MITSUBISHI

PROGRAMMABLE CONTROLLER

MELSEC-A

User's Manual

type A73CPU

MITSUBISHI
ELECTRIC

REVISIONS

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INTRODUCTION

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

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1. INTRODUCTION

This instruction manual describes the items related to the hardware (such as system configuration, components, handling precautions, and related units) required for positioning control with the A73CPU (P21/R21) multi-axis controller unit.

The A73CPU is the CPU incorporating a positioning control CPU (referred to as the PCPU in this manual) and a sequence control CPU (referred to as the SCPU in this manual).

(a) The PCPU monitors positioning control based on the servo program and the control status of the servo amplifier.

(b) The SCPU performs sequence control (the same as the A3NCPU), servo program start-up, manual pulse generator (MPG) operation enabling, JOG operation, etc.

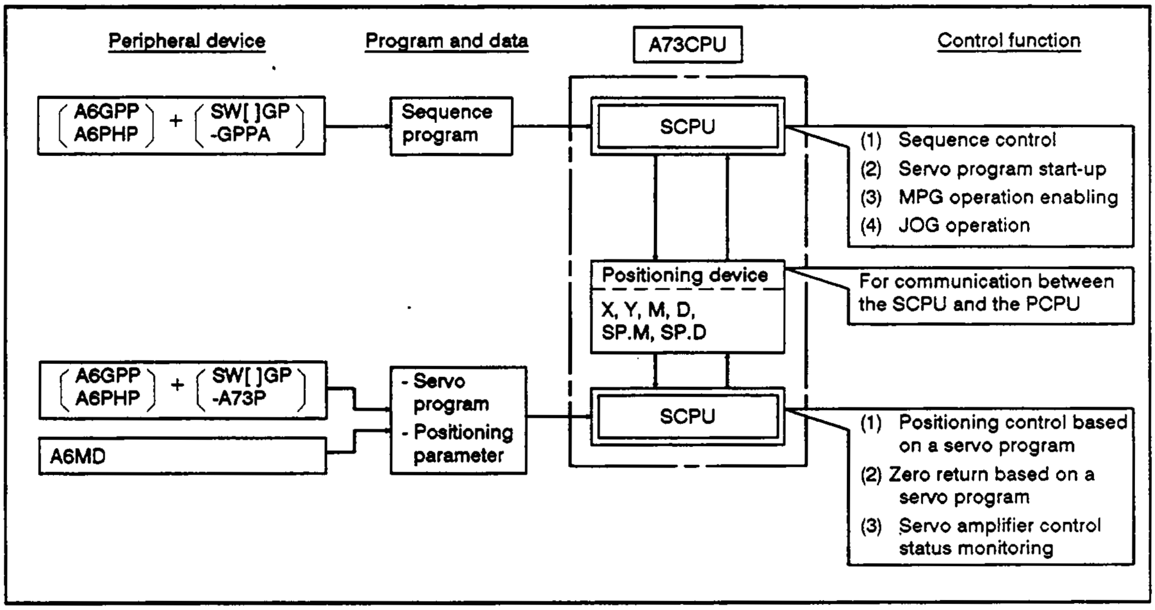


Fig. 1.1 A73CPU Program and Data Preparation and Process Outline

(1) A73CPU Program and Data Preparation

(a) The sequence program used by the SCPU is prepared by an A6GPP/A6PHP started up by the SW[ ]GP-GPPA.

The sequence program is stored in the memory cassette loaded in the A73CPU.

(b) The servo program and positioning parameters used by the PCPU are prepared by an A6GPP/A6PHP or A6MD started up by the SW[ ]GP-A73P.

The servo program and positioning parameters are stored in the E2ROM of the A73CPU unit.

(c) The servo program designated by a sequence program is used to perform positioning control.

(d) The positioning control status can be monitored by an A6GPP/A6PHP or A6MD started up by the SW[ ]GP-A73P.

(e) Servo program execution, JOG operation, and other functions are tested by an A6GPP/A6PHP or A6MD started up by the SW[ ]GP-A73P.

(2) Reference Manual

For information required for the A73CPU operation but is not found in this manual, refer to the following manuals.

(a) A73CPU Reference Manual [IB (NA)-66233]

This manual describes the positioning parameters, devices, servo program, SCPU functions, and other factors required for positioning control.

(b) A6MD Monitor Display Unit User's Manual [IB (NA)-66234]

This manual describes the hardware-related information (on the appearance, installation, connecting cable preparation, etc.).

(c) A6MD Monitor Display Unit Operating Manual [IB (NA)-66235]

This manual describes positioning parameter and servo program preparation, testing, and monitoring with the A6GPP/A6PHP.

This manual describes positioning parameter and servo program preparation, floppy disk storage, printout, monitoring, and testing with the A6GPP/A6PHP.

(d) A6GPP/A6PHP (for the SW3GP-GPPA) Operating Manual [IB (NA)-66212]

This manual describes sequence program, comment, and other data preparation, floppy disk storage, printout, monitoring, and testing with the A6GPP/A6PHP.

(e) ACPU Program Manual [IB (NA)-66147]

This manual describes sequence programs, devices, and other things related to perform sequence control and servo program start up.

(f) Building Block Input/Output Module User's Manual [IB (NA)-66140]

This manual describes the specifications and dimensions of the input/output modules used for sequence control and limit switch output.

1.1 General Information on Positioning Control

This section outlines the positioning control performed by the A73CPU when the MR-SB servo amplifier (referred to as the MR-SB in this manual) or a general-purpose servo amplifier is used.

1.1.1 When an MR-SB servo amplifier is used

The A73CPU and the MR-SB are connected by a digital bus (RS-485) via the servo interface unit (referred to as the A70SF in this manual).

This connection enables MR-SB status monitoring and servo diagnosis (position loop gain/velocity loop gain check) in addition to high-speed and high-precision positioning control.

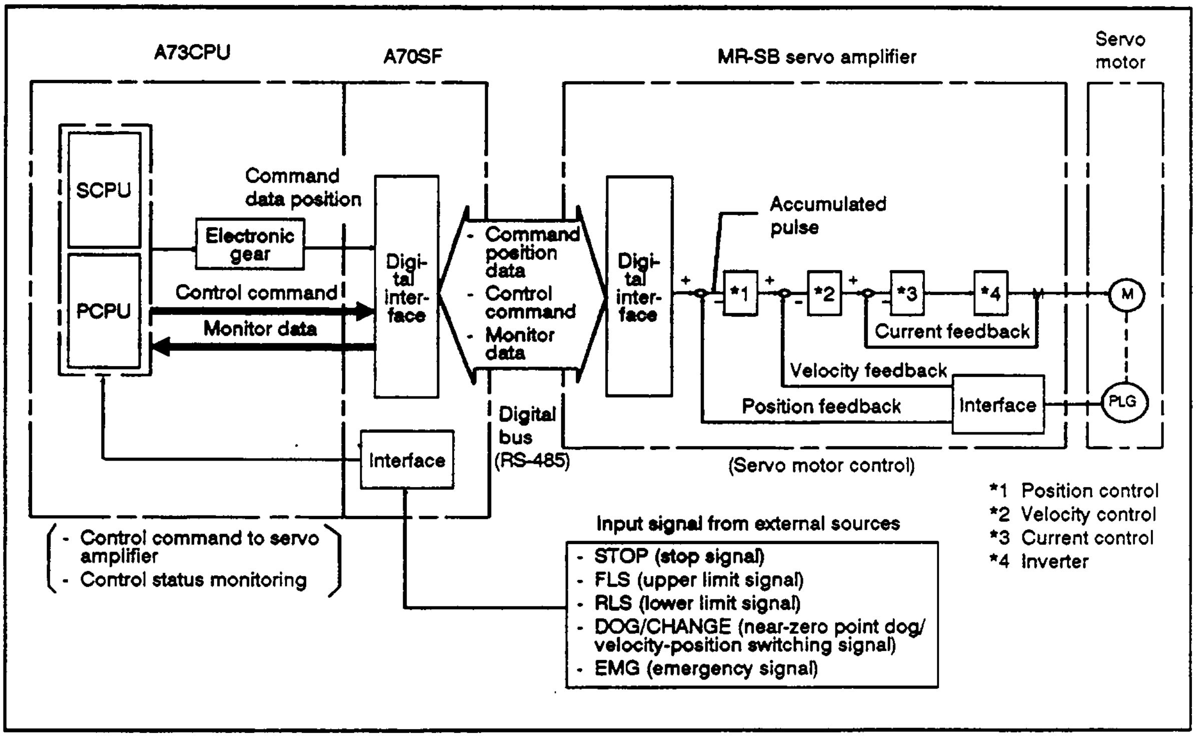


Fig. 1.2 Outline of the Operation Performed When an MR-SB Is Used.

(1) Explanation of Operation

(a) The SCPU requests the PCPU to start the servo program specified by a sequence program.

(b) The PCPU executes the servo program specified by the SCPU and causes the A70SF to output the command position data to the MR-SB via the digital bus.

At all times, it monitors the monitor data from the MR-SB (error counter value, actual position data relative to command position data, error information, etc.) and controls the command position data for the MR-SB.

(c) The MR-SB controls the servo motor with the command position data and the position/velocity feedback data specified by the PCPU.

1.1.2 When a general-purpose amplifier is used

The A73CPU is connected to the general-purpose amplifier on a one-to-one basis using the A70AF general-purpose servo interface unit (referred to as the A70AF in this manual).

The velocity command (analog voltage) is delivered from the A70AF to the general-purpose servo amplifier.

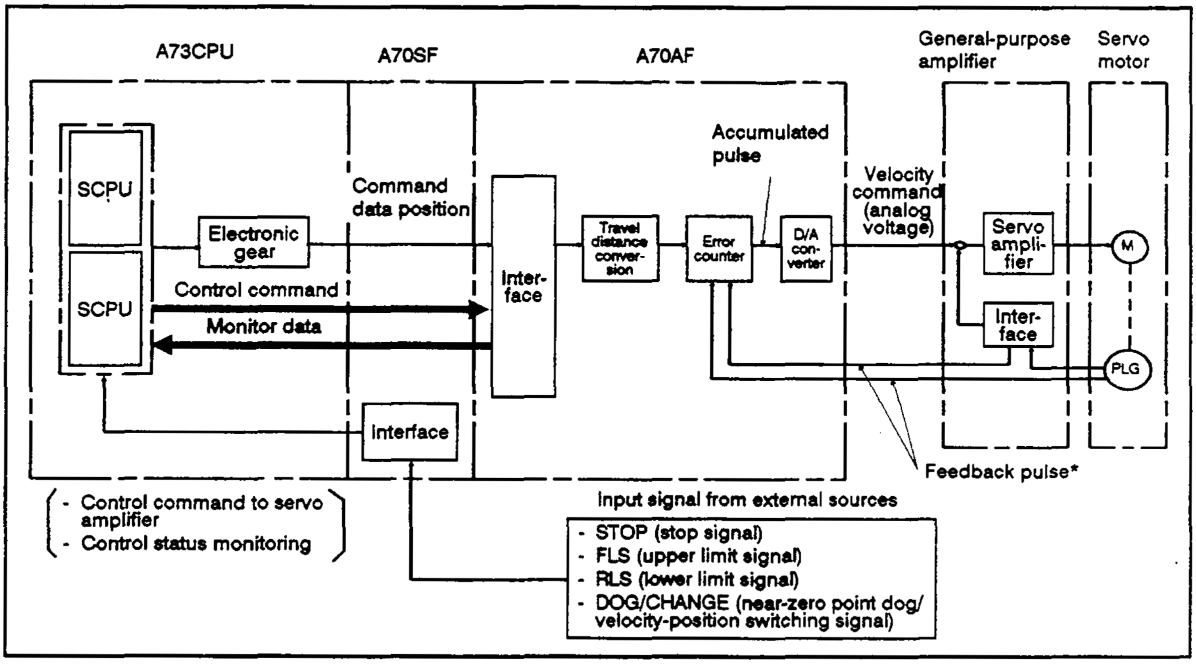


Fig. 1.3 Outline of Operation Performed When a General-Purpose Servo Amplifier Is Used.

(1) Explanation of operation

(a) The SCPU requests the PCPU to start the servo program specified by a sequence program.

(b) The PCPU executes the servo program specified by the SCPU and delivers the command position data to the A70AF.

At all times it monitors the monitor data from the A70AF (error counter value and actual position data relative to command position data) and controls the command position data for the A70AF.

(c) The A70AF converts the command position data from the PCPU into travel distance and causes the error counter to integrate the travel distance. From the integrated value, it subtracts the number of feedback pulses arriving from PLG (pulse generator).

The A70AF converts the error counter value (D/A) and delivers the velocity command (analog voltage) to the servo amplifier.

REMARKS

* The feedback pulse is sent to the A70AF either directly or via the servo amplifier depending on the type of the servo motor.

1.2 Features

The A73CPU has the following features.

(1) Various positioning functions

The A73CPU is capable of positioning controls, such as 8-axis independent control, 2-axis/3-axis linear interpolation control, and 2-axis circular interpolation control.

(2) Bus-connection control is enabled (when connected to an MR-SB servo amplifier).

(a) The A73CPU is capable of servo data collection, parameter change, and monitor diagnosing.

(b) High-precision positioning is enabled with the velocity command issued at a maximum output of 1 Mpps.

(3) Dedicated language-dependent positioning control

Programming is easily performed by describing the positioning operation in the dedicated language. Programming is performed with the A6MD monitor display unit or an A6GPP/A6PHP started up by the SW0GP-A73P multi-axis positioning unit software package.

(4) An absolute value system can be configured.

The use of the MR-SB servo amplifier capable of handling absolute values enables the configuration of the absolute value system.

(5) Connectable to a general-purpose servo amplifier.

The A73CPU can be connected not only to an MR-SB servo amplifier, but also to a general-purpose servo amplifier.

1.3 Comparison of the A73CPU (SCPU Section) and the A3NCPU

The A73CPU uses the SCPU for sequence control and the PCPU for positioning control. Sequence control is performed by the SCPU in accordance with the same specifications as those for the A3NCPU.

Table 1.1 Difference Between the A73CPU (SCPU Section) and the A3NCPU

Item			A73CPU (SCPU Section)	A3NCPU
Usable extension base			A65B, A68B (A55B or A58B not used)	A65B, A68B A55B, A58B
Main base			A74B	A32B, A35B, A38B
Power supply module for main base			A61P *1	A61P, A62P, A63P, A65P
Number of instructions	Sequence instruction		22	22
	Basic instruction		132	132
	Application instruction		107 (DSFL, DSFR : Not used DSFLP, DSFRP: Application changed)	109
Number of I/O points	For sequence control		1920 points (X/Y80 to X/Y7FF)	2048 points (X/Y0 to X/Y7FF)
	For positioning control		128 points (X/Y0 to X/Y7F)	—
Devices	Internal relay/latch relay	For sequence control	2000 points (M/L0 to M/L1999)	2048 points (M/L0 to M/L2047)
		For positioning control	48 points (M2000 to M2047)	—
	Data register	For sequence control	800 points (D0 to D799)	1024 points (D0 to D1023)
		For positioning control	224 points (D800 to D1023)	—
	Special relay	For positioning control	M9073 to M9079 applications added	—
	Special register	For positioning control	D9180 to D9199 applications added	—
Latch range *2			D0 to D799 (D800 to D1023 are not latched even when they are set in the latching range.)	D0 to D1023

POINT

(1) *1: The A62P or the A65P cannot be used because their 5 VDC current capacity is too low.

(2) *2: This range refers to that in which latching is enabled when latch range setting is affected by parameters.

REMARKS

With the A73CPU, the application of the DSFRP and DSFLP instructions is changed as follows:

1) The DSFRP instruction is a servo program start request instruction.

2) The DSFLP instruction is an actual position data and velocity change instruction.

2. SYSTEM CONFIGURATION

The system configuration required to use the A73CPU falls into 4 categories:

(a) When an MR-SB servo amplifier is used.

(b) When a general-purpose servo amplifier is used.

(c) When both the MR-SB and the general-purpose servo amplifier are used.

(d) As the data link system.

This section describes the overall configuration of this system, operating precautions, and components.

2.1 When an MR-SB Servo Amplifier Is Used

2.1.1 Overall configuration

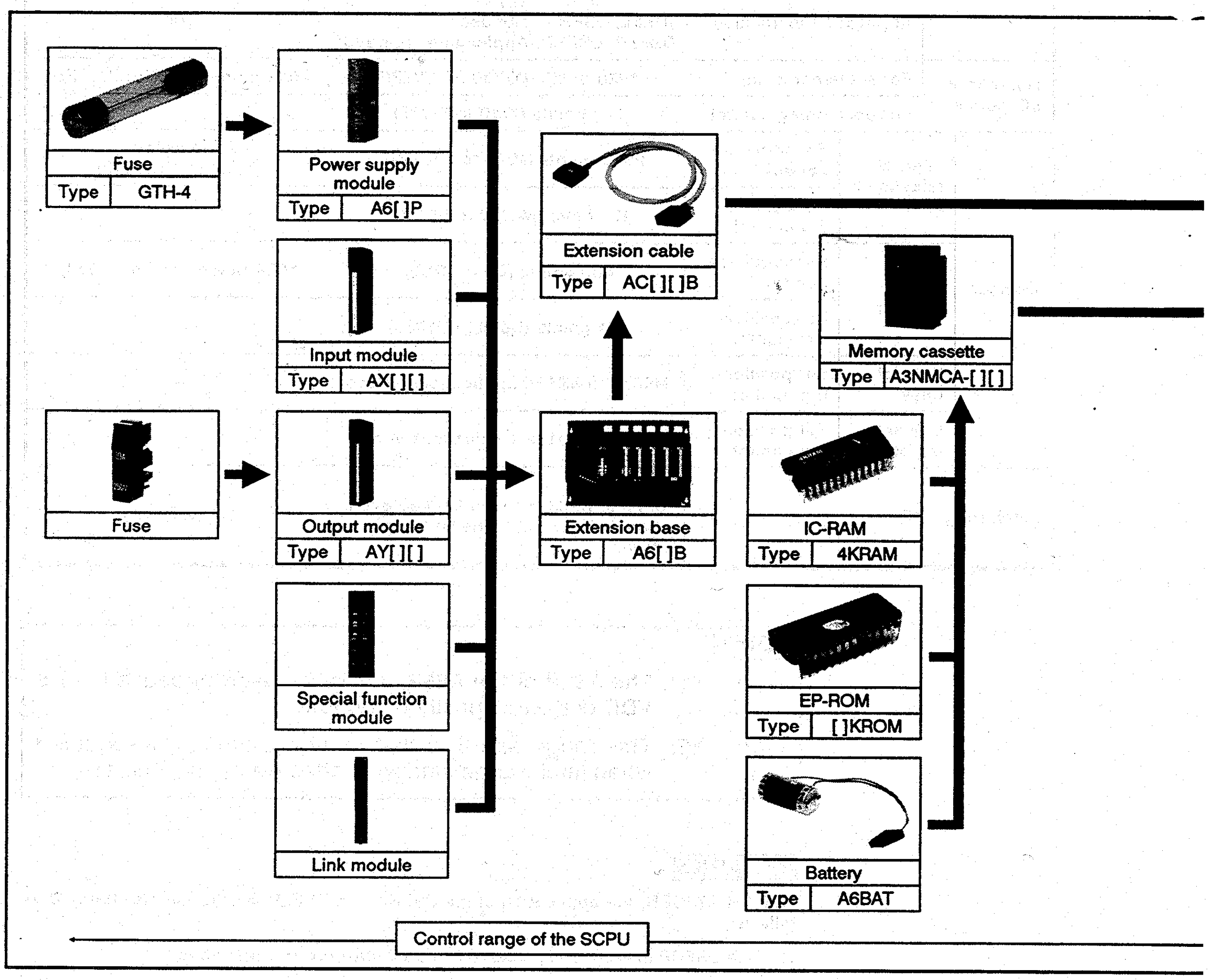


Fig. 2.1 Overall Configuration Established When an MR-SB Servo Amplifier Is Used

POINT

(1) The unit shown in Fig. 2.1 can be mounted on the A74B. The mounting position should be as indicated in Fig. 2.1.

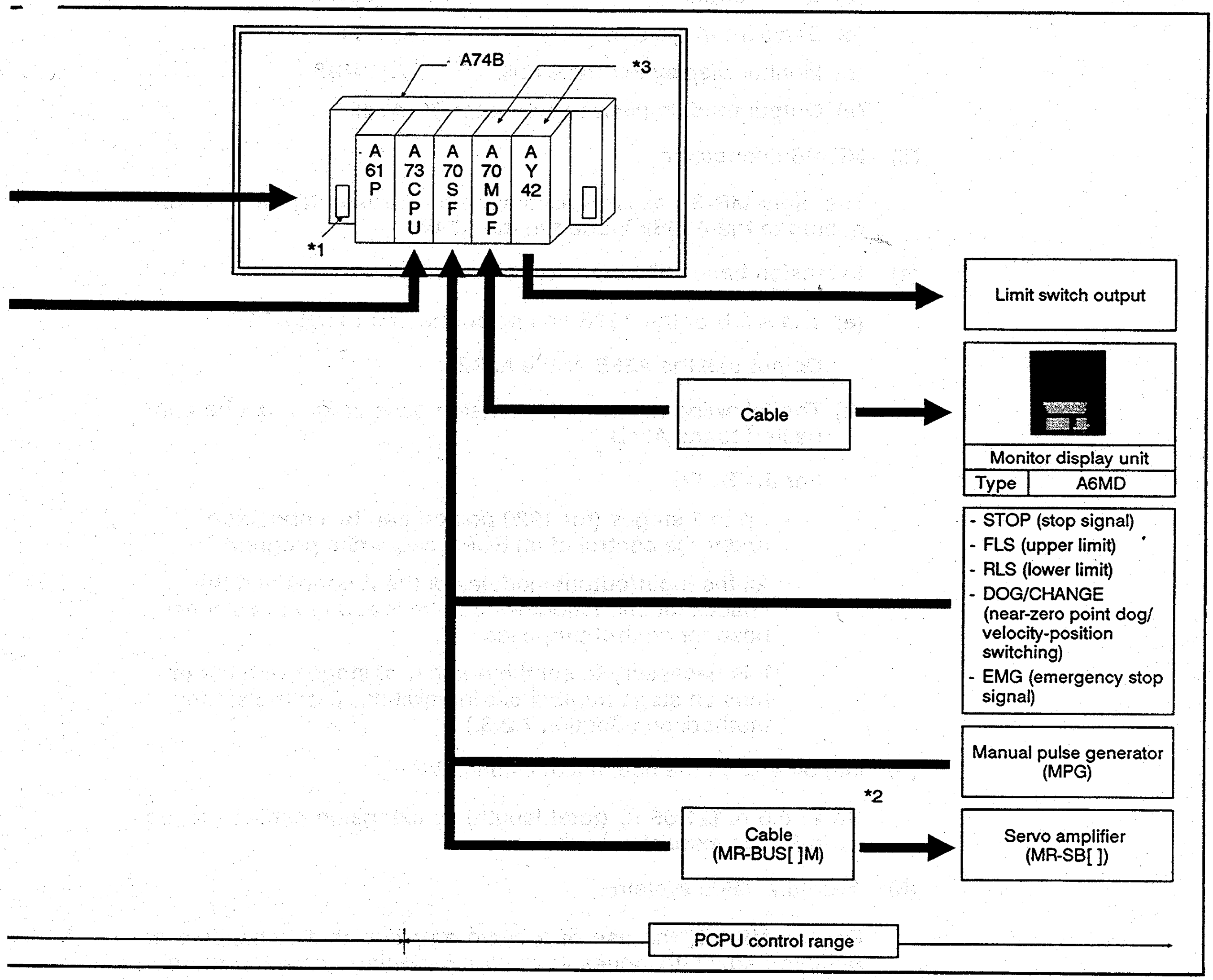
(2) *1: SCPU extension connector (for connecting to the SCPU extension base)

(3) *2: The MR-SB system is divided in half with 4 axes in half. The system is connected to the A70SF.

(4) *3: The A70MDF and the AY42 are optional equipment.

A70MDF : Necessary for monitoring, testing, and servo program preparation with the A6MD

AY42 : Necessary for limit switch output



2.1.2 System configuration precautions

Take the following precautions when configuring the system in which the MR-SB servo amplifier is to be used.

(1) Limitations on the Base Unit

Load the A73CPU onto the A74B base unit (referred to as the A74B in this manual).

With the A73CPU loaded to the other base units (the A32B, A35B, A38B, and A78B), the A73CPU will not operate.

(2) Limitations on units loaded to the A74B

The units that can be loaded to the A74B are as listed below. Their loading positions are predetermined. See Fig. 2.1 for the loading positions.

(a) Power supply module	: A61P
(b) CPU module	: A73CPU
(c) Servo interface unit	: A70SF
(d) Monitor display interface unit	: A70MDF
(e) Output module (limit switch output)	: AY42

(3) MR-SB connection

The eight MR-SB axes (4 axes each for 2 systems) can be connected to the A70SF loaded to the A74B.

(4) Extension base unit connected to the A74B

(a) The A65B or the A68B can be connected to the A74B.

Do not use the A55B or the A58B.

(b) The following number of extension base stages can be connected to the A74B.

For the SCPU:

- Up to 7 stages (for 1920 points) can be connected under the control of an SCPU sequence program.
- All the input/output modules of the A series and the special function modules can be loaded to the extension base for control purposes.
- It is necessary to set the number of stages with the extension stage number setting switch. (For the setting method, see Section 7.2.3.)

(5) Limitations on the use of extension cables

Up to 6.6 m (21.65 ft) (total length) of extension cables can be used for the extension base.

(6) Absolute value system

For the MR-SB, the use of a servo amplifier that is capable of handling absolute values enables positioning control in the absolute value system.

POINT

(1) Ground the MR-BUS[ ]M cable (connecting the A70SF and the MR-SB) of the A70SF to increase noise resistance. Use the cable clamp supplied with the A70AF.

(2) The servo amplifier must be grounded.

Ground LG and FG of the A73CPU system, too.

(3) Make external wiring connections for the following signals to be connected to the A70SF. Positioning control is disabled unless the signal is off (at high level).

(a) STOP: Stop signal

(b) FLS : Upper limit switch signal

(c) RLS : Lower limit switch signal

(d) EMG : Emergency stop signal

2.2 When a General-Purpose Servo Amplifier Is Used

2.2.1 Overall configuration

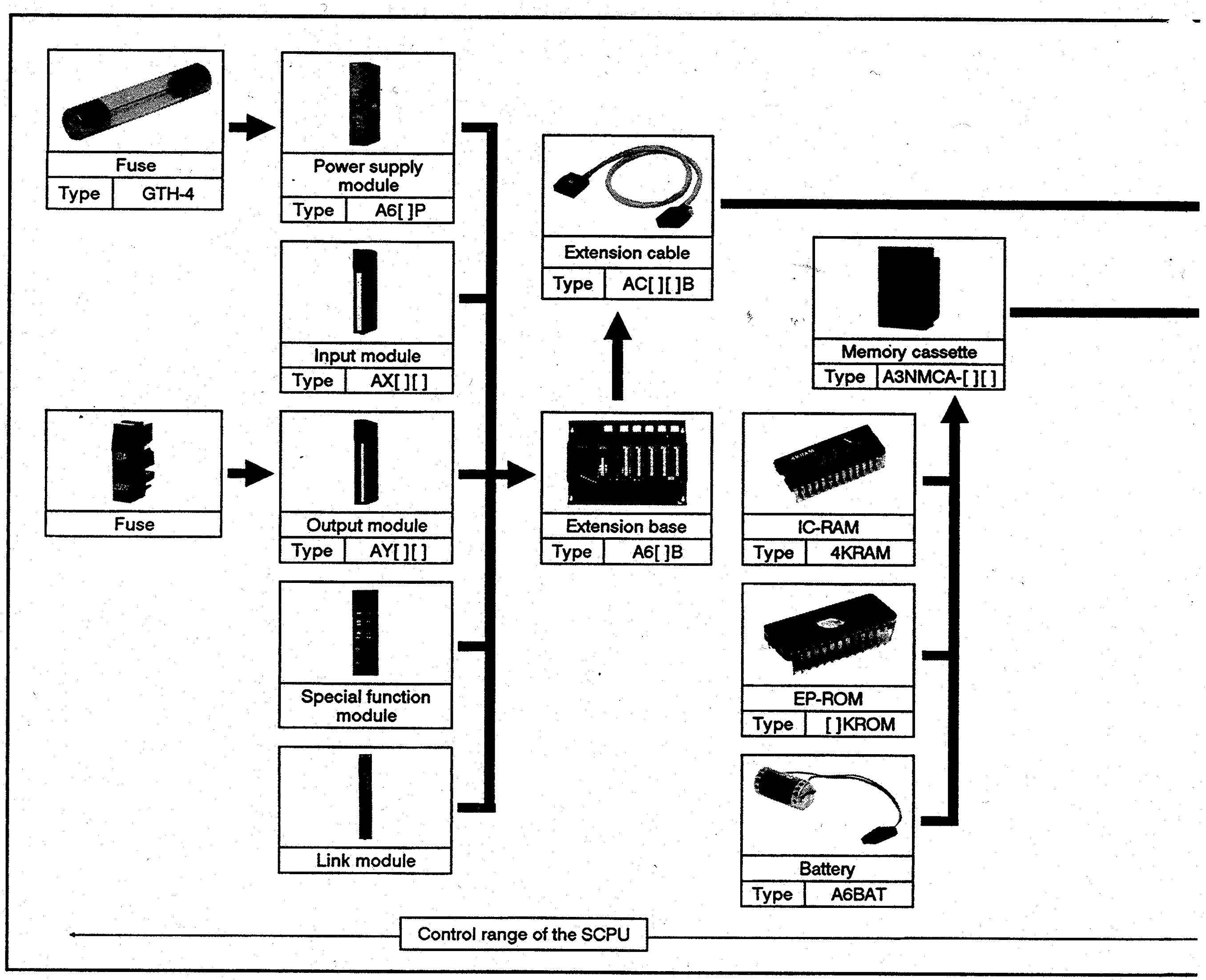


Fig. 2.2 Overall Configuration Established When a General-Purpose Servo Amplifier is Used

POINT

(1) The unit shown in Fig. 2.2 can be mounted on the A74B. The mounting position should be as indicated in Fig. 2.2.

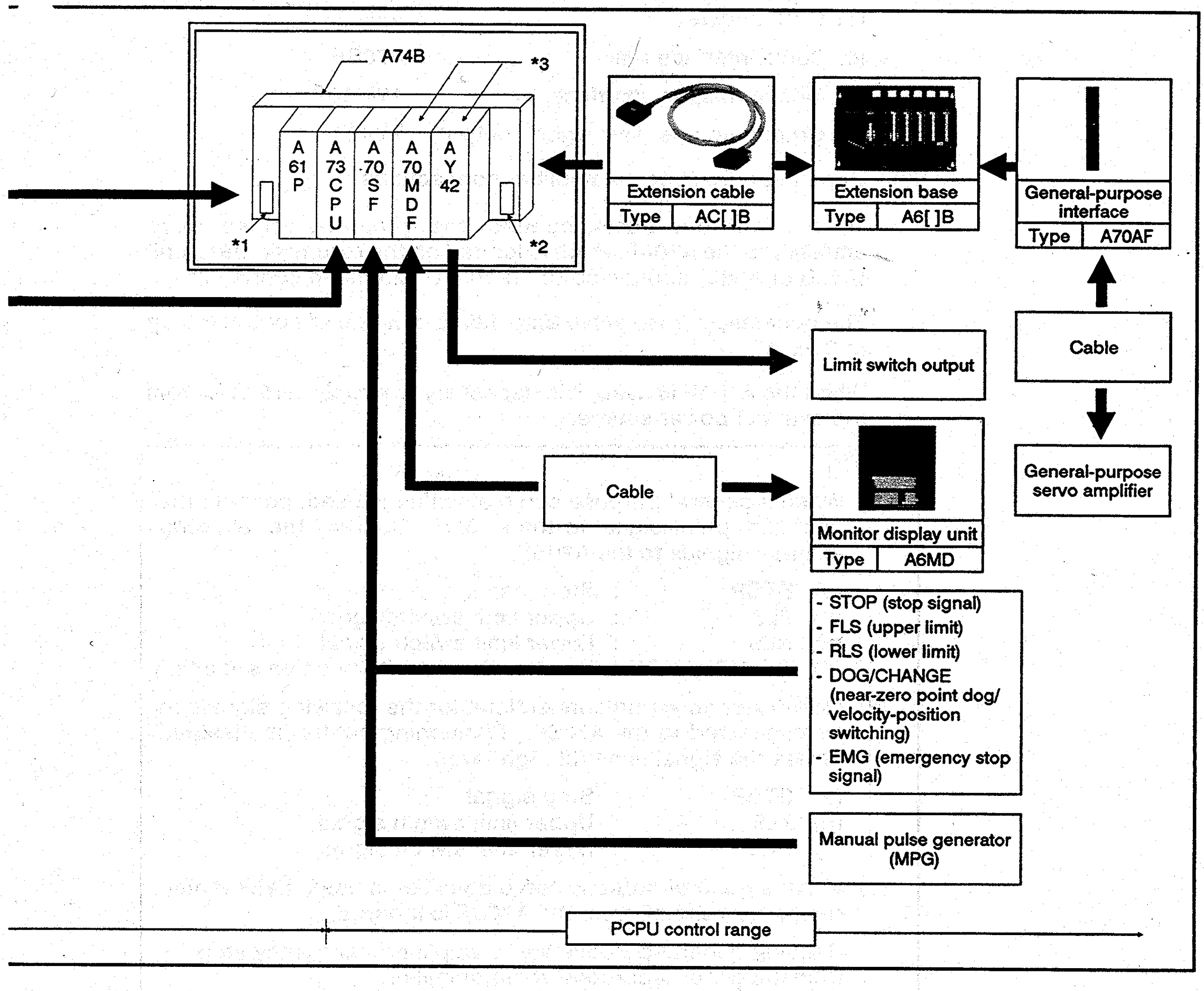
(2) *1: SCPU extension connector (for connecting to the SCPU extension base)

(3) *2: PCPU extension connector (for connecting to the PCPU extension base)

(4) *3: The A70MDF and the AY42 are optional equipment.

A70MDF : Necessary for monitoring, testing, and servo program preparation with the A6MD

AY42 : Necessary for limit switch output



2.2.2 System configuration precautions

Take the following precautions when configuring a system with general-purpose servo amplifier.

(1) Limitations on the Base Unit

Load the A73CPU onto the A74B base unit (referred to as the A74B in this manual).

With the A73CPU loaded to the other base units (the A32B, A35B, A38B, and A78B), the A73CPU will not operate.

(2) Limitations on units loaded to the A74B

The units that can be loaded to the A74B are as listed below. Their loading positions are predetermined. See Fig. 2.2 for the loading positions.

(a) Power supply module : A61P
(b) CPU module : A73CPU
(c) Servo interface unit : A70SF
(d) Monitor display interface unit : A70MDF
(e) Output module (limit switch output) : AY42

(3) General-purpose servo amplifier connections

On a one-to-one basis, connect the general-purpose servo amplifier to the A70AF which is loaded on the extension base unit (A65B or A68B) connected to the PCPU extension connector.

The general-purpose servo amplifier is capable of controlling up to 8 axes.

When the A70AF is used, it is necessary to supply ±15 VDC from the external power source.

POINT

(1) When a general-purpose servo amplifier is used, connect the near-zero point signal to the A70AF. Connect the following external signals to the A70SF.

(a) STOP : Stop signal
(b) FLS : Upper limit switch signal
(c) RLS : Lower limit switch signal
(d) DOG/CHANGE : Used as the velocity-position switching

(2) Make external wiring connections for the following signals to be connected to the A70SF. Positioning control is disabled unless the signal is off (at high level).

(a) STOP : Stop signal
(b) FLS : Upper limit switch signal
(c) RLS : Lower limit switch signal

(3) When a general-purpose servo amplifier is used, EMG (emergency stop signal) from the A70SF is ignored.

Request general-purpose servo amplifier emergency stop from the general-purpose servo amplifier.

(4) Absolute system disallowed

The general-purpose servo amplifier is not capable of positioning control in the absolute value system.

(5) Extension base connectable to the A74B

(a) Either the A65B or the A68B can be connected to the A74B.

(b) Up to the following number of extension base stages can be connected to the A74B.

For the PCPU:

- Only one stage of this base can be connected for loading the A70AF (interface unit for the general-purpose servo amplifier).
- Units other than the A70AF cannot be used for the PCPU extension base.
- Set the extension stage number setting switch to "1".

  (For the setting method, see Section 7.2.4.)

(6) Some of the A6MD monitor display functions cannot be performed when a general-purpose servo amplifier is connected.

Example:

Monitor mode : Servo monitor

Testing mode : Servo start-up

Servo diagnosis (position loop gain/velocity loop gain check)

For further details, see the A6MD Operating Manual IB (NA) - 66235.

IMPORTANT

As long as ±15 VDC remains at the A70AF terminal block, the analog voltage (velocity command) to the servo amplifier can be delivered even when the PC power is turned off. When the A73CPU is turned off, the A70AF SVON signal (see Section 5.4.3) is turned off.

When the servo amplifier of which control can be stopped in response to the SVON signal is used, always connect the SVON signal from the servo amplifier to the A70AF.

When the servo amplifier of which control cannot be stopped in response to the SVON signal is to be used, take the following precautions.

- When the PC is to be turned off, make sure that the analog voltage is 0 V (the motor is at rest).
- Before turning off the PC, set up an external circuit which turns off the ±15 VDC supply at the same time

2.3 When an MR-SB Servo Amplifier and a General-Purpose Servo Amplifier Are Used

2.3.1 Overall configuration

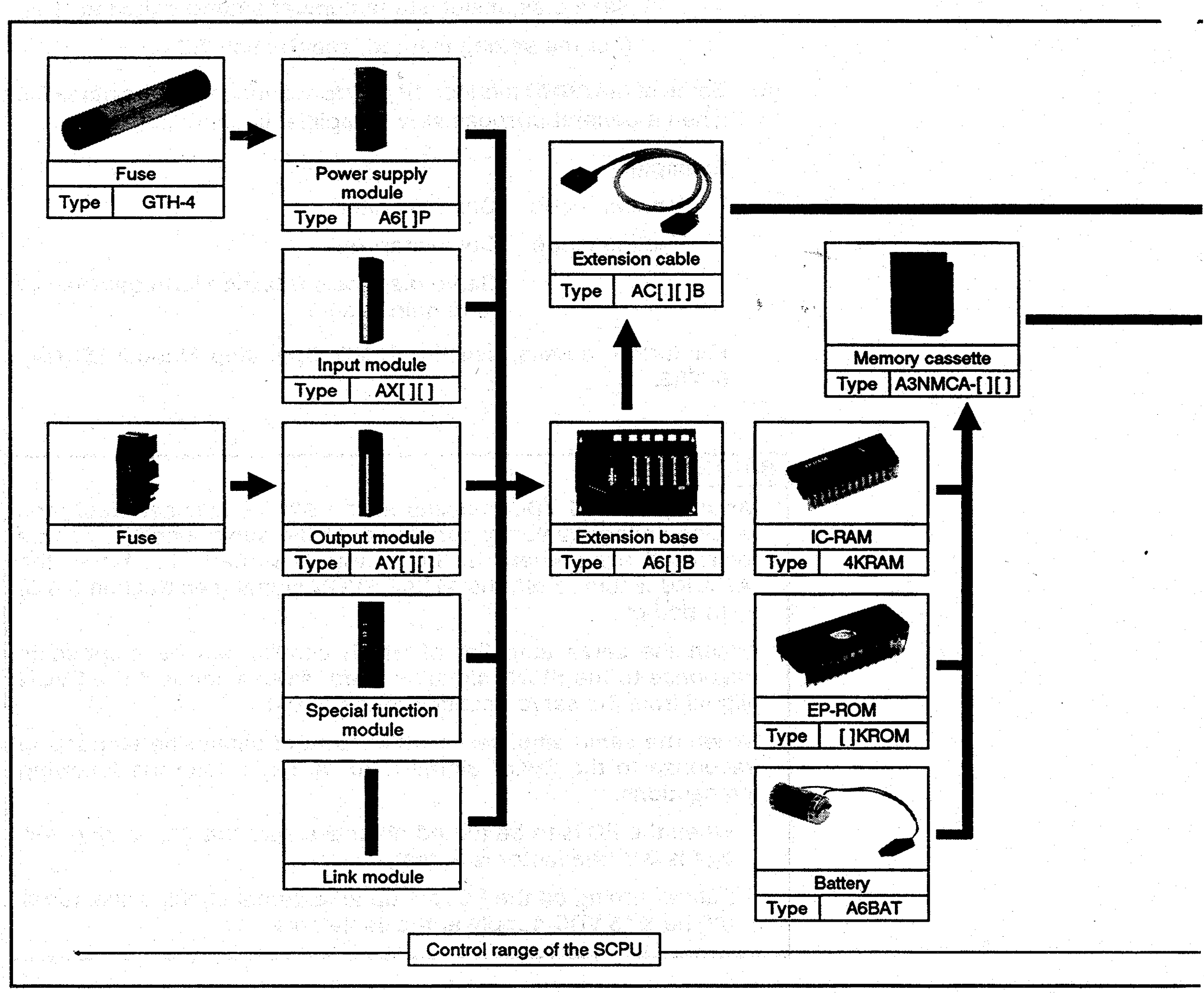


Fig. 2.3 Overall Configuration Established When an MR-SB Servo Amplifier and a General-Purpose Amplifier Are Used

POINT

(1) The unit shown in Fig. 2.3 can be mounted on the A74B. The mounting position should be as indicated in Fig. 2.3.

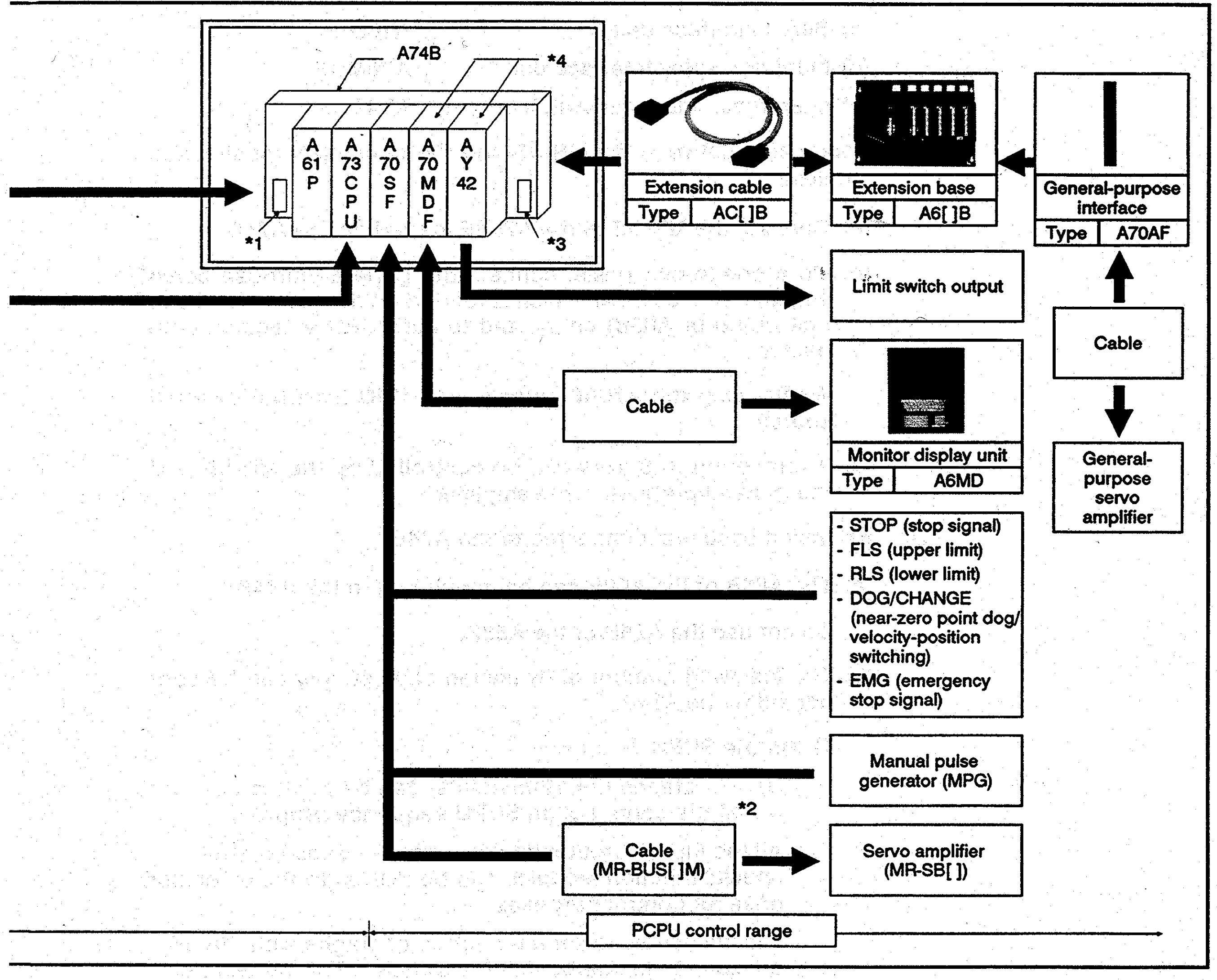
(2) *1: SCPU extension connector (for connecting to the SCPU extension base)

(3) *2: Divide the MR-SB into 2 systems each having 4 axes before connecting it to the A70SF.

(4) *3: PCPU extension connector (for connecting to the PCPU extension base)

(5) *4: The A70MDF and the AY42 are optional equipment.

A70MDF	: Necessary for monitoring, testing, and servo program preparation with the A6MD
AY42	: Necessary for limit switch output



2.3.2 System configuration precautions

Take the following precautions when establishing the system in which an MR-SB and a general-purpose servo amplifier are used.

(1) Limitations on the base unit

Load the A73CPU onto the A74B base unit (referred to as the A74B in this manual).

With the A73CPU loaded to the other base units (the A32B, A35B, A38B, and A78B), the A73CPU will not operate.

(2) Limitations on units loaded to the A74B

The units that can be loaded to the A74B are as listed below. Their loading positions are predetermined. See Fig. 2.3 for the loading positions.

(a) Power supply module : A61P
(b) CPU module : A73CPU
(c) Servo interface unit : A70SF
(d) Monitor display interface unit : A70MDF
(e) Output module (limit switch output) : AY42

(3) Connection between the MR-SB and the general-purpose servo amplifier

(a) Connect the MR-SB to the A70SF loaded on the A74B.

(b) On a one-to-one basis, connect the general-purpose servo amplifier to the A70AF which is loaded on the extension base unit (A65B or A68B) connected to the PCPU extension connector.

When using the A70AF, supply ±15 VDC from the external source.

(c) A total of up to 8 axes can be controlled by the MR-SB and the general-purpose servo amplifier.

(4) Extension base unit connected to the A74B

(a) The A65B or the A68B can be connected to the A74B.

Do not use the A55B or the A58B.

(b) The following number of extension base stages can be connected to the A74B.

1) For the SCPU:

- Up to 7 stages (for 1920 points) can be connected under the control of an SCPU sequence program.
- All the input/output modules of the A series and the special function modules can be loaded to the extension base for control purposes.
- It is necessary to set the number of stages with the extension stage number setting switch. (For the setting method, see Section 7.2.3.)

2) For the PCPU

Only one stage can be connected for loading the A70AF (interface unit for the general-purpose servo amplifier). Units other than the A70AF cannot be loaded on the extension base for the PCPU.

- Set the extension stage number setting switch to "1". (For the setting method, see Section 7.2.4.)

(5) Absolute value system

(a) For the MR-SB, the use of a servo amplifier that is capable of handling absolute values enables positioning control in the absolute value system.

(b) The general-purpose servo amplifier is not capable of positioning control in the absolute value system.

(6) Some of the A6MD monitor display functions cannot be performed when a general-purpose servo amplifier is connected.

Example:

Monitor mode : Servo monitor
Testing mode : Servo start-up
Servo diagnosis (position loop gain/velocity loop gain check)

For further details, see the A6MD Operating Manual IB (NA) - 66235.

POINT

(1) Positioning control of a total of up to 8 axes can be performed when the MR-SB and the general-purpose servo amplifier are used.

(2) When a general-purpose servo amplifier is used, connect the near-zero point signal to the A70AF. Connect the following external signals to the A70SF.

(a) STOP : Stop signal
(b) FLS : Upper limit switch signal
(c) RLS : Lower limit switch signal
(d) DOG/CHANGE : Used as the velocity-position switching

(3) The servo amplifier must be grounded.

Ground LG and FG of the A73CPU system, too.

(4) Make external wiring connections for the following signals to be connected to the A70SF. Positioning control is disabled unless the signal is off (at high level).

(a) STOP : Stop signal
(b) FLS : Upper limit switch signal
(c) RLS : Lower limit switch signal
(d) EMG : Emergency stop signal (for the MR-SB only)

(5) When a general-purpose servo amplifier is used, EMG (emergency stop signal) from the A70SF is ignored.

Request general-purpose servo amplifier emergency stop from the general-purpose servo amplifier.

IMPORTANT

As long as ±15 VDC remains at the A70AF terminal block, the analog voltage (velocity command) to the servo amplifier can be delivered even when the PC power is turned off. When the A73CPU is turned off, the A70AF SVON signal (see Section 5.4.3) is turned off.

When the servo amplifier of which control can be stopped in response to the SVON signal is used, always connect the SVON signal from the servo amplifier to the A70AF.

When the servo amplifier of which control cannot be stopped in response to the SVON signal is to be used, take the following precautions.

- When the PC is to be turned off, make sure that the analog voltage is 0 V (the motor is at rest).
- Before turning off the PC, set up an external circuit which turns off the ±15 VDC supply at the same time.

2.4 When the MELSECNET Data Link Is Required

2.4.1 Overall configuration

This section describes the configuration required for the MELSECNET data link.

(For connection between the servo amplifier and the extension base, see Sections 2.1 through 2.3.)

(1) The A73CPUP21/R21 for the MELSECNET data link can be used for the master and local stations (see the hatched circles in Fig. 2.4).

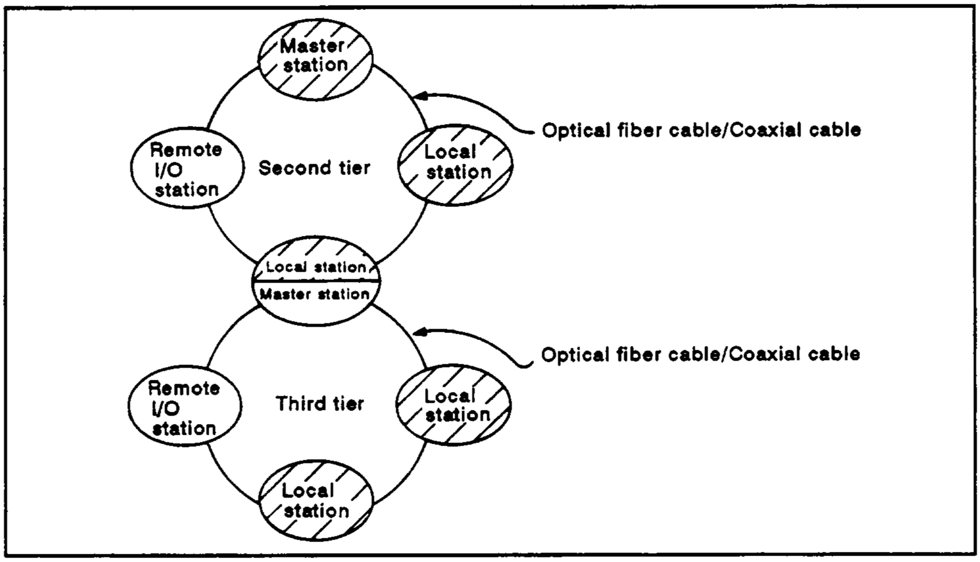


Fig. 2.4 Data Link System

2.4.2 Precautions in system configuring

Take the following precautions when configuring a data link system.

(1) A73CPUP21/R21 independent system

This system is connected with a servo amplifier, extension base, and other equipment in the same manner as independent system (see Sections 2.1 through 2.3).

(2) MELSECNET data link system

The A73CPUP21/R21 can be used as the master and local stations of the MELSECNET data link system composed of the ACPUP21/R21 and the A7LMS.

(3) Limitations on X/Y0 through X/Y7F

X/Y0 through the X/Y7F cannot be used in the data link system even when the extension base is not connected for the SCPU.

2.5 Peripheral Device Configuration

(1) Peripheral device for the PCPU

As the peripheral devices of the PCPU, the A6GPP, A6PHP and A6MD can be used.

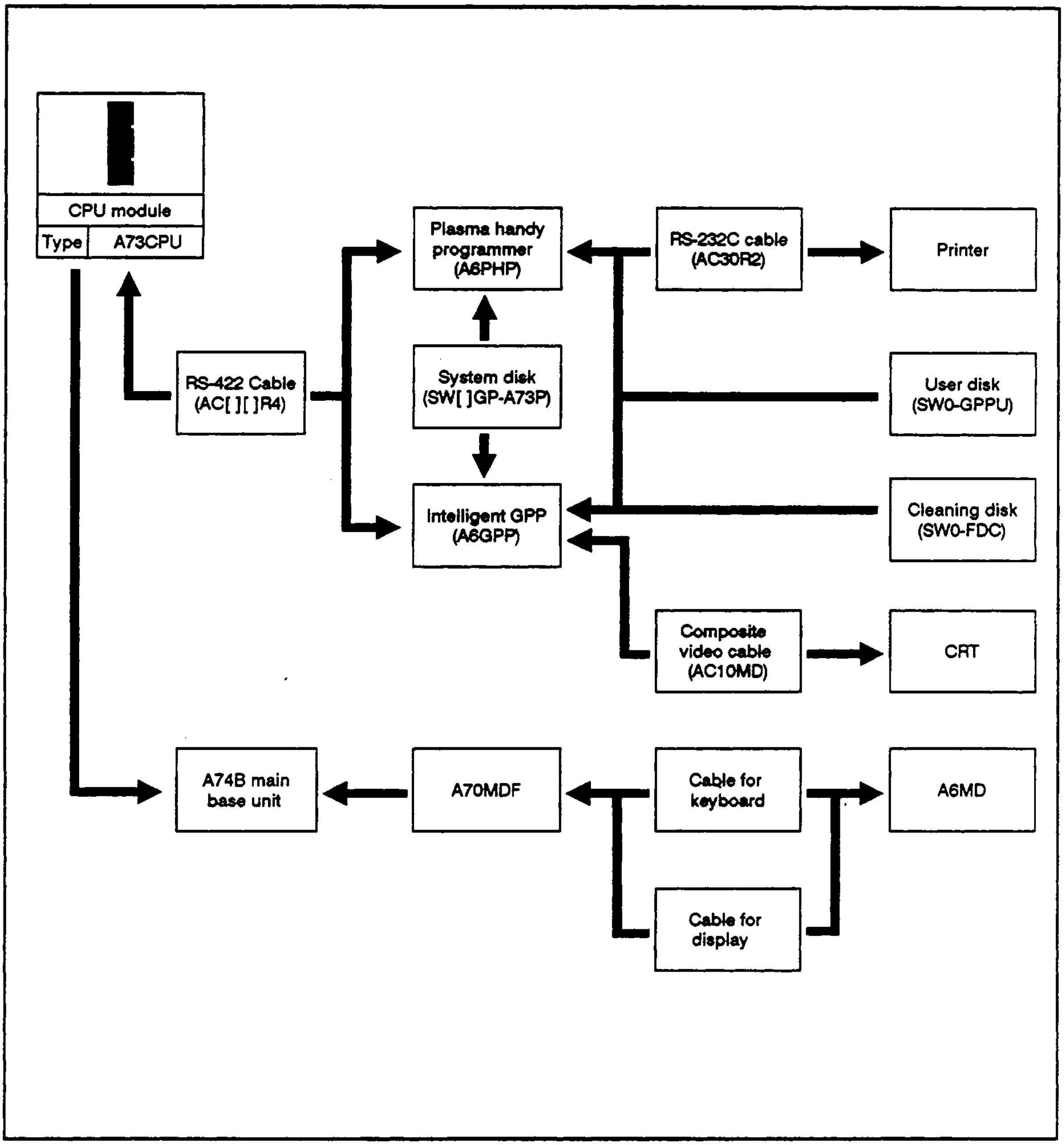


Fig. 2.5 Peripheral Device Configuration for PCPU

(2) Peripheral device for the SCPU

All the A series peripheral devices can be used for the SCPU.

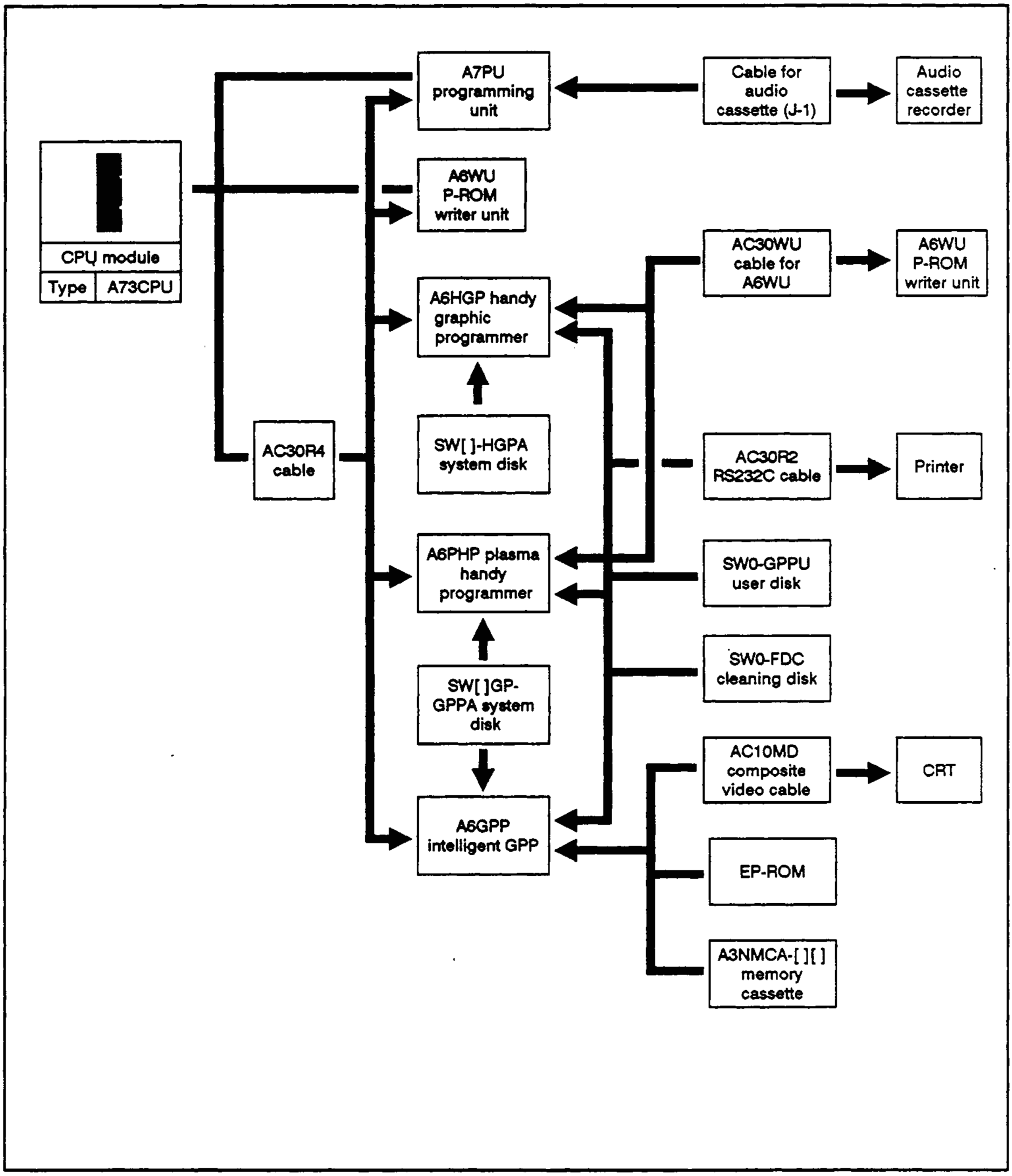


Fig. 2.6 Peripheral Device Configuration for SCPU

2.6 System Equipment

Table 2.1 List of Equipment

Module		Type	Description	Occupied Points (I/O assignment)
CPU module		A73CPU	[Sequence function] Program capacity: 30K steps, I/O points: 2048 T: 256, C: 256, D: 1024, M, L, S: 2048	—
			[Positioning function] Program capacity: 13K steps, Positioning point: about 400 points/axis (varying with each program)	
		A73CPUR21	For coaxial data link (Master/local selectable)	
		A73CPUP21	For optical data link (Master/local selectable)	
PCPU special-purpose unit	MR-SB servo interface	A70SF	For connecting the MR-SB servo amplifier	—
	General-purpose servo interface	A70AF	For connecting the general-purpose servo amplifier	—
	Monitor display interface unit	A70MDF	For connecting the A6MD	—
	Unit for limit switch output	AY42	For 64-point 12/24 VDC transistor output unit, 0.1 A	64 points (output)
	Main base unit	A74B	4 input/output modules loadable	—
Memory cassette		A3NMCA-0	Without IC-RAM memory	—
		A3NMCA-2	With IC-RAM memory 16K bytes	
		A3NMCA-4	With IC-RAM memory 32K bytes	
		A3NMCA-8	With IC-RAM memory 64K bytes	
		A3NMCA-16	With IC-RAM memory 128K bytes	
		A3NMCA-24	With IC-RAM memory 192K bytes	
		A3NMCA-40	With IC-RAM memory 320K bytes	
		A3NMCA-56	With IC-RAM memory 448K bytes	
Memory	IC-RAM	4KRAM	8K bytes (max. 3K steps)	—
	EP-ROM	4KROM	8K bytes (max. 3K steps)	
		8KROM	16K bytes (max. 7K steps)	
		16KROM	32K bytes (max. 15K steps)	
Input module		AX10	16 points, 100 VAC	16 points (input)
		AX11	32 points, 100 VAC	32 points (input)
		AX20	16 points, 200 VAC	16 points (input)
		AX21	32 points, 200 VAC	32 points (input)
		AX40	16 points, 12/24 VDC	16 points (input)
		AX41	32 points, 12/24 VDC	32 points (input)
		AX42	64 points, 12/24 VDC	64 points (input)
		AX60	16 points, 100/110 VDC	16 points (input)

*1 : Positioning control *2 : Sequence control
M : Master station L : Local station R : Remote station
o : Indicates that it is usable.

Current Consumption		System Used		Applicable System								Remarks
				Independent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
–	–	–	o	o	–	–	–	–	–	–	o	Memory cassette to be arranged separately.
		o	–									
		–	o	o	o	o	–	–	–	–	o	
				o	–	–	–	o	o	–	o	
–	–	o	–	o	o	o		o	o		o	Cable clamp supplied
–	–	o	–	o	o	o		o	o		o	
–	–	o	–	o	o	o		o	o		o	
–	0.08 A	o	–	o	o	o		o	o		o	
–	–	o	o	o	o	o		o	o		o	
–	–	–	o	o	o	o	–	o	o	–	o	With two memory sockets A3NMCA-0 can be loaded with IC-RAM or EP-ROM memory. A3NMCA-2 to -56 can be loaded with only EP-ROM memory.
–	–	–	o	o	o	o	–	o	o	–	o	
0.06 A	–	–	o	o	o	o	o	o	o	o	o	
0.11 A	–											
0.06 A	–											
0.11 A	–											
0.06 A	–											
0.11 A	–											
0.12 A	–											
0.06 A	–											

Table 2.1 List of Equipment (Continued)

Module	Type	Description	Occupied Points (I/O assignment)
Input module	AX70	16 points for sensor	16 points (input)
	AX71	32 points for sensor	32 points (input)
	AX80	16 points, 12/24 VDC, source loading	16 points (input)
	AX80E	16 points, 12/24 VDC, source loading	16 points (input)
	AX81	32 points, 12/24 VDC, source loading	32 points (input)
	AX82	64 points, 12/24 VDC, source loading	64 points (input)

Current Consumption		System Used		Applicable System								Remarks
				Independent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
0.06 A	-	-	○	○	○	○	○	○	○	○	○	
0.11 A	-											
0.06 A	-											
0.06 A	-											
0.11 A	-											
0.12 A	-											

POINT

(1) The maximum parameter setting range of the memory cassette A3NMCA-16 is 96K bytes. For details see Section 8.1.1. The unused memory area of this memory cassette may be used as extension file registers by using the SW[ ]GHP-UTLP-FN1.

(2) The maximum parameter setting range of the memory cassettes A3NMCA-24, 40, and 56 is 144K bytes. For details see Section 8.1.1.

   (a) A memory area of more than 114 KB can be used as an extension file register using the SW[ ]GHP-UTLP-FN1.

(3) Any conventional memory cassette A3MCA-[ ] (without N) can be used.

Table 2.1 List of Equipment (Continued)

Module	Type	Description	Occupied Points (I/O assignment)
Output module	AY10	16 points, relay contact	16 points (output)
	AY10A	16 points, relay contact, for independent contact output	16 points (output)
	AY11	16 points, relay contact, with surge suppression	16 points (output)
	AY11A	16 points, relay contact, for independent contact output, with surge suppression	16 points (output)
	AY11E	16 points, relay contact, (with fuse)	16 points (output)
	AY13	32 points, relay contact	32 points (output)
	AY13E	32 points, relay contact, (with fuse)	32 points (output)
	AY22	16 points, triac for 2 A (with fuse)	16 points (output)
	AY23	32 points, triac for 0.6 A (with fuse)	32 points (output)
	AY40	16 points, 12/24 VDC transistor for 0.1 A	16 points (output)
	AY40A	16 points, 12/24 VDC transistor for independent contact output, 0.3 A	16 points (output)
	AY41	32 points, 12/24 VDC transistor for 0.1 A	32 points (output)
	AY42	64 points, 12/24 VDC transistor for 0.1 A	64 points (output)
	AY50	16 points, 12/24 VDC transistor for 0.5 A (with fuse)	16 points (output)
	AY51	32 points, 12/24 VDC transistor for 0.5 A (with fuse)	32 points (output)
	AY60	16 points, 12/24/48 VDC transistor for 2 A (with fuse)	16 points (output)
	AY60E *1	16 points, 12/24/48 VDC transistor for 2 A (with fuse)	16 points (output)
	AY60EP *1	16 points, 12/24 VDC transistor for 2 A with short and overheat protection functions	16 points (output)
	AY70	16 points (5/12 VDC) for TTL, CMOS	16 points (output)
	AY71	32 points (5/12 VDC) for TTL, CMOS	32 points (output)
	AY80 *1	16 points, 12/24/48 VDC transistor for 0.5 A (with fuse)	16 points (output)
	AY80EP *1	16 points, 12/24 VDC transistor 0.8 A with short and overheat protection functions	16 points (output)
	AY81 *1	32 points, 12/24 VDC transistor for 0.5 A	32 points (output)
	AY81EP *1	32 points, 12/24 VDC transistor for 0.8 A with short and overheat protection functions	32 points (output)
	AY82EP *1	64 points, 12/24 VDC transistor for 0.1 A with short and overheat protection functions.	64 points (output)
Dynamic combined I/O module	A42XY	64 inputs, 64 outputs Dynamic scanning mode	64 points (output)

Current Consumption		System Used		Applicable System								Remarks
				Independent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
0.12 A	0.15 A	–	○	○	○	○	○	○	○	○	○	*1 indicates source loading. The other modules are of sink loading. The short and overheat protection functionsof the AY60EP, AY80EP, AY81EP, AY82EP are as follows: [Short protection function] Protects the transistor from overcurrent due to external wiring short, etc. [Overheat protection function] Protects the transistor from abnormally high temperature due to any external factor.
0.12 A	0.15 A											
0.12 A	0.15 A											
0.12 A	0.15 A											
0.12 A	0.15 A											
0.23 A	0.29 A											
0.23 A	0.29 A											
0.31 A	–											
0.59 A	–											
0.12 A	0.02 A											
0.19 A	–											
0.23 A	0.04 A											
0.29 A	0.08 A											
0.12 A	0.13 A											
0.23 A	0.1 A											
0.12 A	0.13 A											
0.12 A	0.13 A											
0.12 A	0.14 A											
0.1 A	0.11 A											
0.2 A	0.2 A											
0.12 A	0.13 A											
0.23 A	0.27 A											
0.23 A	0.1 A											
0.23 A	0.27 A											
0.29 A	0.1 A											
0.11 A	Input 0.06 A Output 0.18 A	–	○	○	○	○		○	○		○	I/O are processed with scanning made in groups of 8 points independently of the CPU module.

Table 2.1 List of Equipment (Continued)

Module		Type	Description	Occupied Points (I/O assignment)
Special function module	Single-axis positioning module	AD70	For single-axis, velocity control, and velocity/position control Analog voltage output (0 to ±10 VDC) The analog input type general-purpose servo amplifier may be used.	32 (32 special points)
	Positioning	AD71	For positioning control Pulse chain output, 2 axes (independent, simultaneous 2 axes, linear interpolation) The stepping motor may be used in conjunction with the AD76.	32 (32 special points)
		AD71S1	For positioning control (Dedicated for the MELDAS-S1 servo driver) Pulse chain output, 2 axes (independent, simultaneous 2 axes, linear interpolation)	32 (32 special points)
		AD71S2	For positioning control, and velocity control Pulse chain output, 2 axes (independent, simultaneous 2 axes, linear interpolation) The stepping motor may be used in conjunction with the AD76.	32 (32 special points)
		AD72	For positioning control Analog voltage output (0 to ±10 VDC) 2 axes (independent, simultaneous 2 axes, linear interpolation)	48 (First half: 16 vacant points) (Second half: 32 special points)
		AD76	Driver for the stepping motor (Used in conjunction with the AD71 or the AD71S2)	16 (16 vacant points)
	Position detection module	A61LS	Absolute detection system Resolution : Each rotation of the resolver = 4096 divisions Response speed : 6 ms or less	48 (First half: 32 special points) (Second half: 16 vacant points)
	High-speed counter	AD61	Binary 24 bits, 1/2 phase input, reversible counter 50 kpps, 2 channels	32 (32 special points)
		AD61S1	Binary 24 bits, 1/2 phase input, reversible counter 1 phase...10 kpps, 2 phases ... 7 kpps 2 channels	32 (32 special points)
	A/D converter	A68AD	4 to 20 mA/0 to ±10 V Analog input, 8 channels	32 (32 special points)
		A68ADS2		32 (32 special points)
	D/A converter	A62DA	4 to 20 mA/0 to ±10 V Analog output, 2 channels	32 (32 special points)
		A62DAS1	4 to 20 mA, 0 to 20 mA/1 to 5 V, 0 to 5 V, 0 to 10 V Analog output, 2 channels	
	A/D, D/A converter	A84AD	4 to 20 mA/0 to ±10 V Analog I/O, 4 channels	48 (First half: 16 vacant points) (Second half: 32 special points)
	Display Control	AD57	CRT display, semigraphic Color/monochrome selectable	64 (64 special points)
		AD57S1		
		AD57-S2	Indication of plasma display (A6MD), semigraphic	64 (64 special points)
		AD58	LCD display, semigraphic	64 (64 special points)

Current Consumption		System Used		Applicable System								Remarks
				Inde-pendent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
0.3 A	–	–	○	○	○	○	○	○	○	○	○	
1.5 A	–	–	○	○	○	○	○	○	○	○	○	
1.5 A	–	–	○	○	○	○	○	○	○	○	○	
1.5 A	–	–	○	○	○	○	○	○	○	○	○	
0.9 A	–	–	○	○	○	○	○	○	○	○	○	
–	–	–	○	○	○	○	○	○	○	○	○	
0.8 A	–	–	○	○	○	○	○	○	○	○	○	
0.3 A	–	–	○	○	○	○	○	○	○	○	○	
0.3 A	–	–	○	○	○	○	○	○	○	○	○	
0.9 A	–	–	○	○	○	○	○	○	○	○	○	
0.9 A	–											
0.6 A	0.35 A	–	○	○	○	○	○	○	○	○	○	
0.24 A	0.53 A	–	○	○	○	○	○	○	○	○	○	
1.21 A	–	–	○	○	○	○		○	○		○	
1.55 A	–											
	–	–	○	○	○	○		○	○		○	
1.27 A	–	–	○	○	○	○		○	○		○	

Table 2.1 List of Equipment (Continued)

Module		Type	Description	Occupied Points (I/O assignment)
Special function module	Memory card Centronics interface	AD59	32K bytes memory, battery backed May be connected with any printer conforming to Centronics Standards.	32 (32 special points)
		AD59S1		
	Voice output	A11VC	Messages can be recorded/replayed on max. 60 channels. 1, 2, 4 or 8 seconds may be selected per channel. Total recording time: 64 seconds	16 points (output)
Data link module	Coaxial data link	A73CPUR21	For master or local station [Sequence function] Program capacity : 30K steps Number of inputs/outputs : 2048 [Positioning function] Program capacity : 13K steps Positioning point : about 400 points/axis (varying with each program)	—
		A3MCPUR21	For master or local station Program capacity : 30K steps Number of inputs/outputs : 2048	—
		A3HCPUR21		
		A3NCPUR21		
		A2NCPU(S1)R21	For master or local station Program capacity : 14K steps Number of inputs/outputs : 512 (1024 points for S1)	—
		A1NCPUR21	For master or local station Program capacity : 6K steps Number of inputs/outputs : 256	—
		A0J2CPUR23	For local station Program capacity : 7K steps Number of inputs/outputs : 336	—
		AJ72R25	For remote I/O station	—
		A0J2CPUR25	For remote I/O station	—
		AJ71R22	For tier 3 master station in three-tier system	32 (32 special points)
	Optical data link	A73CPUP21	For master or local station [Sequence function] Program capacity : 30K steps Number of inputs/outputs : 2048 [Positioning function] Program capacity : 13K steps Positioning point : about 400 points/axis (Varying with each program)	—
		A3MCPUP21	For master or local station Program capacity : 30K steps Number of inputs/outputs : 2048	—
		A3HCPUP21		
		A3NCPUP21		
		A2NPU(S1)P21	For master or local station Program capacity : 14K steps Number of inputs/outputs : 512 (1024 points for S1)	—
		A1NCPUP21	For master or local station Program capacity : 6K steps Number of inputs/outputs : 256	—
		A0J2CPUP23	For local station Program capacity : 7K steps Number of inputs/outputs : 336	—

Current Consumption		System Used		Applicable System								Remarks
				Inde-pendent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
0.3 A	–	–	○	○	○	○	○	○	○	○	○	
0.45 A	0.33 A	–	○	○	○	○		○	○		○	
–	–	–	○		○	○						
4.12 A	–											
1.95 A												
1.78 A	–											
1.63 A	–											
–	–					○						
2.6 A	–						○					
–	–											
2.2 A	–					○						Only one module may be used with one local station.
–	–	–	○					○	○			
3.72 A	–											
1.55 A												
1.38 A	–											
1.23 A	–											
–	–								○			

Table 2.1 List of Equipment (Continued)

Module		Type	Description		Occupied Points (I/O assignment)
Data link module	Optical data link	AJ72P25	For remote I/O station		—
		A0J2CPUP25	For remote I/O station		—
		AJ71P22	For tier 3 master station in three-tier system		32 (32 special points)
Computer link module		AJ71C24	Communicates data with the computer in the fixed format. Transmission speed: 300 BPS to 19.2 KBPS One RS-232C, one RS-422 channels		32 (32 special points)
		AJ71C24-S3			
Intelligent communication module		AD51	Allows max. 8 multitaskings of GPC-BASIC programs for data transfer between the PC and computer and control status monitoring. Data communication with the computer in free format. Two RS-232C, two RS-422 channels.		48 (First half: 16 vacant points) (Second half: 32 special points)
		AD51S3			
Terminal interface unit		AJ71C21	Link unit used for data transmission based on either BASIC-function terminal interface or no procedure. Transmission rate: 600 BPS to 19.2 KBPS 1 channel each for RS-232C and RS-422		32 (32 special points)
		AJ71C21S1			
Multidrop data link module and units		AJ71C22	Multidropped with max. 8 slave stations to make bit data transfer. For multidrop link master station. Transmission speed: 38.4 KBPS One RS-422 channel		32 (32 special points)
		A0J2C25	For multidrop link remote I/O station		—
		A0J2C214	For multidrop link local station (May be used as the computer link or multidrop link master station in an A0J2CPU system)		64
Interrupt module		AI61	For specifying interrupt program execution. (16 interrupt inputs)		32 (32 special points)
Dummy module		AG62	16, 32, 48 or 64 points may be selected.		Setting range (input [number of points set])
Blank cover		AG60	Dustproof cover for use in vacant slot		16 (16 vacant points)
Power supply module		A61P	Input : 100/200 VAC Output : 5 VDC 8 A	(For use in power supply slot)	—
		A62P	Input : 100/200 VAC Output : 5 VDC 5 A 24 VDC 0.8 A	(For use in power supply slot)	
		A63P	Input : 24 VDC Output : 5 VDC 8 A	(For use in power supply slot)	
		A65P	Input : 100/200 VAC Output : 5 VDC 2 A 24 VDC 1.5 A	(For use in power supply slot)	
		A66P	Input : 100/200 VA Output : 24 VDC 1.2 A	(For use in I/O slot)	16 (16 vacant points)
Extension base unit		A68B	Can accommodate 8 I/O modules.		—
		A65B	Can accommodate 5 I/O modules.		
Extension cable		AC06B	600 mm (23.62 in) long	For use between base unit	—
		AC12B	1200 mm (47.24 in) long		
		AC30B	3000 mm (118.11 in) long		

Current Consumption		System Used		Applicable System								Remarks
				Inde-pendent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
2.3 A	-	-	o							o		
-	-											
1.9 A	-								o			Only one module may be used with one local station.
1.4 A	-	-	o								o	Up to two of any modules may be used with one CPU. When the AJ71C21 (S1) is used in the sequence mode (selected by the program mode switch), no limitations are placed on the number of the units used.
1.3 A	-	-	o								o	
0.8 A	-	-	o								o	
0.8 A												
1.4 A	-	-	o	o	o	o		o	o			
-	-	-	o									
-	-	-	o									
0.14 A	-	-	o	o	o	o		o	o			Only one module may be used with one CPU.
0.07 A	-	-	o	o	o	o	o	o	o	o	o	With 16 simulation switches
-	-	o	o	o	o	o	o	o	o	o	o	
-	-	o	o	o	o	o	o	o	o	o	o	
		-										
		o										
		-										
-	-	-	o									
-	-			o	o	o	o	o	o	o	o	Requires a power supply module.
-	-	o	o	o	o	o	o	o	o	o	o	

Table 2.1 List of Equipment (Continued)

Module		Type	Description	Occupied Points (I/O assignment)
Simulation switch		A6SW16	16 points simulation switch	—
		A6SW32	32 points simulation switch	
Others	Battery	A6BAT	IC-RAM backup	—
	Fuse for AY22	HP-70K	Plug type 7 A	—
	Fuse for AY23	HP-32	Plug type 3.2 A	
	Fuse for AY50, AY80	MP-20	Plug type 2 A	
	Fuse for AY60	MP-32	Plug type 3.2 A	
	Fuse for AY60E	MP-50	Plug type 5 A	
	Fuse for power supply	GTH-4	Cartridge type 4 A	

Current Consumption		System Used		Applicable System								Remarks
				Inde-pendent	Coaxial Data Link			Optical Data Link			Computer Link	
5 VDC	24 VDC	*1	*2		M	L	R	M	L	R		
–	–	–	○	○	○	○	○	○	○	○	○	Used with an input module.
–	–			○	○	○		○	○		○	
–	–	–	–	○	○	○	○	○	○	○	○	

Table 2.2 Peripheral Device List

<table>
<tr><th rowspan="2">Unit</th><th rowspan="2">Description</th><th rowspan="2">Type</th><th colspan="2">Current Consumption</th><th rowspan="2" colspan="2">Remarks</th></tr>
<tr><th>5 VDC</th><th>24 VDC</th></tr>
<tr><td rowspan="2">Programming unit with CRT</td><td>Intelligent GPP</td><td>A6GPP-SET</td><td>-</td><td>-</td><td colspan="2">Consists of the following models:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6GPP</td><td>- Programming unit with CRT
- Equipped with ROM writer, FDD and printer interface functions.</td></tr>
<tr><td>SW[ ]GP-GPPA</td><td>A series system disk</td></tr>
<tr><td>SW[ ]GP-GPPK</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connection of CPU and A6GPP 3 m (9.84 ft) length</td></tr>
</table></td></tr>
<tr><td>Composite video cable</td><td>AC10MD</td><td>-</td><td>-</td><td colspan="2">Cable for connection of GPP and expanded monitor display. 1 m (3.28 ft) length.</td></tr>
<tr><td>Programming unit with LCD</td><td>Handy graphic programmer</td><td>A6HGP-SET</td><td>-</td><td>-</td><td colspan="2">Consists of the following models:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6HGP</td><td>- Programming unit with LCD
- Equipped with FDD, printer interface and memory card interface functions.</td></tr>
<tr><td>SW[ ]-HGPA</td><td>A series system disk</td></tr>
<tr><td>SW[ ]-HGPK</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connection of CPU and A6PHP 3 m (9.84 ft) length</td></tr>
</table></td></tr>
<tr><td>Programming unit with plasma display</td><td>Plasma handy programmer</td><td>A6PHP-SET</td><td>-</td><td>-</td><td colspan="2">Consists of the following models:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6PHP</td><td>- Programming unit with plasma display
- Equipped with FDD, printer interface and memory card interface functions.</td></tr>
<tr><td>SW[ ]GP-GPPA</td><td>A series system disk</td></tr>
<tr><td>SW[ ]GP-GPPK</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connection of CPU and A6HGP 3 m (9.84 ft) length</td></tr>
</table></td></tr>
<tr><td>Plasma display</td><td>Monitor display</td><td>A6MD</td><td>-</td><td>-</td><td colspan="2">- Plasma display + operation key (touch key and general-purpose key)
- For positioning data monitoring, servo programming, and testing
- Connectable to the A70MDF and the AD57S2 (Provided with the A70MDF/AD57S2 switch)</td></tr>
<tr><td rowspan="4">Common to programming units with CRT and LCD</td><td rowspan="2">RS-422 cable</td><td>AC30R4</td><td>-</td><td>-</td><td rowspan="2">Cable for connection of CPU and A6GPP/A6HGP/A6PHP</td><td>3 m (9.84 ft) length</td></tr>
<tr><td>AC300R4</td><td>-</td><td>-</td><td>30 m (98.4 ft) length</td></tr>
<tr><td>User disk</td><td>SW0-GPPU</td><td>-</td><td>-</td><td colspan="2">User disk (3.5 inch, formatted) for storing programs</td></tr>
<tr><td>Cleaning disk</td><td>SW0-FDC</td><td>-</td><td>-</td><td colspan="2">Cleaning disk for disk drive</td></tr>
</table>

Table 2.2 Peripheral Device List (Continued)

Unit	Description	Type	Current Consumption		Remarks
			5 VDC	24 VDC	
For programming unit with CRT	Software package for PC servo	SW0GP-A73P	-	-	- Servo programming and monitoring - Data storage and printout - Usable for the A6GPP/A6PHP
Printer	Printer	A6PRE	-	-	For print out of program ladder diagrams and lists.
		A7PRE	-	-	
	RS-232C cable	AC30R2	-	-	Cable for connection of A6GPP/A6HGP/A6HGP and printer. 3 m (9.84 ft) length.
	Printer paper	K6PR-Y	-	-	Paper for K6PRE. 9 inch. Available in units of 2000.
	K6PR (K) Ink ribbon	K6PR-R	-	-	Replacement ink ribbon for A6PRE
Programming unit	Programming unit	A7PU	0.3 A	-	- Connected to the CPU directly or via cable to read and write programs. Equipped with MT function. - The A7PU is supplied with a cable for connection of the A7PU and audio cassette recorder.
	RS-422 cable	AC30R4 AC300R4	-	-	Cable for connection of CPU and A7PU. 3 m (9.84 ft)/ 30 m (98.4 ft) length.
P-ROM writer unit	P-ROM writer unit	A6WU	0.8 A	-	- Used to store programs onto ROM and read programs from ROM to the CPU. - Connected to the CPU directly or via the AC30R4 cable .
	RS-422 cable	AC30R4 AC300R4	-	-	Cable for connection of CPU and A6WU. 3 m (9.84 ft)/ 30 m (98.4 ft) length.

3. GENERAL SPECIFICATIONS

Table 3.1 shows the general specifications for the A6MD.

Table 3.1 General Specifications

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

REMARKS

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

*Note: *JIS: Japanese Industrial Standard*

MEMO

4. CPU MODULE

This section describes the performance, function, part identification and settings, and input/output interface specifications.

For details on the performance and functions of the A73CPU, see the A73CPU Multi-axis Positioning Unit Reference Manual IB (NA) - 68142.

4.1 Performance

Tables 4.1 and 4.2 detail the performance of the A73CPU (PCPU and SCPU).

Table 4.1 PCPU Performance Specifications List

<table>
<tr><th colspan="2">Type
Item</th><th colspan="5">PCPU</th></tr>
<tr><td colspan="2">Number of control axes</td><td colspan="5">8 axes (2 simultaneous, 3 simultaneous, and 8 independent)</td></tr>
<tr><td colspan="2">Interpolation function</td><td colspan="5">Linear interpolation (2 and 3 axes) and circular interpolation (2 axes)</td></tr>
<tr><td colspan="2">Control system</td><td colspan="5">PTP (point-to-point), velocity control, velocity-position control, fixed-rate feed, and constant velocity control</td></tr>
<tr><td colspan="2">Control unit</td><td colspan="5">mm, inches, degrees, pulses</td></tr>
<tr><td rowspan="4">Program</td><td>Language</td><td colspan="5">Dedicated instruction</td></tr>
<tr><td>Capacity</td><td colspan="5">13K steps (13312 steps)</td></tr>
<tr><td>Number of positioning points</td><td colspan="5">About 400 points/axis (varies with the program)
Indirect designation of positioning data enabled.</td></tr>
<tr><td>Setting method</td><td colspan="5">Set by an A6GPP or A6PHP started up by the A6MD or SW0GHP-A73P.</td></tr>
<tr><td rowspan="10">Position-ing</td><td>Method</td><td colspan="5">PTP : Can be switched between absolute and increment methods
Velocity-position control and fixed-rate feed : Increment method
Constant velocity control : Absolute and increment methods mixed</td></tr>
<tr><td rowspan="7">Position command</td><td colspan="5">The command unit is selected for each axis from the following units.</td></tr>
<tr><td rowspan="2">Control unit</td><td rowspan="2">Command unit</td><td colspan="2">Non-absolute value system</td><td>Absolute value system</td></tr>
<tr><td>Setting range</td><td>Maximum setting value</td><td>Setting range</td></tr>
<tr><td>mm</td><td>x 10^{-1} um</td><td rowspan="4">-2^{31} to $(2^{31} - 1)$</td><td>429 m</td><td>−196596000 to 196596000</td></tr>
<tr><td>inch</td><td>x 10^{-5} inch</td><td>42949 inches</td><td>−196596000 to 196596000</td></tr>
<tr><td>degree</td><td>x 10^{-5} degree</td><td>360 degrees</td><td>0 to 35999999</td></tr>
<tr><td>pulse</td><td>pulse</td><td>4294967296 pulses</td><td>−196596000 to 196596000</td></tr>
<tr><td>Velocity command</td><td colspan="5">0.01 to 6000000.00 (mm/min)
0.001 to 600000.000 (inches/min)
0.001 to 600000.000 (degrees/min)
1 to 1000000 (pulses/sec)</td></tr>
<tr><td>Acceleration/ deceleration process</td><td colspan="5">Automatic trapezoidal acceleration and deceleration
Acceleration time .... 1 to 65535 (ms)
Deceleration time .... 1 to 65535 (ms)</td></tr>
<tr><td rowspan="2">Com-pensa-tion</td><td>Electronic gear</td><td colspan="5">(0 to 65535) x position command unit (the unit is converted to pulses; 0 to 255 pulses)</td></tr>
<tr><td>Backlash compensation</td><td colspan="5">Actual travel distance error compensation function relative to the command data</td></tr>
</table>

Table 4.1 PCPU Performance Specifications List (Continued)

Item \ Type	PCPU
Zero return function	Non-absolute value system : Switched between near-zero point dog and count types Absolute value system : Data set
Jog operation function	Provided
MPG operation function	Up to 3 units can be connected; 3 axes/unit controllable
M function	M code; output function provided
Limit switch output function	8 points per axis; Up to 10 ON/OFF set points selectable
Absolute value system	Provided (optional)

Table 4.2 SCPU Performance Specifications List

Item \ Type			SCPU	
Control system			**Repeated operation (using stored program)**	
I/O control method			**Refresh/direct mode selected**	
Programming language			**Language dedicated to sequence control (Combined use of relay symbol type, logic symbolic language, and Sequence Action Program language)**	
Number of instructions	Sequence instruction		22	
	Basic instruction		132	
	Application instruction*		107	
Processing speed (sequence instruction) (μ sec/step)			Direct mode : 1.0 to 2.3 Refresh mode : 1.0	
I/O points *			1920 (X/Y80 to 7FF)	
Watch dog timer (WDT) (msec)			10 to 2000	
Memory capacity			Up to the capacity of the memory cassette loaded	
Program capacity			(Main sequence program + Main microcomputer program) = 30 K steps max. Up to 58 K bytes (29 K steps) can be set for the main microcomputer program.	
			(Sub-sequence program + Sub-microcomputer program) = 30 K steps max. Up to 58 K bytes (29 K steps) can be set for the main microcomputer program.	
Device	Internal relay (M) (points)		1000 (M0 to 999)	The number of Ms + Ls + Ss = 2000 (set in parameters)
	Latch relay (L) (points) *		1048 (L1000 to 1999)	
	Step relay (S) (points)		0 (Defaults to no value)	
	Link relay (B) (points)		1024 (B0 to 3FF)	
	Timer	Number of points	256	
		Specifications	100 ms timer : Setting time 0.1 to 3276.7 sec (T0 to 199) 10 ms timer : Setting time 0.01 to 327.67 sec (T200 to 255) 100 ms retentive timer: Setting time 0.1 to 3276.7 sec	Set in parameters
	Counter	Number of points	256	
		Specifications	Normal counter : Setting range 1 to 32767 (C0 to 255) Counter for interrupt program: Setting range 1 to 32767 → Counters used in interrupt programs	Set in parameters
	Data register (D) (points)*		800 (D0 to 799)	
	Link register (W) (points)		1024 (W0 to 3FF)	
	Annunciator (F) (points)		256 (F0 to 255)	
	File register (R) (points)		Max. 8192 (R0 to 8191)	
	Accumulator (A) (points)		2 (A0, A1)	
	Index register (V, Z) (points)		2 (V, Z)	
	Pointer (P) (points)		256 (P0 to 255)	
	Pointer for interruption (I) (points)		32 (I0 to 31)	
	Special relay (M) (points)		256 (M9000 to 9255)	
	Special register (D) (points)		256 (D9000 to 9255)	

Table 4.2 SCPU Performance Specifications List (Continued)

Item \ Type	SCPU
Comment	Max. 4032 (Specify in batches of 64 points)
Self-diagnostic functions	WDT error monitor, memory error detection, CPU error detection, I/O error detection, battery error detection, etc.
Operation mode at the time of error	STOP/CONTINUE
STOP → RUN output mode	Output data at time of STOP restored/data output after operation execution

REMARKS

- Indicates items not in the A3NCPU specifications.

4.2 Functions List

Tables 4.3 and 4.4 detail the functions of the A73CPU (PCPU and SCPU).

Table 4.3 PCPU Functions List

Function		*1	*2	*3	*4	Function Outline
Positioning	Positioning	o	o	o	o	- Positioning control at velocity 1 - Switched between absolute and increment modes
	Fixed-rate feed	o	o	o	x	- Setting the travel enables infinitely repeated positioning control for the fixed distance.
	Velocity control	o	x	x	x	- Once a start command is received, operation is controlled at the designated velocity until a stop command is received.
	Velocity-position control	o	x	x	x	- Once a start command is received, operation starts at the controlled velocity. The set travel is controlled in relation to position starting from the instant the external position switching input signal (CHANGE) is received from the external source. - Changing of the set travel distance and restart after interruption can be accomplished while the velocity is being controlled.
	Velocity switching control	o	o	o	x	- Once a start command is received, positioning proceeds while the operating velocity is being adjusted to the preset rate at the predetermined points.
	Constant velocity control	–	o	o	o	- Once a start command is received, positioning proceeds at the constant velocity until the end point is reached while the preset position control (randomly selected from circular, linear, and other forms of control) is being performed toward the predetermined pass point. - The repeating command (FOR/NEXT) enables repeating of the same control.
Jog operation		o	x	x	x	- Jog operation is enabled while the jog start signal (Yn2/Yn3) remains on. - Simultaneous start of the jog operation (chosen for each axis between forward and reverse rotations for up to 8 axes) is enabled.
MPG operation		o	x	x	x	- Pulse input with the MPG enables positioning in accordance with the number of input pulses. - It is possible to perform up to 3-axis independent and 3-axis simultaneous MPG operation.
Zero return						- The zero return/start command enables zero return. The present position data obtained at the time of stop is corrected to the zero point. - The zero return method can be selected from the near-zero point dog, counting, and data setting types.
Simultaneous start						- Up to 3 servo programs for positioning control, zero return, and other functions can be started simultaneously.
Control change	Velocity change					- Velocity can be changed during positioning control and Jog operation. However, velocity changes are not allowed during circular interpolation and zero return.
	Travel distance change					- For positioning control based on velocity and positioning, the preset travel distance can be changed during velocity-controlled operation after the input of the position switching input signal (CHANGE).
	Present position data change					- The present position data can be changed during stop.
M code						- For positioning control, an M code (0 to 255) can be delivered. - For velocity switching control, an M code can be set at each velocity switching point. - For constant velocity control, an M code can be set at each pass point.

*1: 1-axis linear interpolation *2: 2-axis linear interpolation
*3: 3-axis linear interpolation *4: 2-axis circular interpolation

Table 4.3 List of PCPU Functions (Continued)

Function	Function Outline
Backlash compensation	- Backlash compensation process can be performed at each startup. - The amount of backlash compensation is set on a peripheral device.
Electronic gear	- The difference between the command position data and the actual travel distance can be compensated. - Effective for all operation.
Torque limit	- Torque limit values (0 to 500%) for all positioning, jog, and other operations can be set with the servo program.
Limit switch output	- Limit switch output corresponding to the present position data of each axis can be obtained on the basis of the preset data. - Up to 10 ON/OFF switching points can be set for each axis. - There are 8 output points for each axis.
Test mode operation	- Each start and teaching operation can be performed in the peripheral device test state. - In the test state, the PC may be either running or at rest.
Absolute position detection	- Compatible with the absolute value system when the servo amplifier capable of handling absolute values is used.

POINT

(1) • Torque limit values can be changed only when an MR-SB is used.

When an general-purpose servo amplifier is used, the setting of torque limit values is ignored.

Table 4.4 List of SCPU Functions

Function	Description
Constant scan	- Executes the sequence program at the predetermined intervals independently of the scan time. - Setting allowed between 10 and 1990 ms.
LATCH	- Retains device data if the PC is switched off or reset of instantaneous power failure occurs 20 ms or longer. - L, B, T, C, D and W can be latched.
Remote RUN/STOP	- Allows remote run/stop from external device (e.g. peripheral, external input, computer) with RUN/STOP switch in RUN position.
PAUSE	- Stops operation with the output (Y) status retained. - Pause function may be switched on by any of the following ways: • RUN/STOP switch on the front of the CPU • Remote pause contact • Peripheral
Status latch	- Stores all device data to the status latch area of the memory cassette when the status latch condition is switched on. - The stored data can be monitored by the peripheral.
Sampling trace	- Samples the specified device operating status at predetermined intervals and stores the sampling result in the sampling trace area of the memory cassette. - The stored data can be monitored by the peripheral.
STEP RUN	- Executes the program one instruction at a time. - Step run may be executed in either of the two ways: • By specifying the loop count. • Per instruction
Online I/O module replacement	- Allows any I/O module to be changed with the CPU running (power on).

4.3 Handling

This section gives handling instructions, part identification and hardware setting instructions.

4.3.1 Handling instructions

(1) Do not subject the CPU module and memory cassette to impact or shock.

(2) Do not remove printed circuit boards from the housing. There are no user-serviceable parts on the boards.

(3) Ensure that no conductive debris can enter the module. If it does, make sure that it is removed. Guard particularly against wire offcuts.

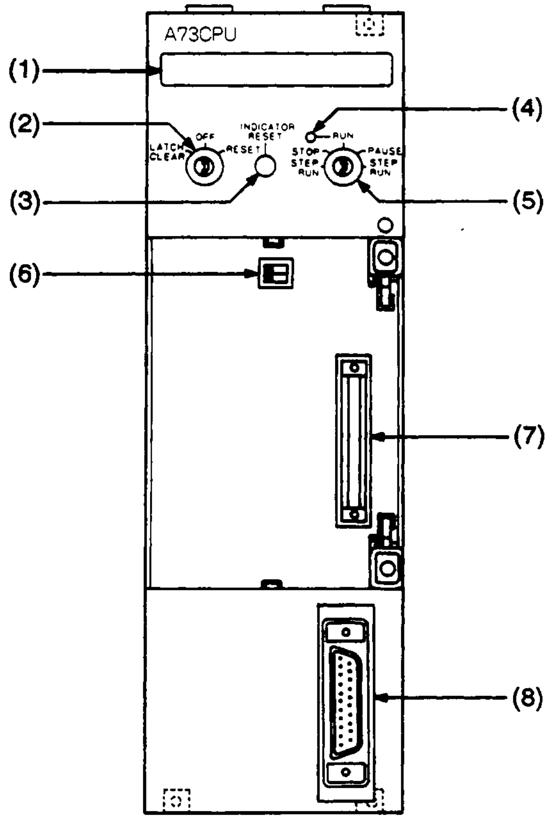
(4) Tighten the module mounting and terminal screws as specified below.

Screw	Tightening Torque kg-cm (lb-in)
Module terminal block installation screws (M4)	10 (8.66) to 14 (12.13)
Module mounting screws (optional) (M4)	8 (6.93) to 12 (10.39)

(5) To load the module onto the base, hook the two lower lugs into the cut out and gently swing the module into place. Ensure that the top catch engages. To remove, press the top catch and swing the module out before unhooking the lower lugs. (See Section 9.5.)

4.3.2 Part identification and setting of A73CPU

(1) Part identification



No.	Name	Description
(1)	LED display	Displays up to 16 alphanumeric characters. May be addressed from the user program using the LED commands and/or displays self-diagnosed error messages.
(2)	Reset key switch	RESET : Hardware reset. Used to reset the CPU after an operation error and to initialize operation. The latch memory is not cleared when the CPU is reset. LATCH CLEAR : Sets all latch area data (as defined in parameters) to OFF or 0. (Valid when the CPU is in STOP status)
(3)	LED display reset switch	Clears the present LED annunciator message. The next message in the annunciator queue is then displayed where appropriate.
(4)	RUN LED	Indicates the run status of the CPU. On : The CPU is in RUN or STEP-RUN status, no operation errors have occurred, the program is being run and the PC is active. Off : The CPU is in STOP, PAUSE or STEP-RUN status and the program is not being run. Flicker : Self-diagnosed error has occurred. (Operation will continue if the error detected has been specified in the parameter setting.)
(5)	RUN/STOP switch	RUN/STOP : To start/terminate running the PC program. PAUSE : To terminate running the PC program and maintain output status. STEP-RUN : To run the program step by step/scan by scan.
(6)	I/O control switch	Used to select direct/refresh mode.
(7)	Memory cassette loading connector	Used to connect the memory cassette to the CPU.
(8)	RS422 connector	Peripheral programmer port. Fit cover (supplied) when not in use.

(2) Settings

(a) Set the I/O control switch to direct or refresh mode as indicated below.

Switch Setting	Input (X)	Output (Y)	D9014 Value
	Direct	Direct	0
	Refresh	Direct	1
	Refresh	Refresh	3
			

POINT

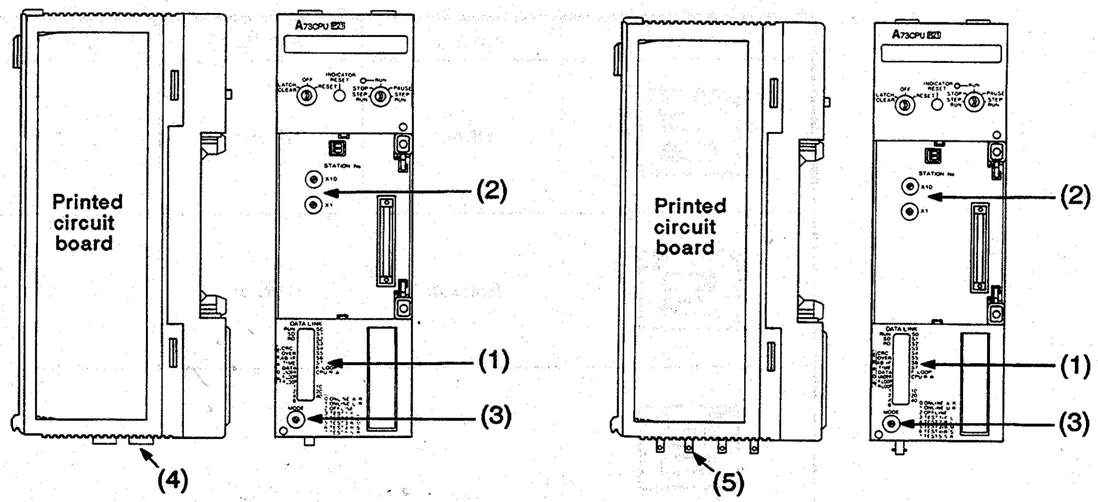
(1) The I/O control switch must be set with power off.

(2) After the switch has been set, the switch status is checked every time the CPU is powered up or reset. Direct input/refresh output setting is processed as refresh input/refresh output (No. 3 of the above) by the CPU.

(3) The BIN value in special register D9014 can be monitored by the peripheral.

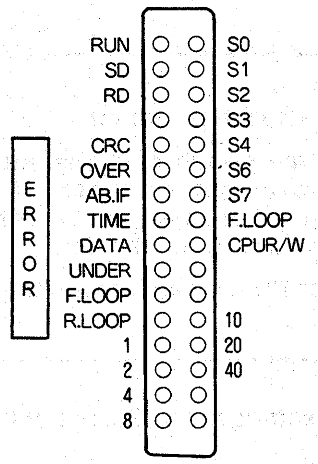
(b) For IC and memory cassette settings, see Section 9.2.

4.3.3 Part identification and setting of A73CPUP21/R21



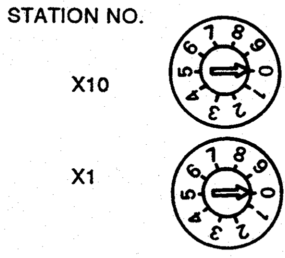
A73CPUP21 A73CPUR21

(1)



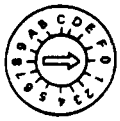
LED	Description	LED	Description
RUN	Lit when data link is normal.	S0	Not used (Flickers during normal data link.)
SD	Lit during data sending.	S1	
RD	Lit during data receiving.	S2	
	Not used (Always off)	S3	
CRC	Lit at code check error time.	S4	
OVER	Lit at data entry delay error time.	S5	
AB.IF	Lit when all data are 1.	S6	
TIME	Lit at time-out time.	S7	
DATA	Lit at receiving data error time.	F.LOOP	Lit when data receiving line is a forward loop. OFF when reverse.
UNDER	Lit at sending data error time.	CPU R/W	Lit during communication with programmable controller CPU.
F.LOOP	Lit at forward loop receiving error time.		Not used (Always off)
R.LOOP	Lit at reverse loop receiving error time.		Not used (Always off)
1	Displays the number of units of station number in BCD.	10	Displays the number of tens of station number in BCD.
2		20	
4		40	
8			Not used (Always off)

(2)



Station number setting switches

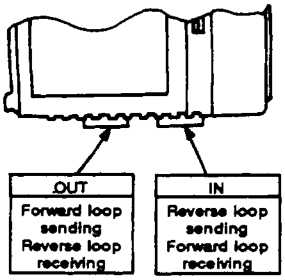
- * Set station numbers, 00 to 64.
- * Set the number of tens of station number to "X10".
- * Set the number of units of station number to "X1".
- * When the station is used as a master station, set "00".
- * When the station is used as a local station, set "01 to 64".

<table>
<tr>
<td>(3)</td>
<td>MODE
 </td>
<td>

Mode select switch

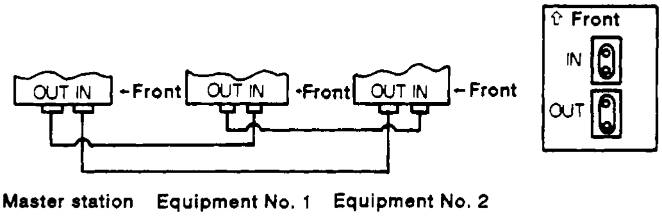
By switching mode, the following functions are available.

<table>
<tr><th>Setting Number</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Online</td><td>Automatic return set during normal operation.</td></tr>
<tr><td>1</td><td>Online</td><td>Automatic return not set during normal operation.</td></tr>
<tr><td>2</td><td>Offline</td><td>Disconnect host station.</td></tr>
<tr><td>3</td><td>Test mode 1</td><td>Forward loop test</td></tr>
<tr><td>4</td><td>Test mode 2</td><td>Reverse loop test</td></tr>
<tr><td>5</td><td>Test mode 3</td><td>Station-to-station test (main station)</td></tr>
<tr><td>6</td><td>Test mode 4</td><td>Station-to-station test (subordinate station)</td></tr>
<tr><td>7</td><td>Test mode 5</td><td>Self-loopback test</td></tr>
<tr><td>8</td><td>-</td><td>Not used</td></tr>
<tr><td>9</td><td>-</td><td>Not used</td></tr>
<tr><td>A</td><td>-</td><td>Not usable</td></tr>
<tr><td>B</td><td>-</td><td>Not usable</td></tr>
<tr><td>C to F</td><td>-</td><td>Not used</td></tr>
</table>

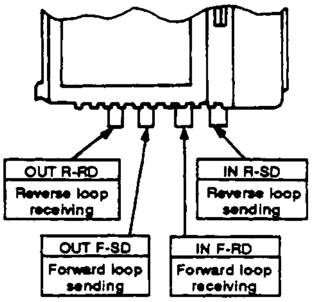
</td>
</tr>
<tr>
<td>(4)</td>
<td> </td>
<td>

Optical fiber cable connector

Connect the cable as shown below.

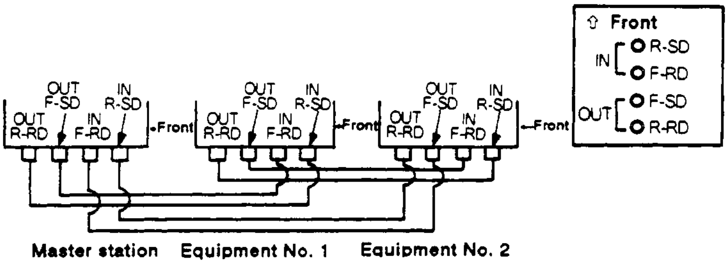


IN: Connect to OUT of preceding station
OUT: Connect to IN of next station

</td>
</tr>
<tr>
<td>(5)</td>
<td> </td>
<td>

Coaxial cable connector

Connect the cable as shown below.



IN-sending : Connect to OUT-receiving of preceding station
IN-receiving : Connect to OUT-sending of preceding station
OUT-sending : Connect to IN-receiving of succeeding station
OUT-receiving : Connect to IN-sending of succeeding station

</td>
</tr>
</table>

(1) Section-to-Section Setting

(a) The following three items can be set for the A73CPUP21/R21 in the data link system.

1) Station Number Setting with the Station Number Setting Switch

- When a given station is to be used as a master station, set the switch to 00.
- When a given station is to be used as a local station, select the station number between 01 and 64.

2) Mode Setting with the Mode Select Switch

Select the appropriate operation and self-diagnosis test states.

3) Link Parameter Setting on the GPP/HGP/PHP

Set the link parameters on the A73CPUP21/R21 which is in use in the two-tier master station and the two-tier local station provided with the AJ71P22/R22.

MEMO

5. POSITIONING UNITS

The positioning units are those required for positioning control by the A73CPU.

(1) A70SF :	For connecting to the MR-SB servo amplifier and fetching signals (upper and lower limit switch input, stop signal, etc.) from external sources.
(2) A70MDF:	Interface unit to be connected to the A6MD monitor display unit.
(3) A70AF :	Interface unit to be connected with the general-purpose servo amplifier.
(4) AY42 :	For delivering limit switch output. (For the specifications, see the Building Block Input/Output Module User's Manual.)

5.1 Handling Precautions

This section describes the precautions to be taken when the positioning unit (see Sections 5.2 through 5.4) is unpacked and installed.

(1) Do not subject the module, memory cassette, terminal block connector and pin connector to impact or shock.

(2) Do not remove printed circuit boards from the housing. There are no user-serviceable parts on the boards.

(3) Ensure that no conductive debris can enter the module. If it does, make sure that it is removed. Guard particularly against wire offcuts.

(4) Tighten the module mounting and terminal screws as specified below.

Screw	Tightening Torque kg-cm (lb-in)
Module terminal block installation screws (M4)	10 (8.66) to 14 (12.13)
Module mounting screws (optional) (M4)	8 (6.93) to 12 (10.39)

(5) To load the module onto the base, hook the tow lower lugs into the cut out and gently swing the module into place. Ensure that the top catch engages. To remove, press the top catch and swing the module out before unhooking the lower lugs. (See Section 9.5)

5.2 A70SF Servo Amplifier Interface Unit

The A70SF servo amplifier interface unit is connected to the MR-SB, upper and lower limit switch, stop command, emergency stop command, near-zero point dog/velocity-position switching command, and MPG.

The A70SF specifications and part identification is listed below.

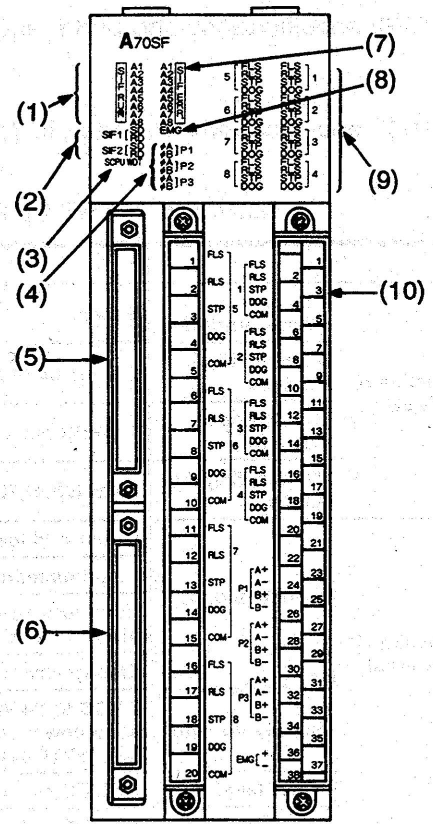
5.2.1 Specifications

The A70SF specifications are listed in Table 5.1.

Table 5.1 A70SF Specifications

Item		Specifications
Connection to the MR-SB	Number of axes controlled	8 max.
	Connecting method	2 systems (4 axes/system)
	Command velocity	1 MBPS max.
	Connecting distance	30 m (98.43 ft) max./system
Connection with external inputs	Connected to:	Upper and lower limit switches
		Stop command
		Near-zero point dog/velocity-position switching command
		Emergency stop command
	Supply voltage	5 VDC to 24 VDC (4.75 VDC to 26.4 VDC; stabilized power supply to be used) 330 mA (1 point: 10 mA)
	HIGH level	3.5 VDC or more/1.2 mA or more
	LOW level	1.5 VDC or less/0.3 mA or less
Connection to the MPG	Number of connections	3 max.
	Rated input voltage	5.5 VDC or less
	HIGH level	4 VDC or more/3 mA or more
	LOW level	1.5 VDC or less/0.3 mA or less
Dimensions (mm) (in)		250 (H) x 75.5 (W) x 121 (D)(9.84 x 2.97 x 4.76)
Weight (kg) (lb)		1.12 (2.46)

5.2.2 Part identification



No.	Name	Application
(1)	SIF RUN LED	(1) Lights when the servo amplifier is started. (2) Remains off when the servo amplifier is not started with the power switch set at OFF or on other occasions.
(2)	SD/RD LED	(1) A70SA and MR-SB transmission status LED indicator (a) SD: sending (b) RD: receiving (2) SIF1 corresponds to connector 1 for the MR-SB and SIF2 corresponds to connector 2 for the MR-SB.
(3)	SCPU WDT LED	(1) Lights when an error is detected through self-diagnosis.
(4)	MPG LED Indicator	(1) Indicates the status of input from MPGs 1 through 3 (P1 through P3). (2) The LED that corresponds to the phase (phase A/phase B) receiving the input from the MPG lights.
(5)	MR-SB connector 1	(1) Connector for A70SF axes 1 to 4 and the MR-SB (2) An MCP-AMP cable (CAM11) is used to connect the A70SF and the MR-SB.
(6)	MR-SB servo amplifier connector 2	(1) Connector for A70SF axes 5 to 8 and the MR-SB (2) An MCP-AMP cable (CAM11) is used to connect the A70SF and the MR-SB.
(7)	SIF ERR LED	(1) Lights when a servo amplifier error is detected.
(8)	EMG LED	(1) Indicates the emergency stop signal input status. (2) Remains lit while the emergency stop input remains on.

No.	Name	Application
(9)	Input LED	(1) Indicates the FLS, RLS, STP, and DOG input status of each axis. (a) FLS :Upper limit (b) RLS :Lower limit (c) STOP :Stop signal (d) DOG :Near-zero point dog/velocity-position switching signal
(10)	Input terminal block	Terminal block for inputting FLS, RLS, STP and DOG of each axis, MPG1 to 3 (P1 to P3) and EMG. (a) FLS :Upper limit (b) RLS :Lower limit (c) STOP :Stop signal (d) DOG :Near-zero point dog/velocity-position switching signal (e) P1 through P3 :MPG (phase A/phase B) inputs (f) EMG :Emergency stop input

5.2.3 Interface with external device

The interface between the A70SF and external devices is indicated in Table 5.2.

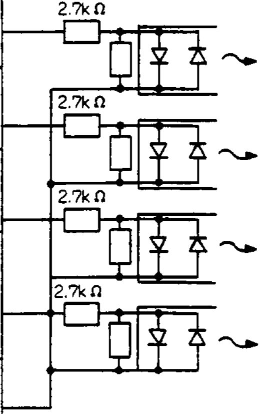
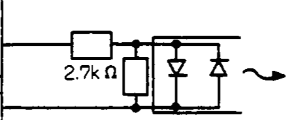
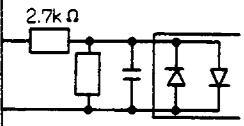
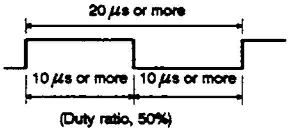
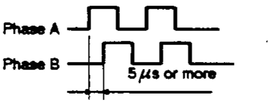
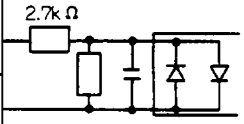
No reference is made to the interface area for connecting the A70SF and an MR-SB.

Table 5.2 Interface Between the A70SF and External Devices

Input/Output Division	Signal Designation	Terminal Designation	Terminal Number										
			38-Point Terminal Block				20-Point Terminal Block				38-Point Terminal Block		
			Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	P1	P2	P3
Input	Upper limit	FLS	1	6	11	16	1	6	11	16			
	Lower limit	RLS	2	7	12	17	2	7	12	17			
	STOP	STP	3	8	13	18	3	8	13	18			
	Near-zero point dog/velocity-positioning input	DOG	4	9	14	19	4	9	14	19			
	Power supply	COM	5	10	15	20	5	10	15	20			
	Emergency stop	EMG	37										
		COM	38										
	MPG phase A	A+									23	27	31
		A–									24	28	32
	MPG phase B	B+									25	29	33
		B–									26	30	34

POINT

The use of a twisted-pair, shielded wire for the MPG signal wire is recommended.

	Internal Circuit	Specifications	Description
		Supply voltage 5 VDC to 24 VDC (4.75 VDC to 26.4 VDC; stabilized power supply to be used) HIGH level 3.5 VDC or more/1.2 mA or more LOW level 1.5 VDC or less/0.3 mA or less	**Signal for detecting the upper stroke limit**
			Signal for detecting the lower stroke limit
			Signal from external source for stopping each positioning control during velocity control
			Signal for near-zero point detection during zero return and for velocity-to-position switching during velocity-position switching control
			Common terminals for FLS, RLS, STP, and DOG
		Supply voltage 5 VDC to 24 VDC (4.75 VDC to 26.4 VDC; stabilized power supply to be used) HIGH level 3.5 VDC or more/1.2 mA or more LOW level 1.5 VDC or less/0.3 mA or less	**Emergency stop signal delivered in the event of an axis abnormality during start-up (effective only for the MR-SB)**
		Rated input voltage 5.5 VDC or less HIGH level 4 VDC or more/3 mA LOW level 1.5 VDC or less/0.3 mA	**MPG phase A and B connection** **Pulse width**  **Rise and fall time: 1 µs or less** **Phase difference**  **(1) The positioning address increases when phase A is advancing ahead of phase B.** **(2) The positioning address decreases when phase B is advancing ahead of phase A.**
			

5.3 A70MDF Monitor Display Unit

This unit is used to connect the A70MDF. It is required when the A6MD is used.
This section describes the A70MDF specifications, part identification, and the connection between the A70MDF and the A6MD.

5.3.1 Specifications

The A70MDF specifications are indicated in Table 5.3.

Table 5.3 A70MDF Specifications

Item	Specifications
To be connected	A6MD monitor display unit
Dimensions (mm) (in)	250(H) x 37.5(W) x 121(D) (9.84 x 0.15 x 4.76)
Weight (kg) (lb)	0.57 (1.25)

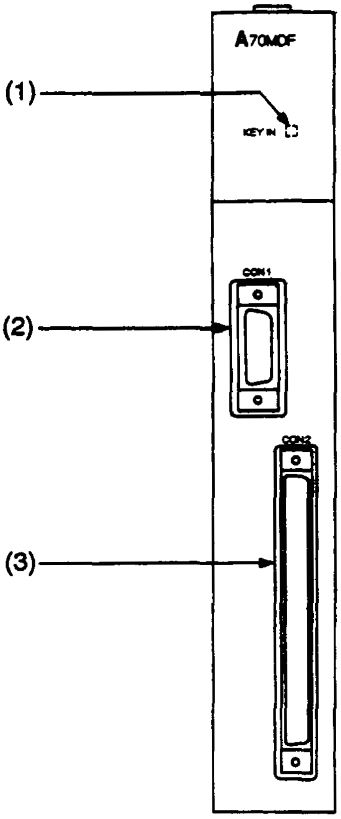
The functions which are performed by the A6MD connected with the A70MDF are listed in Table 5.4.

Table 5.4 List of A6MD Functions

Mode	Function	Application	
		MR-SB Servo Amplifier	General-purpose Servo Amplifier
Data setting mode	Setting, copying, checking, listing, and clearing of: Fixed parameters Servo parameters Zero return data Jog operation data Parameter blocks	o	o
	Limit switch point setting		
Programming mode	Servo program read	o	o
	Servo program write		
	List of servo programs used		
	Servo program check		
	Servo program sort		
	Servo program copy		
	Axis number batch change		
	Servo program areas		
Monitor mode	Present position data monitor	o	o
	Error list display		
	Axis monitor	o	Δ
	Scroll monitor	o	o
Test mode	Servo start-up	o	x
	Servo diagnosis		
	Jog operation	o	o
	MPG operation		
	Zero return test		
	Servo program test operation		
	Teaching		
	Error reset		
	Present position data change		

o : Indicates that operation is allowed.
x : Indicates that operation is disallowed.
Δ : Indicates that operation is partially disallowed.

5.3.2 Part identification



No.	Name	Application
(1)	KEY IN LED	(1) Lights when key input is received from an A6MD touch key or AD57-S2 key.
(2)	CON1	(2) For connecting the A70MDF to the A6MD plasma display.
(3)	CON2	(3) For connecting the A70MDF to the A6MD touch key and the AD57-S2 key.

5.3.3 External wiring

This section describes the precautions to be taken when connecting the A70MDF with the A6MD and cable connecting method.

(1) Wiring precautions

To obtain optimum performance from the A6MD connected to the A70MDF and make a highly reliable system, external wiring that is resistant to noise is indispensable.

Precautions in making external wiring connections between the A70MDF and the A6MD are as follows.

(a) Do not bring the A6MD and the A70MDF connecting cable close to the whole circuit line, high-voltage wire, or load wire from units other than the A73CPU or the PC CPU. Do not bundle the connecting cable with line or wire.

If this instruction is not followed, the cable will be subject to excessive noise, surges, or induction.

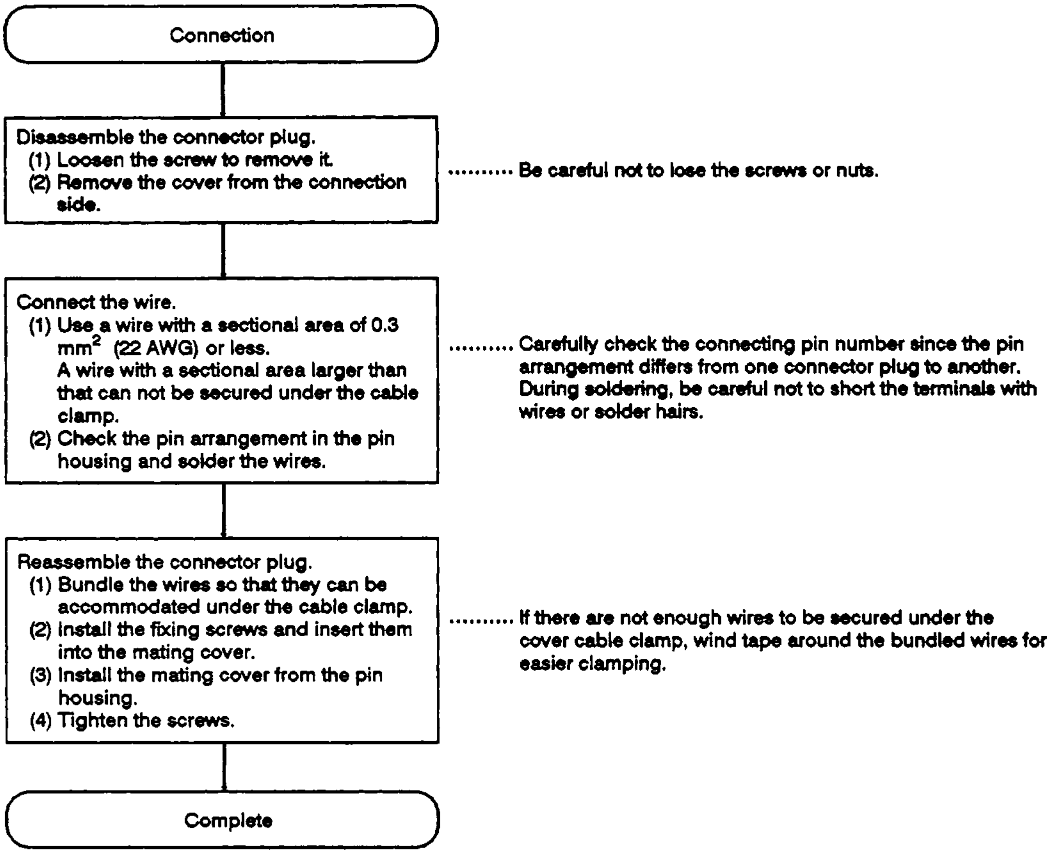
(b) Run external AC and A6MD power cables separately to minimize the effect of surges or induction from the AC side.

(c) After connecting all interfaces, tighten the fixing screws.

(d) Use shielded cable for connections. Ground each shielded cable to A70MDF FG terminal.

(2) Cable connections

This section describes the method of connecting the cable between the A70MDF and the A6MD to the connector plug.



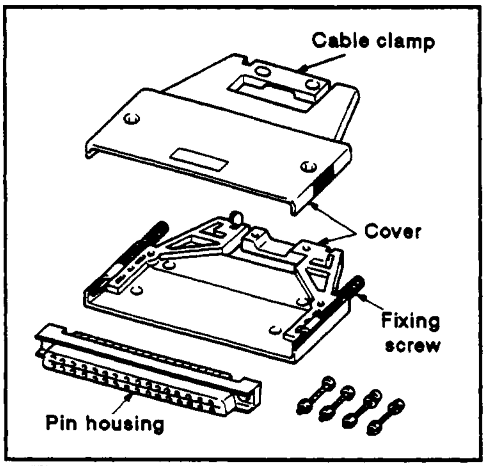
Connection

Disassemble the connector plug.
(1) Loosen the screw to remove it.
(2) Remove the cover from the connection side.
.... Be careful not to lose the screws or nuts.

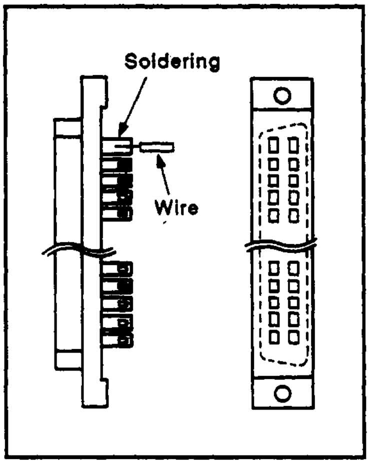
Connect the wire.
(1) Use a wire with a sectional area of 0.3 mm^2 (22 AWG) or less. A wire with a sectional area larger than that can not be secured under the cable clamp.
(2) Check the pin arrangement in the pin housing and solder the wires.
.... Carefully check the connecting pin number since the pin arrangement differs from one connector plug to another. During soldering, be careful not to short the terminals with wires or solder hairs.

Reassemble the connector plug.
(1) Bundle the wires so that they can be accommodated under the cable clamp.
(2) Install the fixing screws and insert them into the mating cover.
(3) Install the mating cover from the pin housing.
(4) Tighten the screws.
.... If there are not enough wires to be secured under the cover cable clamp, wind tape around the bundled wires for easier clamping.

Complete

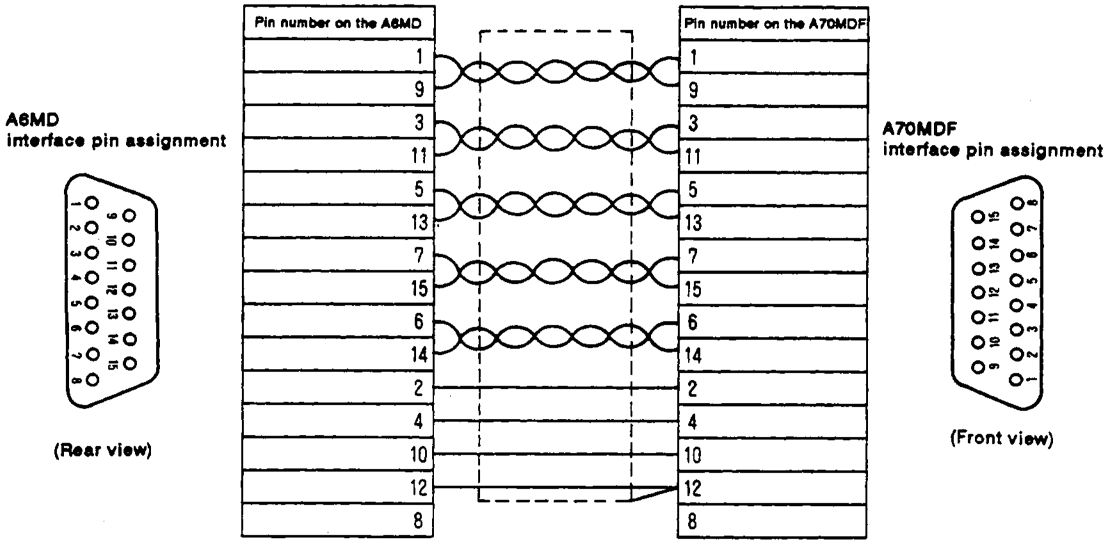


- The shape of the connector and the number of screws differ from one interface section to another.



- Pin arrangement differs from one connector to another.

(3) Wiring connections for the plasma display of the A70MDF and the A6MD



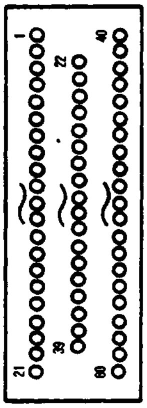
POINT

(1) Make the same wiring connections for the A6MD and the A70MDF.
(2) Use a shielded cable. Connect the shield to the A70MDF.

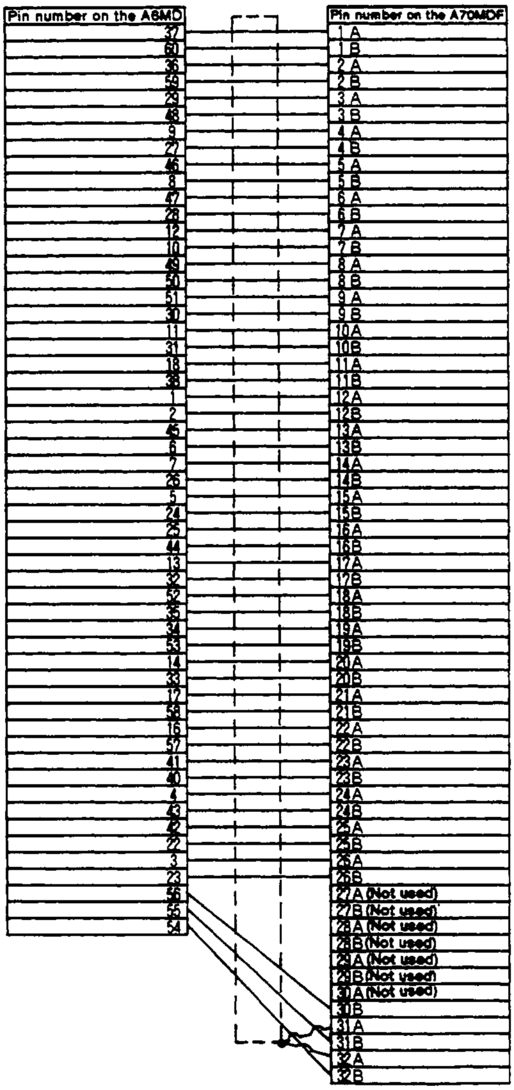
Recommended cable		Twisted-pair, shielded cable
Maximum cable length		30 m (98.43 ft)
Connector model number	A6MD	17JE-23015-02(DA8); Casing + male connector (solder type)

(4) Wiring connections for touch-key panel and operation panel

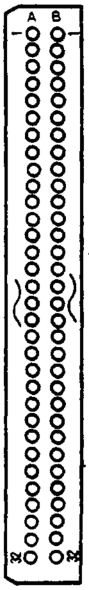
A6MD interface pin assignment



(Rear view)



A70MDF interface pin assignment



(Front view)

POINT

(1) Connect the touch-key panel and the operation panel with one cable.
(2) Use a shielded cable. Connect the shield to the A70MDF.

Recommended cable		Shielded cable
Maximum cable length		30 m (98.43 ft)
Connector model number	A7MD	PD-1660BG male connector (solder type); casing P-1660A-CA(20)
	A70MDF	Casing + male connector FCN-361J064-AU

5.4 A70AF General-Purpose Servo (Analog) Interface Unit

The A70AF is connected to the general-purpose servo amplifier.
The A70AF and the general-purpose servo amplifier are connected on a one-to-one basis.
The specifications, part identification, and settings for the A70AF are described below.

5.4.1 Specifications

The A70AF specifications are listed in Table 5.5.

Table 5.5 Specifications

Item	Specifications
Number of controlled axes	1
Velocity command output	0 to ±10 VDC (can be set in the range ±5 to ±10 V after adjustment)
Positioning feedback pulse input	Pulse frequency: 100 KPPS Type of encoder connected: Open collector, TTL, differential output Pulse multiplication ratio: The number of feedback pulse inputs can be multiplied by 4, 2, 1, and 1/2.
Internal current consumption	5 VDC, 0.3 A
External supply voltage and current	+15 VDC, 0.2 A, -15 VDC, 0.02 A
Dimensions (mm) (in)	250(H) x 3.75(W) x 121(D) (9.84 x 0.15 x 4.76)
Weight (kg) (lb)	0.5 (1.1)

POINT

(1) ±15 VDC are supplied to the A70AF by one of the following methods.

(a) With an A68P power supply module referred to as the A68P:

The A68P can supply ±15 VDC to 6 units of the A70AF (see Section 6).

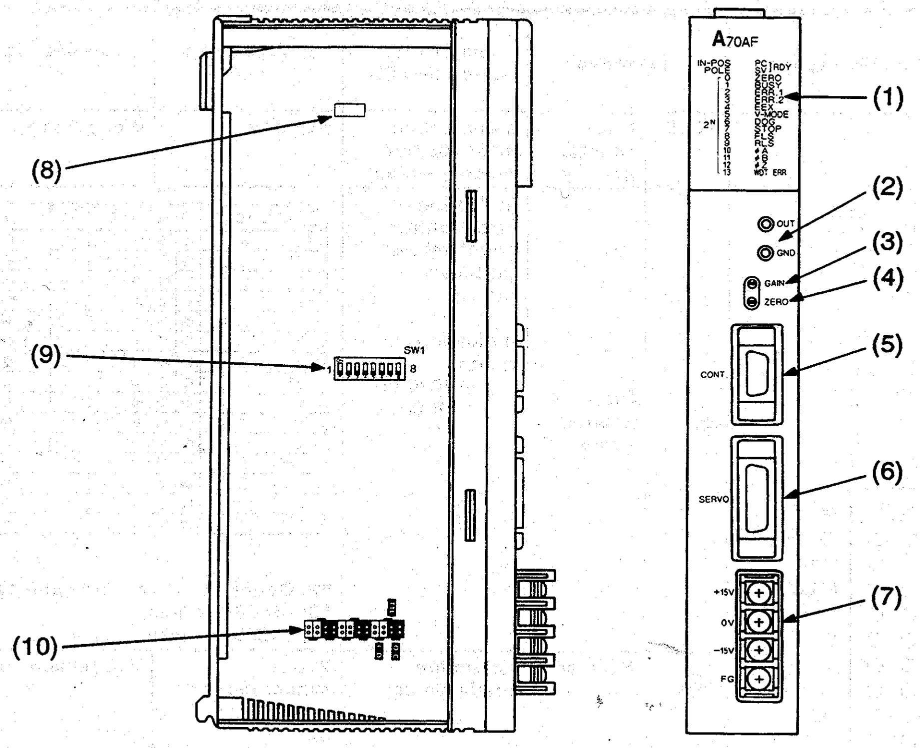
Load the A68P on the PCPU extension base unit or the SCPU extension base unit.

(b) Without an A68P power supply module:

To supply the required voltage to the A70AF without an A68P, the following power requirements should be met.

Item		Specifications
Voltage		+15 VDC±3% (14.55 V to 15.45 V)
		−15 VDC±3% (−14.55 V to −15.45 V)
Current (for 1 A70AF unit)	+15 VDC	0.2 A
	+15 VDC	0.02 A
Ripple voltage		50 mVp-p or less
Spike voltage		100 mVp-p or less
Transient output fluctuations		Within the limits of ±1 V

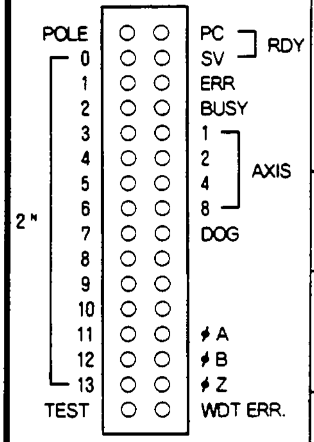
5.4.2 Part identification



No.	Name	Description
(1)	LED	For indicating A70AF RUN and error status. For details, see Section 5.4.3.
(2)	OUT and GND terminals	Check pin for measuring output voltage
(3)	GAIN control	Control for adjusting output voltage gain For the adjusting method, see Section 5.4.5.
(4)	ZERO control	Control for output voltage zero return For the adjusting method, see Section 5.4.5.
(5)	DOG	Connect the near-zero point signal ($\overline{\text{DOG}}$) to pin 1.
(6)	SERVO	Drive unit connector For signal designation related for each pin, see Section 4.4.
(7)	Terminal block	±15 VDC power supply terminal for the A70AF Ground terminal FG
(8)	ACPU-A70CPU jumper	Do not attempt to touch the jumper (set to the A70CPU).
(9)	Slide switch	See Section 5.4.5 for details on the number of accumulated pulses, pulse multiplication ratio, adjustment mode, and switch setting method.
(10)	Encoder I/F jumper	Encoder output setting for phases A, B, and Z. See Section 5.4.5 for the setting method.

5.4.3 LED indication

This section describes the LEDs on the front of the A70AF that indicate the RUN status and error status.

<table>
<tr><th>Details of LED Section</th><th colspan="2">LED Name</th><th>Status Indicated by LED</th><th>Condition for ON</th><th>Condition for OFF</th><th>*1 Initial Condition</th></tr>
<tr><td rowspan="11"> </td><td>POLE</td><td>Error counter polarity</td><td>Indication of error counter polarity status</td><td>Negative</td><td>0 or positive</td><td>OFF</td></tr>
<tr><td>2N</td><td>Error counter value</td><td>Indication of error counter count values (in binary digits)
Indication range:
−14800 to +14800</td><td colspan="2">
<table>
<tr><th>LED \ *2</th><th>*3</th><th>…</th><th>−3</th><th>−2</th><th>−1</th><th>0</th><th>1</th><th>2</th><th>…</th><th>*4</th></tr>
<tr><td>POLE</td><td>●</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>○</td></tr>
<tr><td>2^0</td><td>○</td><td></td><td>●</td><td>○</td><td>●</td><td>○</td><td>●</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^1</td><td>○</td><td></td><td>○</td><td>●</td><td>●</td><td>○</td><td>○</td><td>●</td><td></td><td>●</td></tr>
<tr><td>2^2</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^3</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^4</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^5</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^6</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^7</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^8</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^9</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^{10}</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^{11}</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^{12}</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
<tr><td>2^{13}</td><td>○</td><td></td><td>●</td><td>●</td><td>●</td><td>○</td><td>○</td><td>○</td><td></td><td>●</td></tr>
</table>
● : ON
*2: Count ● : indicates ON
*3: −16384 or less
*4: 16383 or more</td><td>All points: OFF</td></tr>
<tr><td>PC RDY</td><td>PC ready</td><td>Operation ready status</td><td>Y10 is synchronously turned on and off.</td><td>Y10 remains off.</td><td>OFF</td></tr>
<tr><td>SV RDY</td><td>Servo ready</td><td>Servo ready (READY) signal status</td><td>READY signal is turned on.</td><td>READY signal is turned off.</td><td>Depending on external output</td></tr>
<tr><td>BUSY</td><td>BUSY</td><td>BUSY signal ON/OFF status</td><td>M2000 is turned on.</td><td>M2000 is turned off.</td><td>OFF</td></tr>
<tr><td rowspan="2">ERR</td><td rowspan="2">Error</td><td>CPU jumpers are set incorrectly.</td><td>The ACPU-A70CPU jumper is set to ACPU.</td><td>Set to A70CPU</td><td>OFF</td></tr>
<tr><td>Indication of accumulated pulse status (exaggerated indication of errors)</td><td>The number of accumulated pulses exceeds the preset number.</td><td>The number of accumulated pulses is below the preset number.</td><td>OFF</td></tr>
<tr><td>DOG</td><td>Near-zero point dog</td><td>Near-zero point signal ($\overline{\text{DOG}}$) status</td><td>Near-zero point signal is turned on.</td><td>Near-zero point signal is turned off.</td><td>Depending on external input</td></tr>
<tr><td>φA</td><td>Encoder phase A</td><td rowspan="3">Pulse status in phases A, B, and Z</td><td rowspan="3">ON when the pulse is high at pins 13, 5, and 6, indicating encoder input levels.</td><td rowspan="3">OFF when the pulse is low at pins 13, 5, and 6, indicating encoder input levels.</td><td rowspan="3">Depending on external input</td></tr>
<tr><td>φB</td><td>Encoder phase B</td></tr>
<tr><td>φZ</td><td>Encoder phase Z</td></tr>
</table>

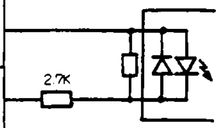
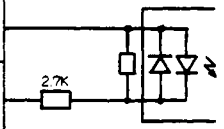
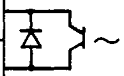
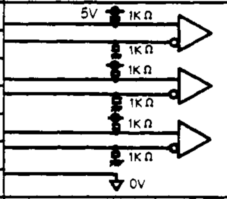
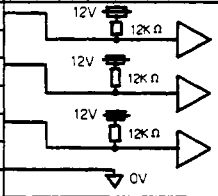
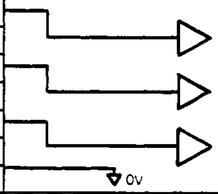
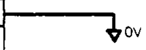
<table>
<tr><th>Details of LED Section</th><th colspan="2">LED Name</th><th>Status Indicated by LED</th><th>Condition for ON</th><th>Condition for OFF</th><th>*1 Initial Condition</th></tr>
<tr><td></td><td>WDT ERR</td><td>WDT error</td><td>Indication of A70AF watchdog timer</td><td>WDT error (X00); ON when the hardware is faulty.</td><td>WDT error (X00); OFF when the hardware is normal.</td><td>OFF</td></tr>
<tr><td></td><td>AXIS</td><td>Selected axis number</td><td>The axis number selected with the slide switch is indicated.</td><td colspan="2"><table>
<tr><th>Axis
LED</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>1</td><td>●</td><td>○</td><td>●</td><td>○</td><td>●</td><td>○</td><td>●</td><td>○</td></tr>
<tr><td>2</td><td>○</td><td>●</td><td>●</td><td>○</td><td>○</td><td>●</td><td>●</td><td>○</td></tr>
<tr><td>4</td><td>○</td><td>○</td><td>○</td><td>●</td><td>●</td><td>●</td><td>●</td><td>○</td></tr>
<tr><td>8</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>●</td></tr>
</table></td><td>With the slide switch</td></tr>
</table>

*1 The initial condition refers to the CPU STOP status reached when the power switch is turned from OFF to ON.

5.4.4 Input/output interface with an external device

The input/output interface between the A70AF and an external device is summarized in Table 5.6.

Table 5.6 Input/Output Interface Between the A70AF and an External Device

Connector		Input/Output Division		Signal Designation	Pin Number	Internal Circuit
Designation	Application					
DOG	For connecting the near-zero point dog	Input		Near-zero point signal (DOG)	5 1	
SERVO	For connecting a general-purpose servo amplifier	Input		Servo ready (READY)	1 2	
		Output		Servo on (SVON)	3 4	
				Speed command	15 14	
		Input	On differential input	Phase A feed-back pulse	13 11	
				Phase B feed-back pulse	5 10	
				Phase Z feed-back pulse	6 7	
				Analog GND	9	
				Phase A feed-back pulse	13 11	
				Phase B feed-back pulse	5 10	
				Phase Z feed-back pulse	6 7	
				Analog GND	9	
			TTL input	Phase A feed-back pulse	13 11	
				Phase B feed-back pulse	5 10	
				Phase Z feed-back pulse	6 7	
				Analog GND	9	
Terminal block	For connecting an external power supply	Input		External power supply	+15V 0V -15V FG	

POINT

The use of a twisted-pair, shielded cable as the feedback pulse signal line to the A70AF is recommended.

	Specifications	Description
	Supply power 5 to 24 VDC (4.75 to 25.4 VDC; stabilized power supply to be used) HIGH level 3.5 VDC or more/1.2 mA or more LOW level 1.5 VDC or less/0.3 mA or less	This signal is used to detect the near-zero point during zero return. Turned on when the near-zero point dog is detected.
	Supply power 5 to 24 VDC (4.75 to 25.4 VDC; stabilized power supply to be used) HIGH level 3.5 VDC or more/1.2 mA or more LOW level 1.5 VDC or less/0.3 mA or less	Turned on when the servo drive unit is normal and ready to receive the feed pulse.
	Output format: Open collector system; Max. voltage drop in ON: 1.0 V or less Load voltage: 4.75 to 26.4 VDC; Leakage current in OFF: 0.1 mA or less Load current: 30 mA max.	OFF signal is delivered when an error is exaggerated or generated during hardware self-diagnosis.
	Output voltage: 0 to ±10 VDC (10 mA)	The number of accumulated pulses is D/A converted and delivered as an analog amount.
	Pulse frequency : 100 KPPS or less Use an RS-422 differential receiver. Use a SN75113 driver or equivalent.	Connected to the encoder pulse output.
	Pulse frequency : 100 Kpps or less Pulse rise time : 1 μsec or less Pulse fall time : 1 μsec or less HIGH level : 4 V or more LOW level : 1 V or more	Internally pulled up to 12 V when the collector is open. Connected to the encoder pulse output.
	Pulse frequency : 100 Kpps or more HIGH level : 2.8 V or more LOW level : 0.8 V or more	Connected to the encoder pulse output.
	+15 VDC±0.3% (+14.55 to +15.45 VDC), 200 mA -15 VDC±0.3% (-14.55 to -15.45 VDC),	Use the A68P power supply unit or a stabilized equivalent.

REMARKS

(1) *1 The load current for the SVON signal is 30 mA maximum. Pay careful attention to the load current when it is received by a miniature relay.

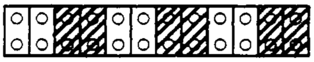
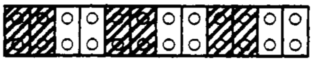
(2) *2 When the input impedance of the servo amplifier is too small, the analog output level may be lowered by this resistance. If this poses problems, re-adjust the gain with the servo amplifier connected.

5.4.5 Settings

(1) Encoder output setting

Set the output of the encoder with the encoder interface jumper on the A70AF side panel.

The jumper has been factory-set to the OPEN COLLECTOR OUTPUT setting.

	Shorting Pin Setting
Open collector output	Phase Z Phase B Phase A 
TTL output	Phase Z Phase B Phase A 
Differential output	Phase Z Phase B Phase A 

(2) Velocity command voltage zero adjustment

Make velocity command voltage zero adjustment with the slide switch and the zero adjustment control on the A70AF side panel.

This voltage has been factory-set to 0 V.

However, re-adjustment is required after a servo motor is connected which can shift the 0 V.

If operation is performed with the 0 V shifted, the motor may rotate slightly upon power on.

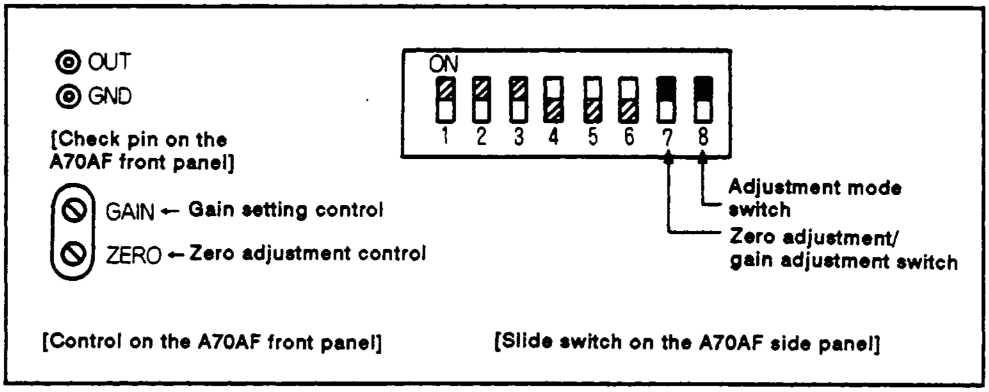


Fig. 5.1 Zero Adjustment Setting

(a) Zero adjustment method

1) Servo-lock the servo motor.

2) Set slide switches [SW7] and [SW8] on the A70AF side panel to ON.

3) Turn the ZERO control on the front panel until the voltage across the check pin is 0 V.

4) After adjustment, set the [SW7] switch to the AXIS SETTING position and the [SW8] switch to the OFF position.

REMARKS

The TEST LED on the A70AF front panel remains lit during adjustment mode selection.

(3) Rated velocity command voltage and position loop gain setting

(a) To set the rated velocity command voltage and position loop gain for a general-purpose servo amplifier, make the gain adjustment with gain adjustment accumulated pulse switches SW1 through SW3.

A70AF velocity command voltage is divided into 8 ranges as indicated in Table 5.7.

Example:

When a general-purpose servo amplifier with a rated velocity command voltage is 5 V is used, the rated velocity command voltage can be set to 5 V over ranges (3) through (7) given in Table 5.7.

Table 5.7 Rated Velocity Command Voltage Adjustment Range and Gain Adjustment Accumulated Pulse Switch Setting

	Rated Velocity Command Voltage Adjustment Range (V)	Accumulated Pulse Switch for Gain Adjustment			Accumulated Pulse Number and Position Loop Gain by Setting Accumulated Pulse Number			
		1	2	3	X1	X2	X3	X4
(1)	1.7 to 3.7	OFF	OFF	OFF	1111* (360)	2222 (180)	3333 (120)	4444 (90)
(2)	1.9 to 4.2	OFF	OFF	ON	1250 (320)	2500 (160)	3750 (107)	5000 (80)
(3)	2.2 to 5.0	OFF	ON	OFF	1429 (280)	2858 (140)	4287 (93)	5714 (70)
(4)	2.5 to 5.7	OFF	ON	ON	1667 (240)	3334 (120)	5000 (80)	6668 (60)
(5)	3.0 to 7.0	ON	OFF	OFF	2000 (200)	4000 (100)	6000 (67)	8000 (50)
(6)	3.7 to 8.7	ON	OFF	ON	2500 (160)	5000 (80)	7500 (53)	10000 (40)
(7)	5.0 to 12.0	ON	ON	OFF	3480 (115)	6960 (57)	10440 (38)	13920 (29)
(8)	5.5 to 12.5	ON	ON	ON	3700 (108)	7400 (54)	11100 (36)	14800 (27)

REMARKS

*** The number of accumulated pulses for delivering the rated velocity command voltage is given above. The position loop gain value obtained at a maximum velocity of 400 kpps is written in parentheses below.**

When the maximum velocity is not 400 kpps, calculate the position loop gain using the formula shown in (4)(b) on page 5-21.

Example:

5 V power is delivered at 1429 PLS when the gain adjustment accumulated pulse switch is set to (3), the gain value is adjusted to 5 V, and the accumulated pulse number switch is set to X1.
(The position loop gain will be 280 sec^{-1} at a maximum speed of 400 kpps.)

(b) The unit has been factory-set so that it delivers 10 V when the number of accumulated pulses reaches 13920 PLS.

(c) Gain adjustment method

1) Set slide switches [SW7] and [SW8] to OFF and ON, respectively.

2) Refer to the rated velocity command voltage adjustment range and the position loop gain settings and set accumulated pulse switches [SW1], [SW2], and [SW3] for gain adjustment.

3) Turn the GAIN setting control on the A70AF front panel until the voltage across the check pin reaches the rated velocity command voltage.

4) After adjustment, set slide switches [SW1], [SW2], [SW3], and [SW7] to their normal positions and set the [SW8] switch to OFF.

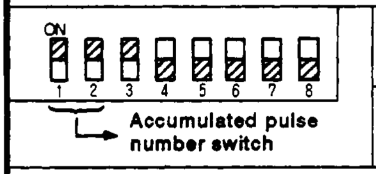
(4) Accumulated pulse number setting

(a) The accumulated pulse number setting is to select the maximum number of pulses able to be counted on the error counter.

(b) When a servo motor is used, pulses, the number of which is represented by the following formula, are generated.

$$\text{Maximum number of pulses} = \frac{\text{Speed command [PPS]}}{\text{Position loop gain [sec}^{-1}\text{]}}$$

(c) Set the accumulated pulse number range to exceed the maximum number of accumulated pulses obtained from the formula given above, using accumulated pulse number switches [SW1] and [SW2].

Accumulated pulse number setting Slide switch		1	2	3	4
	[SW1]	OFF	OFF	OFF	OFF
	[SW2]	ON	ON	ON	ON
Accumulated pulse number setting range		0 to 3700 PLS	0 to 7400 PLS	0 to 11100 PLS	0 to 14800 PLS

(d) The output voltage from the A70AF is as shown in Fig. 5.2 depending on the number of accumulated pulses.

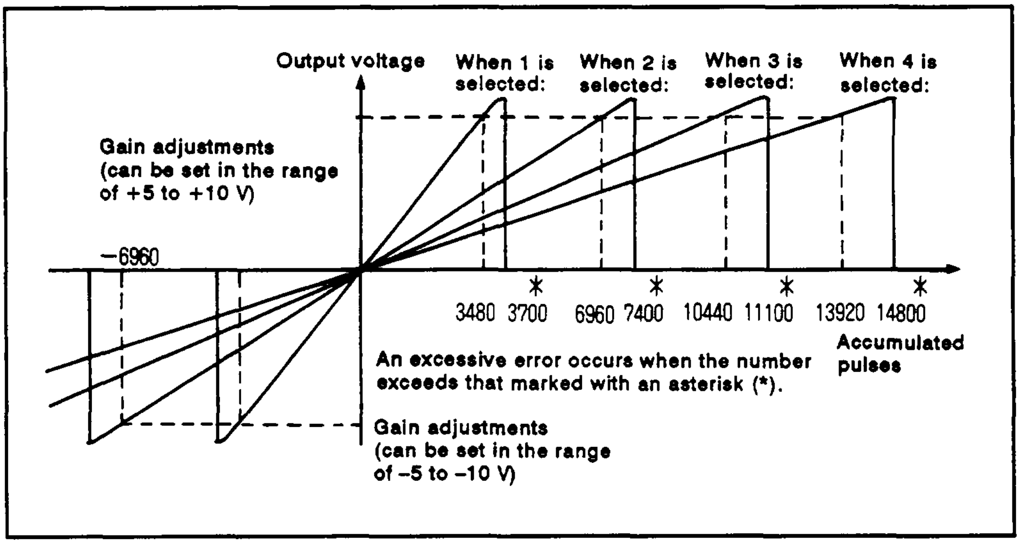


Fig. 5.2 **Relationship Between the Number of Accumulated Pulses and Analog Voltage Output**

Example:

Set the number of accumulated pulses as follows.

Assume that:

(a) Maximum velocity = 400 KPPS
(b) Position loop gain = 30 sec^{-1}

Then:

(c) Accumulated pulses $= \frac{\text{Maximum velocity}}{\text{Position loop gain}} = \frac{400000}{30} = 133333$

Therefore, selecting the gradient from Fig. 5.2 for which the output voltage is not saturated when the number of accumulated pulses is 13333 leads to 'SELECTION ([SW1]: ON; [SW2]: ON)'.

(e) When the number of accumulated pulses exceeds the value marked with an asterisk (*) in Fig. 5.2, an excessive error occurs and the following status is developed.

1) Output voltage : 0 V
2) Accumulated pulses : Set to 0.
3) SVON signal : OFF
4) ERR LED on the front panel : Lit

(5) Multiplier selection

(a) The feedback pulse multipliers from the pulse generator (PLG) are selected.

This is necessary when the travel distance per pulse is to be changed.

(b) Through pulse multiplier selection, the count value for the number of feedback pulses can be multiplied by 4, 2, 1, or 1/2.

Therefore, this selection should be made when the travel distance per pulse needs be multiplied by 1/4, 1/2, 1, and 2.

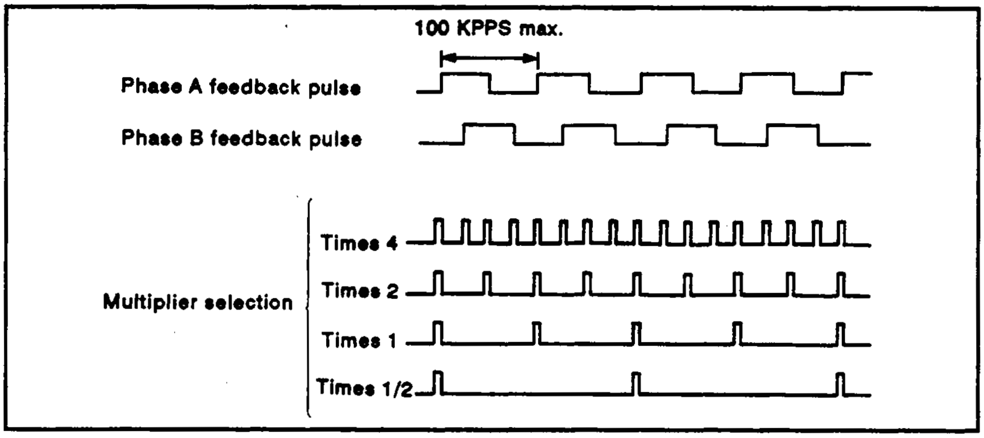
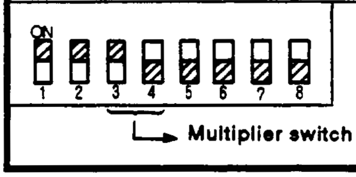


Fig. 5.3 Error Counter Counts Obtained by Multiplier Selection

(c) The relationship between multiplier switch positions and the multipliers is indicated below.

Slide switch		Times 4	Times 2	Times 1	Times 1/2
	[SW3]	OFF	ON	OFF	ON
	[SW4]	OFF	OFF	ON	ON

5.4.6 Wiring connections

This section describes the precautions to be taken and external wiring connectors to be used when the A70AF is connected to an external device.

(1) Wiring precautions

The wiring precautions for the A70AF and external devices (including the drive unit) are as follows.

(a) Length of cable connecting the A70AF to the drive unit

The cable connecting the A70AF to the drive unit is generally 1 to 3 m (3.28 to 9.84 ft) long. However, this length varies with drive unit specifications.

Confirm the specifications of the drive unit used.

(b) Wiring connections for input/output signals

1) Avoid bundling the cables with the power line or main circuit line or bringing them close to such lines (run the cable at least 20 cm (7.87 in) away from the line).

2) When the cable must be close to the line, separate the duct or run the conduits separately.

3) When the cable must be bundled with the line, use a batch shielded cable and ground it at the PC.

4) When running conduits or making wiring connections, ground the conduits.

(c) The length of the cable connecting the A70AF to the encoder is generally as follows, though it depends on the encoder specifications.

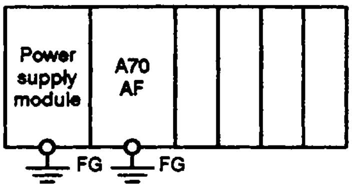
Check the specifications of the encoder.

1) 30 m (98.43 ft) max. for differential output encoder

2) 3 m (9.84 ft) max. for TTL open collector encoder

Use a twisted-pair, shielded cable for the line connected to the A70AF.

(d) The A70AF does not need to be grounded since an antinoise means is provided.
However, in cases where excessive noises develop or cable dislocation occurs, ground the unit as suggested below.

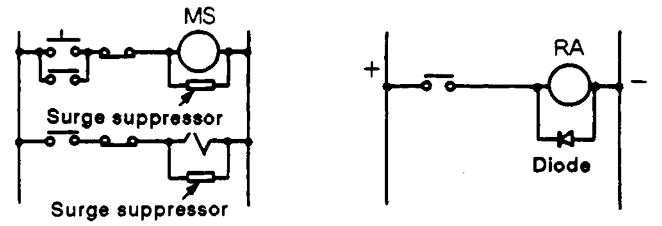


1) When grounding the A70AF, perform independent grounding (Class 3 grounding) by separating the FG terminal of the power supply module from the same terminal of the A70AF as illustrated above.

2) Use a ground wire with a sectional area of at least 2 mm^2 (14 AWG).

Use a ground point close to the PC, keeping the ground wire as short as possible.

(e) Install surge suppressors to the AC relay, AC bulb, and the AC solenoid brake near the drive unit amplifier. Install diodes to the DC relay and DC bulb in parallel with the relays and other parts. For more details, see the drive unit manual.



(a) Installation to AC relay, AC bulb, etc. (b) Installation to DC relay, etc.

Fig. 5.4 Typical Installation of Surge Suppressors

(f) Always connect the A70AF and drive unit SVON signal. Do not turn the signal on and off externally.

(2) Encoder connecting precautions

This section describes the precautions to be taken when connecting the encoder.

(a) The A70AF uses an up-and-down error counter.

Addition and subtraction processes are switched between them through comparison of feedback pulse phases.

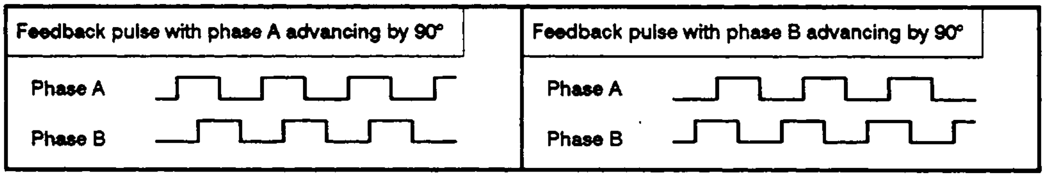
1) When a feedback pulse in which phase A is advancing ahead of phase B by 90° is received, the command pulse count is subtracted.

This subtraction is required when the positive command pulse is to be counted (when the motor is rotating forward), with the velocity command being the positive voltage.

2) When a feedback pulse in which phase B is advancing ahead of phase A by 90° is received, the command pulse count is added.

This addition is required when the negative command pulse is to be counted (when the motor is rotating in reverse), with the velocity command being the negative voltage.

When feedback pulse phases A and B are reversed, both the command pulses and the feedback pulses are counted, resulting in excessive errors in the number of accumulated pulses. In that event, control will be discontinued.



(b) Command pulse and feedback pulse counting processes are changed in the following cases.

1) Setting rotation direction by a peripheral device:

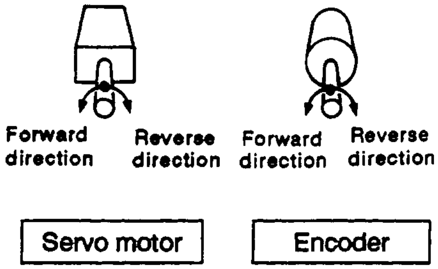
Rotation direction of the motor and the positive and negative counting processes are changed.

2) The rotation direction of the motor and the encoder are different:

The feedback pulse phases are reversed since the encoder rotates in reverse when the motor is rotating.

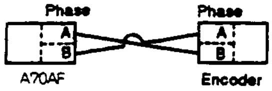
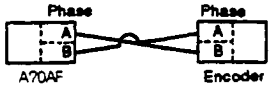
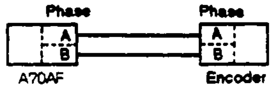
(c) Table 5 indicates the rotation direction set by a peripheral device and the connection method that depends on the difference in the motor and the encoder rotation direction.

Table 5.8 indicates the case when the motor rotates forward at the positive voltage applied to the servo amplifier while the motor and the encoder are rotating as illustrated below.



Assume that encoder feedback pulse phase A advances ahead of phase B by 90° when it is rotating forward.

Table 5.8 Connection Methods

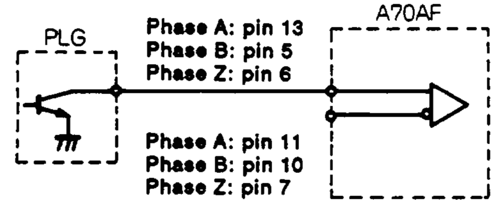
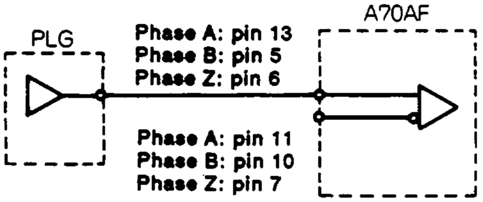
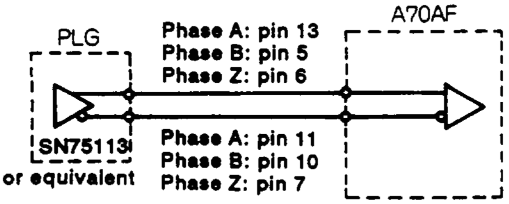
Motor Rotation Direction	Rotation Direction Set by a Peripheral Device	Connection	Remarks
Forward rotation	Forward rotation		The motor and the encoder rotate in the same direction.
			The motor and the encoder rotate in the opposite direction to each other.
Reverse rotation	Reverse rotation		The motor and the encoder rotate in the same direction.
			The motor and the encoder rotate in opposite directions.

POINT

If the A70AF is connected to the encoder incorrectly, the motor will rotate upon power up, causing excessive errors (ERR).

(d) Table 5.9 indicates the connection between the A70AF and the encoder.

Table 5.9 Connections Between the A70AF and the Encoder

Encoder type	Connection
Open collector output encoder	
TTL output encoder	
Differential output encoder	

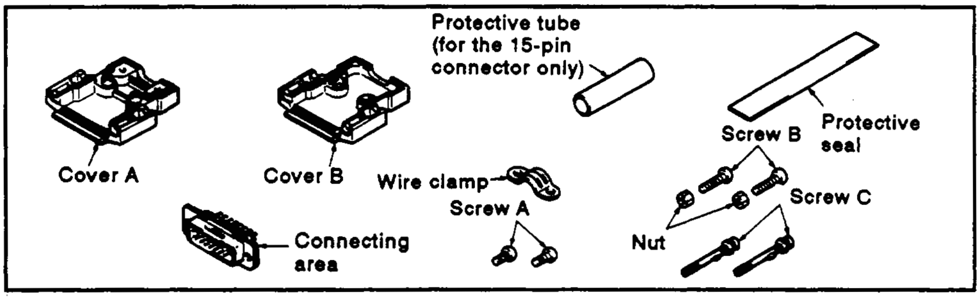
(3) Connection of external wiring connectors

This section describes the method of connecting the external wiring connectors.

The unit is supplied with the following connectors.

9-pin connector (male) x 1	: For CONT connector
15-pin connector (male) x 1	: For SERVO connector

The construction of each connector is illustrated below.

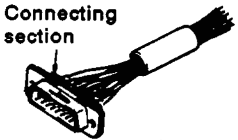


Use the following procedure when assembling the connector.

1) Run the wire through the protective tube (for the 15-pin connector only).

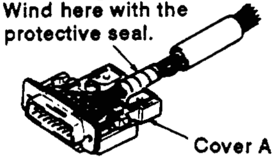
⇓

2) Solder the wire to the connecting section.



⇓

3) Install the connecting section onto cover A and wind the protective seal around the wire portion that makes contact the wire clamp.

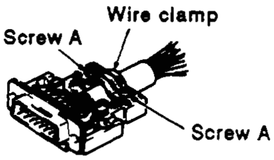


⇓

4) Slide the protective tube until it reaches the protective seal (for the 15-pin connector only).

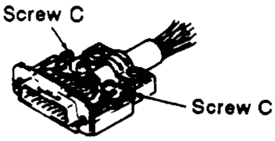
⇓

5) Install the connecting section to cover A and hold the wire (the protective seal or tube) with the wire clamp (using screw A).



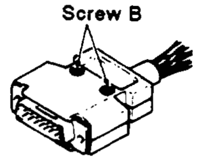
⇓

6) Install screw C to cover A.



⇓

7) Place cover B onto cover A; fasten them with screw B and the nuts.



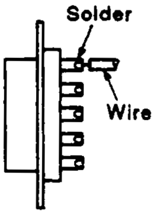
(4) Connector connection

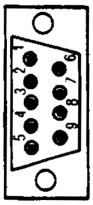
The connector pins are arranged as shown below. Make the connections referring to the input and output numbers in Section 3.5.

(a) Cables with a sectional area of up to 0.3 mm^2 (22 AWG) may be used. Thicker cables will not fit under the cable clamp.

(b) Make the connections by soldering. Strip properly the cable so that short will not be caused by the element wires or solder hairs.

It is recommended to slip an insulating tube on each soldered connection.

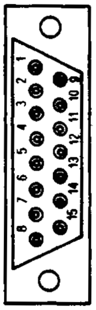




9-pin connector

(Applicable to the CONT connector)

Pin arrangement as viewed from the cable connection side



15-pin connector

(Applicable to the SERVO connector)

6. POWER SUPPLY MODULE

6.1 Power Supply Module Specifications

6.1.1 Power supply module specifications

Table 6.1 Power Supply Module Specifications

Item		Specifications					
		A61P	A62P	A63P	A65P	A66P	A68P
Base loading position		Power supply module loading slot				I/O module loading slot	
Input voltage		100 – 120 VAC $^{+10\%}_{-15\%}$ (85 to 132 VAC)		24 VDC $^{+30\%}_{-35\%}$ (15.6 to 31.2 VDC)	100 – 120 VAC $^{+10\%}_{-15\%}$ (85 to 132 VAC)		
		200 – 240 VAC $^{+10\%}_{-15\%}$ (170 to 264 VAC)			200 – 240 VAC $^{+10\%}_{-15\%}$ (170 to 264 VAC)		
Input frequency		50/60 Hz ±5%		–	50/60 Hz ±5%		
Max. input apparent power		110 VA		65 W	110 VA	95 VA	
Inrush current		20 A, within 8 ms		100 A, within 1 ms	20 A, within 8 ms		
Rated output current	5 VDC	8 A	5 A	8 A	2 A	–	–
	24 VDC	–	0.8 A	–	1.5 A	1.2 A	–
	+15 VDC	–					1.2 A
	–15 VDC	–					0.7 A
*1 Overcurrent protection	5 VDC	8.8 A or higher	5.5 A or higher	8.5 A or higher	2.2 A or higher	–	–
	24 VDC	–	1.2 A or higher	–	2.3 A or higher	1.7 A or higher	–
	+15 VDC	–					1.64 A
	–15 VDC	–					0.94 A
*2 Overvoltage protection	5 VDC	5.5 to 6.5 V	5.5 to 6.5 V	5.5 to 6.5 V	5.5 to 6.5 V	–	–
	24 VDC	–					
Efficiency		65% or higher					
Power indicator		Power LED display					
Terminal screw size		M4 x 0.7 x 6				M3 x 0.5 x 6	
Applicable wire size		0.75 to 2 mm^2 (18 to 14 AWG)					
Applicable solderless terminal		V1.25-4, V1.25-YS4A, V2-S4, V2-YS4A				V1.25-3, V1.25-YS3A, V2-S3, V2-YS3A	
Applicable tightening torque		12 kg-cm (10.39 lb-in)				7 kg-cm (6.06 lb-in)	
External dimensions mm (in)		250 (9.84) x 55 (2.17) x 121 (4.76)				250 (9.84) x 37.5 (1.48) x 121 (4.76)	250 (9.84) x 37.5 (1.48) x 121 (4.76)
Weight kg (lb)		0.98 (2.16)	0.94 (2.07)	0.8 (1.76)	0.94 (2.07)	0.75 (1.65)	0.9 (1.98)
*3 Allowable instantaneous power failure time		within 20 ms		within 1 ms	within 20 ms	–	–

REMARKS

The number of slots occupied in the A66P and the A68P are as follows:

(a) 1 in the A66P
(b) 2 in the A68P

POINT

*1: Overcurrent protection

(a) The overcurrent protection device shuts off the 5 V, 24 VDC circuit and stops the system if the current flowing in the circuit exceeds the specified value.

(b) If a current larger than specified is allowed to flow through the +15 VDC circuit, the overcurrent protection device will be actuated to open the circuit and the following conditions will exist.

1) Both +15 VDC and -15 VDC will be turned off when overcurrent is present on the +15 VDC side.
2) -15 VDC is turned off and +15 VDC will be delivered when overcurrent is present on the -15 VDC side.
3) The LED indicator on the power supply unit goes out or dims due to reduced voltage supply.

(c) When this device is activated, the power supply module LED is switched off or dimly lit. In this case, remove any cause if overcurrent and start up the system.

*2: Overvoltage protection

The overvoltage protection device shuts off the 5 VDC circuit and stops the system if 5.5 to 6.5 V voltage is applied to the circuit.

When this device is activated, the power supply module LED is switched off. In this case, switch off, then on the input power to restart the system. The power supply module must be changed if the system is not booted and the LED remains off.

*3: Allowable instantaneous power failure time

The A73CPU allowable instantaneous power failure time varies according to the type of power supply module. In the case of the A63P module, the allowable instantaneous power failure time is defined from when the 24 VDC stabilized primary supply is cut off until the 24 VDC voltage drops to the defined voltage (15.6 VDC).

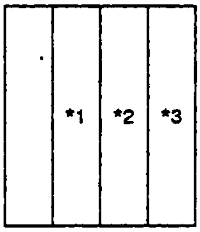
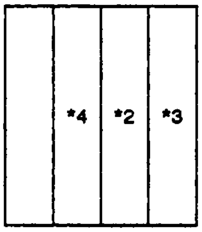
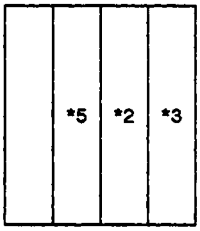
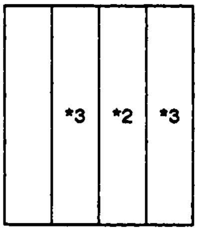
6.1.2 Selection of power supply module

Select the power supply module according to the total current consumption of I/O modules, special function modules, and peripheral device supplied by that power supply module.

(1) Notes on use of the A66P

(a) The A66P gives optimum power output when a vacant slot exists on either side of it. It must be located without an I/O module to the right, preferably with a vacant slot to the left.

(b) The A66P output current (24 VDC) depends on the left-hand adjacent module.

Left Hand Adjacent Module	Power Supply Module	Input Module Dummy Module	Output Module Special Function Module	Vacant
Configuration				
Max. output current for 24 VDC	0.5 A	1.2 A	1.0 A	1.5 A

*1 Power supply module
*2 A66P
*3 Vacant
*4 Input module
Dummy module
*5 Output module
Special function module

6.1.3 Fuse specifications

This section describes the specification of fuses used for the power supply modules and output modules.

Table 6.2 Fuse Specifications

Type / Item	GTH4	SM6.3A	MF51NM8	HP-32	HP-70K	MP-20	MP-32	MP-50
Application	For power supply A61P, A62P, A65P, A66P	For power supply A63P	For output AY11E, AY13E	For output AY23	For output AY22	For output AY50, AY80	For output AY60	For output AY60E
Shape	Cartridge type	Cartridge type	Cartridge type	Plug type	Plug type	Plug type	Plug type	Plug type
Rated current	4 A	6.3 A	8 A	3.2 A	7 A	2 A	3.2 A	5 A
External dimensions mm (in)	ø6 (0.24) x 32 (1.26)	ø6 (0.24) x 32 (1.26)	ø5.2 (0.20) x 20 (0.79)	30.3 (1.19) x 8 (0.31) x 20 (0.79)	30.3 (1.19) x 8 (0.31) x 20 (0.79)	17.2 (0.68) x 5.5 (0.22) x 19 (0.75)	17.2 (0.68) x 5.5 (0.22) x 19 (0.75)	17.2 (0.68) x 5.5 (0.22) x 19 (0.75)

6.2 Handling

This section gives handling instruction, part identification of PC and hardware setting instructions.

6.2.1 Handling instructions

This section describes precautions regarding the handling of the power supply module between unpacking and installation.

(1) The power supply module case, terminal, and pin connectors are made of plastic. Do not subject the power supply module to impact or shock.

(2) Do not remove printed circuit boards from the housing. There are no user-serviceable parts on the boards.

(3) Ensure that no conductive debris can enter the module. If it does, make sure that it is removed.

(4) Tighten the module mounting screws (if required) and terminal screws as specified below.

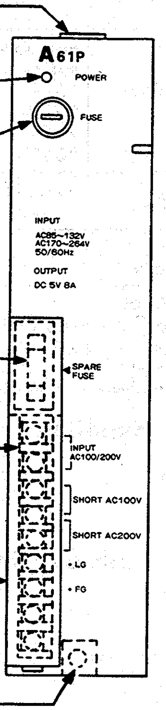
Screw	Tightening Torque kg-cm (lb-in)
Module terminal block installation screws (M3)	5 (4.33) to 8 (6.93)
Module terminal block installation screws (M4)	10 (8.66) to 14 (12.13)
Module mounting screws (optional) (M4)	8 (6.93) to 12 (10.39)

(5) To load the module onto the base, hook the tow lower lugs into the cut out and gently swing the module into place. Ensure that the top catch engages. To remove, press the top catch and swing the module out before unhooking the lower lugs. (See Section 9.5)

6.2.2 Part identification

This section describes the parts of the power supply module.

(1) Part identification of A61P module



Module fixing hook

Hook for fixing the module to the base unit.

"POWER" LED

LED for indicating 5 VDC power

Power fuse and fuse holder

4 A cartridge fuse for AC input power is fixed by the fuse holder.

Spare fuse for power supply

Spare fuse for power supply installed to the rear side of terminal cover.

Terminal block

For details, see below. (Located under the terminal cover)

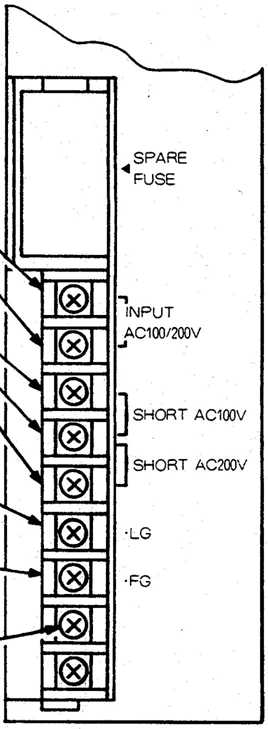
Terminal cover

Cover for protection of terminal block. Remove during wiring. Install after wiring.

Module fixing screw mounting hole

Allows fixing the module with a screw in addition to the module fixing hook. (For M4 screw)

Terminal details



Power input terminals

Power input terminals to which AC power of 100 VAC or 200 VAC is connected.

Applied voltage select terminals

Terminals for selecting applied voltage. Use 100 VAC or 200 VAC as described below. When 100 VAC is input, connect together the "SHORT AC 100V" terminals with the attached short chip. When 200 VAC is input, connect together the "SHORT AC 200V" terminals with the attached short chip.

LG terminal

Grounding of power filter. Has half the input potential.

FG terminal

Connection terminal connected to the shielding pattern on printed circuit board.

Terminal screw

M4 x 0.7 x 6

(2) Part identification of A62P, A65P module

Module fixing hook

Hook for fixing the module to the base unit.

"POWER" LED

LED for indicating 5 VDC power

Power fuse and fuse holder

4 A cartridge fuse for AC input power is fixed by the fuse holder.

Spare fuse for power supply

Spare fuse for power supply installed to the rear side of terminal cover.

Terminal block

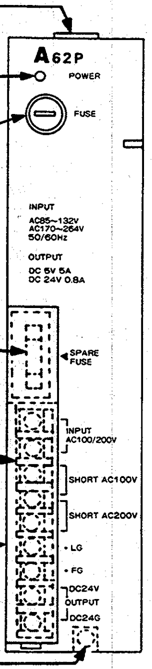
For details, see below. (Located under the terminal cover)

Terminal cover

Cover for protection of terminal block. Remove during wiring. Install after wiring.

Module fixing screw mounting hole

Allows fixing the module with a screw in addition to the module fixing hook. (For M4 screw)



Terminal details

Power input terminals

Power input terminals to which AC power of 100 VAC or 200 VAC is connected.

Applied voltage select terminals

Terminals for selecting applied voltage. Use 100 VAC or 200 VAC as described below. When 100 VAC is input, connect together the "SHORT AC 100V" terminals with the attached short chip. When 200 VAC is input, connect together the "SHORT AC 200V" terminals with the attached short chip.

LG terminal

Grounding of power filter. Has half the input potential.

FG terminal

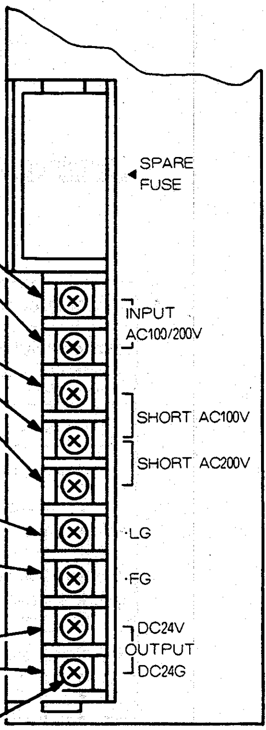
Connection terminal connected to the shielding pattern on printed circuit board.

24 VDC, 24 GDC terminals

For supply to output module which requires 24 V inside the module. (Supplied to the module via external wiring)

Terminal screw

M4 x 0.7 x 6



(3) Part identification of A63P module

Module fixing hook

Hook for fixing the module to the base unit.

"POWER" LED

LED for indicating 5 VDC power

Power fuse and fuse holder

4 A cartridge fuse for AC input power is fixed by the fuse holder.

Spare fuse for power supply

Spare fuse for power supply installed to the rear side of terminal cover.

Terminal block

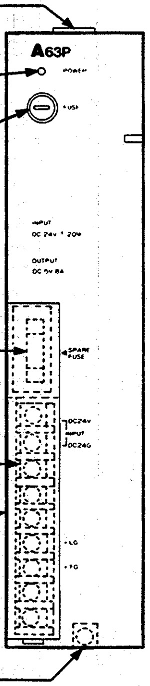
For details, see below. (Located under the terminal cover)

Terminal cover

Cover for protection of terminal block. Remove during wiring. Install after wiring.

Module fixing screw mounting hole

Allows fixing the module with a screw in addition to the module fixing hook. (For M4 screw)



Terminal details

Power input terminals

Power input terminals for 24 VDC. The power fuse will be blown if the positive and negative terminals are reversed.

LG terminal

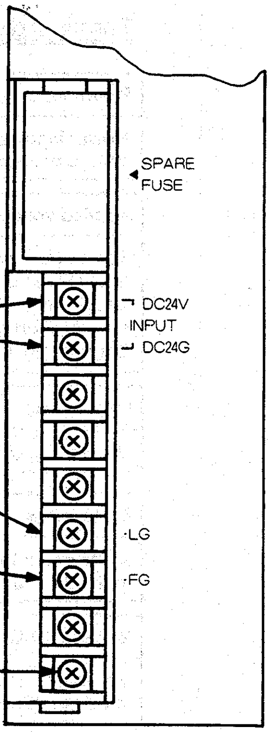
Grounding of power filter. Has half the input potential.

FG terminal

Connection terminal connected to the shielding pattern on printed circuit board.

Terminal screw

M4 x 0.7 x 6



(4) Part identification of A66P module

Module fixing hook

Hook for fixing the module to the base unit.

"POWER" LED

LED for indicating 5 VDC power

Power fuse and fuse holder

4 A cartridge fuse for AC input power is fixed by the fuse holder.

Terminal block fixing screw

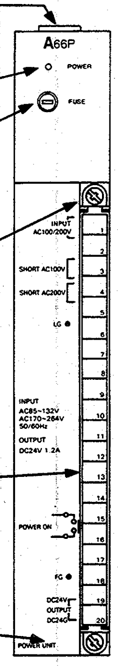
Screw for installing and fixing the terminal block to the module.

Terminal block

For details, see below. (Located under the terminal cover)

Module fixing screw mounting hole

Allows fixing the module with a screw in addition to the module fixing hook. (For M4 screw)



Terminal details

Power input terminals

Power input terminals to which AC power of 100 VAC or 200 VAC is connected.

Applied voltage select terminals

Terminals for selecting applied voltage. Use 100 VAC or 200 VAC as described below. When 100 VAC is input, connect together the "SHORT AC 100V" terminals with the attached short chip. When 200 VAC is input, connect together the "SHORT AC 200V" terminals with the attached short chip.

LG terminal

Grounding of power filter. Has half the input potential.

Power ON terminal

Contact terminal which conducts at normal 24 VDC output when power input turns on.

FG terminal

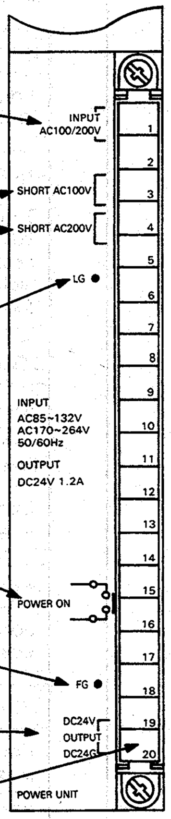
Connection terminal connected to the shielding pattern on printed circuit board.

24 VDC, 24 GDC terminals

For supply to output module which requires 24 V inside the module. (Supplied to the unit via external wiring)

Terminal screw

M3 x 0.5 x 6



(5) Part identification of A68P module

Module fixing hook

Hook for fixing the module to the base unit.

"POWER" LED

LED for indicating 5 VDC power

Power fuse and fuse holder

4 A cartridge fuse for AC input power is fixed by the fuse holder.

Terminal block fixing screw

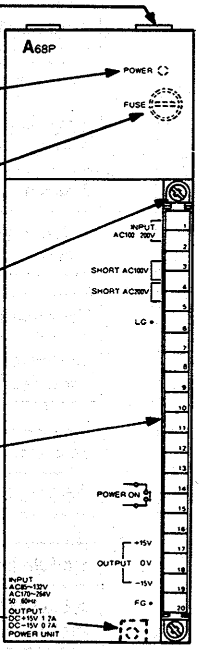
Screw for installing and fixing the terminal block to the module.

Terminal block

For details, see below. (Located under the terminal cover)

Module fixing screw mounting hole

Allows fixing the module with a screw in addition to the module fixing hook. (For M4 screw)



Terminal details

Power input terminals

Power input terminals to which AC power of 100 VAC or 200 VAC is connected.

Applied voltage select terminals

Terminals for selecting applied voltage. Use 100 VAC or 200 VAC as described below. When 100 VAC is input, connect together the "SHORT AC 100V" terminals with the attached short chip. When 200 VAC is input, connect together the "SHORT AC 200V" terminals with the attached short chip.

LG terminal

Grounding of power filter. Has half the input potential.

Power ON terminal

Contact terminal which conducts at normal ±15 VDC output when power input turns on.

+15, 0 V, and –15 V terminals

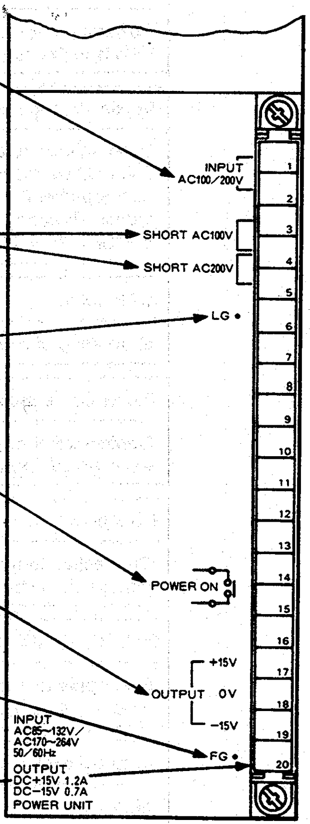
For supplying ±15 VDC to a unit requiring this voltage (via external wiring).

FG terminal

Connection terminal connected to the shielding pattern on printed circuit board.

Terminal screw

M3 x 0.5 x 6



(6) Supply power voltage setting

The input voltage of the A61P, A62P, A65P, A66P, and A68P power supply modules must be selected by placing a jumper (supplied) across two terminals as described below.

Remove the terminal cover from the power supply module.

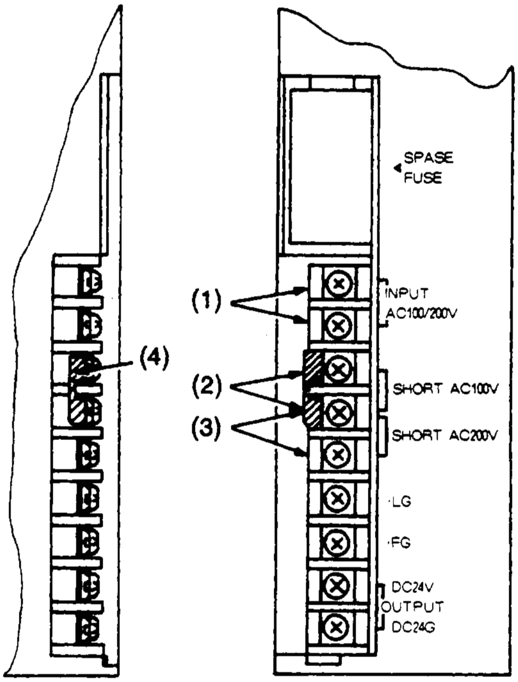
Remove the pair of terminal screws, (2) or (3), according to the supply voltage range 1 used.

(2): For the 100 VAC range.

(3): For the 200 VAC range.

Install the short clip (4) and fix it with the terminal screw.

Install the short chip in the direction shown in the figure at right. (The figure at right shown an example when the supply line voltage is 100 VAC.)



POINT

If the setting differs from the supply line voltage, the following occurs. Therefore, do not mis-set.

	Supply Line Voltage	
	100 VAC	200 VAC
Setting to 100 VAC (Install the short chip to (2))	-	The power supply module is damaged. (The CPU is not damaged.)
Setting to 200 VAC (Install the short chip to (3))	No error occurs in the module. However, the CPU does not operate.	-
No setting (The short chip is not installed)	No error occurs in the module. However, the CPU does not operate.	

7. BASE UNIT AND EXTENSION CABLE

7.1 Base Unit and Extension Cable Specifications

This section describes the specifications of the main and extension base units and the extension cable used in this system.

7.1.1 Specifications of the base units

Table 7.1 Base Unit Specifications

Item / Type	Main Base Unit	Extension Base Unit	
	A74B	A65B	A68B
Loaded I/O modules	4 can be loaded	5 can be loaded	8 can be loaded
Installation hole size	6 mm (0.24 in) dia. pear-shaped hole (for M5 screw)		
External dimensions mm (in)	382 (15.04) x 250 (9.84) x 29 (1.14)	352 (13.86) x 250 (9.84) x 29 (1.14)	480 (18.90) x 250 (9.84) x 29 (1.14)
Weight kg (lb)	1.5 (3.3)	1.4 (3.08)	1.9 (4.18)

7.1.2 Extension cable

Table 7.2 Extension Cable Specifications

Item / Type	AC06B	AC12B	AC30B
Cable length m (ft)	0.6 (1.97)	1.2 (3.94)	3 (9.84)
Resistance value of 5 VDC supply line (Ω at 55°C)	0.019	0.028	0.052
Application	For connection between main base and extension base and between extension bases		
Weight kg (lb)	0.34 (0.75)	0.52 (1.14)	1.06 (2.33)

POINT

The A55B or A58B extension base unit cannot be connected to the A74B.

7.2 Handling

This section describes handling instruction, PC part identification and hardware setting instructions.

7.2.1 Handling instructions

This section describes precautions regarding handling the base unit between unpacking and installation.

(1) The base unit terminal and pin connectors are made of plastic. Do not drop, nor give intense shocks to, the unit.

(2) Do not remove printed circuit boards from the housing. There are no user-serviceable parts on the boards.

(3) Ensure that no conductive debris can enter the module. If it does, make sure that it is removed. Guard particularly against wire offcuts.

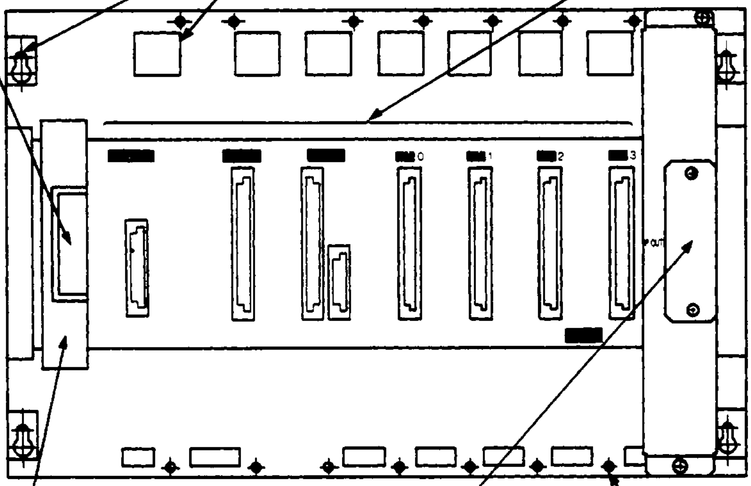
(4) Tighten the module mounting screws (if required) and terminal screws as specified below.

Screw	Tightening Torque kg-cm (lb-in)
Module terminal block installation screws (M4)	10 (8.66) to 14 (12.13)
Module mounting screws (optional) (M4)	8 (6.93) to 12 (10.39)

7.2.2 Part identification

This section describes the parts of the base unit.

(1) Main base unit (A74B)



Guide hole for base installation

Pear-shaped hole for mounting this base unit to the panel of control box, etc. (For M5 screw)

Module fixing hole

Cut out to accept projection and hook at rear of modules.

Extension connector for the SCPU

This connector is connected to the SCPU extension base unit for signal transmission purposes. The extension cable (AC[ ][ ]B) is used to make the connection.

Module connectors

- * For loading the A61P, A73CPU, A70SF, A70MDF, and AY42.
- Load the blind cap or blank cover (AG60) or dummy module (AG62) to vacant connectors, in order to prevent the entry of dust.

Base cover

Protecting cover for the PCPU extension connector. When an extension is to be made, remove this cover with a screwdriver.

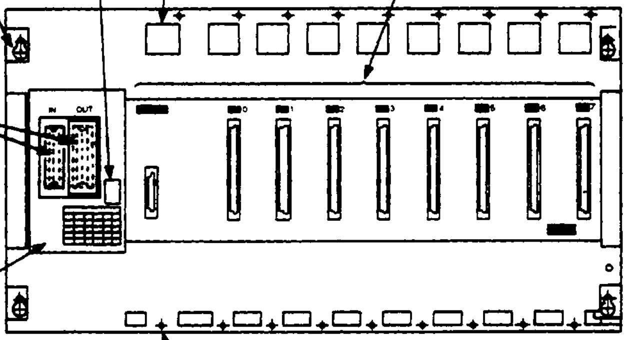
Extension connector for the PCPU

This connector is connected to the PCPU extension base for signal transmission purposes. The extension cable (AC[ ][ ]B) is used for connection.

Module fixing screw

The module can be fixed with a screw in addition to the module fixing hook. Screw size: M4 X 0.7 screw

(2) Extension base unit (A65B, A68B)



Stage number setting switch

Switch for setting the stage number of extension base. (Located under the base cover)
For the stage number setting procedure, refer to Section 7.2.3.

Module fixing hole

Cut out to accept projection and hook at rear of modules.

Module connectors

- * Connectors where the power supply module, CPU module, I/O modules, special function modules are loaded.
- Load the blind cap or blank cover (AG60) or dummy module (AG62) to vacant connectors, in order to prevent the entry of dust.

Guide hole for base installation

Pear-shaped hole for mounting this base unit to the panel of control box, etc. (For M5 screw)

Connector for extension cable

Connector for sending and receiving signals to and from the extension base unit. Connect the extension cable (AC[ ][ ]B).

Base cover

Cover for protection of connector for extension cable. When connection is made with another extension base, it is necessary to remove the area enclosed by a groove at the OUT character portion above the base cover with a tool such as nippers.

Module fixing screw

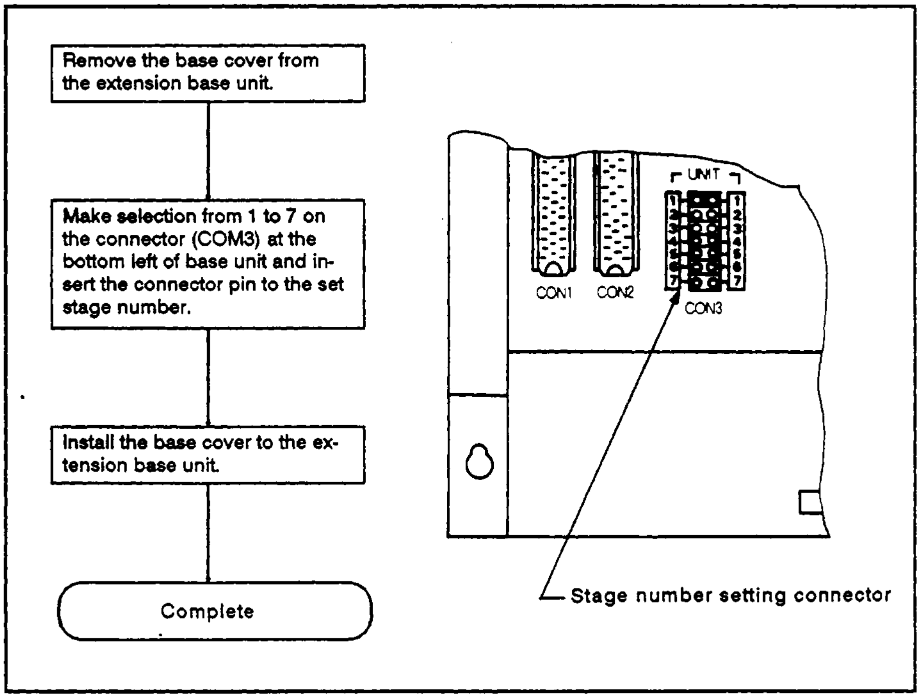
The module can be fixed with a screw in addition to the module fixing hook.
Screw size: M4 X 0.7 screw

REMARKS

It is necessary to set the shaded portion before installing the base and starting operation.

7.2.3 Extension stage number setting on the SCPU extension base

When the extension base unit is connected to the SCPU extension connector, it is necessary to set the extension stage number for each extension base unit.



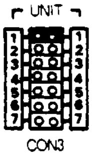
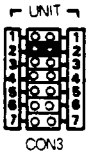
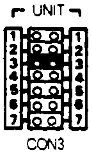
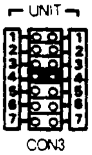
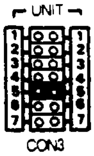
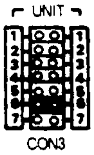
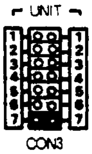
Remove the base cover from the extension base unit.

Make selection from 1 to 7 on the connector (COM3) at the bottom left of base unit and insert the connector pin to the set stage number.

Install the base cover to the extension base unit.

Complete

Extension Base Unit Stage Number Setting

	Extension Stage Number Setting						
	1st stage	2nd stage	3rd stage	4th stage	5th stage	6th stage	7th stage
Stage number setting							

POINT

Set the stage number setting connector (CON3) to a number, from 1 to 7, which matches the number of extension stages. If the same number has been set to two or more extension base units, or no stage number has been set, mis-input or mis-output will result.

7.2.4 Extension stage number setting on the PCPU extension base

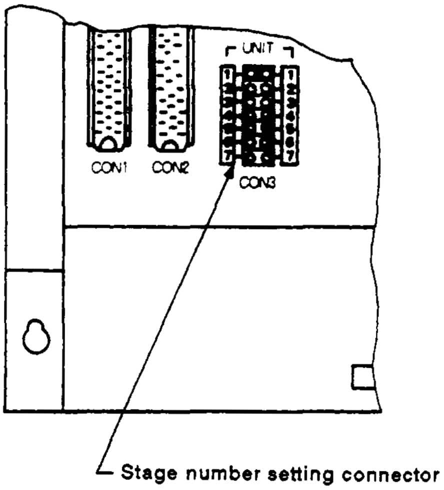
When the extension base unit is connected to the PCPU extension connector, it is necessary to set the extension stage number for each extension base unit.

Remove the base cover from the extension base unit.

Make selection from 1 to 7 on the connector (COM3) at the bottom left of base unit and insert the connector pin to the set stage number.

Install the base cover to the extension base unit.

Complete



8. MEMORIES AND MEMORY CASSETTES

8.1 Specifications

This section describes the specifications of memories and memory cassettes which can be used with the A73CPU.

8.1.1 Memory cassette specifications

This section describes the specifications of memory cassettes to be used.

Table 8.1 Memory Cassette Specifications

Type Item	A3NMCA-0	A3NMCA-2	A3NMCA-4	A3NMCA-8	A3NMCA-16	A3NMCA-24	A3NMCA-40	A3NMCA-56
*RAM memory capacity (Parameter setting range)	None installed	16K (16K)	32K (32K)	64K (64K)	128K (96K)	192K (144K)	320K (144K)	448K (144K)
Number of ROM loading sockets	2 pcs. (for 28 pins)							
Type of loadable ROM	4KROM, 8KROM, 16KROM							
Type of loadable RAM	4KRAM	Unloadable						
External dimensions mm (in)	110 (4.33) x 79.5 (3.13) x 33 (1.30)							
Weight kg (lb)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.13 (0.29)	0.15 (0.33)	0.15 (0.33)

* The RAM memory capacity is the total memory capacity of the RAM chips soldered to the pattern on the memory cassette printed circuit board. The parameter setting range is the memory area set by parameters to store parameters, main programs, subprograms, comments, etc. For details of the types of data and order in which it is stored, refer to Section 8.2.4.

8.1.2 Memory specifications

This section describes the specifications of the ROM and RAM memories that can be used in the memory cassette.

Table 8.2 Memory Specifications

Type Item	4KRAM	4KROM	8KROM	16KROM
Memory specifications	IC-RAM (Read and write possible)	EP-ROM (only read is possible)		
Memory capacity (bytes)	8K	8K	16K	32K
Structure	28-pin IC package	28-pin IC package	28-pin IC package	28-pin IC package
Note	When loading memory into the memory cassette two memory ICs of the same specification are always required.			

8.1.3 Battery specifications

This section describes the specifications of battery used for RAM memory backup and power failure compensation.

Table 8.3 Battery Specifications

Item / Type	A6BAT
Nominal voltage	3.6 VDC
Guaranteed life	5 years
Total power failure backup time	Depends on memory cassette type as indicated below: A3NMCA-0: Min. 4100 hours, A3NMCA-56: Min. 450 hours
Application	For IC-RAM memory backup and power failure compensation function
External dimensions mm (in)	ø16 (0.63) x 30 (1.18)

8.2 Handling

This section explains the handling instructions from unpacking to installation and also part identification and setting.

8.2.1 Handling instructions

This section describes precautions regarding the handling of the memory cassette and battery from unpacking to installation.

(1) Memory cassettes and memories

(a) Do not subject the memory cassette and memories to impact or shock.

(b) Do not remove printed circuit boards from the housing. There are no user-serviceable parts on the boards.

(c) Ensure that no conductive debris can enter the module. If it does, make sure that it is removed. Guard particularly against wire offcuts.

(d) When loading the memory cassette into the main unit, press the memory cassette securely into the housing.

(e) When loading the memory into the socket, press the memory securely against the socket and lock it with the lever.

After loading, check that the memory is flush with the socket.

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

(g) Do not touch the legs of the memory. Also, do not bend the legs.

(h) When mounting the memory, be sure to fit the memory the right way round as indicated on the socket. If reversely installed, the memory will be damaged.

(i) Do not touch the CPU memory cassette connector. Touching the connector may result in improper contact.

IMPORTANT

Before installing or removing the memory cassette to or from the CPU or GPP, be sure to turn off the power. If installation or removal is performed with the power on, the contents of the memory cassette will be damaged.

(2) Battery

(a) Do not short-circuit the battery.

(b) Do not disassemble the battery.

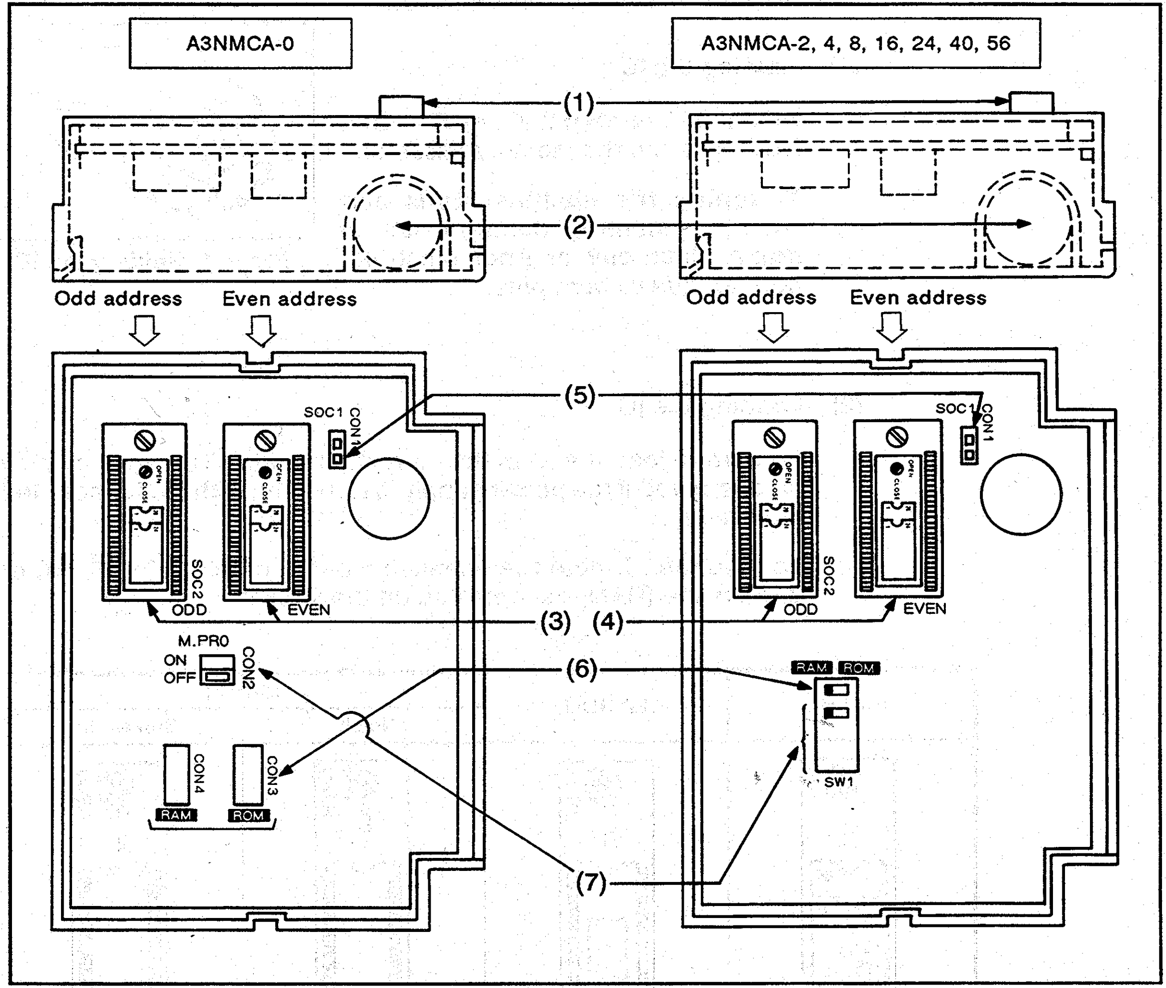
(c) Do not throw the battery into flames.

(d) Do not heat the battery.

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

8.2.2 Part identification

This section describes the parts of the memory cassette.



No.	Name	Description	Note
(1)	CPU connector	Connects the memory cassette to the CPU.	
(2)	Battery (A6BAT)	RAM backup and power failure compensation	
(3)	Program memory sockets	IC socket with locking facility for IC-RAM/EP-ROM. Identical types of memories must be loaded into the two sockets. When ROMs are used, the odd-address ROM must be loaded into SOC1 and the even-address ROM into SOC2.	*
(4)		IC socket with locking facility for EP-ROM only Identical types of memories must be loaded into the two sockets. The odd-address ROM must be loaded into SOC1 and the even-address ROM into SOC2.	*
(5)	Battery lead connector	Connect the battery leads to the connector (CON1). Before shipment, the wires are disconnected to prevent battery discharge.	*
(6)	Memory setting switch	Memory select switch	*
(7)	Memory protect switch	Set the protect range of the IC-RAM contents. (With protect ON, writing to the RAM is disabled.)	*

* Requires setting before using the memory cassette.

8.2.3 Memory IC installation

This section describes the procedure to load RAM and ROM in the memory cassette and to set the IC type.

(1) Holding the IC

Hold the IC as shown in Fig. 8.1 when loading it into the memory cassette.

Touching the memory leads can result in memory damage due to static electricity or poor electrical contact due to bent pins.

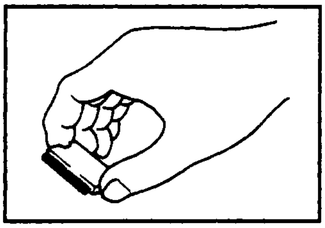


Fig. 8.1 Holding the IC

(2) Loading the IC

Be sure to load the IC in the correct direction. The memory may be destroyed if the power supply is turned on with the IC mounted incorrectly.

To load the IC, note the orientation of the notch (ROM, RAM) or broken line (RAM) as indicated on the socket.

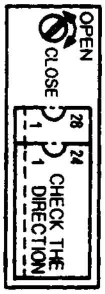
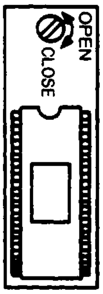
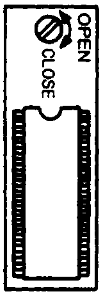
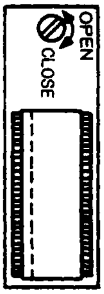
Socket	EP-ROM	IC-RAM	
		Notch	Broken line
			

Fig. 8.2 IC Loading Direction

(3) Setting the IC type

Set the jumper or switch to RAM or ROM in accordance with the IC used.

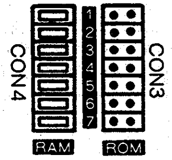
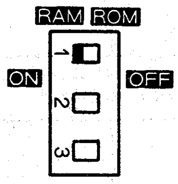
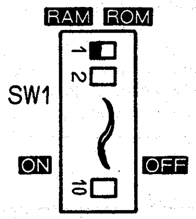
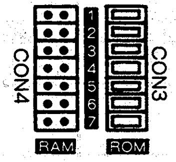
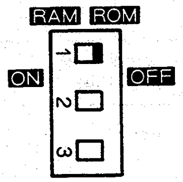
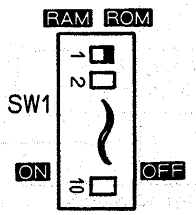
		A3NMCA-0	A3NMCA-2, 4	A3NMCA-8, 16, 24, 40, 56	
IC type setting	RAM				*1 *2 *3
	ROM				

Fig. 8.3 Setting the IC Type

*1 Load the IC after setting its type.

*2 When the A3NMCA-0 is used, set the jumper to CON3 (ROM) or CON4 (RAM).

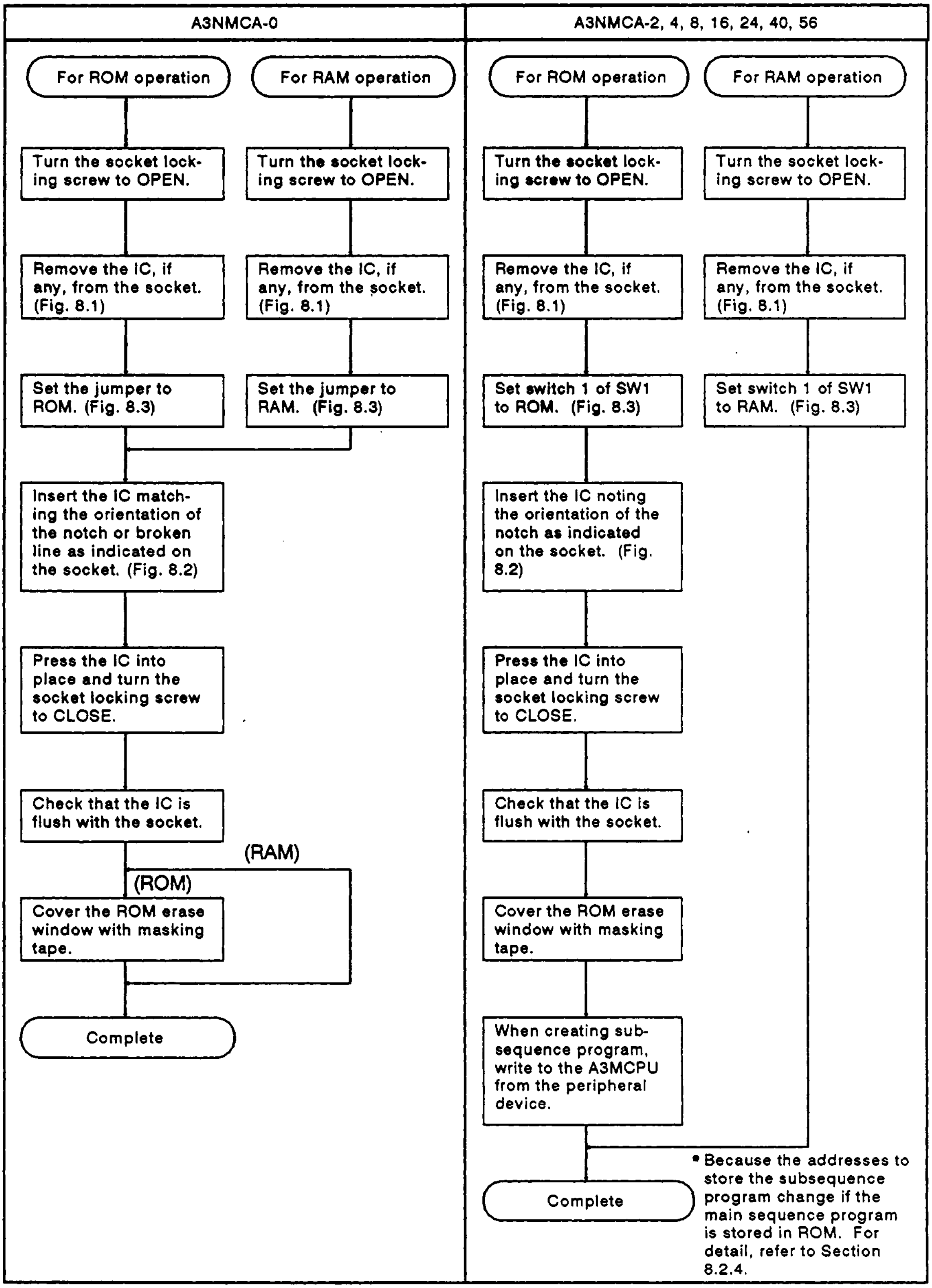
*3 When the A3NMCA-2 to 56 is used, set switch 1 of SW1 to the appropriate position.

REMARKS

The IC type is set to RAM when the memory cassette is dispatched from the factory.

(4) IC loading procedure

Load the IC correctly according to the procedure below.



- Because the addresses to store the subsequence program change if the main sequence program is stored in ROM. For detail, refer to Section 8.2.4.

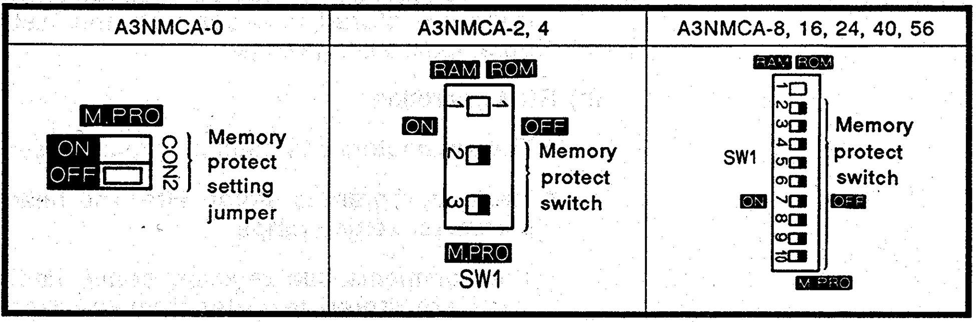
8.2.4 Memory protect switch setting

The RAM memory may be protected by switching the memory protect switch ON (See below). This protects the memory from accidental program changes.

When changes to the PC program are to be made, switch the memory protect switch OFF.

(1) The switch layout varies depending on the memory cassette type as shown below.

The memory protect switch is set OFF when the memory cassette is dispatched from the factory.



(2) The memory ranges protected by each switch are shown below:

Memory Protect Range (Byte number)	Setting	Applicable Memory Cassette						
0 to 16K	A3NMCA-0 Jumper set to ON of CON2 A3NMCA-2 to 56 2 of SW1 ON	A3NMCA-0 and A3NMCA-2	A3NMCA-4	A3NMCA-8	A3NMCA-16	A3NMCA-24	A3NMCA-40	A3NMCA-56
16K to 32K	3 of SW1 ON							
32K to 48K	4 of SW1 ON							
48K to 64K	5 of SW1 ON							
64K to 80K	6 of SW1 ON							
80K to 96K	7 of SW1 ON							
96K to 112K	8 of SW1 ON							
112K to 128K	9 of SW1 ON							
128K to 144K								
144K to 192K	10 of SW1 ON							
192K to 320K								
320K to 448K								

(3) Check the memory cassette areas where programs and data are stored before setting the protected memory ranges.

The order in which data is stored in the memory cassette is shown in the diagram below.

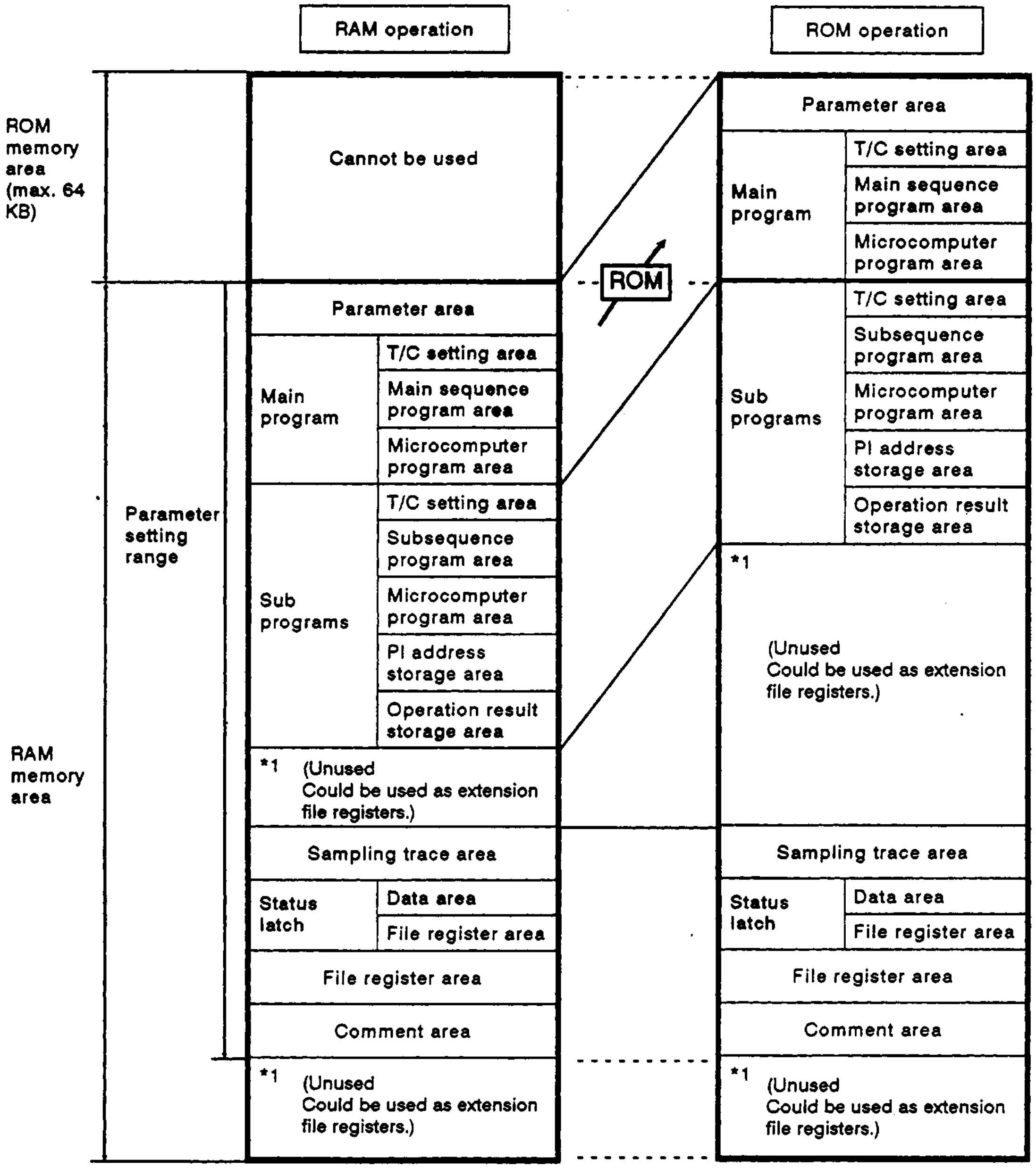
The types of data stored are set with the parameters.

(a) RAM operation

- * The parameters, main program, and subprogram are stored in order from the head address of the parameter setting range.
- * The comments, file register, status latch, and sampling trace are stored in order from the last address of the parameter setting range.

(b) ROM operation

- * The parameters and main program are stored in ROM.
- • The subprogram is stored after the head address of the parameter setting range.
- * The comments, file register, status latch, and sampling trace are stored in order from the last address of the parameter setting range.



*1 Can be used as extension file registers if the SW0GHP-UTLPC-FN1 utility package is used.

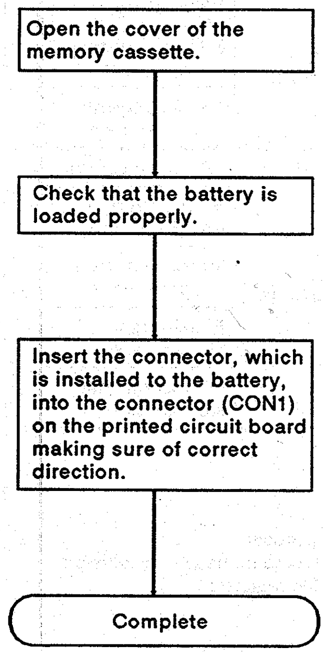
POINT

(1) Do not protect the memory before executing sampling trace or status latch. This prevents data from being stored in memory.

(2) Turn OFF switch 10 of SW1 when using the SW0GHP-UTLPC-FN1 utility package or the SW0GHP-MBASC software package.

8.2.5 Battery installation

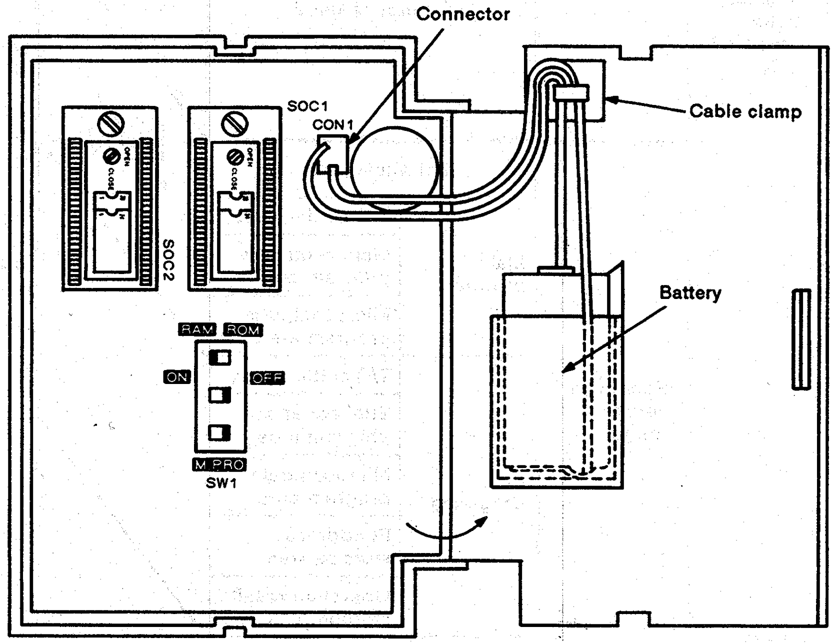
The connector of battery is disconnected before shipment. When power failure compensation is required, connect by the following procedure.


Open the cover of the memory cassette.

Check that the battery is loaded properly.

Insert the connector, which is installed to the battery, into the connector (CON1) on the printed circuit board making sure of correct direction.

Complete



REMARKS

The connector of the battery has been disconnected in order to prevent discharging of the battery during transportation and storage. Couple the connector before use.

MEMO

9. LOADING AND INSTALLATION

This section describes the loading and installation procedures and instructions for maximum reliability of the system.

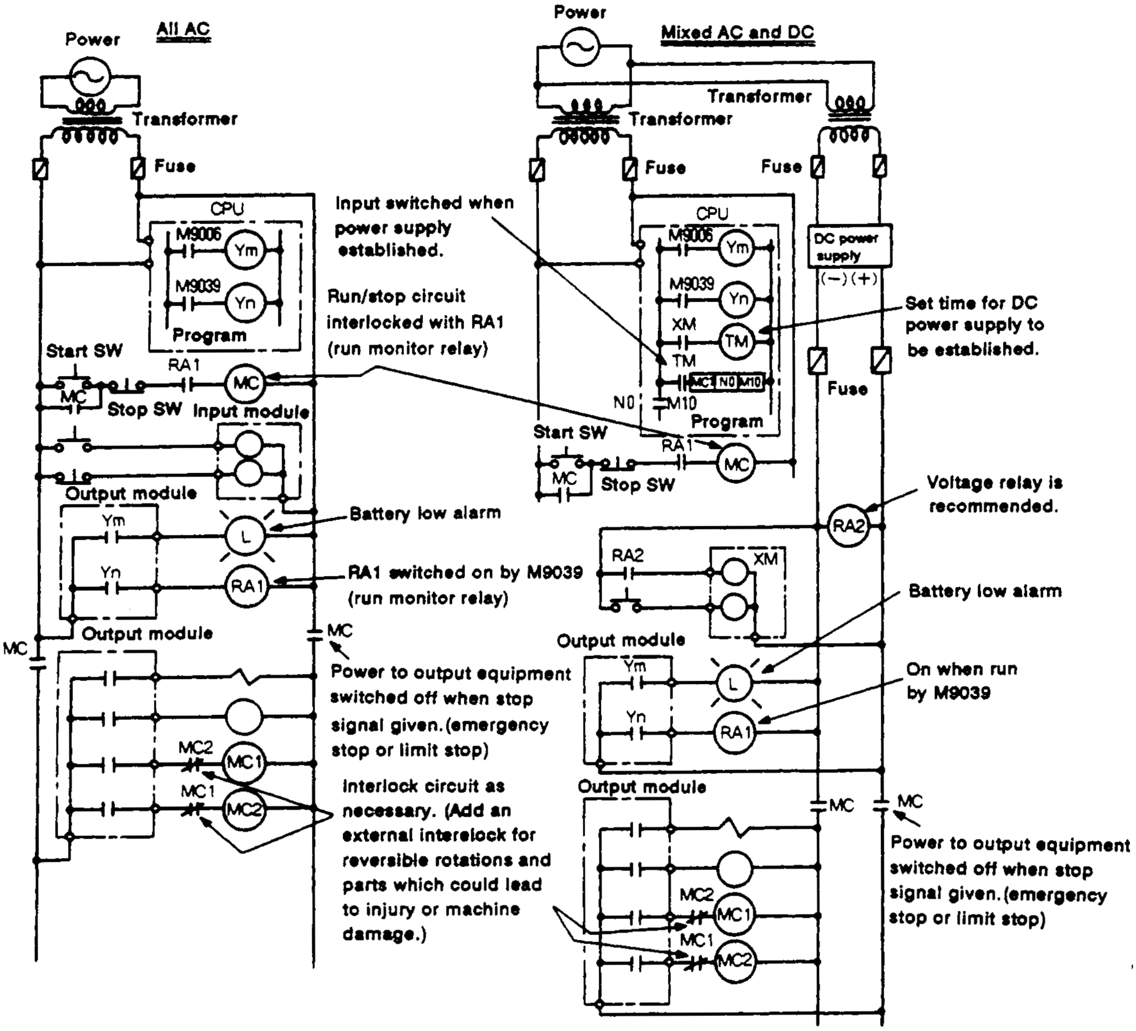
9.1 Consideration for Safety

9.1.1 Consideration for safety

When the power of system is turned on or off, process output may not temporarily perform normal operation due to the difference between the delay time and rise time of the power supply of programmable controller main unit and the external power supply (especially DC) for the process. Also, at the time of an error of the external power supply, output process may possibly make an erroneous operation.

In order to prevent the aforementioned erroneous operations from resulting in an erroneous operation of the entire system and also for safety reasons, constitute circuits (such as emergency stop circuit, protection circuit, and interlock circuit), that prevent machine damage and/or accident due to erroneous operation outside the programmable controller.

A system design circuit example based on the above concept is shown on the following page.



Input switched when power supply established.

Run/stop circuit interlocked with RA1 (run monitor relay)

Battery low alarm

RA1 switched on by M9039 (run monitor relay)

Power to output equipment switched off when stop signal given.(emergency stop or limit stop)

Interlock circuit as necessary. (Add an external interelock for reversible rotations and parts which could lead to injury or machine damage.)

Set time for DC power supply to be established.

Voltage relay is recommended.

Battery low alarm

On when run by M9039

Power to output equipment switched off when stop signal given.(emergency stop or limit stop)

The start-up procedure is as follows:

For AC

(1) Switch on power.

(2) Set CPU to RUN.

(3) Switch on the start switch.

(4) When the magnetic contactor (MC) comes in, output equipment is powered and may be driven from the program.

For AC/DC

(1) Switch on power.

(2) Set CPU to RUN.

(3) When DC power is established, RA2 turns on.

(4) Timer (TM) times out after the DC power reaches 100%. (The set value of TM should be the period of time from when RA2 switches on to the establishment of 100% DC voltage. Set the set value to approximately 0.5 second.)

(5) Switch on the start switch.

(6) When the magnetic contactor (MC) comes in, the output equipment is powered and may be driven by the program.

9.1.2 Precautions in using a positioning system employing an MR-SB servo amplifier

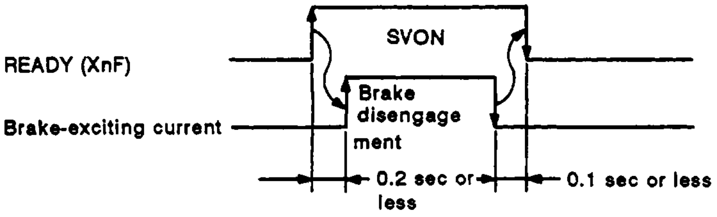
(1) Wiring connections required when a motor with a solenoid brake is used

(a) The motor with a solenoid brake comes to a stop in an emergency through the application of a dynamic brake. Therefore, combined use of the solenoid brake is not helpful in reducing coasting distance.

To ensure safety, calculate the coasting distance moved by the motor in the event of failure of the dynamic brake.

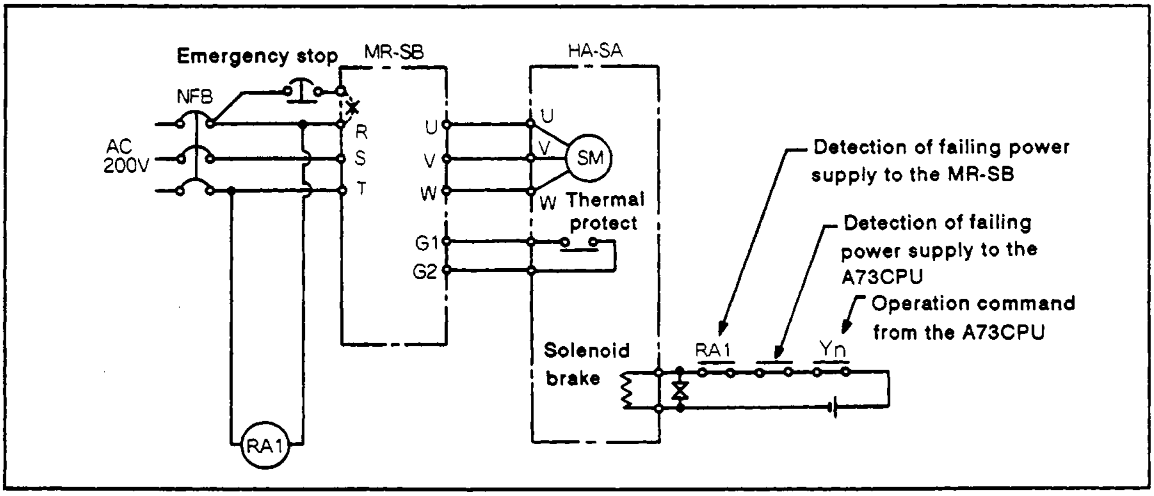
1) Refer to the figure below when using a brake as a preventive means against drop of upper and lower axes.

Remember that this figure is given not for motor protection but for preventing the drop during initialization.



(b) Operation circuit for a motor with a solenoid brake

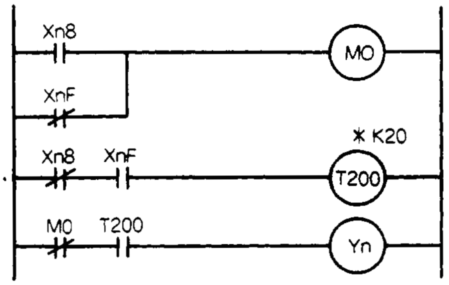
The solenoid brake is applied to the motor when the solenoid brake terminal is turned off. In the A73CPU system, the wiring connections required for the solenoid brake to be actuated are as follows:



(2) Operation sequence program of the A73CPU solenoid brake

When an A73CPU sequence program is used, turn off the solenoid brake output by turning off the servo error detection signal (Xn8) or servo ready signal (XnF).

Make sure that the solenoid brake output is turned off 200 ms after the servo is found normal (Xn8: OFF and XnF: ON).



M0 is turned on when the servo error detection signal (X8n: ON) or the servo ready signal (XnF) is turned off.

T200 is turned on 200 ms after the servo error signal is turned off and after servo ready signal is turned on.

Y80 is turned on when H0 is turned off and when T0 is turned on.

Xn8 : Servo error detection
XnF : Servo ready
MO : Flag for servo error or servo ready turn-off detection
T200 : Timer for measuring the 200 ms that have elapsed after the servo is returned to normal
Yn : Solenoid brake operation command

POINT

T200 is a 10 ms timer. It is subject to error produced by scan time of the sequence program. The error is within the limits of -2 scans/+1 scan.

Disengage the solenoid brake and adjust the settings so that the servo is free of errors.

(3) Emergency stop methods

The MR-SB is brought to an emergency stop by the methods described below.

(a) By an emergency stop command to the A70SF

1) This enables a batch emergency stop for all axes of the MR-SB.

2) The batch emergency stop for all MR-SB axes is affected by turning on (low level) the A70SF EMR (emergency stop) terminal.

After emergency stop, operation of the MR-SB can be resumed by removing the cause of the problem and turning off (high level) the EMR terminal to the A70SF and the error detection signal (Xn7).

(b) By making emergency stop wiring connections to the MR-SB

1) The MR-SB axes can be brought to an emergency stop individually.

2) This method is the most reliable since the emergency stop is affected by opening the emergency stop contact in the MR-SB.

After emergency stop, it is necessary to start up the MR-SB again.

(4) Allowable duration of a momentary power failure

(a) The allowable duration of a momentary power failure is 70 ms.

However, the MR-SB may stop control in the event of a momentary power failure since its allowable power failure duration is 15 ms at 200 V. In that event, the MR-SB will require initial startup.

9.2 Installation Environment

Never install the A73CPU, I/O module in the following environments:

(1) Locations where ambient temperature is outside the range 0 to 55°C.

(2) Locations where ambient humidity is outside the range of 10 and 90%RH.

(3) Locations where dew condensation takes place due to sudden temperature changes.

(4) Locations where there are corrosive gasses or combustible gasses.

(5) Locations where there is a high level of conductive powder such as dust and iron filings, oil mist, salt, and organic solvent.

(6) Locations exposed to the direct rays of the sun.

(7) Locations where a strong power field or magnetic field is generated.

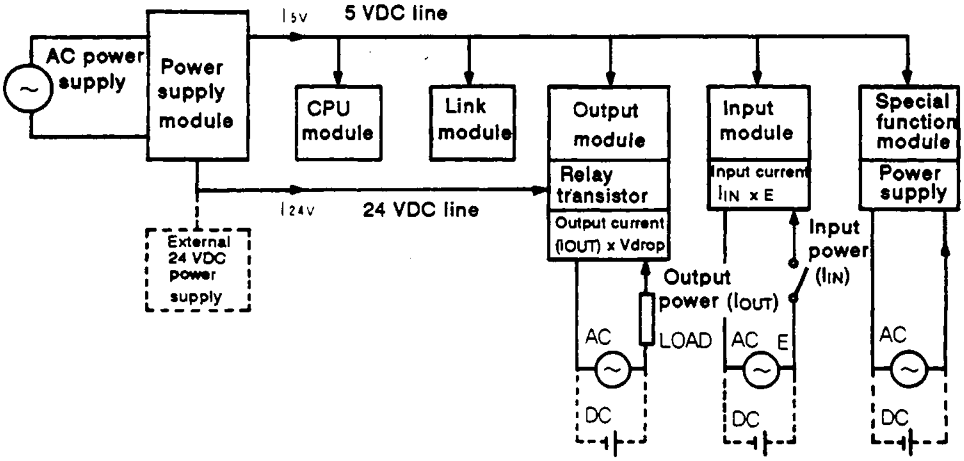
(8) Locations where vibration and shock are directly transmitted to the main unit.

9.3 PC Generated Heat Calculation

The ambient temperature around the PC installed in a panel must be kept below 55°C (131°F). To provide adequate cooling for the control box, the average current consumption (heat generation) for all equipment and instruments inside the panel must be calculated. The average current consumption for the A73CPU and the resulting temperature rise are calculated as follows:

Average power consumption

Power is consumed by the following PC areas:



(1) Power supply module power consumption

Approximately 70% of the power supply module current is converted into power with the remaining 30% dissipated as heart, i.e., 3/7 of the output power is used.

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

where, I_{5V} = 5 VDC logic circuit current consumption of each module.

I_{24V} = current consumption of the output modules (with an average number of points switched on) ...(Not for 24 V input power supply modules)

(2) Total 5 VDC power consumption

5 V is supplied to each module via the base plate, this powers the logic circuitry.

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

(3) Total 24 VDC output module power consumption (with an average number of points switched on)

24 V is supplied to drive output devices.

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

(4) Power consumption of output circuits (with an average number of points switched on)

W_{out} = I_{out} x V_{drop} x average number of outputs on at one time (W)

where, I_{out} = output current (actual operating current) (A)

V_{drop} = voltage dropped across each output load (V)

(5) Power consumption of input circuits (with an average number of points switched on)

W_{in} = I_{in} x E x average number of inputs on at one time (W)

Where, I_{in} = input current (effective value for AC) (A)

E = input voltage (actual operating voltage) (V)

(6) Power consumption of the special function module power supply is expressed as:

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

The sum of the above values is the power consumption of the entire PC system.

$$\underline{\underline{W = W_{pw} + W_{5V} + W_{24V} + W_{out} + W_{in} + Ws \text{ (W)}}}$$

Further calculations are necessary to work out the power dissipated by the other equipment in the panel.

Generally temperature rise in the panel is expressed as:

$$T = \frac{W}{UA} \text{ (°C)}$$

where, W = power consumption of the entire PC system (obtained as above)

A = panel inside surface area (m^2)

U = 6 if the panel temperature is controlled by a fan, etc. 4 if panel air is not circulated.

POINT

Fans, heat exchangers, or cooling units must be installed if the panel temperature is likely to exceed the specified temperature.

If using a fan for ventilation, beware of effects on the PC from dust drawn in with the air.

9.4 Mounting the Base Unit

This section describes precautions regarding installation of the main base and extension base units.

9.4.1 Mounting instructions

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

(1) To improve ventilation or facilitate the replacement of unit, provide 80 mm (3.15 in) or more the clearance around the PC.

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

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

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

(5) Provide a wiring duct as necessary.

However, if the dimensions from the top and bottom of the PC are less than those shown in Fig. 9.1, note the following points:

(a) When the duct is located above the PC, the height of the duct should be 50 mm (1.97 in) or less to allow for sufficient ventilation.

Set the distance form the top of the PC so that the hook latch at the top of the module can be pushed. If the hook latch at the top of the module cannot be pushed, the module cannot be replaced.

(b) When the duct is located under the PC, install the duct so that optical fiber cables or coaxial cables may be connected and also consider the minimum bending radius of the cable.

(6) All other equipment should be installed at least 100 mm (3.94 in) away from the PC to protect it from heat and noise. The bases must be installed at least 50 mm (2 in) away from any equipment on both sides.

9.4.2 Installation

This section explains the mounting procedure for the main and extension base units.

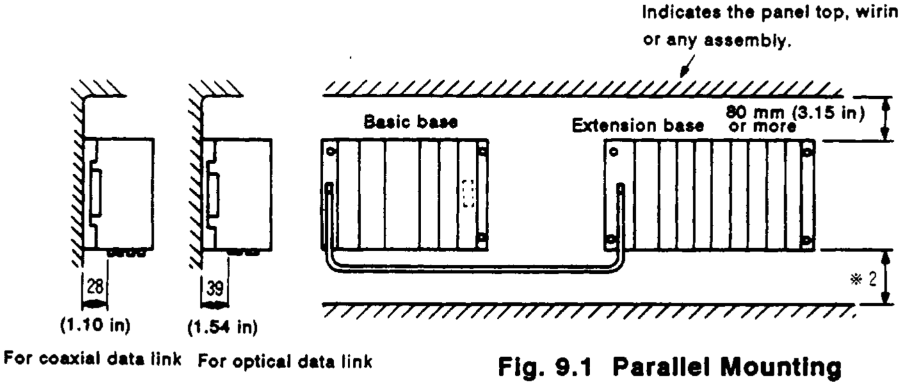


Fig. 9.1 Parallel Mounting

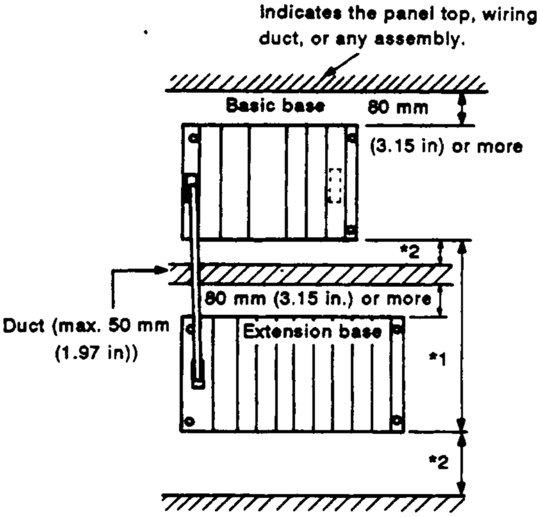


Fig. 9.2 Serial Mounting

*1: Depends on the length of the extension cable as indicated below.

450 mm (17.72 in) or less for Type AC06B cable

1050 mm (41.34 in) or less for Type AC12B cable

2850 mm (112.20 in) or less for Type AC30B cable

*2: 100 mm (3.94 in) or more when the link unit is not used.

150 mm (5.91 in) or more when ø4.5 mm (0.18 in) dia. optical fiber cable or coaxial cable issued.

180 mm (7.09 in) or more when ø8.5 mm (0.33 in) optical fiber cable is used.

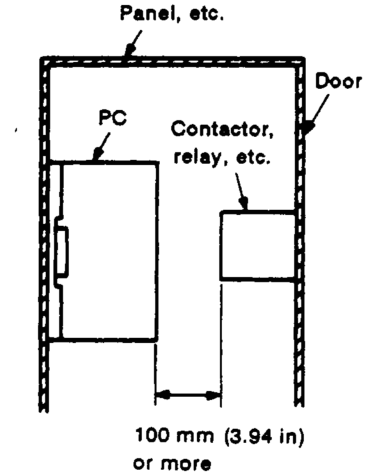


Fig. 9.3 Minimum Front Clearance

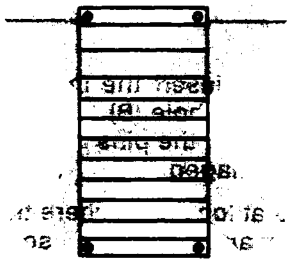


Fig. 9.4 Vertical Mounting (Not allowed)

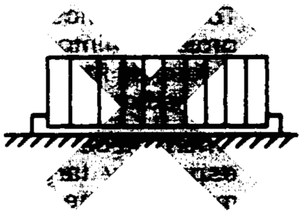


Fig. 9.5 Horizontal Mounting (Not allowed)

9.5 Installation and Removal of Module

This section explains the installation and removal procedures of the power supply module, CPU module, I/O module, special function module, etc. to and from the base module.

(1) Installation of module

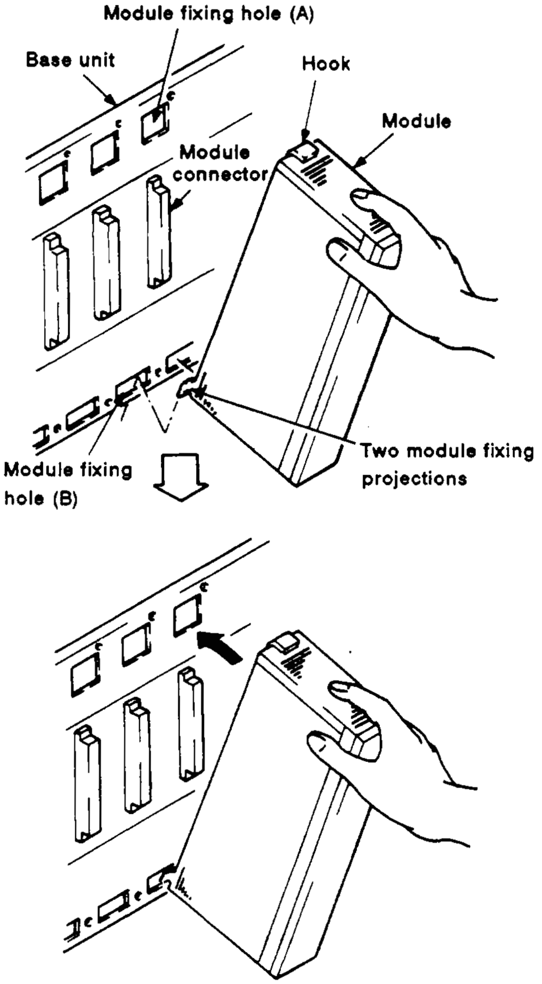
The installation procedure is as follows.

Insert the two module fixing projections (two) into the module fixing hole (B) in the base unit.

Load the module into the base unit by pushing it in the direction of arrow.

Check if the hook of module is securely inserted in the module fixing hole (A) in the base unit.

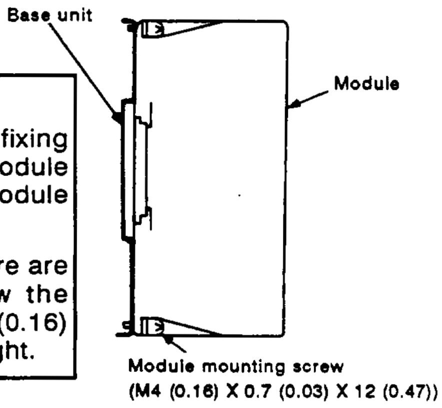
Complete



POINT

(1) To fix the module, be sure to insert the module fixing projection into the module fixing hole (B). If the module is forcibly fixed without insertion, the pins in the module connector may be bent or damaged.

(2) When the base unit is used at locations where there are especially large vibration and/or shock, screw the module to the base. Applicable screw size is M4 (0.16) x 0.7 (0.03) x 12 mm (0.47 in). See the figure at right.



(2) Removal of module

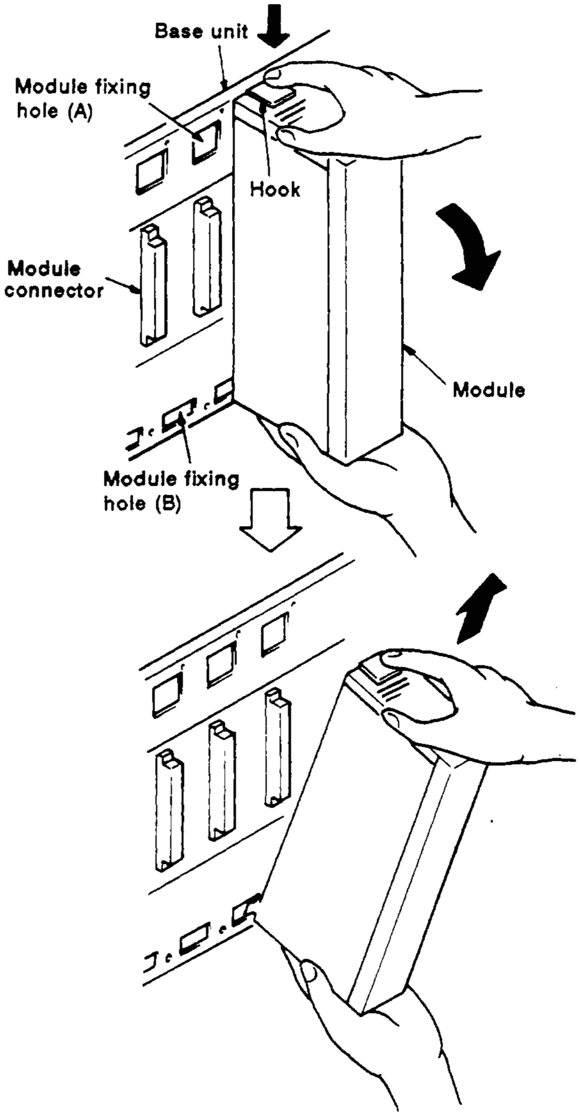
The removal procedure is as follows.

Hold the module with both hands and push down the hook latch at the top of module.

While pushing down the hook latch, pull the module toward you.

Lift upwards and remove the module fixing projections from the module fixing hole (B).

Complete



POINT

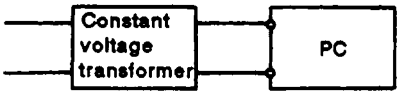
To remove the module, be sure to disengage the hook from the module fixing hole (A) and then remove the module fixing projections from the module fixing hole (B). If the module is forcibly removed, the hook or module fixing projections will be damaged.

9.6 Wiring

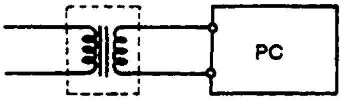
9.6.1 Wiring instructions

(1) Wiring of power source

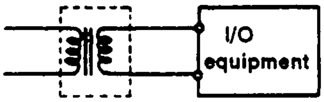
(a) When voltage fluctuations are larger than the specified value, use a constant-voltage transformer.



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



Insulating transformer



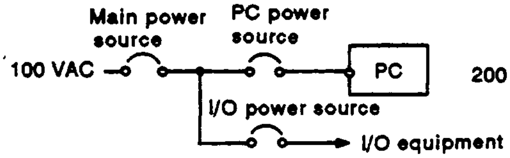
Insulating transformer

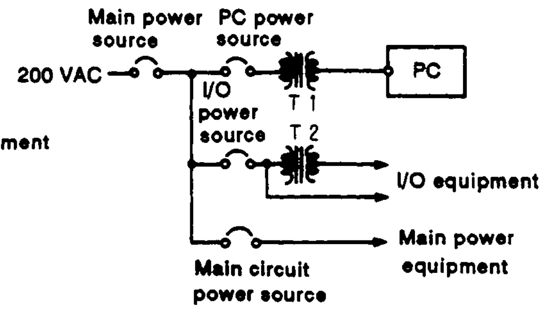
(c) When a power transformer or insulating transformer is employed to reduce the voltage from 200 VAC to 100 VAC, use one with a capacity greater than that indicated in the following table.

Power Supply Module	Transformer Capacity
A61P	100 VA x n
A62P	100 VA x n
A65P	100 VA x n
A66P	95 VA x n
A68P	95 VA x n

'n' stands for the number of power supply modules.

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





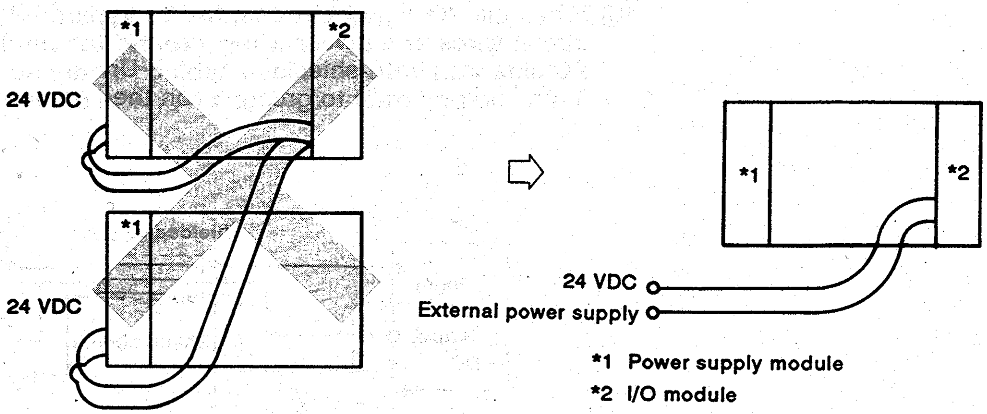
REMARKS

As safety measures, install a switch for use with "online I/O module change" only to each of the corresponding modules and equipment.

(e) Note on using 24 VDC output of the A66PC power supply modules

To protect the power supply modules, do not supply one I/O module with 24 VDC from several power supply modules connected in parallel.

If 24 VDC output capacity is insufficient for one power supply module, supply 24 VDC from the external 24 VDC power supply as shown below:

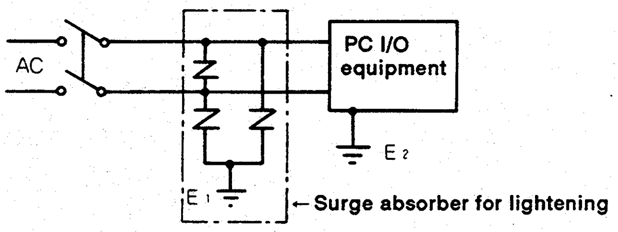


(f) Twist the 100 VAC, 200 VAC, and 24 VDC cables as closely as possible. Connect modules with the shortest possible wire lengths.

(g) To minimize voltage drop, use the thickest (max. 2 mm^2 (14 AWG)) wires possible for the 100 VAC, 200 VAC, and 24 VDC cables.

(h) Do not bundle the 100 VAC and 24 VDC cables with main-circuit wires or the I/O signal wires (high-voltage, large-current). Also, do not wire the above indicated cables close to the aforementioned wires. If possible, provide more than 100 mm (3.94 in) distance between the cables and wires.

(i) As a measure against very large surges (e.g. due to lightening), connect a surge absorber as shown below.



POINT

(1) Ground the surge absorber (E1) and the PC (E2) separately from each other.

(2) Select a surge absorber making allowances for power voltage rises.

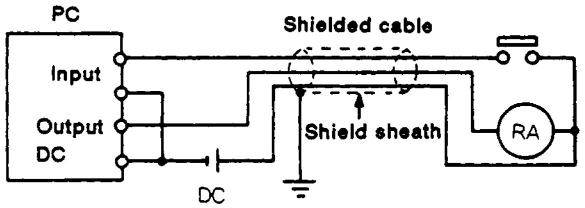
(2) Wiring of I/O equipment

(a) Applicable size of the wire which connects to the terminal block connector is 0.75 (18) to 2 mm^2 (14 AWG). However, it is recommended to use wires of 0.75 mm^2 (18 AWG) for handling convenience.

(b) Separate the input and output lines.

(c) I/O signal wires must be at least 100 mm (3.94 in) away from high-voltage and large-current main circuit wires.

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



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

(f) Separate the 24 VDC I/O cables from the 100 VAC and 200 VAC cables.

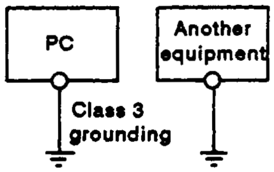
(g) If wiring requires over 200 mm (7.87 in) or longer distance, trouble can be caused by leakage currents due to line capacity. Take corrective action as described in Section 7.4.

(3) Grounding

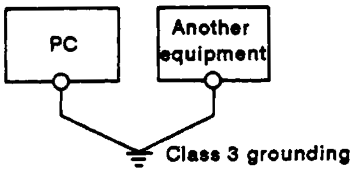
(a) The A series PC has good noise resistance. Therefore, the PC may be used without grounding except when there is excessive noise.
However, follow (b) to (e) described below.

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

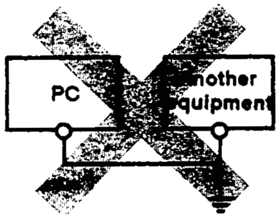
(c) When independent grounding is impossible, use the joint grounding method as shown in the figure below (2).



1) Independent grounding.... Best



2) Joint grounding........... Good



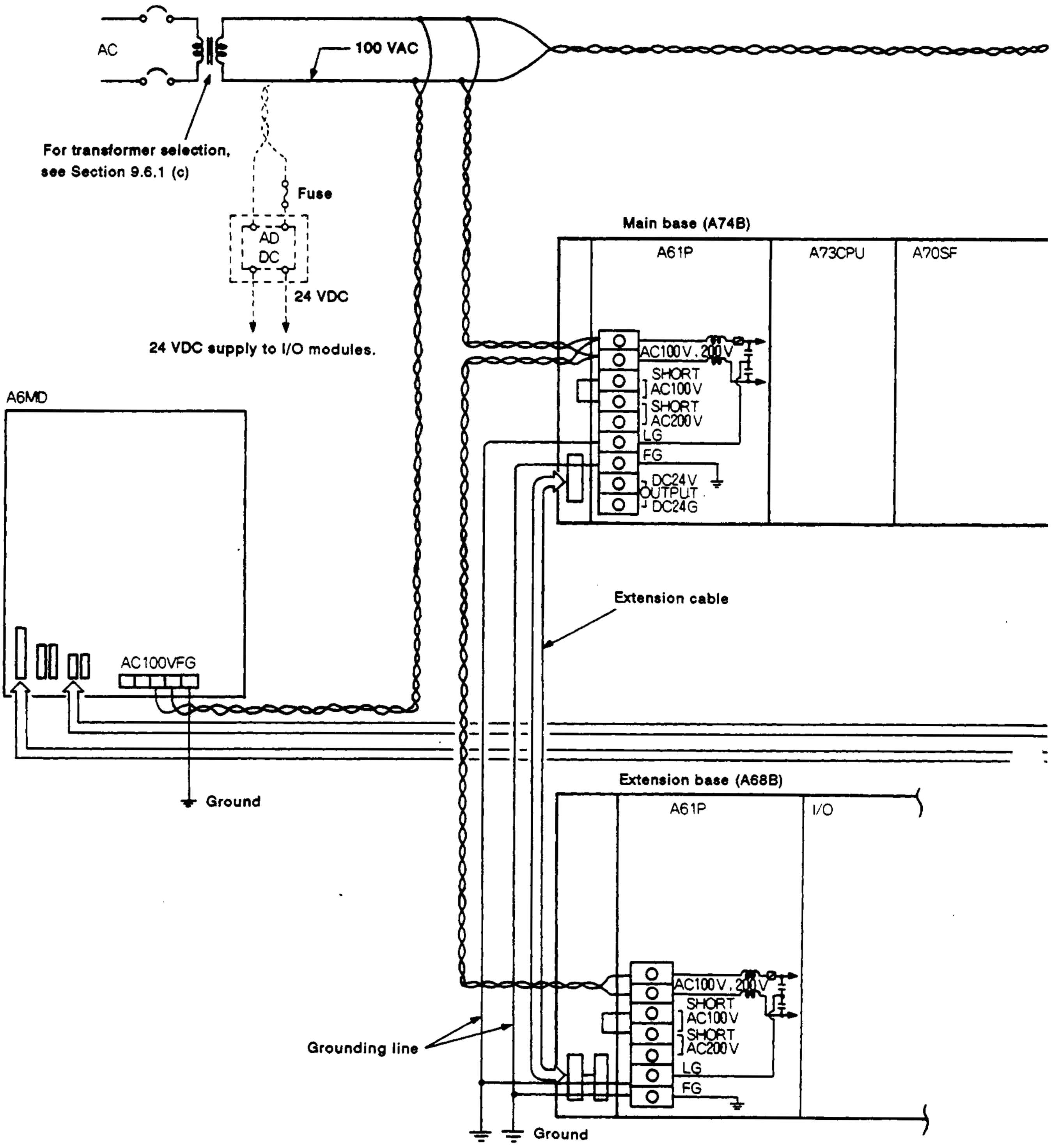
3) Joint grounding......... Not allowed

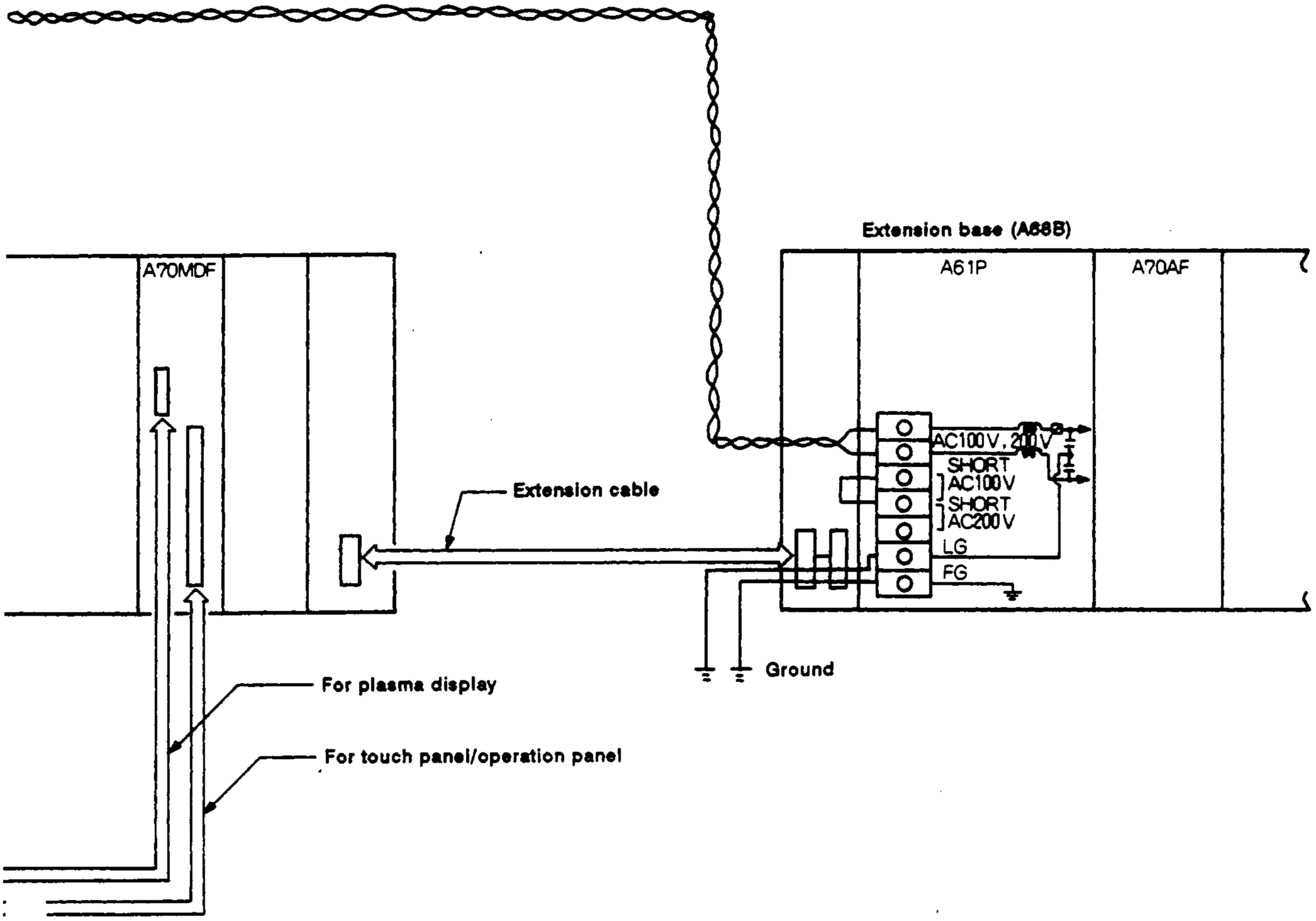
(d) Use 2 mm^2 (14 AWG) or thicker grounding wire. Grounding point should be as near to the PC as possible to minimize the distance of the grounding cable.

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

9.6.2 Wiring to terminals

This section explains the wiring of power lines and grounding lines to the CPU module and power supply module.





POINT

(1) Use the thickest possible (max. 2 mm^2 (14 AWG)) wires for the 100 V/200 VAC and 24 VDC power cables. Be sure to twist these wires starting at the connection terminals. To prevent shortcircuit should any screws become loose, use solderless terminals with insulation sleeves.

(2) When the LG terminals and FG terminals are connected, be sure to ground the wires. Do not connect the LG terminals and FG terminals to anything other than ground. If LG terminals and FG terminals are connected without grounding the wires, the PC may be susceptible to noise. Also since the LG terminal has half the potential of the input voltage, the operator may get an electric shock if he touches it.

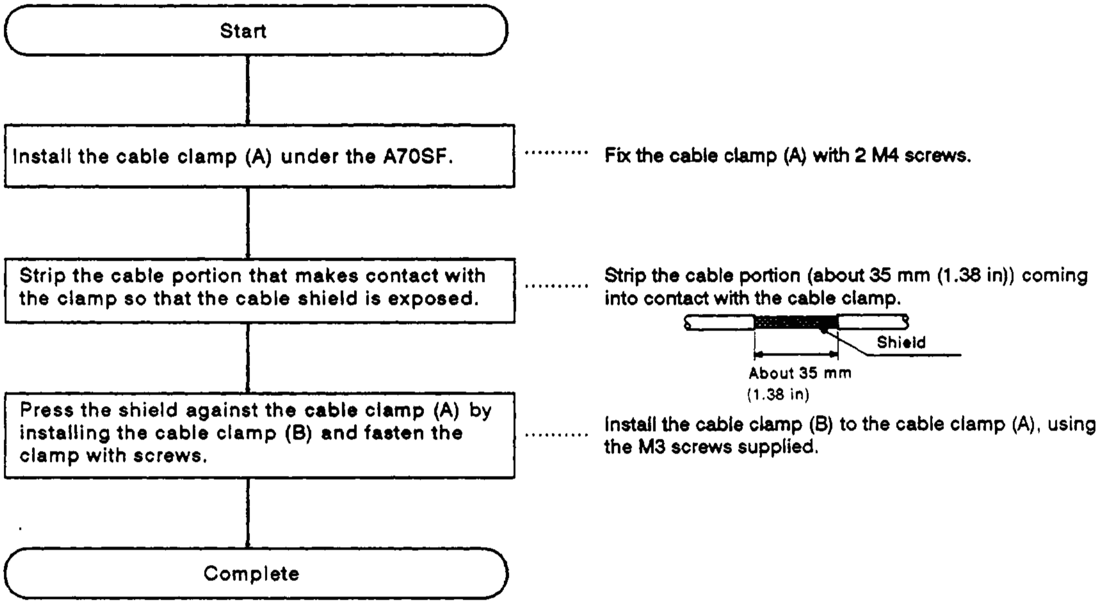
(3) Make sure that the power to the main base (A74B) and extension base (A65B/A68B) power supply modules the A68P power supply modules, and the A6MD remains the same.

(4) Ground terminal FG of the A6MD.

9.7 Grounding the A70SF-MR-SB Cable with Cable Clamps

The cable (MR-BUS[ ]M) connecting the A70SA with the MR-SB must be grounded with the cable clamp (supplied with the A70SF) provided on the A70SF side.

Using the cable clamp, ground the cable according to the procedure described below.



Start

Install the cable clamp (A) under the A70SF. .... Fix the cable clamp (A) with 2 M4 screws.

Strip the cable portion that makes contact with the clamp so that the cable shield is exposed. .... Strip the cable portion (about 35 mm (1.38 in)) coming into contact with the cable clamp.

Press the shield against the cable clamp (A) by installing the cable clamp (B) and fasten the clamp with screws. .... Install the cable clamp (B) to the cable clamp (A), using the M3 screws supplied.

Complete

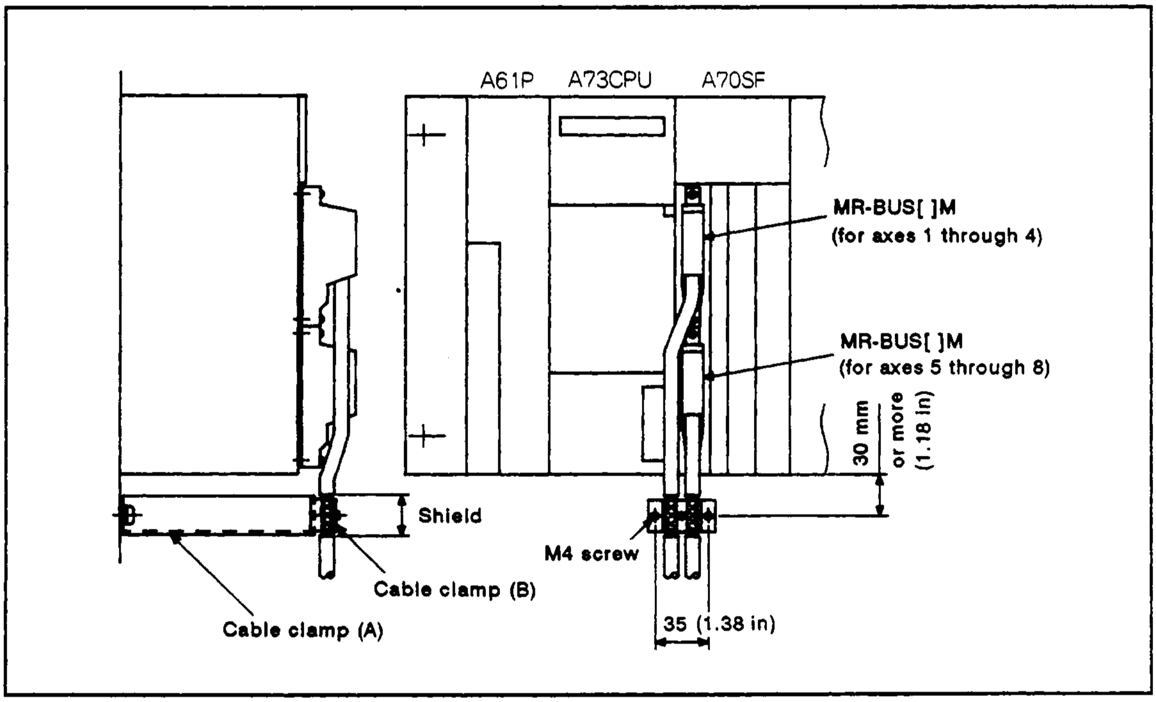


Fig. 9.6 Grounding of MR-BUS[ ]M Cable with Cable Clamps

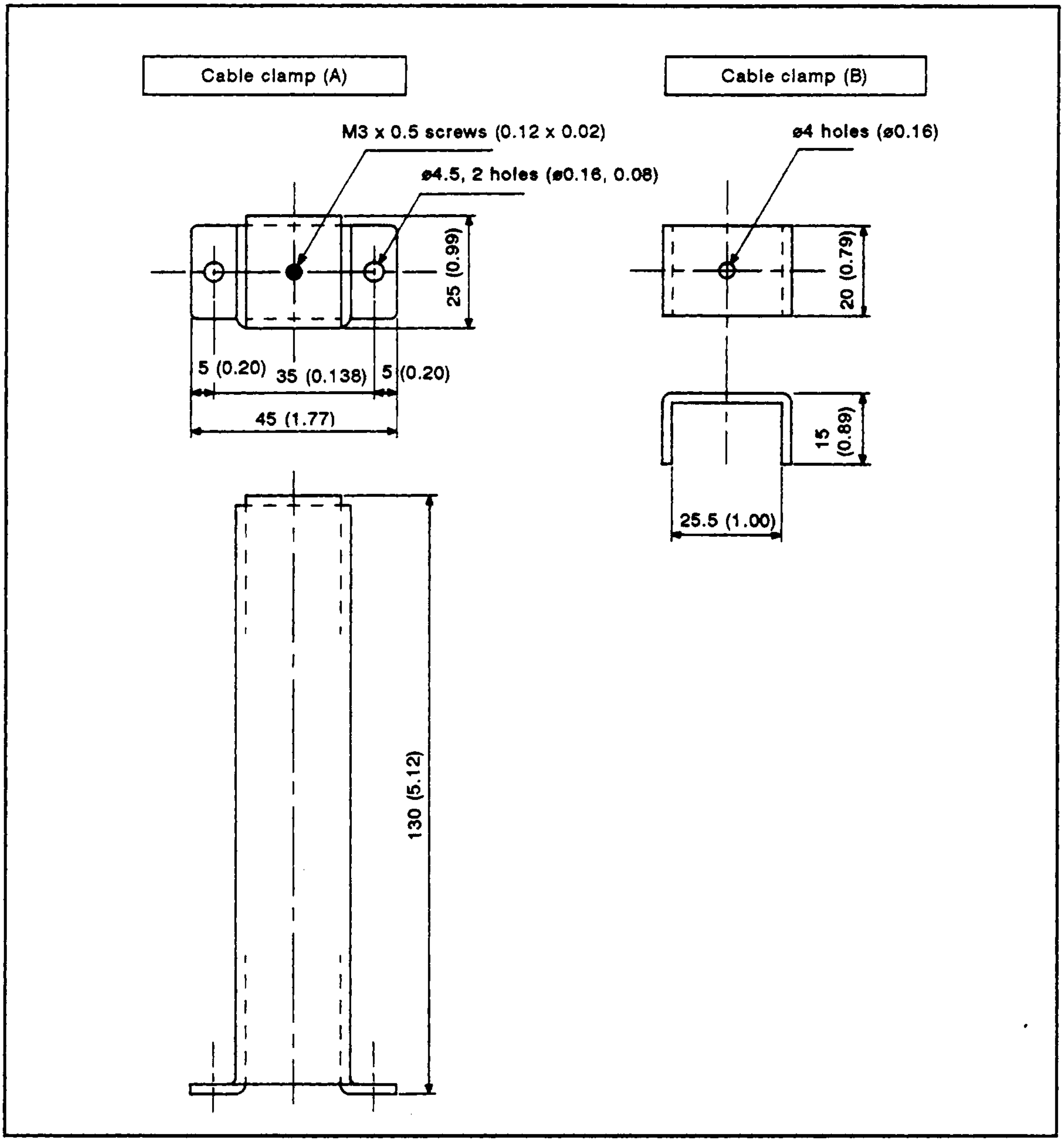


Fig. 9.7 Cable Clamp

10. PRE-START-UP AND TEST PROCEDURES

10.1 Checks Before Test Start

Checks before testing are listed in Table 10.1.

Table 10.1 Checks Before Test Start

Check Item	Check Point	Refer to
CPU module	(1) Check that the memory cassette is securely loaded in the CPU.	Section 8.2.1
	(2) Check that the memory capacity matches the memory cassette capacity.	Section 8.1.1
	(3) Check that RAM/ROM selection is correct.	Section 8.2.3
	(4) Check that EP-ROM or IC-RAM is securely loaded in the ROM socket (when the A3NMCA-0 or EP-ROM is used).	
	(5) Check that the two EP-ROMs and IC-RAMs loaded are of the same type.	Section 8.1.2
	(6) Check that the memory protect switch is set to OFF.	Section 8.2.4
	(7) Check that the lead wire connector of the memory cassette battery (A6BAT) is securely connected to the pin connector on the printed circuit board.	Section 8.2.5
	(8) Check if the battery is low on voltage (nominal value: 3.16 V).	Section 11.3
Power supply module	(1) Check that the type of the power supply module installed on the base is correct (only the A61P can be installed on the A74B).	—
	(2) Check for blown fuse.	Section 6.2.2
	(3) Check that the supply voltage and the power supply module voltage are correct (this check is not applicable to the A63P).	
	(4) Check that the polarity (+/–) of the power cable is not reversed (this check is applicable only to the A63P).	
	(5) Check that the FG and LG terminals are correctly wired.	Section 9.6.2
	(6) Check that the terminals are fully tightened.	Section 6.2.1
	(7) Check that the size of the cable wire is correct.	Section 6.1.1
Input/output module	(1) Check that the cables connected to the terminals on the terminal blocks match the designations of the signals.	Building Block Input/Output Module User's Manual
	(2) Check that the terminal screws are fully tightened.	
	(3) Check that the size of the cable wire is suitable.	
	(4) Check that the external supply power line is properly connected (24 VDC, ±15 VDC, etc.).	
Special function module	(1) Check that switch positions are correct.	User's Manual for the special module used
	(2) Check that the terminals on the terminal blocks match the designations of the signals connected.	
	(3) Check that the terminal screws are fully tightened.	
	(4) Check that the size of the cable wire is correct.	
	(5) Check that the external supply power line is correctly connected (24 VDC, ±15 VDC, etc.).	
Dummy module (AG62)	(1) Check that the point number setting switches are correctly set.	Building Block Input/Output Module User's Manual

Check Item	Check Point	Refer to
Main base unit	(1) Check that the type of the main base unit used is correct (the A73CPU can only be loaded on the A74B).	Sections 2.1 through 2.3
	(2) Check that the unit loaded is correct.	
	(3) Check that the loading order is correct.	
	(4) Check that the unit is securely loaded.	Section 9.5
Extension base unit	(1) Check that the extension base unit is correct (only the A65B/A68B can be connected to the A74B).	Sections 2.1 through 2.3
	(2) Check that the unit loaded is correct.	Section 2.6
	(3) Check if the total number of input/output points on the input/output module and the special function module exceeds the number of input/output points of the CPU module.	Section 4.1
	(4) Extension stage number setting (a) Check that the number is set. (b) Check that the same number is set. (c) Check that one base unit is used to affect two or more settings.	Sections 7.2.3 and 7.2.4
	(5) Check that the unit is securely loaded.	
Extension cable	(1) Check that the extension cable connector is correctly connected to the base unit connector.	Section 7.1.2
	(2) Check that the extension cable connector is correctly positioned.	Section 7.2.2
	(3) Check that the total length of extension cables is 6.6 m (21.65 ft.) or less.	Sections 2.1 through 2.3

10.2 Servo Start-up

This section describes the servo start-up procedure to be followed by the A73CPU and peripheral devices.

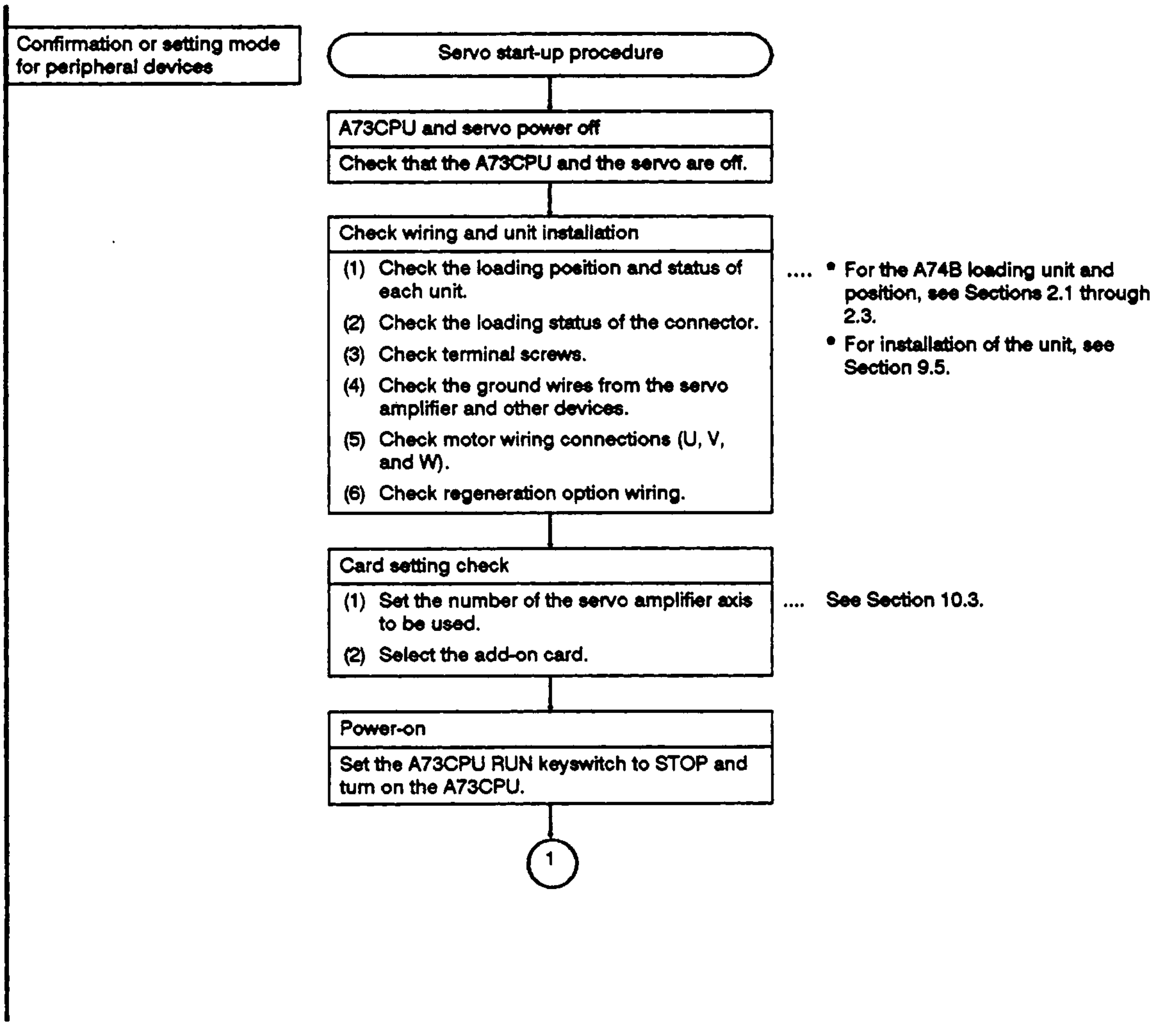
POINT

(1) The nameplate cannot be seen when the motor is installed on the machine. Take note of the motor model number on the nameplate before motor installation.

(2) Before initially turning on the servo amplifier or servo motor, check its performance separately. This precaution should be taken to prevent unexpected machine failure or accident.

(3) The confirmation or setting mode for peripheral devices applies when the MR-SB is used.

Confirmation or setting cannot be affected in modes marked with an asterisk (*) when a general-purpose servo amplifier is used.



Confirmation or setting mode for peripheral devices

Servo start-up procedure

A73CPU and servo power off

Check that the A73CPU and the servo are off.

Check wiring and unit installation

(1) Check the loading position and status of each unit.
(2) Check the loading status of the connector.
(3) Check terminal screws.
(4) Check the ground wires from the servo amplifier and other devices.
(5) Check motor wiring connections (U, V, and W).
(6) Check regeneration option wiring.

....
- For the A74B loading unit and position, see Sections 2.1 through 2.3.
- For installation of the unit, see Section 9.5.

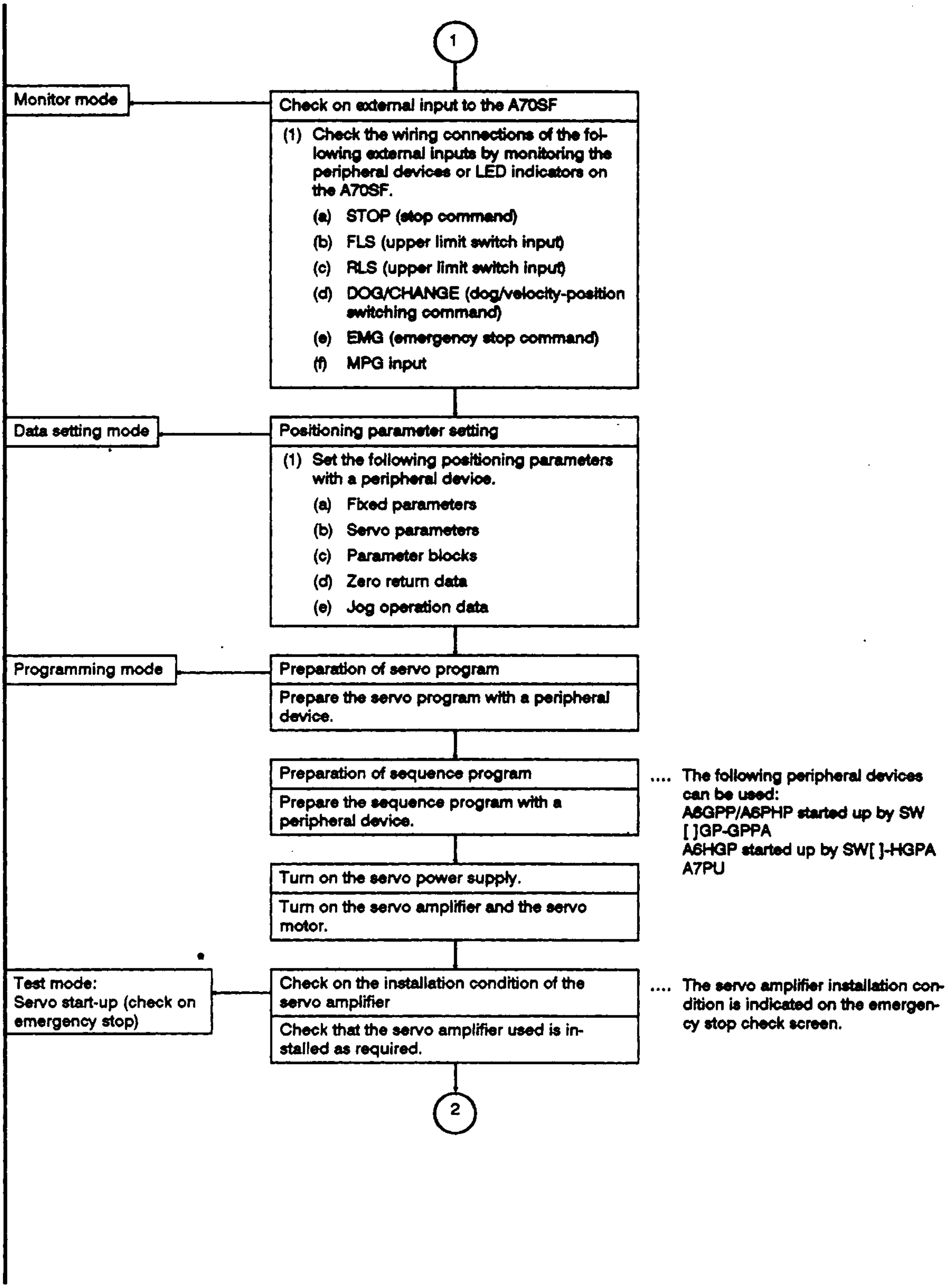
Card setting check

(1) Set the number of the servo amplifier axis to be used.
(2) Select the add-on card.

.... See Section 10.3.

Power-on

Set the A73CPU RUN keyswitch to STOP and turn on the A73CPU.



Monitor mode

Check on external input to the A70SF

(1) Check the wiring connections of the following external inputs by monitoring the peripheral devices or LED indicators on the A70SF.
- (a) STOP (stop command)
- (b) FLS (upper limit switch input)
- (c) RLS (upper limit switch input)
- (d) DOG/CHANGE (dog/velocity-position switching command)
- (e) EMG (emergency stop command)
- (f) MPG input

Data setting mode

Positioning parameter setting

(1) Set the following positioning parameters with a peripheral device.
- (a) Fixed parameters
- (b) Servo parameters
- (c) Parameter blocks
- (d) Zero return data
- (e) Jog operation data

Programming mode

Preparation of servo program

Prepare the servo program with a peripheral device.

Preparation of sequence program

Prepare the sequence program with a peripheral device.

.... The following peripheral devices can be used:
A6GPP/A6PHP started up by SW [ ]GP-GPPA
A6HGP started up by SW[ ]-HGPA
A7PU

Turn on the servo power supply.

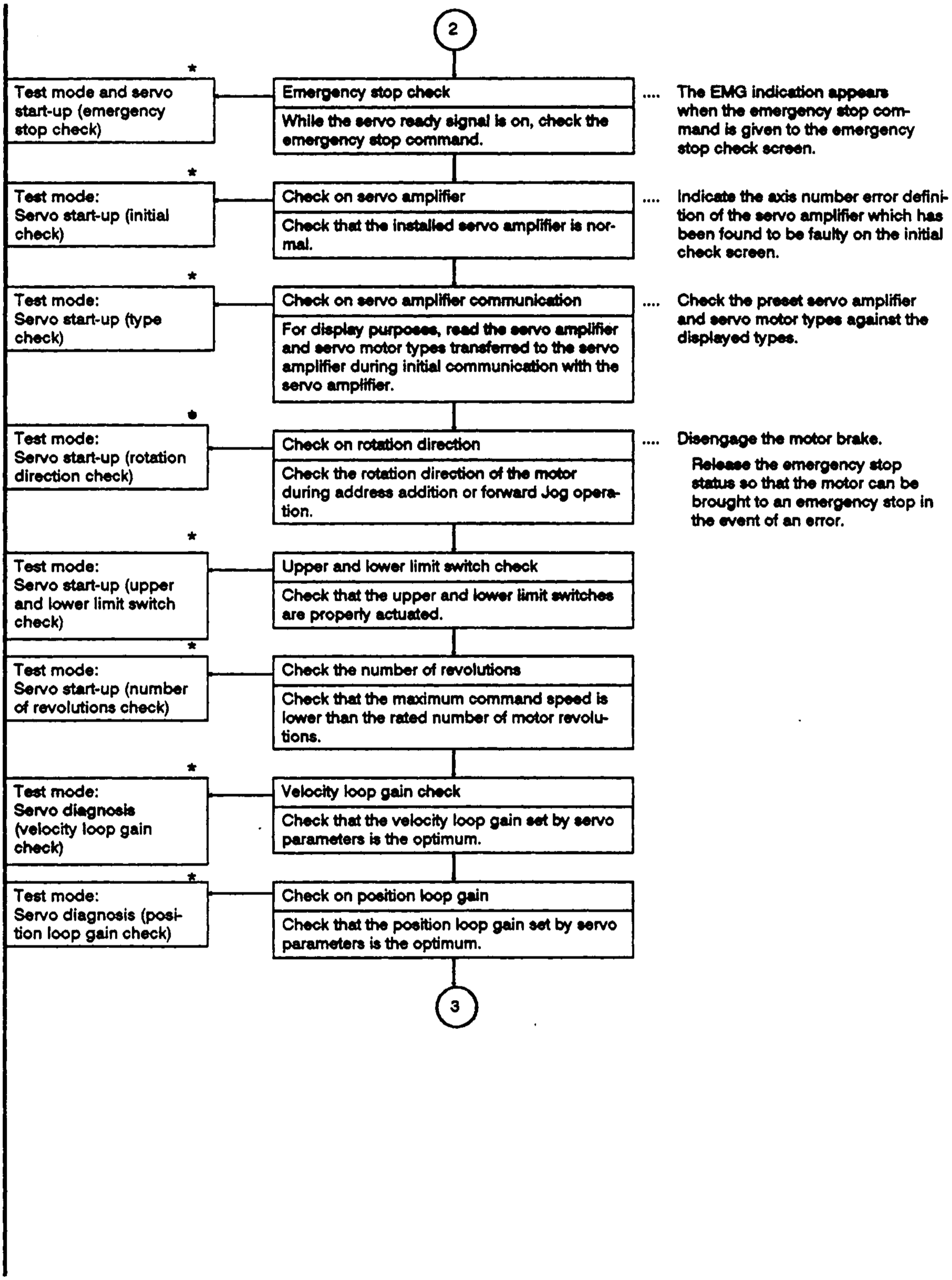
Turn on the servo amplifier and the servo motor.

**Test mode:
Servo start-up (check on emergency stop)**

Check on the installation condition of the servo amplifier

Check that the servo amplifier used is installed as required.

.... The servo amplifier installation condition is indicated on the emergency stop check screen.



* Test mode and servo start-up (emergency stop check)

Emergency stop check
While the servo ready signal is on, check the emergency stop command.

.... The EMG indication appears when the emergency stop command is given to the emergency stop check screen.

* Test mode: Servo start-up (initial check)

Check on servo amplifier
Check that the installed servo amplifier is normal.

.... Indicate the axis number error definition of the servo amplifier which has been found to be faulty on the initial check screen.

* Test mode: Servo start-up (type check)

Check on servo amplifier communication
For display purposes, read the servo amplifier and servo motor types transferred to the servo amplifier during initial communication with the servo amplifier.

.... Check the preset servo amplifier and servo motor types against the displayed types.

* Test mode: Servo start-up (rotation direction check)

Check on rotation direction
Check the rotation direction of the motor during address addition or forward Jog operation.

.... Disengage the motor brake.
Release the emergency stop status so that the motor can be brought to an emergency stop in the event of an error.

* Test mode: Servo start-up (upper and lower limit switch check)

Upper and lower limit switch check
Check that the upper and lower limit switches are properly actuated.

* Test mode: Servo start-up (number of revolutions check)

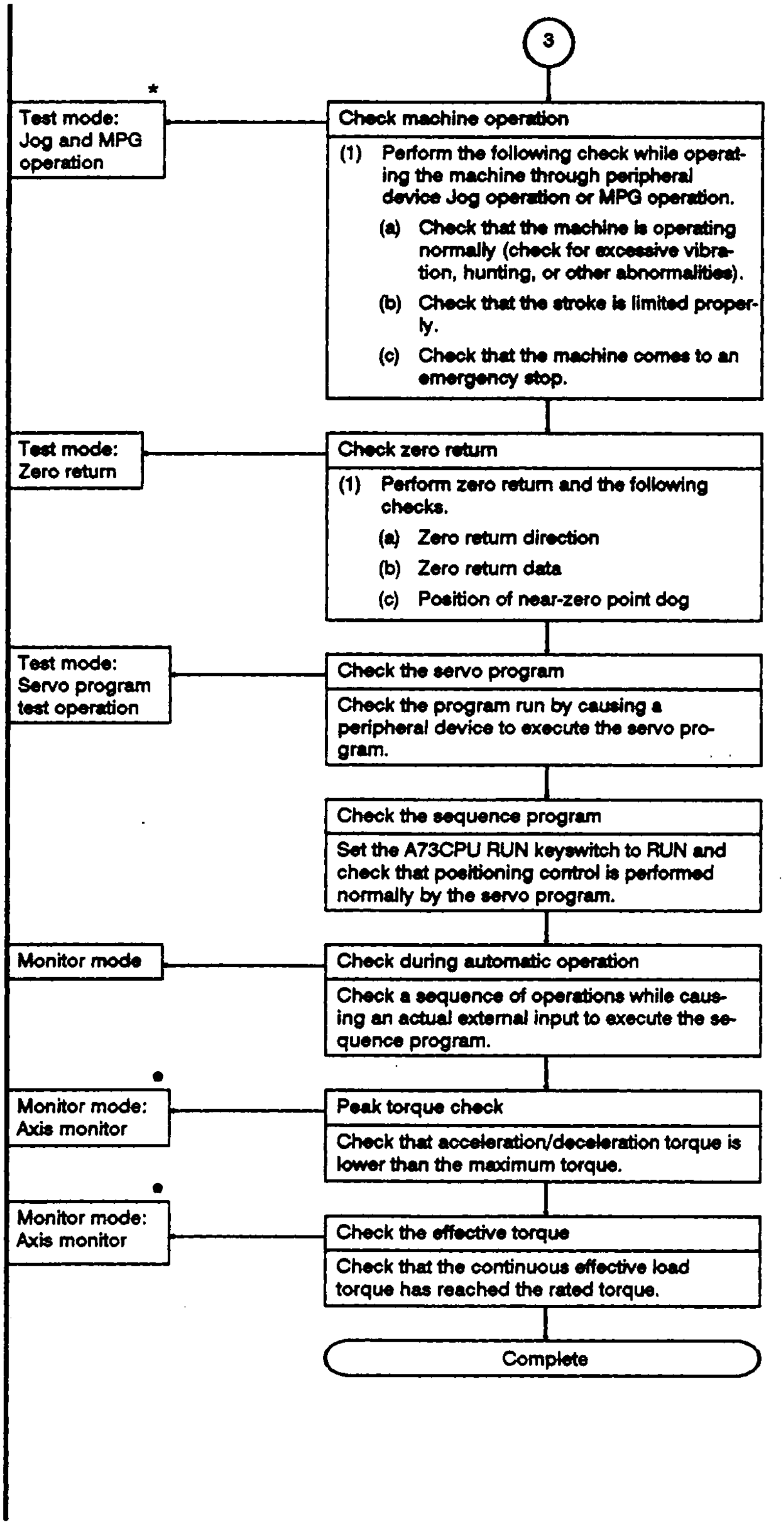
Check the number of revolutions
Check that the maximum command speed is lower than the rated number of motor revolutions.

* Test mode: Servo diagnosis (velocity loop gain check)

Velocity loop gain check
Check that the velocity loop gain set by servo parameters is the optimum.

* Test mode: Servo diagnosis (position loop gain check)

Check on position loop gain
Check that the position loop gain set by servo parameters is the optimum.



Check machine operation

(1) Perform the following check while operating the machine through peripheral device Jog operation or MPG operation.

(a) Check that the machine is operating normally (check for excessive vibration, hunting, or other abnormalities).

(b) Check that the stroke is limited properly.

(c) Check that the machine comes to an emergency stop.

Check zero return

(1) Perform zero return and the following checks.

(a) Zero return direction

(b) Zero return data

(c) Position of near-zero point dog

Check the servo program

Check the program run by causing a peripheral device to execute the servo program.

Check the sequence program

Set the A73CPU RUN keyswitch to RUN and check that positioning control is performed normally by the servo program.

Check during automatic operation

Check a sequence of operations while causing an actual external input to execute the sequence program.

Peak torque check

Check that acceleration/deceleration torque is lower than the maximum torque.

Check the effective torque

Check that the continuous effective load torque has reached the rated torque.

10.3 Axis Number Setting

The A73CPU is capable of controlling a total of 8 axes for an MR-SB and a general-purpose servo amplifier.

During positioning control, all the axes are controlled on an axis number basis.

The method of setting the axis number for the MR-SB and the general-purpose servo amplifier is described below.

(1) MR-SB

Connect 2 MR-SB systems, each consisting of 4 axes, to the A70SF.

When the axis number switch is set from 0 to 3 in either system, the MR-SB switch setting represents axes 1 to 4 or axes 5 to 8 when the A70SF connector is connected. The axis number can be set without regard to the connecting order of servo amplifiers.

However, the axis number set for one MR-SB amplifier should not be the same as those set for another MR-SB amplifier connected to the same connector. If the same axis number is set, that axis will not function.

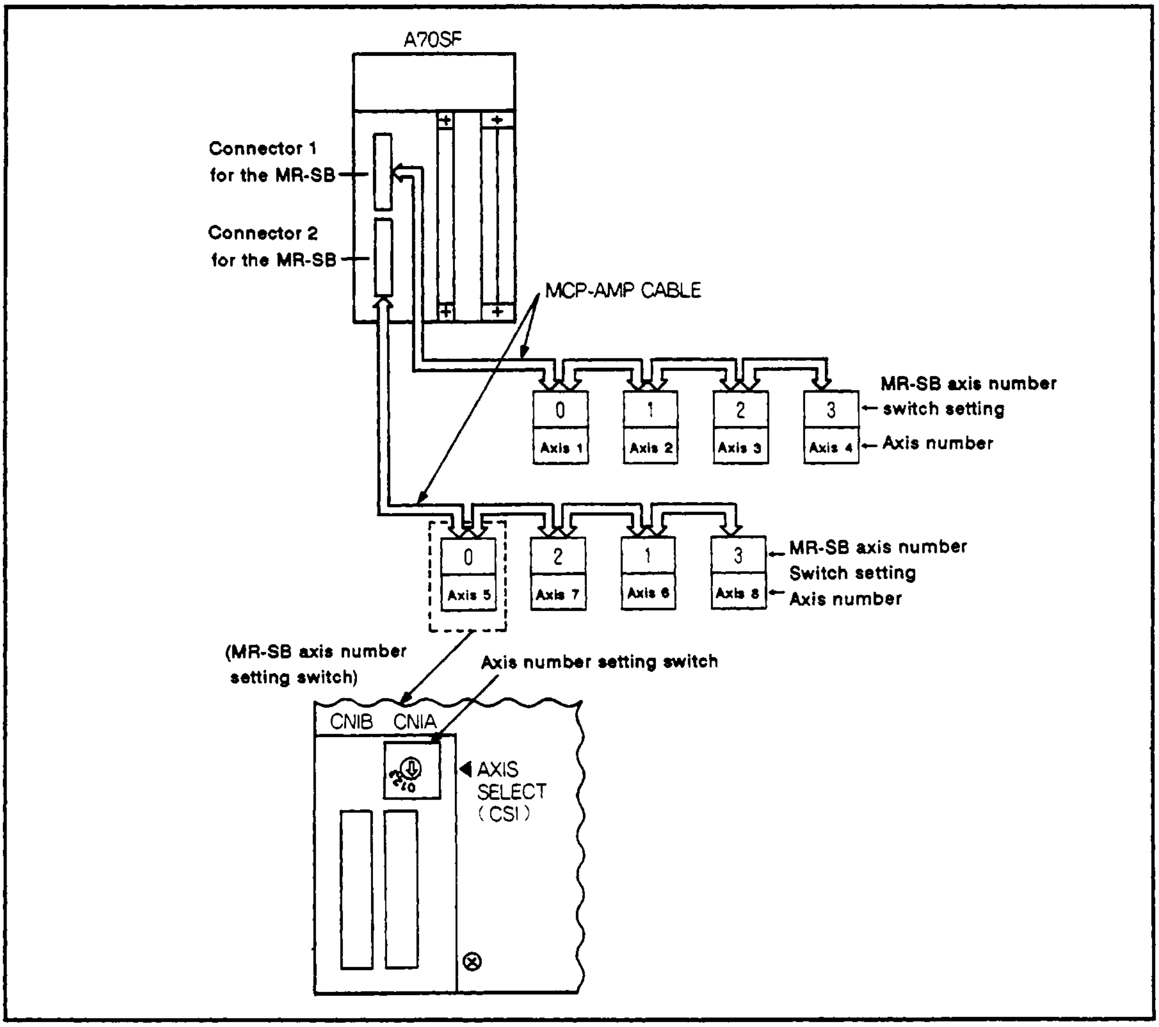


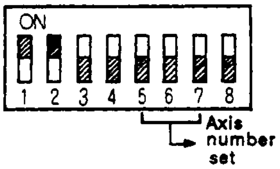
Fig. 10.1 MR-SB Axis Number Setting

(2) General-purpose Servo Amplifier

The general-purpose servo amplifier is connected to the A70AF on a one-to-one basis.

When the axis number is set, use slide switches 5 to 7 on the A70AF so that axes 1 to 8 can be set. The axis number can be set without regard to the loading order of the A70AF.

The axis number set by the general-purpose servo amplifier should not be the same as that set by the general-purpose servo amplifier connected to the same connector. If the same axis number is set, that axis will not function.

Slide Switch		Axis Number Setting							
		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
	SW5	OFF	ON	OFF	ON	OFF	ON	OFF	ON
	SW6	OFF	OFF	ON	ON	OFF	OFF	ON	ON
	SW7	OFF	OFF	OFF	OFF	ON	ON	ON	ON

(3) When an MR-SB and a general-purpose servo amplifier are used together

When an MR-SB and a general-purpose servo amplifier are used together, a total of 8 axes can be used and axes 1 to 8 can be selected through axis number setting.

The axis number set by the MR-SB should not be the same as that set by the general-purpose servo amplifier.

If the same axis number is set, the following condition will exist:

(a) The axis number which is set at the same time by two MR-SB amplifiers or by two A70AF interfaces will not function.

(b) When the axis number set by the MR-SB is the same as that set by the general-purpose servo amplifier, the servo amplifier that has been set with parameters will function.

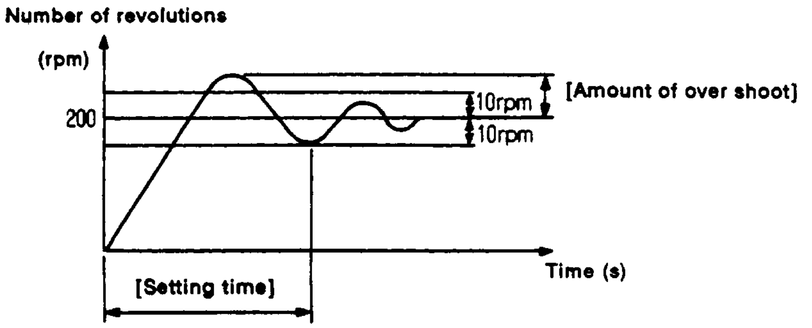
10.4 Servo Diagnosis

The term 'servo diagnosis' means checking, at the peripheral device, whether the velocity and position loop gain values are optimum to the load connected to the servo motor.

Servo diagnosis can only be performed when the MR-SB servo amplifier is in use.

(1) Velocity loop gain check

(a) During velocity loop gain check, the responsibility and stability of the servo motor are diagnosed by checking the settling time (response time) and the amount of overshoot which are measured when the motor rotates 1.6 turns in response to the number of revolutions (200 rpm) command from the A73CPU.



(1) The amount of overshoot is determined by the following equation:

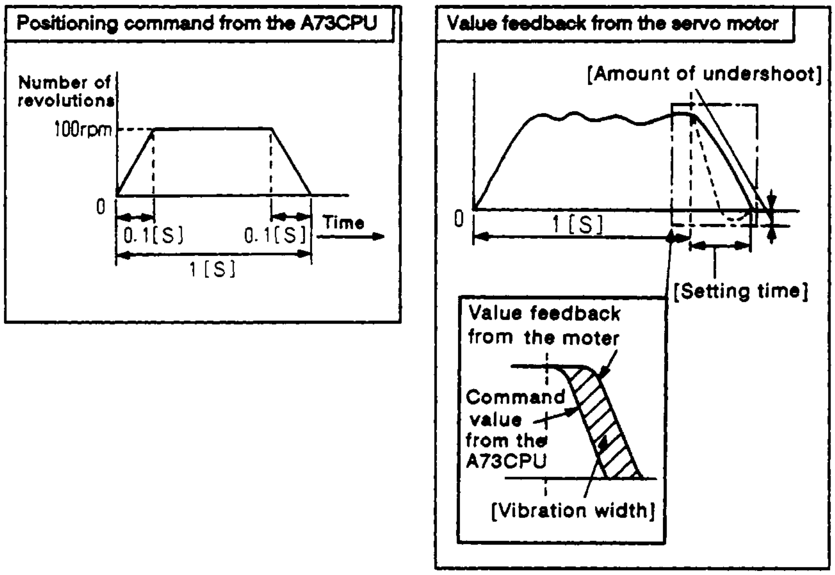
$$(\text{Amount of overshoot}) = \frac{(\text{Maximum number of revolutions}) - 200}{200} \times 100\ [\%]$$

(2) Here 'settling time' means the time taken for the number of revolutions to reach 200 rpm ±10 rpm.

Fig. 10.2 Velocity Loop Gain Check

(2) Position loop gain check

During the position loop gain check, the responsibility and stability of the servo motor are diagnosed by checking the amount of undershoot feedback in response to the positioning command from the A73CPU, settling time (response time), and vibration width (number of pulses accumulated in the error counter).



(1) The amount of undershoot is determined by the following equation:

$$\text{(Amount of undershoot)} = \frac{\text{Max. number of revolutions in reverse from stop}}{100}$$

(2) Here 'settling time' means the elapsed time (in ms) from the moment the command value reaches zero to the moment the motor comes to a stop.

(3) The vibration width indicates the number of accumulated pulses.

Fig. 10.3 Position Loop Gain Check

10.5 Self-diagnosis

(1) In self-diagnosis, the A73CPUP21/R21 hardware, fiber optic cable, and coaxial cable are checked for broken wires. Any of the following checks can be selected by changing the mode select switch position.

Switch Position	Mode Designation	Description
3	Forward loop test mode	In this mode, the fiber optic cable or coaxial cable line of the entire data link system is checked. The forward loop side on which normal linking is performed is checked.
4	Reverse loop test mode	In this mode, the fiber optic cable or coaxial cable line of the entire data link system is checked. The reverse loop side, on which loopback is performed in the event of an error, is checked.
5	Station-to-station test mode (main station)	In this mode, the line connecting the two stations is checked. Before checking, the station with the smaller station number is designated as the main station; the other is the subordinate station.
6	Station-to-station test mode (subordinate station)	
7	Self-loopback test mode	In the self-loopback test, the hardware containing the transmission and receiving circuits is checked on an individual link unit basis.

(2) For tests other than the self-loopback test, see the MELSECNET Data Link System Reference Manual.

10.5.1 Self-loopback test

(1) Self-loopback test

(a) The self-loopback test is intended to check the link unit hardware containing the transmission and receiving circuits (forward and reverse loops) on an individual link unit basis.

(b) A distinction between normal and faulty conditions is made depending on whether the data sent from the send end can be received within the specified duration at the receive end of the forward and reverse loops.

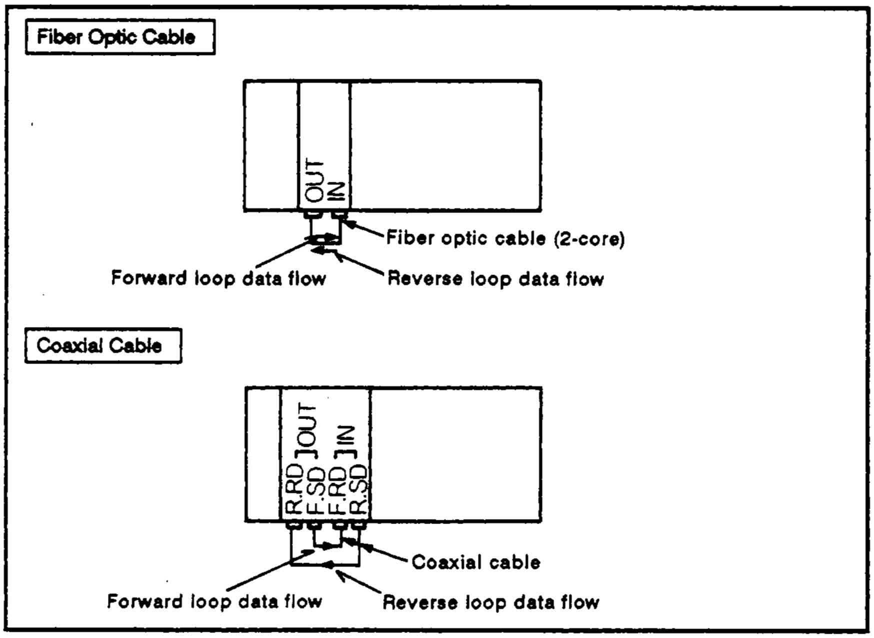
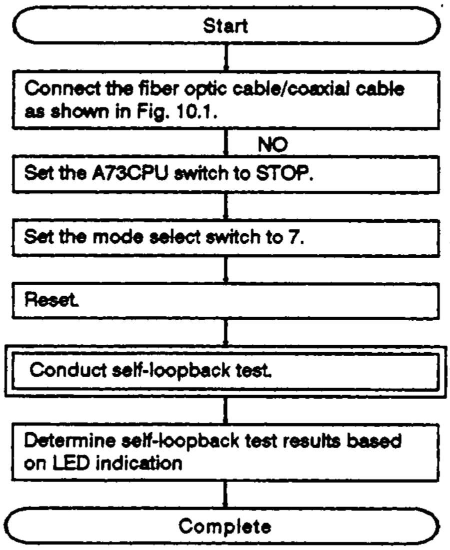


Fig. 10.4 Self-loopback Test

(2) Testing method

The self-loopback test procedure is given below.



.... Self-loopback test is selected.

.... Conduct self-loopback test about 7 sec. after reset.

(3) Judgment on test results

The test results are indicated by the LEDs on the A73CPUP21/R21 front panel.

(a) When the results are normal:

The CRC, OVER, AB.IF, TIME, DATA, and UNDER LEDs successively turn on and off.

(b) When the results are abnormal:

The LED indicating the error in question lights and the test is discontinued.

1) When the F.LOOP, R.LOOP, and TIME LEDs are lit:

  i) The forward loop cable is broken.

  ii) The forward loop send side and receive side are not connected.

  iii) The forward loop send side is connected with the reverse loop send side and the reverse loop receive side is connected with the forward loop receive side.

2) When the F.LOOP, R.LOOP, and DATA LEDs are lit:

  i) The reverse loop cable is broken.

  ii) The reverse loop send side and receive side are not connected.

3) When the ERROR LEDs other than those mentioned in items (1) and (2) are lit:

  i) The hardware is faulty.

  ii) The cable was disconnected during testing.

  iii) The cable was broken during testing.

11. MAINTENANCE AND INSPECTION

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

11.1 Daily Inspection

Table 11.1 shows the inspection items which are to be checked daily.

Table 11.1 Daily Inspection

No.	Check Item		Check Point	Judgment	Corrective Action
1	Base unit mounting conditions		Check for loose mounting screws and cover.	The base unit should be securely mounted.	Retighten screws.
2	Mounting conditions of I/O module, etc.		Check if the module is disengaged or the hook is securely engaged.	The hook should be securely engaged and the module should be positively mounted.	Securely engage the hook.
3	Connecting conditions		Check for loose terminal screws.	Screws should not be loose.	Retighten terminal screws.
			Check distance between solderless terminals.	Proper clearance should be provided between solderless terminals.	Correct.
			Check connectors of extension cable.	Connections should not be loose.	Retighten connector mounting screws.
4	CPU module indicator lamps	"POWER" LED	Check that the LED is on.	On. (Off indicates an error.)	See Section 12.2.2.
		"RUN" LED	Check that the LED is on during run.	On. (Off or flicker indicates an error.)	See Section 12.2.3 and 12.2.4.
		Input LED	Check that the LED turns on and off.	On when input is on. Off when input is off. (Any discrepancy from the above indicates an error.)	See Section 12.2.5.
		Output LED	Check that the LED turns on and off.	On when input is on. Off when output is off. (Any discrepancy from the above indicates an error.)	See Section 12.2.5.

REMARKS

To change any I/O module during PC operation, see Section 2.2.8 "Online I/O module replacement" (see the A73CPU Reference Manual).

11.2 Periodic Inspection

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

Table 11.2 Periodic Inspection

No.	Check Item		Check Method	Judgment	Corrective Action
1	Ambient environment	Ambient temperature	Measure with thermometer and hygrometer. Measure corrosive gas.	0 to 55°C	When PC is used inside a panel, the temperature in the panel is ambient temperature.
		Ambient humidity		10 to 90% RH	
		Atmosphere		There should be no corrosive gases.	
2	Line voltage check		Measure voltage across 100/200 VAC terminal.	85 to 132 V 170 to 264 VAC	Change supply power. Change transformer tap.
3	Mounting conditions	Looseness, play	Try to move the unit.	The module should be mounted securely and positively.	Retighten screws. For CPU, I/O, and power supply modules check all connections.
		Adhesion of dust or foreign material	Visual check	There should be no dust or foreign material, in the vicinity of the P.C.	Remove and clean.
4	Connecting conditions	Loose terminal screws	Retighten.	Connectors should not be loose.	Retighten.
		Distances between solderless terminals.	Visual check.	Proper clearance should be provided between solderless terminals.	Correct.
		Loose connector	Visual check	Connectors should not be loose.	Retighten connector mounting screws.
5	Battery		Check battery status by monitoring special auxiliary relays M9006 and M9007. Replace battery if necessary.	Preventive maintenance	If battery capacity reduction is not indicated, change the battery when specified service life is exceeded.
6	Fuse		Check fuses.	Preventive maintenance	Change the fuse periodically due to rush current.

11.3 Replacement of Battery

M9006 or M9007 turns on when the voltage of battery for program backup and power failure compensation reduces.

Even if this special relay turns on, the contents of the program and power failure compensation are not lost immediately.

However, if the ON state is overlooked, the PC contents may be lost.

Special auxiliary relays M9006 and M9007 are switched on to indicate that the battery life has reduced to the time (minimum) indicated in Table 11.3 and it must be replaced if continued power failure RAM and/or data back-up is required.

The following sections gives the battery service life and the battery changing procedure.

11.3.1 Service life of battery

This service life of the battery depends on the capacity of the memory. Table 11.3 shows service life according to memory.

Table 11.3 Battery Life

Battery Life / Memory Cassette Type	Battery Life (Total power failure time) [Hr]		
	Guaranteed Value (Min.)	Actually Applied Value (Typ)	After M9006, M9007 has turned on.
A3NMCA-0	4100	10250	168
A3NMCA-2	4100	10250	168
A3NMCA-4	3410	8525	168
A3NMCA-8	3410	8525	168
A3NMCA-16	2600	6500	168
A3NMCA-24	2140	5350	168
A3NMCA-40	1400	3500	168
A3NMCA-56	450	1125	168

- The actually applied value indicates a typical value and the guaranteed value indicates the minimum value.

Preventive maintenance is as described below.

(1) Even if the total power failure time is less than the guaranteed value in the above table, change the battery after four to five years.

(2) When the total power failure time has exceeded the guaranteed value in the above table and M9006 has turned on, change the battery.

11.3.2 Battery changing procedure

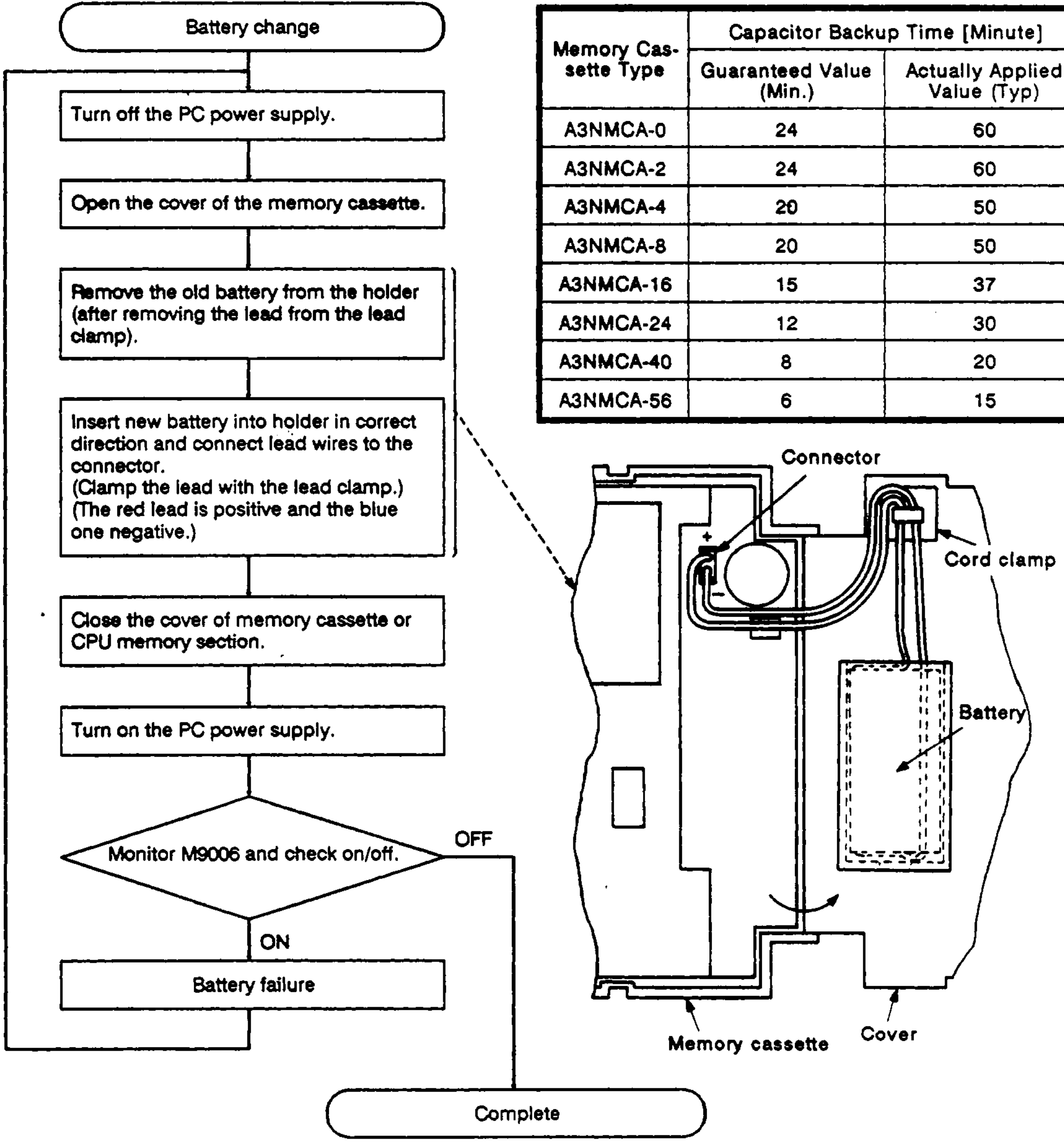
When the service life of the battery has expired, change the battery using the following procedure.

Even if the battery is removed, the memory is backed by a capacitor for some time.

However, if the changing time exceeds the guaranteed value shown in the following table, the contents of the memory may be lost. Therefore, change the battery as fast as possible.

Table 11.4 Backup Time by Capacitor

Memory Cassette Type	Capacitor Backup Time [Minute]	
	Guaranteed Value (Min.)	Actually Applied Value (Typ)
A3NMCA-0	24	60
A3NMCA-2	24	60
A3NMCA-4	20	50
A3NMCA-8	20	50
A3NMCA-16	15	37
A3NMCA-24	12	30
A3NMCA-40	8	20
A3NMCA-56	6	15

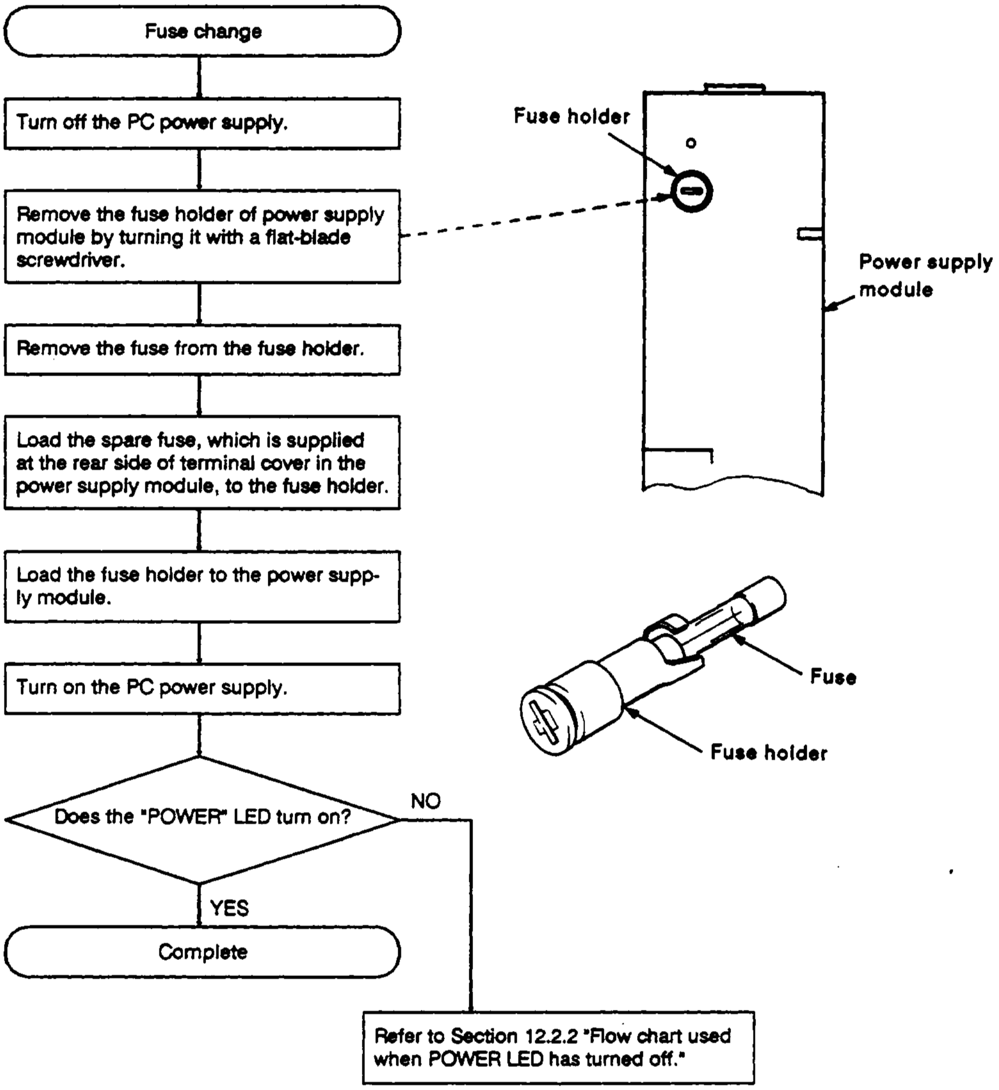


11.4 Replacement of Fuse

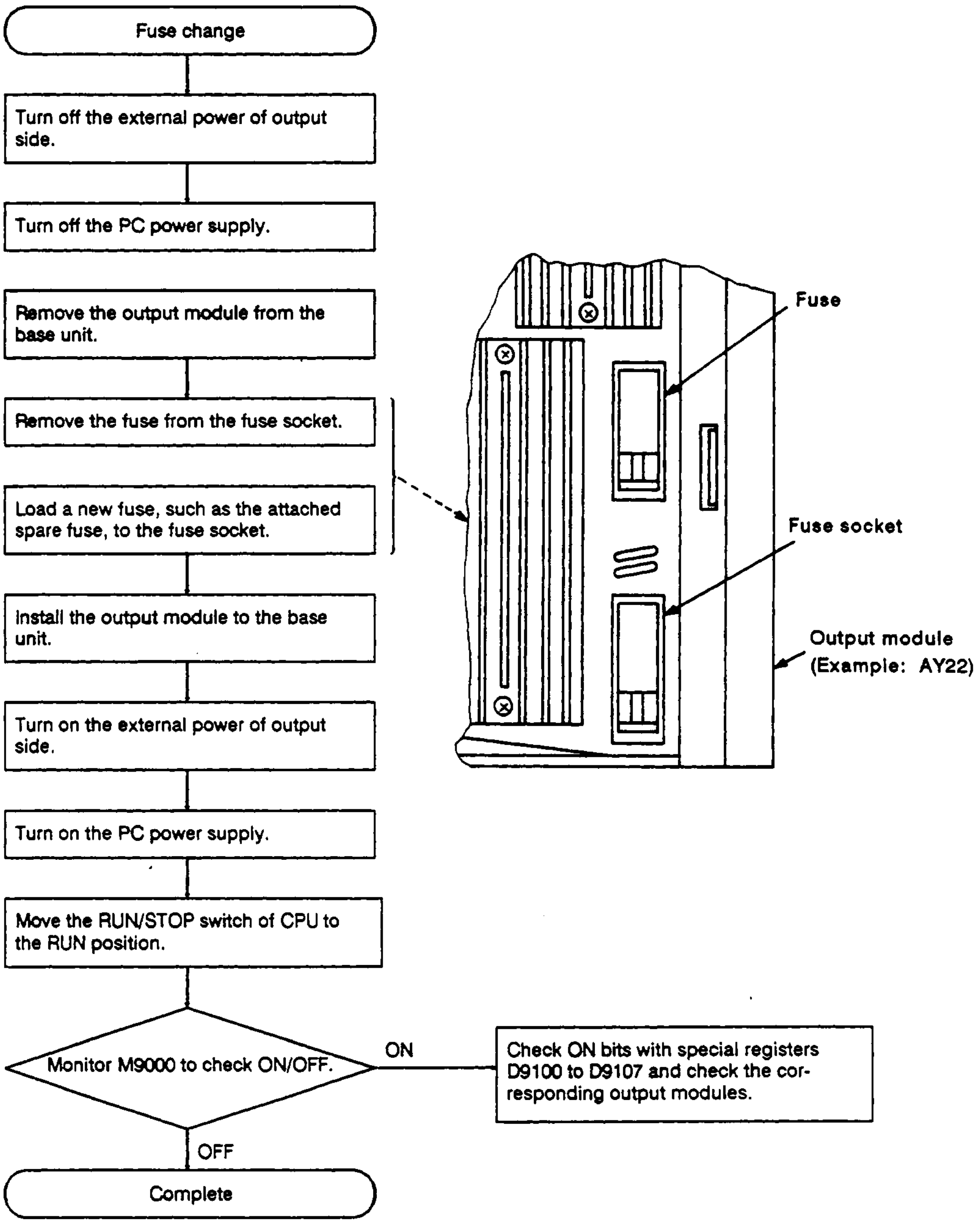
Even if the fuse does not blow, its element may be consumed due to rush current. Therefore, it is recommended to change the fuse periodically.

11.4.1 Replacement of fuse for power supply

The fuse changing procedure is explained.



11.4.2 Replacement of fuse for output module



12. TROUBLESHOOTING

This section describes various procedures for establishing the nature of any faults, and corrective action.

12.1 Basic Troubleshooting

System reliability depends not only on reliable equipment but also on short down-time in the event of faults.

The basic points to be kept in mind in troubleshooting are the following three.

(1) Visual checks

Check the following points.

- (a) Machine motions (in stop and operating statuses)
- (b) ON or OFF of power
- (c) Status of I/O equipment
- (d) Conditions of wiring (I/O wires, cables)
- (e) Display states of various indicators (such as POWER LED, RUN LED, and I/O LED)
- (f) States of various setting switches (such as extension base and power failure compensation)

After checking (a) to (f), connect the peripheral device and check the running status of PC and the contents of program.

(2) Trouble check

Observe any changes in the error condition with the following procedure.

- (a) Set the RUN key switch to the "STOP" position.
- (b) Perform reset by the RESET key switch.
- (c) Turn the power on and off.

(3) Narrow down the possible causes of the trouble

Deduce where the fault lies i.e:

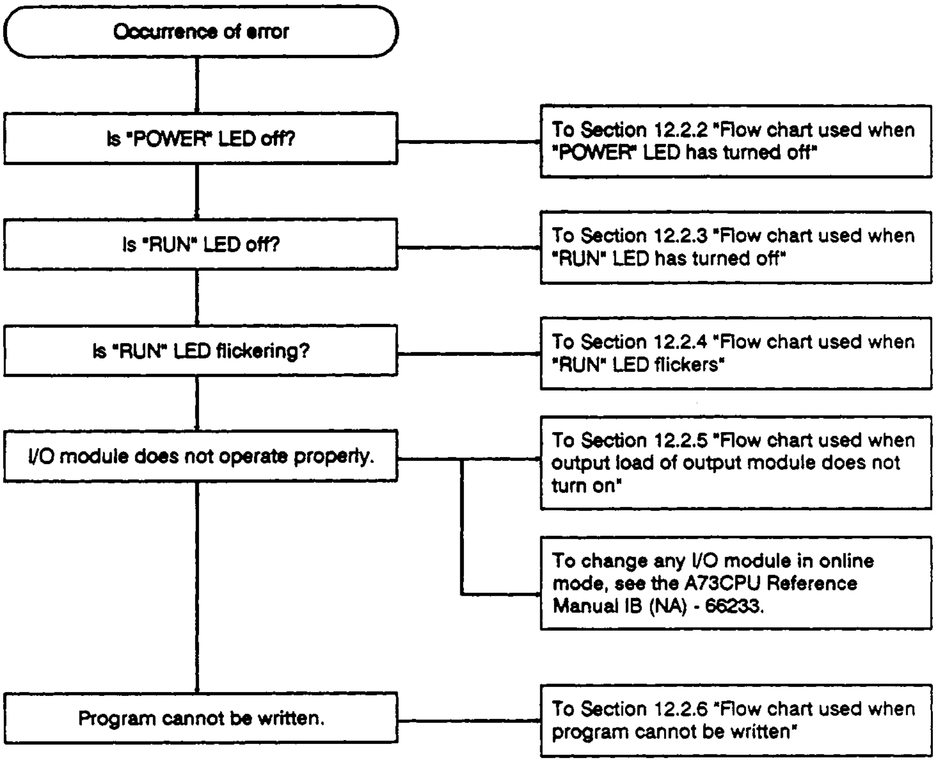
- (a) Inside or outside of PC.
- (b) I/O module or another module.
- (c) Sequence program.

12.2 Troubleshooting

This section explains the procedure for determining the cause of problems and the errors and corrective actions for error codes.

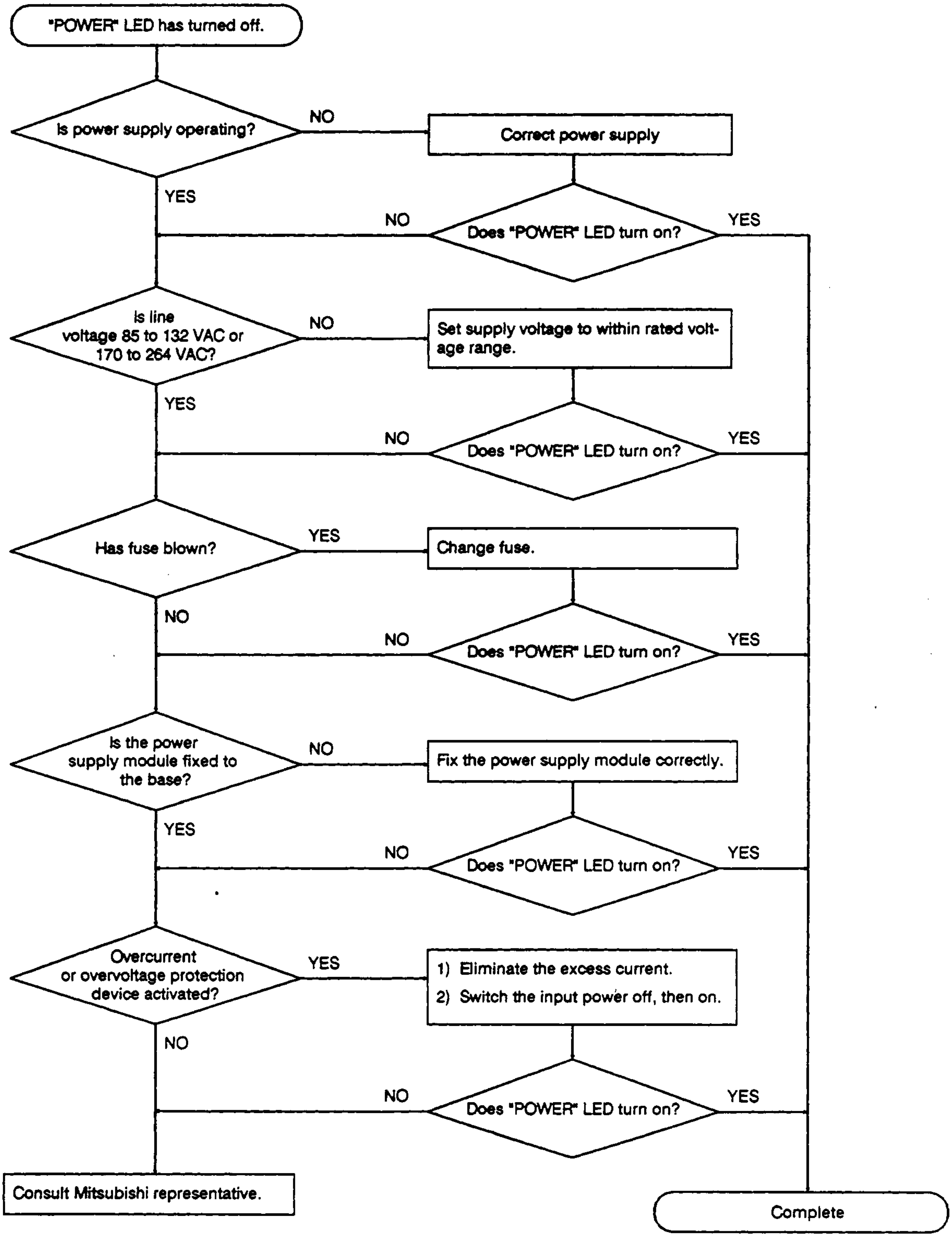
12.2.1 Troubleshooting flow chats

Details for fault finding may be found as follows:



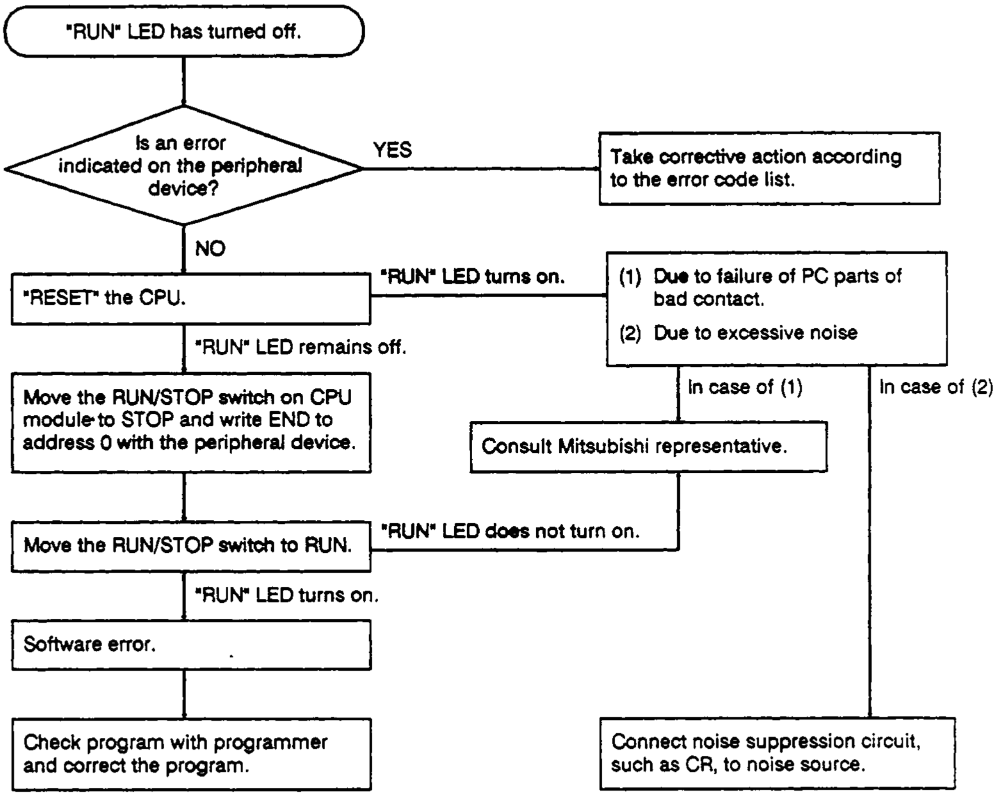
12.2.2 Flow chart used when "POWER" LED has turned off

The flow chart below shows the procedure for when the POWER LED turns off during operation or when the power is turned on.



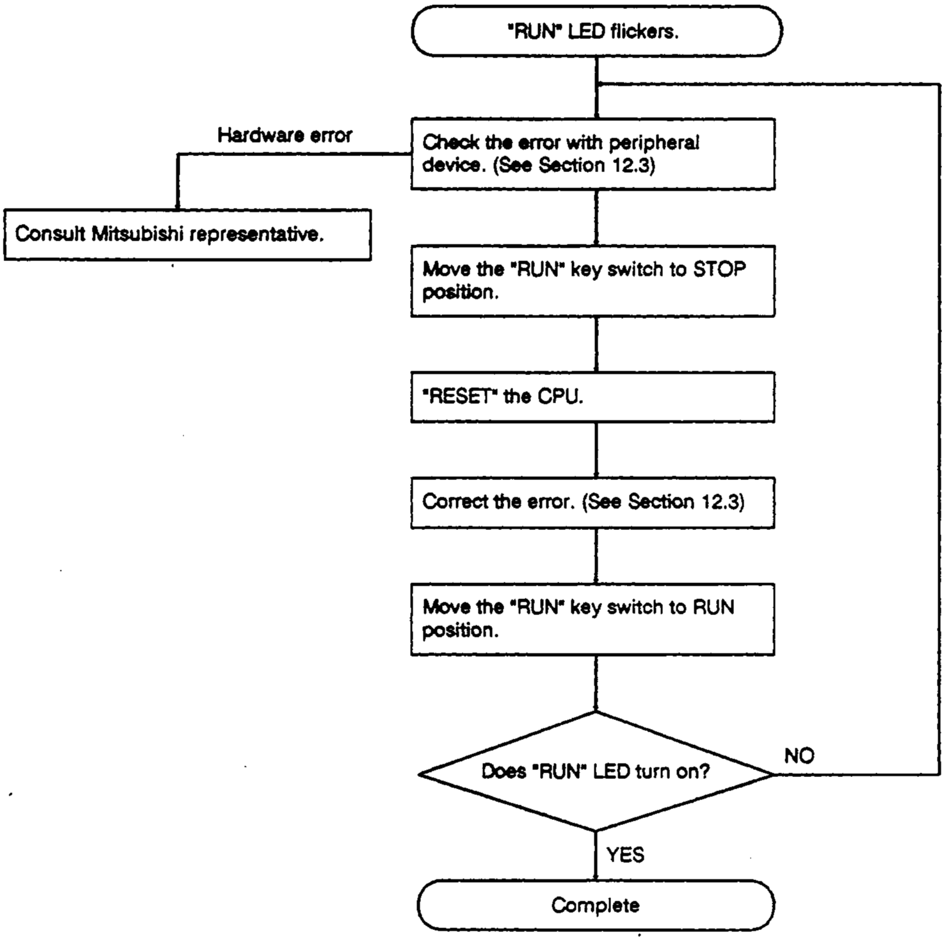
12.2.3 Flow chart used when "RUN" LED has turned off

The flow chart below shows the procedure for when the RUN LED turns off during operation.



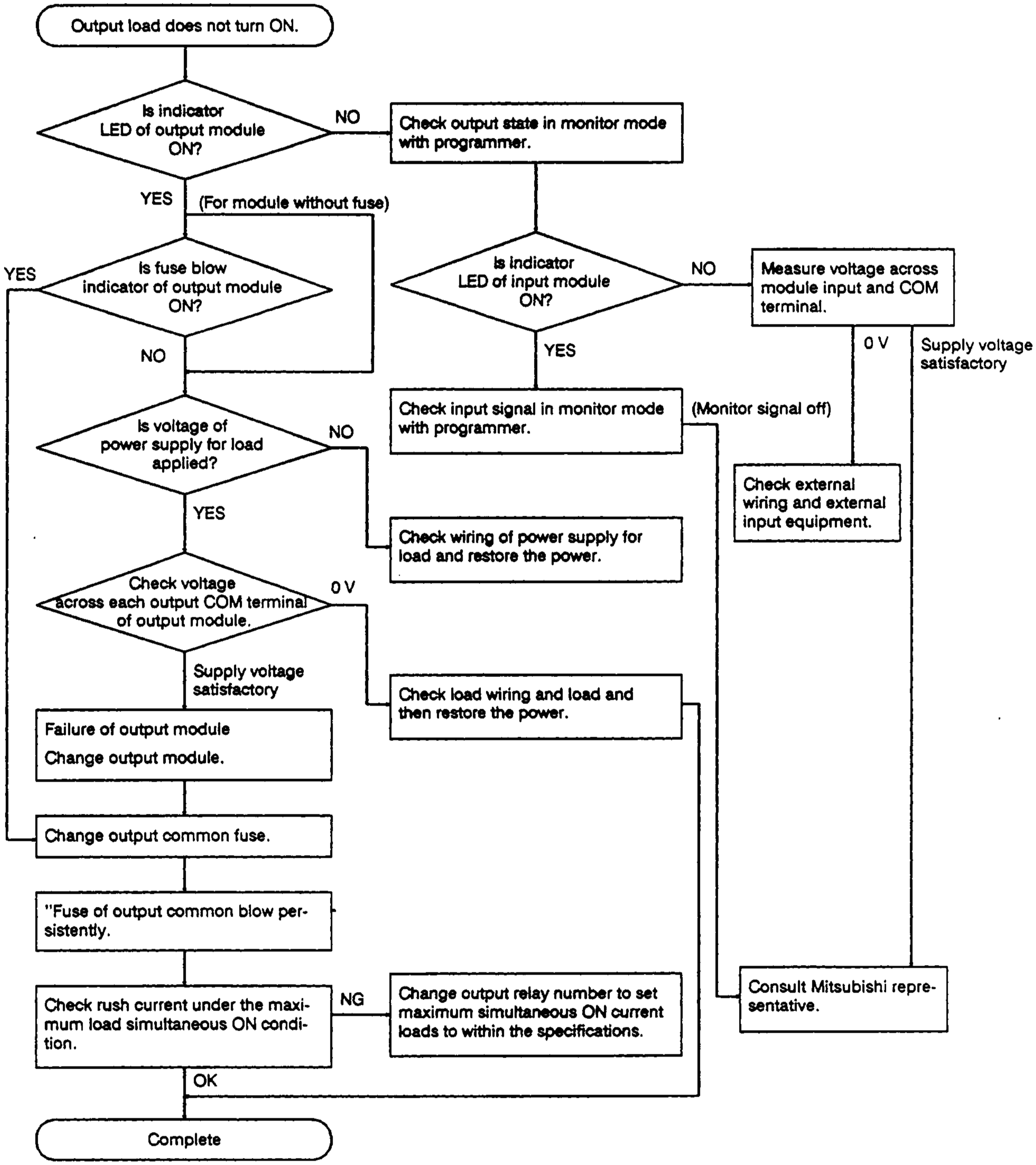
12.2.4 Flow chart used when "RUN" LED flickers

The flow chart below shows the procedure for when the RUN LED flickers when the power is turned on, when operation is started or during operation.



12.2.5 Flow chart used when output load of output module does not turn on

The flow chart below shows the procedure for when the output load of an output module does not turn ON during operation.

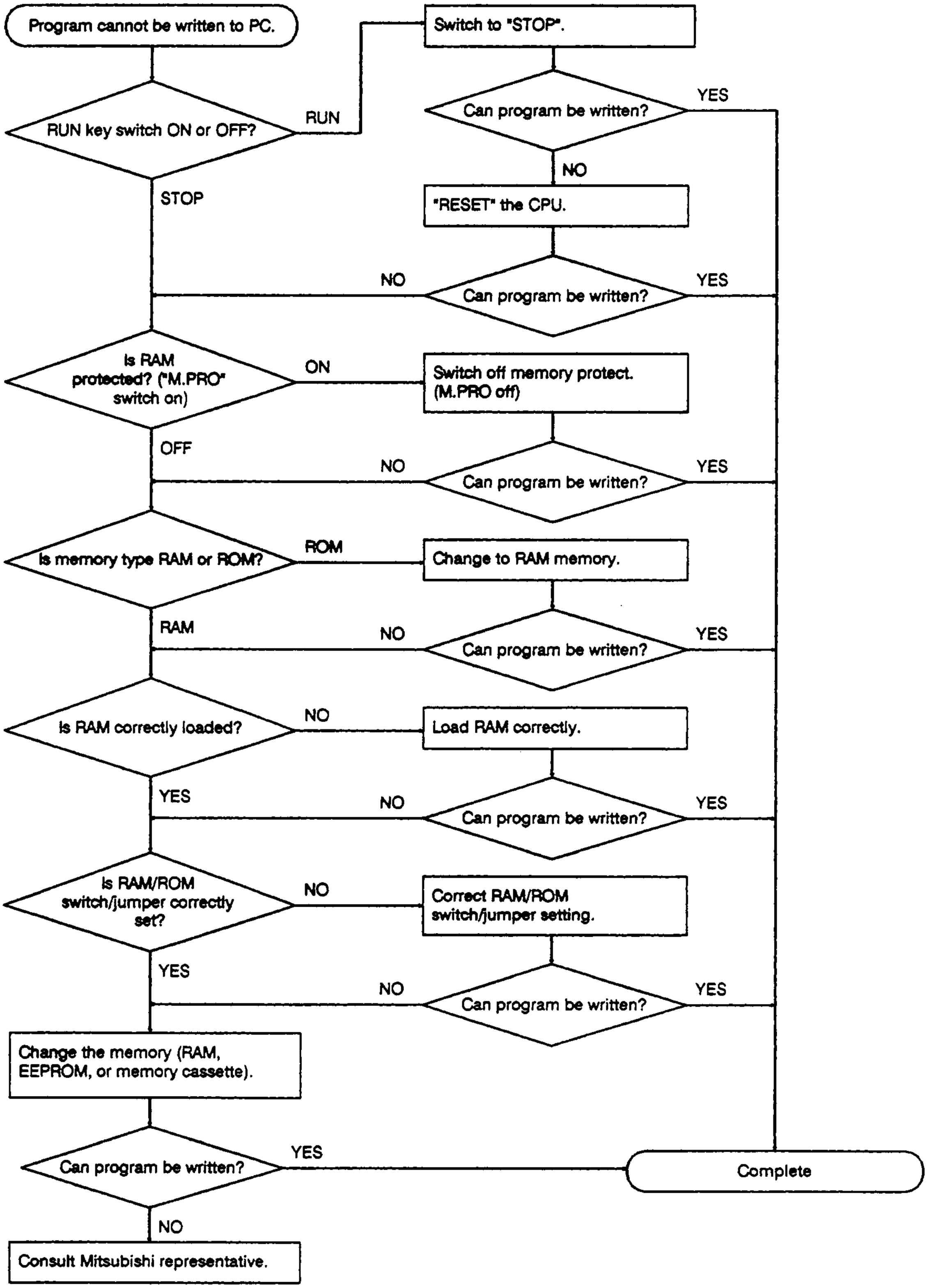


POINT

If the input signal or load is not switched off, see Section 12.4.

12.2.6 Malfunction in program down load to PC

The flow chart below shows the procedure for when a program cannot be written to the CPU.



12.3 I/O Connection Troubleshooting

This section explains possible problems with I/O circuits.

12.3.1 Input wiring troubleshooting

This section describes possible problems with the input circuit and corrective actions.

Table 12.1 Input Circuit Troubles and Corrective Actions

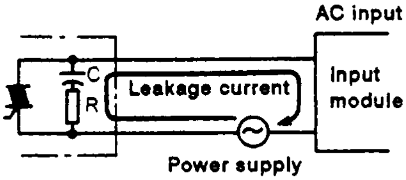
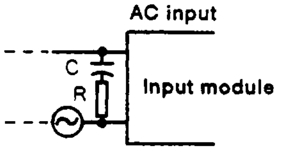
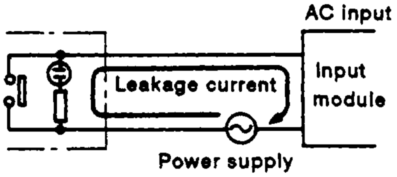
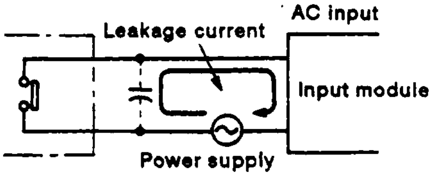
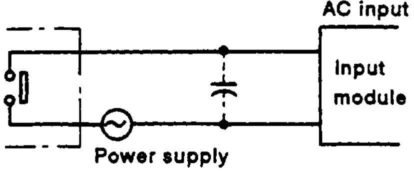
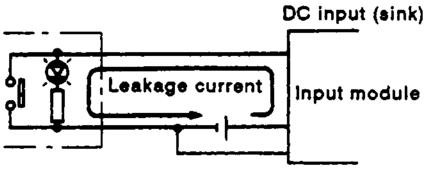
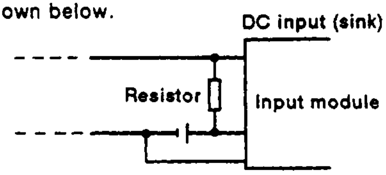
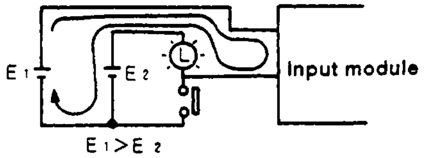
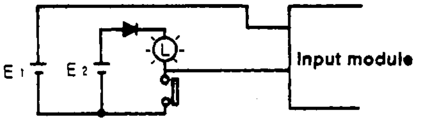
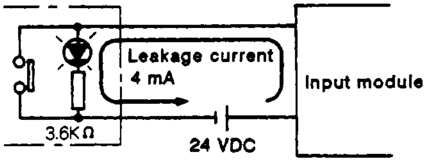
Example	Condition	Cause	Corrective Action
1	Input signal does not turn off.	Leakage current of input switch (such as drive by non-contact switch).  	Connect an appropriate register which will make the voltage across terminals of input module lower than OFF voltage value.  It is recommended to use 0.1 to 0.47 μF + 47 to 12 Ω (1/2 W) for the constant of CR.
2	Input signal does not turn off.	• Drive by a limit switch with neon lamp.  	Same as Example 1. Or make up another independent display circuit.
3	Input signal does not turn off.	Leakage current due to line capacity of wiring cable. Line capacity C of twisted pair wire is approx. 100 PF/m (39.37 in).  	Same as Example 1. However, leakage current is not generated when power supply is located on the input equipment side as shown below. 
4	Input signal does not turn off.	* Drive by switch with LED indicator.  	Connect a resistor which will make the voltage across input unit terminal and common higher than OFF voltage, as shown below.  The calculation example of connected resistor value is shown on the following page.

Table 12.1 Input Circuit Troubles and Corrective Actions (Continued)

Example	Condition	Cause	Corrective Action
5	Input signal does not turn off.	Sneak path due to the use of two power supplies.  	Use only one power supply. Connect a sneak path prevention diode. (Figure below) 

Calculation example for Example 4

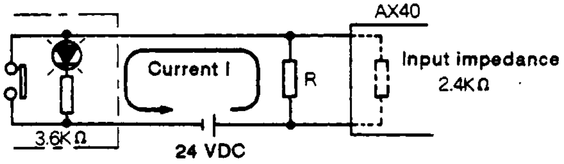


The switch with LED indicator is connected to AX40 and there is 4 mA leakage current.

- The voltage V_{TB} across terminal and common is obtained by the following expression:

  V_{TB} = 4 [mA] x 2.4 [kΩ] = 9.6 [V]
  (The voltage drop of LED is ignored.)

  Since this voltage does not satisfy the OFF voltage of 6 [V] or lower, the input signal does not turn off. Therefore, connect a resistor as shown below.



- Calculate the resistor value, R, as shown below:
  For an input voltage 6V, current I must be:

  (24 - 6 [V]) ÷ 3.6 [kΩ] = 5 mA

  Resistor R must be selected to give a current I 5 mA.

- Hence, for resistor, R

  6 [V] ÷ R > 5 - 2.5 [mA]
  6 [V] ÷ 2.5 [mA] > R
  2.4 [kΩ] > R

  For R = 2kΩ, the power capacity must be:

  W = (applied voltage)^2/R (or W = (maximum current)2 x R)

  Resistor R terminal voltage is:

  $$\frac{2.4 \times 2}{2.4+2}\,[\mathrm{k}\Omega] : \frac{2.4 \times 2}{2.4+2} + 3.6\,[\mathrm{k}\Omega] = x : 24\,[\mathrm{V}]$$
  $$x = 5.58\,[\mathrm{V}]$$

  Therefore, the power capacity W or resistor R is

  W = (5.58 [V])^2/2 [kΩ] = 0.015 [W]

- Use a safety factor of 3 to 5. Resistor should therefore be rated at 0.5 to 1 W. A 2 kΩ, 0.5 to 1 W resistor should therefore be connected across the relevant input terminal and its COM.

12.3.2 Output circuit problems and corrective action

This section described possible problems with the output circuit and corrective actions to be taken.

Table 12.2 Output Circuit Failures and Corrective Actions

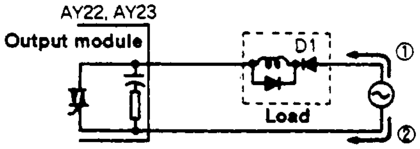
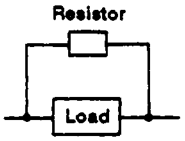
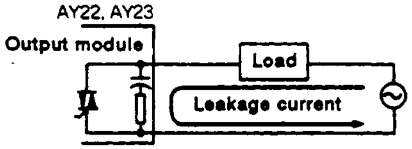
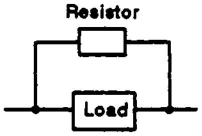
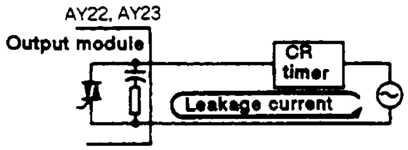
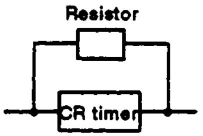
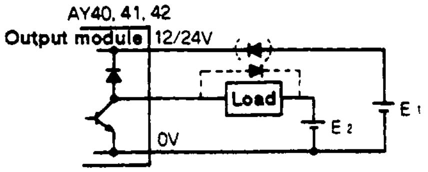
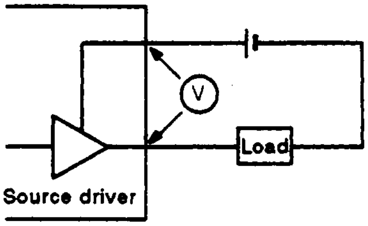
Example	Condition	Cause	Corrective Action
1	When output is off, excessive voltage is applied to load.	Load is half-wave rectified inside (seen in some solenoids).  When the polarity of power supply is as shown by (1), C is charged. When the polarity is as shown by (2), voltage charged in C plus line voltage are applied across D1. Max. voltage in approx. 2.2 E.	Connect a resistor of several ten kΩ to several hundred kΩ across the load. If a resistor is used in this way, it does not pose problem to output element but may sometimes cause the diode, which is built in the load, to deteriorate, resulting in burning etc. 
2	Load does not turn off. (Triac output)	Leakage current due to built-in noise suppression  	Connect C and R across the load. When wiring distance from output card load is long, there may be a leakage current due to the line capacity. 
3	When load is C-R type timer, time constant fluctuates. (Triac output)	 	After driving the relay, drive the C-R type timer by the same contact. Some timers have half-wave rectified internal circuits. Therefore, take precautions as indicated in Example 1.  Calculate the CR constant depending on the load.
4	Load does not turn off. (For direct current)	• Sneak path due to the use of two power supplies.  • When E1 < E2, sneak path occurs.	• Reduce the power supplies from two to one. • Connect a sneak path prevention diode. When the load is a relay or similar device, it is necessary to connect a reverse-voltage absorbing diode to the load. (Shown by the dotted line in the figure on the left)

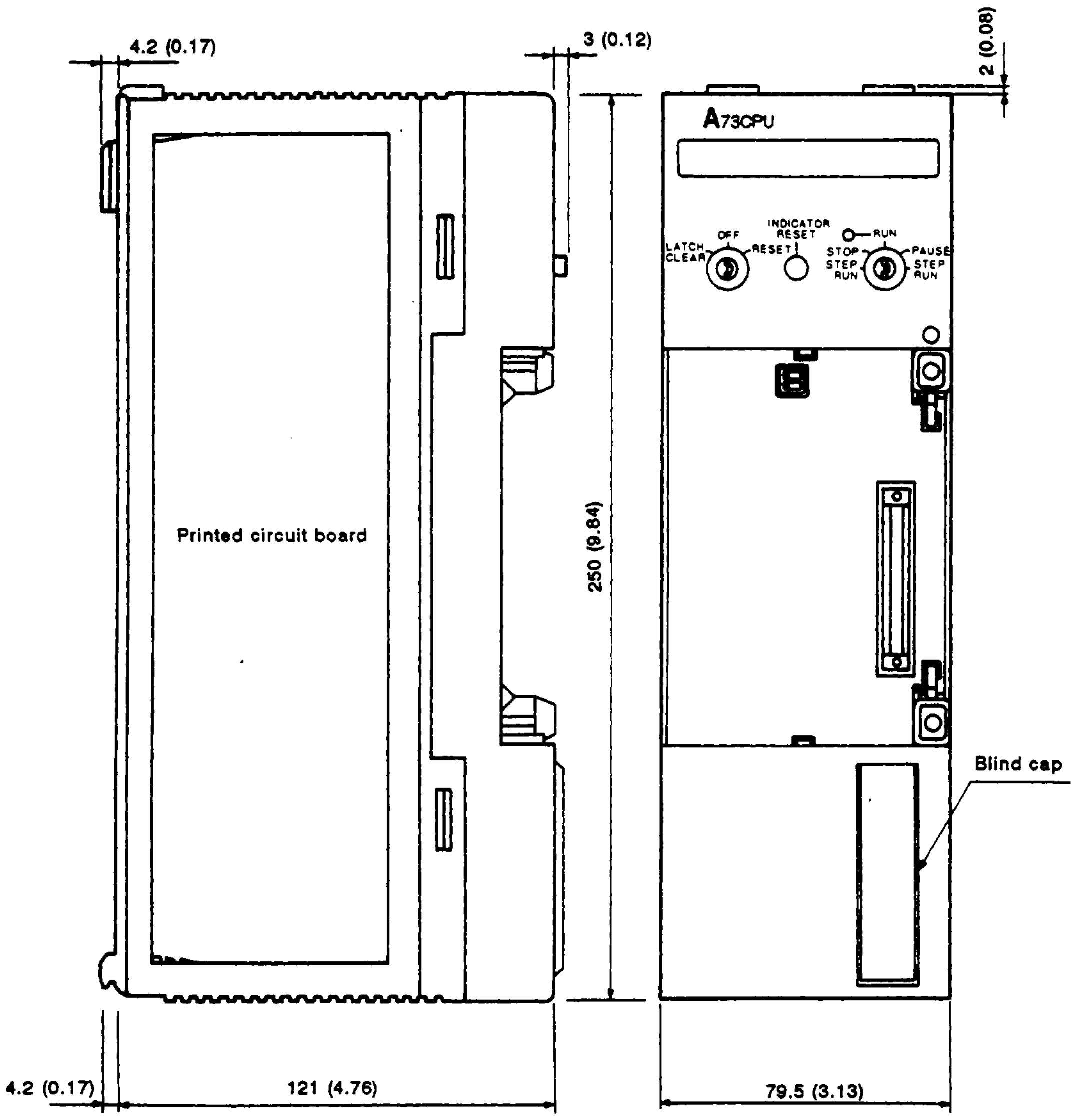
Table 12.2 Output Circuit Failures and Corrective Actions (Continued)

Example	Condition	Cause	Corrective Action
5	Load does not operate normally (due to external shorting, etc.) AY60EP, AY80EP, AY81EP, AY82EP	External load malfunction or incorrect connection.	Check the external load. Check voltage across the following terminals with output (Y) on. If output voltage exceeds 3 V, check external load and wiring for short circuits. 

APPENDIX 1 Dimensions

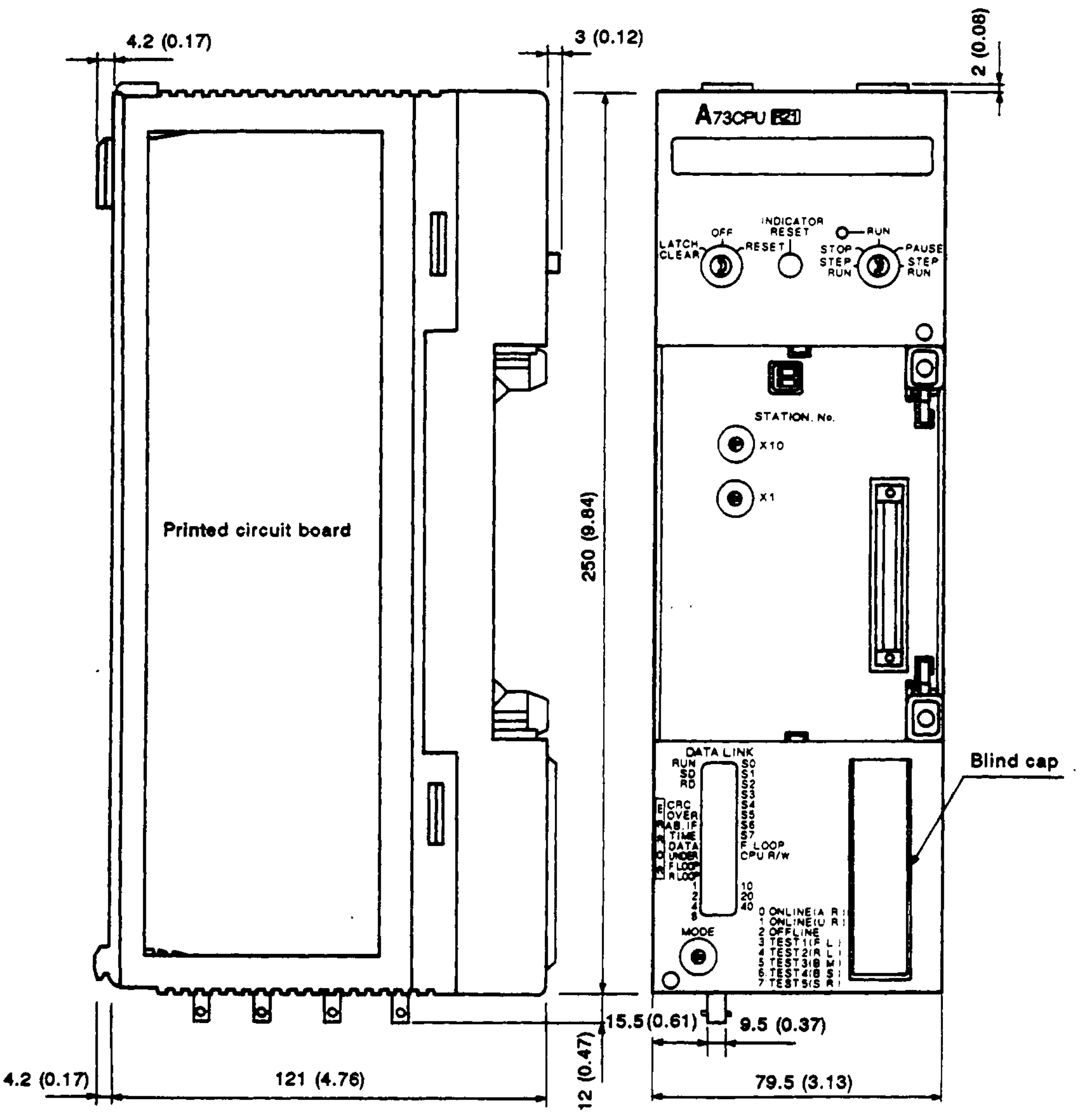
1.1 CPU Module

(1) A73CPU



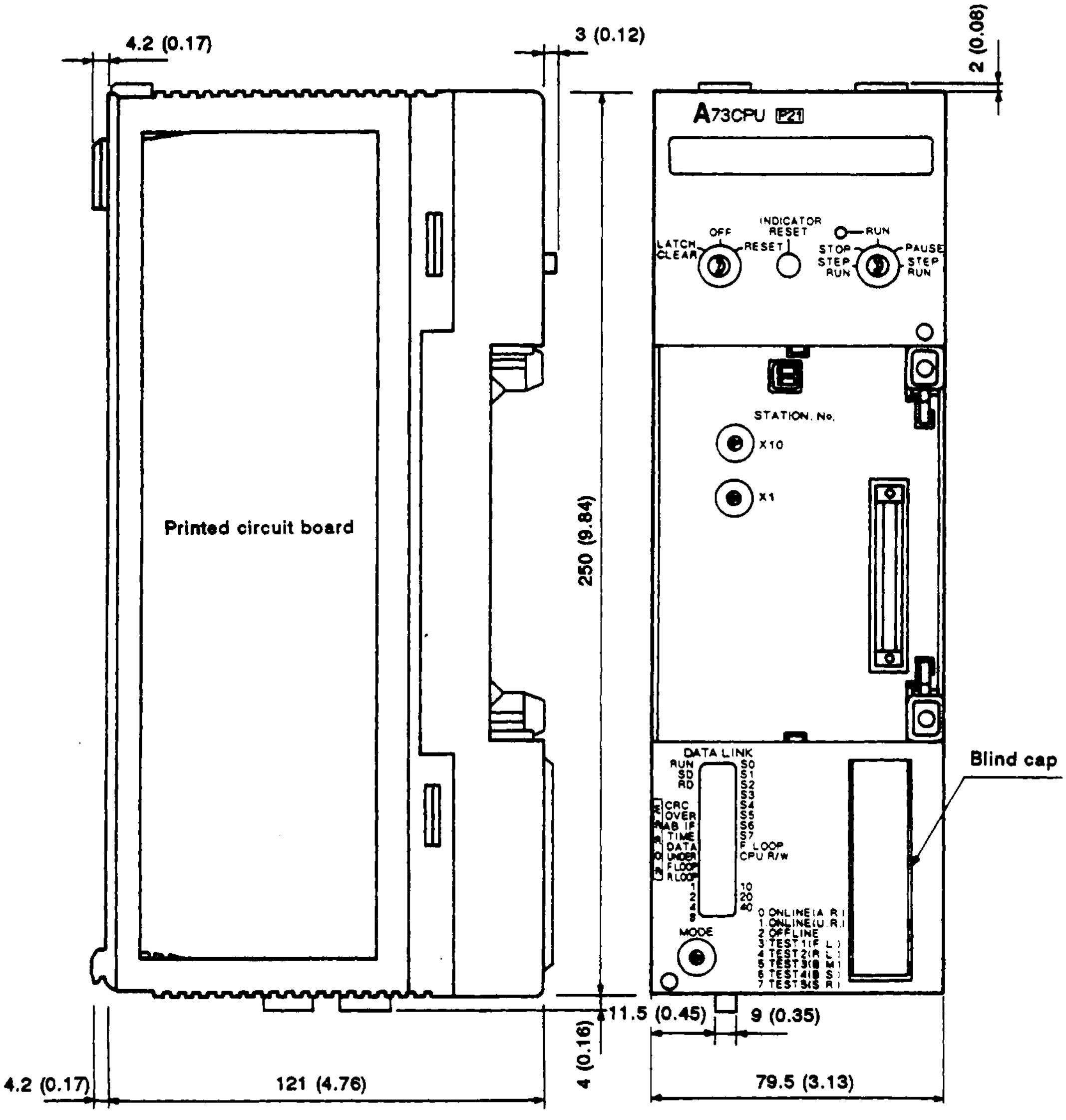
Unit: mm (in)

(2) A73CPUR21



Unit: mm (in)

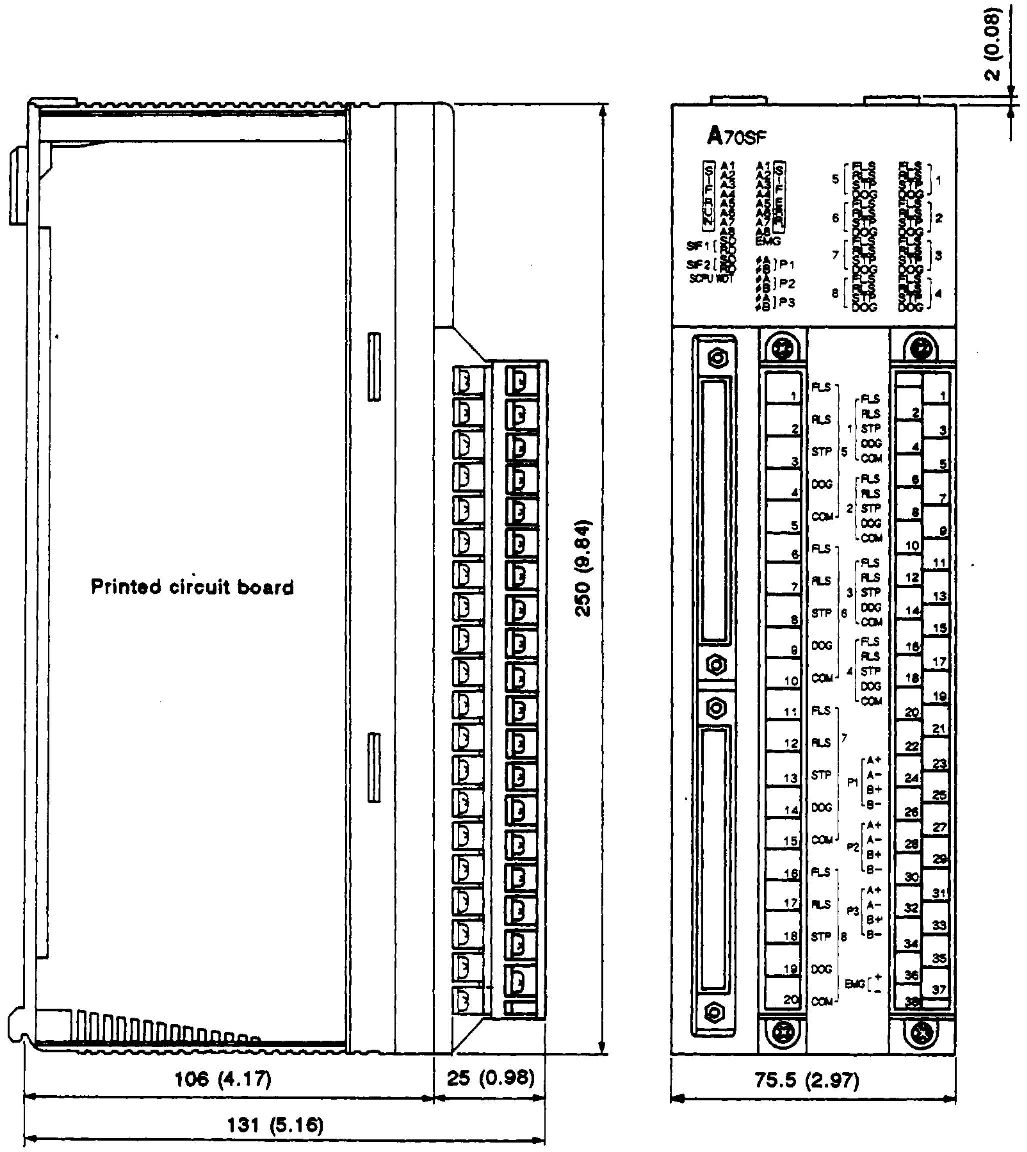
(3) A73CPUP21



Unit: mm (in)

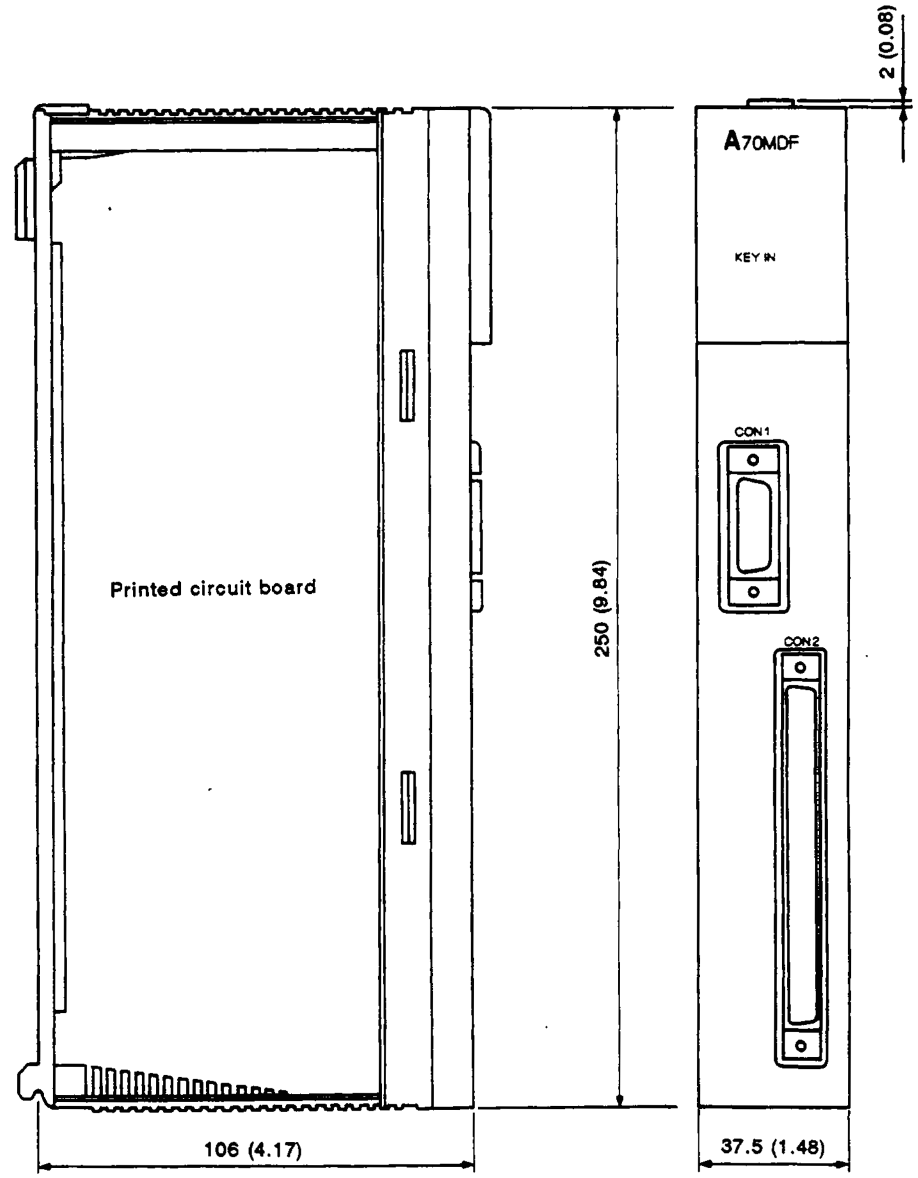
1.2 Positioning Module

1.2.1 A70SF

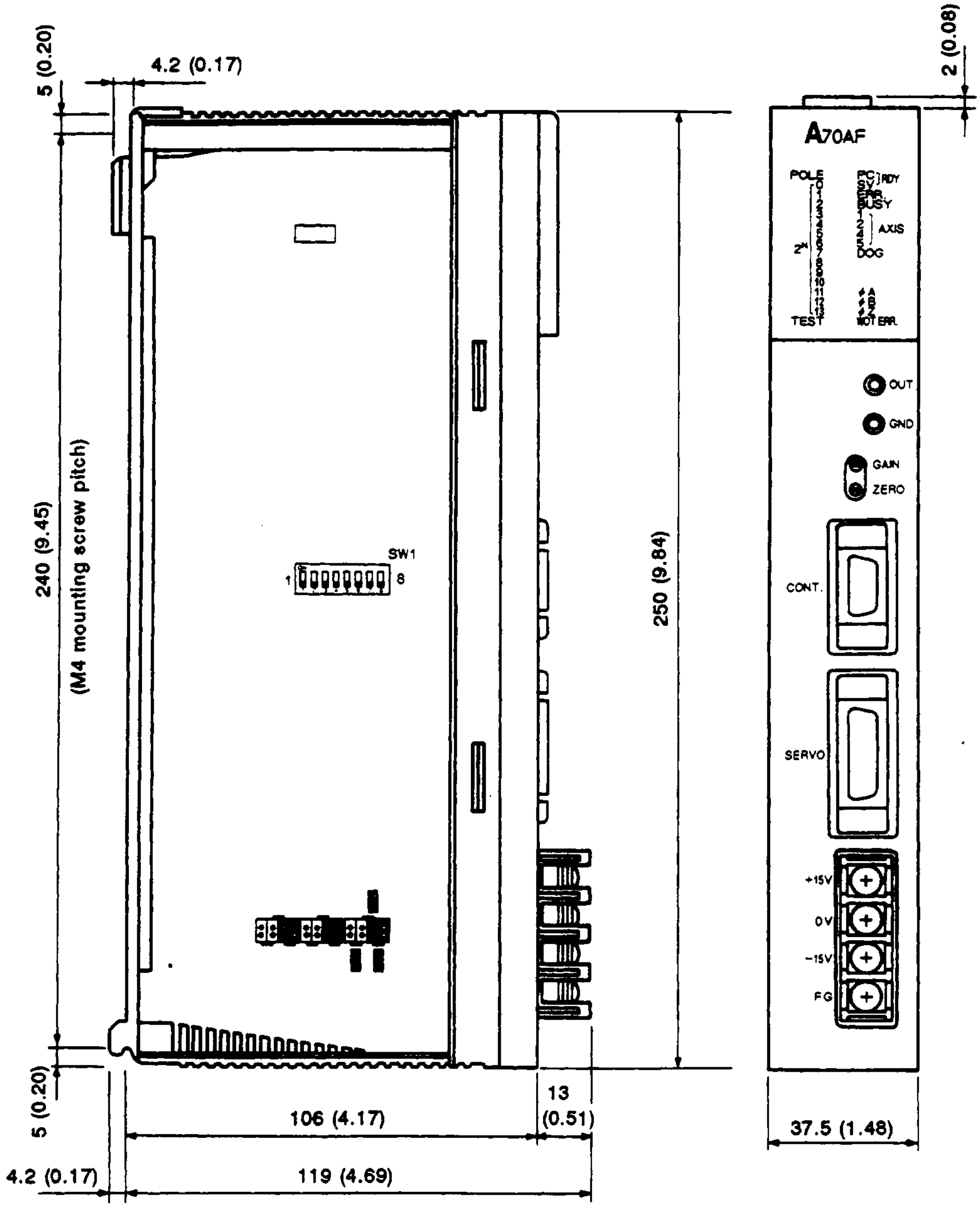


Unit: mm (in)

1.2.2 A70MDF


2 (0.08)
A70MDF
KEY IN
CON 1
CON 2
Printed circuit board
250 (9.84)
106 (4.17)
37.5 (1.48)

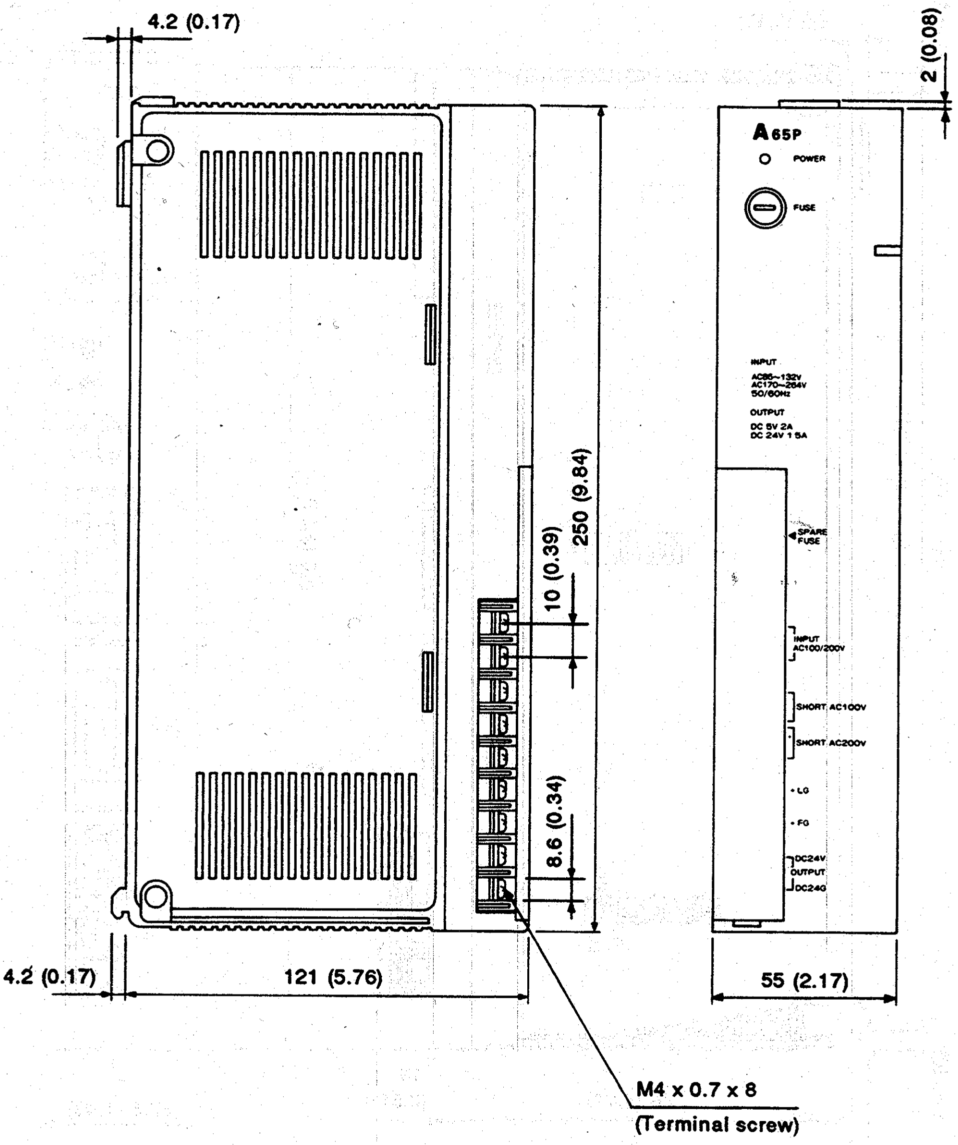
1.2.3 A70AF



Unit: mm (in)

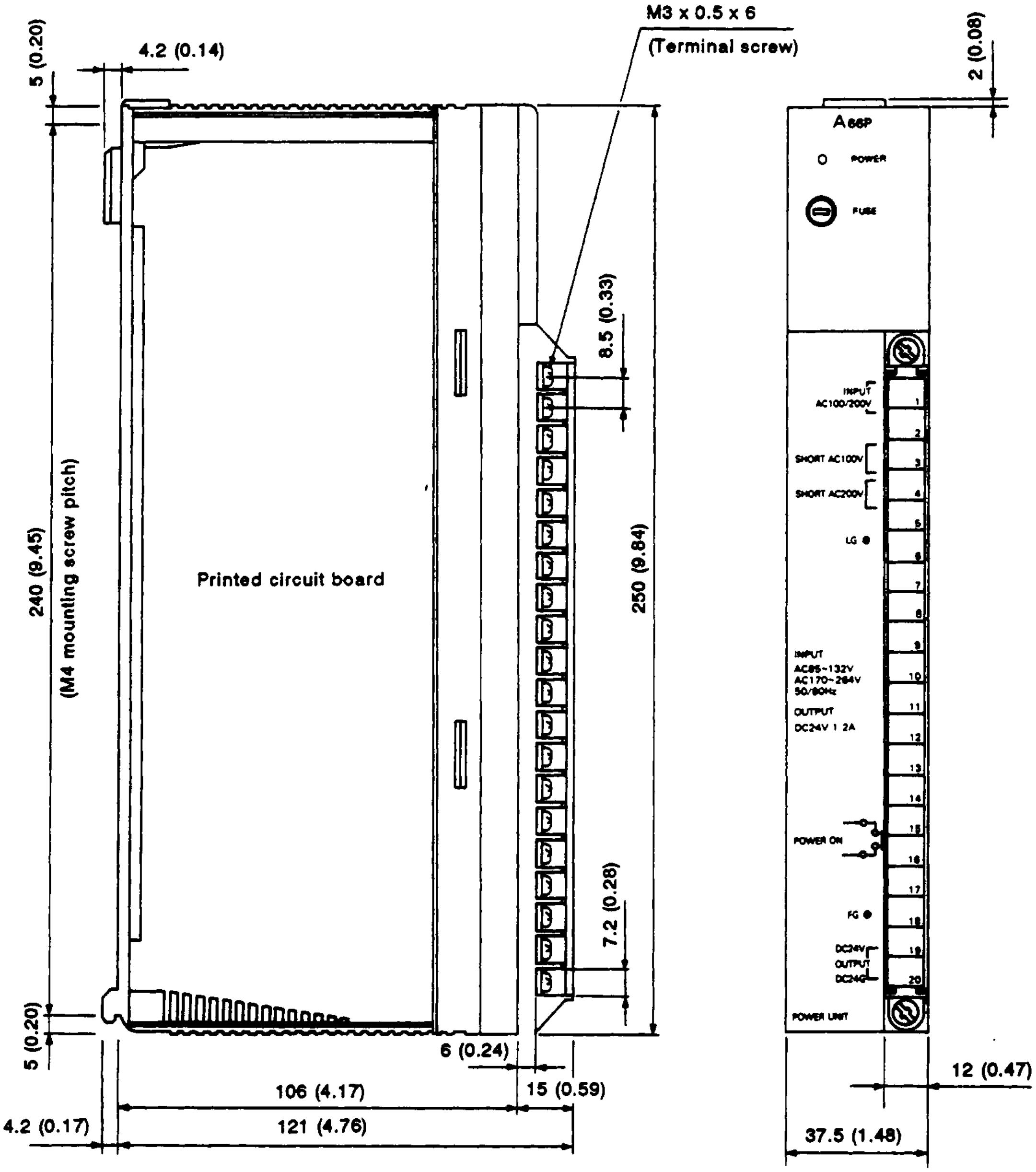
1.3 Power Supply Module

(1) Type A61P, A62P, A63P and A65P power supply module



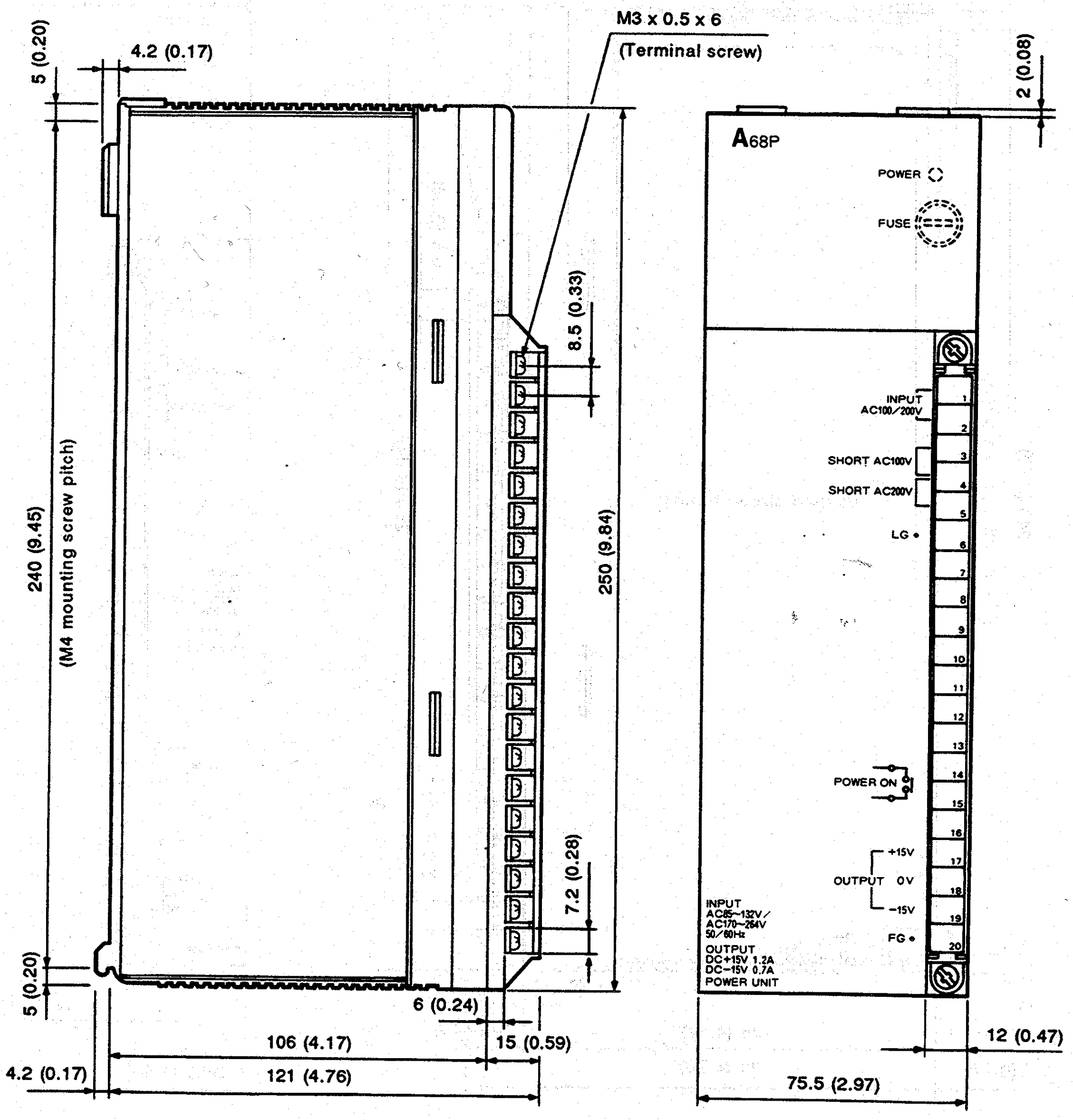
Unit: mm (in)

(2) Type A66P power supply module



Unit: mm (in)

(3) Type A68P power supply module

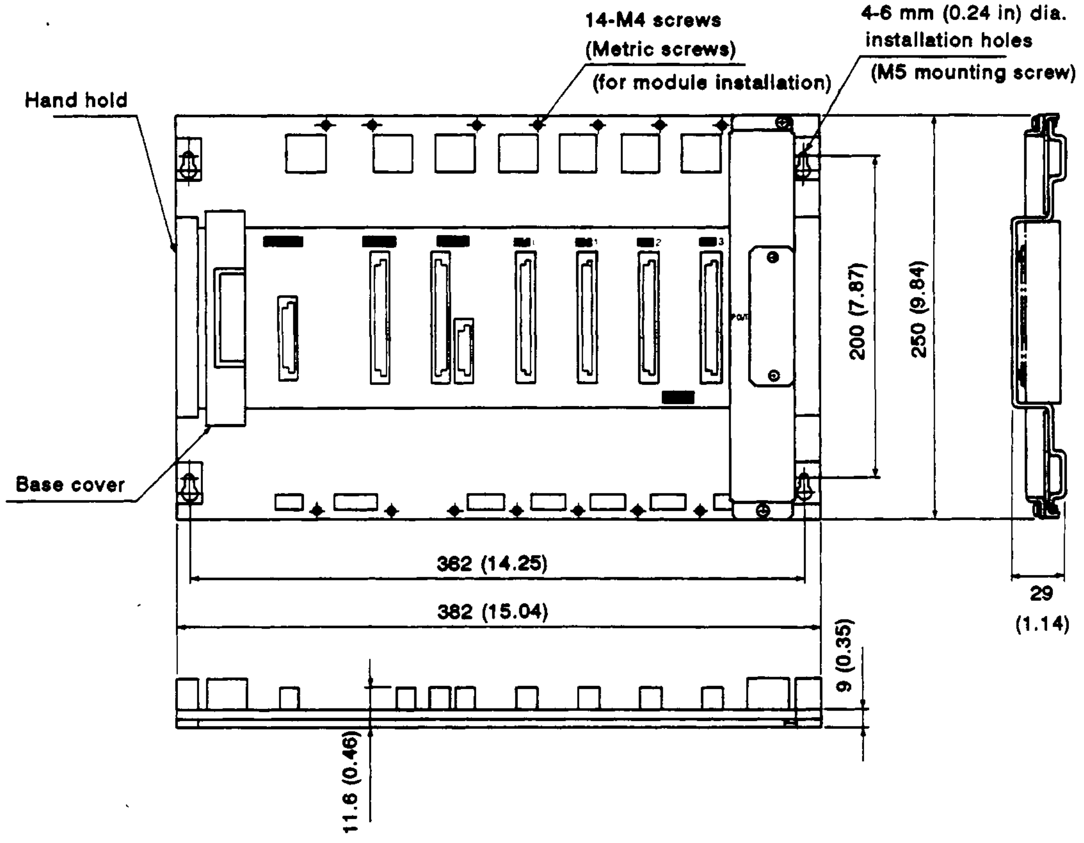


Unit: mm (in)

1.4 Base Units

1.4.1 Main base units

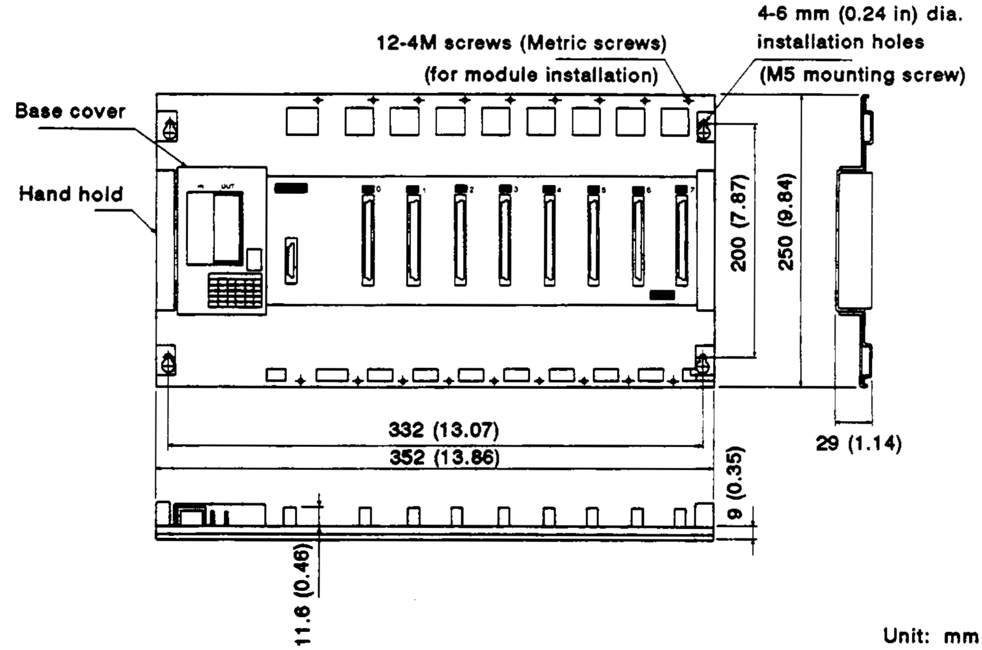
(1) Type A74B base unit



Unit: mm (in)

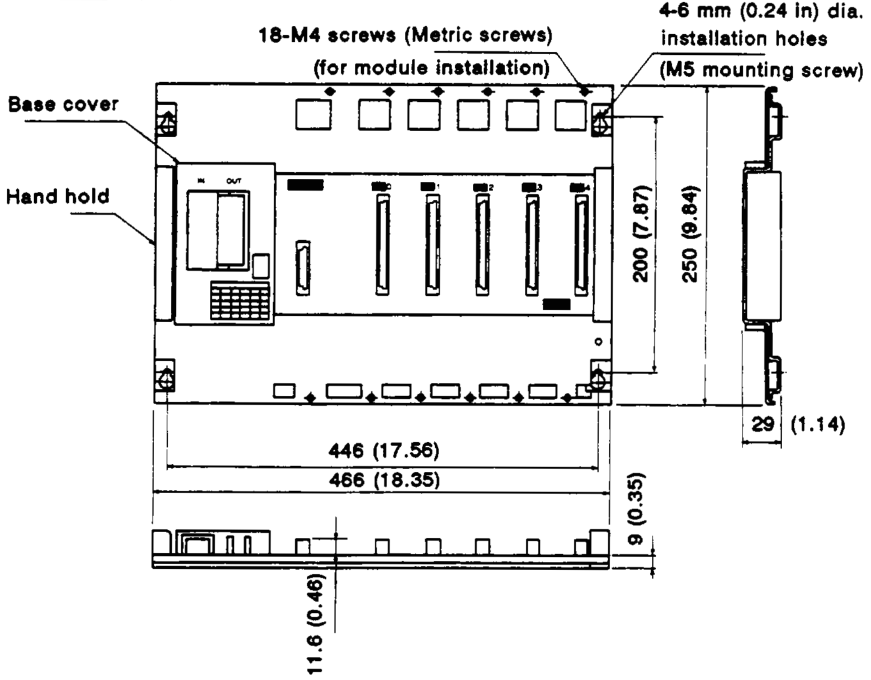
1.4.2 Extension base units

(1) Type A65B base unit



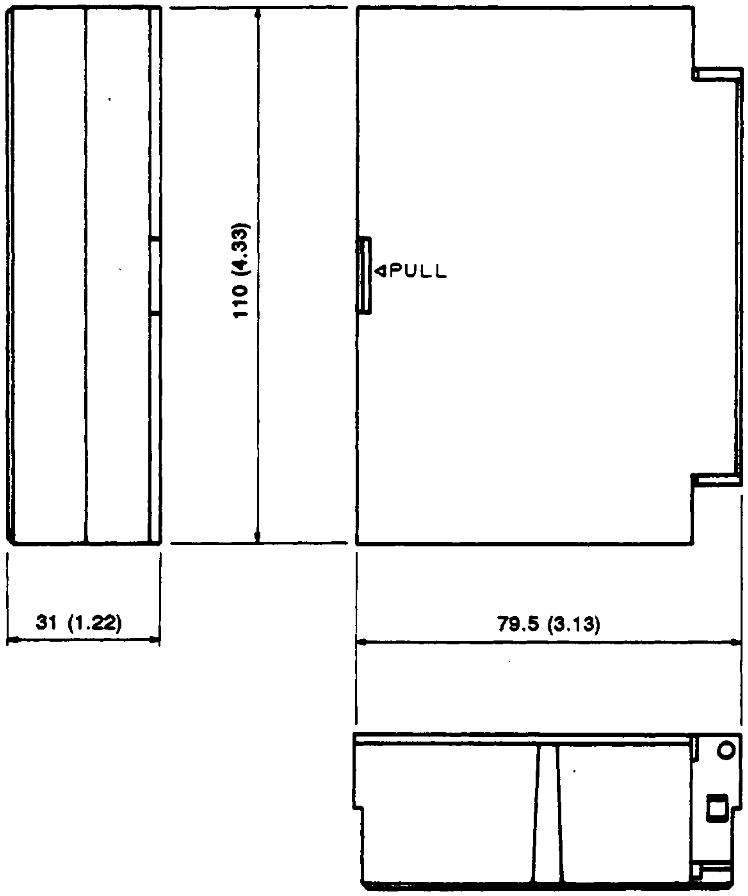
Unit: mm (in)

(2) Type A68B base unit



Unit: mm (in)

1.5 Memory Cassette (A3NMCA-[ ])



IMPORTANT

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

(1) Ground human body and work bench.

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

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