the system. The A171SCPU indicator goes out.
To restart the system, switch the input power supply off, and then turn it back on. The system initial start commences.
If the system does not start up and the indicator display remains off, the A171SCPU must be changed.

6.1.2 Names and settings of parts

This section describes the names and settings of the A171SCPU power supply parts.

(1) Names of parts



No.	Name	Application
(1)	POWER indicator	Display indicator for 5 VDC power supply.
(2)	24VDC, 24GDC terminals	Supplies output modules which require 24 VDC internally (supplied through external wiring).
(3)	FG terminal	A grounding terminal connected with the shielding pattern on the printed circuit board.
(4)	Operating voltage select terminals	Terminals to select 100 VAC or 200 VAC operation with a jumper. Short the terminals with the jumper supplied if 100 VAC is input, or leave the terminals open if 200 VAC is supplied.
(5)	LG terminal	Ground for power supply filter, with half the electrical potential of the input voltage.
(6)	Power supply input terminals	Connect the 100 VAC or 200 VAC power supply to the power supply input terminals.
(7)	Terminal screws	M 3.5 x 7
(8)	Terminal cover	A cover to protect the terminal block.
(9)	Module fixing screws	Screws to fix the module to the base unit.

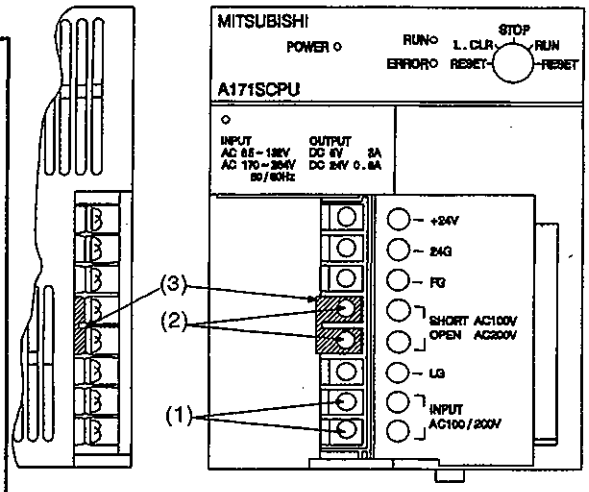
(2) Setting the supply voltage

According to what voltage is supplied to the A171SCPU power supply, short or leave open the operating voltage select terminals.
The setting method is described below.

Open the terminal cover.

Short or leave open the operating voltage select terminals (2) according to the voltage supplied at the input terminals (1).

- Short the operating voltage select terminals (2) with the jumper (3) supplied if the supply voltage is 100 VAC.
- Do not short the operating voltage select terminals (2) if the supply voltage is 200 VAC.



(Set the jumper if 100 VAC is supplied.)

⚠ 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 (operating voltage select terminals shorted)	———	Destruction of A171SCPU power supply.
Set to 200 VAC (operating voltage select terminals open)	No abnormality in the module, but CPU does not operate	———

6. A171SCPU INTERNAL POWER SUPPLY

6.2 Extension Base Power Supply Module

This section describes the extension base power supply module specifications and how to select an extension base power supply module.

6.2.1 Power supply module specifications

The specifications of the power supply module are shown in Table 6.2.

Table 6.2 Power Supply Module Specifications

Item		Specifications	
		A1S61P	A1S62P
Mounting position in base		Power supply module mounting slot	
Input power supply		100-120 VAC $^{+10\%}_{-15\%}$ (85 to 132 VAC)	
		200-240 VAC $^{+10\%}_{-15\%}$ (170 to 264 VAC)	
Input frequency		50/60 Hz ±3 Hz	
Max. apparent input power		105 VA	
Rush current		20 A 8 ms max.	
Rated output current	5 VDC	5 A	3 A
	24 VDC ±10%		0.6 A
*1 Overcurrent protection	5V DC	5.5 A min.	3.3 A min.
	24 VDC		0.66 A min.
*2 Overvoltage protection	5 VDC	5.5 to 6.5 V	5.5 to 6.5 V
	24 VDC		———
Efficiency		65 % min.	
Power indicator		LED indicator	
Terminal screw size		M3.5 x 7	
Applicable power cable size		0.3 to 2 mm^2	
Applicable solderless terminal		1.25-3.5 V1.25-YS3A 2-3.5 2-YS3A V1.25-M3 V2-YS3A V2-S3 V2-YS3A	
Applicable tightening torque		59 to 88N (6 to 9 kg•cm)	
External dimensions mm(inch)		130 x 55 x 94 (5.12 x 2.17 x 3.7)	
Weight kg(lb)		0.53 (1.17)	0.55 (1.21)
Permissible instantaneous power interruption time		20 ms max.	

6. A171SCPU INTERNAL POWER SUPPLY

POINTS

*1 : Overcurrent protection

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

*2 : Overvoltage protection

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

6.2.2 Handling precautions

This section describes handling precautions for the power supply module between opening the packaging and installation.

(1) The power supply module casing, terminal connectors, and pin connectors are made of plastic. Take care not to drop the module or subject it to strong shock.

(2) Do not remove the printed circuit boards from the casing. This will cause faults.

(3) Ensure no wiring waste or other foreign matter enters the top of the module during wiring operations. Remove any foreign matter that does enter the module.

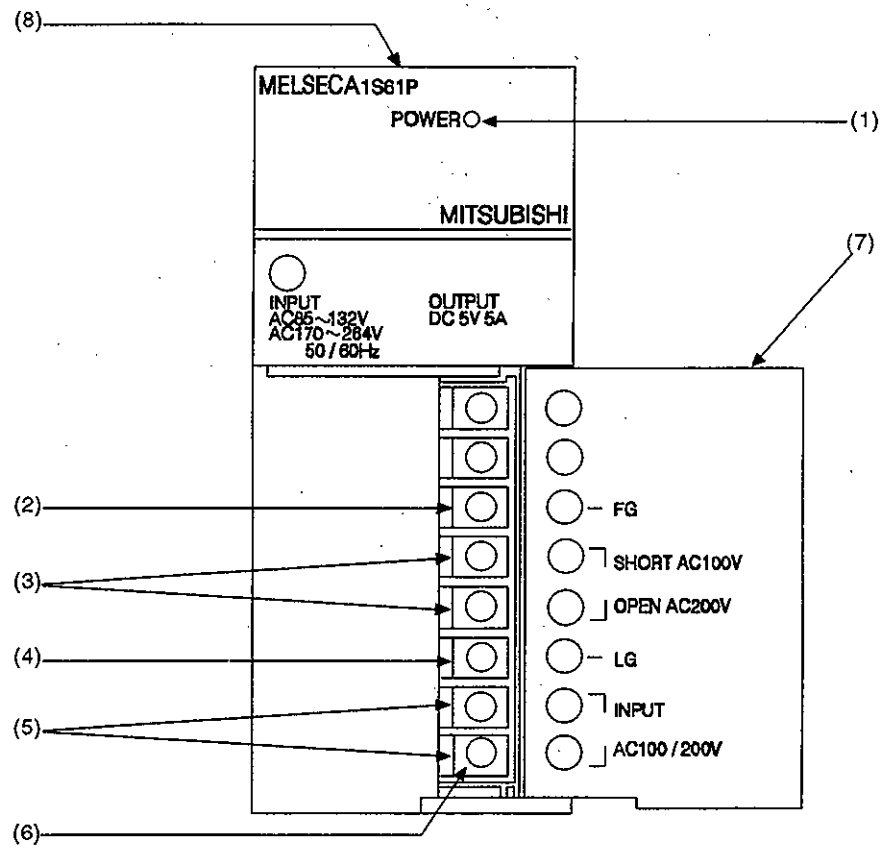
(4) Ensure that module mounting screws and terminal screws are tightened within the prescribed torque ranges.

Screw Name	Tightening Torque Range (N•cm [kg•cm](lb•ft))
Module mounting screw (M3.5)	58 to 88 [6 to 9] (5.2 to 7.79)
Terminal block, terminal screw (M4)	78 to 118 [8 to 12] (6.93 to 10.39)

6.2.3 Names and settings of parts

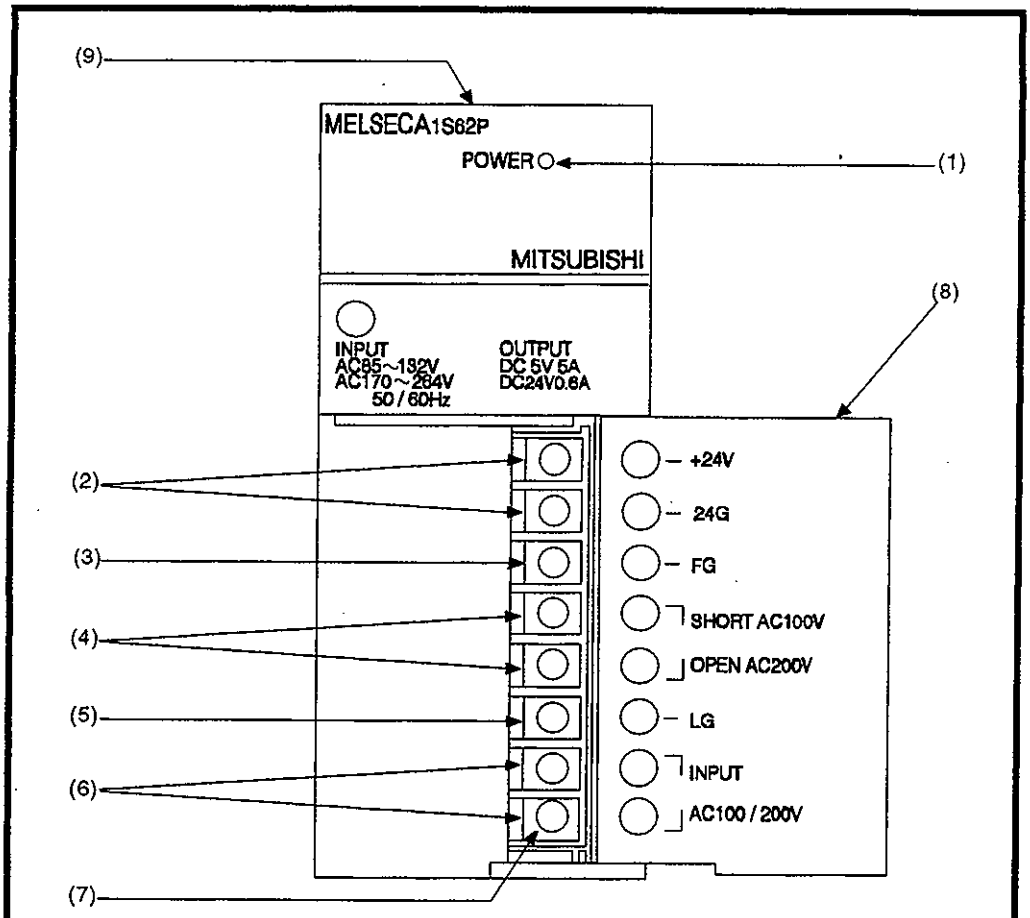
This section describes the names and settings of the power supply module parts.

(1) A1S61P power supply module names of parts



No.	Name	Application
(1)	POWER indicator	Display indicator for 5 VDC power supply.
(2)	FG terminal	A grounding terminal connected with the shielding pattern on the printed circuit board.
(3)	Operating voltage select terminals	Terminals to select 100 VAC or 200 VAC operation with a jumper. Short the terminals with the jumper supplied if 100 VAC is input, or leave the terminals open if 200 VAC is supplied.
(4)	LG terminal	Ground for power supply filter, with 1/2 the electrical potential of the input voltage.
(5)	Power supply input terminals	Connect the 100 VAC or 200 VAC power supply to the power supply input terminals.
(6)	Terminal screws	M 3.5 x 7
(7)	Terminal cover	A cover to protect the terminal block.
(8)	Module fixing screws	Screws to fix the module to the base unit.

(2) A1S62P power supply module names of parts



No.	Name	Application
(1)	POWER indicator	Display indicator for 5 VDC power supply.
(2)	24VDC, 24GDC terminals	Supplies output modules which require 24 V internally (supplied through external wiring).
(3)	FG terminal	A grounding terminal connected with the shielding pattern on the printed circuit board.
(4)	Operating voltage select terminals	Terminals to select 100 VAC or 200 VAC operation with a jumper. Short the terminals with the jumper supplied if 100 VAC is input, or leave the terminals open if 200 VAC is supplied.
(5)	LG terminal	Ground for power supply filter, with 1/2 the electrical potential of the input voltage.
(6)	Power supply input terminals	Connect the 100 VAC or 200 VAC power supply to the power supply input terminals.
(7)	Terminal screws	M 3.5 x 7
(8)	Terminal cover	A cover to protect the terminal block.
(9)	Module fixing screws	Screws to fix the module to the base unit.

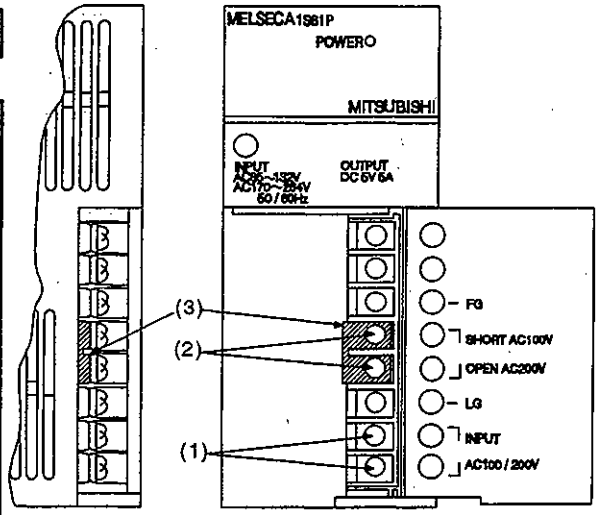
(3) Setting the supply voltage

According to what voltage is supplied to the A1S61P or A1S62P power supply module, short or leave open the operating voltage select terminals. The setting method is described below.

Open the terminal cover.

Short or leave open the operating voltage select terminals (2) according to the voltage supplied at the input terminals (1).

- Short the operating voltage select terminals (2) with the jumper (3) supplied if the supply voltage is 100 VAC.
- Do not short the operating voltage select terminals (2) if the supply voltage is 200 VAC.



Set the jumper if 100 VAC is supplied.

⚠ 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 (operating voltage select terminals shorted)	———	Destruction of power supply module (no abnormality in CPU).
Set to 200 VAC (operating voltage select terminals open)	No abnormality in the module, but CPU does not operate	———

7. BASE UNITS AND EXTENSION CABLES

7.1 Specifications

This section describes the specifications of the base units (main base unit and extension base unit) and extension cables which can be used with the system, and operation standards for using an extension base unit.

7.1.1 Base unit specifications

(1) Main base unit specifications

Table 7.1 Table of Main Base Unit Specifications

Item \ Model Name	A172B	A178B (S1)
Max. I/O modules mountable	2 modules	8 modules
Extension connections	OK	
Mounting hole size	φ6 dia. slot (for M5 screw)	
External dimensions mm(inch)	222 x 130 x 28 (8.66 x 5.12 x 1.1)	430 x 130 x 28 (10.93 x 5.12 x 1.1)
Weight kg(lb)	0.51 (1.12)	0.97 (2.14)
Accessories	Mounting screws M5 x 25, 4	

POINT

When configuring the system, select the motion module and MELSEC-A series input/output moudles so that the total 5 VDC current consumption of the motion modules, MILSEC-A series input/output modules, synchronous encoders and manual pulse generators connected to the main base unit does not exceed 3 A.

(2) Extension base unit specifications

Table 7.2 Table of Extension Base Unit Specifications

Item \ Model Name	A1S65B	A1S38B
Max. I/O modules mountable	5 modules	8 modules
Power supply module	Must be mounted	
Mounting hole size	φ6 dia. slot (for M5 screw)	
External dimensions mm(inch)	315 x 130 x 28 (12.4 x 5.12 x 1.1)	420 x 130 x 28 (16.54 x 12 x 1.1)
Weight kg(lb)	0.17 (1.56)	0.95 (2.09)
Accessories	Mounting screws M5 x 25, 4	

7.1.2 Specifications of extension cable

The specifications for extension cables which can be used with the A171SCPU system are shown in Table 7.3.

Table 7.3 Table of Extension Cable Specifications

Item / Model Name	A1SC01B	A1SC03B	A1SC12B	A1SC30B
Cable length m (inch)	0.055 (2.17)	0.33 (12.99)	1.2 (47.24)	3.0 (118.11)
Resistance of 5 VDC supply line (Ωat 55C°)	0.02	0.021	0.055	0.121
Application	Connecting main base unit to extension base unit			
Weight kg (lb)	0.025 (0.06)	0.10 (0.22)	0.20 (0.44)	0.4 (0.48)

7. BASE UNITS AND EXTENSION CABLES

7.2 Handling

This section describes the cautions on handling from unpacking to mounting the base unit, the names and setting of parts.

7.2.1 Handling precautions

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

⚠ CAUTION

⚠ The base unit casing, teminal 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.

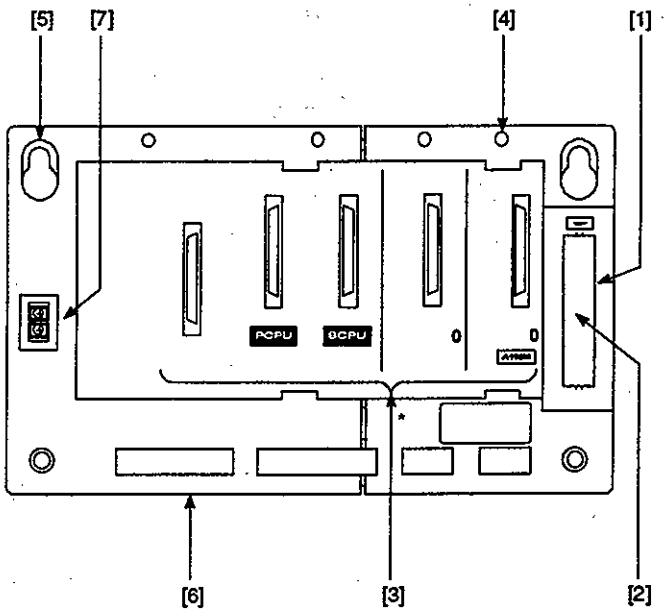
⚠ Do not stand on the unit, or rest heavy objects on the unit.

⚠ The unit must be installed in the correct orientation.

7.2.2 Names of parts

This section describes the names of the base unit parts.

(1) Main base unit (A172B, A178B (S1))

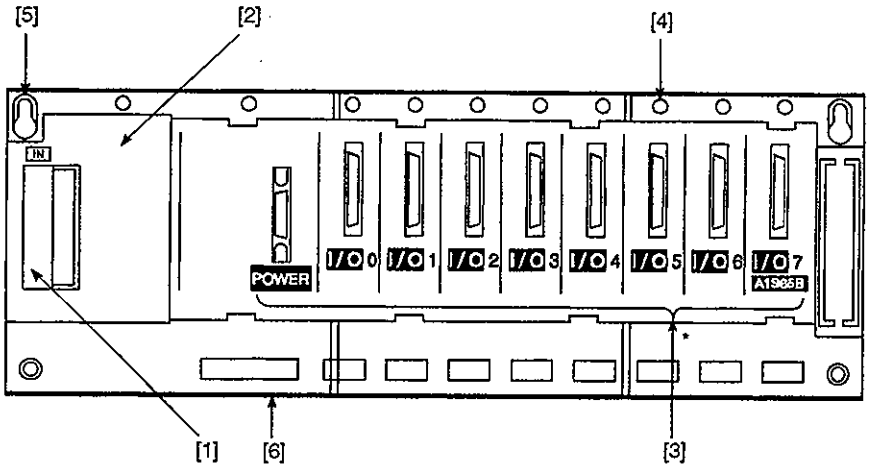


No.	Name	Application
[1]	Extension cable connector	Connects to the signal communications connector on the extension base unit with the extension cable.
[2]	Base cover	A cover for protecting the extension cable connector. When connecting to an extension base unit, cut out the area surrounded by the groove under the word "OUT" on the base cover with side cutters, or some other tool.
[3]	Module connector	Connectors to mount the CPU module, I/O modules, and special-function modules. Install the supplied connector cover or blank cover (A1SG60) to prevent dust penetrating empty connector spaces.
[4]	Unit fixing screw	Screws to fix the unit to the base. Screw size M4 x 12.
[5]	Base mounting hole	Slots for mounting the base unit onto the control board panel (for M5 screws)
[6]	DIN rail hooks	Hooks to attach to the DIN rail. A172B .....1 A178B (S1).....2
[7]	Emergency stop terminal	Terminal block to apply servomotor emergency stop.

⚠ CAUTION

⚠ Install the supplied blind cap or blank cover (A1SG60) to prevent dust penetrating the empty connector spaces. Failure to do so can cause malfunctioning.*

(2) Extension base unit (A1S65B, AIS68B)



No.	Name	Application
[1]	Extension cable connector	Connects to the signal communications connector on the main base unit with the extension cable. Remove the connector cover before connecting the extension cable.
[2]	Base cover	A cover for protecting the extension cable connector.
[3]	Module connector	Connectors to mount the power supply module, I/O modules, and
[4]	Unit fixing screw	Screws to fix the unit to the base. Screw size M4 x 12.
[5]	Base mounting hole	Slots for mounting the base unit onto the control board panel (for M5 screws)
[6]	DIN rail hooks	Hooks to attach to the DIN rail. A1S65B, AIS68B ... 2

⚠ CAUTION

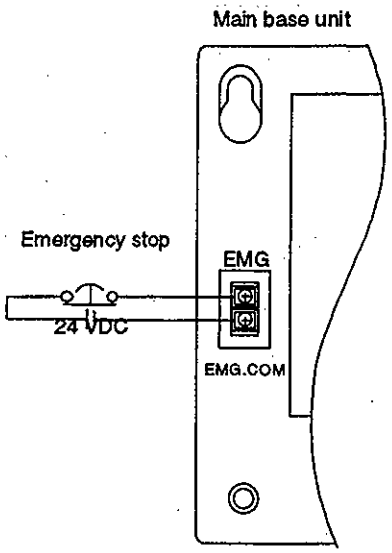
⚠ Install the supplied blind cap or blank cover (A1SG60) to prevent dust penetrating the empty connector spaces. Failure to do so can cause malfunctioning.*

7.2.3 Emergency stop method

(1) By opening the main base unit emergency stop (EMG) circuit, it is possible to effect an emergency stop all axes of the separate servo amplifiers (MR-H-B/MR-J-B/MR-J2-B) simultaneously.

After an emergency stop, eliminate the cause of the emergency stop and reset the emergency stop by closing the emergency stop circuit (turning EMG circuit ON). (In the event of an emergency stop, the sevo error detection signal does not come ON.)

An example of emergency stop wiring connections is shown below.



(2) Do not use the emergency stop terminals of the separate servo amplifiers.
If an independent emergency stop circuit is also required at a separate servo amplifier, provide an external circuit that shuts off the power supply to the separate servo amplifier.

7.2.4 DIN rail

The main base unit and extension base unit are fitted with DIN rail mounting hooks as standard.

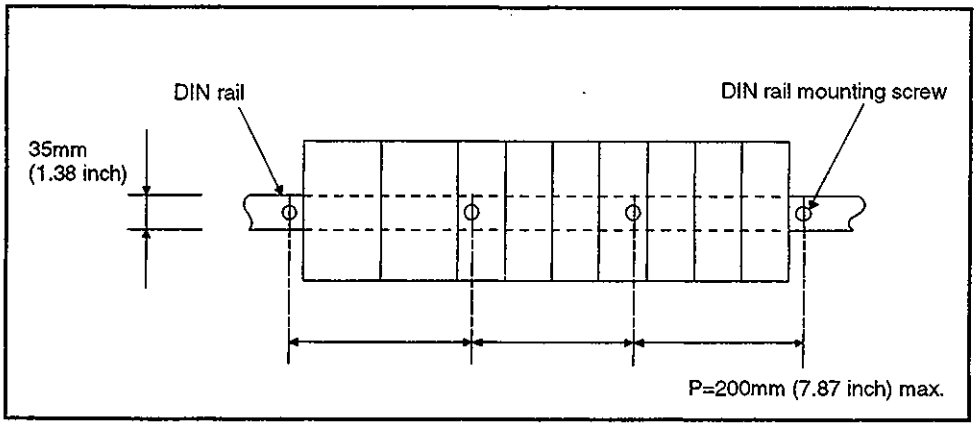
This section describes the method for mounting the DIN rail.

(1) Applicable DIN rail models (JIS-C2B12)

TH35-7.5Fe
TH35-7.5Al
TH35-15Fe

(2) Spacing of DIN rail mounting screws

If a TH35-7.5Fe or TH35-7.5Al DIN rail is used, insert screws at a pitch of 200 mm (7.87 inch) max. to reinforce the rail mounting.



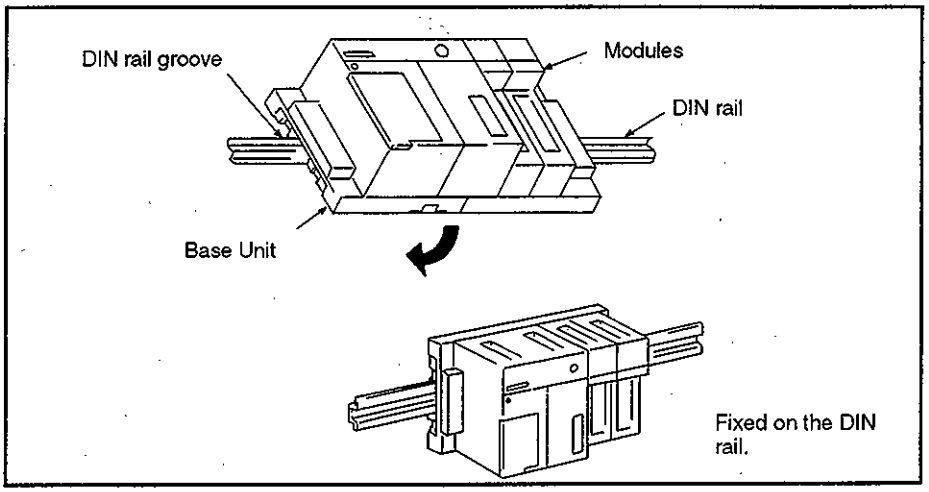
(3) Mounting units to, and removing them from, the DIN rail

(a) Mounting to DIN rail

The procedure to mount a base unit on the DIN rail is described below.

1) Engage the top of the base unit DIN rail groove with the top of the DIN rail.

2) Push the base unit toward the DIN rail to fasten it.

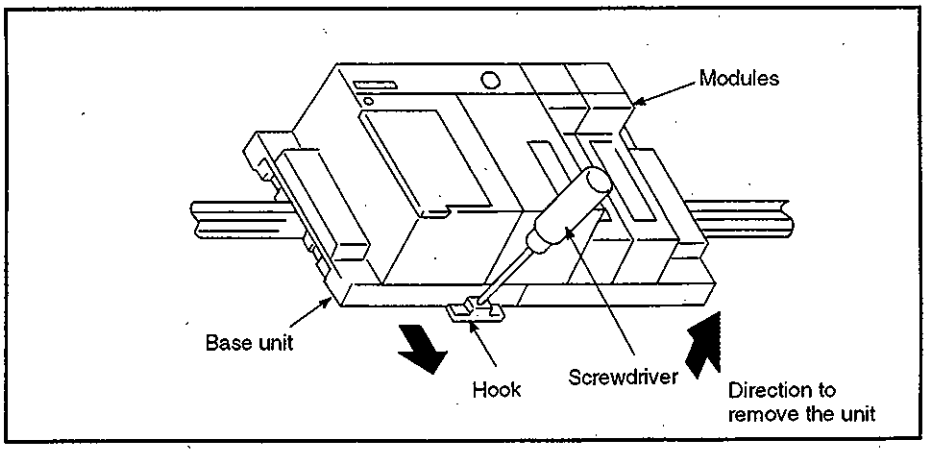


(b) Removing from DIN rail

The procedure to remove a base unit from the DIN rail is described below.

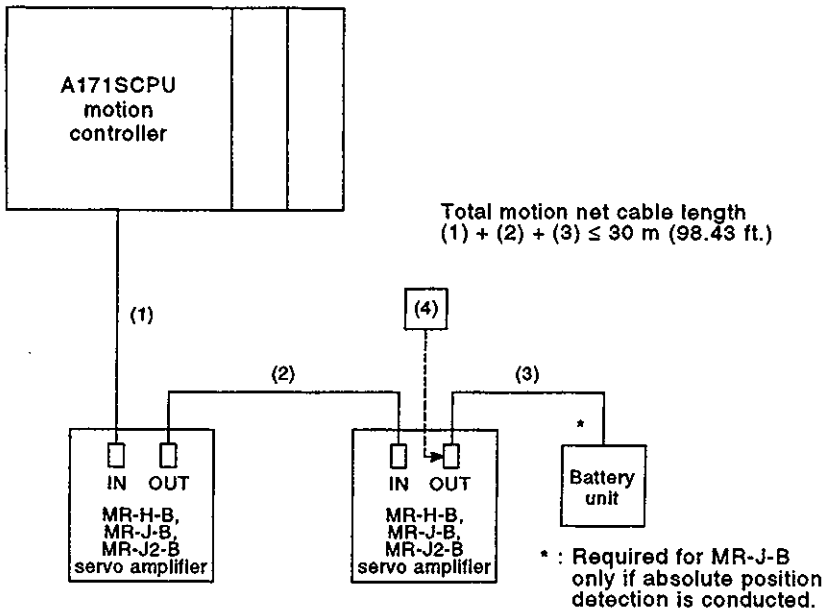
1) Use a flat screwdriver (6 x 100) to push down the hook under the base unit.

2) Pull the unit forward while pushing the hook down to remove the unit from the DIN rail.



8. MOTION NET CABLE AND TERMINATION RESISTOR SPECIFICATIONS

The specifications of the motion net cables and termination resistors that can be used with the motion controller are descrbed below.



No.	Product Name	Model Name	Description
(1)	Motion net cable	MR-HBUS[ ]M [ ] contains cable length (0.5 m (19.69 in.), 5 m (196.85 in.))	To connect A171SCPU to MR-H-B, MR-J-B servo amplifier
(2)			To connect MR-H-B, MR-J-B servo amplifier to MR-H-B, MR-J-B servo amplifier
(3)			To connect MR-H-B, MR-J-B servo amplifier to MR-JBAT [ ] battery unit
(1)		MR-J2HBUS[ ]M-A The cable length (0.5 m, 1 m, 5 m) is indicated inside the [ ].	For connecting A171SCPU and servo amplifier (MR-J2-B)
(2)			For connecting a servo amplifier (MR-H-B/MR-J-B) and servo amplifier (MR-J2-B)
(3)			For connecting a servo amplifier (MR-J2-B) and battery unit (MR-JBAT[ ])
(2)		MR-J2HBUS[ ]M The cable length (0.5 m, 1 m, 5 m) is indicated inside the [ ].	For connecting a servo amplifier (MR-J2-B) and servo amplifier (MR-J2-B)
(4)	Termination resistor	MR-TM	Connected to last MR-H-B, MR-J-B servo amplifier in motion network. However, not required if a battery unit is connected when using MR-J-B.
		MR-A-TM	Fitted to the last servo amplifier (MR-J2-B) in the motion network. However, there is no need to mount one if MR-J-B is used and a battery unit is connected.

8. MOTION NET CABLE AND TERMINATION RESISTOR SPECIFICATIONS

8.1 Table of Motion Net Cable Specifications

(1) MR-HBUS[ ]M

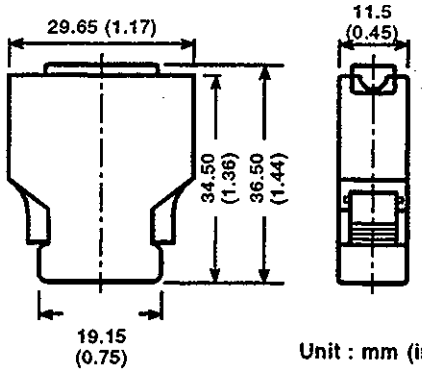
Item \ Model Name	MR-HBUS05M	MR-HBUS5M
Cable length m (inch)	0.5 (19.69)	5 (196.85)

(2) MR-J2HBUS[ ]M (-A)

Item \ Model Name	MR-J2HBUS05M (-A)	MR-J2HBUS1M (-A)	MR-J2HBUS5M (-A)
Cable length m (inch)	0.5 (19.69)	1 (0.39)	5 (196.85)

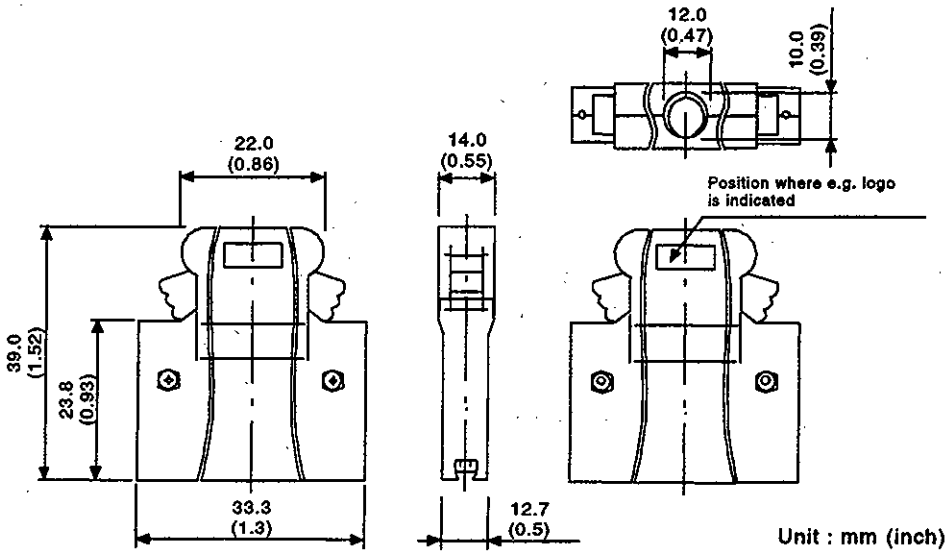
8.2 Termination Resistor External Dimensions

(1) MR-TM



Unit : mm (inch)

(2) MR-A-TM



Unit : mm (inch)

9. BATTERY

This section describes the battery specifications and handling precautions.

9.1 Battery in A171SCPU

9.1.1 Specifications

The specifications of the battery for memory back-up are shown in the table below.

Table 9.1 Battery Specifications

Item \ Model Name	A6BAT
Nominal voltage	3.6 VDC
Battery warranty period	5 years
Total power interruption	The range is as follows. for details, see Section 12.3. Min. 5400 hrs.
Applications	(1) IC-RAM back-up and memory back-up functions (2) Back up for the absolute data of a synchronous encoder
External dimensions mm (inch)	Ø16 (0.63) x 30 (1.18)

9.1.2 Handling

Follow the precautions below when handling batteries.

⚠ CAUTION

⚠ Do not short a battery.

⚠ Do not disassemble a battery.

⚠ Do not burn a battery.

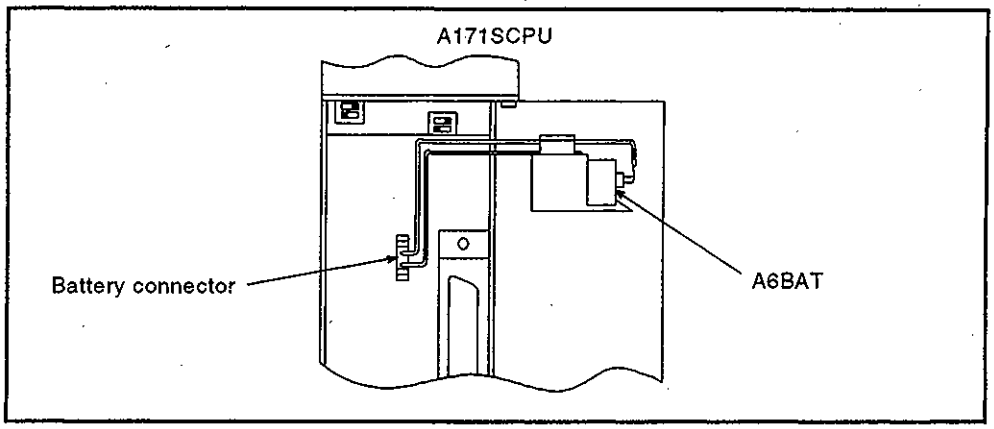
⚠ Do not overheat a battery.

⚠ Do not solder the battery terminals.

9.1.3 Mounting the battery

To reduce battery deterioration during distribution and storage, the leads are not connected during shipment.
Connect the battery lead connector to the battery connector on the A171SCPU printed circuit board when using the A171SCPU as follows:

- using sequence programs in the A171SCPU internal user program area;
- using the power failure holding functions.



9. BATTERY

9.2 Battery Unit

9.2.1 Battery unit life

The following table shows the life of the MR-JBAT[ ][ ] battery unit to back up absolute data for absolute position detection and control with an MR-J-B servo amplifier.

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

9.2.2 Handling

Follow the precautions below when handling the battery unit.

⚠ CAUTION

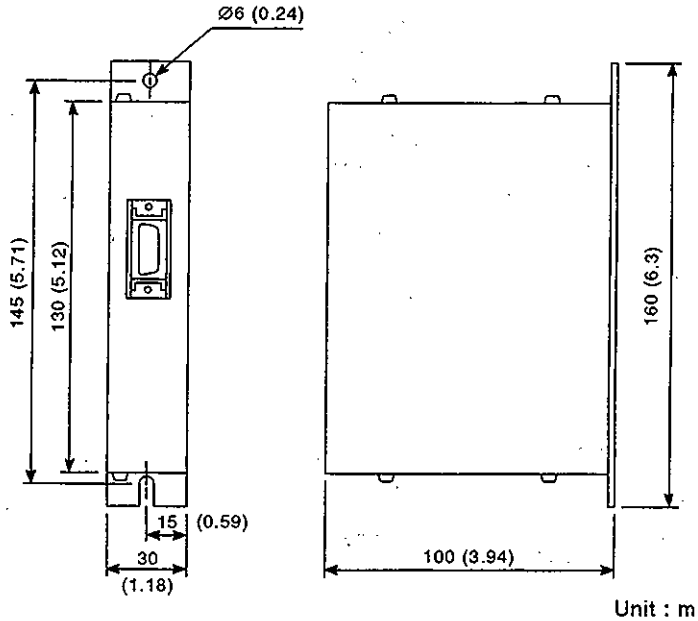
⚠ Do not disassemble the battery unit.

⚠ Do not burn the battery unit.

⚠ Do not overheat a battery.

9.2.3 Battery unit mounting dimension diagram

The battery unit mounting dimensions are shown in the diagram below.
No special requirements apply to the mounting position.



Unit : mm (inch)

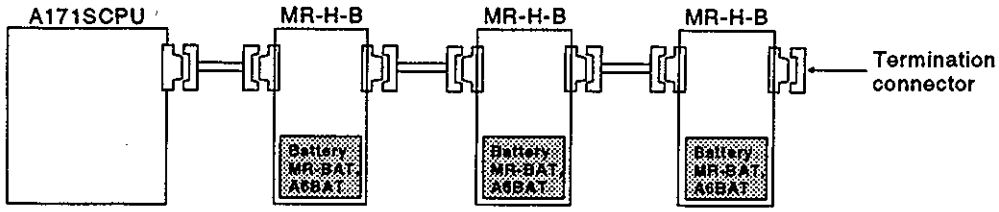
Model Name	Application
MR-JBAT4	for 4 axes max.
MR-JBAT8	for 8 axes max.

Built-in termination resistor

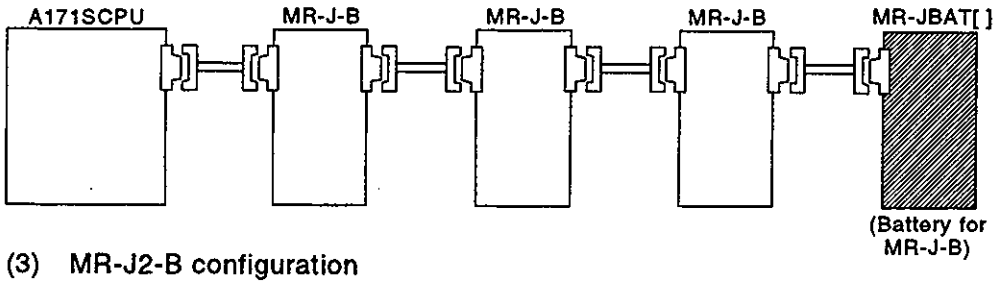
9.3 Battery Unit Connection in an Absolute Position System

This section shows battery unit connection examples using motors with absolute position detectors.

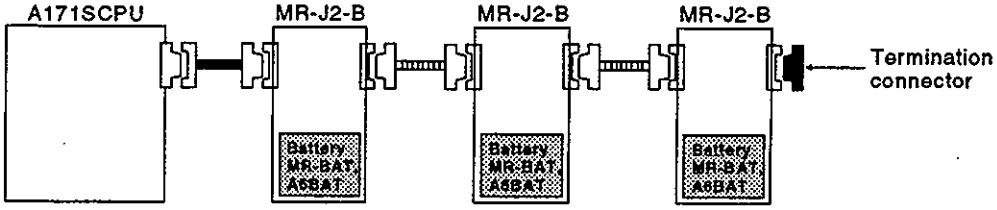
(1) MR-H-B configuration



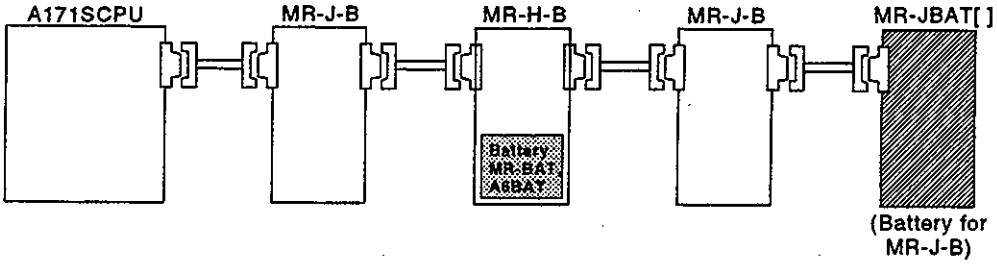
(2) MR-J-B configuration



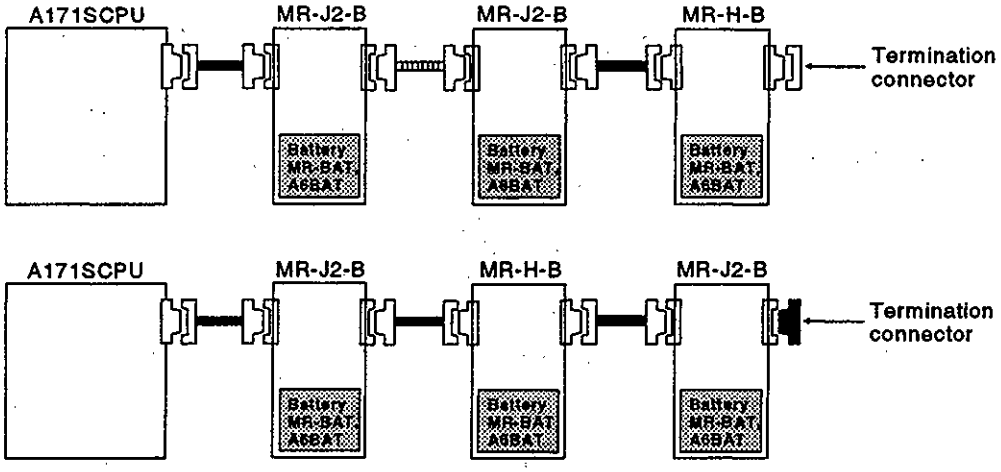
(3) MR-J2-B configuration



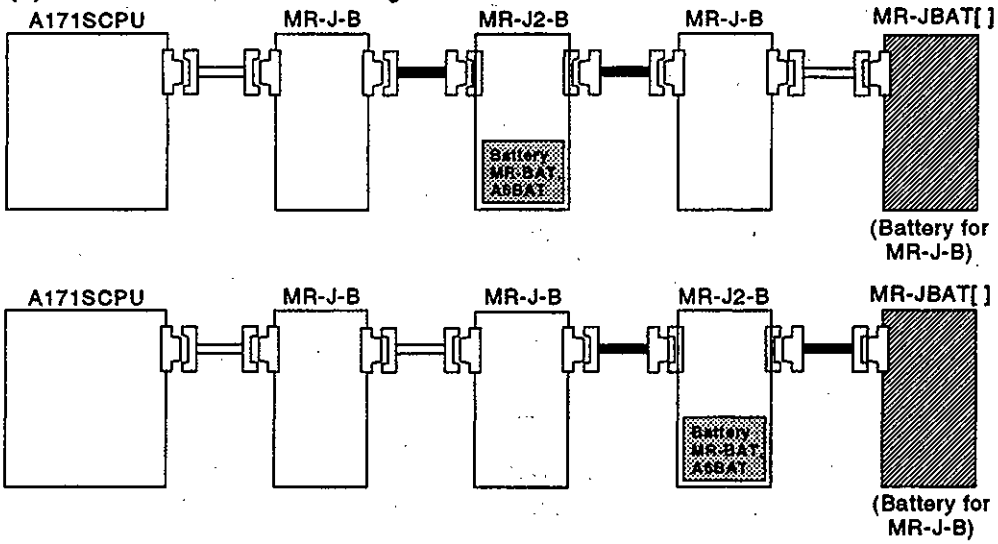
(4) MR-H-B + MR-J-B configuration



(5) MR-J2-B + MR-H-B configuration



(6) MR-J-B + MR-J2-B configuration



10. 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.

10.1 Concept for Fail-Safe Circuits

The lag time and difference in rise times of the A171SCPU power supply and external process power supply (particularly DC) can cause a temporary abnormal process output when the A171SCPU 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 A171SCPU is turned on, the DC output module can issue an abnormal output when the A171SCPU is turned on.

Therefore, a circuit is required to ensure that the A171SCPU turns on first.

Malfunctions are also possible if a fault occurs in the external power supply or if the A171SCPU 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 A171SCPU.

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.

10. MOUNTING AND LOCATION SELECTION

⚠ CAUTION

⚠ 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.

⚠ 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.

10. MOUNTING AND LOCATION SELECTION

⚠ CAUTION

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

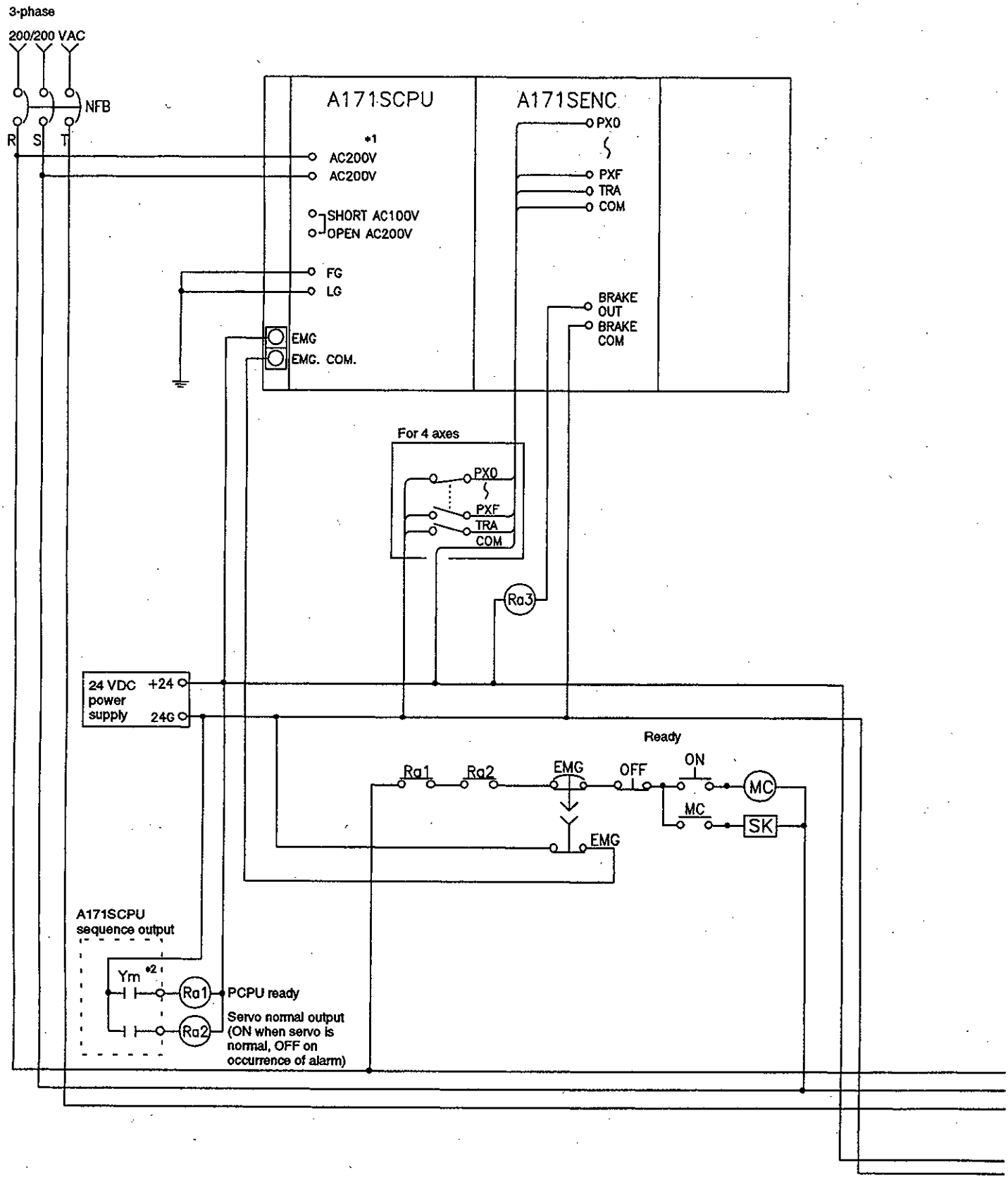
⚠ Attach covers to prevent servomotor rotating parts being touched during operation.

⚠ 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.

POINT

A fuse-blown error may be detected by an A171S series output module when the external power supply is turned on.
In the circuits shown on the following pages, a fuse-blown error is detected because the output module external power supply is established after the A171SCPU starts up.
This problem can be overcome by turning M9084 ON to disable the fuse-blown check before the external power supply is established. The I/O module verification checks and battery check are not conducted if M9084 is ON.

(1) Sample system circuit design for motion control

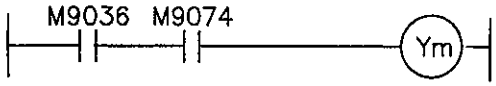


10. MOUNTING AND LOCATION SELECTION

POINTS

(1) *1 : A 100 VAC power supply can also be used as the power supply to the A171SCPU.
To use the 100 VAC power supply, install the jumper at "SHORT AC100V".

(2) *2 : PC program



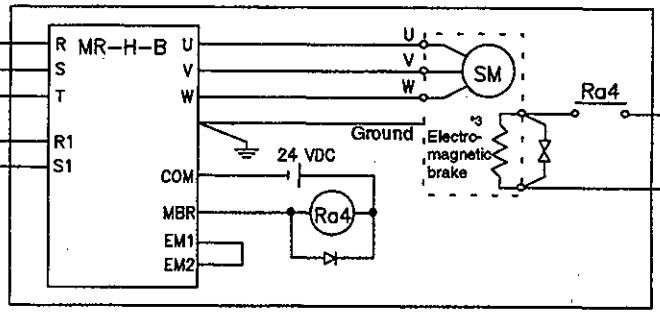
(3) *3 : It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.

(4) *4 : When using MR-J-B, use an A171SENC brake relay as the relay contact for the electromagnetic brake.

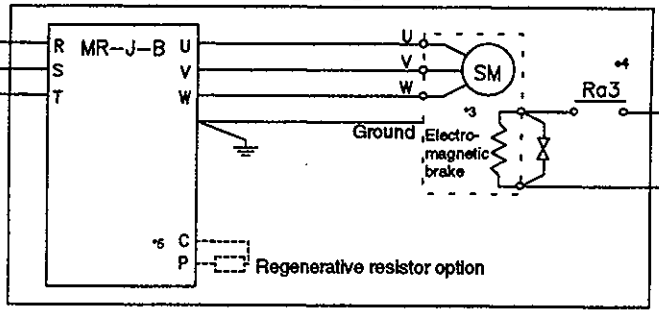
(5) *5 : Connected when a regerative option is used.
(A regenerative option is required for servo amplifiers of 300 W or more.)

(6) For details on connecting motion net cables, termination resistors, and battery units, refer to Sections 2.1.2 and 9.3.

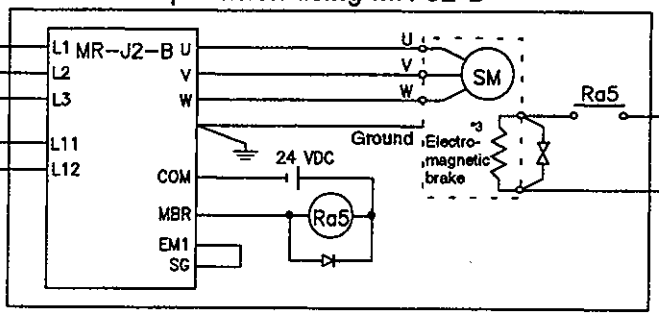
Circuit example when using MR-H-B



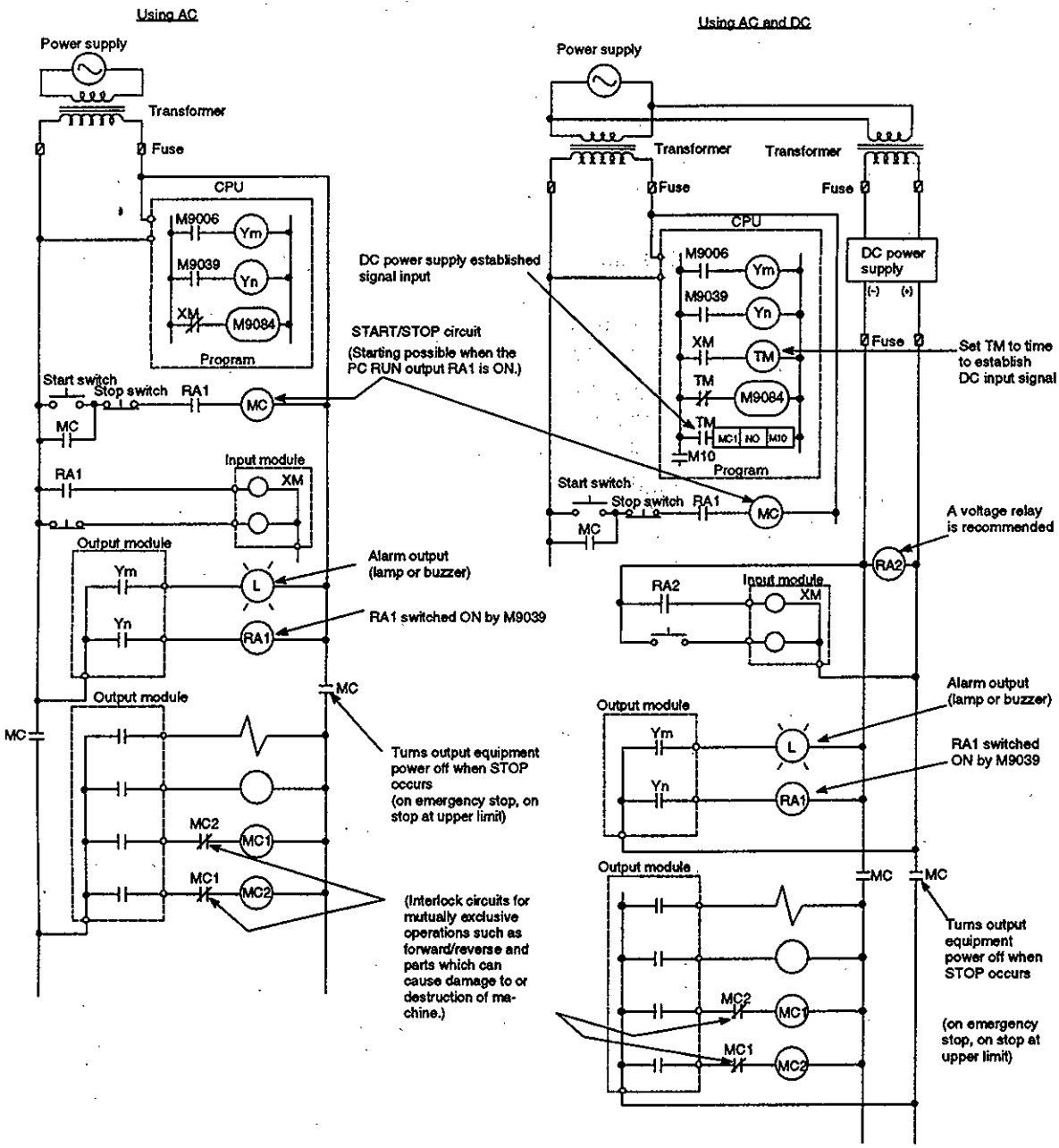
Circuit example when using MR-J-B



Circuit example when using MR-J2-B



(2) Sample system circuit designs



Procedure to start up the power supply.

AC

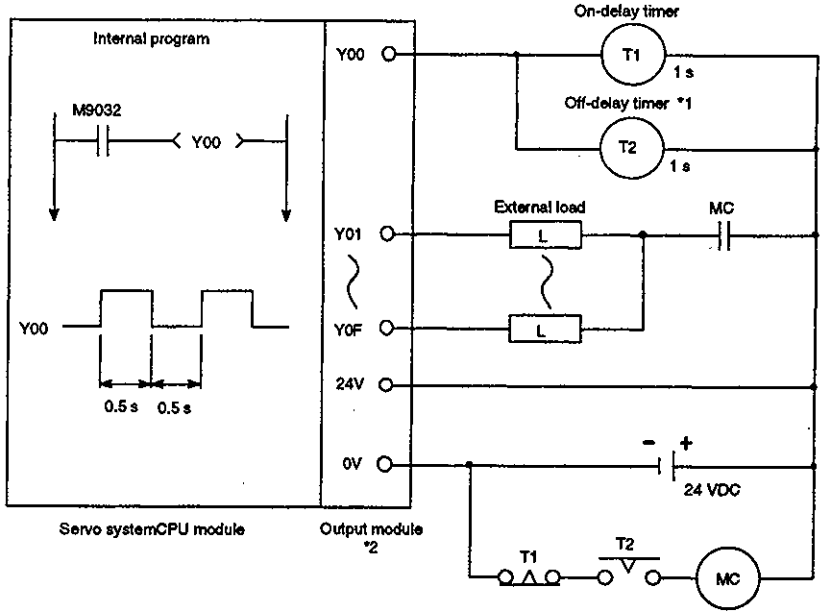
(1)Set the CPU to RUN.
(2)Turn on the power supply.
(3)Turn on the start switch.
(4)Output equipment driven by program when the electromagnetic contactor (MC) turns on.

AC and DC

(1)Set the CPU to RUN.
(2)Turn on the power supply.
(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 DCpower 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.

(3) Failsafe measures for PC failure

Failure of the A171SCPU or memory is detected by the self-diagnosis function, but some abnormalities in the I/O control components cannot be detected by the 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 manufacturer 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 A171SCPU.
An example of a failsafe circuit is shown in the diagram below.

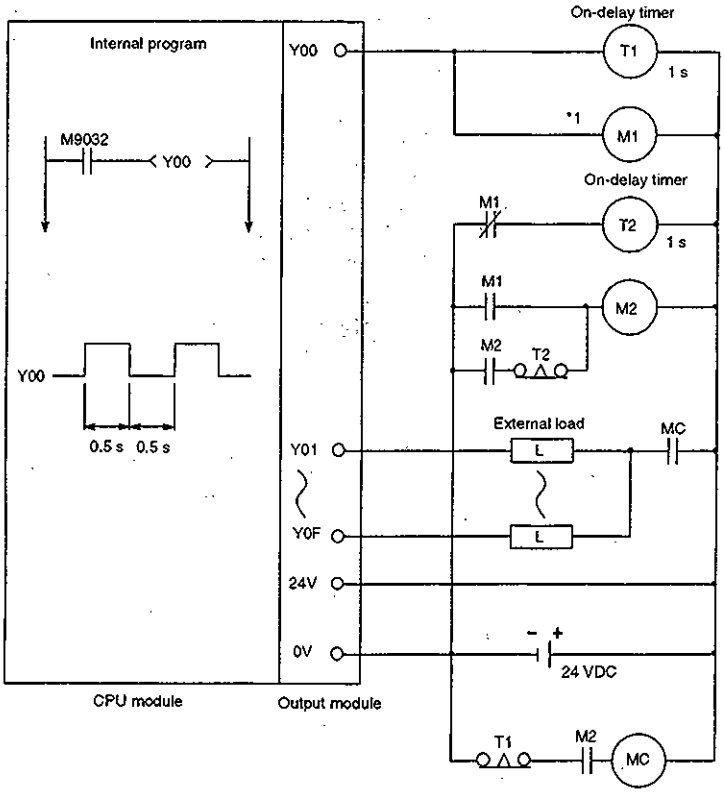


*1 Failsafe measures can be taken using only on-delay timers, as shown on the following page, if an off-delay timer (particularly a miniature timer) cannot be obtained.

⚠ 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.

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.

10. MOUNTING AND LOCATION SELECTION

10.2 Location Environment

Avoid locating the A171SCPU system in environments subject to:
(1) Ambient temperature outside the range 0C to 55C
(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 unit.

⚠ CAUTION

⚠ The storage conditions are listed in the table below.

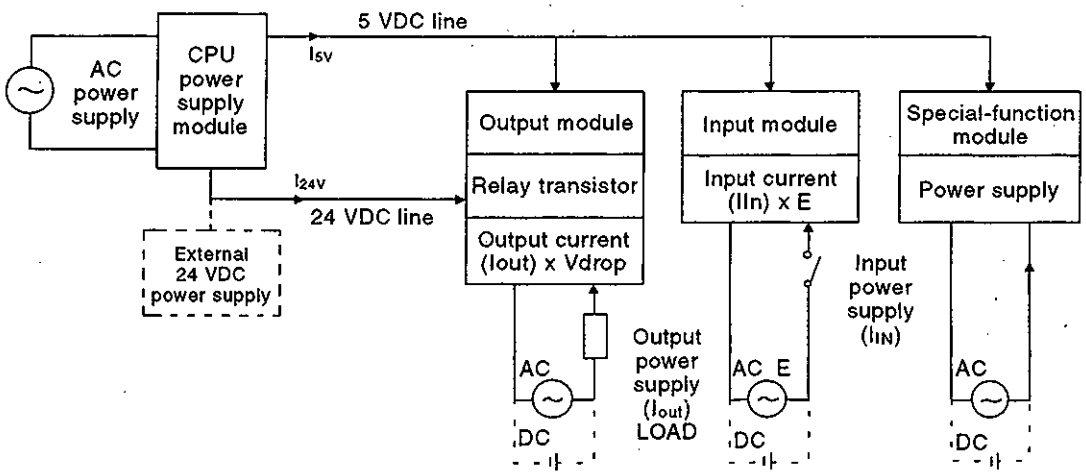
Environment	Conditions
Ambient temperature	0°C to 55°C
Ambient humidity	10% to 90% RH
Atmosphere	No condensation resulting from sudden temperature changes No corrosive or inflammable gas Low levels of conducting dust or iron filings, oil mist, salt, organic solvents Not subject to direct sunlight No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

10.3 Calculating Heat Generated by A171SCPU

If an A171SCPU is installed in an enclosure, the temperature inside the enclosure must be restricted to the operation ambient temperature of 55C. 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 A171SCPU system power losses and average power consumption. Calculate the temperature rise in the enclosure from the power consumption.

Calculating Average Power Consumption

The major A171SCPU parts consuming power 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:

$$Wpw = \frac{3}{7} \{(I_{5V} \times 5) + (I_{24V} \times 24)\} \text{ (W)}$$

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 power supply for output module internal consumption (current consumption of simultaneously ON points)

(2) Total power consumption of 5 VDC logic circuits of all modules
The CPU power supply 5 VDC output circuit power is the total power consumption of each module.

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

(3) Output module average power consumption (power consumption of simultaneously ON points)
The CPU power supply 24 VDC output circuit average power is the total power consumption of each module.

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

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

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

I_{out} : I_{out} is the output current (actual operation current) (A)

Vdrop : 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)

$Win = I_{in} \times E \times$ (no. input points) $\times$ (simultaneously ON ratio) (W)

I_{in} : I_{in} is the input current (effective value for AC) (A)

E : E is the input voltage (actual operation voltage) (V)

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

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

The total power consumption of each block described above is the power consumption of the entire PC system.

$W = W_{PW} + W_{5V} + W_{24V} + W_{OUT} + W_{IN} + W_S$ (W)

Use the overall calculated power consumption (W) to calculate the heat generation and temperature rise inside the enclosure.
The following equation approximately calculates the temperature rise in the enclosure:

$$T = \frac{W}{UA} \text{ (°C)}$$

W : W is the overall power consumption of the motion controller (calculated above)
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.

10.4 Installing the Base Units

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

10.4.1 Precautions on installation

This section describes the precautions related to mounting an A171SCPU in an enclosure.

(1) To improve ventilation and permit easy mounting of the unit, leave a space of at least 30 mm (1.18 inch) between the top of the unit 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 A171SCPU are less than those shown in Fig. 10.1.

(a) If the duct is above the A171SCPU, limit the duct height to 50 mm (1.97 inch) max. to improve ventilation.
Leave sufficient clearance above the A171SCPU to allow the mounting screws on top of the unit to be tightened or removed. It is impossible to replace the unit if the screws cannot be removed.

(b) If the duct is below the A171SCPU, leave sufficient clearance to eliminate effects on the CPU power supply 100/200 VAC input cables, the I/O module input wires, and 12/24 VDC wires.

⚠ 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.

10.4.2 Installation

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

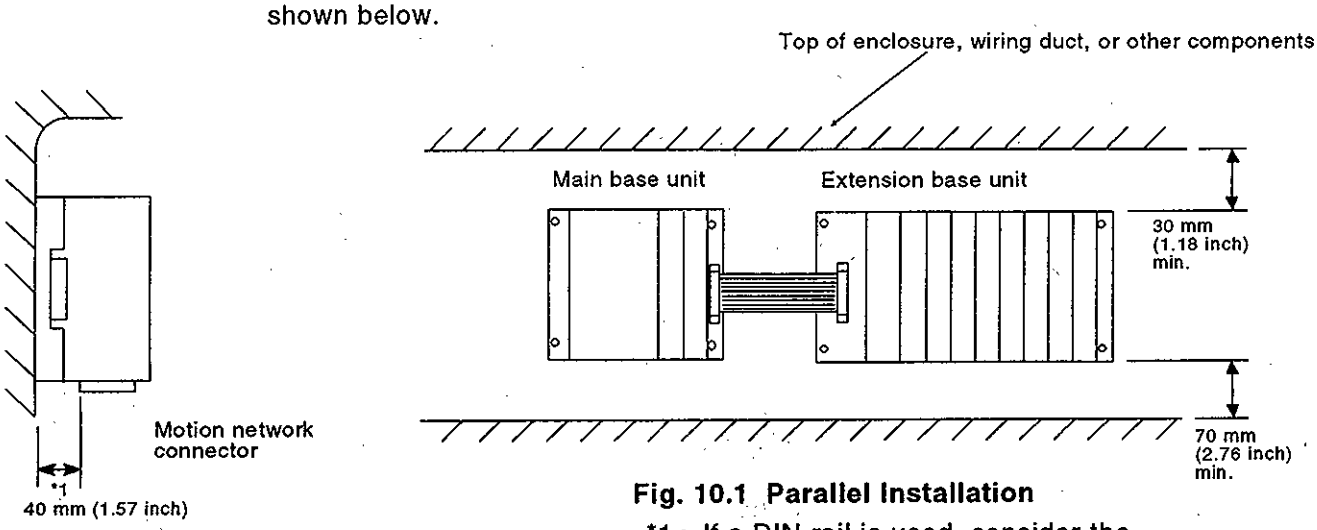


Fig. 10.1 Parallel Installation

*1 : If a DIN rail is used, consider the mounting position of the DIN rail.

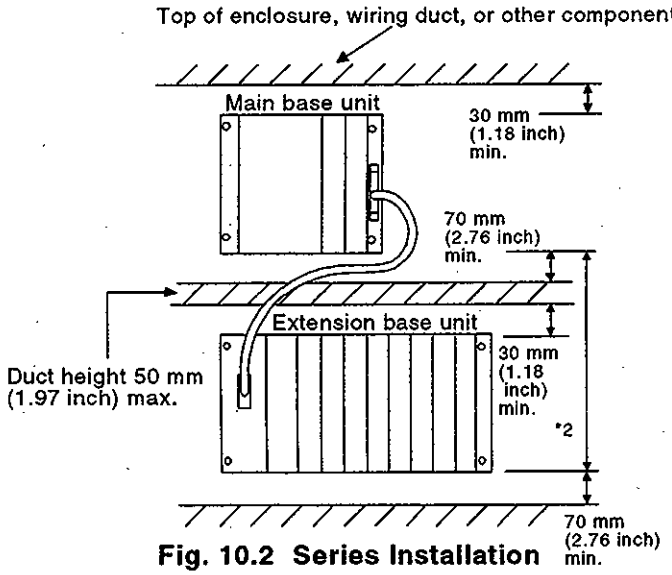


Fig. 10.2 Series Installation

*2 : Extension Cable Lengths
A1SC03B cable 280 mm (11.02 inch) max.
A1SC12B cable 1100 mm (43.3 inch) max.
A1SC30B 2900 mm (114.17 inch) max.

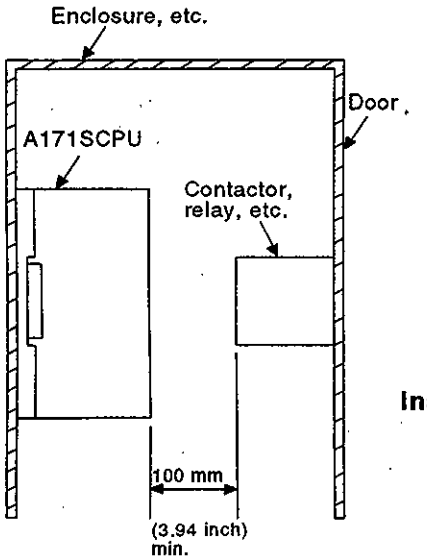


Fig. 10.3 Clearance to Instruments in Front of A171SCPU

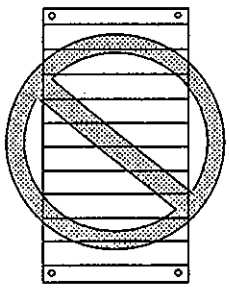


Fig. 10.4 Vertical Installation (Not Permitted)

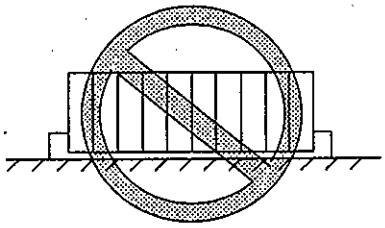
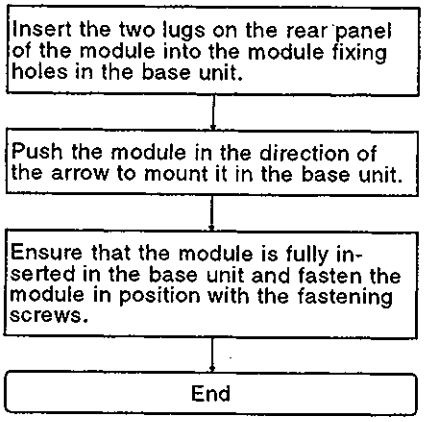


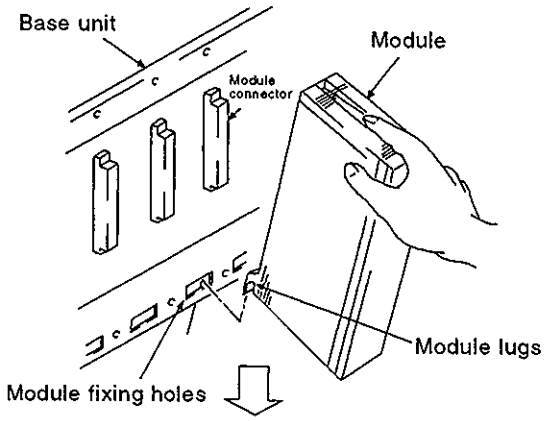
Fig. 10.5 Horizontal Installation (Not Permitted)

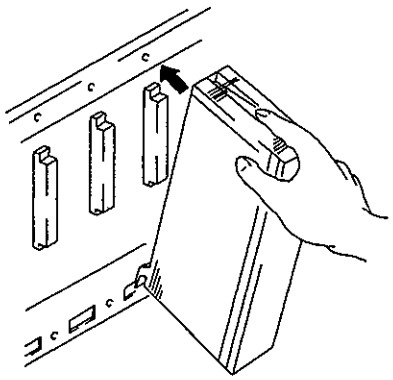
10.5 Mounting and Removing Modules

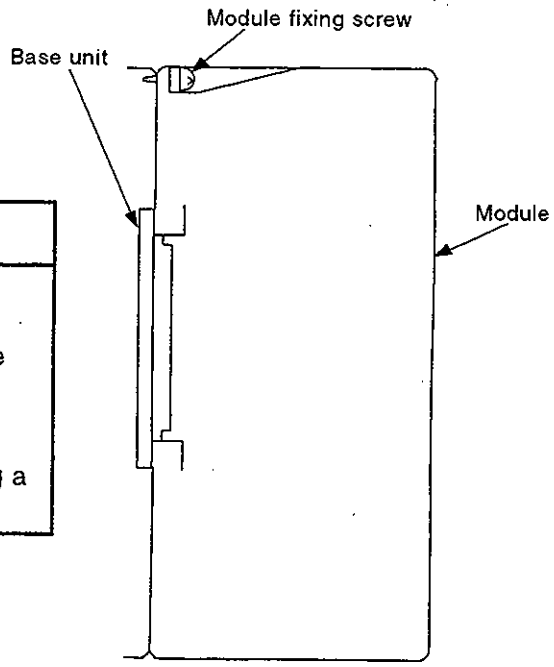
This section describes how to mount CPU modules, I/O modules, and special-function modules in a base unit, and how to remove them.

(1) Mounting modules
Follow the procedure below to mount a module in the base unit.







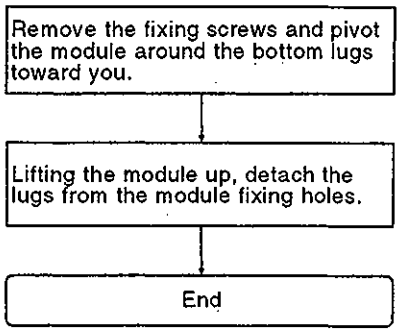


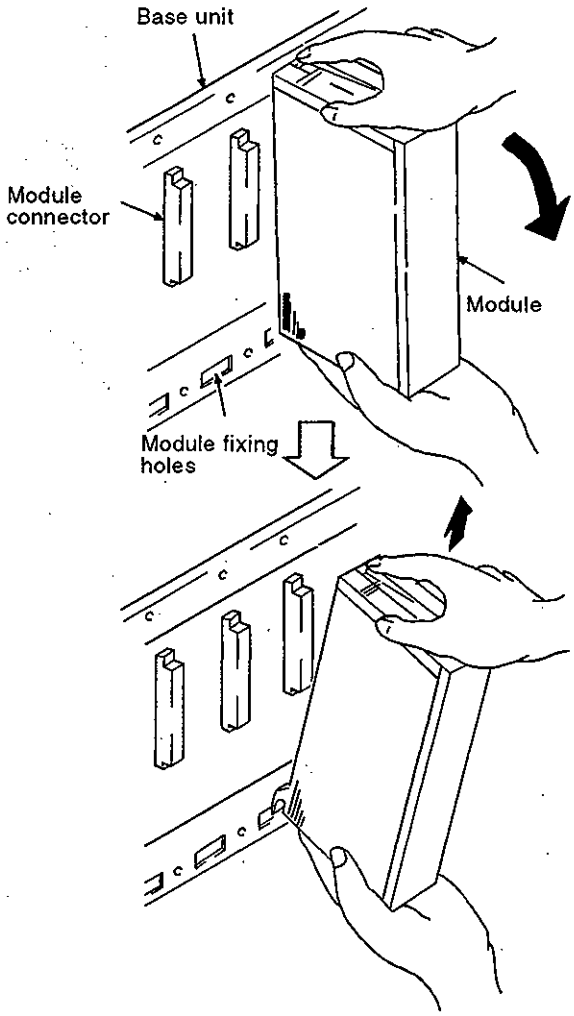
⚠ CAUTION

⚠ The lugs must be inserted in the module fixing holes when the module fixing screws are inserted. Forcibly fixing a module in place without insering the lugs in the holes will bend the module connector pins and cause other damage.

⚠ Turn off the power supply before mounting or removing a module.

(2) Removing modules
Follow the procedure below to remove a module from the base unit.





⚠ CAUTION

⚠ When removing a module, remove the module fixing screws before attempting to remove the lugs from module fixing holes. Forcing out a module may damage the lugs.

⚠ Turn off the power supply before mounting or removing a module.

10.6 Wiring

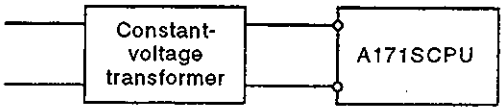
This section explains important information about wiring the system.

10.6.1 Wiring precautions

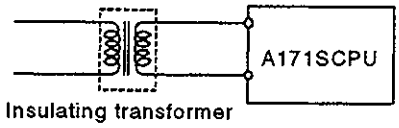
Precautions when wiring the power supply and I/O cables.

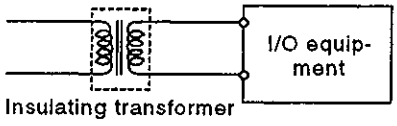
(1) Wiring the power supply

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



(b) Use a power supply with low noise.
Connect an insulating transformer if high levels of noise exist.



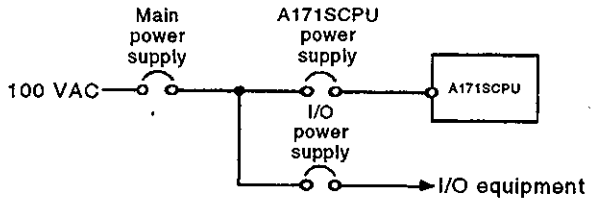


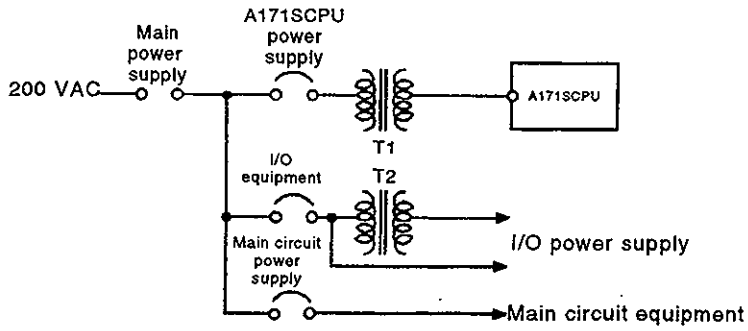
⚠ CAUTION

⚠ Refer to the table below for the minimum transformer capacity required when selecting a step-down power transformer from 200 VAC to 100 VAC or an insulating transformer.

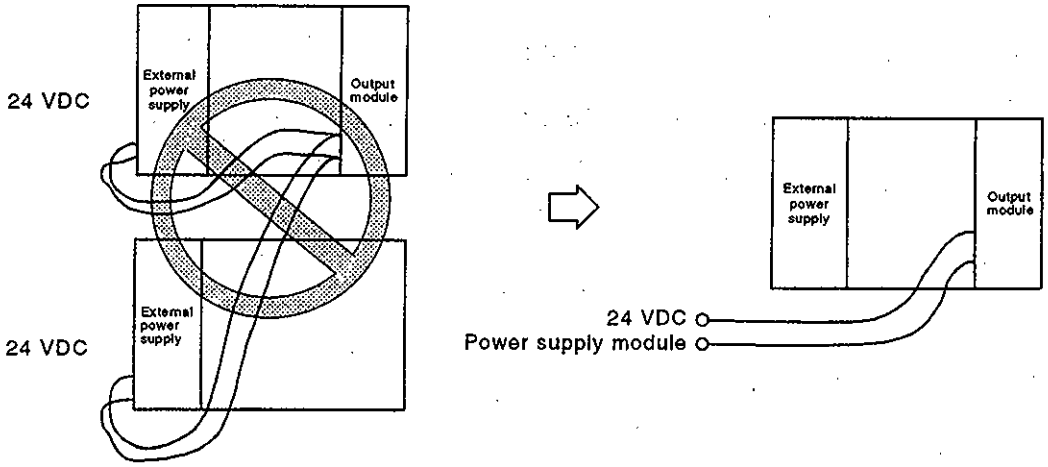
Power Supply Module Model Name	Transformer Capacity
A1S61P	110VA
A1S62P	110VA
A171SCPU	110VA

(c) Connect wiring to the A171SCPU power supply separate from the wiring to I/O equipment and power equipment, as shown below.





(d) Precautions when using the A1S62P 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 units together over the minimum distance.

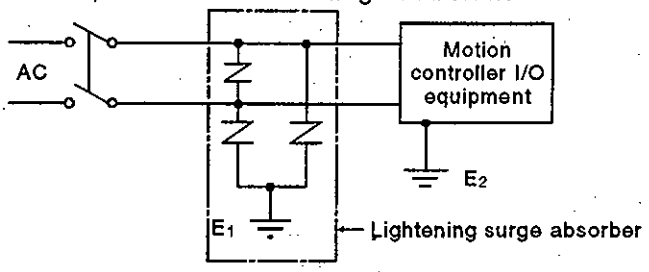
(f) To minimize the voltage drop, use the thickest 100 VAC, 200 VAC, and 24 VDC wires possible (2 mm^2 max.).

⚠ 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 100 VAC, 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 100 mm (3.94 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 I/O equipment

(a) Wires between 0.75 mm^2 and 1.5 mm^2 can be connected to the terminal block, but 0.75 mm^2 wires are recommended.

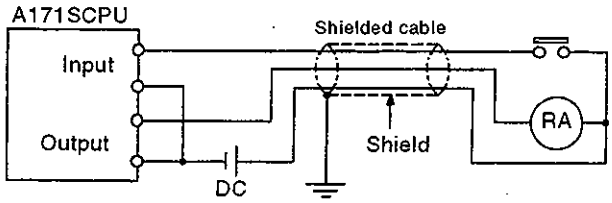
(b) If wires pass through a conduit, the conduit must be grounded.

⚠ 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-cir-cuit 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 A171SCPU 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.

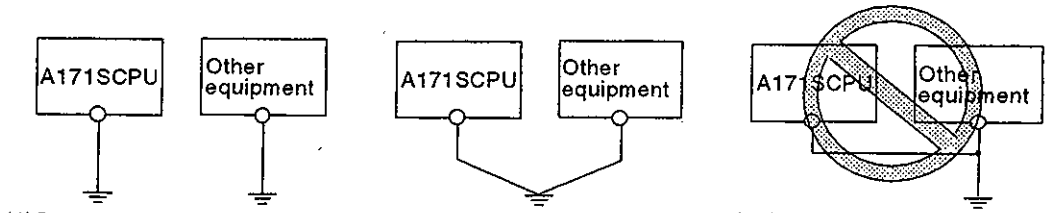
⚠ The leakage current over long-distance wiring connections exceeding 200 m (656.17 ft.) can lead to problems.
See Section 13.4 for appropriate countermeasures.

(c) Keep 24 VDC I/O wires separatIf wires from 100 VAC and 200 VAC wires.

(3) Grounding
Connect the ground wiring as described in steps (a) to (d) below.

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

(b) 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

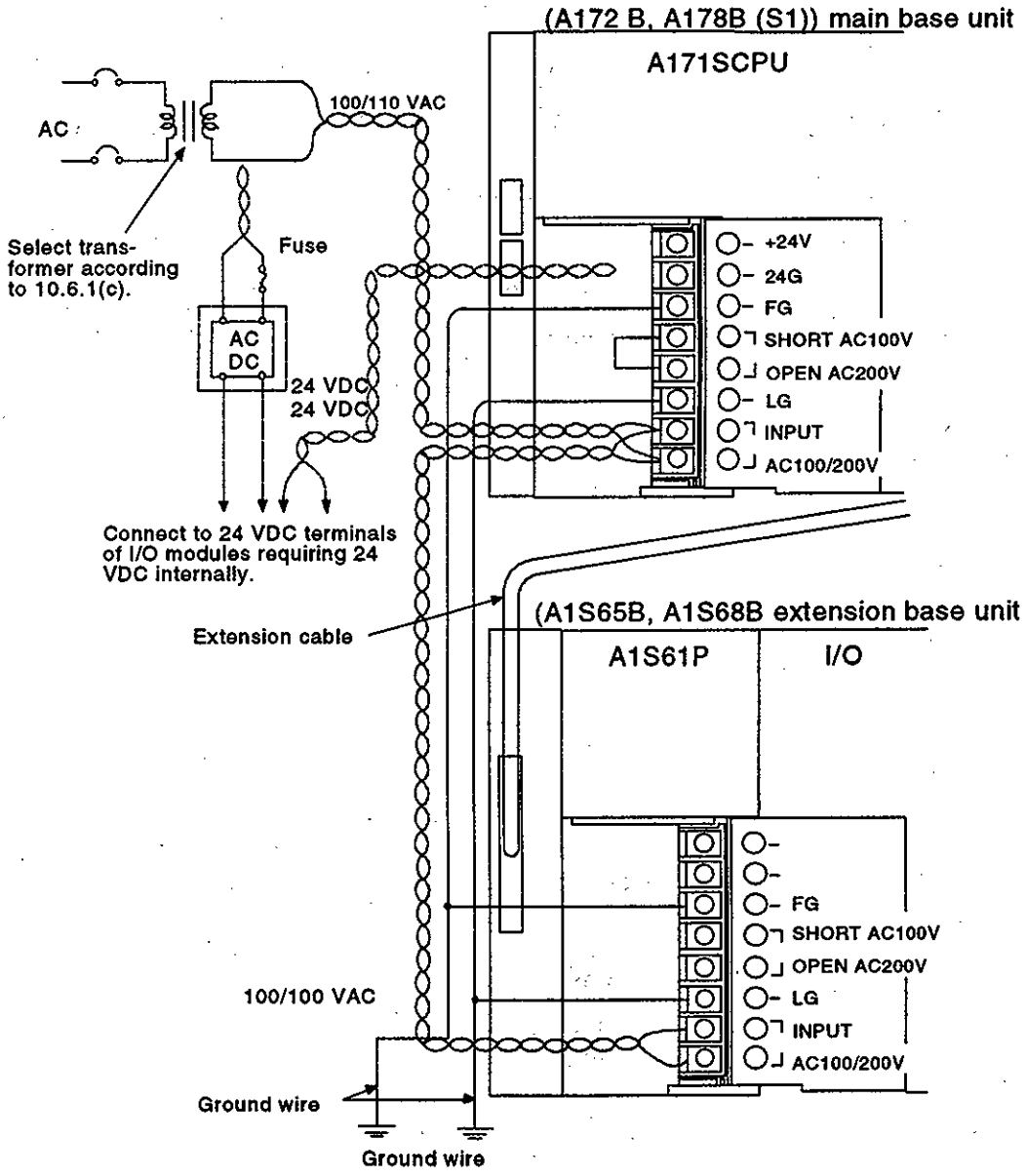
(c) Grounding cables to be 2 mm^2 min.
Grounding point to be as close as possible to the A171SCPU and the distance to the grounding point as short as possible.

⚠ WARNING

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

10.6.2 Wiring module terminals

This section shows examples of wiring the main base unit and extension base unit power-supply and ground wires.



POINTS

(1) Use wires as thick as possible (2 mm^2 max.) for the 100 VAC, 200 VAC, 24 VDC wires. Twist the wires when connected to the terminals. Use solderless terminals with insulating tubes to prevent shorting if the screw in the solderless terminal is loose.

(2) Grounding is required if the FG and LG terminals are connected or resistance to noise is reduced.
A shock may be felt when touching the LG terminal as it has a potential of 1/2 input voltage.

10.7 Serial Synchronous Encoder

Precautions when using a MR-HENC serial synchronous encoder.

10.7.1 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. Ensure that excessive force (greater than the permitted shaft load) is not applied to the encoder.

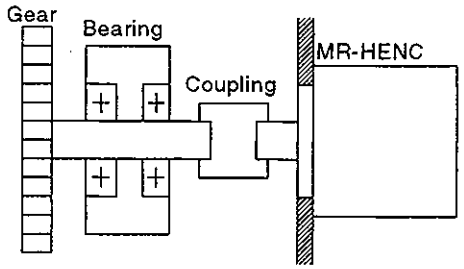


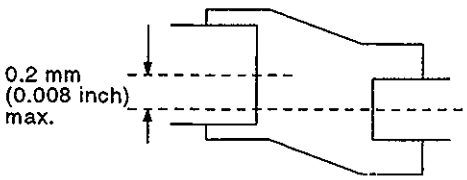
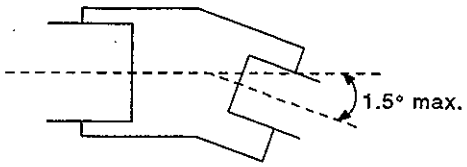
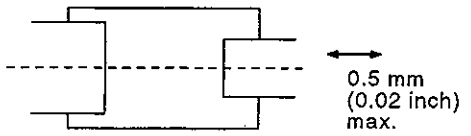
Fig. 10.6 Example of Encoder Linked to a Gear

Table 10.1 Permitted Shaft Loads

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

(2) Large errors in eccentricity and angle of deviation during mounting can apply an excessive force to the MR-HENC shaft, which can cause deterioration in performance drastically reduce 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. 10.2 for the recommended coupling type.

Table 10.2 Permitted Values for Coupling Mounting Errors

Eccentricity	
Angle of deviation	
Axial displacement	

Recommended coupling : Mini Coupling manufactured by Eagle Industry.

Model Name	Machine Shaft Diameter
EFCS38B120x150Z	12 mm (0.47 inch)
EFCS38B080x150Z	8 mm (0.31 inch)

⚠ 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 vibration exceeding the prescribed limits.

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

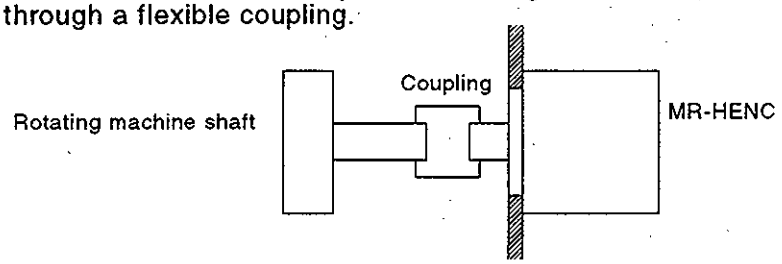


Fig. 10.7 Connecting the Encoder to a Machine Shaft

⚠ 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.

10.7.2 Precautions on wiring

(1) Use a shielded twisted-pair cable for connection to the MR-HENC.

(2) If the cable has to be extended, do not make it longer than 30 m (98.43 ft.). However, in principle, wires should be kept as short as possible to avoid 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.

10.7.3 Operating environment

(1) The MR-HENC contains optical components. Mount it in an environment with very low levels of water droplets, oil, and dust.

(2) Apply a cover if the encoder is used where water or oil may fall on it. Tilt connector cables downward to prevent oil or water running along a cable to the MR-HENC. Provide a trap if the cable has to be attached vertically or diagonally upward.

(3) Use the encoder inside the prescribed temperature range of 0°C to 55°C.

11. 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.

11.1 Checklist before Trial Operation

Check the points in Table 11.1 before starting trial operation of the motion controller.

Table 11.1 Checklist before Trial Operation

Model Name	Check Item	Reference
CPU module	(1) Is memory protection switch ON?	4. 4. 4
	(2) Is the memory cassette battery (A6BAT) lead connector fully inserted into the PCB pin connector.	9. 1. 3
	(3) Is the battery voltage normal? (Nominal value: 3.16 V)	9. 1
	(4) Are the supply voltage and power supply module rated voltage correct?	6. 1. 1
	(5) Are FG and LG wired correctly?	10. 6. 2
	(6) Are terminal screws correctly tightened?	4. 3
	(7) Are cable sizes correct?	10. 6. 2
A171SENC manual pulse generator/ synchronous encoder interface module	(1) Is the module mounted in the correct position (option slot)?	2. 2
	(2) Is the interface with external equipment correct?	5. 3 to 5. 5
Main base unit	(1) Are the mounted module models correct?	2. 2
	(2) Is the mounting order correct?	
	(3) Are the modules correctly mounted?	10. 5
Extension base power supply module	(1) Is the correct power module model mounted?	6. 2. 1
	(2) Are the supply voltage and power supply module rated voltage correct?	6. 2. 3
	(3) Are FG and LG wired correctly?	10. 6. 2
	(4) Are terminal screws correctly tightened?	6. 2. 2
	(5) Are cable sizes correct?	6. 2. 1

11. TRIAL OPERATION

Model Name	Check Item	Reference
I/O module	(1) Do cables connected to each terminal of the terminal block match the signal names?	A1SCPU User's Manual
	(2) Are terminal screws correctly tightened?	
	(3) Are cable sizes correct?	
	(4) Is the external power supply correctly connected? (24 VDC, 5 VDC)	
Special-function module	(1) Are the setting switches correctly set?	
	(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 the external power supply correctly connected? (24 VDC, 5 VDC)	
A1SG62 dummy module	(1) Is the point-setting switch correctly set?	
Extension base unit	(1) Is the extension base unit model correct (A1S65B or A1S68B)?	7. 1. 1
	(2) Are the mounted module models correct?	2. 3
	(3) Check that the total I/O module and special-function module I/O points does not exceed the number of CPU module I/O points.	4. 1
	(4) Are the modules correctly mounted?	10. 5
Extension cable	(1) Is the extension cable connector correctly inserted in base unit connector?	7. 1. 2
	(2) Is the extension cable connector position correct?	7. 2. 2
	(3) Does the total length of the extension cables exceed 3 m (118.11 inch)?	2. 2. 3

⚠ 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 intenal power supply, internal ground, or signal wires. This can cause electric shocks.

11. TRIAL OPERATION

⚠ CAUTION

⚠ The machine may make unpredicted movements after a servo amplifer or sevomotor is turned on. Top 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 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 injuy, do not approach machiney during trial or teaching operation.

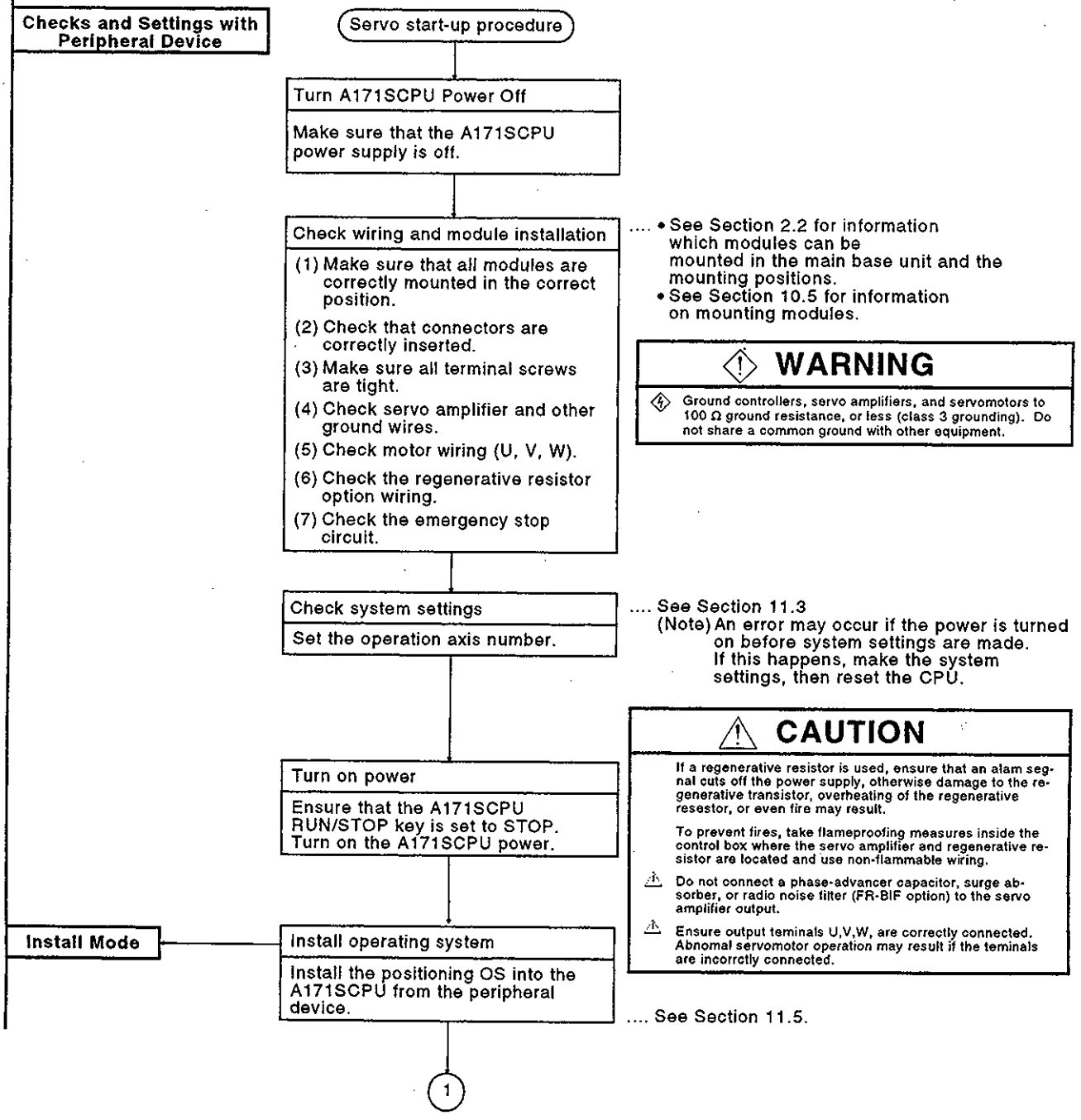
11.2 Servo Start-Up

The servo start-up procedure using the A171SCPU and peripheral device is described below.

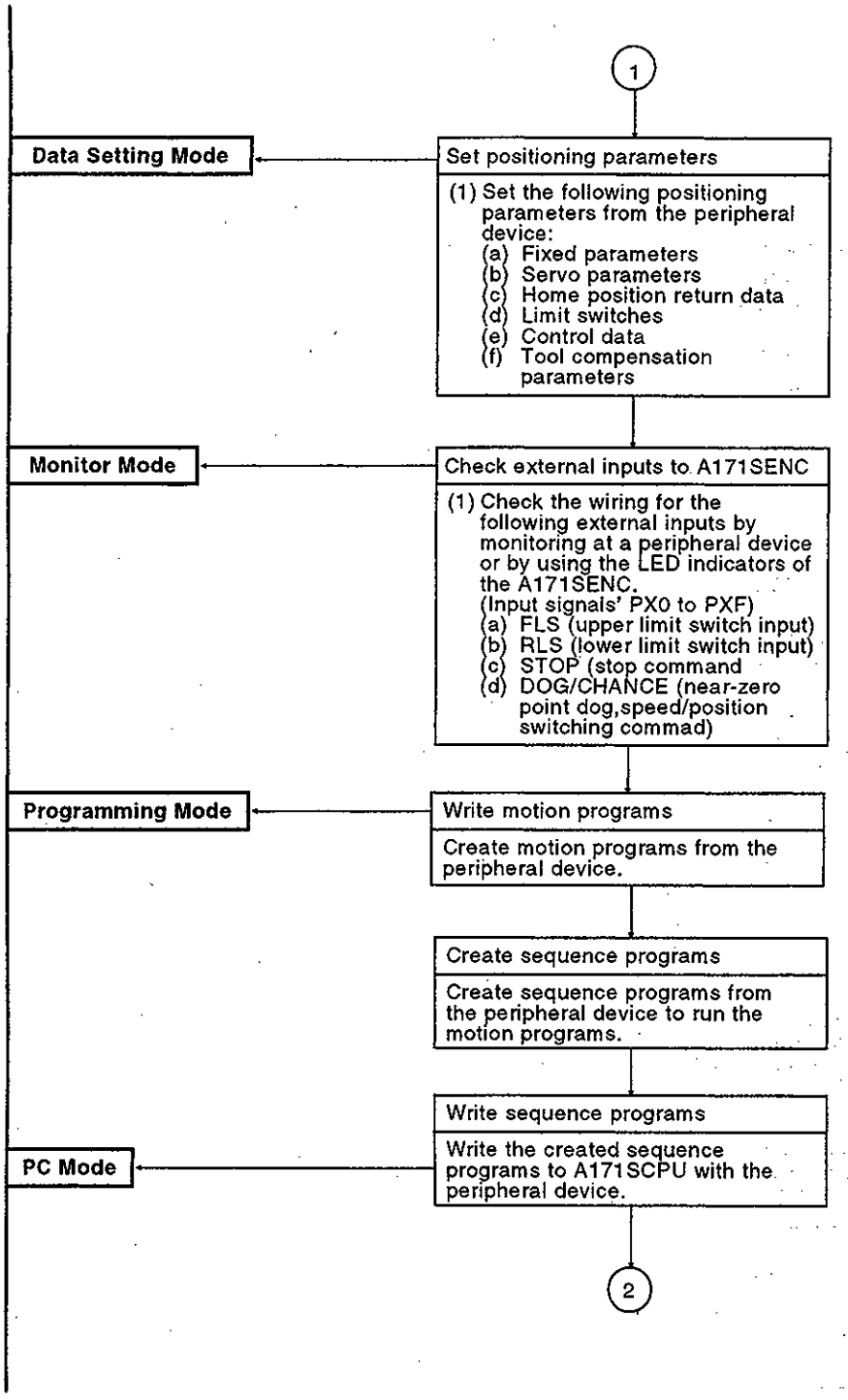
POINTS

(1) Make note of motor model names before the motor is installed on a machine. The motor name plate may not be visible after the motor is installed.

(2) The machine may make unpredictable movements after a servo amplifier or servomotor is first turned on. To prevent accidents, check the operation of each individual motor.



11. TRIAL OPERATION



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

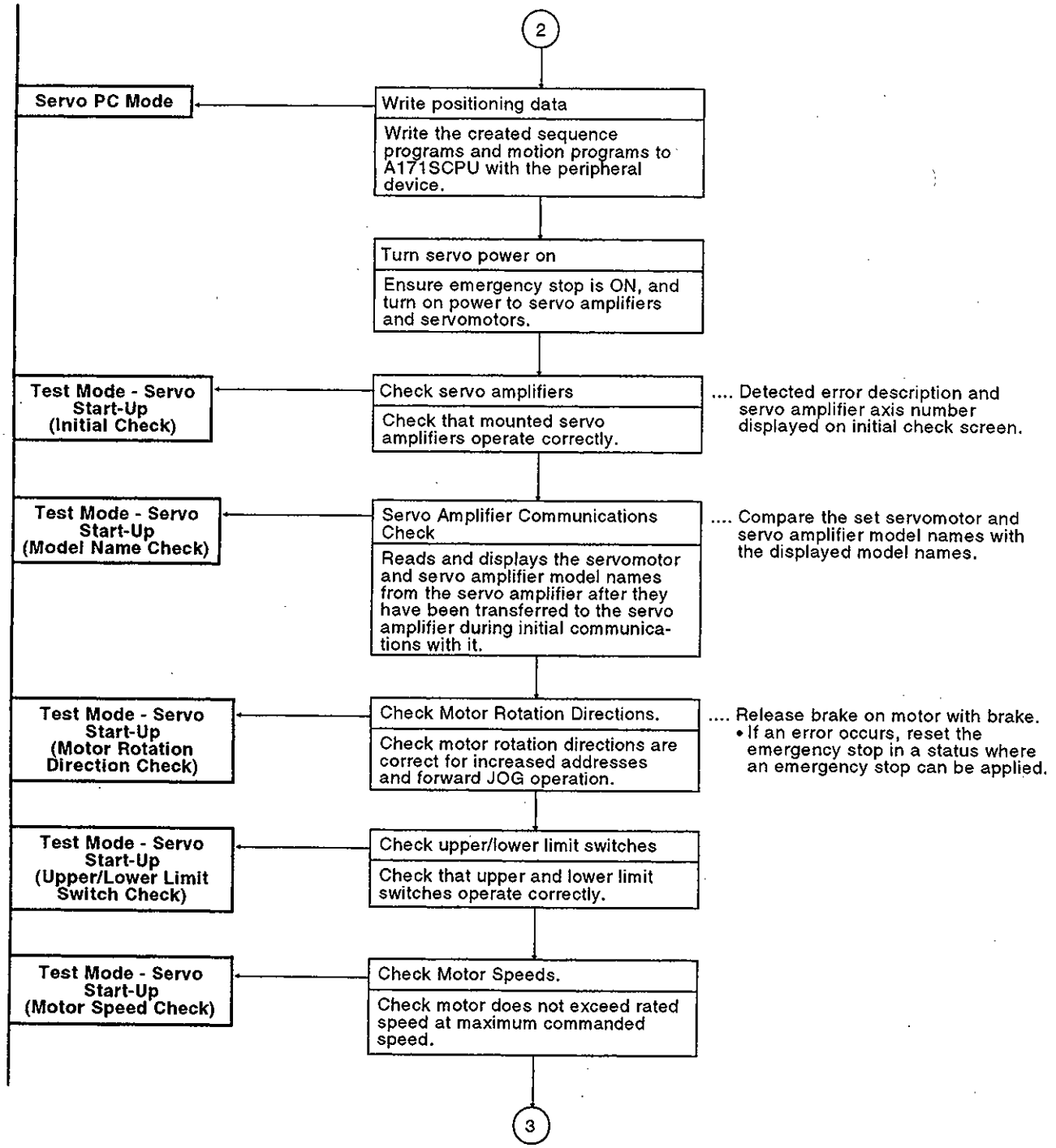
- Even if the power is tumed off, do not open the front casing or terminal covers, except to connect wiring or conduct scheduled inspections. Charged components in the controller or servo amplifier can cause electric shocks.
- To avoid electric shocks, turn off the power, wait at least ten minutes, then 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.

CAUTION

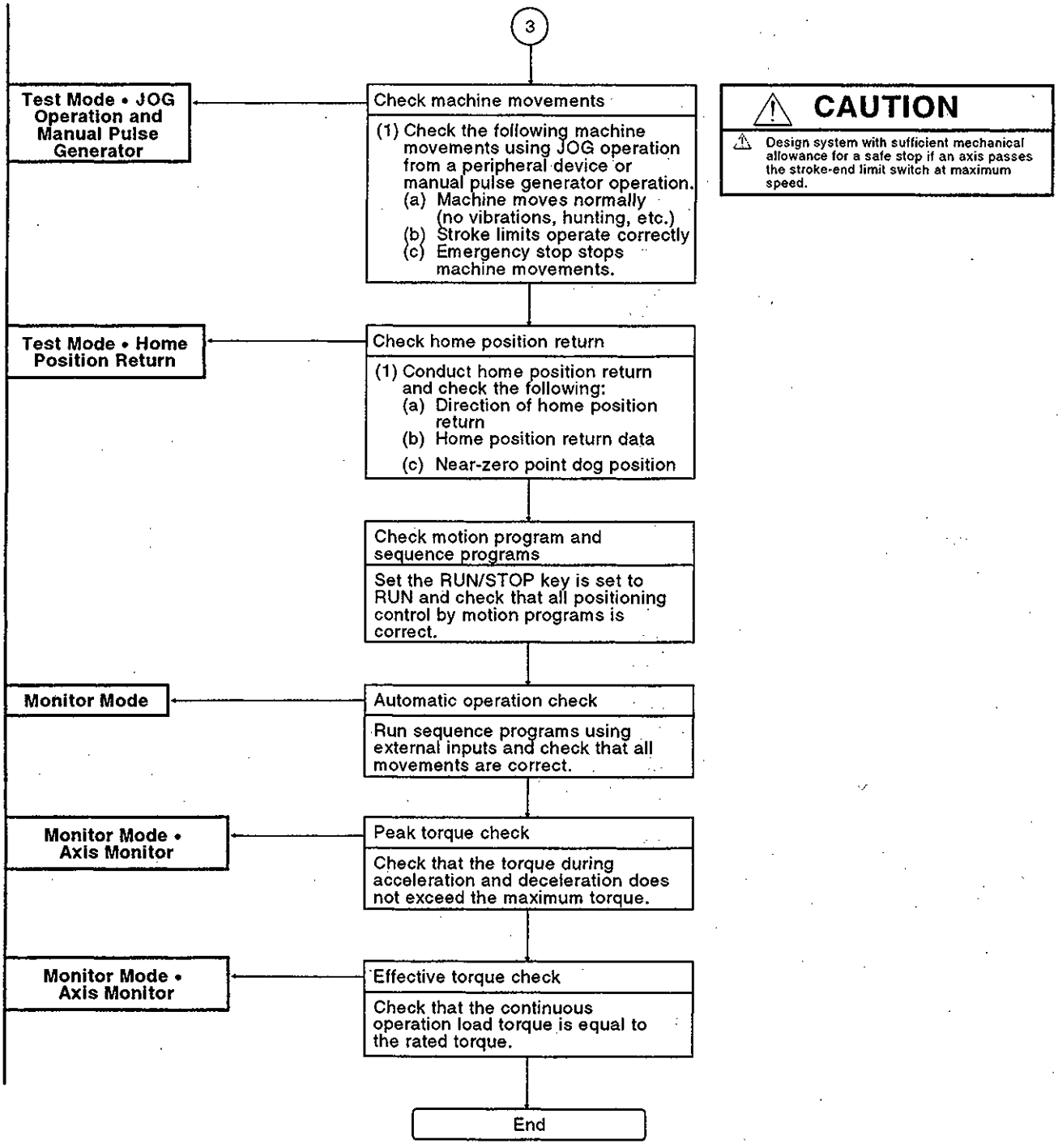
- Connect a leak breaker to the controller and servo amplifier power supply.
- Provide an extemal emergency stop circuit to instantaneously stop operation and cut off power.
- Follow the conditions prescribed in this manual and the product instrotion manuals when programming using the program commands.
- When programming, follow the conditions prescribed in this manual regarding devices which 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 standads.
- Configure safety circuits extemal to the controller or servo amplifiers if their abnomal operation could cause axis motion in a direction other than the safe operating direction for the system.

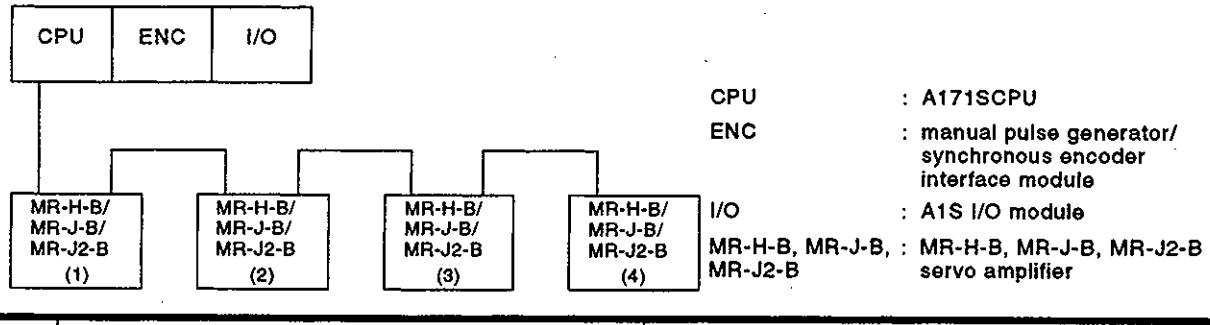

2
Servo PC Mode
Write positioning data
Write the created sequence programs and motion programs to A171SCPU with the peripheral device.
Turn servo power on
Ensure emergency stop is ON, and turn on power to servo amplifiers and servomotors.
Test Mode - Servo Start-Up (Initial Check)
Check servo amplifiers
Check that mounted servo amplifiers operate correctly.
.... Detected error description and servo amplifier axis number displayed on initial check screen.
Test Mode - Servo Start-Up (Model Name Check)
Servo Amplifier Communications Check
Reads and displays the servomotor and servo amplifier model names from the servo amplifier after they have been transferred to the servo amplifier during initial communications with it.
.... Compare the set servomotor and servo amplifier model names with the displayed model names.
Test Mode - Servo Start-Up (Motor Rotation Direction Check)
Check Motor Rotation Directions.
Check motor rotation directions are correct for increased addresses and forward JOG operation.
.... Release brake on motor with brake.
• If an error occurs, reset the emergency stop in a status where an emergency stop can be applied.
Test Mode - Servo Start-Up (Upper/Lower Limit Switch Check)
Check upper/lower limit switches
Check that upper and lower limit switches operate correctly.
Test Mode - Servo Start-Up (Motor Speed Check)
Check Motor Speeds.
Check motor does not exceed rated speed at maximum commanded speed.
3

11. TRIAL OPERATION



11.3 Setting Axis Numbers

The A171SCPU can control a total of 4 axes maximum using MR-H-B, MR-J-B, MR-J2-B servo amplifiers.
The system settings set the axis number of each MR-H-B, MR-J-B connected to the A171SCPU.
Do not duplicate axis number settings.
The MR-H-B, MR-J-B, MR-J2-B axis number settings are shown in the diagram.



No.	Item	Description
(1)	MR-H-B, MR-J-B, MR-J2-B axis number setting	• Sets the axis number of each MR-H-B, MR-J-B, MR-J2-B. • Set in the range between 1 and 4.
(2)		
(3)		
(4)		

Fig. 11.1 Axis Number Settings

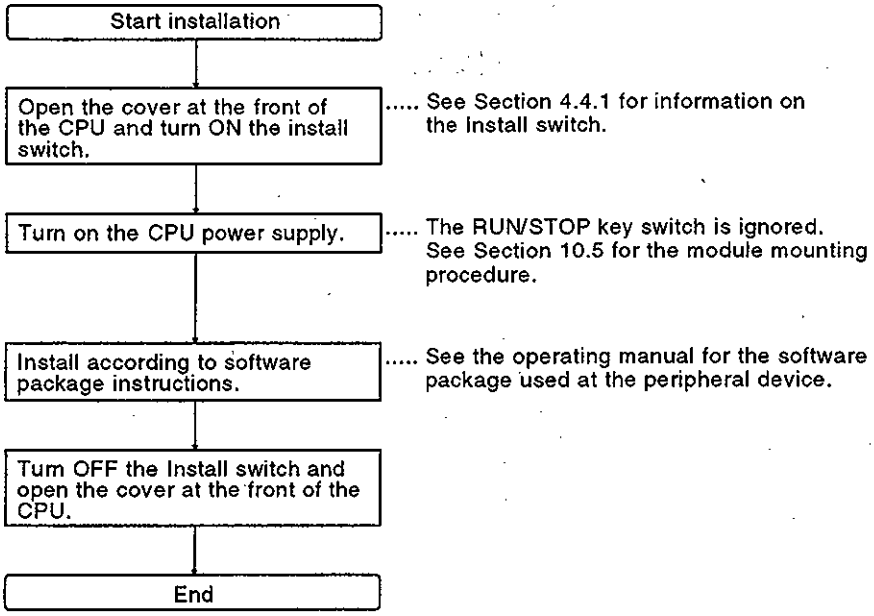
POINT

(1) Refer to the SW[ ]SRX-GSV[ ][ ]PE Operating Manual for details of the system setting method.

11.4 Operating System Installation Procedure

The A171SCPU operating system (OS) can be changed using a peripheral device and software package.
Changing the operating system is called "installing" the operating system.

The installation procedure is shown below.



POINT

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

12. INSPECTION AND MAINTENANCE

This section describes the daily and scheduled inspections required to maintain the A171SCPU 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, srevo-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. INSPECTION AND MAINTENANCE

⚠ CAUTION

⚠ Perform daily and periodic inspections in accordance with the directions in this manual and the instruction manual for the product used.

⚠ Make backups of controller and servo amplifier programs and parameters before carrying out maintenance and inspection.

⚠ Be careful not to trap your fingers in the gaps when opening and closing parts that can be opened and closed.

⚠ Replace batteries and other consumable parts at the intervals indicated in this manual and the instruction manuals for the products used.

⚠ Do not touch the IC leads or the contacts of connectors.

⚠ Do not place a controller or servo amplifier on a metallic surface where current leakage is possible, or on surfaces that can become charged with static electricity, such as wood, plastics, and vinyl.

⚠ Do not perform a megger test (insulation resistance measurement) during inspections.

⚠ When replacing a controller or servo amplifier, set the settings of the new unit correctly.

⚠ On completing maintenance and inspection, check that position detection by the absolute position sensing function is correct.

⚠ Do not charge, heat, burn, or disassemble batteries.

⚠ Since electrolytic capacitors can generate gases when faulty, do not put your face close to the controller or servo amplifier.

⚠ The electrolytic capacitor and fan deteriorate over time. Replace them regularly in order to avoid secondary accidents in the event of their becoming faulty. These parts must be replaced at a service center or service station.

12. INSPECTION AND MAINTENANCE

12.1 Daily Inspections

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

Table 12.1 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	I/O (and other) module mounting		Modules correctly mounted in base unit.	Fully mounted and screws tightened.	Tighten loose screws.
3	Connections		Terminal screws tight	Spacing between solderless terminals.	Extension cable connectors
			No loose screws	Correct spacing is maintained.	Connectors fully tightened
			Tighten loose screws	Adjust spacing.	Tighten connector screws
4	Indicators	POWER indicator	Check that indicator lights	Indicator lights (otherwise abnormal)	See Section 13.2.2.
		RUN indicator	Lights in RUN status	Indicator lights (otherwise abnormal)	See Section 13.2.3 or 13.2.4.
		ERROR indicator	Lights when an error occurs.	Indicator not lit (otherwise error)	See Section 13.2.5 or 13.2.6.
		INPUT indicator	Check the indicator lighting status.	Indicator lights when input is ON and goes out when input is OFF (otherwise abnormal).	See Section 13.2.7.
		OUTPUT indicator	Check the indicator lighting status.	Indicator lights when output is ON and goes out when output is OFF (otherwise abnormal).	See Section 13.2.7.

12. INSPECTION AND MAINTENANCE

12.2 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 12.2 Scheduled Inspections

No.	Item		Description	Evaluation Standard	Remedy
1	Ambient environment	Ambient temperature	Measure temperature 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	Firmly installed	Dirt, foreign matter	No dirt or foreign matter
		Move units and check	Tighten screws.	Visual	Clean
4	Connections	Loose terminal screws	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	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.

12.3 Replacing the Battery

12.3.1 Replacing the A171SCPU battery

M9006 or M9007 turns ON if the voltage drops from the A6BAT battery which backs up programs and provides memory back-up functions. Program and memory contents are not lost immediately when these special relays turn ON, but memory contents may be lost if this special realy status is overlooked.
After M9006 or M9007 turns ON, replace the battery within the total power-interruption time shown in Table 12.3 below.
This section gives replacement guidelines and describes the replacement method.

(1) Battery life
An alarm occurs and the error message "BATTERY ERROR" is displayed when the battery life has almost expired.
Replace the battery when this alarm occurs. The battery life is approximately 1 year under normal operating conditions at an ambient temperature of 25C.
The battery life is shown in Table 12.3.

Table 12.3 Battery Life

Battery Life / Synchronous Encoder Used/ Not Used	Battery life Battery Life (Total Power-Interruption Time) (Hr)		
	Guaranteed Time (minimum)	Actual Time (typical)	After M9006, M9007 Turns ON
Not used	5400	13000	168
Used	3800	9500	168

* The "actual time" is the average value. The "guaranteed time" is the minimum value.

Preventative Maintenance Guidelines
1) Replace battery every year, even if total power-interruption time is less than the value in the table.
2) Replace the battery if the total power-interruption time exceeds the guaranteed time shown in the table and M9006 is ON.

(2) Replacing a battery

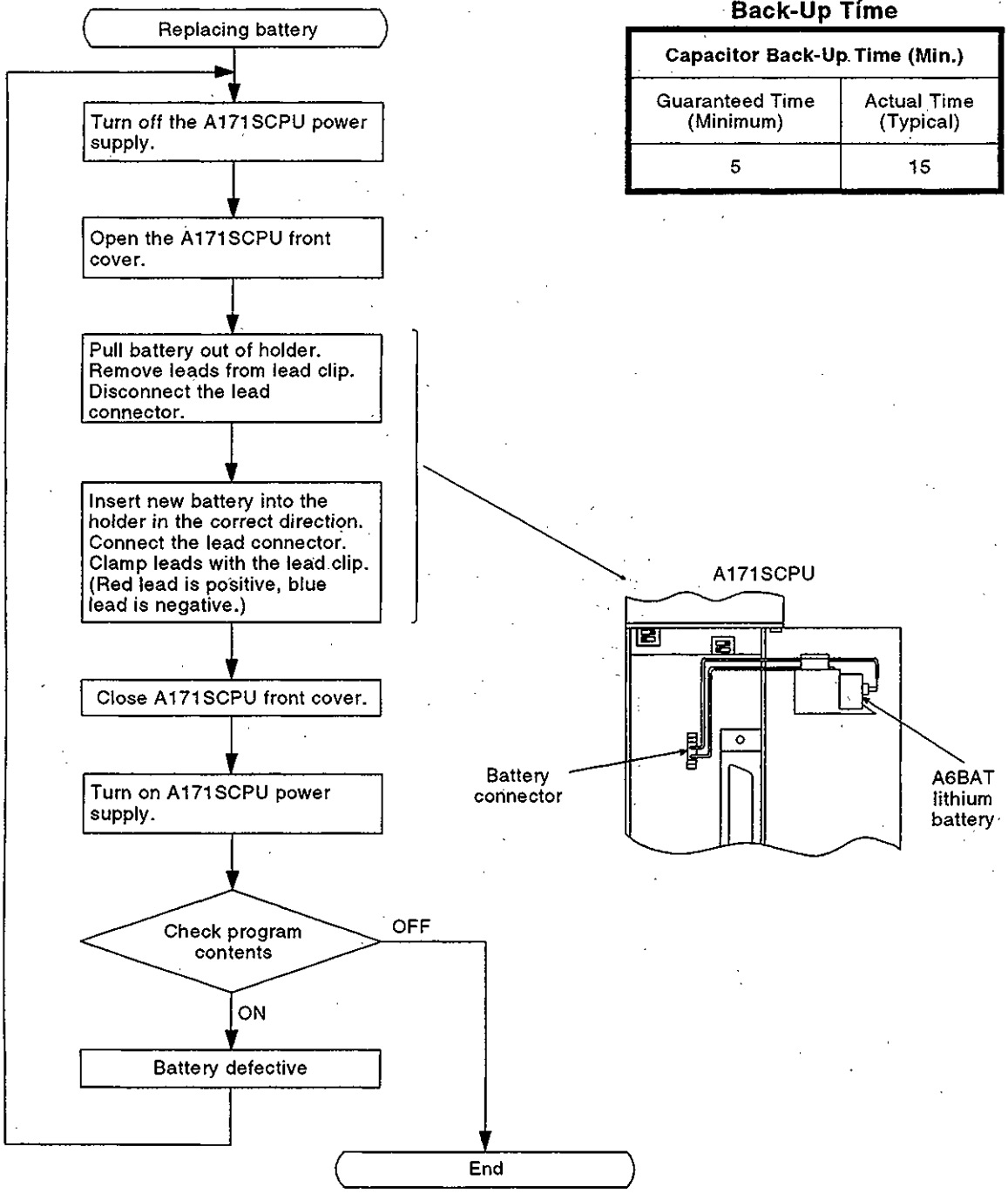
Follow the procedure below to replace a battery when its life expires. After the battery is disconnected, a capacitor maintains memory back-up for a short time. Complete the battery change operation within the time specified in Table 12.4 or the memory contents may be lost.

⚠ CAUTION

⚠ Dispose of batteries according to local government regulations.

Table 12.4 Capacitor Back-Up Time

Capacitor Back-Up Time (Min.)	
Guaranteed Time (Minimum)	Actual Time (Typical)
5	15



IMPORTANT

Some components mounted on the printed circuit board are sensitive to static electricity. Take the following precautions before directly handling the printed circuit board:
(1) Ground your body or the work bench.
(2) Do not directly touch the conductive parts or electrical components in the product.

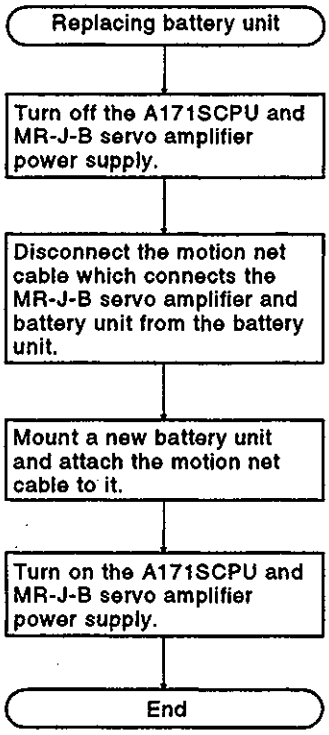
12.3.2 Battery unit

(1) Battery unit life
The following table shows the life of the MR-JBAT[ ] battery unit to back up absolute data for absolute position detection and control with an MR-J-B servo amplifier.

Table 12.5 Battery Unit Life

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

(2) Replacing battery unit
Follow the procedure below to replace a battery unit when its life expires.

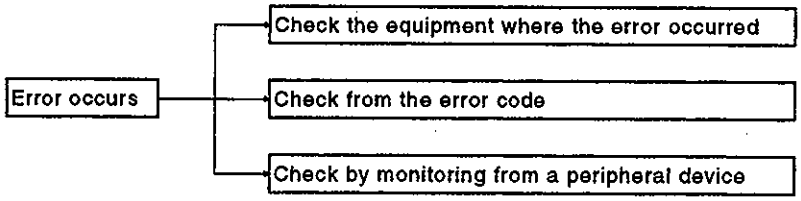


13. TROUBLESHOOTING

This section describes the errors which could occur when using the system and what to do about them.
Refer to the appropriate software package operating manual for information on the error messages displayed during peripheral device operation.

[How to Use Troubleshooting]

When an error occurs, the system status can be determined by checking the equipment where the error occurred, from the error codes, or by monitoring with a peripheral device. To quickly recover from an error, use the



appropriate method to determine the cause of the error.

(1) Checking the equipment where the error occurred
Visually determine the cause of the error from the indicators on the front of the module, from the operating status of the equipment, etc.

(2) Checking the error codes
Determine the cause of the error by monitoring the error codes stored when the error occurred.
The error code storage devices are listed below.
Refer to the appropriate operating system programming manual for descriptions of the error codes.

(a) Error codes during sequence control

Error code	D9008

(b) Error codes during motion control

1) Using SV13, SV22

• Servo program setting error/motion program setting error

Error code	D9190
Error program number	D9189

• Positioning error
<For SV13, SV22 in real mode>

	Axis 1	Axis 2	Axis 3	Axis 4
Minor error	D806	D826	D846	D866
Major error	D807	D827	D847	D867
Servo error	D808	D828	D848	D868

<SV22 in virtual mode>

			Axis 1	Axis 2	Axis 3	Axis 4
Drive module	Virtual servomotor	Minor error	D702	D708	D714	D720
		Major error	D703	D709	D715	D721
	Synchronous encoder	Minor error	D750	D754	D758	
		Major error	D751	D755	D759	
Output module		Minor error	D806	D826	D846	D866
		Major error	D807	D827	D847	D867
		Servo error	D808	D828	D848	D868

• Error on switching from real mode to virtual mode

Error code	D9195

2) Using SV42

• Positioning error

Device / Error	Error Code Storage Register			
	Axis 1	Axis 2	Axis 3	Axis 4
Servo error code	D610	D626	D642	D658

Device / Error	Error Code Storage Register			
	System 1	System 2	System 3	System 4
Operation error code	D730	D746	D762	D778
Operation error axis number	D731	D747	D763	D779
Operation stop code	D732	D748	D764	D780
Program error code	D733	D749	D765	D781
System alarm code	D740	D756	D772	D788
Emergency stop code	D741	D757	D773	D789

(3) Checking by monitoring from the peripheral device
Use the peripheral device monitor functions to determine the control status. The following statuses can be determined.
Refer to the appropriate peripheral software package operating manual for details about the operating procedures.

(a) Present value monitor
Displays servomotor present value addresses and error codes. It permits the present control status to be checked.

(b) Scroll monitor/G-code monitor
Monitor the servo program and motion program operating status, operating axes, and instruction execution in real time. Permit the program operating status to be checked.

(c) Error list monitor
Displays the error code history.
Allows error codes to be checked after multiple errors occur and permits past error codes to be checked.

(d) Trace graph
Graphic display of position command value, position droop, speed command values, servomotor speed, and motor current.
The suitability of the servomotor for the machine (factors such as overload status) can be checked by monitoring the servomotor current value.

During monitoring operation, press [ALT] + [F11] to easily switch to the servo monitor or sequence program monitor.

13.1 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, memory back-up, etc.).

Check items (a) to (f) then connect a peripheral device and check the A171SCPU 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), assess whether the problem is:

(a) in the A171SCPU, or external;

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

(c) in the sequence program.

⚠ 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, srevo-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.

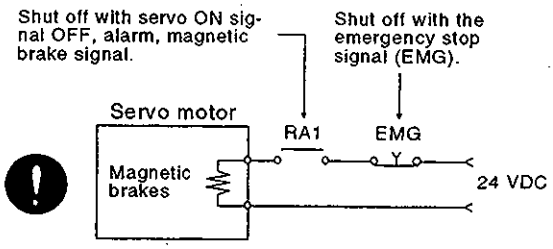
13. TROUBLESHOOTING

⚠ 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 electromagentic 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 sefety 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.

13. TROUBLESHOOTING

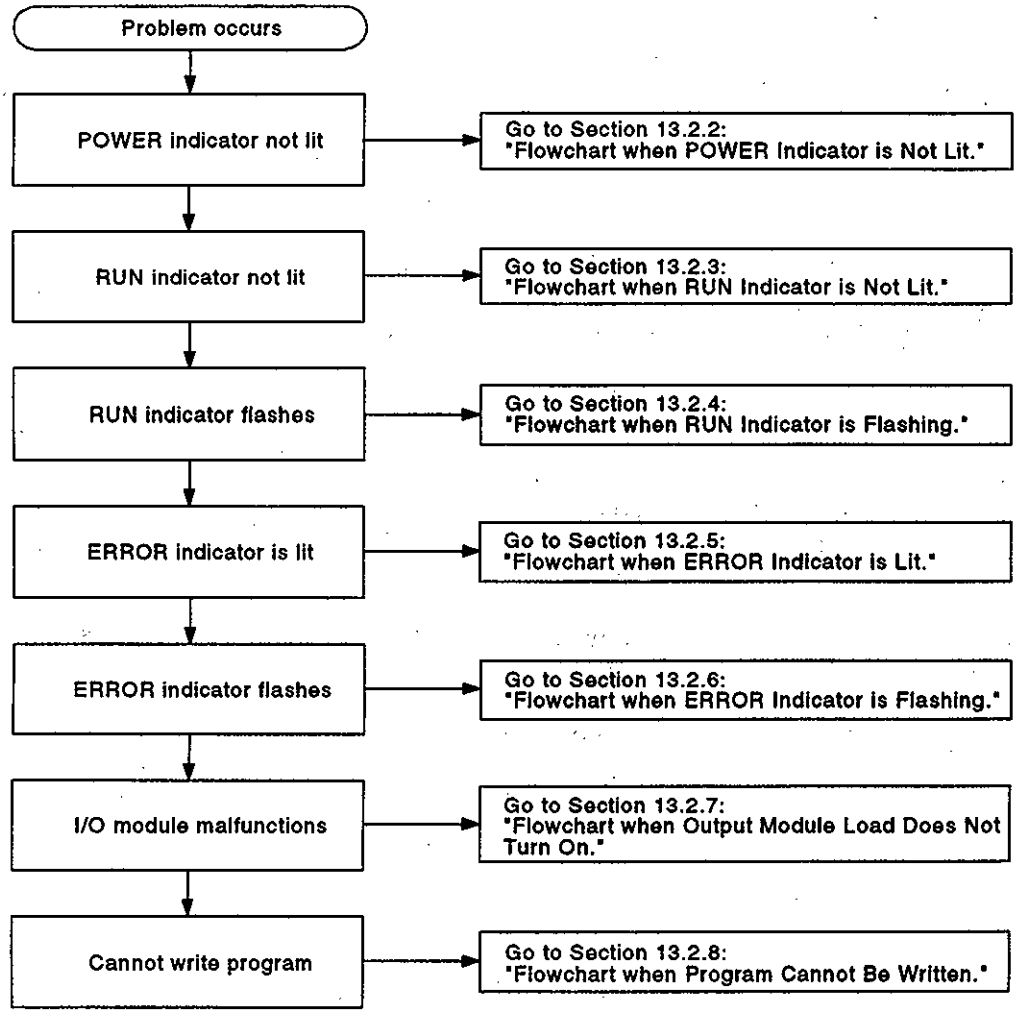
13.2 Troubleshooting

This section explains how to determine the cause of problems occurring in the A171SCPU SCPU or modules mounted in an extension base unit, and gives descriptions and remedies the errors indicated by each error code. This manual does not give troubleshooting flowcharts that apply to the use of MR-H-B, MR-J-B and MR-J2-B servo amplifiers. Refer to the instruction manual(s) for the servo amplifier(s) you are using:

- MITSUBISHI Motion Controller AC Servo MELSERVO-H-B Specifications and Instruction Manual
- MITSUBISHI Motion Controller AC Servo MELSERVO-J-B Specifications and Instruction Manual
- MITSUBISHI Motion Controller AC Servo MELSERVO-J2-B Specifications and Instruction Manual

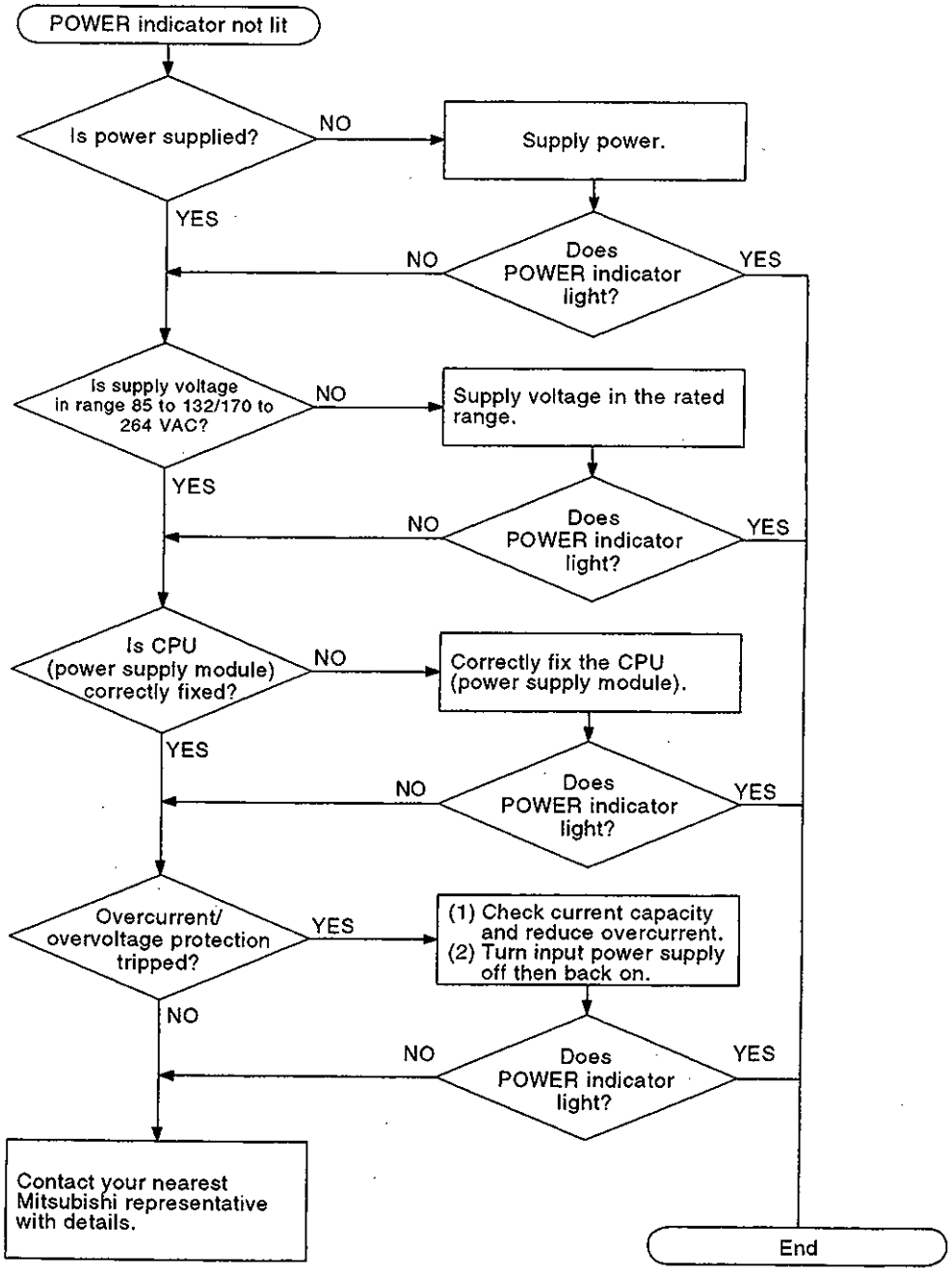
13.2.1 Troubleshooting flow charts

The flowcharts below are classified according to symptoms.



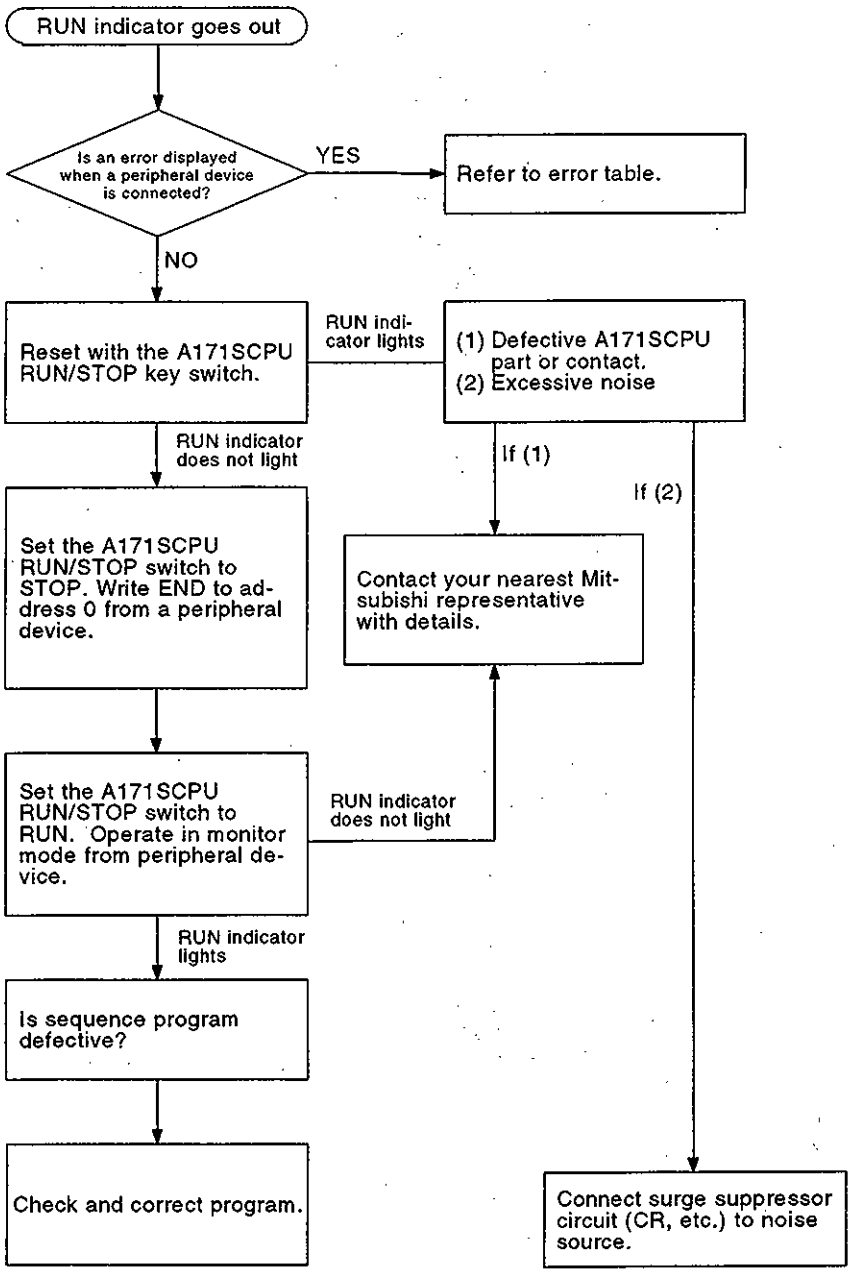
13.2.2 Flowchart when POWER indicator is not lit

Follow the flowchart below if the POWER indicator does not light when the power is turned on or goes out during operation.



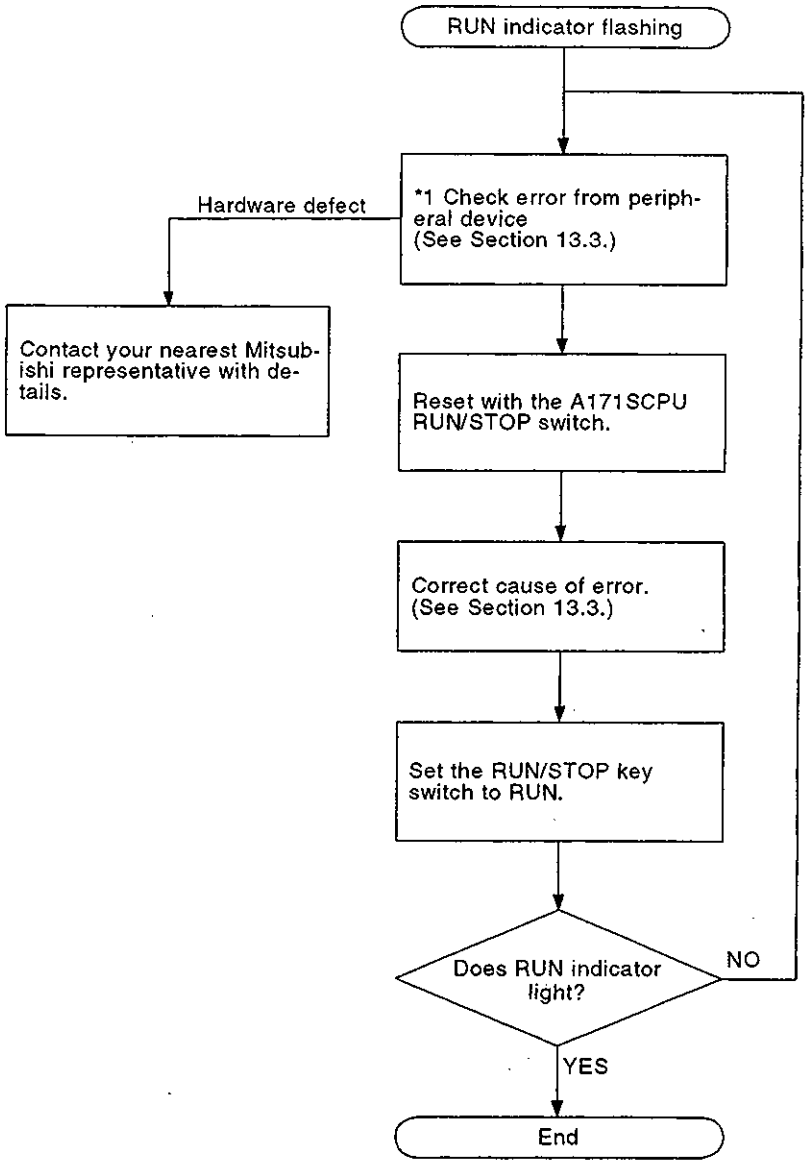
13.2.3 Flowchart when RUN indicator is not lit

Follow the flowchart below if the RUN indicator goes out during operation.



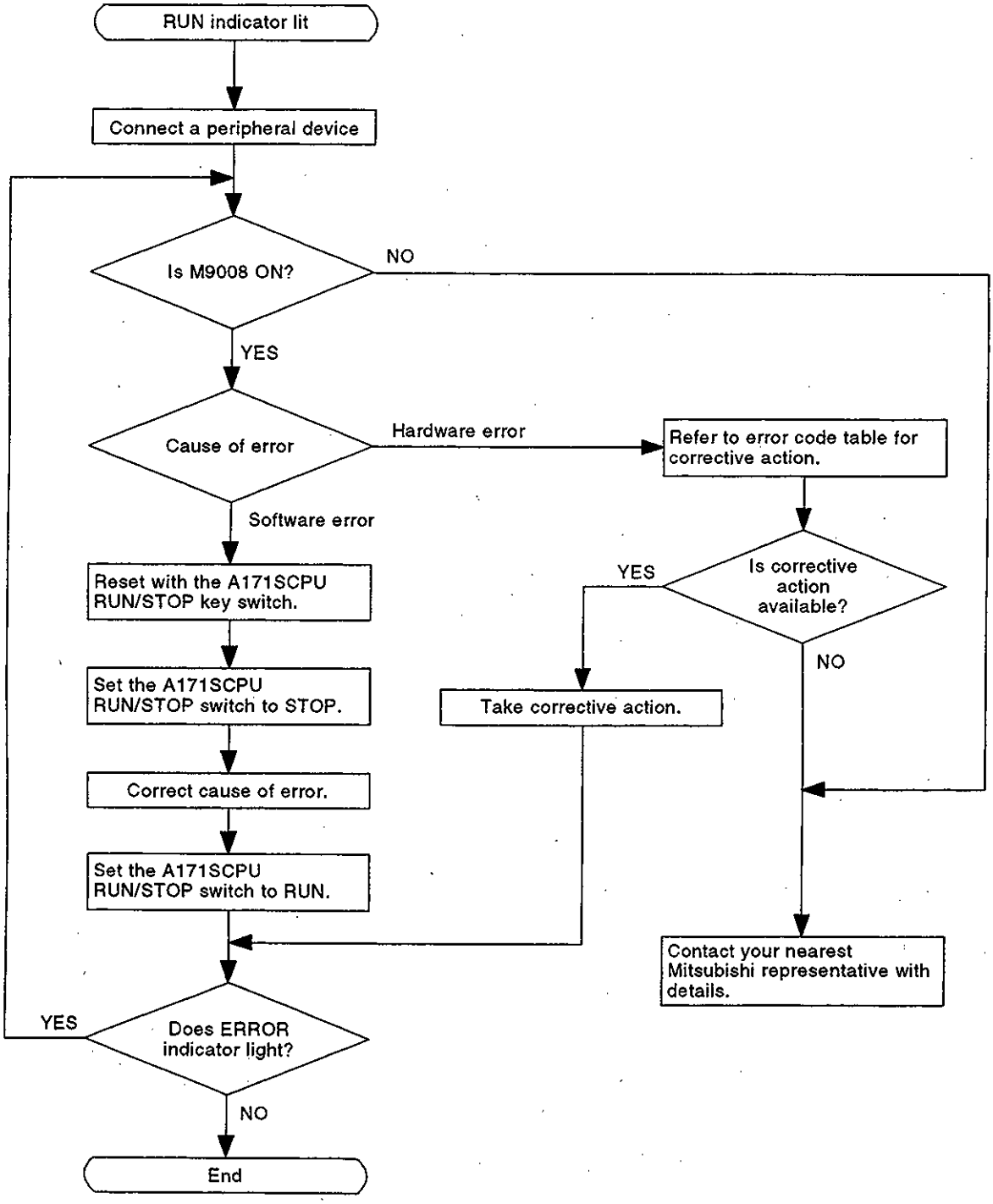
13.2.4 Flowchart when RUN indicator is flashing

Follow the flowchart below if the RUN indicator flashes when the power is turned on or during operation.



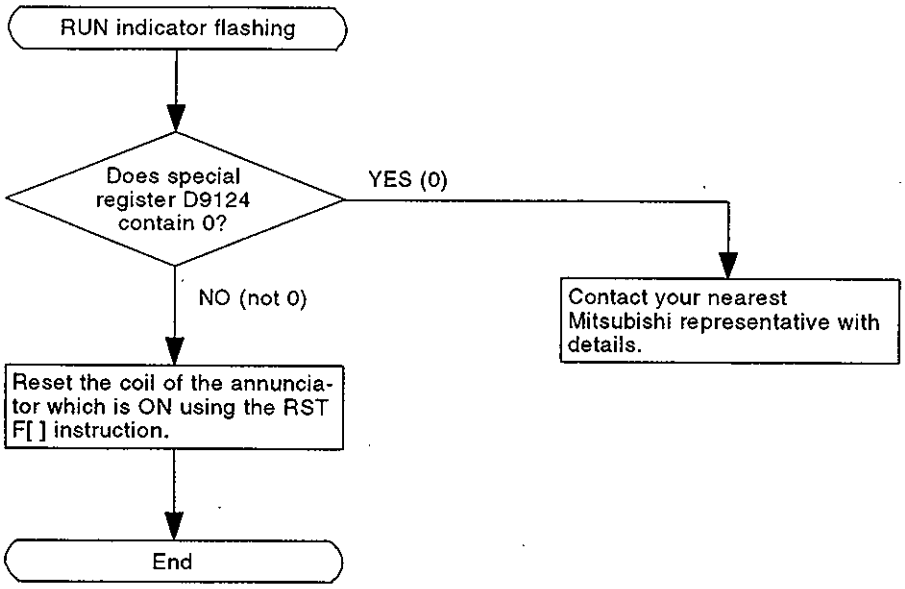
13.2.5 Flowchart when ERROR indicator is lit

Follow the flowchart below if the ERROR indicator lights during operation.



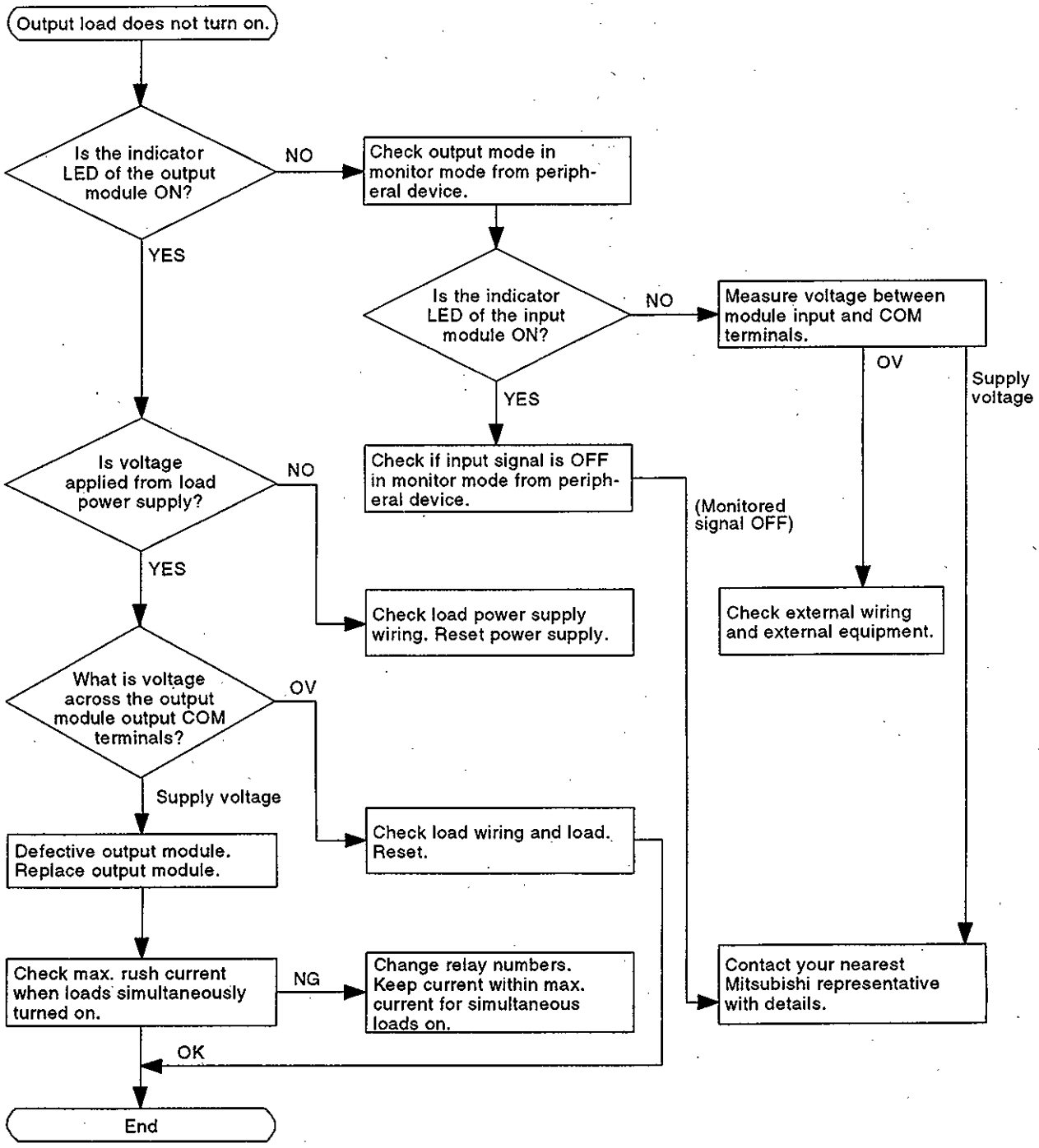
13.2.6 Flowchart when ERROR indicator is flashing

Follow the flowchart below if the ERROR indicator flashes during operation.



13.2.7 Flowchart when output module load does not turn on

Follow the flowchart below if the output module loads do not turn on during operation.

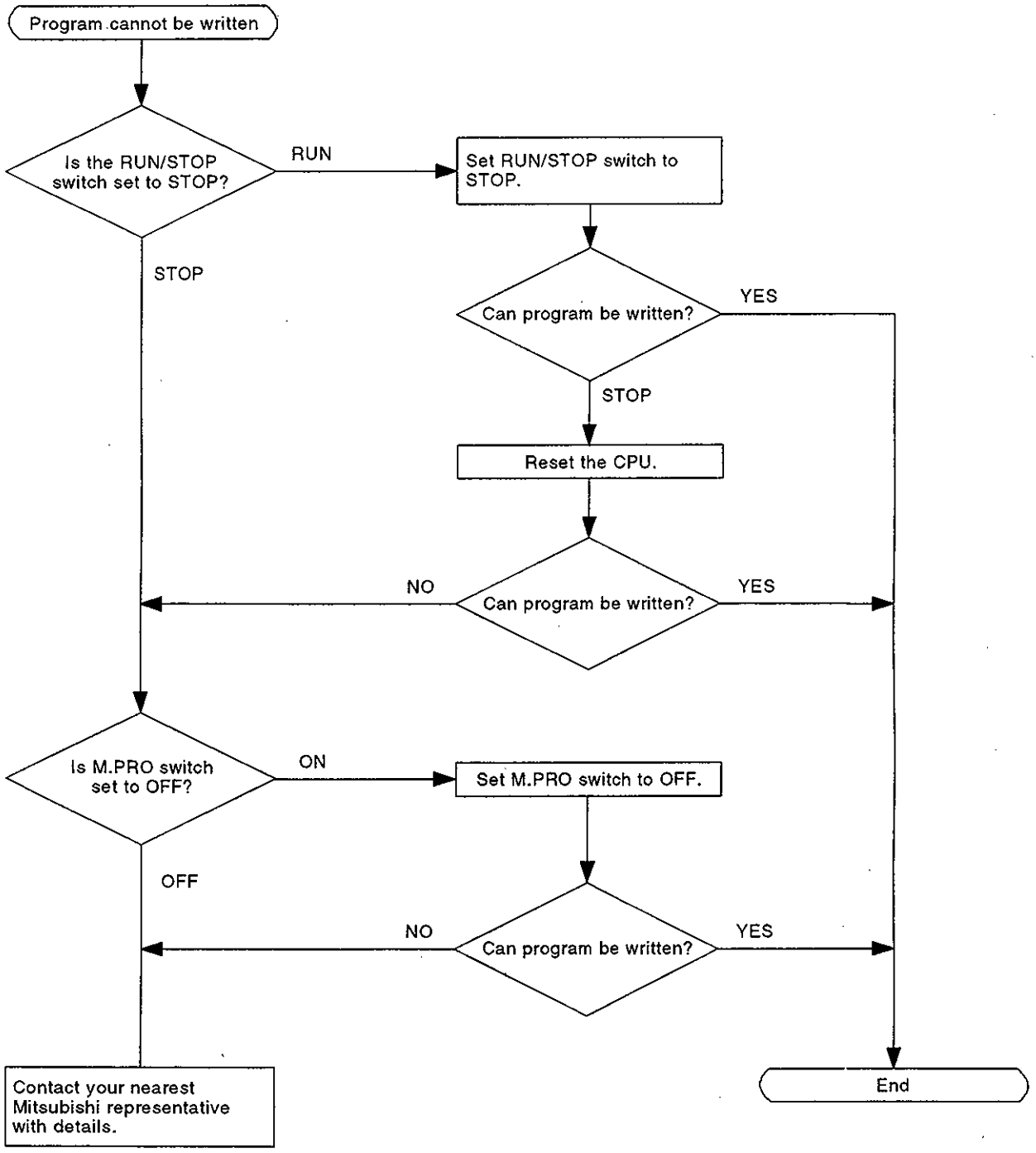


POINT

If the input signal or load does not turn off, refer to Section 13.4 "Possible Problems with I/O Modules."

13.2.8 Flowchart when program cannot be written

Follow the flowchart below if programs or other data cannot be written to the CPU.



13.3 Table of Error Codes

If an error occurs when RUN is executed or during A171SCPU operation, the self-diagnosis function displays an error or stores an error code (including step number) in the special registers. Table 13.1 shows the methods for reading the error codes when an error occurs and describes how to check and correct the error. Take the corrective action described to eliminate the cause of the error.

13.3.1 Table of error codes

The tables gives an error description and cause and describes suitable corrective action for each error number and error message.

Table 13.1 Error Code List

Error	Contents (BIN) of Special Register D9008.	CPU Status	Error Description and Cause	Corrective Action
"INSTRCT CODE ERR."	10	STOP	The CPU could not decode an instruction code in the program. (1) The memory contents have been changed for some reason and include instruction codes which cannot be decoded.	(1) Read the error step with the peripheral device and modify the program at this step.
"PARAMETER ERROR"	11	STOP	The contents of the CPU memory parameters has been changed by noise.	(1) Read the CPU memory parameters with the peripheral device, check and correct the contents, and re-write to memory.
"MISSING END INS."	12	STOP	(1) No END (FEND) instruction in program.	(1) Write an END instruction at the end of the program.
"CAN'T EXECUTE (P)"	13	STOP	(1) The jump destination designated by the CJ SCJ CALL CALLP JMP instruction does not exist or is duplicated. (2) Cannot execute because RET instruction exists in program but no CALL instruction. (3) The jump destination of a CJ SCJ CALL CALLP JMP instruction is after the END instruction. (4) The number of FOR instructions does not match the number of NEXT instructions. (5) A JMP instruction between a FOR and NEXT instruction jumps out of the FOR-NEXT loop. (6) A JMP instruction before the RET instruction jumps out of the sub-routine. (7) A JMP instruction destination is a step between a FOR and NEXT instruction or into a sub-routine.	(1) Read the error step with the peripheral device and correct the program (insert jump destination, eliminate duplicate jump destinations, etc.).

Table 13.1 Table of Error Codes (cont.)

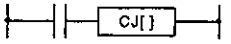
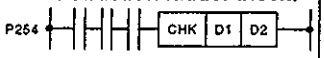
Error	Contents (BIN) of Special Register D9008.	CPU Status	Error Description and Cause	Corrective Action
"CHK FORMAT ERR."	14	STOP	(1) A CHK instruction ladder block contains an instruction (including NOP) other than LDX, LDIX, ANDX, ANIX. (2) Multiple CHK instruction exist. (3) More than 150 contacts exist in a CHK instruction ladder block. (4) The X device number in a CHK instruction ladder block exceeds X7FE. (5) No  ladder block exists before the CHK instruction ladder block. (6) The [CHK] [D1] [D2] instruction D1 device number does not match the device number of the contacts before the CJ[ ] instruction. (7) No pointer P254 exists at the start of the CHK instruction ladder block. 	(1) Check the CHK instruction ladder block for items (1) to (7) in the column to the left. Correct problems with the peripheral device and start operation again. (2) This error message is valid for direct I/O control only.
"CAN'T EXECUTE (I)"	15	STOP	(1) An interrupt module is used, but the program contains no equivalent interrupt pointer number, or duplicate interrupt pointers. (2) No IRET instruction exists in interrupt program. (3) An IRET instruction exists outside the interrupt program.	(1) Check if an interrupt program exists for the interrupt module, then create an interrupt program or eliminate duplicate I numbers, as appropriate. (2) Check if IRET instruction exists in the interrupt program, and insert, if required. (3) Check if an IRET instruction exists outside the interrupt program, and remove, if necessary.
"RAM ERROR"	20	STOP	(1) A check determined normal reading and writing to the CPU data memory area is not possible.	A problem with the CPU hardware. Contact your nearest Mitsubishi representative with details.
"OPE. CIRCUIT ERR."	21	STOP	(1) The CPU operation circuits which handle sequence processing are inoperative.	

Table 13.1 Table of Error Codes (cont.)

Error	Contents (BIN) of Special Register D9008.	CPU Status	Error Description and Cause	Corrective Action
" WDT ERROR "	22	STOP	The scan time exceeded the watchdog timer set time. (1) Scan time too long because of user program conditions. (2) Scan time too long because of instantaneous power interruption during scan.	(1) Calculate and check the scan time in the user program, reduce the scan time with the CJ instruction. (2) Monitor the contents of special register D9005 from a peripheral device. A non-zero value indicates an unstable power supply voltage. If the value is not 0, check the power supply and reduce the voltage fluctuations.
" END NOT EXECUTE "	24	STOP	(1) During execution, the END code was read as a different instruction code due to noise, or some other cause. (2) The END instruction changed to another instruction code for some reason.	(1) Reset the CPU and run again. If the same error is displayed again, a problem exists in the CPU hardware. Contact your nearest Mitsubishi representative with details.
" WDT ERROR "	25	STOP	A sequence program run by a CJ instruction is stuck in a loop and the END instruction cannot be executed.	Check if a program contains an infinite loop and modify, as required.
" UNIT VERIFY ERR."	31	STOP (RUN)	Problem with I/O module at power on. (1) During operation, the I/O module is loose or has come out of its slot, or the wrong module is mounted.	(1) The bit corresponding the module causing the verification error is set to 1 in special register D9116. Monitor the contents of this special register from the peripheral device. Check the module where the error occurred and replace, if necessary. (2) If the module position is correct, reset with the RUN/STOP key switch.
" FUSE BREAK OFF "	32	STOP (RUN)	(1) A fuse is blown in an output module. (2) The external power supply for the output load is turned off or not connected.	(1) Check the ERR indicator on each output module and replace the module with the indicator lit. (2) The module with a blown fuse can also be identified from a peripheral device. The bit corresponding the module with the blown fuse is set to 1 in special register D9100. Monitor the contents of this special register to identify the module. (3) Ensure that the external power supply for the output load is turned on.
" CONTROL-BUS ERR."	40	STOP	FROM and TO instructions could not be executed. (1) Control bus error with a special-function module.	(1) A hardware error exists in a special-function module, CPU module, or the main base unit. Replace the module or unit and check the defective module or unit for defects. Contact your nearest Mitsubishi representative with details.

Table 13.1 Table of Error Codes (cont.)

Error	Contents (BIN) of Special Register D9008.	CPU Status	Error Description and Cause	Corrective Action
" SP. UNIT DOWN "	41	STOP	When a FROM or TO instruction was executed, no reply was received that the special-function module was accessed. (1) The accessed special-function module is defective.	A hardware error exists in the accessed special-function module. Contact your nearest Mitsubishi representative with details.
" I/O INT.ERROR"	43	STOP	An interrupt was generated but no interrupt module is mounted.	(1) A hardware error exists in one of the modules. Replace the module and check the defective module for defects. Contact your nearest Mitsubishi representative with details.
" SP. UNIT LAY. ERR "	44	STOP	(1) Three or more computer link modules mounted with one CPU module. (2) Two or more A1SJ71AP21/R21, A1SJ71T21B mounted. (3) Two or more interrupt modules mounted. (4) The I/O allocation set in the peripheral device parameters allocate a special-function module where an I/O module is mounted, or vice-versa.	(1) Do not mount more than 2 computer link modules. (2) Do not mount more than 1 A1SJ71AP21/R21, A1SJ71T21B. (3) Mount 1 interrupt module. (4) Change the I/O allocation set in the peripheral device parameters to match the special-function modules mounted.
" SP.UNIT ERROR "	46	STOP (RUN)	(1) An attempt was made to access (by executing FROM and TO instructions) a position where no special-function module is mounted.	(1) Read the error step with the peripheral device and check and modify the FROM and TO instructions at this step.
" LINK PARA. ERROR "	47	RUN	(1) The contents written to the link parameter area after parameter setting at a peripheral device differ from the link parameter contents read by the CPU. (2) The total number of slave stations is set to zero.	(1) Write the parameters again and check. (2) If the same error is displayed again, a problem exists in the hardware. Contact your nearest Mitsubishi representative with details.
" OPERATION ERROR "	50	RUN (STOP)	(1) BCD conversion result exceeds the prescribed limit (9999 or 99999999). (2) Operation not possible because a setting was outside the prescribed device range. (3) A program used a file register for which the file register size is not set.	(1) Read the error step with the peripheral device and check and modify the program at this step. (Check the device setting range, BCD conversion range, etc.)
" BATTERY ERROR "	70	RUN	(1) Battery voltage is below the prescribed limit. (2) Battery lead connector is not connected.	(1) Replace the battery. (2) Connect the battery lead connector to use the internal RAM or memory back-up function.

13.3.2 Reading error codes

The error code can be read from a peripheral device after an error occurs. Refer to the peripheral device operating manual for details.

13. TROUBLESHOOTING

13.4 Possible Problems with I/O Modules

This section describes possible problems with input and output circuits, and what to do about them.

13.4.1 Troubleshooting input circuits

Table 13.2 describes problems and corrective actions for input circuits.

Table 13.2 Troubleshooting Input Circuits

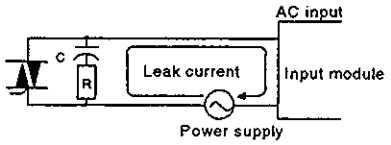
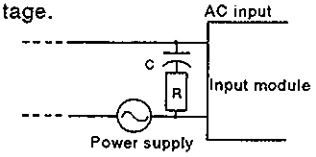
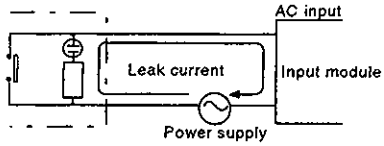
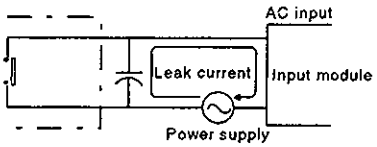
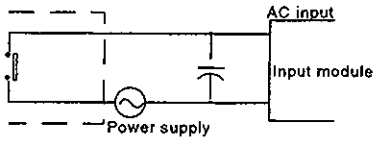
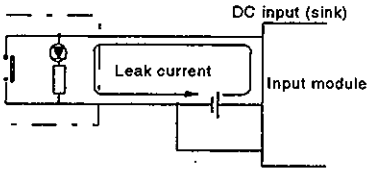
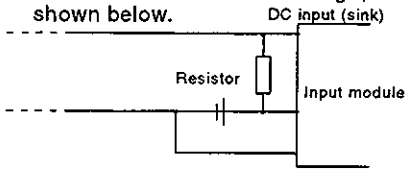
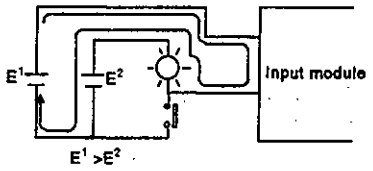
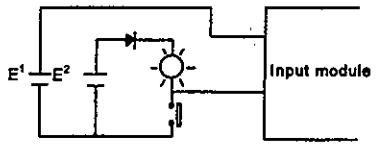
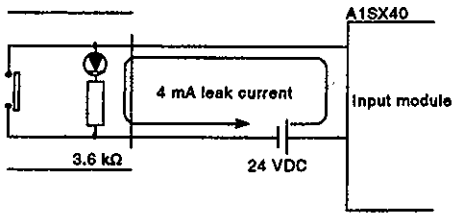
	Symptom	Cause	Corrective Action
Example1	nput signal does not turn OFF	• Current leakage through input switch. (Driven using a contactless switch, etc.) 	• Connect an appropriate resistor to lower the voltage between the input module terminals below the OFF voltage.  CR constant : 0.1 to 0.47μF+ 47 to 120 (1/2 W) recommended
Example2	nput signal does not turn OFF	• Driven using a limit switch with neon lamp. 	• See Problem 1, above. • Alternatively, provide a separate, independent display circuit.
Example3	nput 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. 
Example4	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 terminal and common terminal below the OFF voltage, as shown below.  *The method of calculating the resistor to connect is shown below.

Table 13.2 Troubleshooting Input Circuits (cont.)

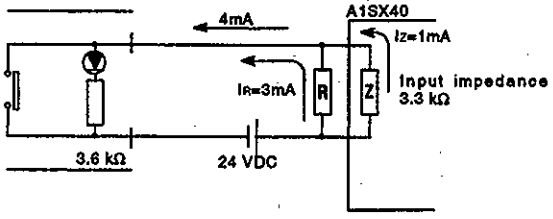
	Symptom	Cause	Corrective Action
Example5	Input signal does not turn OFF	Sneak path due to use of two power supplies. 	• Use a single power supply. • Connect a diode to prevent sneak paths, as shown in the diagram. 

<Resistor Resistance Calculation for Example 4>

For the case with a limit switch with LED indicator connected to A1SX40, causing 4 mA leak current.



(1) This circuit does not turn OFF because the A1SX40 OFF current of 1mA is not reached. Therefore, the connection of a resistor is required, as shown below.



(2) Resistance calculation
To achieve the A1SX40 OFF current of 1 mA, a resistor should be connected such that a current of 3 mA min. flows through the resistor.

$$I_R : I_Z = Z \text{ (Input impedance)} : R$$

$$R \leq \frac{I_Z}{I_R} \times \text{(Input impedance)} = \frac{1}{3} \times 3.3 = 1.1[k\Omega]$$

A resistance value of R < 1.1 kΩ
If a 1 k resistor is used, the resistor power capacity (W) is given by:

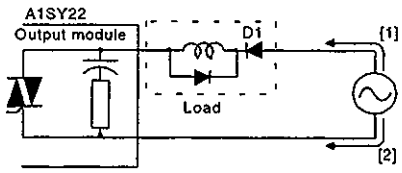
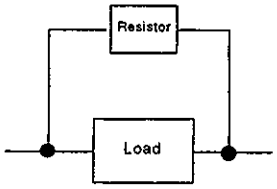
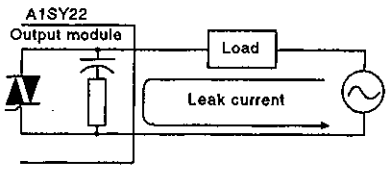
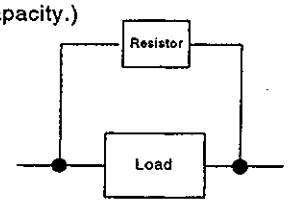
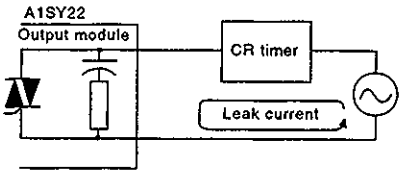
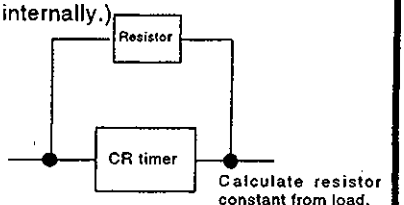
$$W = (\text{Current value})^2 \times R = 0.003^2(A) \times 1000(\Omega) = 0.009(W)$$

(3) In practice, a 1[kΩ] 0.5[W] resistor, which has a power capacity 3 to 5 times the actual power consumption, is connected across the terminals where the problem exists.

13.4.2 Troubleshooting output circuits

Table 13.3 describes problems and corrective actions for output circuits.

Table 13.3 Troubleshooting Output Circuits

	Symptom	Cause	Corrective Action
Example1	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. 2.2V	• Connect a resistor between several k and several hundred k across the load. (This method causes no problems with outputterminals but can lead to deterioration or burn-out of load internal diodes.) 
Example	Load does not turn OFF (Triac output)	• Leak current due to internal surge suppresor. 	• 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.) 
Example3	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 Example1, as some timers are half-wave rectified internally.) 

APPENDICES

APPENDIX 1 COMBINATIONS OF SERVO AMPLIFIER AND SERVO MOTOR

1.1 Combinations of MR-H-B/MR-J-B and Servo Motors

(1) List of combinations with MR-H-B/MR-J-B

Servo Amplifier / Servo Motor		MR-J-B Separate Servo Amplifier						MR-H-B Separate Servo Amplifier												Motor Capacity (kW)	Motor Rated Current (A)
		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		
Small capacity HA-MH, 3000 r/min 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
Small capacity HA-FH, 3000 r/min 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
Medium capacity HA-SH, 1000 r/min series	HA-SH81					○						○								0.85	4.5
	HA-SH121						○						○							1.2	6
	HA-SH201						○						○							2.0	9.5
	HA-SH301													○						3.0	14
Medium capacity HA-SH, 2000 r/min 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
Medium capacity HA-SH, 3000 r/min 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

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Servo Amplifier / Servo Motor		MR-J-B Separate Servo Amplifier						MR-H-B Separate Servo Amplifier												Motor Capacity (kW)	Motor Rated Current (A)
		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		
Low inertia HA-LH, 2000 r/min series	HA-LH52										O									0.5	3.5
	HA-LH102												O							1.0	7
	HA-LH152												O							1.5	9.4
	HA-LH202													O						2.0	14
	HA-LH302														O					3.0	18
	HA-LH502														O					5.0	28
	HA-LH702															O				7.0	37
	HA-LH11K2																O			11.0	68
	HA-LH15K2																	O		15.0	87
	HA-LH22K2																		O	22.0	126
Flat HA-UH, 2000 r/min series	HA-UH32									O										0.3	2.7
	HA-UH52										O									0.5	3.4
	HA-UH102												O							1.0	7.4
	HA-UH152												O							1.5	10
	HA-UH222													O						2.2	14
	HA-UH352														O					3.5	20
	HA-UH452														O					4.5	27

(2) Servo motor list

(a) Small capacity 3000 r/min 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
				O	O	O	O	O	O			O	O			O	O
HA-MH 3000 r/min series	With reducer for high accuracy	Reduction 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
				O	O	O	O	O	O	O	O	O	O	O	O		
HA-FH 3000 r/min series	With reducer for general industrial use	Reduction ratio	1/5	O	O	O	O	O	O	O	O	O	O	O	O		
			1/10	O	O	O	O	O	O	O	O	O	O	O	O		
			1/30	O	O	O	O	O	O	O	O	O	O	O	O		

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(b) Medium capacity/large 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
			Electro-magnetic 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	Yes	No	No	No
HA-SH 1000 r/min series								○	○			○	○			○	○			○	○												
HA-FH 2000 r/min series						○	○			○	○			○	○	○	○					○	○			○	○	○	○				
	With reducer for general industrial use	Reduction ratio	1/6			○	○			○	○			○	○	○	○					○	○										
			1/8																							○	○						
			1/11			○	○			○	○			○	○	○	○					○	○			○	○	○	○				
			1/17			○	○			○	○			○	○	○	○					○	○			○	○	○	○				
			1/29			○	○			○	○			○	○	○	○					○	○			○	○	○	○				
			1/35			○	○			○	○			○	○	○	○					○	○			○	○	○	○				
			1/43			○	○			○	○			○	○	○	○					○	○			○	○	○	○				
			1/59			○	○			○	○			○	○	○	○					○	○										
	With reducer for high accuracy	Reduction ratio	1/5			○	○			○	○			○	○	○	○					○	○			○	○	○	○				
			1/9			○	○			○	○			○	○	○	○					○	○			○	○						
			1/20			○	○			○	○			○	○	○	○					○	○										
			1/29			○	○			○	○			○	○	○	○																
			1/45			○	○			○	○			○	○	○	○																
HA-SH 3000 r/min series						○	○			○	○			○	○	○	○					○	○										
Low inertia HA-LH 2000 r/min series						○				○				○		○				○						○		○		○	○	○
	With reducer for high accuracy	Reduction ratio	1/5			○				○				○		○				○													
			1/9			○				○				○		○				○													
			1/20			○				○				○		○				○													
			1/29			○				○				○		○																	
			1/45			○				○				○		○																	
Flat HA-UH 2000 r/min series				○	○	○	○			○	○			○	○			○	○			○	○	○	○								

(3) Absolute encoders

Absolute encoders can also be installed.

HA-SH-Y	Encoder resolution 16384P/rev
HA-LH-Y	
HA-UH-Y	
HA-FH-Y	Encoder resolution 8192P/rev
HA-MH-Y	

1.2 Combinations of MR-J2-B and Servo Motors

(1) List of combinations with MR-J2-B

Servo Motor \ Servo Amplifier		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		
Small capacity HC-MF, 3000 r/min series	HC-MF053	O						0.05	0.85
	HC-MF13	O						0.1	0.85
	HC-MF23		O					0.2	1.5
	HC-MF43			O				0.4	2.8
	HC-MF73					O		0.75	5.1
Small capacity HA-FF, 3000 r/min series	HA-FF053	O						0.05	0.6
	HA-FF13	O						0.1	1.1
	HA-FF23		O					0.2	1.3
	HA-FF33			O				0.3	1.9
	HA-FF43			O				0.4	2.5
	HA-FF63				O			0.6	3.6
Medium capacity HC-SF, 2000 r/min series	HC-SF52				O			0.5	3.2
	HC-SF102						O	1.0	6

(2) Servo motor list

(a) Small capacity 3000 r/min 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 r/min series					O	O	O	O	O	O			O	O			O	O
	With reducer for general industrial use	Reduction ratio	1/5		O	O	O	O	O	O			O	O			O	O
			1/12		O	O	O	O	O	O			O	O			O	O
			1/20		O	O	O	O	O	O			O	O			O	O
	With reducer for high accuracy	Reduction 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
HA-FF 3000 r/min series					O	O	O	O	O	O	O	O	O	O	O	O		
	With reducer for general industrial use	Reduction ratio	1/5		O	O	O	O	O	O	O	O	O	O	O	O		
			1/10		O	O	O	O	O	O	O	O	O	O	O	O		
			1/30		*1 O	*1 O	*1 O	*1 O	O	O	O	O	O	O	O	O		
	With reducer for high accuracy	Reduction ratio	1/5		O	O	O	O	O	O	O	O	O	O	O	O		
			1/9										O	O	O	O		
			1/10		O	O	O	O	O	O	O	O						
			1/15		O	O	O	O	O	O								
			1/20						O	O	O	O	O	O	O	O		
			1/25		O	O	O	O										
			1/29						O	O	O	O	O	O	O	O		
			1/45				O	O	O	O	O	O	O	O	O	O		

*1 : HA-FF053, HA-FF13 are the opposite direction.

(b) Medium capacity series

Motor Rated Output		(kw)		0.5		1.0		1.5		2.0		3.5	
		Electro-magnetic Brake		No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
HC-SF 2000 r/min series				O	O	O	O	O	O	O	O	O	O
	With reducer for general industrial use	Reduction 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 reducer for high accuracy	Reduction 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 2 DYNAMIC BRAKE CHARACTERISTICS

(1) HA-MH/FH/SH/LH/UH series motors

On occurrence of a power interruption or emergency stop the dynamic brake unit operates and the servo motor executes a rapid stop. When this happens the machine decelerates to a stop as shown by the pattern in Figure 1. The maximum coasting distance (at rapid feed speed) when the dynamic brake operates is the area of the shaded part in Figure 1 and can be roughly calculated using the following expression (2-1). The effects of load torque are greater near the region of the stop, and when the load torque is large, the motor will stop earlier than calculated by this expression. The brake time constant τ in the expression (2-1) changes in accordance with the motor rotation speed at emergency stop, as shown in Figures 2 through 4.

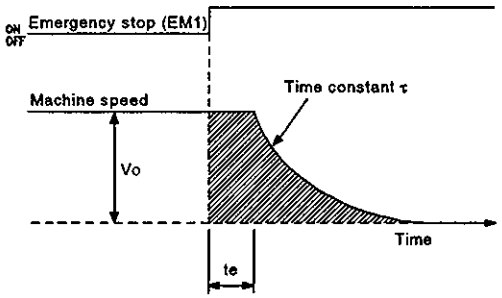


Figure 1 Dynamic Brake Braking Diagram

$$Lmax = \frac{Vo}{60}\left\{ te + \tau\left(1 + \frac{JL}{JM}\right)\right\} \quad \ldots (2\text{-}1)$$

Where:

Lmax	: Maximum coasting distance	[mm]
Vo	: Machine's fast feed speed	[mm/min]
JM	: Servo motor inertia	[kg · cm^2]
JL	: Load inertia converted into equivalent value on servo motor shaft	[kg · cm^2]
τ	: Brake time constant (Figures 2, 3, 4, Table 1)	[sec]
te	: Delay time of control section (figure to left) (The delay time of the internal relay is approximately 30 msec.)	[sec]

Table 1 Dynamic brake time constant

Servo Motor	Brake Time Constant τ (sec)
HA-MH053	0.02
HA-MH13	0.03
HA-MH23	0.04
HA-MH43	0.06
HA-MH73	0.05

Servo Motor	Brake Time Constant τ (sec)
HA-FH053	0.02
HA-FH13	0.02
HA-FH23	0.05
HA-FH33	0.07
HA-FH43	0.09
HA-FH63	0.12

[Dynamic brake permissible load GD^2]
If the dynamic brake is operated at a load exceeding that indicated below, the resistance can burn the brake inside the amplifier.

Amplifier Model Name	GDL/GDM
MR-H10B to MR-H100B	30 x
MR-H200B	20 x
MR-H350B to MR-H700B	10 x
MR-H11KB to MR-H22KB	30 x

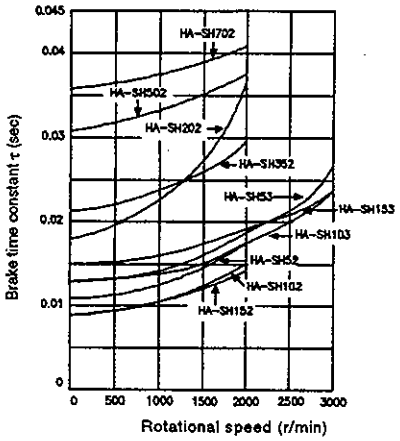


Figure 2 Dynamic Brake Time Constant (HA-SH)

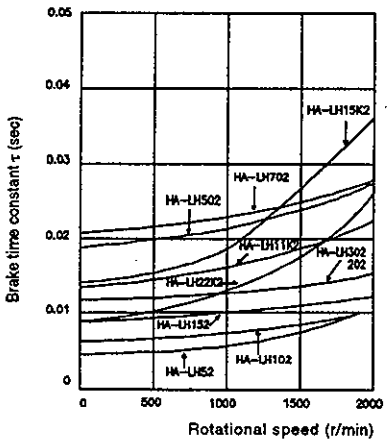


Figure 3 Dynamic Brake Time Constant (HA-LH)

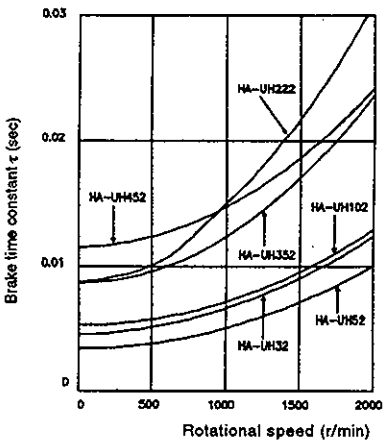


Figure 4 Dynamic Brake Time Constant (HA-UH)

(2) HC-MF/HA-FF/HC-SF series motors

On occurrence of a power interruption or emergency stop the dynamic brake unit operates and the servo motor executes a rapid stop. When this happens the machine decelerates to a stop as shown by the pattern in Figure 5. The maximum coasting distance (at rapid feed speed) when the dynamic brake operates is the area of the shaded part in Figure 5 and can be roughly calculated using the following expression (2-2). The effects of load torque are greater near the region of the stop, and when the load torque is large, the motor will stop earlier than calculated by this expression. The brake time constant τ in the expression (2-2) changes in accordance with the motor rotation speed at emergency stop, as shown in Figures 6 and 7.

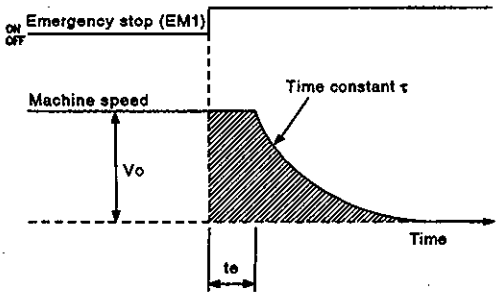


Figure 5 Dynamic Brake Braking Diagram

$$Lmax = \frac{Vo}{60}\left\{ te + \tau\left(1 + \frac{JL}{JM}\right)\right\} \quad \ldots (2\text{-}2)$$

Where:

Lmax	: Maximum coasting distance	[mm]
Vo	: Machine's fast feed speed	[mm/min]
JM	: Servo motor inertia	[kg · cm^2]
JL	: Load inertia converted into equivalent value on servo motor shaft	[kg · cm^2]
τ	: Brake time constant (Figures 6, 7, Table 2)	[sec]
te	: Delay time of control section (figure to left) (The delay time of the internal relay is approximately 30 msec.)	[sec]

Table 2 Dynamic brake time constant

Servo Motor	Brake Time Constant τ (sec)
HA-FF053 · 13	0.02
HA-FF23	0.05
HA-FF33	0.07
HA-FF43	0.09
HA-FF63	0.12

[Dynamic brake permissible load GD^2]

If the dynamic brake is operated exceeding the load indicated below, the resistance can burn the brake inside the amplifier.

Amplifier Model Name	GDL/GDM
MJ-J2-10B to MR-J2-100B	30 x
MR-J2-200B	
MR-J2-350B	

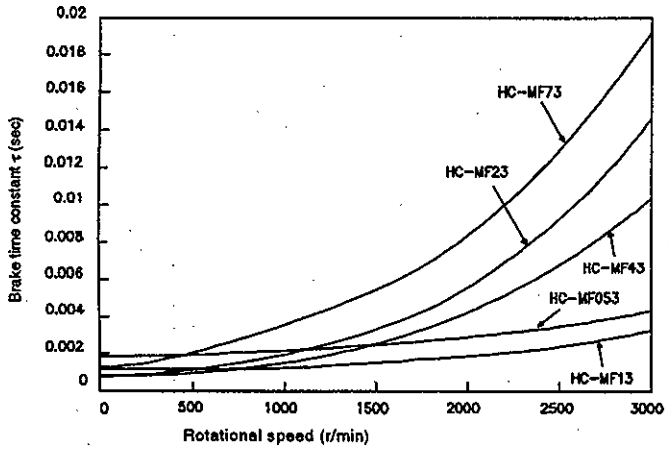


Figure 6 Dynamic Brake Time Constant (HC-MF)

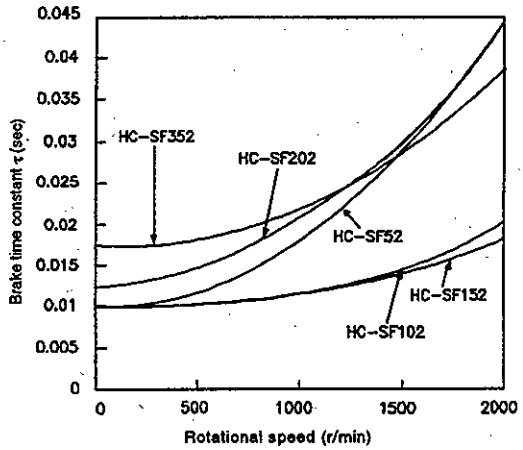


Figure 7 Dynamic Brake Time Constant (HC-SF)

APPENDIX 3 ELECTROMAGNETIC BRAKE CHARACTERISTICS

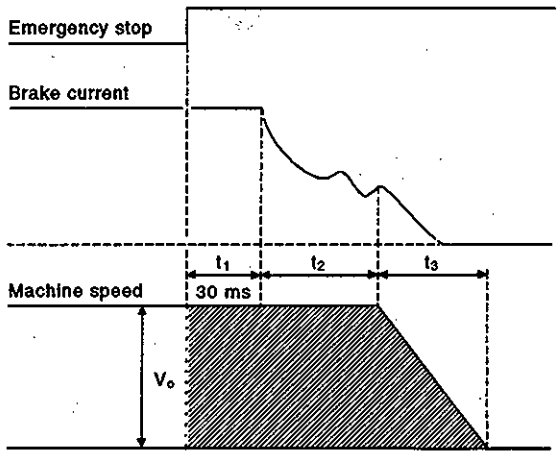
The characteristics of the load-holding electromagnetic brakes used the with motors that feature electromagnetic brakes are described here. When used in vertical motion applications, these brakes are used to hold the load when the power is turned off, and are also used in conjunction with dynamic braking during emergency stops to provide an extra level of safety and prevent collisions.

(1) HA-MH/FH/SH/UH series motors

Item		HA-MH Series Motors			HA-FH Series Motors			HA-SH Series Motors		HA-UH Series Motors			
		HA-MH053 HA-MH13	HA-MH23 HA-MH43	HA-MH73	HA-FH053 HA-FH13	HA-FH23 HA-FH33	HA-FH43 HA-FH63	HA-SH52 to 152 HA-SH53 to 153 HA-SH81	HA-SH 202 to 702 HA-SH 203 to 353 HA-SH 121, 201, 301	HA-UH32 HA-UH52	HA-UH102 HA-UH152	HA-UH222 HA-UH352	HA-UH452
Model		Spring braking type safety brake											
Rated voltage		24 VDC											
Rated current (A)	When cooled (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
	When 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
Exciter coil resistance (Ω)	When cooled (20 °C)	90	63	47	111	78	52	38	23	43	38	33	30
	When 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
Brake release 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
Brake active 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
Inertia moment	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 off	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 off	0.01	0.02	0.02	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Tolerable braking amount	Per braking	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)	180 (18)	460 (47)	3900 (400)	44000 (4500)	1900 (200)	3900 (400)	3900 (400)	3900 (400)
Brake play at motor shaft (degrees)		0.19 to 2.2	0.12 to 1.01	0.088 to 1.01	0.3 to 3.5	0.2 to 2.0	0.2 to 1.3	0.2 to 0.6		0.2 to 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 (4.4)	6 (13.2)	0.8 (1.76)	1.2 (2.64)	2.1 (4.62)	2.3 (5.06)
Brake life		20,000 brakings assuming 4 N·m per braking	20,000 brakings assuming 15 N·m per braking	20,000 brakings assuming 32 N·m per braking	30,000 brakings assuming 4 N·m per braking	30,000 brakings assuming 18 N·m per braking	30,000 brakings assuming 47 N·m per braking	20,000 brakings assuming 200 N·m per braking	20,000 brakings assuming 2000 N·m per braking	20,000 brakings assuming 100 N·m per braking	20,000 brakings assuming 200 N·m per braking		

Coasting distance

When the motor has to be stopped suddenly, for example for an emergency stop, the dynamic brake (option) is used. The coasting distance cannot be made much shorter even by using the electromagnetic brake in conjunction with it. If the dynamic brake does not operate due to failure, the motor will decelerate in accordance with the pattern shown below, and the maximum coasting distance (at rapid feed speed) Lmax in this case is the area of the shaded part in the figure and can be roughly calculated using the expression given below. The effects of load torque are greater near the region of the stop, and when the load torque is large, the motor will stop earlier than calculated by this expression.



Coasting distance during emergency stop

$$Lmax = \frac{Vo}{60}\left(t_1 + t_2 + \frac{t_3}{2}\right)$$

Where:

Lmax	: Maximum coasting distance	[mm]
V_O	: Machine's fast feed speed	[mm/min]
t_1	: Delay time of control section	[s]
t_2	: Braking delay time of brake *	[s]
t_3	: Braking time	[s]

$$t_3 = \frac{(J_L + J_M) \cdot N_O}{9.55 \times 10^4 \cdot (T_L + 0.8T_B)}$$

J_L	: Load inertia converted into equivalent value on servo motor shaft	[kg · cm^2]
J_M	: Servo motor inertia	[kg · cm^2]
N_O	: Servo motor speed during fast feed	[r/min]
T_L	: Load torque converted into equivalent value on servo motor shaft	[N · m]
T_B	: Brake static friction torque *	[N · m]

* t_2 and T_B are the values noted in the characteristics table (1). J_L is the sum of the motor's inertia moment and electromagnetic brake's inertia moment (Table (1)).

(2) HC-MF/HA-FF series motors

Item		HC-MH Series Motors			HA-FF Series Motors		
		HC-MF053 HC-MF13	HC-MF23 HC-MF43	HC-MF73	HA-FF053 HA-FF13	HA-FF23 HA-FF33	HA-FF43 HA-FF63
Model		Spring braking type safety brake					
Rated voltage		24 VDC					
Rated current at 20 °C (A)		0.26	0.33	0.42	0.22	0.31	0.46
Exciter coil resistance at 20 °C (Ω)		91	73	57	111	78	52
Capacity (W)		6.3	7.9	10	7	7.4	11
Brake release current (A)		0.18	0.16	0.2	0.15	0.2	0.3
Brake active 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
Inertia moment	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 off	0.08	0.1	0.12	0.08	0.1	0.12
	DC off	0.01	0.02	0.03	0.01	0.03	0.03
Tolerable braking amount (N · m) {kgf · cm}	Per braking	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 at motor shaft (degrees)		0.19 to 2.5	0.12 to 1.2	0.1 to 0.9	0.3 to 3.5	0.2 to 2.0	0.2 to 1.3
Brake life		20,000 brakings assuming 4 N·m per braking	20,000 brakings assuming 15 N·m per braking	20,000 brakings assuming 32 N·m per braking	30,000 brakings assuming 4 N·m per braking	30,000 brakings assuming 18 N·m per braking	30,000 brakings assuming 47 N·m per braking

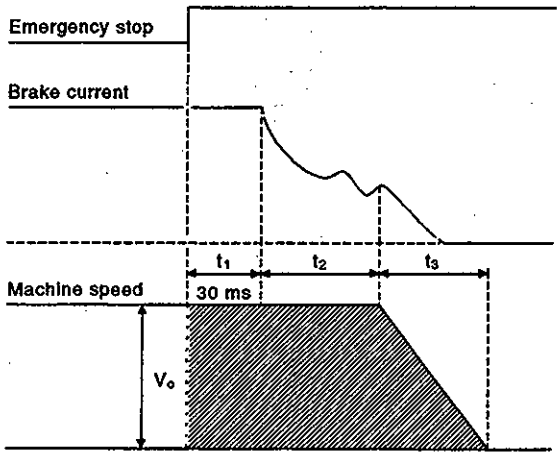
(3) HC-SF series motors

Item		HC-SF Series Motors
		HC-SF52B to HC-SF152B
Model		Spring braking type safety brake
Rated voltage		24 VDC
Rated current at 20 °C (A)		0.8
Exciter coil resistance at 20 °C (Ω)		29
Capacity (W)		19
Brake release current (A)		0.2
Brake active current (A)		0.08
Static friction torque	(N · m)	8.3
	(kgf · cm)	85
	(oz · in)	1175
Inertia moment	J (kg · cm^2)	2.0
	GD^2 (kgf · cm^2)	8.0
	WK^2 (oz · in^2)	10.9

Item			HC-SF Series Motors
			HC-SF52B to HC-SF152B
Release delay time (S)			0.04
Braking delay time (S)	AC off		0.12
	DC off		0.03
Tolerable braking amount	Per braking	(N · m)	400
		(kgf · cm)	4082
		(oz · in)	56648
	Per hour	(N · m)	4000
		(kgf · cm)	40816
		(oz · in)	566476
Brake play at motor shaft (degrees)			0.2 to 0.6
Brake life	Number of times		20000
	Per braking	(N · m)	200
		(kgf · cm)	2041
		(oz · in)	28324

Coasting distance

When the motor has to be stopped suddenly, for example for an emergency stop, the dynamic brake (option) is used. The coasting distance cannot be made much shorter even by using the electromagnetic brake in conjunction with it. If the dynamic brake does not operate due to failure, the motor will decelerate in accordance with the pattern shown below, and the maximum coasting distance (at rapid feed speed) Lmax in this case is the area of the shaded part in the figure and can be roughly calculated using the expression given below. The effects of load torque are greater near the region of the stop, and when the load torque is large, the motor will stop earlier than calculated by this expression.



Coasting distance during emergency stop

$$Lmax = \frac{Vo}{60}\left(t_1 + t_2 + \frac{t_3}{2}\right)$$

Where:

Lmax	: Maximum coasting distance	[mm]
Vo	: Machine's fast feed speed	[mm/min]
t_1	: Delay time of control section	[s]
t_2	: Braking delay time of brake *	[s]
t_3	: Braking time	[s]

$$t_3 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4 \cdot (T_L + 0.8T_B)}$$

J_L	: Load inertia converted into equivalent value on servo motor shaft	[kg · cm^2]
J_M	: Servo motor inertia	[kg · cm^2]
No	: Servo motor speed during fast feed	[r/min]
T_L	: Load torque converted into equivalent value on servo motor shaft	[N · m]
T_B	: Brake static friction torque *	[N · m]

* t_2 and T_B are the values noted in the characteristics table (2). J_L is the sum of the motor's inertia moment and electromagnetic brake's inertia moment (Table (2)).

APPENDIX 4 CONNECTING CABLES

The connection of motion net cables and encoder cables is described here.

4.1 Motion Net Cables

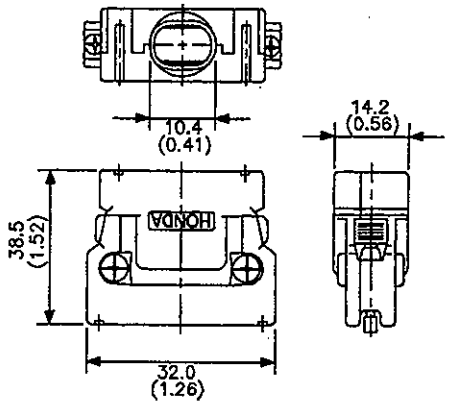
(1) MR-HBUS[ ]M

(a) Cables
For motion net cables, use the shielded twisted pair cables indicated below or equivalents.

Model Name	Core Size (mm)	Finished Diameter (mm)	Characteristics of One Electric Wire		Color
			Configuration (wires/mm)	Conductor Resistance (Ω/km)	
A14B2343	6 pairs x 0.2	7.9	40/0.08	105 or less	Black

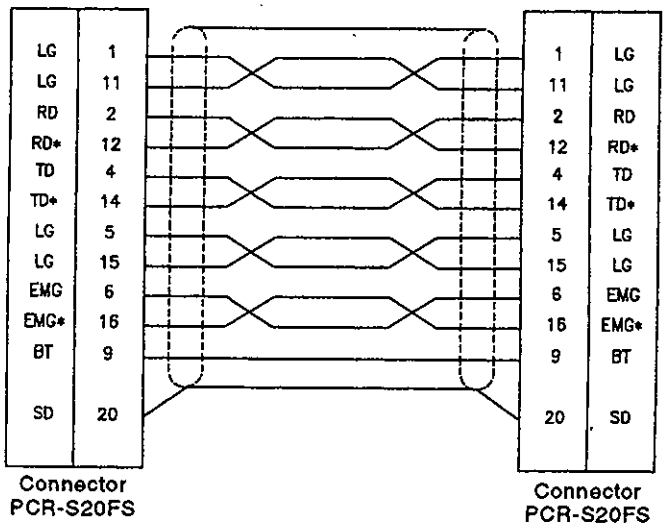
Maker : Junkosha
Obtained from : Toa Denki

(b) Connectors
Use PCR-S20FS (case: PCR-LS20LA1) connectors made by Honda Tsushin Kogyo.



Unit : mm (inch)

(c) Connections

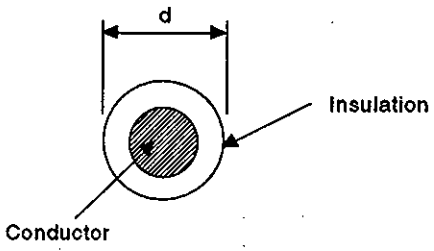


(2) MR-J2HBUS[ ]M-A/MR-J2HBUS[ ]M

(a) Cables
For motion net cables, use the shielded twisted pair cables indicated below or equivalents.

Core Wire Size (mm^2) x Pairs	Outer Diameter of Core Wire Insulation *d (mm)	Recommended Wire Model Name	Color
0.2 x 7	0.9 to 1.27	UL20276 AWG28 10pair	Black

*The meaning of "d" is as follows.

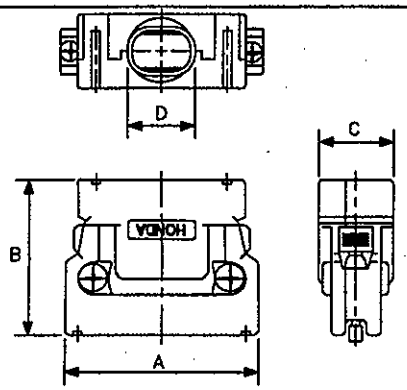


Cross section of core wire

(b) Connectors
Use the following connectors.

1) MR-J2HBUS[ ]M-A

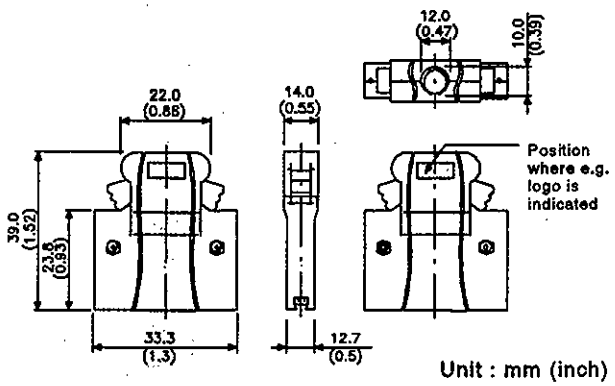
Connector at Motion Controller Side (made by Honda Tsushin Kogyo)



Number of Pins	Case	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)

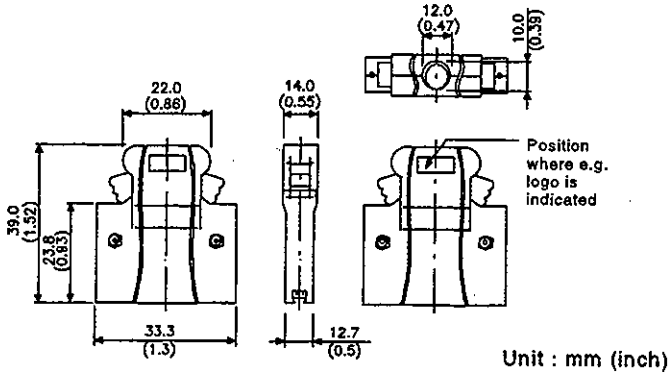
Connector at Amplifier Side (made by Sumitomo 3M) CN3A



Unit : mm (inch)

Case	Connector
10320-3210-000	10120-6000EL

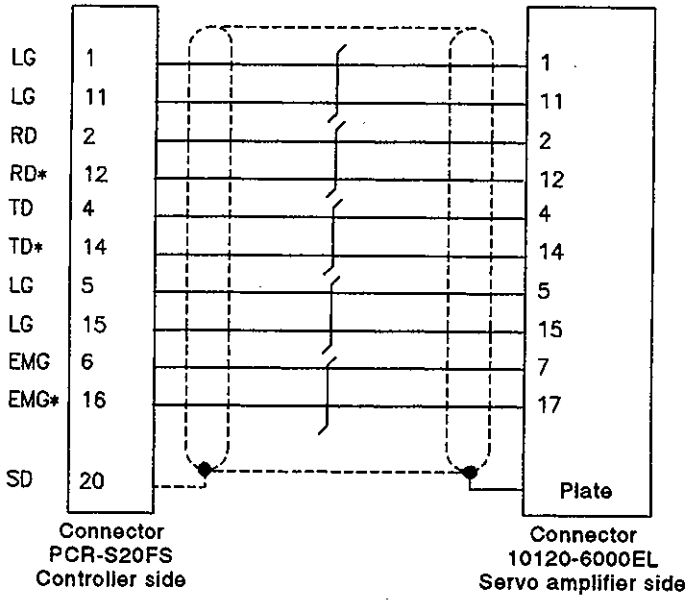
2) MR-J2HBUS[ ]M
Use the 10120-6000EL by Sumitomo 3M as the connector (case: 10320-3210-000).



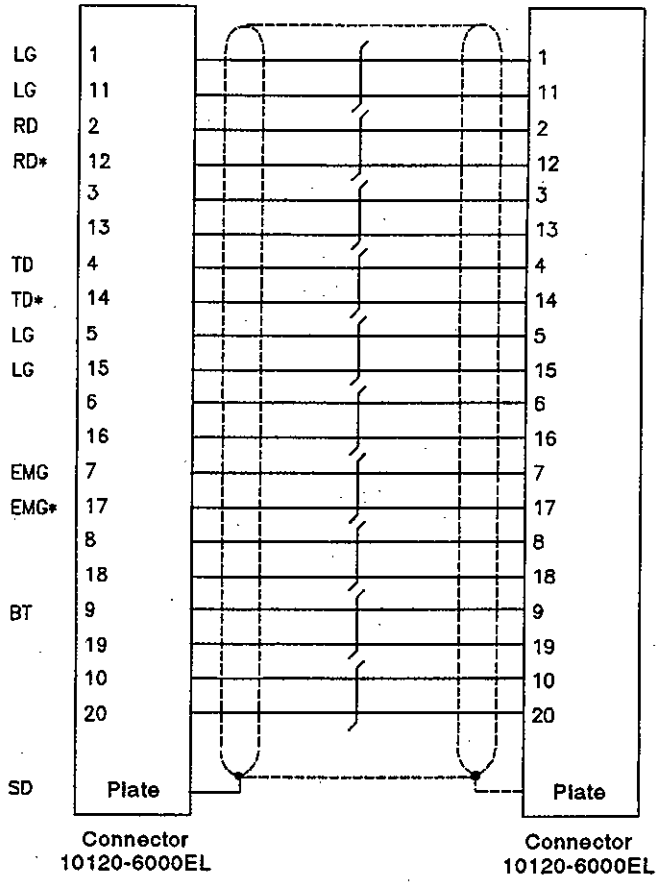
Unit : mm (inch)

(c) Connections

1) MR-J2-HBUS[ ]M-A



2) MR-J2HBUS[ ]M


LG 1
LG 11
RD 2
RD* 12
3
13
TD 4
TD* 14
LG 5
LG 15
6
16
EMG 7
EMG* 17
8
18
BT 9
19
10
20
SD
Plate
Connector
10120-6000EL
1
11
2
12
3
13
4
14
5
15
6
16
7
17
8
18
9
19
10
20
Plate
Connector
10120-6000EL

4.2 Encoder Cables

(1) MR-HCBL[ ]M/MR-HSCBL[ ]M

(a) Cables
For encoder cables, use the shielded twisted pair cables indicated below or equivalents.

1) 4-pair shielded cable for encoders (applicable to MR-HSCBL5M, MR-HSCBL5M)

Model Name	Core Size (mm)	Finished Diameter (mm)	Characteristics of One Electric Wire		Color
			Configuration (Wires/mm)	Conductor Resistance (Ω/km)	
A14B2339	4 pairs x 0.2	7.2	40/0.08	105 or less	Black

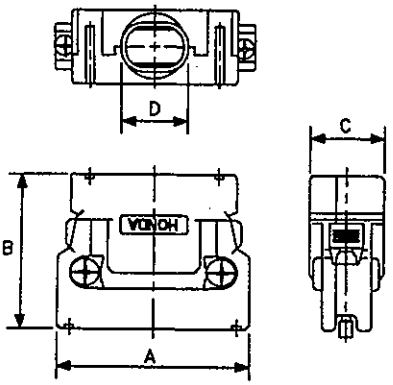
2) 6-pair shielded wire
Applicable to MR-HCBL10M to MR-HCBL30M
MR-HSCBL10M to MR-HSCBL30M
MR-HBUS[ ]M to MR-HBUS[ ]M

Model Name	Core Size (mm)	Finished Diameter (mm)	Characteristics of One Electric Wire		Color
			Configuration (Wires/mm)	Conductor Resistance (Ω/km)	
A14B2343	6 pairs x 0.2	7.9	40/0.08	105 or less	Black

Maker : Junkosha
Obtained from : Toa Denki

(b) Connectors
Use the following connectors.

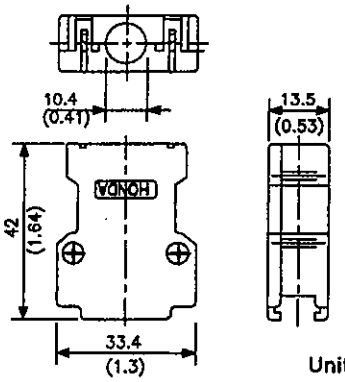
Connector at Amplifier Side (made by Honda Tsushin Kogyo) CN2, CN1A, CN1B



Number of Pins	Case	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)

Relay Connector at Encoder Side (made by Honda Tsushin Kogyo) For HA-FH

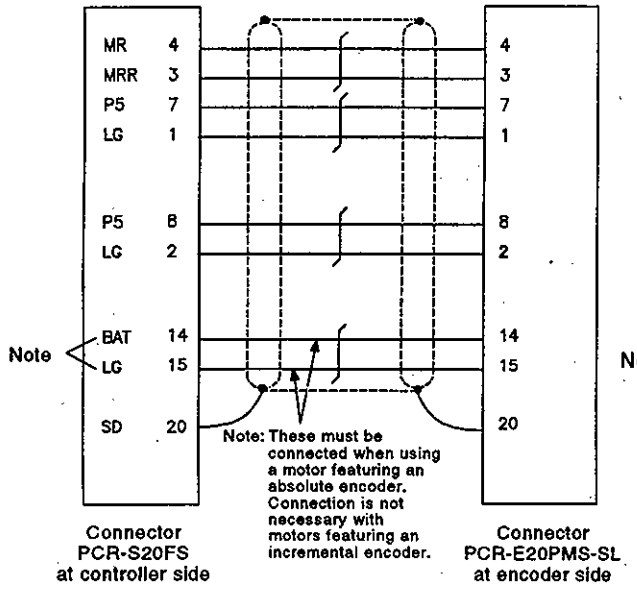


Unit : mm (inch)

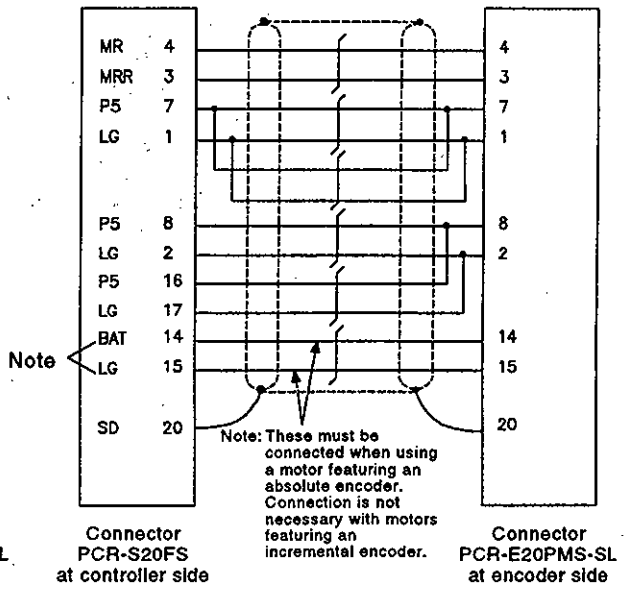
Number of Pins	Case	Connector
20	PCR-S20PMLA2	PCR-E20PMRS-SL

(c) Connections

1) MR-HCBL[ ]M (applicable to HA-MH/FH series motors)

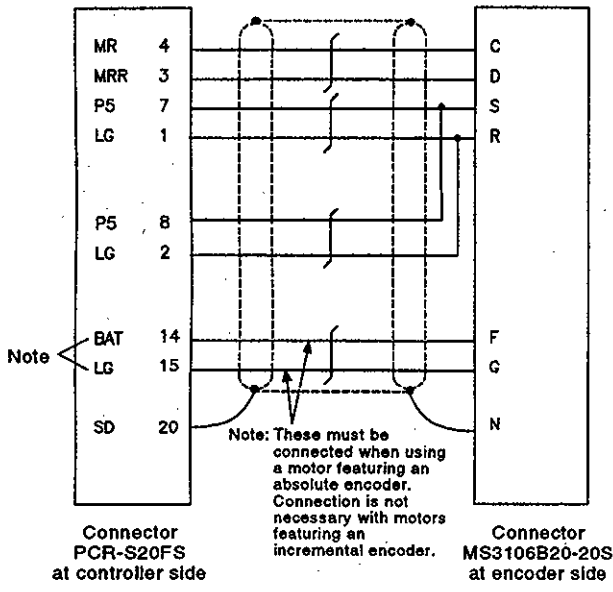


MR-HCBL5M (within 10 m)

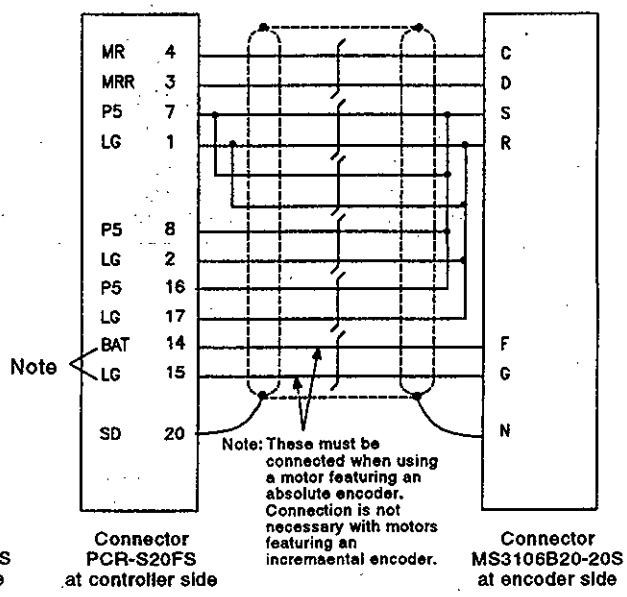


MR-HCBL10M to MR-HCBL30M
(can be connected within 10 m to 50 m)

2) MR-HSCBL[ ]M (applicable to HA-SH/LH/UH series motors)



MR-HSCBL5M (within 10 m)



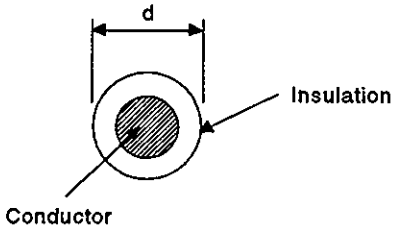
MR-HSCBL10M to MR-HSCBL30M
(can be connected within 10 m to 50 m)

(2) MR-JCCBL[ ]M/MR-JHSCBL[ ]M

(a) Cables
For encoder cables, use the shielded twisted pair cables indicated below or equivalents.

1) Standard cable (applicable to MR-JCCBL[ ]M-L)

Core Wire Size (mm^2) x Pairs	Outer Diameter of Core Wire Insulation * d (mm)	Recommended Wire Model Name	Color
0.2 x 7	0.9 to 1.27	UL20276 AWG28 7pair	Black
0.3 x 7		UL20276 AWG24 7pair	



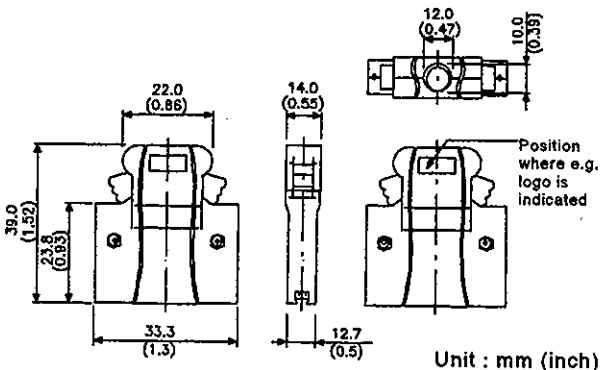
2) High bending life cables Applicable to MR-JCCBL[ ]M-H
MR-JHSCBL[ ]M-H

Core Wire Size (mm^2) x Pairs	Characteristics of One Electric Wire		Recommended Wire Model Name	Color
	Configuration (Wires/mm)	Conductor Resistance (Ω/km)		
0.2 x 6	40/0.08	105 or less	A14B2343	Black

Maker : Junkosha
Obtained from : Toa Denki Kogyo

(b) Connectors
Use the following connectors.

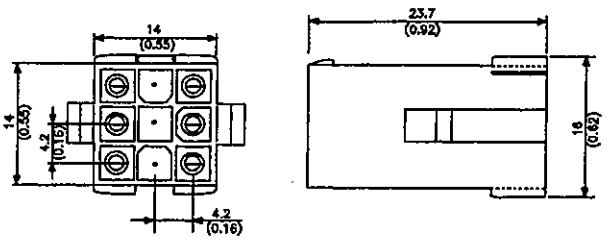
Connector at Amplifier Side (made by Sumitomo 3M) CN3A



Unit : mm (inch)

Case	Connector
10320-52F0-008	10120-3000VE

Encoder Side Relay Connector (made by AMP(Japan)-ltd.) For HC-MF/HA-FF



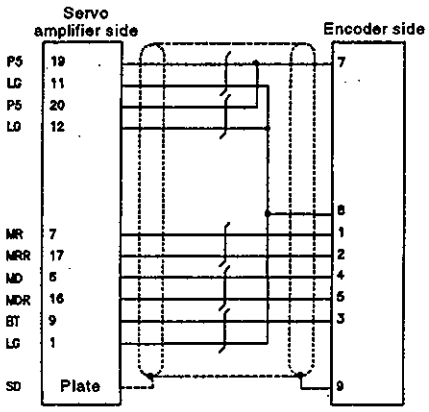
Unit : mm (inch)

Housing	Connector Pins	Crimping Tools
1-72161-9	170359-1	755330-1

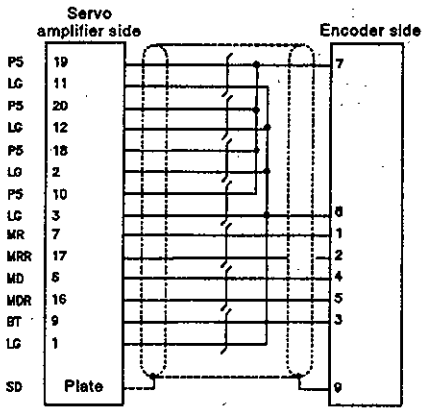
(c) Connections

1) MR-JCCBL[ ]M (applicable to HC-MF/HA-FF series motors)

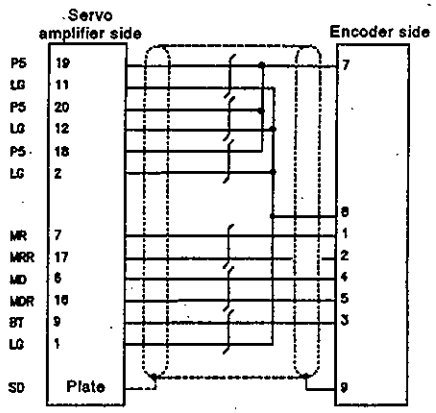
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L
MR-JCCBL10M-H
MR-JCCBL20M-H
MR-JCCBL30M-H

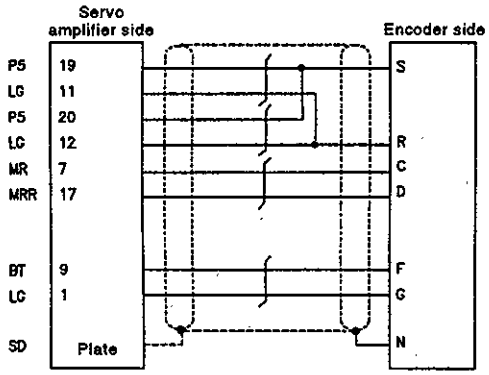


MR-JCCBL20M-L
MR-JCCBL30M-L



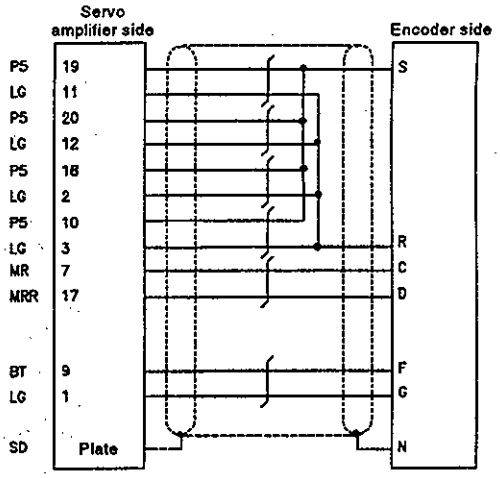
2) MR-JHSCBL[ ]M (applicable to HC-SF series motors)

MR-JHSCBL2M-H
MR-JHSCBL5M-H



(When within 10 m)

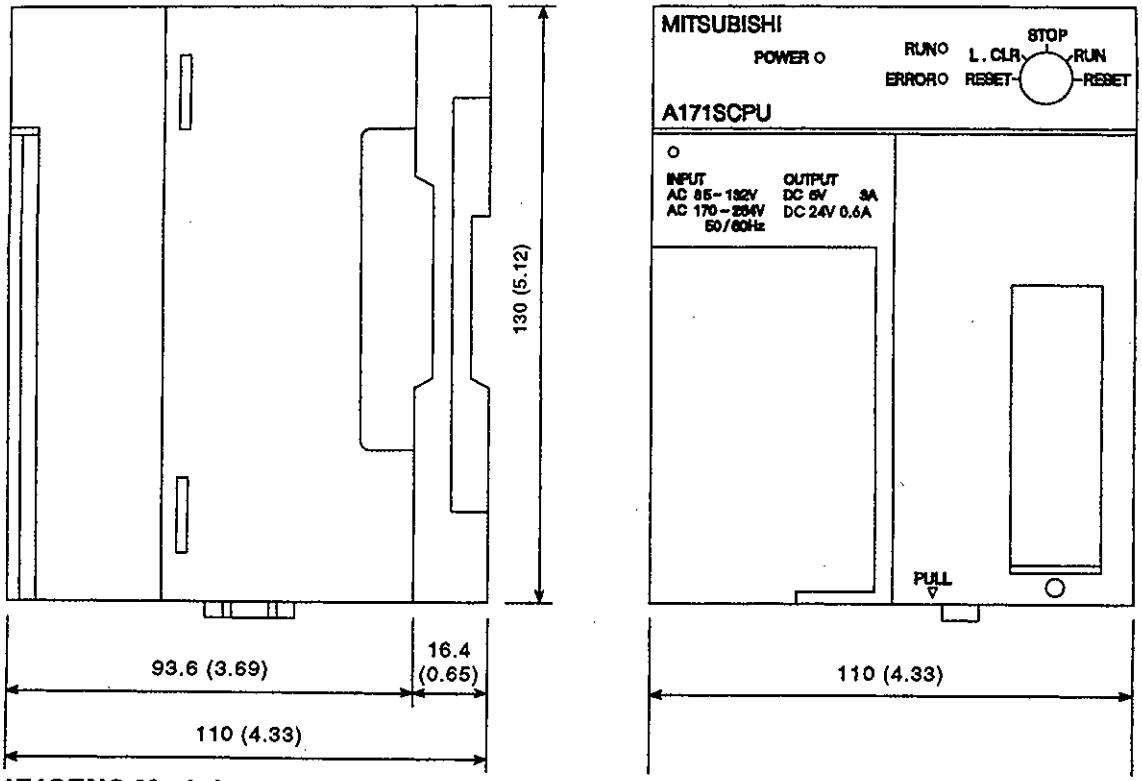
MR-JHSCBL10M-H
MR-JHSCBL20M-H
MR-JHSCBL30M-H



(When 10 to 50 m)

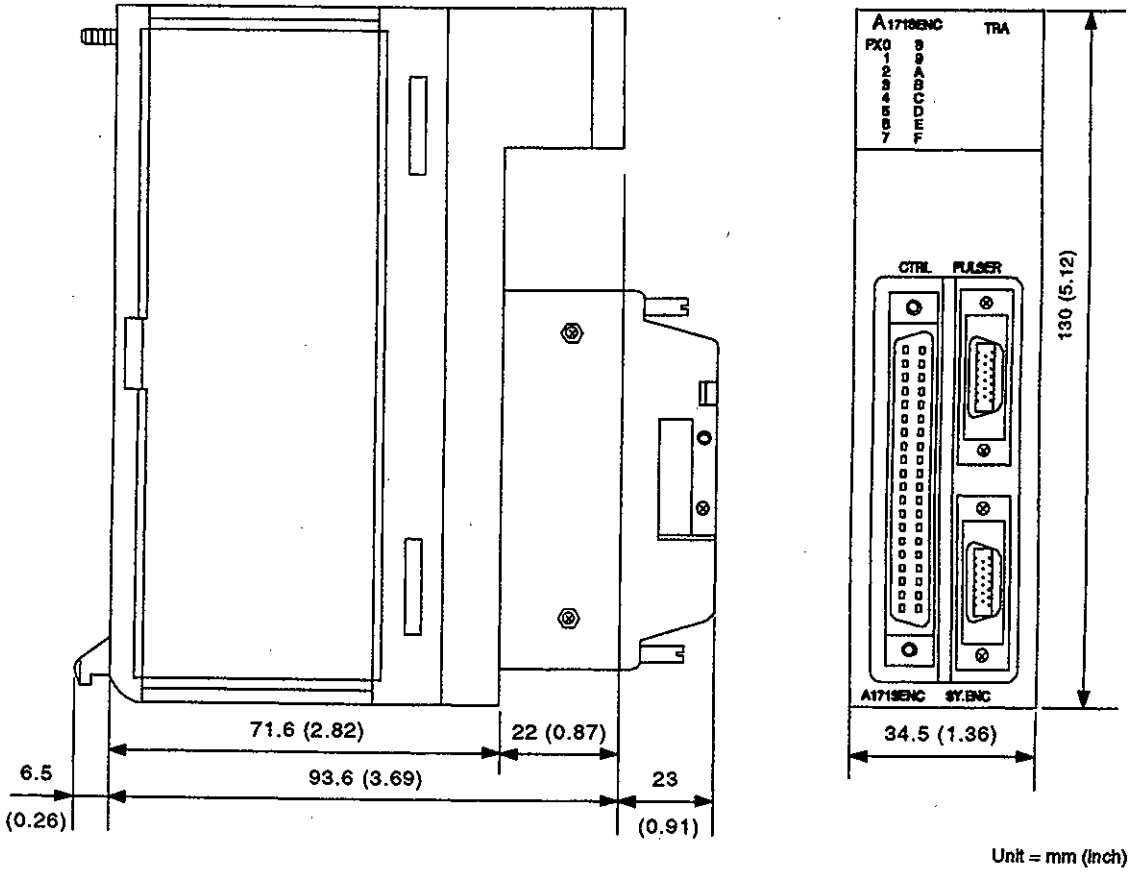
APPENDIX 5 OUTSIDE DIMENSIONS

5.1 A171SCPU Module



Unit = mm (inch)

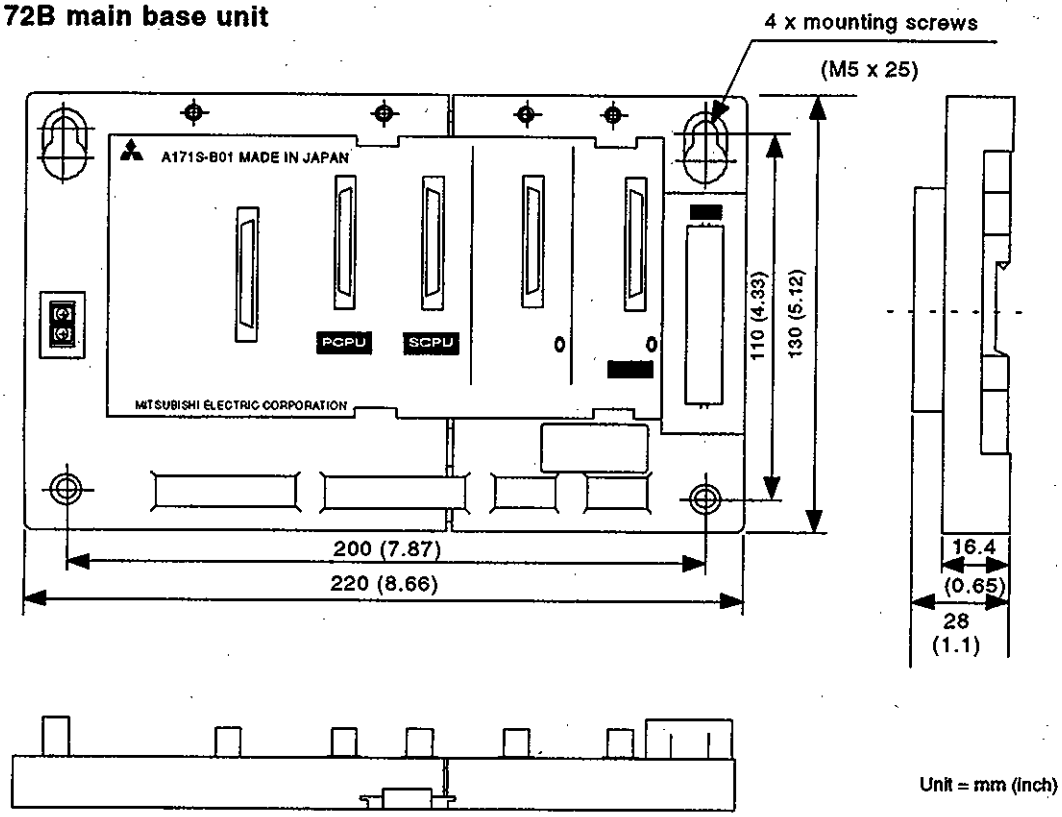
5.2 A171SENC Module



Unit = mm (inch)

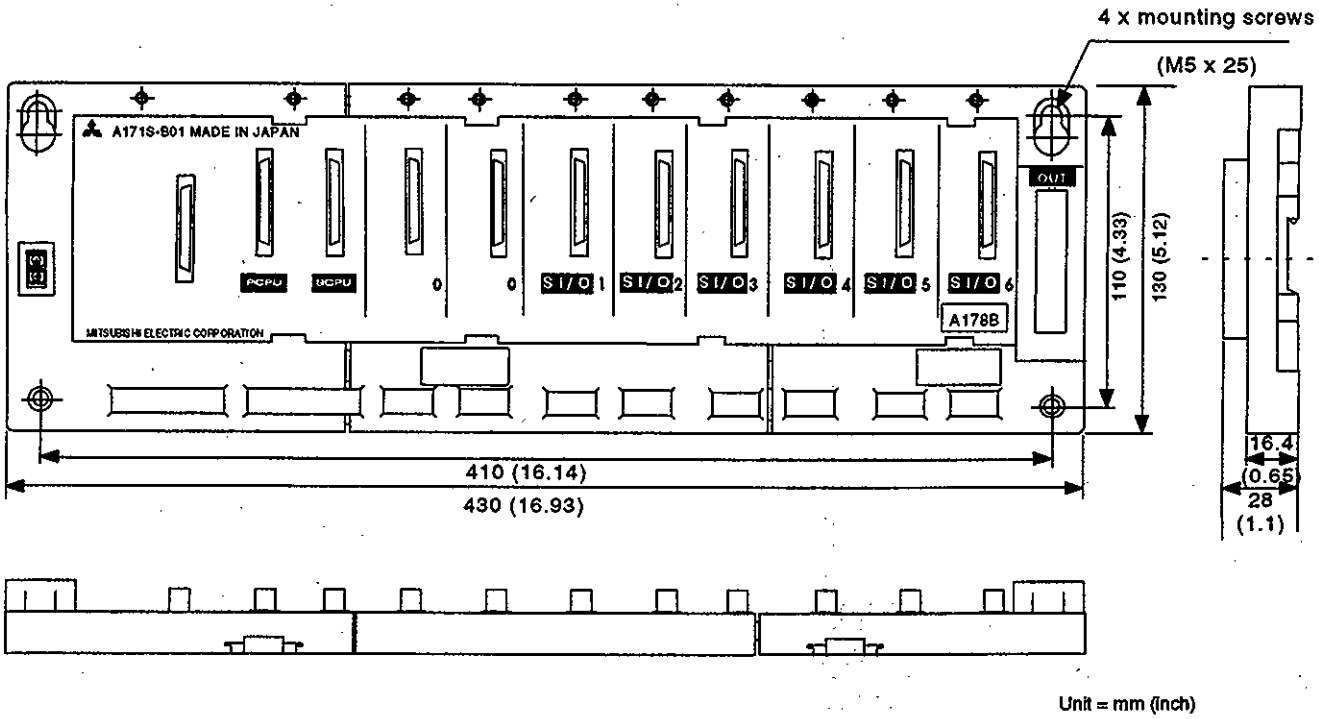
5.3 Main Base Unit

5.3.1 A172B main base unit



Unit = mm (inch)

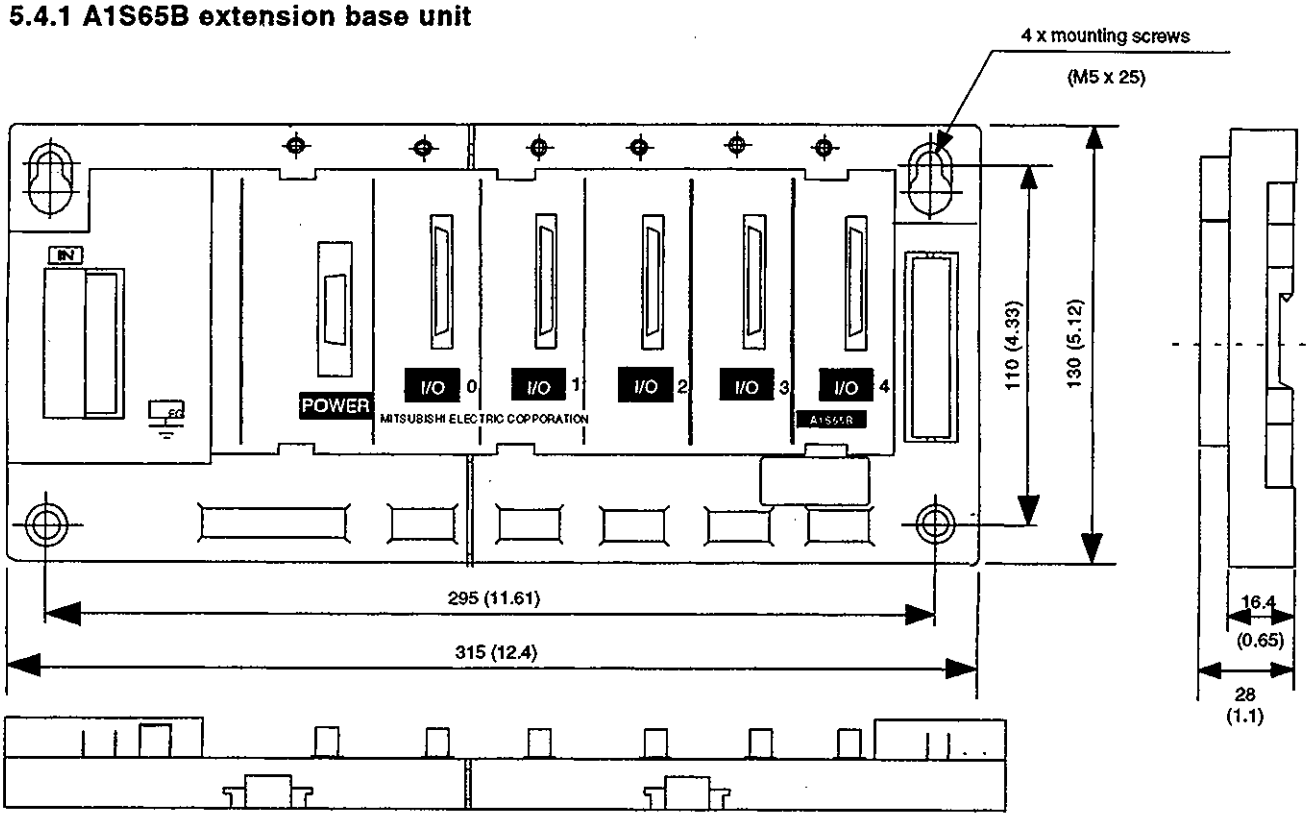
5.3.2 A178B (S1) main base unit



Unit = mm (inch)

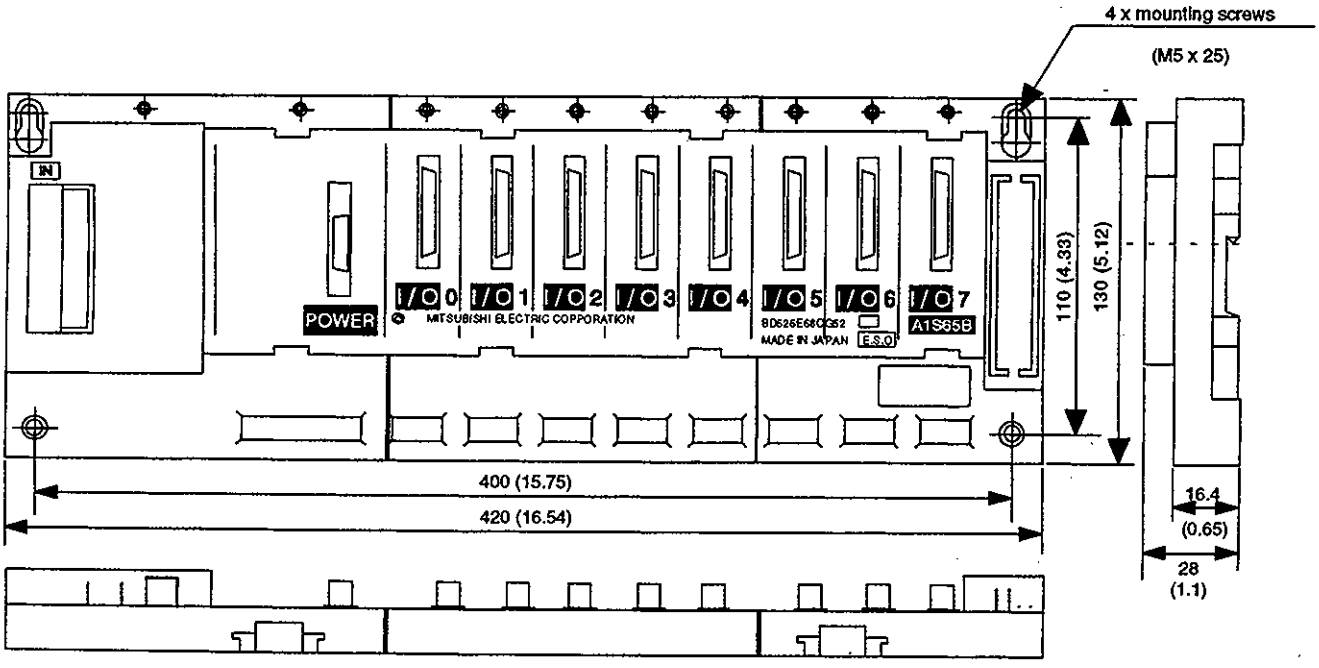
5.4 Extension Base Units

5.4.1 A1S65B extension base unit



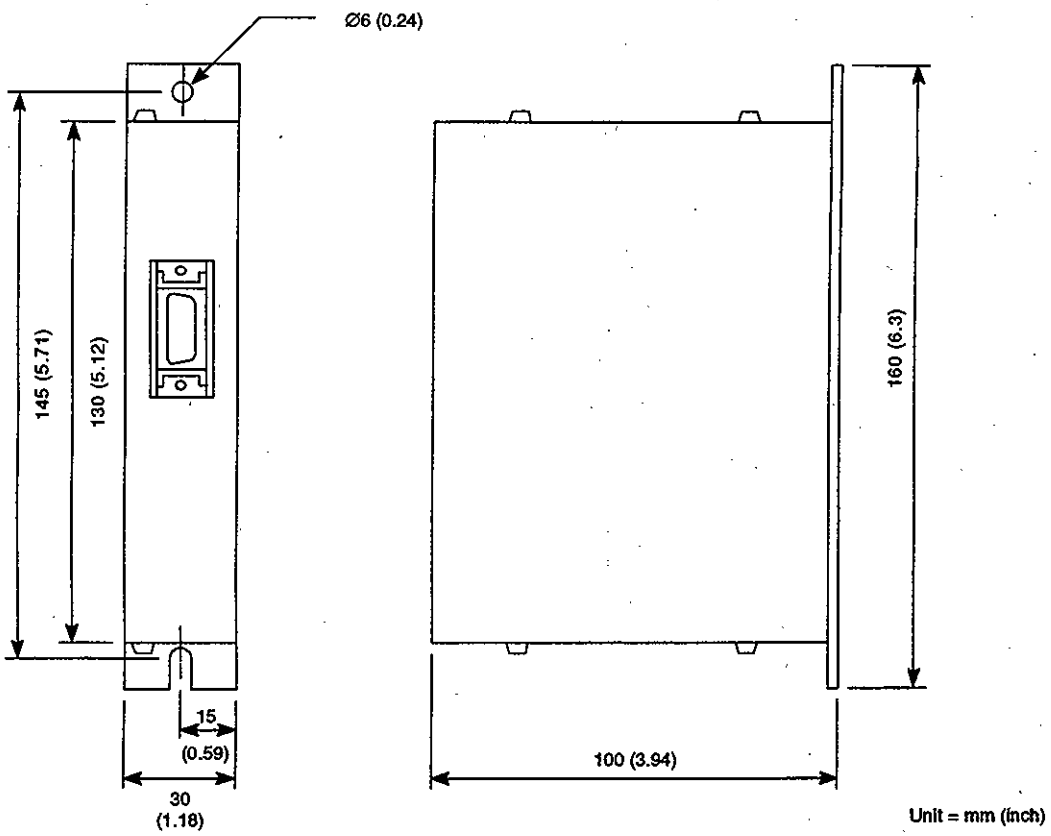
Unit = mm (inch)

5.4.2 A1S68B extension base unit

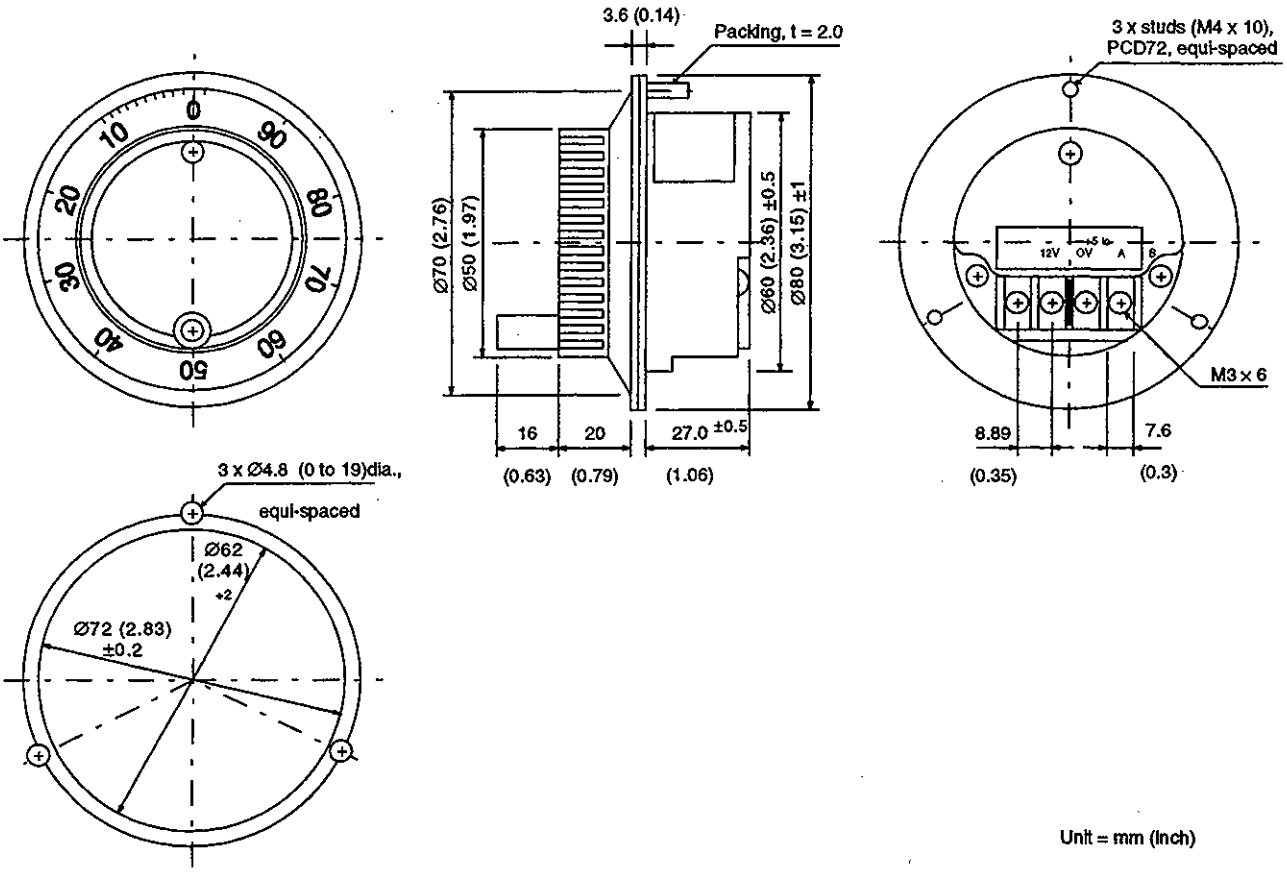


Unit = mm (inch)

5.5 MR-JBAT[ ] Battery Unit



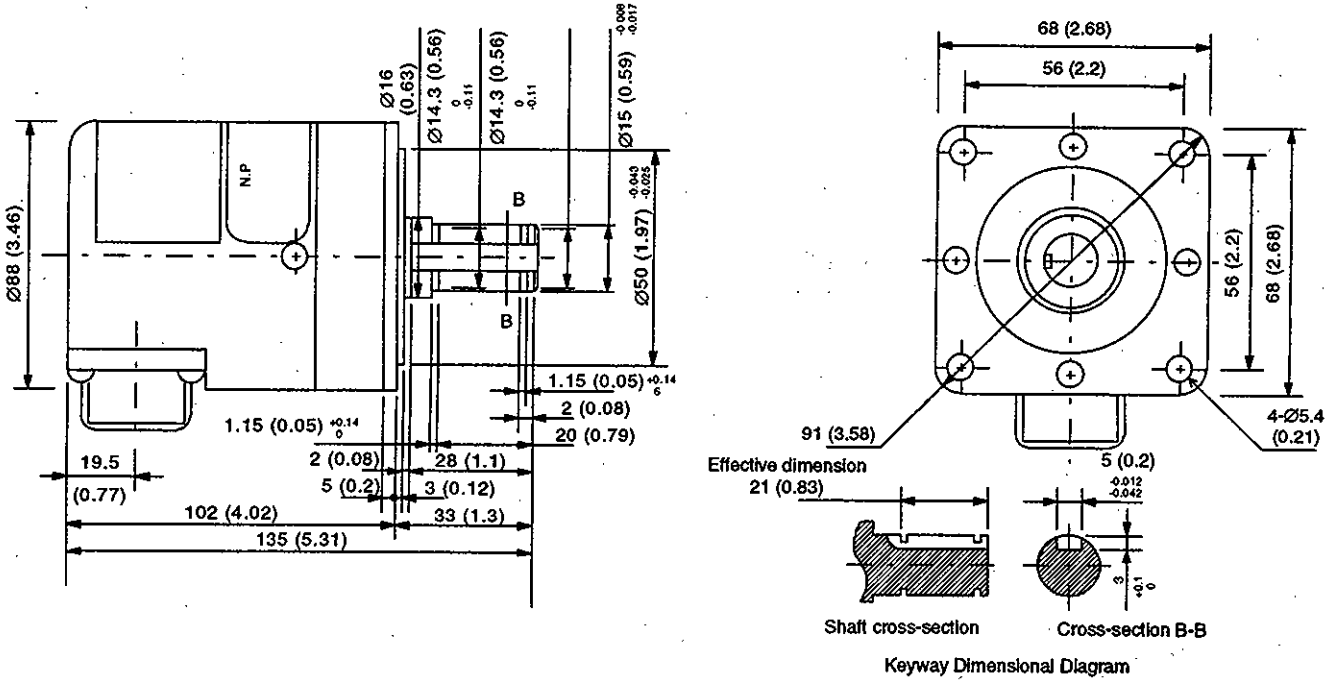
APPENDIX 6 MANUAL PULSE GENERATOR SPECIFICATIONS



Unit = mm (inch)

Item	Specification
Model name	MR-HDP01
Pulse resolution	25 pulse/rev (100 pulse/rev after magnification by 4 in A171SENC)
Output method	Open-collector output, output current = 20 mA max.
Supply voltage	DC4.5 to 13.2V
Current consumption	60mA
Life	1,000,000 revolutions min., at 200 rpm.
Permitted axial loads	Radial load: 2 kg max. (4.41lb)
	Thrust load: 1 kg max. (2.2lb)
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, 90phase difference

APPENDIX 7 SERIAL SYNCHRONOUS ENCODER SPECIFICATIONS



Unit = mm (inch)

Item	Specification
Model name	MR-HENC
Resolution	16384 pulse/rev
Transmission method	Serial communications (connected to A171SENC)
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. (22.03lb)
	Thrust load: 5 kg max. (11.01lb)
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

Connect to a machine through a coupling.

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-8310 TELEX : J24532 CABLE MELCO TOKYO
NAGOYA WORKS : 1-14 , YADA-MINAMI 5 , HIGASHI-KU, NAGOYA , JAPAN