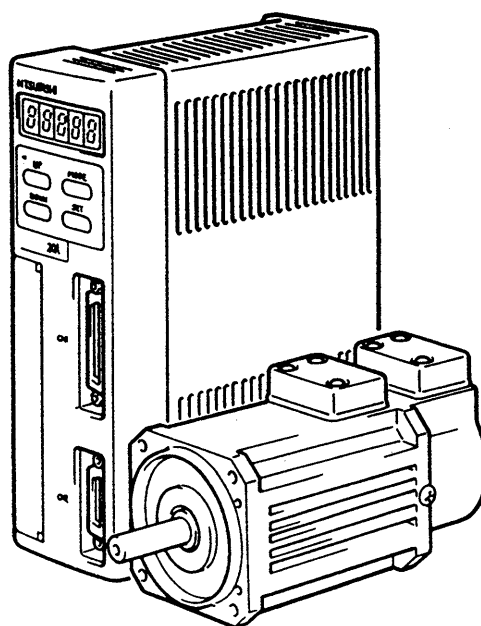


# MITSUBISHI

General Purpose AC Servo

# MELSERVO-J

## Specifications and Instruction Manual





Incorrect handling or misuse of servo drive equipment may cause equipment damage or bodily harm! In addition to the safety and handling information given throughout this manual, please follow the below listed precautions to assure safe equipment operation.

### **1. Installation**

- (1) Maintain the operating environment, power supply voltage, etc. within the specified ranges.
- (2) Do not connect AC power directly to the servo motor.
- (3) Keep combustible materials away from the servo amplifier and any regenerative resistor. Provide for adequate heat dissipation around the servo amplifier and any regenerative resistor.
- (4) Provide adequate protection to prevent oil, water, and foreign matter from entering the servo amplifier and servo motor.
- (5) Do not subject the servo motor shaft or encoder to impact, or shock loads.
- (6) Eliminate and prevent stress or damage to the encoder, servo motor, electromagnetic brake and other cables.
- (7) The grounding terminals of the servo amplifier and servo motor must be connected together at one point and then connected to earth ground at one point.
- (8) The load connected to the servo motor must be within the recommended moment of inertia load-ratio as noted in specifications.
- (9) Do not connect a capacitive filter, etc, to the servo amplifier output.
- (10) When using servo motors with gear reducers, observe noted restrictions pertaining to installation orientation, speed, torque characteristics, permissible moments of inertia loading, etc.
- (11) Maintain servo motor shaft end loading within specified value.

### **2. OPERATION**

- (1) When using emergency stop switches, and/or forward and reverse stroke limit switches, test their proper operation before operating the machine.
- (2) For safety, test machine operation at lowest possible speed.
- (3) When furnished, the electromagnetic brake supplied on a servo motor is designed only for holding a properly sized load while the drive is stopped. The brake is not intended for bringing the load to a stop.
- (4) Provide adequate protection to prevent oil, water, and foreign matter from entering the servo amplifier and servo motor.

### **3. MAINTENANCE**

- (1) Three minutes must be allowed after power has been switched off to the equipment, before conducting maintenance, adjustments, repairs, etc.
- (2) The encoder must not be disassembled or removed from the servo motor. To do so, will void warranty.
- (3) The servo amplifier must not be tested with a megger.

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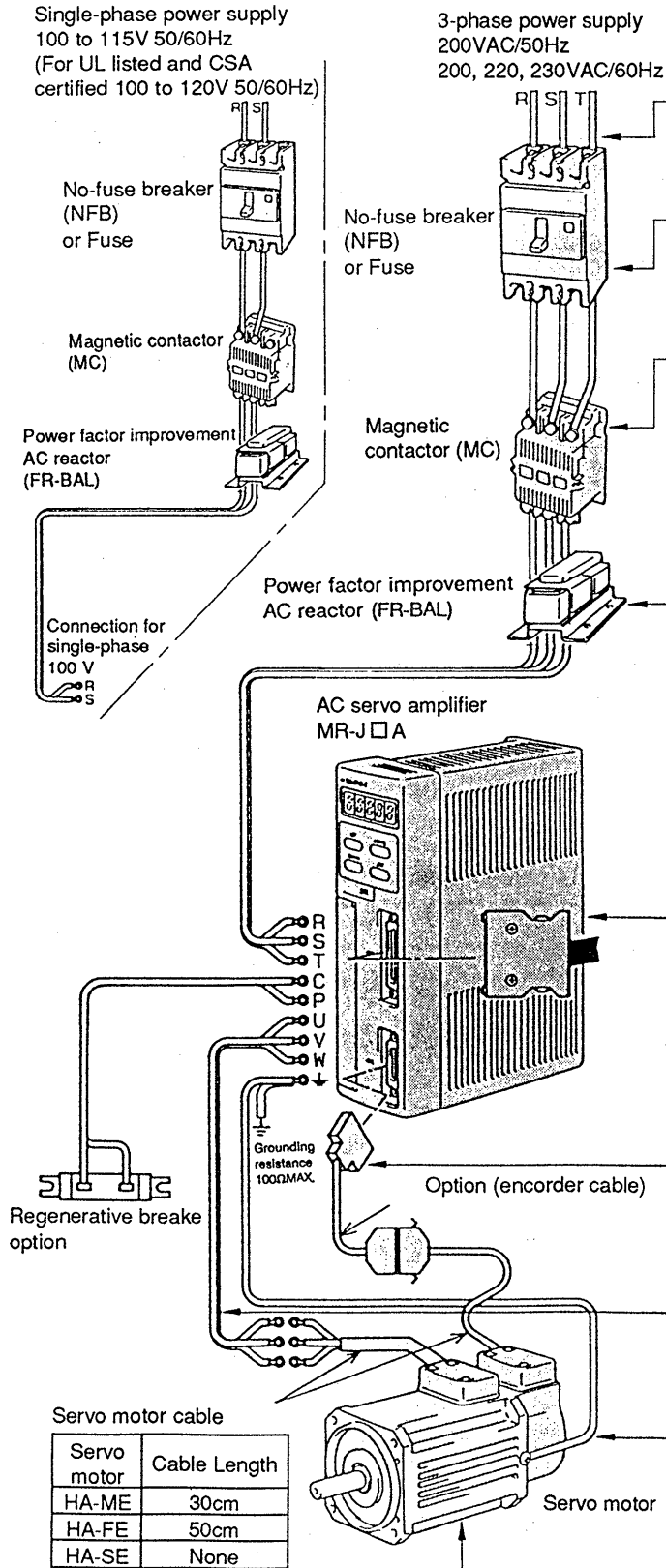
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# 1. Installation and Operation

## 1-1 General installation and operation

With the following information and guidance, the servo system will provide many years of reliable and efficient operation. Please use this information to assist in operation and installation.



Points for handling	Refer to:
<b>Power supply specifications</b> Please use the servo within the tolerable power supply specifications.	Section 10-2
<b>No-fuse breaker, leakage current breaker or fuse</b> A large inrush current is applied to the servo when the power supply is switched ON. Refer to the selection table for the breaker or fuse.	Section 6-6 Section 6-11
<b>The magnetic contactor use</b> Always install this magnetic contactor. Do not start and stop the servo with this magnetic contactor, as the life of the servo may be shortened.	Section 2-2.1 Section 6-6
<b>Reactor installation</b> The optional reactor must be installed for power factor improvement or with a large power capacity (500KVA or more with a wiring distance less than 10m). Select the reactor according to the servo model.	Section 6-6
<b>Installation site</b> The life of the servo is affected by the ambient temperature. The maximum value for the ambient temperature is a MAX of 55 °C, and the unit should be used at an average of 40 °C.	Section 1-4
<b>Wiring</b> Incorrect wiring will lead to servo damage. The control signal line and main circuit should be separated a proper distance, to reduce noise.	Section 2-1 Section 3-6.1 Section 4-6.1
<b>Position control mode specifications</b> The position servo start-up and operations are noted.	Chapter 3
<b>Speed control mode</b> The speed servo start-up and operations are noted.	Chapter 4
<b>Optional specifications</b> The methods for using the auxiliary equipment and options are noted.	Chapter 6
<b>Output side connecting equipment</b> Do not connect a phase advancing capacitor, surge suppressor, or radio noise reduction filter (option FR-BIF). These may cause damage or faults in the equipment.	Section 1-2
<b>Grounding</b> Ground the servo motor and servo amplifier terminals at one point with the minimum distance to prevent an electric shock and noise.	Section 2-1
<b>Servo motor assembly</b> Do not shock the servo motor shaft or detector by hammering, etc.	Section 1-2 Section 2-1.3

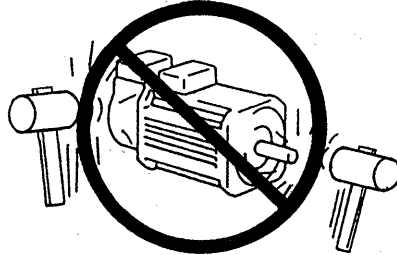
# 1. Installation and Operation

## 1-2 Precautions when installing the unit

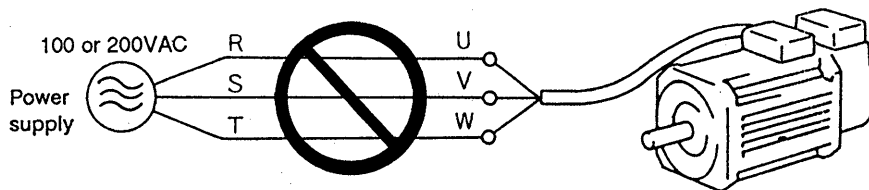
Improper handling of equipment may cause damage. The important points are noted below. Refer to these and other related items for proper use of the unit.

### Handling

- (1) Do not shock the servo motor or encoder. The servo motor may fail if the shaft is hammered or the servo motor dropped.



- (2) Do not directly apply commercial power (200VAC) to the servo motor. The windings will be damaged and the servo motor magnet will be demagnetized. Always drive the servo motor with the specified servo amplifier.

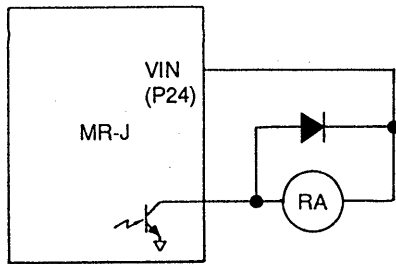


### Connections

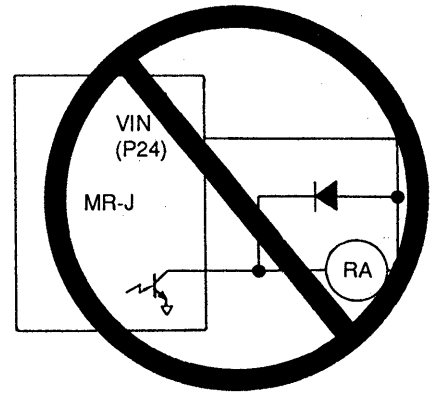
- (1) Connect the servo amplifier and servo motor ground terminals on the amplifier side, and ground the terminals together with the minimum distance possible. To prevent an electrical shock and malfunctions, the terminals should be grounded at the resistance of 100Ω max.
- (2) Always match the servo amplifier and servo motor U, V and W phases.  
The rotation direction cannot be changed like a general-purpose servo motor by inverting two wires.
- (3) The amplifier may be damaged if AC power is applied to the servo amplifier U, V and W terminals. Supply the correct AC power to the R, S and T terminals.  
If a power supply voltage used is other than the specified, connect a power transformer.
- (4) Connect the correct option to the regenerative option terminal (between C-P), and set the corresponding parameters.  
The amplifier may be damaged and the regenerative resistor overheated or burnt out if these are incorrect.
- (5) When connecting external relays, it is imperative that a diode be connected correctly across the relay-see diagram.



# 1. Installation and Operation



Correct Diode connections



Incorrect Diode connection

## Operation and sequence

- (1) The servo motor's electromagnetic brake is used only in times of emergency and holding. It has been designed as a holding device during power failures. If it is used for braking during deceleration, the brake will wear out quickly.
- (2) Connect the power supply R, S and T terminals to the breaker and magnetic contactor. These are necessary to shut off the circuit to prevent secondary disasters when an alarm occurs or an erroneous current flows.
- (3) An undervoltage alarm may occur when the servo amplifier is switched on again immediately being switched OFF. Switch the power on again after the waiting time shown in the following table.

(All values given are the MAX values.)

Model	J10A to 60A J10A1, 20A1 J10MA to 40MA J10MA1, 20MA1	J100A J70A J70MA	J200A	J350A	J40A1 J40MA1
Waiting time	10 sec.	11 sec.	12 sec.	13 sec.	15 sec.

## ⚠ CAUTION

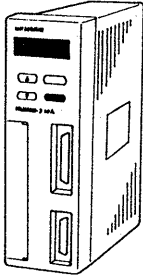
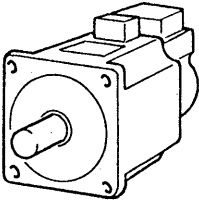
- (1) A "high voltage" will remain in the servo amplifier for a short time even after the power is switched off.
- (2) The servo amplifier may be damaged if a megger test is performed. Megger tests must not be done. Continuity checks using a circuit tester are recommended.
- (3) The servo motor encoder cannot be removed. Do not remove the cover, etc.

# 1. Installation and Operation

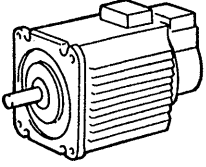
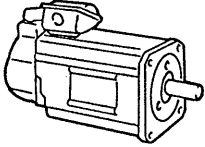
## 1-3 Inspection at delivery

Confirm the following items after unpacking.

- (1) Inspect the nameplate and confirm that the specifications are as ordered.

	Appearance	Details on the nameplate	Details on the model (See Section 10-1)																																						
Servo amplifier	<p>MR-J□□(-UL)</p> 	<p>Applicable motor capacity</p> <p>Model</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p><b>AC SERVO</b></p> <p>MITSUBISHI</p> <p>MODEL <b>MR-J10A</b></p> <p>POWER 100W</p> <p>AC INPUT AC200 to 230V 50/60Hz</p> <p>OUTPUT 1.1A</p> <p>SERIAL 210075AA</p> <p>TC300A022G51</p> <p>MITSUBISHI ELECTRIC CORPORATION MADE IN JAPAN</p> </div> <p>Manufacturing No. + current status</p> <p>Rated output current</p> <p>Applicable power supply</p>	<p>Mitsubishi general-purpose AC servo amplifier MR-J series</p> <p>MR-J□□□□□□□□</p> <table border="1"> <tr> <th>Symbol</th> <th>Corresponding servo motor</th> </tr> <tr> <td>A</td> <td>HA-FE HA-SE</td> </tr> <tr> <td>MA</td> <td>HA-ME</td> </tr> </table> <table border="1"> <tr> <th>Symbol</th> <th>Power supply</th> </tr> <tr> <td>None</td> <td>3-phase 200V</td> </tr> <tr> <td>1</td> <td>Single-phase 100v</td> </tr> </table> <table border="1"> <tr> <th>Symbol</th> <th>Version</th> </tr> <tr> <td>None</td> <td>Japanese</td> </tr> <tr> <td>UL</td> <td>UL listed CSA certified</td> </tr> </table> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Capacity (W)</th> <th>Symbol</th> <th>Capacity (W)</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>50, 100</td> <td>70</td> <td>500, 750</td> </tr> <tr> <td>20</td> <td>200</td> <td>100</td> <td>850 to 1200</td> </tr> <tr> <td>40</td> <td>300, 400</td> <td>200</td> <td>1500, 2000</td> </tr> <tr> <td>60</td> <td>600</td> <td>350</td> <td>3000, 3500</td> </tr> </tbody> </table>	Symbol	Corresponding servo motor	A	HA-FE HA-SE	MA	HA-ME	Symbol	Power supply	None	3-phase 200V	1	Single-phase 100v	Symbol	Version	None	Japanese	UL	UL listed CSA certified	Symbol	Capacity (W)	Symbol	Capacity (W)	10	50, 100	70	500, 750	20	200	100	850 to 1200	40	300, 400	200	1500, 2000	60	600	350	3000, 3500
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# 1. Installation and Operation

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1	100	4	400																																							
2	200	6	600																																							
<p>HA-SE □ (C)(B) (G)(-UL)</p> 	<p>Manufacturing date</p> <p>Manufacturing No.</p>	<p>AC servo motor HA-SE Series</p> <p>HA-SE □ □ □ B G - □</p> <p>Reduction gear included</p> <p>Brake included</p> <p>(Note)</p> <table border="1"> <thead> <tr><th>Symbol</th><th>Connection</th></tr> </thead> <tbody> <tr><td>None</td><td>Lead wire</td></tr> <tr><td>C</td><td>Connector</td></tr> </tbody> </table> <table border="1"> <thead> <tr><th>Symbol</th><th>Version</th></tr> </thead> <tbody> <tr><td>None</td><td>Japanese</td></tr> <tr><td>UL</td><td>UL listed CSA certified</td></tr> </tbody> </table> <table border="1"> <thead> <tr><th>Symbol</th><th>Rated speed (r/min)</th></tr> </thead> <tbody> <tr><td>1</td><td>1000</td></tr> <tr><td>2</td><td>2000</td></tr> <tr><td>3</td><td>3000</td></tr> </tbody> </table> <table border="1"> <thead> <tr><th>Symbol</th><th>Rated output (W)</th><th>Symbol</th><th>Rated output (W)</th></tr> </thead> <tbody> <tr><td>5</td><td>500</td><td>15</td><td>1500</td></tr> <tr><td>8</td><td>850</td><td>20</td><td>2000</td></tr> <tr><td>10</td><td>1000</td><td>30</td><td>3000</td></tr> <tr><td>12</td><td>1200</td><td>35</td><td>3500</td></tr> </tbody> </table> <p>Note: Connectors are used to connect the UL listed servo motor.</p>	Symbol	Connection	None	Lead wire	C	Connector	Symbol	Version	None	Japanese	UL	UL listed CSA certified	Symbol	Rated speed (r/min)	1	1000	2	2000	3	3000	Symbol	Rated output (W)	Symbol	Rated output (W)	5	500	15	1500	8	850	20	2000	10	1000	30	3000	12	1200	35	3500
Symbol	Connection																																									
None	Lead wire																																									
C	Connector																																									
Symbol	Version																																									
None	Japanese																																									
UL	UL listed CSA certified																																									
Symbol	Rated speed (r/min)																																									
1	1000																																									
2	2000																																									
3	3000																																									
Symbol	Rated output (W)	Symbol	Rated output (W)																																							
5	500	15	1500																																							
8	850	20	2000																																							
10	1000	30	3000																																							
12	1200	35	3500																																							

Options are noted in Chapter 6.

The low noise function and the HA-SE servo motors for 1,000 rpm and 3,000 rpm can be used only with the new version.

To identify the version: The version is indicated by the last one or two digits of the SERIAL number provided on the nameplate.

Old version: One alphabet character

New version: Two alphabet characters

# 1. Installation and Operation

## 1-4 Installation

### Installation of the servo amplifier

#### (1) Working environment

<b>Ambient temperature</b>	0 to 55 °C (with no freezing) (Note)
<b>Ambient humidity</b>	90%RH or less (with no dew condensation)
<b>Vibration</b>	5.9m/s <sup>2</sup> {0.6G} or less

Note: To ensure servo amplifier long life and high reliability, the temperature in the control box should be designed and maintained to be as low as possible. (but above the minimal)

#### (2) Installation direction and clearance

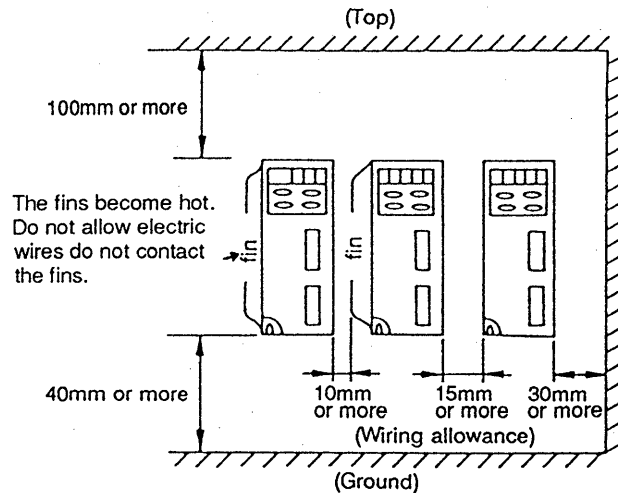
- Install the MELSERVO-J so that it can be seen from the front.
- When installing two servo amplifiers side by side in a closed panel, provide a 10mm clearance or more between the sides of the amplifiers. Also provide a 40mm clearance or more over the top and under the bottom of the servo amplifiers.

When installing several servo amplifiers side by side, provide a 100mm clearance over the top of the servo amplifiers or install a ventilating fan to ensure proper heat dissipation.

- When using regeneration units, install them away from the servo amplifier.

#### (3) Keep out foreign materials

- When installing unit on a panel or inside and enclosure, prevent drill chips and wire fragments from entering the servo amplifier.
- Prevent oil, water, and metallic dust from entering the amplifier through openings in the enclosure.
- Provide positive pressure in control enclosure by forcing in clean, dry, cool, non-toxic, non-corrosive, non-explosive air.

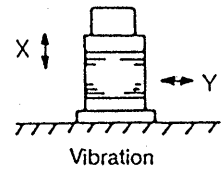


# 1. Installation and Operation

## Installation of the servo motor

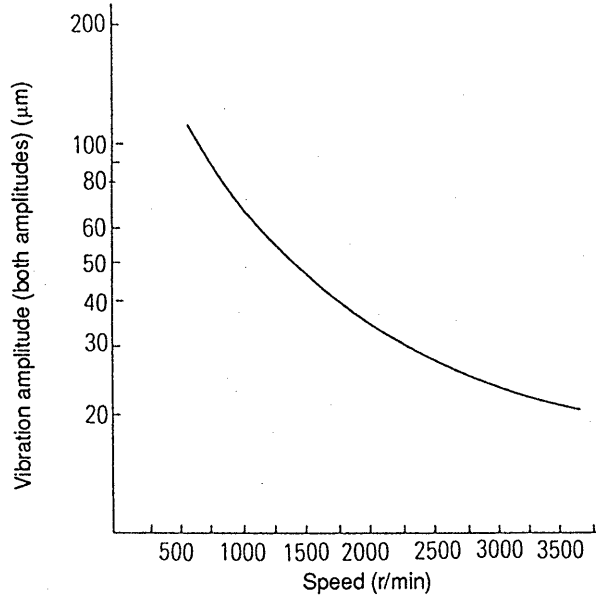
### (1) Working environment

<b>Ambient temperature</b>		0 to 40 °C (with no freezing)
<b>Ambient humidity</b>		80%RH or less (with no dew condensation)
<b>Vibration</b>	<b>HA-FE, HA-ME</b>	X, Y: 19.6m/s <sup>2</sup> {2G}
	<b>HA-SE 1.5kW or less</b>	X: 9.8m/s <sup>2</sup> {1G} Y: 24.5m/s <sup>2</sup> {2.5G}
	<b>HA-SE 2, 3.5kW</b>	X: 19.6m/s <sup>2</sup> {2G} Y: 49m/s <sup>2</sup> {5G}



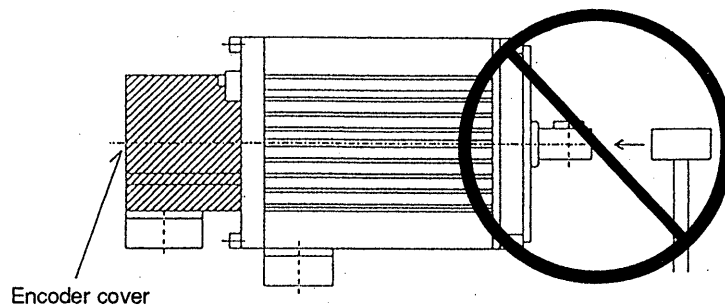
1

Graph of vibration servo amplitude vs, speed.



### (2) Servo motor load-mounting precautions

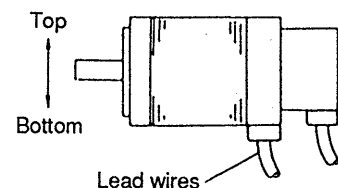
- Use the screw hole on the end of the shaft (only for the HA-FE servo motor) when mounting a pulley.
- When removing a pulley, use a pulley remover.
- Do not push or pull on encoder to move servo motor.
- During assembly, the shaft end must not be hammered. (The encoder may fail.)



- The orientation of the encoder on the servo motor cannot be changed.

### (3) Installation orientation

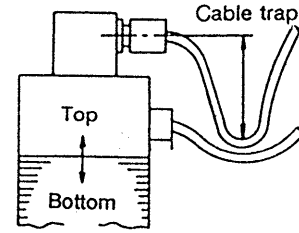
- The servo motor can be installed horizontally or vertically, with the shaft end up or down.
- Install the servo motor so that the cables face downward.
- When installing vertically, provide a cable trap so that oil and water do not enter the servo motor.



# 1. Installation and Operation

(4) Cable protection

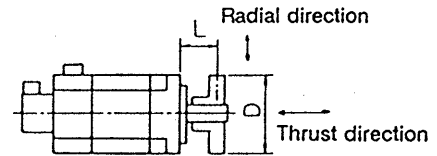
- Provide stress relief to cables. Prevent cable abrasion.
- In applications where the servo motor moves, the cable bending radius must be determined according to the bending life and type of wire.



(5) Tolerable load for the shaft

- Use flexible coupling, and make sure that the misalignment of the shaft is less than the maximum value.
- When using a pulley, sprocket or timing belt, select a diameter that will fit into the maximum radial load.

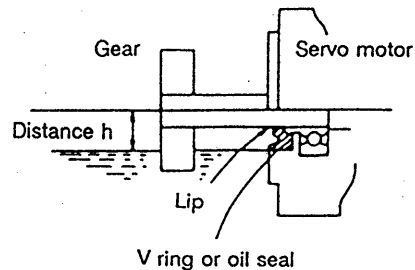
Servo Motor	Maximum radial load (N)	Maximum thrust load (N)
HA-ME053, 13	88 {9kgf} L=30	59 {6kgf}
HA-ME23, 43	245 {25kgf} L=30	98 {10kgf}
HA-ME73	392 {40kgf} L=30	147 {15kgf}
HA-FE053	108 {11kgf} L=30	98 {10kgf}
HA-FE13	118 {12kgf} L=30	98 {10kgf}
HA-FE23, 33	176 {18kgf} L=30	147 {15kgf}
HA-FE43, 63	323 {33kgf} L=40	284 {29kgf}
HA-SE52 to 152	980 {100kgf} L=55	490 {50kgf}
HA-SE53 to 153		
HA-SE81		
HA-SE202, 352	2058 {210kgf} L=79	980 {100kgf}
HA-SE203, 353		
HA-SE121 to 301		



(6) Oil and water protection

- The servo motor is not waterproof. Prevent oil and water from entering the servo motor.
- When installed to a gear box, maintain the oil level distance(h) from the servo motor shaft V ring oil seal according to the following chart. Also provide a breathing hole on the gear box to suppress the internal pressure.

Motor	Distance h (mm)
HA-FE053, 13	8
HA-FE23, 33	12
HA-FE43, 63	14
HA-SE52 to 152	20
HA-SE53 to 153	
HA-SE81	
HA-SE202, 352	25
HA-SE203, 353	
HA-SE121 to 301	

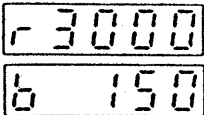


- The HA-FE servo motor with oil seal is standard.
- The HA-ME servo motor is not supplied with an oil seal. Seal the gear box so that lubricant does not enter the servo motor.

# 1. Installation and Operation

## 1-5 Making start up easier

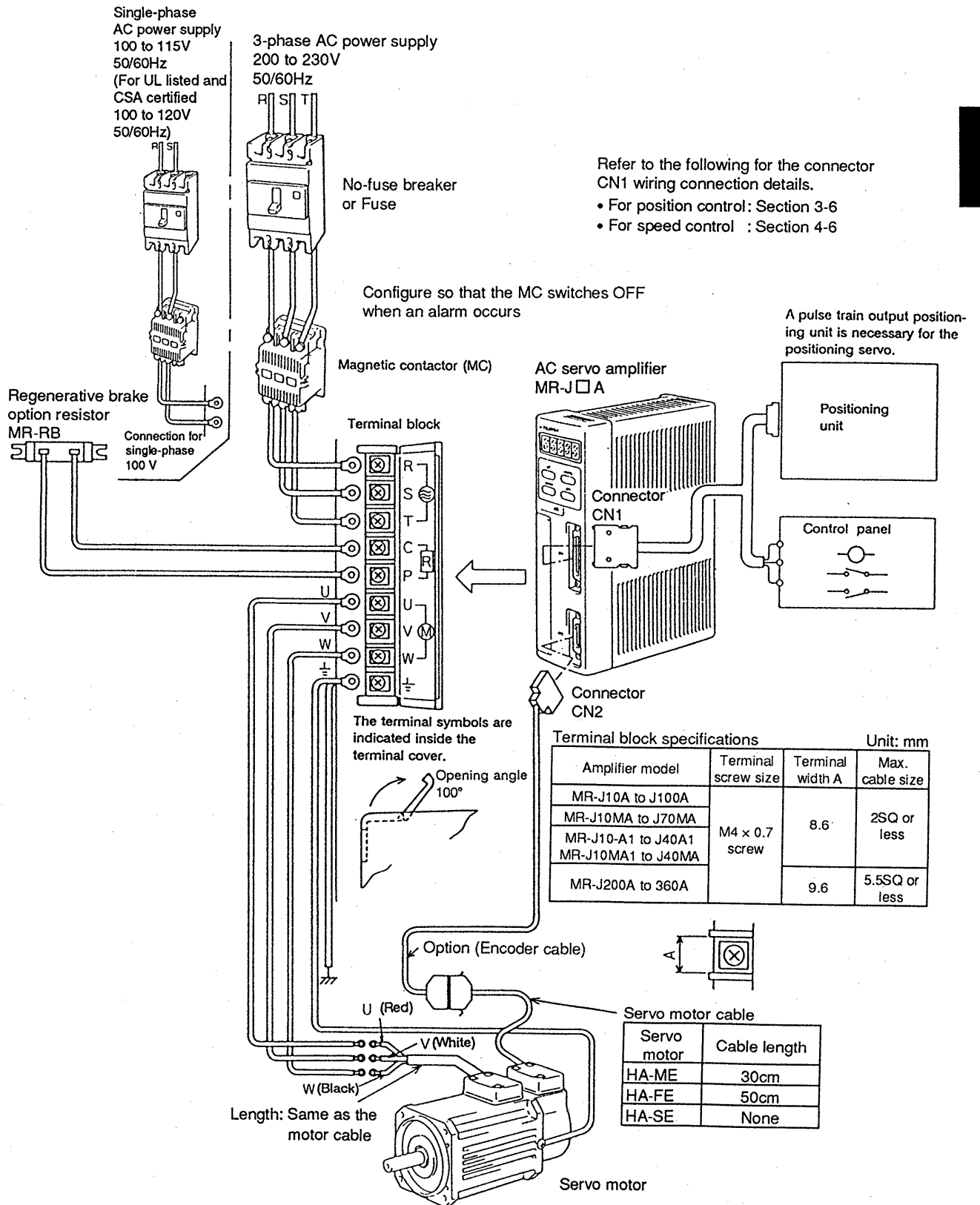
The following chart lists the engineered-in functions and features that help make the start up and use of the Mitsubishi servo system easy and quick.

Main function	Explanation	Refer to:
[Auto tuning]	By detecting the current and speed at start up, the inertia of the load is automatically calculated. The optimum gain for obtaining smooth acceleration/deceleration is automatically selected.	Section 5-1.2
[Test operation without external commands] (Test mode operation 1)	The motor can now be rotated without external commands from the positioning unit or control unit, just by using the four buttons on the front panel of the servo amplifier. The rotation speed can also be set. This allows the machine movement test testing.	Section 5-2.3
[Operation without motor] (Test mode operation 2)	The servo amplifier can be operated without the motor. Confirmation of the functions with the control board unit and sequence checks are possible.	Section 5-2.4
[Digital input signal test]	The ON/OFF status of the servo ON, stroke end, ready etc., can be monitored. The wiring can be checked before operation or when the servo motor does not rotate.	Section 3-5.3 Section 4-5.3
[Forced output of the digital signals] (do <Output signal> check screen)	The digital outputs such as trouble, ready, positioning complete, zero speed and limiting torque can be forcibly switched ON/OFF for each point. Use this for checking the wiring.	Section 5-2.2
[Self diagnosis] (Display of reason for motor not operating)	The cause is displayed if the servo motor does not operate when the input signal is input. The servo motor can be restored to operation in a short time if errors as displayed are checked.	Section 5-2.1
[Automatic offset]	The analog speed command offset adjustment is performed. Set this before operation.	Section 5-2.6
[Various status display functions]	The speed, load ratio, or input/output status is displayed, and diagnosis is simple with this feature. (Ex.)  → Rotating speed 3000r/min → The peak load ratio is 150% of the motor rated load	Section 3-5 Section 4-5
[Connector relay terminal block]	An option that converts the connector to terminal blocks has been prepared. The connectors no longer need to be soldered.	Section 6-5

## 2. Outline of Wiring and Operation

### 2-1 Connection of the power supply and servo motor

#### 2-1.1 Connection systems



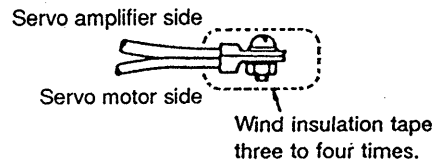


## 2. Outline of Wiring and Operation

### 2-1.2 Servo motor connection precautions

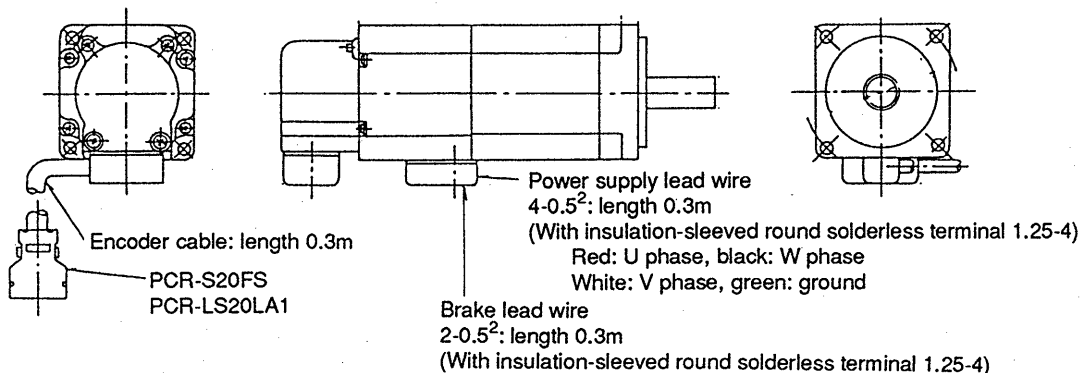
- 1) Always match the motor lead phases (U, V, W) with the servo amplifier output terminals (U, V, W).
- 2) The servo motor may be demagnetized or burntout if AC power is applied to the servo motor terminals (U, V, W).  
The servo motor cannot be connected to any terminals other than the servo amplifier output terminals (U, V, W).
- 3) Always ground the servo motor with the grounding terminal E. To ground, connect the servo amplifier grounding terminal, and the earth plate in the control panel to earth.  
Refer to Sections 3-6.2 and 4-6.2.
- 4) The user must supply a 24VDC power supply (the current capacity is given in Section 9-5) for the brake lead of the servo motor with electromagnetic brake is used.  
The power supply VDD (24VDC) in the servo amplifier cannot be used for the brake.

Note: Use a screw and nut when connecting servo amplifier and servo motor wires as shown in the diagram on the right.  
Wind several layers of insulation tape around the connection. For the HA-SE servo motor, take care not to damage the insulation when connecting the terminal box.

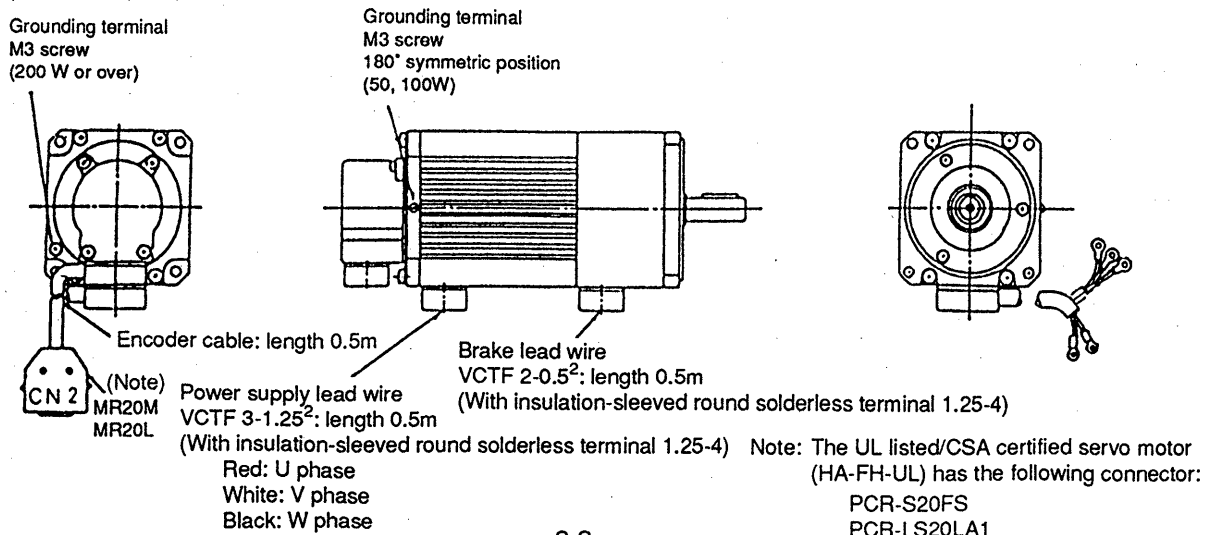


### 2-1.3 Servo motor terminal details

#### (1) HA-ME(-UL) series

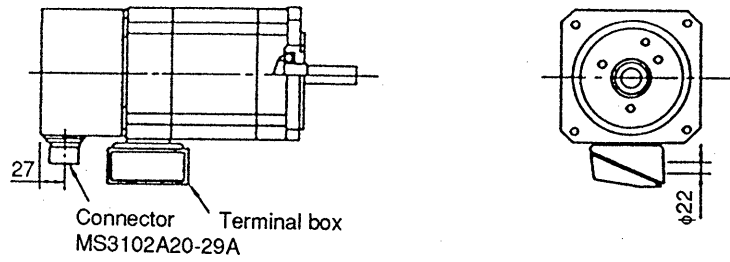


#### (2) HA-FE(-UL) series

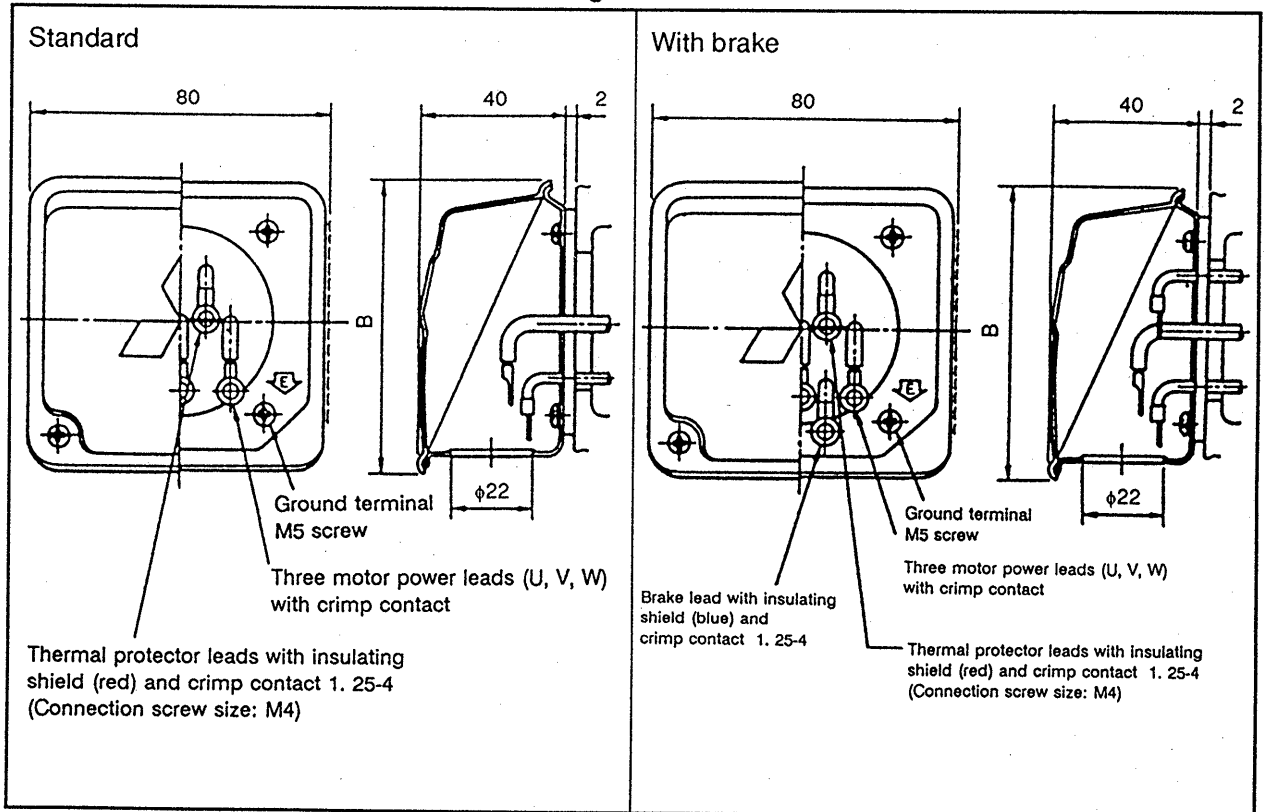


## 2. Outline of Wiring and Operation

### (3) HA-SE series



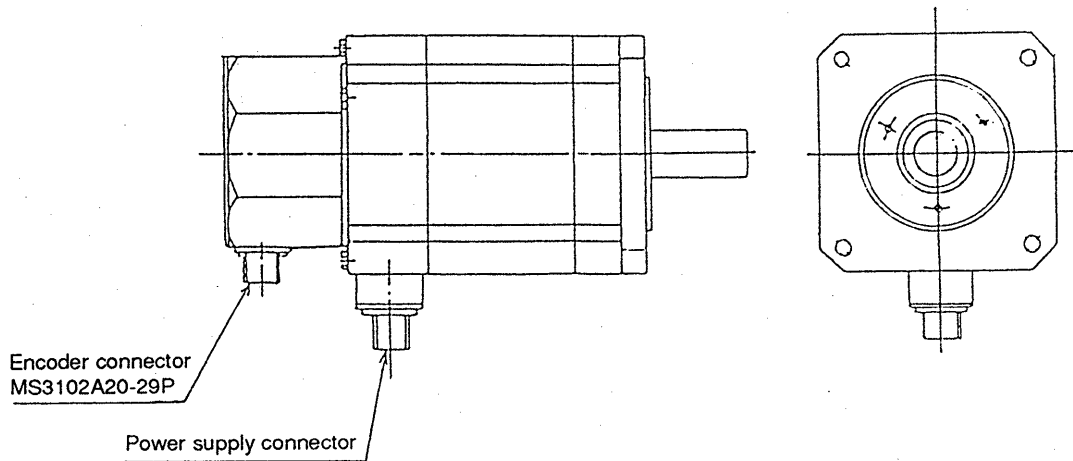
### HA-SE servo motor terminal box detailed diagram



HA-SE102 to HA-SE352

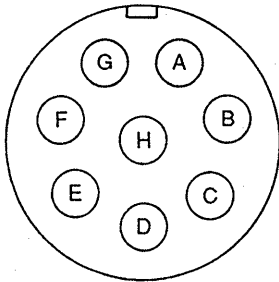
## 2. Outline of Wiring and Operation

### (4) HA-SE-UL series



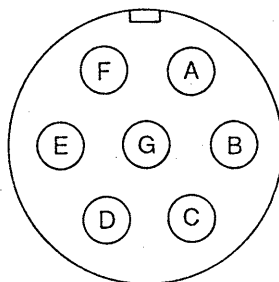
1000 r/min series	2000 r/min series	3000 r/min series	Power supply connector	Cable connector
—	HA-SE52C(B)-UL	HA-SE53C(B)-UL	MS3102A22-23P	MS3106B22-23S
—	HA-SE102C(B)-UL	HA-SE103C(B)-UL		
HA-SE81C(B)-UL	HA-SE152C(B)-UL	HA-SE153C(B)-UL		
HA-SE121C(B)-UL	HA-SE202C(B)-UL	HA-SE203C(B)-UL	MS3102A24-10P	MS3106B24-10S
HA-SE201C(B)-UL	HA-SE352C(B)-UL	HA-SE353C(B)-UL		
HA-SE301C(B)-UL	—	—		

Cable connector (Cannon make)  
MS3106B22-23S



Symbol	Signal
A	Power supply (U)
B	Power supply (V)
C	Power supply (W)
D	Ground
E	Thermal protector
F	Thermal protector
G	Blank
H	Blank

Cable connector (Cannon make)  
MS3106B24-10S



Symbol	Signal
A	Power supply (U)
B	Power supply (V)
C	Power supply (W)
D	Ground
E	Thermal protector
F	Thermal protector
G	Blank

## 2. Outline of Wiring and Operation

- (5) The details of each servo motor encoder's connector pin layout are noted on the reference section given below.

Servo motor	Refer to:
HA-ME	Section 6-4.4(1)
HA-ME-UL	
HA-FE	Section 6-4.4(2)
HA-FE-UL	Section 6-4.4(1)
HA-SE HA-SE-UL	Section 6-4.4(3)

Note: The connection cable between the servo motor encoder and amplifier is an option. Refer to Section 6-4 for details of producing this cable.

### 2-1.4 Wiring the servo amplifier terminal block

FIELD WIRING REFERENCE TABLE FOR INPUT (R, S, T) AND OUTPUT (U, V, W)

Servo amplifire	SCREW SIZE	SCREW TORQUE (POUND INCH)	CRIMPING TERMINALS TYPE AND TOOL TYPE (Note 1)		WIRE SIZE/ TEMP RATING (Note 2)
			CRIMPING TERMINALS	CRIMPING TOOLS	
MR-J350A	M4	13	35787-0 32543-0	59239	AWG10/75°C
MR-J200A	M4	13	34169-0	59239-0	AWG12/75°C
OTHER MODELS	M4	13	32959	47387	AWG14/75°C

Note: 1. Manufacturer: AMP INCORPORATED, HARRISBURG, PA 17105

2. Use copper wire only.

## 2. Outline of Wiring and Operation

### 2-2 Power supply

#### 2-2.1 Power and main control circuit wiring

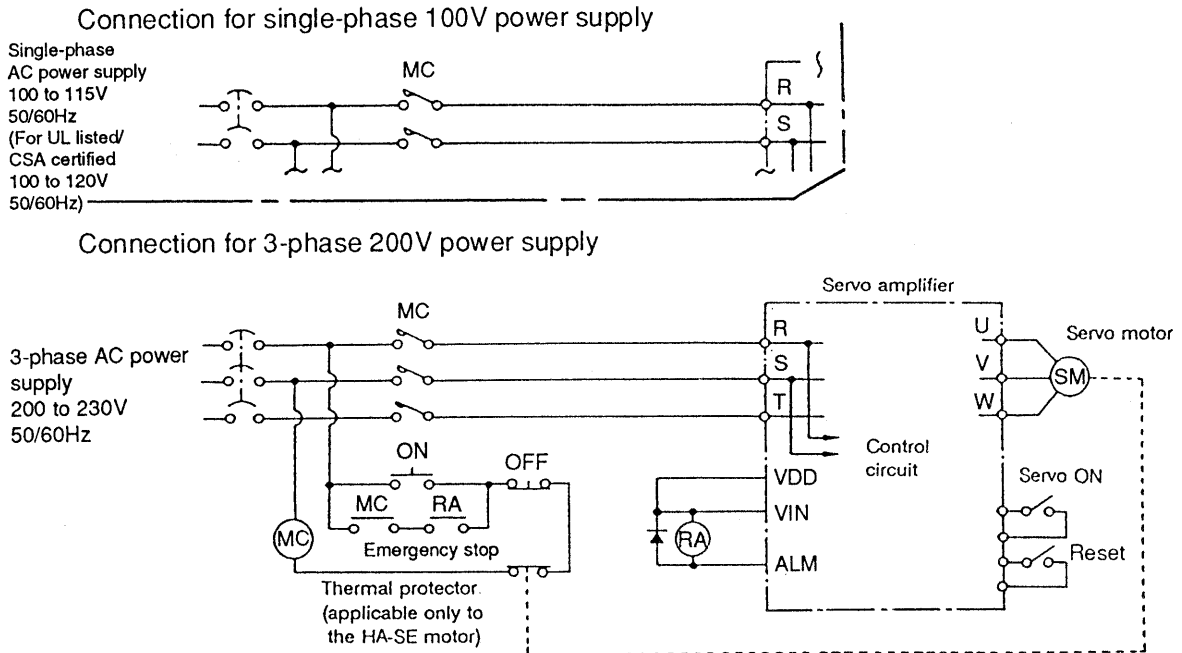
The AC power and main control circuit should be wired as shown below.

##### Basic connection

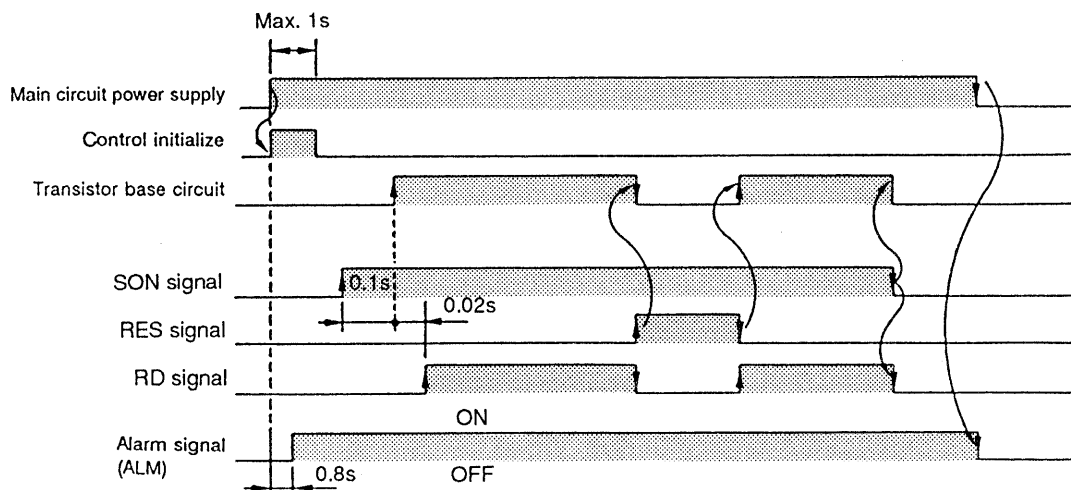
The control circuit will be enabled when the AC power is applied to terminals R,S,(T).

Allow at least one second for initialization, then close the "Servo on" contact to enable the drive.

The main circuit will be switched off when the reset (RES) contact is closed. This will cause the servo motor to coast to a stop.



**Fig. 2-1 Main circuit connection diagram**



**Fig. 2-2 Timing chart when power is switched on**

## 2. Outline of Wiring and Operation

### 2-2.2 Emergency stop circuit

Use the dynamic brake (optional) when the motor must be stopped immediately when an alarm or emergency occurs.

Refer to Section 6-2 for wiring and timing chart.

### 2-2.3 Alarm occurrence timing chart

When an alarm occurs in the servo amplifier, the transistor's bases will be shut off and the servo motor will coast to stop. The power should be shut off. (Refer to Fig. 2-1.)

To restart the drive, remove the cause, and switch the power ON.

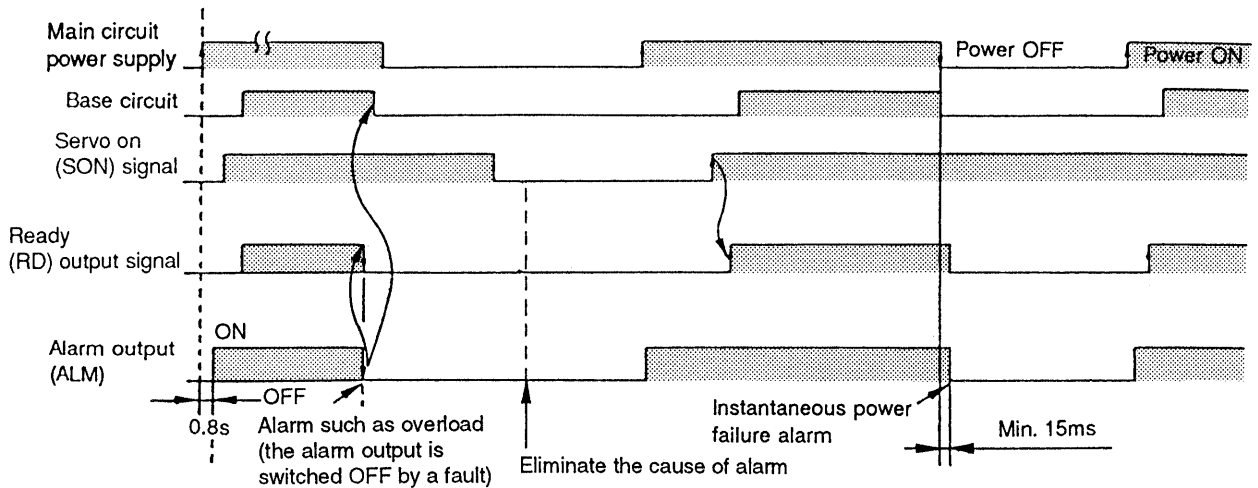


Fig. 2-3 Timing chart during alarm

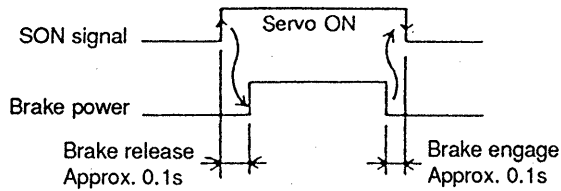
**Important** Do not repeatedly restart the drive without removing the cause of an overload or over current alarm. Continued attempts to run under these conditions could damage the servo amplifier.

## 2. Outline of Wiring and Operation

### 2-2.4 Electromagnetic brake operation (Refer to section 9-5)

For applications requiring a brake to hold the motor shaft (vertical lift applications), an electromagnetic brake should be used with the servo motor. Please note the following:

- 1) The brake is a fail-safe type. The brake will operate when the power supply (24VDC) is off.
- 2) When operating the brake, always switch OFF the "servo ON" signal.
- 3) In all applications take the braking delay time into consideration.



- If a time delay cannot be provided at servo off, the DC power for the brake should be switched off when the "servo ON" signal switches OFF in order to minimize switching delay.

Braking delay time:

DC OFF: Approx. 0.03s

## 2. Outline of Wiring and Operation

### 2-3 Servo amplifier display operation

#### Status display flow chart

The servo amplifier status can be monitored and parameters can be set with the display section (5-digit, 7-segment display) on the front of the servo amplifier. Confirm the parameter settings before operation, diagnose errors, confirm external sequences, and confirm the operation status with this display.

An example of the display flow chart (for the position servo) is shown below. Refer to Section 3-5.1 or 4-5.1 for a detailed flow chart for the position or speed control. For details of the display, refer to the subsequent pages.

Momentarily press "MODE" to move across chart. Momentarily press "UP" or "DOWN" to move up or down columns.

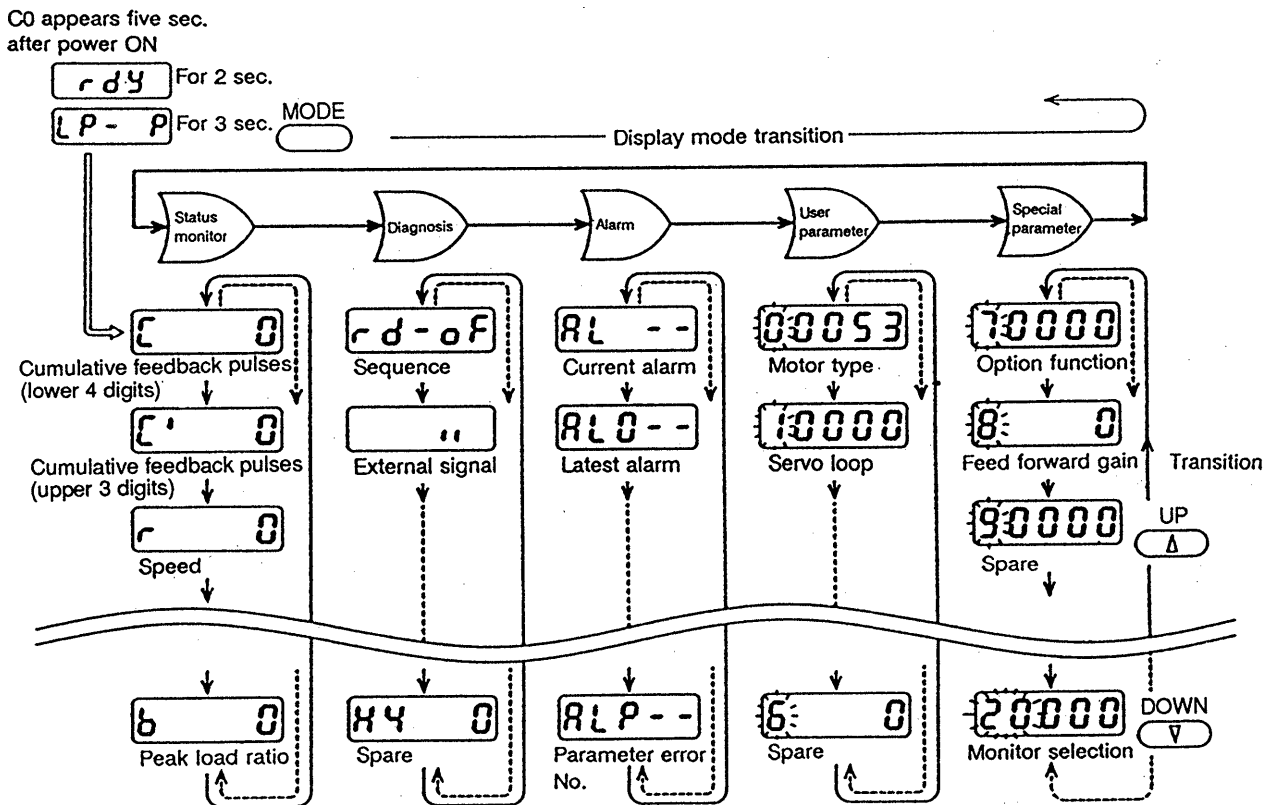


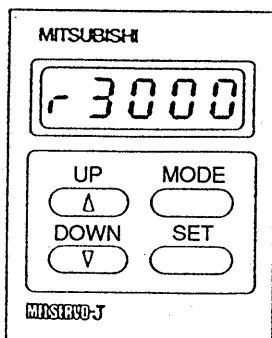
Fig. 2-4 Details of the display



## 2. Outline of Wiring and Operation

### Display and button operation

#### (1) Layout of the display section



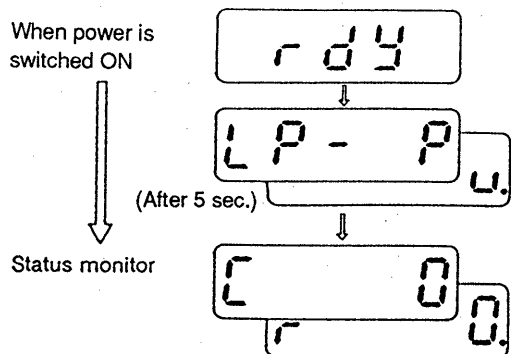
#### Button functions:

MODE : The setting status, diagnosis/setting, parameter and display details.

SET : This is used to set the parameter data.

UP } This is used to change the display in each  
DOWN } mode and to change the data numerical values.

#### (2) Display after power is switched ON



- When the power is switched ON, "rdy", indicating initialization, will be displayed for approx. 2 seconds. Keys pressed during this display will be ignored.
- Next, the servo type will be displayed.
  - LP-P: positioning servo
  - LP-U: speed servo
- Then, the status will show.
  - : positioning servo
  - : speed servo

#### (3) Mode details

##### 1) Status display mode

The display details are selected by pressing the "UP" or "DOWN" button.

##### 2) Diagnosis/setting mode

Automatic tuning, ON/OFF status diagnosis of the external input/output signals, and test operation with the operation buttons is possible.

##### 3) Alarm mode

The alarm code will be displayed from any screen when an alarm occurs.

##### 4) Parameter mode

The parameters required for the motor type, e.g. control method (position, speed) electronic gears, and acceleration/deceleration times, must be set before operation.

Refer to the parameter tables in Sections 3-5.5 and 4-5.5, and set with the following procedure.

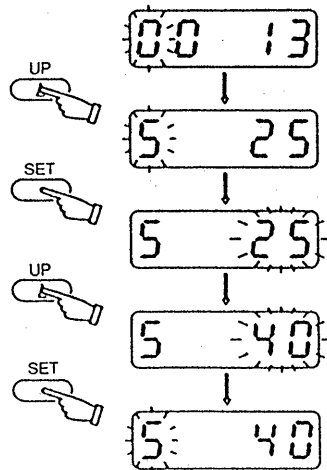
Note: Parameters marked "\*" in the table are validated when the power is cycled after setting.

To ensure safety, set the parameters with the "servo ON" signal switched OFF.

Confirm that the setting for Pr. 0 and Pr. 1 is correct before operation.

## 2. Outline of Wiring and Operation

### Operation procedure



- Enter the parameter mode by pressing the "MODE" button. "0" will flicker as the Pr. No.
- Select the Pr. No. to be set with the "UP, DOWN" buttons.
- The parameter to be set, Pr. 5, and the data will be displayed.
- The data part will flicker when the "SET" button is pressed.
- Change the data with the "UP, DOWN" buttons.
- Press the "SET" button, and the setting will be completed.

Note: Some parameters will not be validated unless the power is switched OFF and ON once (ex. Pr. 0, Pr. 1). Refer to Sections 3-5.5 and 4-5.5 for details.

## 3. Start Up and Operation of Position Servo

### 3-1 Wiring

Wire according to the wiring diagram. Refer to Section 3-7 for the definitions and use of the servo amplifier signals and functions.

Examples of operation with positioning unit AD71 or FX-1GM are shown in Section 3-6.1.

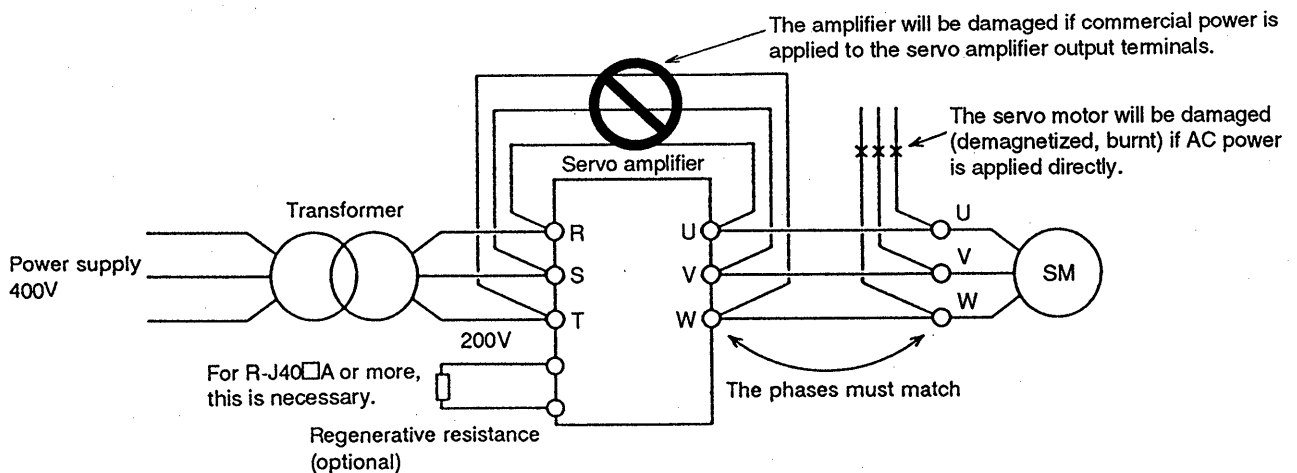
### 3-2 Checking wiring

- (1) Refer to the wiring diagram and confirm that the wiring is correct. (Refer to Section 3-6)
- (2) Especially note the following wiring. The unit may be damaged if it is miswired.

#### Main circuit

- 1) A source of AC power which conforms to the specification must be connected to the servo amplifier power supply terminals (R, S, T). If the power does not conform to the specification, drop the voltage to the specified voltage by using a transformer.
- 2) Power supply lines (R, S, T) must not be connected to the servo motor output terminals (U, V, W).
- 3) The phases of the output terminals (U, V, W) and servo motor terminals (U, V, W) must match.
- 4) AC power must not be directly applied to the servo motor.

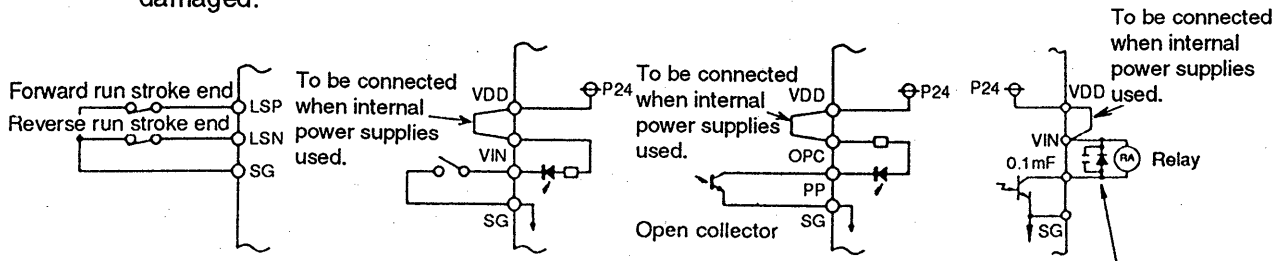
#### 3-phase 200 V series



### 3. Start Up and Operation of Position Servo

#### Control circuit

- 1) Stroke end limit switches LSs (LSP, LSN on CN1) and SG must be connected as shown below (normally closed). "Jumper" circuit when there is no limit switch on the machine.
- 2) Connect 24VDC to the interface power supply terminal (VIN). Connect VIN and VDD when using the power supply in the servo amplifier (VDD).
- 3) If the pulse train is an open collector type, connect the open collector power supply (OPC) terminal and VDD. Do not connect when a differential type is used.
- 4) When connecting a relay to the open collector output terminals, insert a diode parallel to the relay. The diode must be connected with correct polarity. Otherwise, the servo amplifier will be damaged.



**⚠ CAUTION**  
The servo amplifier will be damaged if the diode is not connected as shown.  
Some relays have internal snubber diodes, observe polarity.

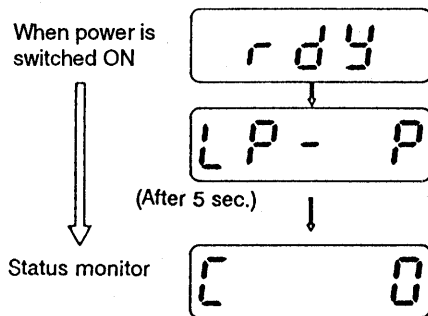
### 3. Start Up and Operation of Position Servo

#### 3-3 Switching power on and setting parameters

The setting of the 1) motor type and 2) servo loop type has been set factory set. These parameters are validated when the power is switched OFF once after setting and then switching ON again.

##### (1) Switching power ON

Switch the SON signal OFF and switch ON the AC power.



- When the power is switched ON, "rdy", indicating initialization, will be displayed for approx. 2 seconds.
- Next, the servo type will be displayed. LP-P: positioning servo
- Status display  
The cumulative feedback pulse will be displayed.

##### (2) Setting parameters

After switching the power ON, the parameters must be set as needed.

The unit may not operate properly if the following three items are not set correctly. Always confirm the settings, and set as needed.

##### 1) Motor type (Parameter No. 0 MTY)

Refer to the combination table below and set the parameter according to the type of servo motor being used. The servo motor may be damaged if not set correctly. Values in shaded areas in the table shown below are initial values.

		Servo motor series	Servo motor rating (parameter setting value)											
Amplifier	MR-J	-	10A 10A1	20A 20A1	40A 40A1	60A	70A	100A	200A	350A	10MA 10MA1	20MA 20MA1	40MA 40MA1	70MA
Motor	HA-FE	0	053	23	33	63	-	-	-	-	-	-	-	-
			13	-	43	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-	-
	HA-SE	1	-	-	-	-	52	102	152	352	-	-	-	-
			-	-	-	-	53	103	202	353	-	-	-	-
			-	-	-	-	-	81	153	301	-	-	-	-
			-	-	-	-	-	121	203	-	-	-	-	-
	HA-ME	3	-	-	-	-	-	-	-	-	053	23	43	73
			-	-	-	-	-	-	-	-	-	13	-	-

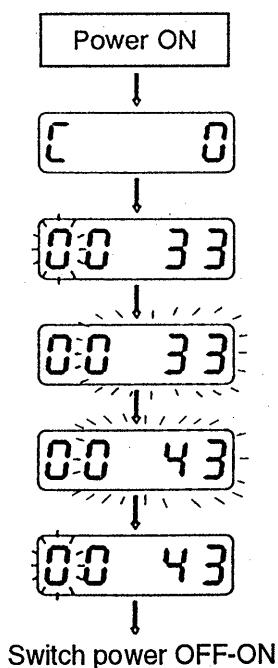
The setting for the HA-FE and HA-SE servo motors cannot be made by the MR-J□MA servo amplifier.

### 3. Start Up and Operation of Position Servo

#### Setting example

Operate HA-FE43 with servo amplifier MR-J40A.

The value for Parameter No. 0 for this combination of servo motor and servo amplifier must be changed from the factory setting. The table on the previous page shows that the value must be changed from "33" to "43". Use the following procedure to change the value.



Press the [MODE] button three times.

The initial value (HA-FE33) will be displayed. Press the [SET] button.

The data section will flicker. Change the data to 0 43 with the [UP] and [DOWN] buttons.

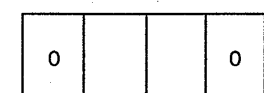
Press the [SET] button.

The setting will be finished, and the parameter No. section will flicker.

The data will be registered and the setting completed.

#### 2) Servo loop type (Parameter No. 1 STY)

The servo loop type, Parameter No. 1, defines whether the drive is a speed or position type. The value of the parameter also defines the auto tuning mode and whether the regenerative option is to be used. If a model above the MR-J40A is used, the regenerative option must be installed. Set the parameter value according to the following chart.



- 0: Standard mode, position servo (pulse train)
- 1: Standard mode, speed servo (analog, three internal speeds)
- 4: Low noise mode, position servo (pulse train)
- 5: Low noise mode, speed servo (analog, three internal speeds)

- Auto tuning
- 0: Medium response
  - 1: Fast response
  - 2: Slow response
  - 3: Invalid

Setting value	Regenerative option(combination)	Regenerative power (W)	Applicable amp.
0	No regenerative option	—	
1	MR-RB013	10	MR-J10A to MR-J100A MR-J10A1 to MR-J40A1 MR-J10MA to MR-J70MA MR-J10MA1 to MR-J40MA1
2	MR-RB064	30	
3	MR-RB064 × 2	100	
4	MR-RB064	60	MR-J200A
5	MR-RB10 × 2	150	
6	MR-RB30 × 2	500	
7	MR-RB10	100	MR-J350A
8	MR-RB30	300	
9	MR-RB50	500	

### 3. Start Up and Operation of Position Servo

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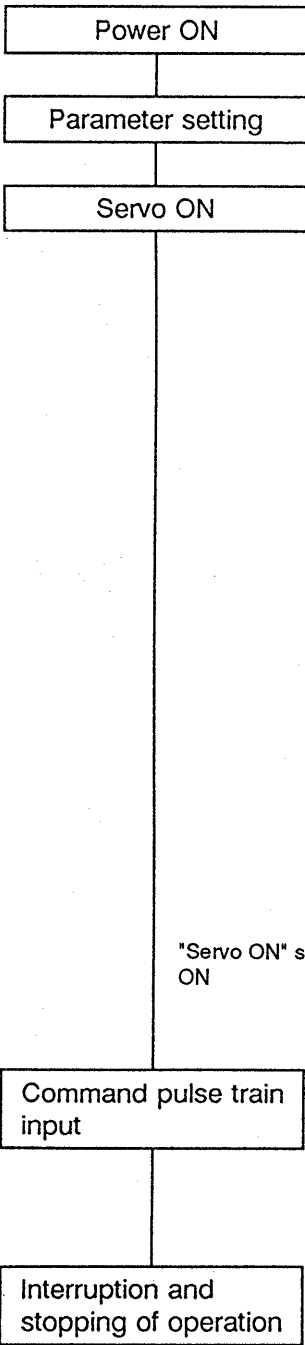
3) Electronic gears (Parameters No. 2, 3 CMX, CDV)

Set this according to the machine. Normally the movement amount for one command pulse is set to a value such as 1 $\mu$ m, 10 $\mu$ m. Refer to Section 3-5.5 (2) for setting methods.

### 3. Start Up and Operation of Position Servo

#### 3-4 Operation

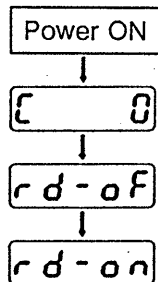
The servo motor is operated with the following procedure after the power is switched ON and the parameters have been set.



The "servo ON" signal is switched ON. The operable status is entered, and the motor is servo-locked. If the motor is not servo-locked, the "servo ON" signal is not ON. Confirm the status with the monitor, and check the wiring.

[Diagnosis screen]

- Servo ON/OFF check



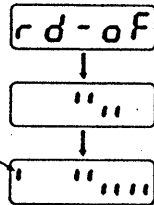
Press the [MODE] button once.

Switch servo ON.

This display will show when the servo ON turns ON.

- Input signal check

When the following steps are carried out from the above **rd-of** display, the input signal ON/OFF status can be checked.



Press the [UP] button once.

The external input/output signal ON/OFF status will be displayed. Switch the servo ON. When the servo ON switch ON, the following will be displayed.

\* The ready and positioning completed signals will be output simultaneously and displayed.

"Servo ON" signal ON

- When a pulse train is input from the positioning unit, the motor will begin to rotate. First, drive the servo motor at a low speed with JOG, and confirm the rotation direction and stroke, etc. If the servo motor is not rotating as desired, check the input signal again. Refer to Sections 3-5.3 and 5-2.
- Confirm the motor speed, command pulse frequency and load ratio, etc. on the servo amplifier status display monitor.
- When the checking of the machine operation has been completed, confirm automatic operation with the positioning unit program.

The operation will be interrupted or stopped when the following are carried out.

- 1) Servo OFF ..... The main transistor's base current will be shut off and the servo motor will coast to stop.
- 2) Reset ..... The main transistor's base will be shut off and the servo motor will coast to stop. The dynamic brake (optional) will not operate.
- 3) Stroke end OFF ..... The motor will stop immediately and be locked by the servo. Rotation in the reverse direction will be possible.
- 4) Alarm ..... The main transistor's base will be shut off when an alarm occurs.



# 3. Start Up and Operation of Position Servo

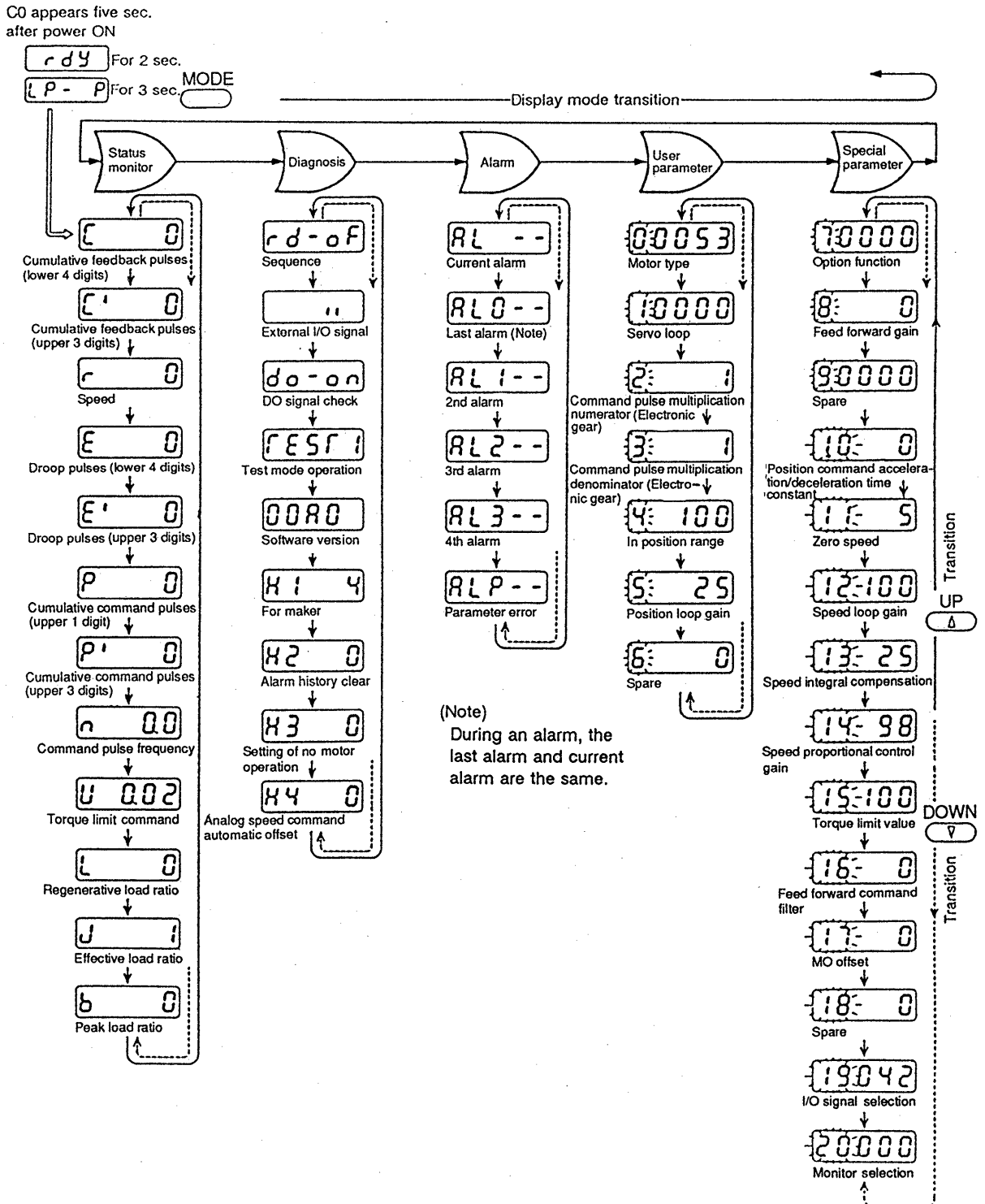
## 3-5 The display and setting functions

### 3-5.1 Display flow chart

#### Details of the display

The status can be monitored and parameters set with the display section (5-digit, 7-segment display) on the front of the servo amplifier. Confirm the parameter settings before operation, diagnosis trouble, confirm external sequences, and confirm the operation status with this display.

An example of the display flow chart (for the position servo) is shown below. Refer to sections 3-5.2 to 3-5.5 for details on the display.



### 3. Start Up and Operation of Position Servo

#### 3-5.2 Status display

The various states during operation are displayed. The display details can be changed freely with the UP and DOWN buttons. The display when the power is switched ON is set to Pr. 20.

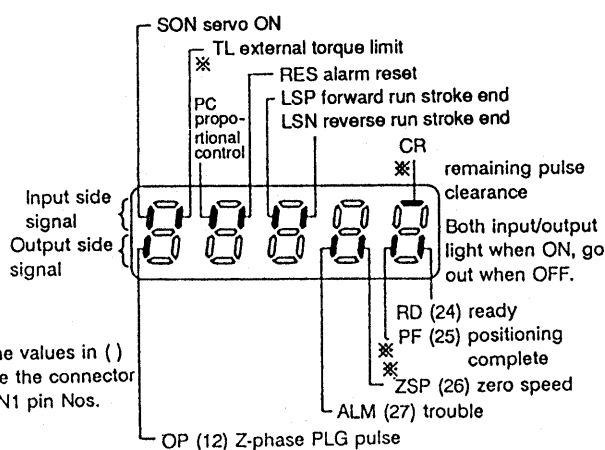
Name	Sym- bol	Display range, unit	Details
Cumulative feedback pulses (lower 4 digits)	C	-9999999 to 9999999 pulses	The feedback pulses (4-times multiplying) are counted. When the count overflows, it returns to zero. The lower 2nd, 3rd and 4th digit decimal points will light for reverse run pulses (negative values). The display will be reset to "0" when the "SET" button is pressed.
Cumulative feedback pulses (upper 3 digits)	C'		
Speed	r	3.0.0.0 to 3000 r/min	The servo motor speed is displayed. The lower 2nd, 3rd and 4th digit decimal points will light during reverse run.
Cumulative droop pulses (lower 4 digits)	E	-65535 to 65535 pulses	The details of the position deviation counter are displayed. The lower 2nd, 3rd and 4th digit decimal points will light for reverse run pulses (negative values).
Cumulative droop pulses (upper 1 digit)	E'		
Cumulative command pulses (lower 4 digits)	P	-9999999 to 9999999 pulses	The command pulses before the pulses are multiplied with the electronic gear are displayed. The lower 2nd, 3rd and 4th digit decimal points will light for reverse run pulses (negative values). The display will be reset to "0" when the "SET" button is pressed.
Cumulative command pulses (upper 3 digits)	P'		
Command pulse frequency	n	-200.0 to 200.0 kpps	The command pulse frequency, before the pulses are multiplied with the electronic gear, is displayed. During reverse run, the lower 3rd and 4th decimal points light, and the lower 2nd decimal point will go out.
Speed command voltage	F	±10.00V	The speed command voltage is displayed. During negative voltage, the lower 2nd and 4th decimal points light, and the lower 3rd decimal point goes out.
Torque limit command	U	0 to 10.00V	The torque limit command voltage is displayed.
Regenerative load ratio	L	0 to 100%	The regenerative load ratio for the regenerative option tolerance value selected in Pr. 1 is displayed in %. A short time (approximately 30 to 40 minutes) is required for stabilizing.
Effective load ratio (Note)	J	0 to 300%	The load ratio for the rated torque is displayed in %. The servo motor temperature is assumed, so the effective torque and display value are not linear. A short time (approximately 10 to 20 minutes) is required for stabilizing.
Peak load ratio	b	0 to 300%	The load ratio is displayed in % according to the rated torque.

\* Note: When the display value is not 100%, the display value and effective load ratio will differ. Refer to Section 4-5.2 for this relationship. When the display value is 90, 80 or 70, the effective load ratio is 95, 89 or 84%.

### 3. Start Up and Operation of Position Servo


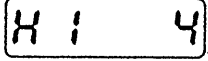

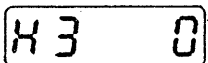
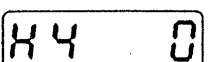
#### 3-5.3 Diagnosis mode

This is used to confirm the status of the external sequence, etc.

Name	Display	Details
Sequence (automatic tuning)	r d - o f	Not ready. The unit is being initialized after the servo ON has been switched ON, or an alarm has occurred. Automatic tuning can be performed from this screen. (Refer to Section 5-1 for details.)
	r d - o n	Ready. Enter the operable status after initialization after switching the servo ON. Automatic tuning can be performed from this screen.
External input/output signal	 <p>The values in ( ) are the connector CN1 pin Nos.</p>	<p>The external input/output signal ON-OFF status is displayed.</p> <p>The upper of the vertical line of each segment in the 5-digit LED is the input signal, and the lower corresponds to the output signal.</p> <p>The figure on the left shows the status when all input/output signals are switched ON.</p> <p>The relation of each segment's vertical line and input/output signal is shown on the left.</p> <p>Note 1. The input signal pin Nos. marked "*" respond to the factory default setting. (Change these with parameter No. 19.)</p>
DO signal check	d o - o n	<p>The <span style="border: 1px solid black; padding: 2px;">...i</span> DO signal check display will appear when the [SET] button is pressed for more than two seconds.</p> <p>The output from connector CN1's 24, 25, 26 and 27 pins enter the state where they can be forcibly switched ON/OFF. Always operate these with the servo switched OFF. (Refer to Section 5-3 for details.)</p>
Test mode operation	r e s r 1	<p>The <span style="border: 1px solid black; padding: 2px;">d 200</span> (200r/min) speed display will appear when the [SET] button is pressed for more than two seconds, and the test operation state will be entered.</p> <p>Always operate this with the servo switched OFF. (Refer to Section 5-4 for details.)</p>



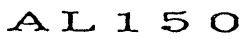

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### 3. Start Up and Operation of Position Servo

Name	Display	Details
Software version		For MITSUBISHI use
For MITSUBISHI		For MITSUBISHI use
Alarm history clear		Change DATA from 0 to 1, press "SET", and the alarm history will be cleared. (Refer to Section 5-2.5 for details.)
No-motor operation setting		Change the DATA to 53, press "SET" and the unit will operate without the motor. (Refer to Section 5-2.4 for details.)
VC input/automatic offset		The automatic tuning of the speed command input voltage offset will be executed with "13" and "SET". (Refer to Section 5-1.2 for details.)

#### 3-5.4 Alarm mode

The history of past alarms, and parameter errors are displayed in this mode.

Name	Display example	Details
Current alarm		This shows that an alarm has not occurred.
		This shows that alarm 33 (overvoltage) has occurred. During an alarm, A and the first character's decimal point will flicker. (This will flicker even when the screen is changed.)
Alarm history		This shows that alarm 50 (overload) occurred one alarm ago.
Parameter error		This shows that there is an error in the Pr. 5 data.

#### Functions during an alarm

- (1) The alarm mode display can be entered from any screen other mode.
- (2) Other displays can be viewed when an alarm occurs, but the first digit's (5th digit) decimal point will flicker, so you can determine if an alarm is occurring.
- (3) To reset after an alarm has occurred, switch the power OFF, or switch the external reset signal ON.
- (4) When resetting the alarm from the servo amplifier unit, press the [SET] button with the current alarm displayed.

Note: Create a sequence so that when an alarm occurs, the main circuit contactor MC will be switched off. (Refer to Section 2-2.1.)

### 3. Start Up and Operation of Position Servo

#### 3-5.5 Parameters

##### (1) Parameter list

Table 3-1 Parameter list for positioning servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range
User parameter	0	*MTY	Motor type	####		
	1	*STY	Servo loop (1) Positioning/speed servo (2) Regenerative resistor option (3) Auto tuning selection	0000		0 to 7395h
	2	CMX	Command pulse multiplication (numerator) electronic gears	1		1 to 9999
	3	CDV	Command pulse multiplication (denominator) electronic gears	1		1 to 9999
	4	INP	In-position range	100	pulse	0 to 9999
	5	PGN	Position loop gain	25	rad/s	5 to 150
	6	—	Spare	0		
Special parameters	7	*OPS	Option functions (1) Command pulse input format (2) Command pulse input signal logic (3) Speed proportional command valid	0000		0 to 111Fh
	8	FFC	Feed forward gain	0	%	0 to 100
	9	—	Spare	0		
	10	PST	Position command acceleration/deceleration time constant (smoothing)	0	10ms(1ms)	0 to 999 (-99 to 0)
	11	ZSP	Zero speed	5	10r/min	1 to 500
	12	VGN	Speed loop gain	100		70 to 999
	13	VIC	Speed integral compensation	25	ms	1 to 999
	14	VDC	Speed proportional control gain	98	%	0 to 100
	15	TLL	Torque limit value	100	%	0 to 100
	16	FST	Feed forward command filter	0		0 to 7
	17	MOO	Analog monitor, offset	0	mV	-20 to 100
	18	—	Spare	0		
	19	IPO	Input/output signal selection	042		0 to 1AFh
	20	*DMD	Monitor selection (1) Status display when power is switched ON (2) Encoder output division rate (3) Analog monitor output selection	000		0 to DFBh

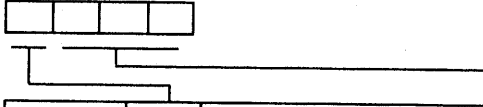
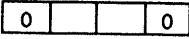
####: The initial value (factory default value) will differ according to the servo amplifier size

\* : These are validated when the power is cycled after setting.

### 3. Start Up and Operation of Position Servo

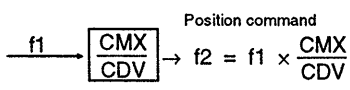
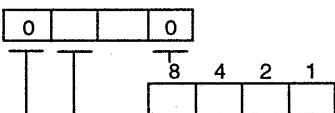
(2) Explanation of parameters

Table 3-2 Details of positioning servo parameters

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																																																																																																																																																																
User parameter	0	*MTY	<p>Motor type:</p>  <table border="1" data-bbox="523 571 1508 1108"> <thead> <tr> <th colspan="2"></th> <th>Motor series</th> <th colspan="12">Motor rating (parameter setting value)</th> </tr> <tr> <th rowspan="2">Amplifier</th> <th rowspan="2">MR-J</th> <th rowspan="2">-</th> <th>10A</th> <th>20A</th> <th>40A</th> <th>60A</th> <th>70A</th> <th>100A</th> <th>200A</th> <th>350A</th> <th>10MA</th> <th>20MA</th> <th>40MA</th> <th>70MA</th> </tr> <tr> <th>10A1</th> <th>20A1</th> <th>40A1</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>10MA1</th> <th>20MA1</th> <th>40MA1</th> <th></th> </tr> </thead> <tbody> <tr> <td rowspan="6">Motor</td> <td rowspan="3">HA-FE</td> <td rowspan="3">0</td> <td>053</td> <td>23</td> <td>33</td> <td>63</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>13</td> <td>-</td> <td>43</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="4">HA-SE</td> <td rowspan="4">1</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>52</td> <td>102</td> <td>152</td> <td>352</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>53</td> <td>103</td> <td>202</td> <td>353</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>81</td> <td>153</td> <td>301</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>121</td> <td>203</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">HA-ME</td> <td rowspan="2">3</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>053</td> <td>23</td> <td>43</td> <td>73</td> </tr> <tr> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>13</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>The highlighted values in the table are the initial values.</p>			Motor series	Motor rating (parameter setting value)												Amplifier	MR-J	-	10A	20A	40A	60A	70A	100A	200A	350A	10MA	20MA	40MA	70MA	10A1	20A1	40A1							10MA1	20MA1	40MA1		Motor	HA-FE	0	053	23	33	63	-	-	-	-	-	-	-	-	13	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HA-SE	1	-	-	-	-	52	102	152	352	-	-	-	-	-	-	-	-	53	103	202	353	-	-	-	-	-	-	-	-	-	81	153	301	-	-	-	-	-	-	-	-	-	121	203	-	-	-	-	-	HA-ME	3	-	-	-	-	-	-	-	-	053	23	43	73	-	-	-	-	-	-	-	-	-	13	-	-	-			
			Motor series	Motor rating (parameter setting value)																																																																																																																																																																		
Amplifier	MR-J	-	10A	20A	40A	60A	70A	100A	200A	350A	10MA	20MA	40MA	70MA																																																																																																																																																								
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	1	*STY	<p>Servo loop type: The servo loop and validity of the regenerative option are set.</p>  <ul style="list-style-type: none"> <li>0: Positioning servo (pulse train)</li> <li>1: Speed servo (analog, three internal speeds)</li> <li>4: Low noise mode, position servo (pulse train)</li> <li>5: Low noise mode, speed servo (analog, three internal speeds)</li> </ul> <ul style="list-style-type: none"> <li>0: No regenerative option</li> <li>1: Regenerative option (MR-RB013)</li> <li>2: Regenerative option (MR-RB033)</li> <li>3: Regenerative option (MR-RB064x2 series)</li> <li>4: Regenerative option (MR-RB064)</li> <li>5: Regenerative option (MR-RB10x2 series)</li> <li>6: Regenerative option (MR-RB30x2 series)</li> <li>7: Regenerative option (MR-RB10)</li> <li>8: Regenerative option (MR-RB30)</li> <li>9: Regenerative option (MR-RB50)</li> </ul> <p>The combination of the regenerative option and servo amplifier is restricted. Refer to Section 6-1.</p> <ul style="list-style-type: none"> <li>0: Automatic tuning valid (medium response)</li> <li>1: Automatic tuning valid (fast response)</li> <li>2: Automatic tuning valid (slow response)</li> <li>3: Automatic tuning invalid</li> </ul>	0000		0 to 7395h																																																																																																																																																																

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### 3. Start Up and Operation of Position Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range
User parameter	2	CMX	Command pulse multiplication (numerator): The multiplier of the input command pulses is set here.	1		1 to 9999
	3	CDV	Electronic gears Command pulse multiplication (denominator): The divisor of the input command pulses is set here. (Ex.) Input command pulse  Setting range $\frac{1}{50} < \frac{CMX}{CDV} < 20$	1		1 to 9999
	4	INP	In-position range When the number of droop pulses as set in this parameter is counted, the positioning completed output is set.	100	pulse	0 to 9999
	5	PGN	Position loop gain The position loop gain is set here. The value will change automatically when automatic tuning is executed.	25	rad/s	5 to 150
	6		Spare	0		
Special parameter	7	*OPS	Special function selection:  (a) Command pulse input format 0: forward/reverse run pulse train input 1: symbol/pulse train input 2: 2-phase pulse train input (x1) 3: 2-phase pulse train input (x2) 4: 2-phase pulse train input (x4) (b) Command pulse input signal logic 0: input signal negative logic 1: input signal positive logic 0: speed proportional command invalid Valid only when the external input signal PC is ON. 1: speed proportional command valid (c) LSP, LSN Stop pattern when OFF 0: immediate stop 1: erasing stop  For the setting method, refer to Section 3-7.	0		1 to 111Fh
	8	FFC	Feed forward gain The feed forward gain of the position loop is set. When set to 100%, the droop pulses will be zero when operating at a constant speed. The overshoot will increase when sudden acceleration or deceleration is carried out. (As a guideline, at FFC=100%, the acceleration/deceleration time to the rated speed is 1s or more.)	0	%	1 to 100

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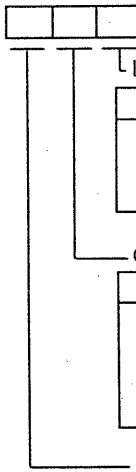
### 3. Start Up and Operation of Position Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																			
Special parameter	9		Spare	0																					
	10	PST	Position command acceleration/deceleration time constant (smoothing) This parameter is used to apply a low pass filter to the command pulse train.  (Ex.) When commanded from an encoder for synchronization, synchronized operation can be started smoothly even when started during line operation.	0	10msec 1msec	0 to 9999 -99 to 0																			
	11	ZSP	Zero speed The speed for switching on the zero speed output signal (ZSP) is set here.	5	10r/min	1 to 500																			
	12	VGN	Speed loop gain The speed loop gain is set here. The value will change automatically when automatic tuning is executed.	100		70 to 999																			
	13	VIC	Speed integral compensation The time constant for integral compensation is set. The value will change automatically when automatic tuning is executed.	25	msec	1 to 999																			
	14	VDC	Speed proportional control gain The proportional control will be validated when parameter Pr. 7 is set or the proportional control input signal (PC) is switched ON. The proportional integral control will be activated when set to 100, and the proportional gain will decrease with a smaller value.	98	%	0 to 100																			
15	TLL	Torque limit value With a maximum torque of 100%, the proportion of MAX torque to be used is set. When the external torque limit input signal (TL) switches ON, the smaller of the external torque limit value or this parameter set value will be used. The MAX torque set with this parameter will be 8V when the torque is monitored with monitor output.	100	%	0 to 100																				
16	FST	Feed forward command time constant The filter time constant for the position loop feed forward command is set here.	0	$2^{(x-1)}$ ms X: Set value 0ms when set to X=0	0 to 7																				
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Set value</th> <th>Filter time constant</th> <th>Set value</th> <th>Filter time constant</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0ms</td> <td>4</td> <td>8</td> </tr> <tr> <td>1</td> <td>1</td> <td>5</td> <td>16</td> </tr> <tr> <td>2</td> <td>2</td> <td>6</td> <td>32</td> </tr> <tr> <td>3</td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>			Set value	Filter time constant	Set value	Filter time constant	0	0ms	4	8	1	1	5	16	2	2	6	32	3	4					
Set value	Filter time constant	Set value	Filter time constant																						
0	0ms	4	8																						
1	1	5	16																						
2	2	6	32																						
3	4																								

Continued on the next page.



### 3. Start Up and Operation of Position Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																										
Special parameter	17	MOO	Analog monitor offset The offset for the analog monitor output is set here.	0	mV	-20 to 100																										
	18		Spare	0																												
	19	IPO	I/O signal selection The input signal functions of the connector CN1 pins 32 and 33, and the output signal functions of pins 25 and 26 are selected. <div style="margin-top: 10px;">  <p style="margin-left: 20px;">Input pin function selection</p> <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <thead> <tr> <th>Setting</th> <th>Pin 32</th> <th>Pin 33</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">PC</td> <td style="text-align: center;">YL</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">CR</td> <td style="text-align: center;">TL</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">CR</td> <td style="text-align: center;">PC</td> </tr> </tbody> </table> <p style="margin-left: 20px;">(For signal name, refer to Section 3-7.) ← Initial value</p> <p style="margin-left: 20px;">Output pin function selection</p> <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <thead> <tr> <th>Setting</th> <th>Pin 25</th> <th>Pin 26</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">ZSP</td> <td style="text-align: center;">PF</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">TLC</td> <td style="text-align: center;">PF</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">PF</td> <td style="text-align: center;">ZSP</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">TLC</td> <td style="text-align: center;">ZSP</td> </tr> </tbody> </table> <p style="margin-left: 20px;">← Initial value</p> <p style="margin-left: 20px;">Alarm code output 0: invalid 1: valid The alarm codes from the output pins (24, 25, 26) during an alarm are output in 3 bits.</p> <p style="margin-left: 20px;">Note: The alarm code will be output when an alarm occurs and the ALM output is switched OFF.</p> </div>	Setting	Pin 32	Pin 33	1	PC	YL	2	CR	TL	6	CR	PC	Setting	Pin 25	Pin 26	1	ZSP	PF	2	TLC	PF	4	PF	ZSP	6	TLC	ZSP	042	
Setting	Pin 32	Pin 33																														
1	PC	YL																														
2	CR	TL																														
6	CR	PC																														
Setting	Pin 25	Pin 26																														
1	ZSP	PF																														
2	TLC	PF																														
4	PF	ZSP																														
6	TLC	ZSP																														

Alarm name	Alarm No.	ZSP (26)	PF (25)	RD (24)	Code
Undervoltage	AL10	0	1	0	2
Memory error 1 (RAM, ROM)	12	0	0	0	0
Memory error 2 (EEPROM)	15	0	0	0	0
Magnetic polarity detection error	16	0	1	1	3
PCB error (A/D error)	17	0	0	0	0
Over-regeneration	30	1	0	0	4
Overspeed	31	1	0	1	5
Overcurrent	32	0	0	1	1
Overvoltage	33	1	0	0	4
Command frequency error	35	1	0	1	5
Parameter error	37	0	0	0	0
Fin overheating	45	1	1	0	6
Overload	50	1	1	0	6
Excessive difference	52	1	0	1	5
Screen changed during servo ON	90	1	1	1	7

1: continuity with SG, 0: no continuity

Continued on the next page.



### 3. Start Up and Operation of Position Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																															
Special parameter	20	*DMD	Monitor selection The display, monitor output and encoder output division rate are set. <div style="border: 1px solid black; width: 40px; height: 15px; margin: 5px 0;"></div>	0		0 to dFbh																															
			Display status selection when power is ON 0: Cumulative feedback pulses (lower 4 digits) 1: Cumulative feedback pulses (upper 3 digits) 2: Speed 3: Droop pulses (lower 4 digits) 4: Droop pulses (upper 3 digits) 5: Cumulative command pulses (lower 4 digits) 6: Cumulative command pulses (upper 3 digits) 7: Command pulse frequency 8: Torque limit command voltage 9: Regenerative load ratio A: Effective load ratio b: Peak load ratio <p>* Encoder output division rate is validated by switching the power ON/OFF. Analog monitor output selection setting is made valid by pressing the [SET] button.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Setting</th> <th>Setting of encoder output (FPA, FPB) division rate</th> <th>Analog monitor output selection</th> </tr> </thead> <tbody> <tr> <td>00</td> <td>1/1</td> <td rowspan="5">Speed monitor (full scale: 8V)</td> </tr> <tr> <td>01</td> <td>1/2</td> </tr> <tr> <td>02</td> <td>1/3</td> </tr> <tr> <td>03</td> <td>1/4</td> </tr> <tr> <td>0F</td> <td>1/16</td> </tr> <tr> <td>10</td> <td>1/17</td> <td rowspan="4">Torque monitor (full scale: 8V)</td> </tr> <tr> <td>1F</td> <td>1/32</td> </tr> <tr> <td>40</td> <td>1/1</td> </tr> <tr> <td>41</td> <td>1/2</td> </tr> <tr> <td>42</td> <td>1/3</td> <td rowspan="3">Speed monitor (Zero center meter, full scale: 5V ±4V)</td> </tr> <tr> <td>5F</td> <td>1/32</td> </tr> <tr> <td>80</td> <td>1/1</td> </tr> <tr> <td>9F</td> <td>1/32</td> <td rowspan="3">Torque monitor (Zero center meter, full scale: 5V ±4V)</td> </tr> <tr> <td>C0</td> <td>1/1</td> </tr> <tr> <td>dF</td> <td>1/32</td> </tr> </tbody> </table>				Setting	Setting of encoder output (FPA, FPB) division rate	Analog monitor output selection	00	1/1	Speed monitor (full scale: 8V)	01	1/2	02	1/3	03	1/4	0F	1/16	10	1/17	Torque monitor (full scale: 8V)	1F	1/32	40	1/1	41	1/2	42	1/3	Speed monitor (Zero center meter, full scale: 5V ±4V)	5F	1/32	80	1/1	9F
Setting	Setting of encoder output (FPA, FPB) division rate	Analog monitor output selection																																			
00	1/1	Speed monitor (full scale: 8V)																																			
01	1/2																																				
02	1/3																																				
03	1/4																																				
0F	1/16																																				
10	1/17	Torque monitor (full scale: 8V)																																			
1F	1/32																																				
40	1/1																																				
41	1/2																																				
42	1/3	Speed monitor (Zero center meter, full scale: 5V ±4V)																																			
5F	1/32																																				
80	1/1																																				
9F	1/32	Torque monitor (Zero center meter, full scale: 5V ±4V)																																			
C0	1/1																																				
dF	1/32																																				
			(Setting example) Encoder output: 1/4 Analog monitor output: Speed monitor When "Speed" is set as the default status monitor, set <div style="border: 1px solid black; width: 80px; height: 15px; margin: 5px 0; display: flex; justify-content: space-around;"> <span>0</span> <span>0</span> <span>3</span> <span>2</span> </div>																																		

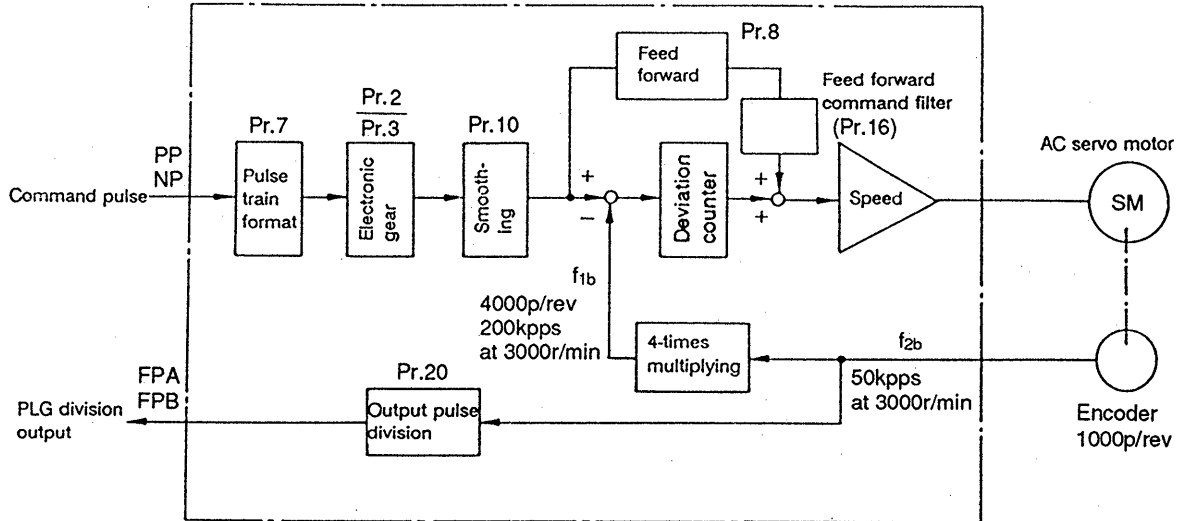
Refer to Table 3-5 in Section 3-7 (4) 5).

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### 3. Start Up and Operation of Position Servo

(3) Relationship of the command pulse and feedback pulse

The relationship of the command pulse and feedback pulse varies according to the setting of each parameter. This relationship is shown in the following diagram.



1) Setting example for operating with AD71

AD7 max. output pulse frequency	Parameter				Motor		Feedback pulse frequency	
	Pulse train format	Electronic gear		Smoothing	Type (rated rotation speed)	PLG	f <sub>1b</sub>	f <sub>2b</sub>
	Pr.7	Pr.2	Pr.3	Pr.10				
200 kpps (A type)	0000 Forward/ reverse run pulse train	1	1	0	HA-ME (3000 r/min)	1000 p/rev	200 kpps	50 kpps
		1	1		HA-FE (3000 r/min)	1000 p/rev	200 kpps	50 kpps
		1	1		HA-SE (1000 r/min) (2000 r/min) (3000 r/min)	1000 p/rev	200 kpps	50 kpps

2) Smoothing (Pr. 10)

- (a) When the electronic gear rate is large (10-fold or more) and the speed is low, the speed will not be smooth, and will cause a pulsating type of rotation. Here, the rotation will smooth-out when Pr. 10 is set to "1" (10ms).
- (b) When an acceleration/deceleration time is not applied to the command pulse train, and if the command pulse frequency changes suddenly, an overshoot or excessive difference alarm "AL-52" will occur. Set the acceleration/deceleration time constant with Pr. 10.

3) Feed forward (Pr. 8)

This function cancels the delay caused by the droop pulses in the deviation counter. If the delay becomes a problem, gradually increase the setting in Pr. 8, and set within the range where overshooting does not occur. This cannot be used if the acceleration/deceleration is rapid.

4) Feed forward command filter (Pr. 16)

A filter is used for the feed forward command.

### 3. Start Up and Operation of Position Servo

#### 3-6 Wiring

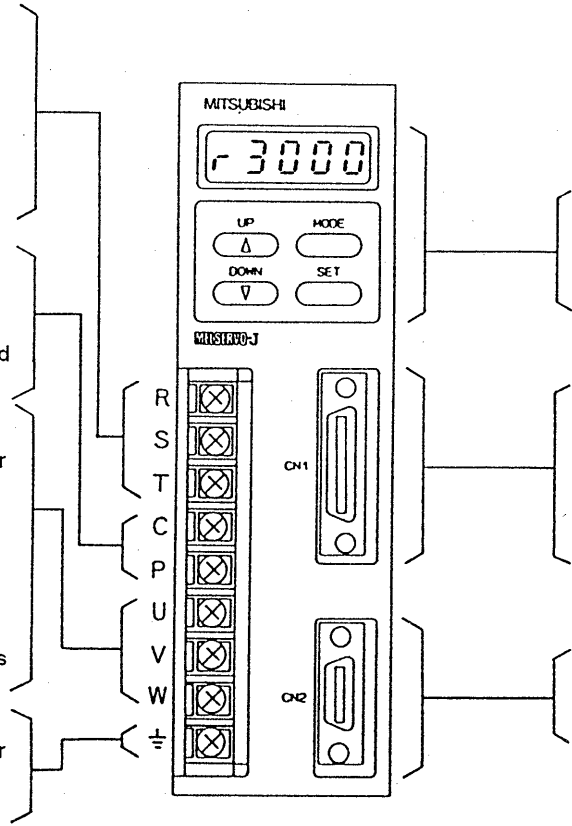
##### (1) Servo amplifier front view

**Power supply connection (R, S, T)**  
 3-phase 200 V series:  
 Connect to a commercial power supply of 200 to 230 VAC, 50/60 Hz.  
 Single phase 100 V series:  
 Connect to a commercial power supply of 100 to 115 VAC, 50/60 Hz.

**Regenerative option connection (C, P)**  
 Connect between P and C when using the regenerative option. This is always needed for MR-J40□A or more.

**Servo motor connection (U, V, W)**  
 Connect with the servo motor power supply terminals U, V and W.  
 Proper operation will not be possible if the phases on the motor and amplifier are mistakenly connected. The amplifier may be damaged if a commercial power supply is connected.

**Grounding**  
 Connect with the servo motor ground terminal, and ground (grounding resistance 100Ω MAX.)



**Display/setting section**  
 The status and alarms are displayed and parameters are set.

**Connector CN1**  
 Various control signals are input/output. Refer to Section 3-7 for explanations on the signals. Refer to section (2), 1 for the pin layout.

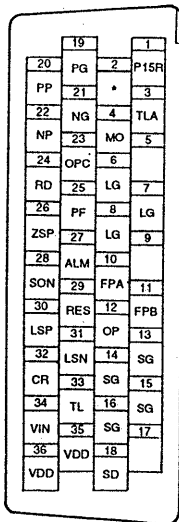
**Connector CN2**  
 Connect to the servo motor detector. Refer to section (2), 2 for the pin layout.

##### (2) Connector pin layout diagram

The connector pin layout diagram looking from the cable wiring side is shown below. The pin number is indicated on the upper row, and the signal name on the lower row.

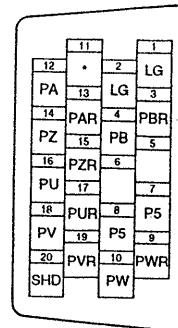
- 1) CN1 (connector for control signals)  
 Model PCR-S36FS connector  
 (Made by HONDA)  
 PCR-LS36LA (case)

- 2) CN2 (connector for PLG signals)  
 Model PCR-S20FS connector  
 (Made by HONDA)  
 PCR-LS20LA1 (case)



Pin No.  
 Signal name

Connector pin layout diagram



Pin No.  
 Signal name

Connector pin layout diagram

# 3. Start Up and Operation of Position Servo

## 3-6.1 Standard connection diagram

### (1) Example of connection with AD71

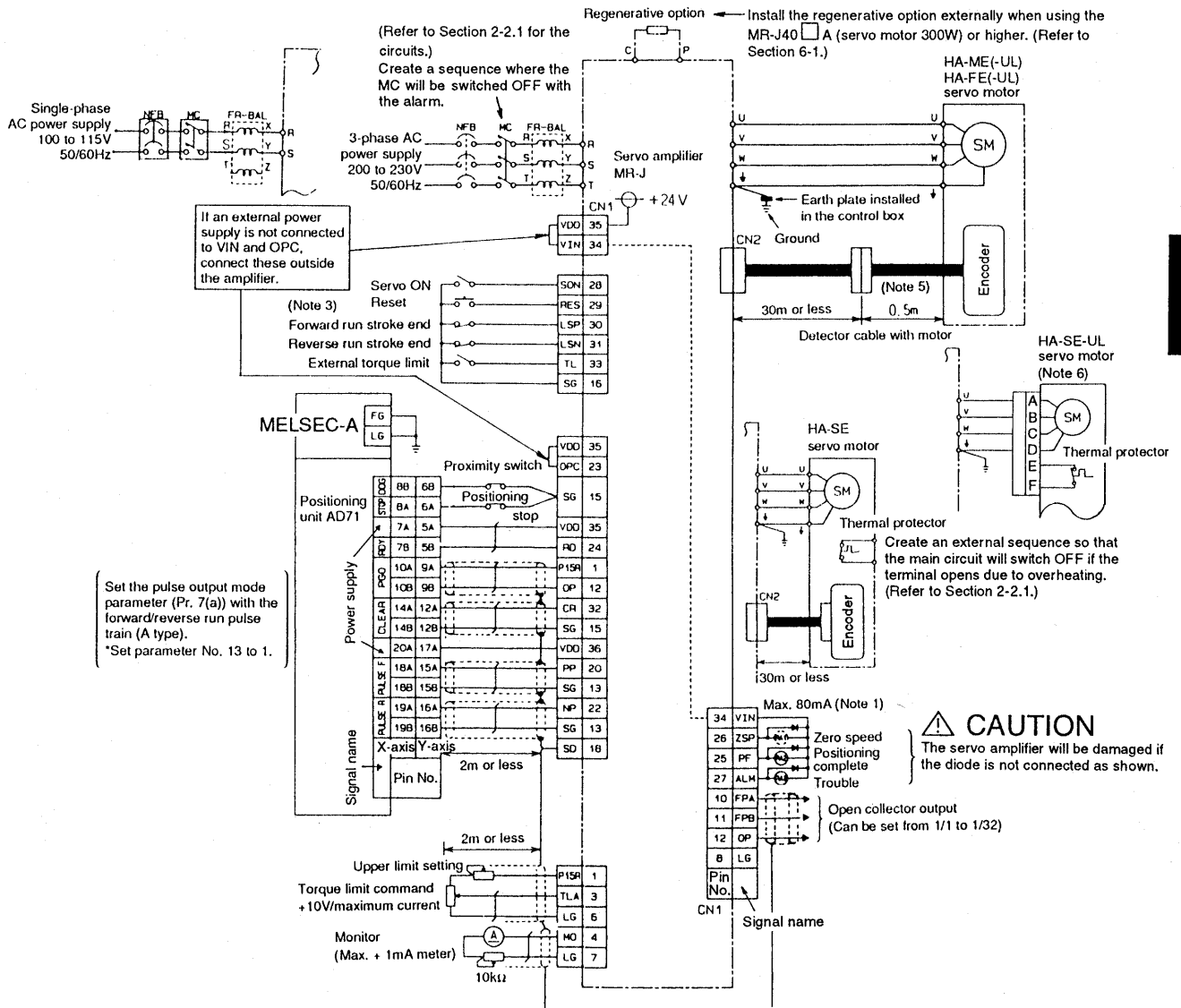


Fig. 3-1 Standard connection diagram I for position control operation

- Note:
1. The total current to the external relays should not exceed 80mA. When it exceeds 80mA, supply the I/F power from an external source (refer to Section 3-6.3).
  2. The servo amplifier may be damaged if the diode polarity is inverted and connected.
  3. Always connect the stroke end LSP and LSN during operation (normally closed).
  4. The pins with the same signal name are connected inside the servo amplifier.
  5. 0.3m for the HA-ME series.
  6. For the UL listed and CSA certified HA-SE servo motor, connectors are used for connection with the power supply. (Refer to Section 2-1.4.)

Motor side : MS3102A22-23P or MS3102A24-10P

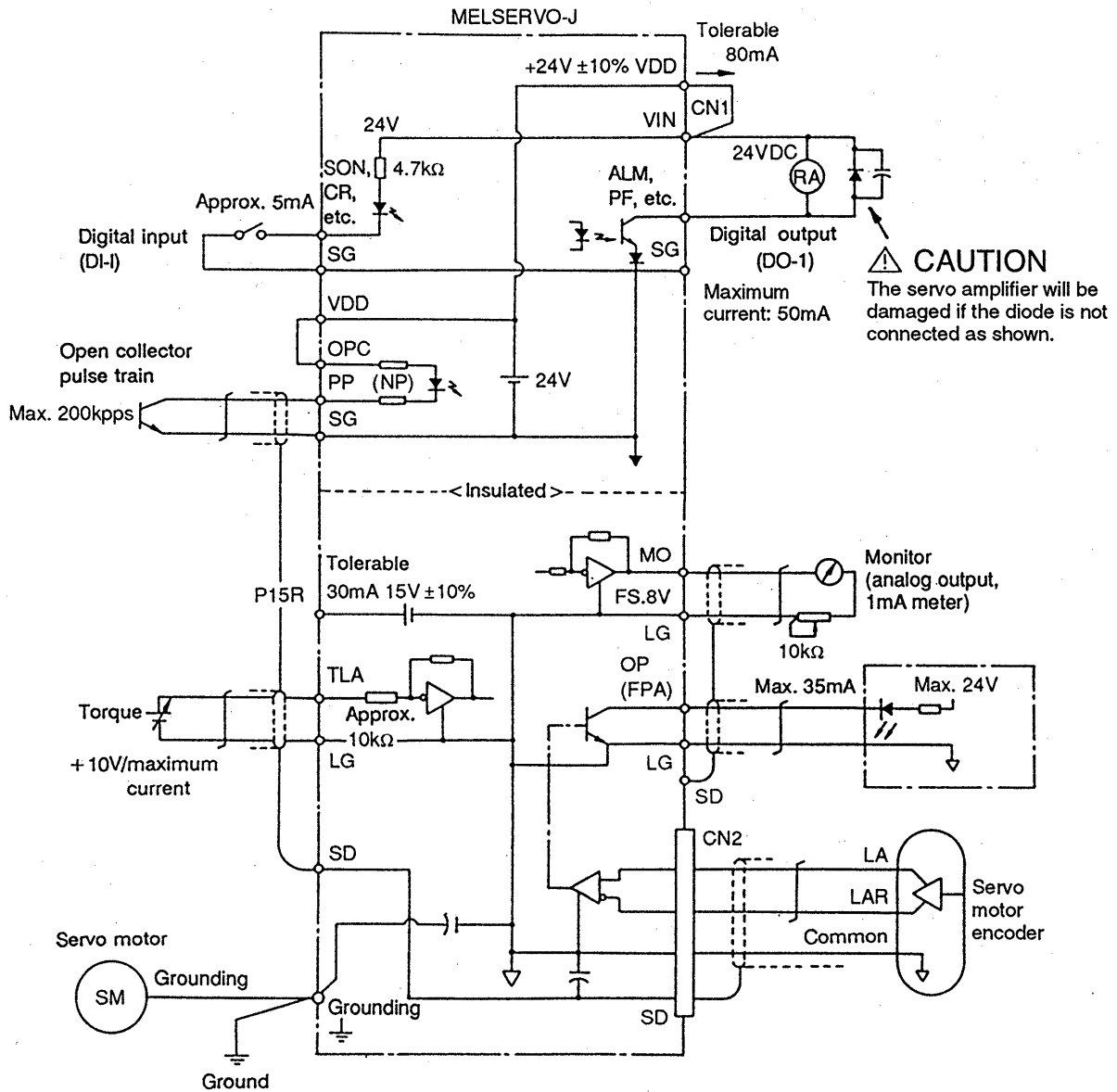
Cable side : MS3106B22-23S or MS3106B24-10S



### 3. Start Up and Operation of Position Servo

#### 3-6.2 Common line diagram for position servo

The internal power supply (24V, 15V) and the common lines of the servo amplifier are shown below. The power supply is separated in two systems, so properly wire these. Use shields if the unit is affected by external noise, and carefully ground these.

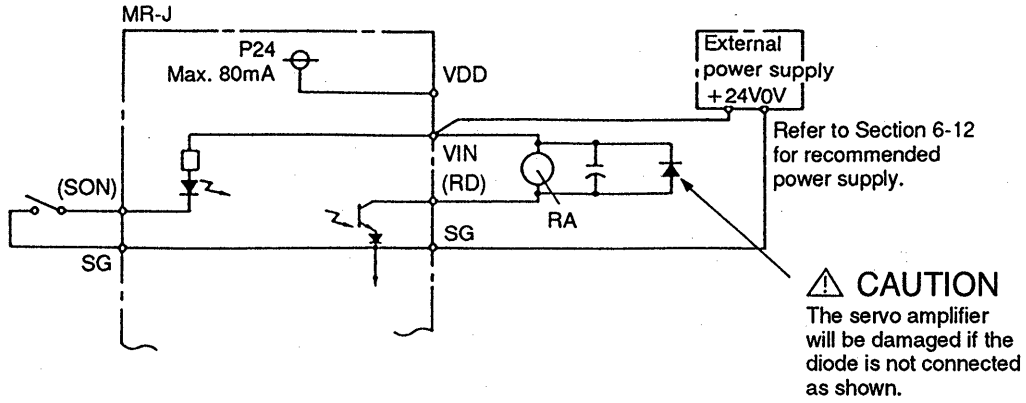


3

### 3. Start Up and Operation of Position Servo

#### 3-6.3 Interface power supply

The power supply VDD (+24V) built into the servo amplifier can be used for digital input/output signals. If the current capacity is insufficient, do not connect VDD and VIN, instead use an external power supply.





### 3. Start Up and Operation of Position Servo

#### 3-7 Explanation of signals

(1) Explanation of signals

Table 3-3 List of terminals

Signal name	Symbol	Pin No.	Explanation	I/O class
Servo ON	SON	28	Operation is possible when the servo ON signal is switched ON. The base is shut off when switched OFF, and the servo motor will coast to stop.	DI-1
Alarm reset	RES	29	The alarm can be reset when the alarm reset signal is switched ON for 50msec or more. However, memory, card and parameter errors cannot be reset with this signal. For regenerative and overload errors, the base will be shut off and the servo motor will coast to stop if this signal is switched ON before the regenerative resistor or power transistor cools down. The CPU will not be reset with this signal. The CPU is reset by switching the power OFF → ON.	
Forward run stroke end	LSP	30	The servo motor will not rotate unless the forward run or reverse run stroke end signal is ON. If the forward run stroke end is switched OFF, the servo motor will not rotate in the forward direction. If the reverse run stroke end is switched OFF, the servo motor will not rotate in the reverse direction.	
Reverse run stroke end	LSN	31		
Clear	CR	32	The droop pulses will be cleared when the clear signal is switched ON.	
External torque limit	TL	(*1) 33	When the external torque limit signal is switched ON, the torque output will be limited to the torque limit command (TLA) value from an external source.	
Proportional control	PC		When the proportional control signal is switched ON, the speed servo loop will be changed from a proportional integral type to a proportional type.	
Forward run pulse train Reverse run pulse train	PP, PG NP, NG	20, 19 22, 21	<p>The command pulse is input</p> <ul style="list-style-type: none"> <li>• For the open collector type, connect the 24V power supply VDD and open collector power supply OPC, and input each pulse train between PP-SG, NP-SG.</li> <li>• For the differential receive type, open the open collector power supply OPC and input each pulse train between PP-PG and NP-NG.</li> <li>• Select the forward/reverse run pulse method, symbol + pulse method, A B phase pulse method and the input pulse positive/negative logic with parameter No. 7.</li> </ul>	DI-2
Pulse train Pulse train Symbol	PP, PG NP, NG	20, 19 22, 21		
A-phase pulse train B-phase pulse train	PP, PG NP, NG	20, 19 22, 21		
Torque limit command	TLA	3	Input the motor torque limit value when the external torque limit signal is switched ON. The maximum torque is 0 to +10V. (The maximum torque given in Section 10-2 is reached at 0V.)	Analog input
15V power supply	P15R	1	+15V±10% is output between P15R and the control common LG. The maximum current available is 30mA.	—
Control command	LG	6, 7, 8	This is the common terminal for the torque limit command TLA, monitor MO, A B Z-phase PLG pulse FPA, FPB, OP signals.	

Continued on the next page.

### 3. Start Up and Operation of Position Servo

Signal name	Symbol	Pin No.	Explanation	I/O class
Open collector power supply	OPC	23	Connect this terminal to a 24V power supply VDD when inputting the pulse train with the open collector method.	—
24V power supply	VDD	35, 36	+24V±10% is output between VDD and common SG. The maximum current available is 80mA.	—
24V common	SG	13, 14, 15, 16	This is the common terminal for the 24V power supply.	—
Digital I/F power supply input	VIN	34	A 24V power supply is input for the digital I/F. Connect between VIN and VDD when using the 24V power supply in the servo amplifier.	—
Shield	SD	18	Connect one end of the shield wire.	—
Ready	RD	24	The ready signal switches ON when the servo ON signal is input and the servo is active.	DO-1
Trouble	ALM	27	The trouble signal will switch OFF when an alarm occurs in the servo. If there is no trouble, the trouble signal will switch ON approx. 0.8 seconds after the power is turned ON.	
Positioning complete	PF	(*2) 25 26	The positioning complete signal switches ON when the number of droop pulses is smaller than the in-position range set in the parameter.	
Zero speed detection	ZSP		The zero speed signal switches ON when the motor speed drops below the zero speed set as in the parameter.	
Limiting torque	TLC		The limiting torque signal switches ON when the torque output reaches the torque limit value.	
A-phase PLG pulse	FPA	10	The feedback pulse from the encoder mounted onto the servo motor is output. The feedback pulse can be divided from 1/1 to 1/32 with the parameter.	DO-2
B-phase PLG pulse	FPB	11	When the servo motor is rotating in the forward direction, the FPA will be the pulse that is a 90° phase shift forward from FPB.	
Z-phase PLG pulse	OP	12	One pulse will be output with one servo motor rotation.	
Monitor	MO	4	The servo motor speed or torque is output as or analog voltage. Select whether to output the speed or torque with parameter No. 20. When outputting the speed, this is 8V/maximum speed, and when outputting the torque, this will be 8V/maximum torque as set in parameter No. 15. Output accuracy: ±5%	Analog output

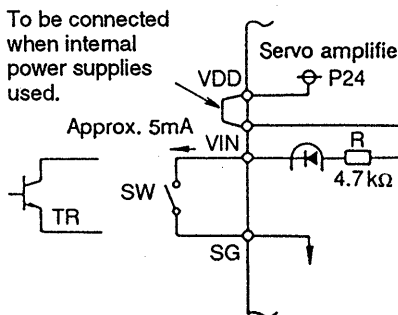
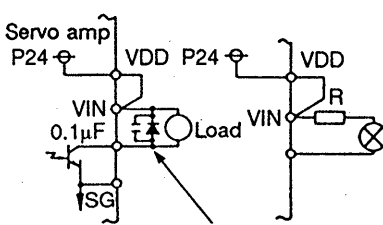
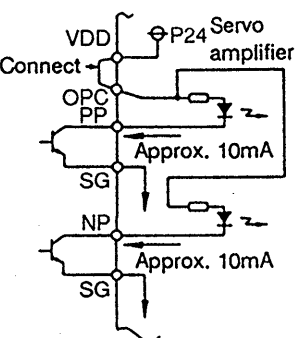
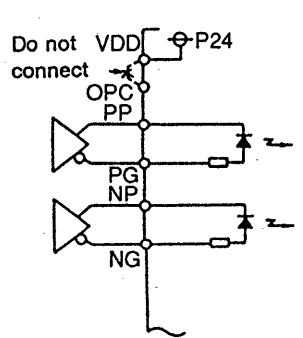
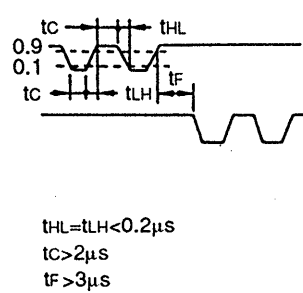
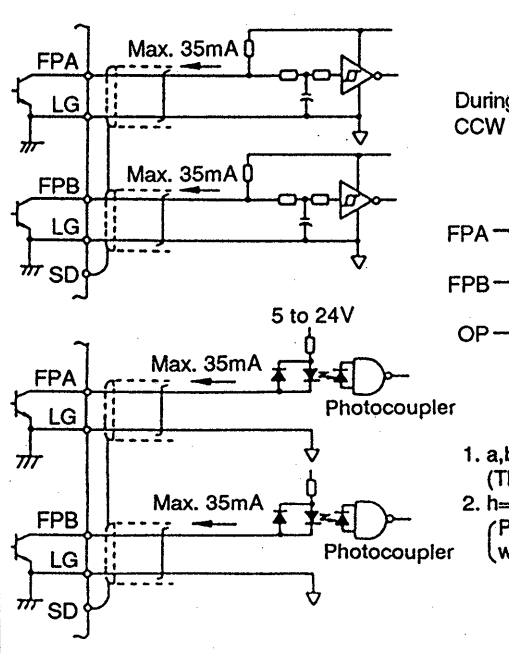
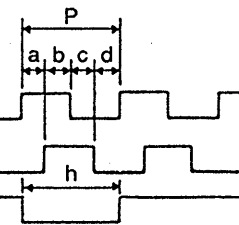
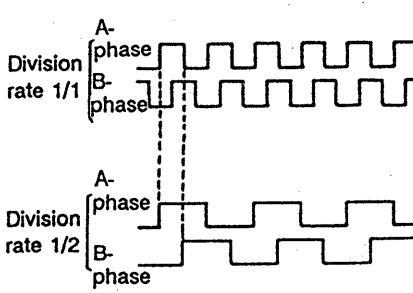
\*1: Assign clear, external torque limit, or proportional control to pins 32 or 33. Select with parameter NO. 19. The initial setting value is CR-32, TL-33.

\*2: Assign positioning complete, zero speed detection, or limiting torque to pins 25 and 26. Select with parameter NO. 19. The initial setting value is PF-25, ZSP-26.

### 3. Start Up and Operation of Position Servo

#### (2) Interface

The details of each interface noted in Table 3-3 (I/O class) are shown below.

Digital input interface (DI-1)	Digital input interface (DO-1)	
<p>Apply a signal with a miniature relay or open collector transistor (TR).</p> <p>To be connected when internal power supplies used.</p>  <p>Approx. 5mA</p> <p>4.7kΩ</p>	<p>The lamp, relay or photocoupler can be driven.</p> <p>Tolerable current: 50mA Rush current: 100mA</p> <p>Note: For an inductive load install an absorber (D.C.), and for lamp load install a resistor (R) for rush current suppression.</p>  <p>CAUTION The servo amplifier will be damaged if the diode is not connected as shown.</p>	
Pulse train input interface (DI-2)		
<p>• Open collector type Max. 200 kpps</p>  <p>Approx. 10mA</p> <p>Approx. 10mA</p>	<p>• Differential receiver type Max. 200 kpps</p> <p>Do not connect</p> 	 <p><math>t_{LH} = t_{LH} &lt; 0.2\mu s</math> <math>t_C &gt; 2\mu s</math> <math>t_F &gt; 3\mu s</math></p>
Pulse train output interface (DO-2)		
<p>• Interface example</p>  <p>Max. 35mA</p> <p>Max. 35mA</p> <p>5 to 24V</p> <p>Max. 35mA</p> <p>Max. 35mA</p> <p>Photocoupler</p> <p>Photocoupler</p>	<p>• Phase relation</p> <p>During servo motor CCW rotation</p>  <p>• Division waveform</p> <p>Either ON or OFF width is a multiple of each division. (50% duty)</p>  <p>Division rate 1/1</p> <p>Division rate 1/2</p> <p>1. <math>a, b, c, d = P/4 \pm P/8 \pm 1\mu s</math> (This is established regardless of the output division rate.)</p> <p>2. <math>h = P' \pm P'/2 \pm 1\mu s</math> (P' equals to the duration of one FPA pulse when the output division rate is 1/1.)</p>	

3

### 3. Start Up and Operation of Position Servo

#### (3) Command pulse train format

The position command pulse train can be input in any of three formats (forward/reverse run pulse train, symbol + pulse train, AB-phase pulse train), and the positive and negative logic can be selected. Select the command section pulse train format from the following table, and set with the servo amplifier parameter No. 7.

**Table 3-4 Specified pulse format**

Command pulse train format		Forward run	Reverse run	Pr. 7 setting		Remarks
Negative logic	Forward run pulse train			(Factory default setting) 0000		AD71 (A type) Note: When the A and B types are mistaken, one side will be inoperable.
	Reverse run pulse train					
	Symbol + pulse train			0001		AD71 (B type)
	A-phase pulse train			×1 multiply	0002	Pulse train after multiply Set so that the frequency will be below 200kpps.
B-phase pulse train			×2 multiply	0003		
			×4 multiply	0004		
Positive logic	Forward run pulse train			0008		
	Reverse run pulse train					
	Symbol + pulse train			0009		
	A-phase pulse train			×1 multiply	000A	Pulse train after multiply Set so that the frequency will be below 200kpps.
B-phase pulse train			×2 multiply	000B		
			×4 multiply	000C		

Note: and indicate the timing of reading the command pulse.

### 3. Start Up and Operation of Position Servo

#### (4) Explanation of output signals

##### 1) Torque limit:

Normally, the torque is limited in the servo amplifier to the value set in parameter No. 15. If there are mechanical system limits such as with the gear capacity, the max. torque is set smaller with Pr. 15. To change the torque limit value from an external source, wire as shown in the right diagram, and switch the external torque limit command TL ON. The torque limit value will be the smaller of the TLA level and Pr. 15 level.

##### Torque limit command and motor torque

The relation of the TLA voltage level and the motor generated torque is shown on the right. The motor generated torque will have a difference of about 5% depending on the motor. If the speed command is low such as 50mV, a proper limit will not be applied, and the torque will fluctuate. If there are problems, increase the limit value.

##### 2) Limiting torque (TLC):

This switches ON when the servo motor torque reaches the set torque limit value such as during acceleration or deceleration.

If the external torque limit is not applied, this will turn ON at the output of torque whose torque limit has been set with Pr. 15.

##### 3) Zero speed (ZSP):

This switches ON when the servo motor speed drops to or below that set with Pr. 11.

The detection has a hysteresis as shown on the right.

##### 4) Positioning complete (PF):

This switches ON when the droop pulses in the deviation counter are in the positioning complete range (in-position) set in parameter No. 4. When operating at a low speed, the droop pulses will be small, so when the positioning complete range No. 4 is large, the PF signal will stay ON for a longer time.

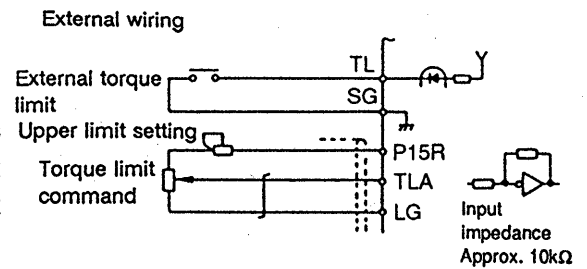


Fig. 3-3 External torque limit connection diagram

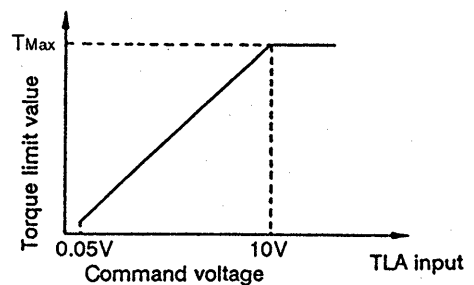


Fig. 3-4 Torque limit level

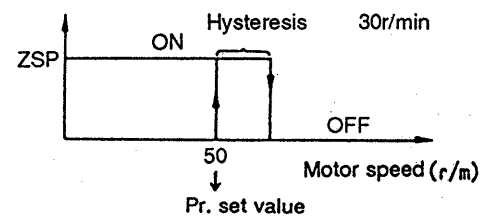


Fig. 3-5 Zero speed detection level

3

### 3. Start Up and Operation of Position Servo

#### 5) Analog monitor output (MO)

Any of the following four levels can be selected with parameter No. 20.

Table 3-5 Monitor output pattern

Monitor	Speed		Torque (motor current)	
Pr. 20	Factory default value 0□□	8□□	4□□	c□□
MO output details	(+8V/maximum speed) 	(5±4V/maximum speed) 	(+8V/No. 15 setting Max. torque) 	(5±4V/No. 15 setting Max. torque) 

## 4. Start Up and Operation of Speed Servo

### 4-1 Wiring

Wire according to the wiring diagram. Refer to Section 4-7 for the definition and use of the servo amplifier signals and functions.

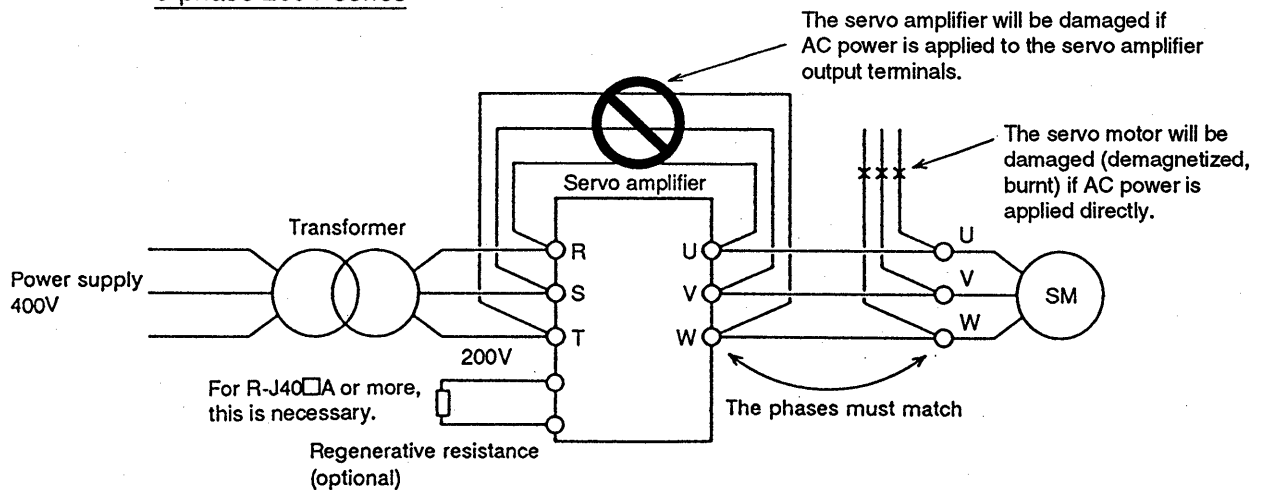
### 4-2 Checking wiring

- (1) Refer to the wiring diagram and confirm that the wiring is correct. (Section 4-6)
- (2) Especially note the following wiring. The unit may be damaged if it is miswired.

#### Main circuit

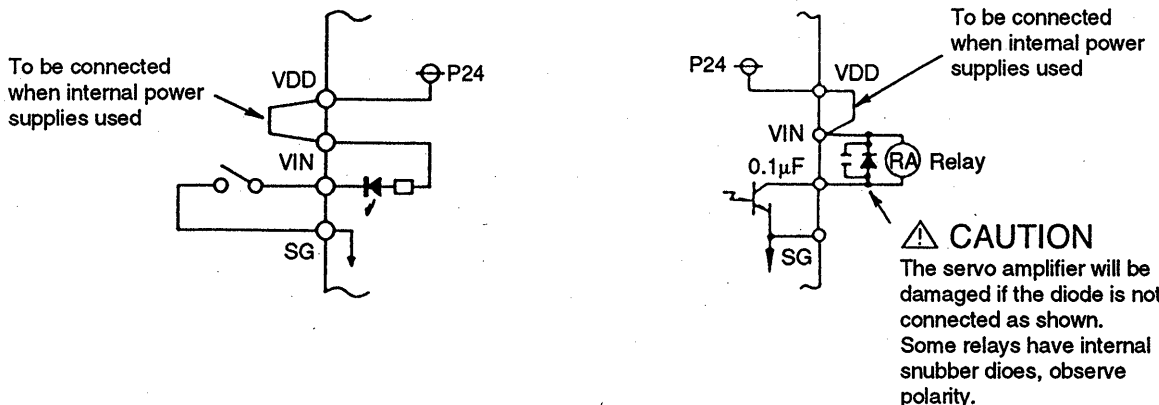
- 1) A source of AC power which conforms to the specification must be connected to the servo amplifier power supply terminals (R, S, T). If the power does not conform to the specification, drop the voltage to the specified voltage by using a transformer.
- 2) Power supply lines (R, S, T) must not be connected to the servo motor output terminals (U, V, W).
- 3) The phases of the output terminals (U, V, W) and motor terminals (U, V, W) must match.
- 4) AC power must not be directly applied to the servo motor.

#### 3-phase 200V series



#### Control circuit

- 1) Connect 24VDC to the interface power supply terminal (VIN). Connect VIN and VDD when using the power supply in the servo amplifier (VDD).
- 2) When connecting a relay to the open collector output terminals, insert a diode parallel to the relay. The diode must be connected with us shown. Otherwise, the servo amplifier will be damaged.



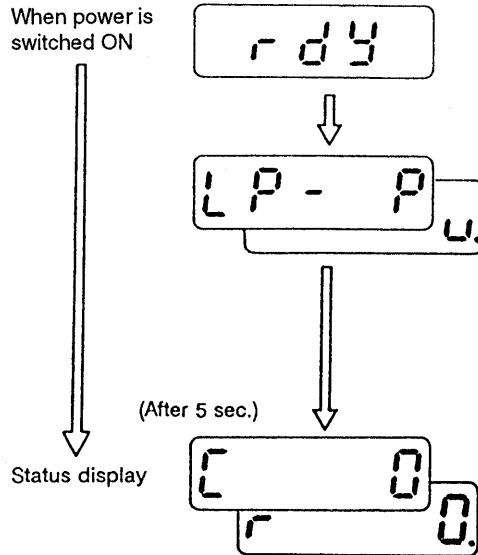
## 4. Start Up and Operation of Speed Servo

### 4-3 Switching power on and setting parameters

The setting of the 1) motor type and 2) servo loop type has been factory set. These parameters are validated when the power is switched OFF once after setting and then switching ON again.

(1) Switching power ON

Switch the SON signal OFF and switch ON the power.



- When the power is turned ON, "rdy", indicating initialization, will be displayed for approx. 2 seconds.
- Next, the servo type will be displayed.  
The initial value is set at the positioning servo.  
After setting the motor type (refer to section (2), 1)), set to the speed servo (refer to section (2), 2)).
  - LP-P: Positioning servo
  - LP-V: Speed servo
- Status display  
 The cumulative feedback pulses will be displayed when the power is switched ON.

(2) Setting parameters

After switching the power ON, the parameters must be set as needed.

The unit may not operate properly if the following two items are not set correctly. Always confirm the settings, and set as needed.

1) Motor type (Parameter No. 0 MTY):

Refer to the combination table below and set the parameter according to the type of motor being used. The motor may be damaged if not set correctly. Values in shaded areas in the table shown below are factory set values.

		Servo motor series	Servo motor rating (parameter value No.0)												
Amplifier	MR-J	-	10A 10A1	20A 20A1	40A 40A1	60A	70A	100A	200A	350A	10MA 10MA1	20MA 20MA1	40MA 40MA1	70MA	
Motor	HA-FE	0	053	23	33	63	-	-	-	-	-	-	-	-	
			13	-	43	-	-	-	-	-	-	-	-		
			-	-	-	-	-	-	-	-	-	-	-	-	
	HA-SE	1	-	-	-	-	52	102	152	352	-	-	-	-	
			-	-	-	-	53	103	202	353	-	-	-		
			-	-	-	-	-	81	153	301	-	-	-		
			-	-	-	-	-	121	203	-	-	-			
	HA-ME	3	-	-	-	-	-	-	-	-	-	053	23	43	73
			-	-	-	-	-	-	-	-	-	13	-	-	

The setting for the HA-FE and HA-SE servo motors cannot be made by the MR-J □ MA servo amplifier.

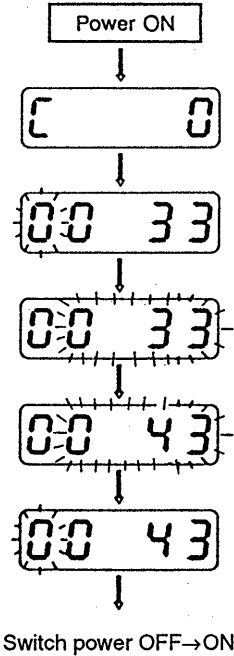


## 4. Start Up and Operation of Speed Servo

### Setting example

The value for Parameter No.0 for this combination of servo motor and servo amplifier must be changed from the factory setting. The table on the previous page shows that the value must be changed from "33" to "43".

Use the following procedure to change the value.



Press the [MODE] button three times.

The initial value (HA-FE33) will be displayed.  
Press the [SET] button.

The data section will flicker.

Change the data to 0 43 with the [UP] and [DOWN] buttons.

Press the [SET] button.

The setting will be finished, and the parameter No. section will flicker.

The data will be registered and the setting completed.

### 2) Servo loop type (Parameter No. 1 STY):

The servo loop type, Parameter No.1, defines whether the drive is a speed or position type. The value of the parameter also defines the auto tuning mode and whether the regenerative option is to be used. If a model above the MR-J40A is used, the regenerative option must be installed. Set the parameter value according to the following chart.

Setting value	Regenerative option (combination)	Tolerable power (W)	Applicable amplifier
0	No regenerative option	—	MR-J10A, 20A
1	MR-RB013	10	MR-J10A to MR-J100A MR-J10A1 to MR-J40A1 MR-J10MA to MR-J70MA MR-J10MA1 to MR-J40MA1
2	MR-RB033	30	
3	MR-RB064 × 2	100	
4	MR-RB064	60	MR-J200A
5	MR-RB10 × 2	150	
6	MR-RB30 × 2	500	
7	MR-RB10	100	MR-J350A
8	MR-RB30	300	
9	MR-RB50	500	

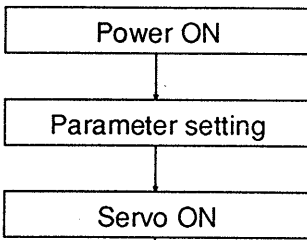
Auto tuning  
0: Medium response  
1: Fast response  
2: Slow response  
3: Invalid.

0: Standard mode, position servo (pulse train)  
1: Standard mode, speed servo (analog, three internal speeds)  
4: Low noise mode, position servo (pulse train)  
5: Low noise mode, speed servo (analog, three internal speeds)

## 4. Start Up and Operation of Speed Servo

### 4-4 Operation

The servo motor is operated with the following procedure after the power is switched ON and the parameters have been set.



The "servo ON" signal is switched ON.

The operable status is entered, and the servo motor is servo locked. If the servo motor is not servo locked at this point, the "servo ON" signal is not ON. Confirm the status with the monitor, and check the wiring.

[Diagnosis screen]

- Servo ON/OFF check

Power ON

r 0

Press the [MODE] button once.

r d - o F

Switch servo ON.

r d - o n

This display will show when the "servo ON" switches ON.

- Input signal check

When the following steps are carried out from the above display, the input signal ON/OFF status can be checked.

r d - o F

Press the [UP] button once.

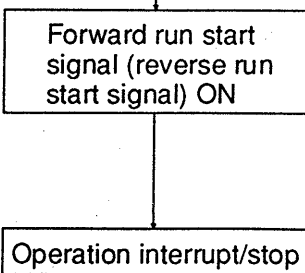
" "

The external input/output signal ON/OFF status will be displayed. Switch the servo ON.

Servo ON signal  
" " " " " "

When the servo switches ON, the screen on the left will be displayed.

\* The ready and positioning complete signals will be output simultaneously and displayed.



- When the start signal switches ON, the motor will rotate at the speed set with the external command. First, set this to a low speed to confirm the rotation direction and movement status of the machine. Set the acceleration/deceleration times in parameters No. 5 and 6. If the motor is not rotating as desired, check the input signal again. Refer to Sections 4-5.3 and 5-2.
- When operating with the internal parameter speed, select signals DI1, and DI2.
- The servo motor speed and load rate, etc. can be checked on the servo amplifier's status display monitor.

The operation will be interrupted or stopped when the following are carried out.

- 1) Servo OFF ..... The main transistor's base current will be shut off and the servo motor will coast to stop.
- 2) Reset ..... The base will be shut off and the motor will coast to stop. The dynamic brake (optional) will not operate.
- 3) Start signal OFF ..... The servo motor will stop and be locked by the servo when both start signals (ST1 and ST2) are switched OFF or ON.
- 4) Alarm ..... The base will be shut off when an alarm occurs.

# 4. Start Up and Operation of Speed Servo

## 4-5 Display and setting function

### 4-5.1 Display flow chart

#### Details of the display

The status can be monitored and parameters set with the display section (5-digit, 7-segment display) on the front of the servo amplifier. Confirm the parameter settings before operation, diagnose trouble, confirm external sequences, and confirm the operation status with this display.

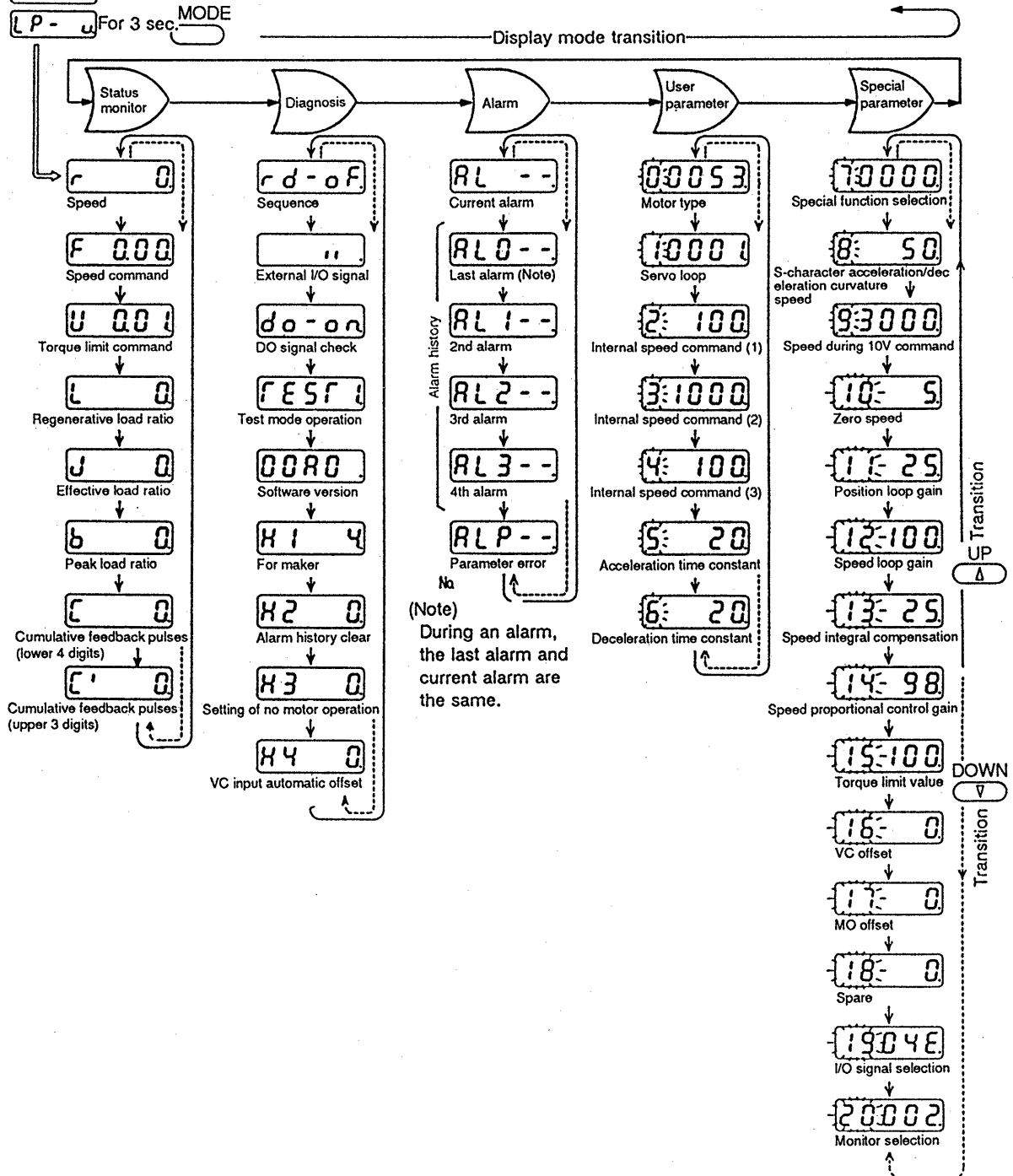
An example of the display flow chart (for the speed servo) is shown below. Refer to sections 4-5.2 to 4-5.5 for details on the display.

When using as a speed servo, the least digit decimal point on the 7 segment LED will light constantly.

r0. appears five sec.  
after power ON

rdy For 2 sec.

LP- u For 3 sec. MODE



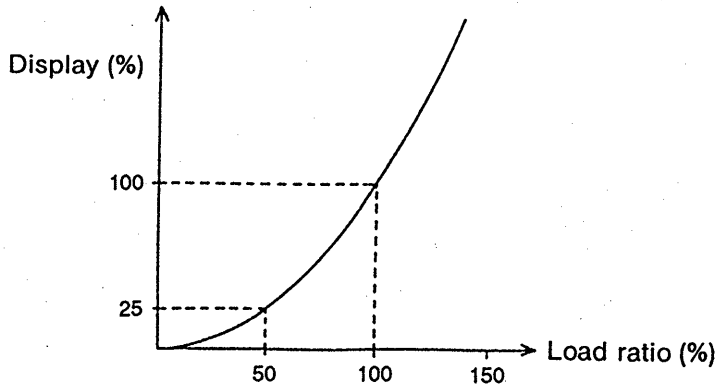
## 4. Start Up and Operation of Speed Servo

### 4-5.2 Status display

The various states during operation are displayed. The display details can be changed freely with the UP and DOWN buttons. The display when the power is switched ON is set to Pr. 20.

Name	Sym- bol	Display range, unit	Details
Speed	r	3.0.0.0 to 3000 r/min	The servo motor speed is displayed. The lower 2nd, 3rd and 4th digit decimal points will light during reverse run. Forward run: 3000. Reverse run: 3.0.0.0. (The lowermost decimal point will always light during speed servo.)
Speed command voltage	F	± 10.00V	The speed command voltage is displayed. During negative voltage, the lower 2nd and 4th decimal points light, and the lower 3rd decimal point goes out. Positive voltage: 10.00. Negative voltage: 1.00.0.
Torque limit command	U	0 to 10.00V	The torque limit command voltage is displayed.
Regenerative load ratio	L	0 to 100%	The regenerative load ratio for the regenerative option tolerance value selected in Pr. 1 is displayed in %. A short time (approximately 30 to 40 minutes) is required for stabilizing.
Effective load ratio (Note)	J	0 to 300%	The load ratio for the rated torque is displayed in %. The servo motor temperature is assumed, so the effective torque and display value are not linear. A short time (approximately 10 to 20 minutes) is required for stabilizing.
Peak load ratio	b	0 to 300%	The load ratio is displayed in % according to the rated torque.
Cumulative feedback pulses (lower 4 digits)	C	-9999999 to 9999999 pulses	The feedback pulses (4-times multiplying) are counted and displayed. When the counter overflows, it will be cleared to zero. For the reverse run pulses (negative), the lower 2nd, 3rd and 4th digit's decimal points will light. The display will be reset to "0" when the "SET" button is pressed.
Cumulative feedback pulses (upper 3 digits)	C'		

Note: When the display value is not 100%, the display value and effective load ratio will differ. Actual relationship between the load ratio and display is as shown below.

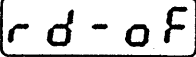
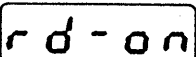
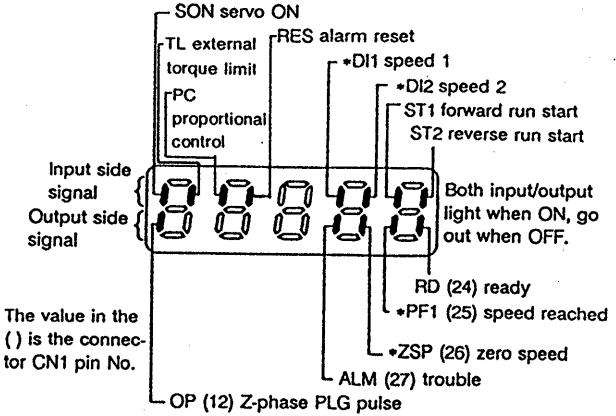
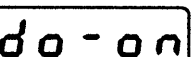
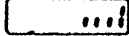
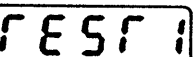
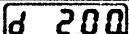
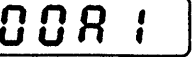
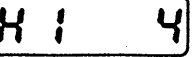


Effective load ratios for display values 90, 80 and 70 are 95, 89 and 84(%).


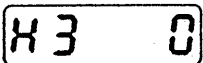
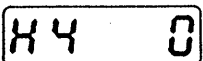
## 4. Start Up and Operation of Speed Servo

### 4-5.3 Diagnosis mode

This is used to confirm the status of the external sequence, etc.

Name	Display	Details
Sequence (automatic tuning)		Not ready. The unit is being initialized after the servo ON has been switched ON, or an alarm has occurred. Automatic tuning can be performed from this screen. (Refer to Section 5-1 for details.)
		Ready. Enter the operable status after initialization after switching the servo ON. Automatic tuning can be performed from this screen.
External input/output signal		<p>The external input/output signal ON-OFF status is displayed.</p> <p>The upper vertical line of each segment in the 5-digit LED is the input signal, and the lower corresponds to the output signal.</p> <p>The figure on the left shows the status when all input/output signals are switched ON.</p> <p>The relation of each segment's vertical line and input/output signal is shown on the left.</p> <p>Note 1. The output signal pin Nos. marked * respond to the factory default setting. (Change these with parameter No. 19.)</p>
DO signal check		<p>The  DO signal check display will appear when the [SET] button is pressed for more than two seconds. The output from connector CN1's 24, 25, 26 and 27 pins enter the state where they can be forcibly switched ON/OFF. Always operate these with the servo ON signal switched OFF. (Refer to Section 5-3 for details.)</p>
Test mode operation		<p>The  (200r/min) speed display will appear when the [SET] button is pressed for more than two seconds, and the test operation state will be entered. Always operate this with the servo ON signal switched OFF. (Refer to Section 5-4 for details.)</p>
Software version		MITSUBISHI USE
For MITSUBISHI		MITSUBISHI USE

## 4. Start Up and Operation of Speed Servo

Name	Display	Details
Alarm history clear		Change DATA from 0 to 1, press "SET" button, and the alarm history will be cleared. (Refer to Section 5-6 for details.)
No-motor operation setting		Change DATA to 53, press "SET" button and the unit will operate without the motor. (Refer to Section 5-5 for details.)
VC input/automatic offset		The automatic tuning of the speed command input voltage offset will be executed with "13" and "SET". (Refer to Section 5-7 for details.)

### 4-5.4 Alarm mode

The current alarm, history of past alarms, and parameter errors are displayed in this mode, refer to Section 3-5.4 for details on the alarm display and functions during an alarm.

## 4. Start Up and Operation of Speed Servo

### 4-5.5 Parameters

(1) Parameter list

Table 4-1 Parameter list for speed servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range
User parameters	0	*MTY	Motor type	####		
	1	*STY	Servo loop (1) Positioning/speed servo (Note) The unit is set to positioning servo as the default, so change to "0001" for the speed servo. (2) Regenerative resistor option (3) Auto tuning selection	0000		0 to 7395h
	2	SC1	Internal speed command (1)	100	r/min	0 to max speed
	3	SC2	Internal speed command (2)	1000	r/min	0 to max speed
	4	SC3	Internal speed command (3)	2000	r/min	0 to max speed
	5	STC	Acceleration time constant	20	10ms	0 to 5000
	6	STB	Deceleration time constant	20	10ms	0 to 5000
Special parameters	7	*OPC	Special functions (1) Speed S-character acceleration/deceleration (2) Servo lock validity when speed selection I and II signals are OFF	0		0 to 113h
	8	SCH	S-character acceleration/deceleration, curvature point speed	50	r/min	50 to 5000
	9	VCM	Speed at 10V command	Rated	r/min	0 to 6000
	10	ZSP	Zero speed	5	10r/min	1 to 500
	11	PGN	Position loop gain	25	rad/s	5 to 150
	12	VGN	Speed loop gain	100		70 to 999
	13	VIC	Speed integral compensation	25	ms	1 to 999
	14	VDC	Speed proportional control gain	98	%	0 to 100
	15	TLL	Torque limit value	100	%	0 to 100
	16	VCO	VC offset	Note) Default setting	mV	-99 to 99
	17	MOO	Analog monitor, offset	0	mV	-20 to 100
	18	—	Spare	0		
	19	IPO	Input/output signal selection	04E		0 to 1AFh
	20	*DMD	Monitor selection (1) Status display when power is switched ON (2) Encoder output division rate (3) Analog monitor output selection	002		0 to DF7h

#### : The initial value (factory default value) will differ according to the amplifier size.

\* : These are validated when the power is switched OFF/ON after setting.

Note: The default value is set so that the motor speed with a speed command voltage of 0V will be less than  $\pm 6$ r/min.



## 4. Start Up and Operation of Speed Servo

### (2) Explanation of parameters

**Table 4-2 Details of speed servo parameters**

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																																																																																																																															
User parameters	0	*MTY	Motor type: <div style="border: 1px solid black; width: 100px; height: 20px; margin-bottom: 5px;"></div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2"></th> <th style="text-align: center;">Motor series</th> <th colspan="14" style="text-align: center;">Motor rating (parameter set value)</th> </tr> <tr> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Amplifier</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">MR-J</th> <th style="text-align: center;">—</th> <th style="text-align: center;">10A 10A1</th> <th style="text-align: center;">20A 20A1</th> <th style="text-align: center;">40A 40A1</th> <th style="text-align: center;">60A</th> <th style="text-align: center;">70A</th> <th style="text-align: center;">100A</th> <th style="text-align: center;">200A</th> <th style="text-align: center;">350A</th> <th style="text-align: center;">10MA 10MA1</th> <th style="text-align: center;">20MA 20MA1</th> <th style="text-align: center;">40MA 40MA1</th> <th style="text-align: center;">70MA</th> </tr> </thead> <tbody> <tr> <td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">Motor</td> <td rowspan="2" style="writing-mode: vertical-rl; transform: rotate(180deg);">HA-FE</td> <td style="text-align: center;">0</td> <td style="background-color: #cccccc;">053</td> <td style="background-color: #cccccc;">23</td> <td style="background-color: #cccccc;">33</td> <td style="background-color: #cccccc;">63</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> <tr> <td style="text-align: center;">—</td> <td style="text-align: center;">13</td> <td style="text-align: center;">—</td> <td style="text-align: center;">43</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> <tr> <td rowspan="3" style="writing-mode: vertical-rl; transform: rotate(180deg);">HA-SE</td> <td rowspan="3" style="text-align: center;">1</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="background-color: #cccccc;">52</td> <td style="background-color: #cccccc;">102</td> <td style="background-color: #cccccc;">152</td> <td style="background-color: #cccccc;">352</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> <tr> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">53</td> <td style="text-align: center;">103</td> <td style="text-align: center;">202</td> <td style="text-align: center;">353</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> <tr> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">81</td> <td style="text-align: center;">153</td> <td style="text-align: center;">301</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> <tr> <td rowspan="2" style="writing-mode: vertical-rl; transform: rotate(180deg);">HA-ME</td> <td rowspan="2" style="text-align: center;">3</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">053</td> <td style="text-align: center;">23</td> <td style="text-align: center;">43</td> <td style="text-align: center;">73</td> </tr> <tr> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">13</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> <td style="text-align: center;">—</td> </tr> </tbody> </table>			Motor series	Motor rating (parameter set value)														Amplifier	MR-J	—	10A 10A1	20A 20A1	40A 40A1	60A	70A	100A	200A	350A	10MA 10MA1	20MA 20MA1	40MA 40MA1	70MA	Motor	HA-FE	0	053	23	33	63	—	—	—	—	—	—	—	—	—	13	—	43	—	—	—	—	—	—	—	—	—	HA-SE	1	—	—	—	—	52	102	152	352	—	—	—	—	—	—	—	—	—	53	103	202	353	—	—	—	—	—	—	—	—	—	81	153	301	—	—	—	—	HA-ME	3	—	—	—	—	—	—	—	—	—	053	23	43	73	—	—	—	—	—	—	—	—	—	13	—	—	—	The highlighted values in the table are the initial values.		
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			Note: When combining with a servo motor whose rated speed is not equal to the initial value, change settings of Pr. 2, 3, 4 and 9. A parameter alarm (AL 37) may occur if the power is switched ON without changing the settings.																																																																																																																																		
	1	*STY	Servo loop type: The servo loop and validity of the regenerative option are set here. <div style="border: 1px solid black; width: 100px; height: 20px; margin-bottom: 5px; display: flex; justify-content: space-between; padding: 2px;"> <span>0</span> <span>1</span> </div> <ul style="list-style-type: none"> <li>0: Standard mode, position servo (pulse train)</li> <li>1: Standard mode, speed servo (analog, three internal speeds)</li> <li>4: Low noise mode, position servo (pulse train)</li> <li>5: Low noise mode, speed servo (analog, three internal speeds)</li> <li>0: No regenerative option</li> <li>1: Regenerative option (MR-RB013)</li> <li>2: Regenerative option (MR-RB033)</li> <li>3: Regenerative option (MR-RB064 × 2 series)</li> <li>4: Regenerative option (MR-RB064)</li> <li>5: Regenerative option (MR-RB10 × 2 series)</li> <li>6: Regenerative option (MR-RB30 × 2 series)</li> <li>7: Regenerative option (MR-RB10)</li> <li>8: Regenerative option (MR-RB30)</li> <li>9: Regenerative option (MR-RB50)</li> </ul> <p>There are limits to the combination of the regenerative option and servo amplifier. Refer to Section 6-1.</p> <ul style="list-style-type: none"> <li>0: Automatic tuning valid (medium response)</li> <li>1: Automatic tuning valid (fast response)</li> <li>2: Automatic tuning valid (slow response)</li> <li>3: Automatic tuning invalid</li> </ul>	0000		0 to 7395h																																																																																																																															
			(Note) The factory default setting is set to the position servo. Change Pr. 1 when using as a speed servo.																																																																																																																																		

Continued on the next page.



## 4. Start Up and Operation of Speed Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range
User parameters	2	SC1	Internal speed command (1) The first of the three internal speed commands is set. This is selected when input signal DI1 is switched ON.	100	r/min	0 to Max. speed
	3	SC2	Internal speed command (2) The second of the three internal speed commands is set. This is selected when input signal DI2 is switched ON.	1000	r/min	0 to Max. speed
	4	SC3	Internal speed command (3) The third of the three internal speed commands is set. This is selected when both input signals DI1 and DI2 are switched ON.	2000	r/min	0 to Max. speed
	5	STC	Acceleration time constant The acceleration time to reach the rated speed for the speed command (external analog, internal three speeds) is set here.  <div style="text-align: center;"> <p>When a commanded speed is lower than the rated speed, the acceleration/deceleration time decreases.</p> </div>	20	10 msec	0 to 5000
	6	STB	Deceleration time constant The deceleration time to reach zero speed for the speed command (external analog, internal three speeds) is set here.	20	10 msec	0 to 5000

Continued on the next page.

## 4. Start Up and Operation of Speed Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range	
Special parameters	7	*OPC	Special function selection: <div style="border: 1px solid black; display: inline-block; padding: 2px; margin: 5px;"> <span style="border: 1px solid black; padding: 2px 5px;">0</span> </div> <p style="margin-top: 10px;">S-character acceleration/deceleration selection</p> <p>0: S-character acceleration/deceleration invalid (trapezoid acceleration/deceleration will be used.)</p> <p>1: S-character acceleration/deceleration (1) valid</p> <p>2: S-character acceleration/deceleration (2) valid</p> <p>3: S-character acceleration/deceleration (3) valid</p> <p>The slope at the start and stop of the S-character acceleration/deceleration will increase in 2, 3, and 4-fold as shown below.</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>Selection of validity of servo lock during forward /reverse run start signal (ST1, ST2) OFF</p> <p>0: Servo lock valid</p> <p>1: Servo lock invalid</p> <p>Note: When servo lock is valid, the application of an external force in the rotating direction during a stop of the motor generates a counterforce to maintain the position. When servo lock is invalid, the counterforce is generated but does not return the motor shaft to the original position.</p>	0000		0000 to 113h	
	8	SCH	S-character acceleration/deceleration time constant changing speed The speed for changing the S-character acceleration/deceleration slope is set.	<div style="text-align: center; margin: 10px 0;"> </div>	50	r/min	50 to 5000
	9	VCM	Speed during 10V command The speed for when a 10V is input to the external speed command voltage is set. Change this when operating the HA-FE servo motor at more than 3000r/min. (Ex.) Set to "4000" to run with the 10V command at 4000r/min.	Rated	r/min	0 to 6000	

Continued on the next page.


## 4. Start Up and Operation of Speed Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range
Special parameters	10	ZSP	Zero speed The output signal (ZSP) is switched ON when the speed is below the set zero speed.	5	10r/min	1 to 500
	11	PGN	Position loop gain The position loop gain during servo lock is set here. This value will change automatically when automatic tuning is executed.	25	rad/S	5 to 150
	12	VGN	Speed loop gain The speed loop gain is set. The value will change automatically when automatic tuning is executed.	100		70 to 999
	13	VIC	Speed integral compensation The time constant for integral compensation is set here. The value will change automatically when automatic tuning is executed.	25	msec	1 to 999
	14	VDC	Speed proportional control gain The proportional control will be validated when the proportional control input signal (PC) is switched ON. The proportional integral control will be activated when set to 100, and the proportional gain will decrease with a smaller value.	98	%	0 to 100
	15	TLL	Torque limit value With a maximum torque of 100%, the MAX torque to be used is set. When the external torque limit input signal (TL) switches ON, the smaller of the external torque limit value or this parameter set value will be valid. The MAX torque set with this parameter will be 8V when the torque is monitored with monitor output.	100	%	0 to 100
	16	VCO	External speed command (VC) offset The offset for the external speed command analog input is set here. Set a value where the servo motor will not rotate with the speed command zero. Refer to Section 5-7 for the automatic offset adjustment.	Factory setting	2mV	-99 to 99
	17	MOO	Analog monitor offset The offset for the analog monitor output is set here.	0	mV	-20 to 100
	18		Spare	0		

Continued on the next page.

4

## 4. Start Up and Operation of Speed Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																																																																																																
Special parameters	19	IPO	<p>Input/output signal selection The input signal functions of the connector CN1 pins 32 and 33, and the output signal functions of pins 25 and 26 are selected.</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;">  </div> <div> <p>Input pin function selection</p> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Setting</th> <th>Pin 32</th> <th>Pin 33</th> </tr> </thead> <tbody> <tr><td>1</td><td>PC</td><td>TL</td></tr> <tr><td>2</td><td>DI1</td><td>TL</td></tr> <tr><td>3</td><td>DI2</td><td>TL</td></tr> <tr><td>6</td><td>DI1</td><td>PC</td></tr> <tr><td>7</td><td>DI2</td><td>PC</td></tr> <tr><td>b</td><td>DI2</td><td>DI1</td></tr> <tr><td>E</td><td>DI1</td><td>DI2</td></tr> </tbody> </table> <p style="font-size: small;">(For signal names, refer to Table 4-3.)</p> <p style="font-size: small;">← Initial value</p> </div> </div> <div style="margin-top: 10px;"> <p>Output pin function selection</p> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Setting</th> <th>Pin 25</th> <th>Pin 26</th> </tr> </thead> <tbody> <tr><td>1</td><td>ZSP</td><td>PF</td></tr> <tr><td>2</td><td>TLC</td><td>PF</td></tr> <tr><td>4</td><td>PF</td><td>ZSP</td></tr> <tr><td>6</td><td>TLC</td><td>ZSP</td></tr> </tbody> </table> <p style="font-size: small;">← Initial value</p> </div> <div style="margin-top: 10px;"> <p>Alarm code output 0: invalid 1: valid The alarm codes from the output pins (24, 25, 26) during an alarm are output in 3 bits.</p> </div> <div style="margin-top: 10px;"> <p style="font-size: small;">Note: The alarm code will be output when an alarm occurs and the ALM output is turned off.</p> </div>	Setting	Pin 32	Pin 33	1	PC	TL	2	DI1	TL	3	DI2	TL	6	DI1	PC	7	DI2	PC	b	DI2	DI1	E	DI1	DI2	Setting	Pin 25	Pin 26	1	ZSP	PF	2	TLC	PF	4	PF	ZSP	6	TLC	ZSP	04E		1 to 1AFh																																																									
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## 4. Start Up and Operation of Speed Servo

Class	Pr.	Abb.	Name	Initial Value	Unit	Range																																																		
Special parameters	20	DMD	<p>Monitor selection</p> <p>The display, monitor output and encoder output division rate are set here.</p> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 30px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 30px; height: 20px;"></div> </div> <p style="margin-left: 40px;">Display status selection when power is ON</p> <ul style="list-style-type: none"> <li>0: Cumulative feedback pulses (lower 4 digits)</li> <li>1: Cumulative feedback pulses (upper 3 digits)</li> <li>2: Speed</li> <li>3: Speed command voltage</li> <li>4: Torque limit command voltage</li> <li>5: Regenerative load ratio</li> <li>6: Effective load ratio</li> <li>7: Peak load ratio</li> </ul> <p style="margin-left: 40px;">Encoder output division ratio setting is made valid by re-setting the power.</p> <p style="margin-left: 40px;">Analog monitor output selection setting is made valid by pressing the [SET] button.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 15%;">Setting</th> <th style="width: 20%;">Setting of encoder output (FPA, FPB) division rate</th> <th style="width: 65%;">Analog monitor output selection</th> </tr> </thead> <tbody> <tr><td>00</td><td>1/1</td><td rowspan="7">Speed monitor (full-scale: 8V) Refer to the explanation of terminals in Section 7-4 (3), 8) for details.</td></tr> <tr><td>01</td><td>1/2</td></tr> <tr><td>02</td><td>1/3</td></tr> <tr><td>03</td><td>1/4</td></tr> <tr><td>:</td><td>:</td></tr> <tr><td>0F</td><td>1/16</td></tr> <tr><td>10</td><td>1/17</td></tr> <tr><td>:</td><td>:</td></tr> <tr><td>1F</td><td>1/32</td></tr> <tr><td>40</td><td>1/1</td><td rowspan="5">Torque monitor (full-scale: 8V)</td></tr> <tr><td>41</td><td>1/2</td></tr> <tr><td>42</td><td>1/3</td></tr> <tr><td>:</td><td>:</td></tr> <tr><td>5F</td><td>1/32</td></tr> <tr><td>80</td><td>1/1</td><td rowspan="3">Speed monitor (Zero center meter, full-scale: 5V ± 4V)</td></tr> <tr><td>:</td><td>:</td></tr> <tr><td>9F</td><td>1/32</td></tr> <tr><td>C0</td><td>1/1</td><td rowspan="3">Torque monitor (Zero center meter, full-scale: 5V ± 4V)</td></tr> <tr><td>:</td><td>:</td></tr> <tr><td>dF</td><td>1/32</td></tr> </tbody> </table> <p>(Setting example)</p> <p>Encoder output division rate: 1/4</p> <p>Analog monitor output: Speed monitor (repeated full-scale)</p> <p>"Speed" is set as the default status monitor:</p> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;">0</div> <div style="border: 1px solid black; padding: 2px;"> <table style="border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">0</td> <td style="width: 30px; text-align: center;">3</td> <td style="width: 30px; text-align: center;">2</td> </tr> </table> </div> </div> <div style="margin-left: 40px; margin-top: 10px;"> <p>Speed</p> <p>Encoder output 1/4 speed monitor full scale</p> </div>	Setting	Setting of encoder output (FPA, FPB) division rate	Analog monitor output selection	00	1/1	Speed monitor (full-scale: 8V) Refer to the explanation of terminals in Section 7-4 (3), 8) for details.	01	1/2	02	1/3	03	1/4	:	:	0F	1/16	10	1/17	:	:	1F	1/32	40	1/1	Torque monitor (full-scale: 8V)	41	1/2	42	1/3	:	:	5F	1/32	80	1/1	Speed monitor (Zero center meter, full-scale: 5V ± 4V)	:	:	9F	1/32	C0	1/1	Torque monitor (Zero center meter, full-scale: 5V ± 4V)	:	:	dF	1/32	0	3	2		002	0 to DF7h
			Setting	Setting of encoder output (FPA, FPB) division rate	Analog monitor output selection																																																			
00	1/1	Speed monitor (full-scale: 8V) Refer to the explanation of terminals in Section 7-4 (3), 8) for details.																																																						
01	1/2																																																							
02	1/3																																																							
03	1/4																																																							
:	:																																																							
0F	1/16																																																							
10	1/17																																																							
:	:																																																							
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dF	1/32																																																							
0	3	2																																																						

## 4. Start Up and Operation of Speed Servo

### (3) Acceleration/deceleration patterns

The acceleration/deceleration patterns that can be set with the internal parameters are explained below. Acceleration/deceleration patterns other than those explained cannot be set.

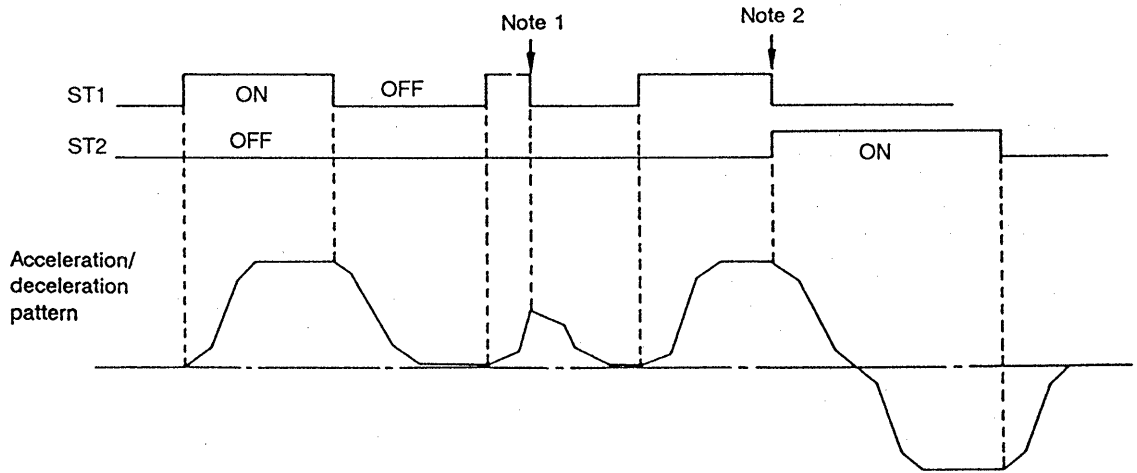
#### 1) Setting example

No.	Parameter No. (name) setting value				Acceleration/deceleration pattern	Explanation
	Pr. 5 STC	Pr. 6 STB	Pr. 7 Lower 1 digit OPC	Pr. 8 SCH		
1	STC	STB	0	SCH (Ignored)	<p>Acceleration/deceleration pattern 1 (OPC=0)</p>	<p>When the start signal (ST1, ST2) switches ON, the acceleration will be according to the acceleration time set in Pr. 5, and the deceleration will be according to the deceleration time set in Pr. 6.</p> <p>Only one setting for each acceleration and deceleration time can be set.</p>
2	STC	STB	1	SCH	<p>Acceleration/deceleration pattern 2 (OPC=1-3)</p> <p>Constants</p> <p>I : Acceleration/deceleration according to inclination b</p> <p>II : Acceleration according to inclination a</p> <p>III: Deceleration according to inclination c</p>	<p>The acceleration time is set in Pr. 5, the deceleration time in Pr. 6. The acceleration and deceleration between 0 and SCH and between (speed command value) and (speed command value-SCH) will both be the times of STC*2 (twice STC).</p>
3	STC	STB	2	SCH		<p>The time for S-character acceleration/deceleration (1) will be STC*3 (three times STC) between 0 and SCH and between (speed command value) and (speed command value-SCH).</p>
4	STC	STB	3	SCH	<p>When OPC = 1, X = STC x 2</p> <p>When OPC = 2, X = STC x 3</p> <p>When OPC = 3, X = STC x 4</p>	<p>The time for S-character acceleration/deceleration (1) will be STC*4 (four times STC) between 0 and SCH and between (speed command value) and (speed command value-SCH).</p>

## 4. Start Up and Operation of Speed Servo

### 2) S-character acceleration/deceleration time chart

#### a. Start signal (ST1, ST2) and acceleration/deceleration pattern

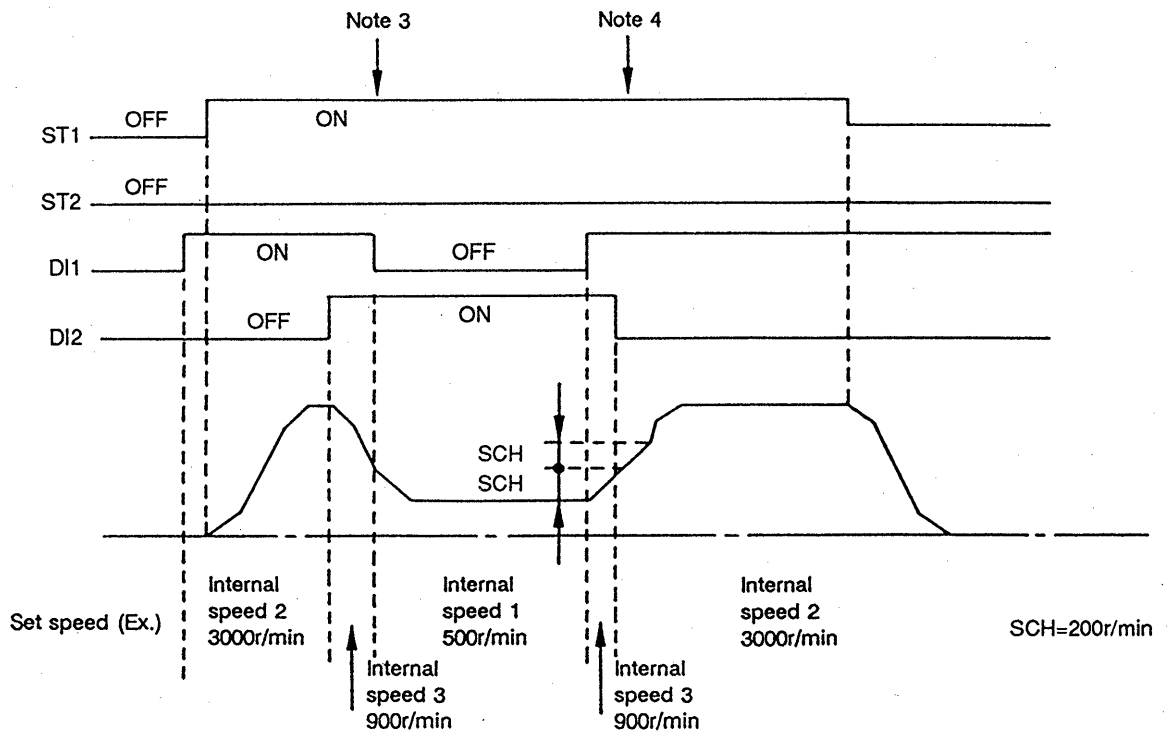


Note 1: If the start signal switches OFF during acceleration, the motor will S-character decelerate.

Note 2: To change over from forward run (ST1) to reverse run (ST2), the motor will S-character decelerate to stop from forward run, and then will S-character accelerate to reverse run.

#### b. Speed selection (DI1, DI2) and acceleration/deceleration patterns

If the speed change from the current speed command to the next speed command is not  $2 \cdot \text{SCH}$  (twice SCH) or more, the acceleration/deceleration will be a gradual acceleration/deceleration time ( $\text{STC} \cdot (\text{fold set in Pr. 7})$ ). Even when the speed is changed by the internal speed commands the acceleration/deceleration times will be one type for both acceleration and deceleration.



## 4. Start Up and Operation of Speed Servo

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Note 3: When decelerating from internal speed 2 (3000r/min) to internal speed 3 (900r/min), and the acceleration/deceleration time is changed gradually at 1100r/min, a change to internal speed 1 (500r/min) will cause a gradual acceleration/deceleration time to be applied between 1100r/min and 500r/min.

4: The gradual acceleration/deceleration time range may extend in the same way also during acceleration.

### 3) External analog speed command and S-character acceleration/deceleration

- a. If the change in the external analog speed command (hereafter VC command) is  $2 \cdot \text{SCH}$  or less, the speed will change with a gradual acceleration/deceleration time.  
(If there is a large noise or ripple in the VC command, set a gradual acceleration/deceleration time range in the area where the noise or ripple occurs. A filter will be applied to these noises and ripples, and the servo motor speed will be smoothed.)
- b. If the VC command changes, and the VC command with servo amplifier input sampling changes  $2 \cdot \text{SCH}$  or more, an S-curve acceleration/deceleration pattern will be created. Thus, a gradual acceleration/deceleration time that is longer than the SCH duration may be applied.



# 4. Start Up and Operation of Speed Servo

## 4-6 Wiring

### (1) Servo amplifier front view

**Power supply connection (R, S, T)**

3-phase 200V series:  
Connect to a commercial power supply of 200 to 230 VAC, 50/60Hz.  
Single-phase 100V series:  
Connect to a commercial power supply of 100 to 115VAC, 50/60Hz.

**Regenerative option connection (C, P)**

Connect between P and C when using the regenerative option.

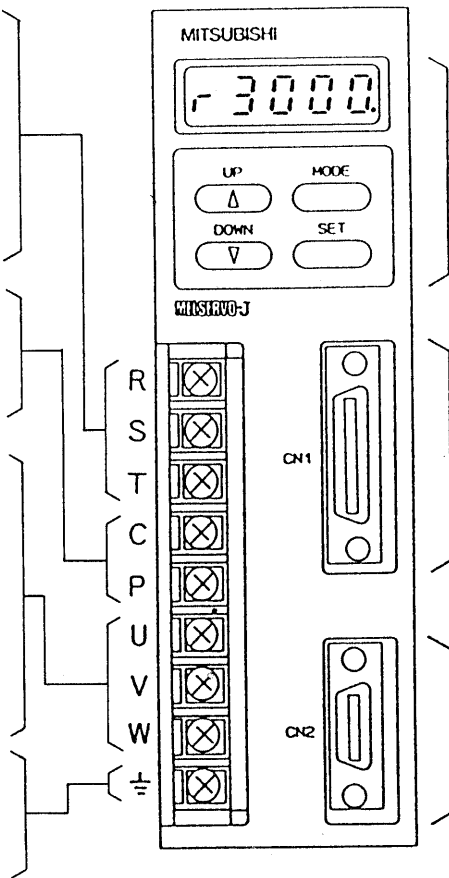
**Servo motor connection (U, V, W)**

Connect with the servo motor power supply terminals U, V and W.

Proper operation will not be possible if the phases on the servo motor and servo amplifier are mistakenly connected. The amplifier may be damaged if a commercial power supply is connected.

**Grounding**

Connect with the servo motor ground terminal, and ground (grounding resistance 100Ω MAX.)



**Display/setting section**  
The status and alarms can be displayed and parameters can be set here.

**Connector CN1**  
Various control signals are input/output. Refer to Section 4-7 for explanations on the signals. Refer to section (2), 1) for the pin layout.

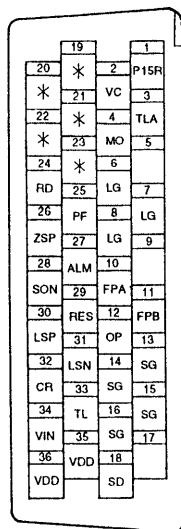
**Connector CN2**  
Connect to the motor detector. Refer to section (2), 2) for the pin layout.

### (2) Connector pin layout diagram

The connector pin layout diagram looking from the cable wiring side is shown below. The pin number is indicated on the upper row, and the signal name on the lower row.

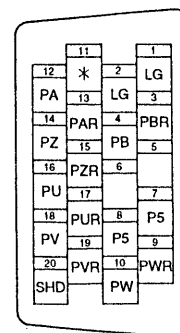
- 1) CN1 (connector for control signals)  
Model PCR-S36FS connector  
(Made by HONDA)  
PCR-LS36LA (case)

- 2) CN2 (connector for PLG signals)  
Model PCR-S20FS connector  
(Made by HONDA)  
PCR-LS20LA1 (case)



Pin No.
Signal name

Connector pin layout diagram



Pin No.
Signal name

Connector pin layout diagram

## 4. Start Up and Operation of Speed Servo

### 4-6.1 Standard connection diagram

#### (1) Standard connection for speed control operation

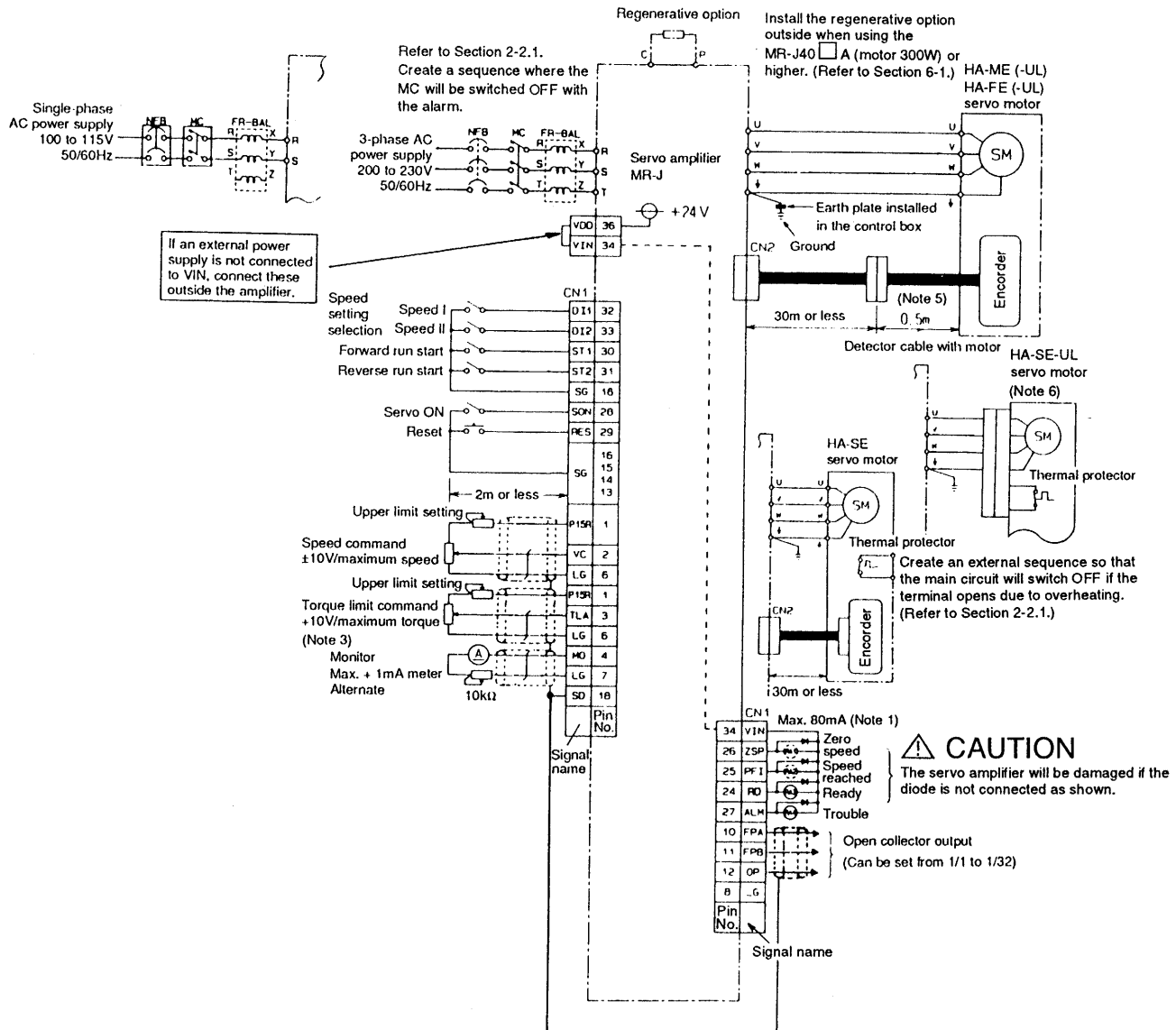


Fig. 4-1 Standard connection diagram for speed control operation

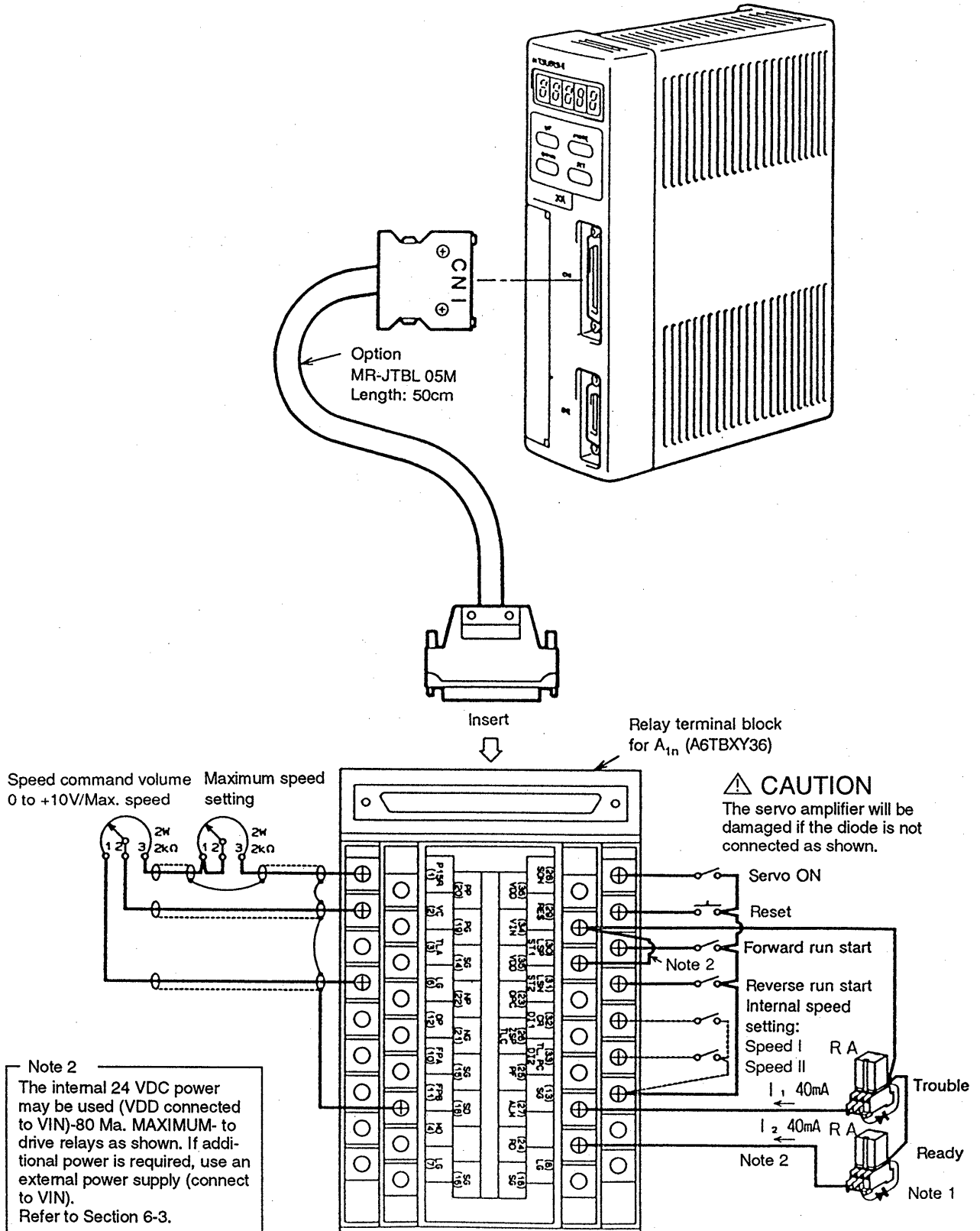
- Note:
- The total current to the external relays should not exceed 80mA.
  - The servo amplifier may be damaged if the diode polarity is inverted and connected.
  - When validating the external torque limit, validate the torque limit function with the parameter setting.
  - The pins with the same signal name are connected inside the servo amplifier.
  - 0.3m for the HA-ME series.
  - For the UL listed and CSA certified HA-SE servo motor, connectors are used for connection with the power supply. (Refer to Section 2-1.4.)

Motor side: MS3102A22-23P or MS3102A24-10P  
Cable side: MS3106B22-23S or MS3106B24-10S

## 4. Start Up and Operation of Speed Servo

### (2) Basic wiring

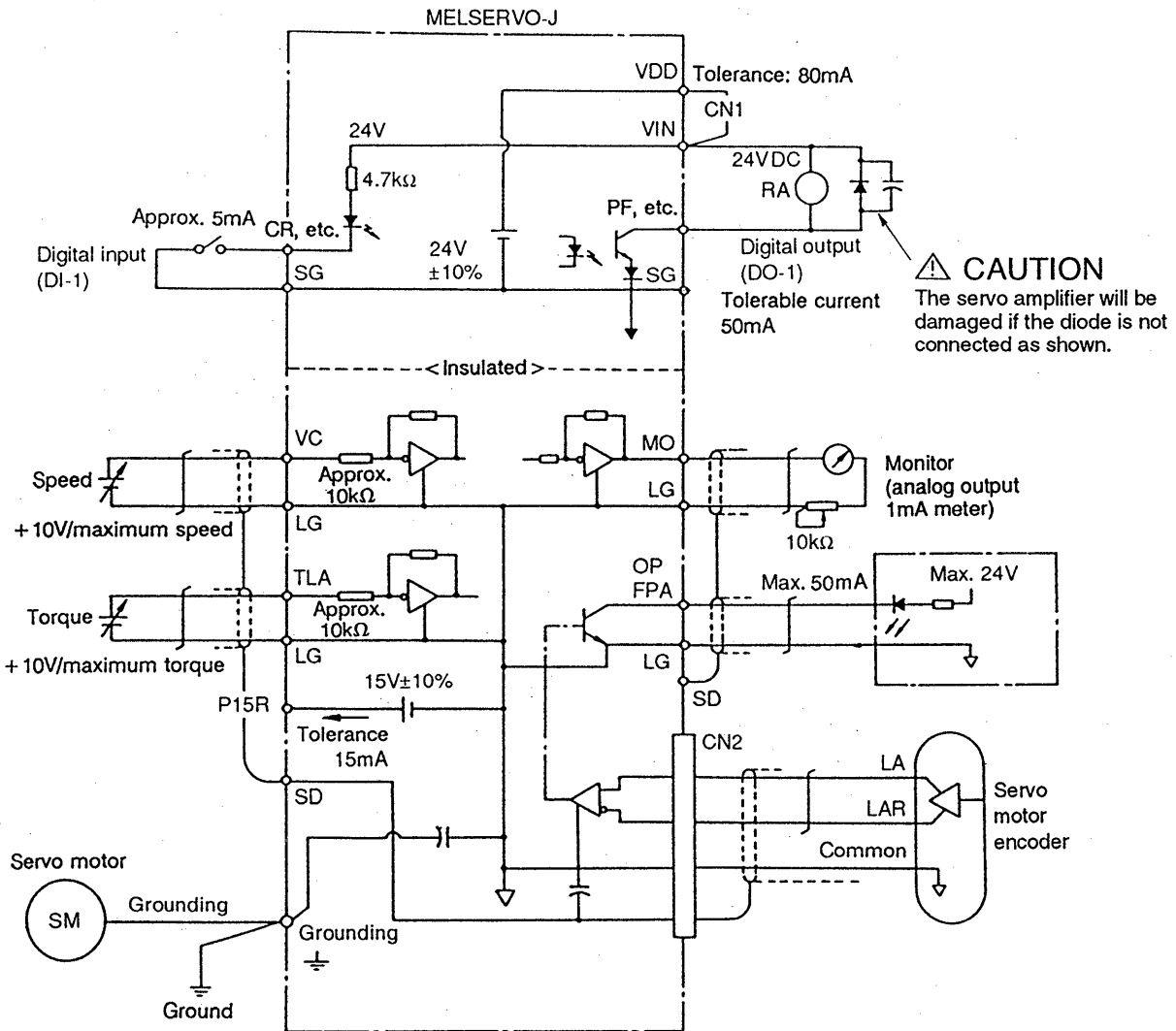
- Connection example using a relay terminal block



## 4. Start Up and Operation of Speed Servo

### 4-6.2 Common line diagram for speed servo

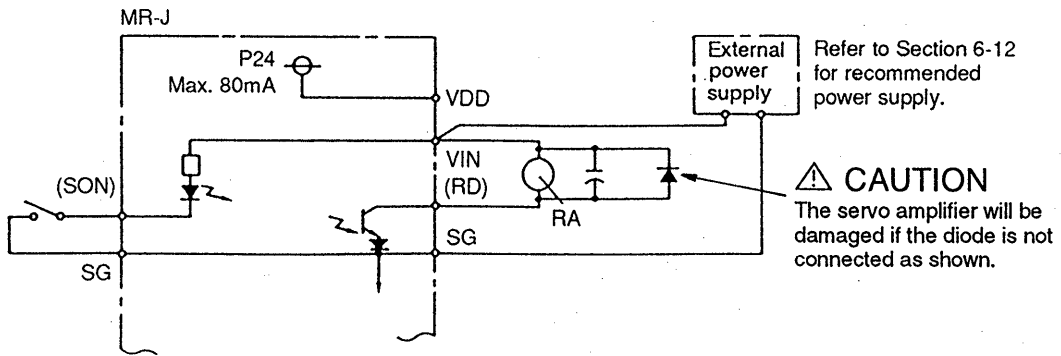
The internal power supply (24V, 15V) and the common lines of the servo amplifier are shown below. The power supply is separated into two systems, properly wire these. Use shields if the unit is affected by external noise, and carefully ground these.



## 4. Start Up and Operation of Speed Servo

### 4-6.3 Interface power supply

The power supply VDD (+24V) built into the servo amplifier can be used for digital input/output signals. If the current capacity is insufficient, do not connect VDD and VIN, instead use an the externally installed power supply.



## 4. Start Up and Operation of Speed Servo

### 4-7 Explanation of signals

#### (1) Explanation of signals

**Table 4-3 List of signals**

Signal name	Symbol	Pin No.	Explanation	I/O class
Servo ON	SON	28	Operation is possible when the servo ON signal is switched ON.	DI-1
Reset	RES	29	The alarm can be reset when the alarm reset signal is switched ON for 50msec or more. However, memory, card and parameter errors cannot be reset with this signal. For regenerative and overload errors, the alarm cannot be reset with the alarm reset signal until the regenerative resistor or power transistor cools down.	
Forward run start	ST1	30	The motor will rotate when the forward run start signal is switched ON. The servo motor will run forward when the speed command (VC) is a positive voltage, and will run reverse when a negative voltage. When switched OFF, the servo motor will stop, and when both ST1 and ST2 are ON, will not run.	
Reverse run start	ST2	31	The motor will rotate when the reverse run start signal is switched ON. The servo motor will run reverse when the speed command (VC) is a positive voltage, and will run forward when a negative voltage.	
Speed I selection	DI1	32 33 (*1)	According to the combination of DI1 and DI2, the motor speed is set by the speed command (VC) or the internal speed command, (SC1, SC2, SC3). These are set.  When the external torque limit signal is switched ON, the torque output by the servo motor will be limited to the torque limit command (TLA) value, input with analog from an external source.  When the proportional control signal is switched ON, the speed servo loop will be changed from a proportional integral type to a proportional type.	
Speed II selection	DI2			
External torque limit	TL			
Proportional contro	PC			
Speed command	VC	2	The motor speed is set. The speed will be 0 to $\pm 10V/0$ to $\pm 3000r/min$ . However, the servo motor speed input with 10V can be changed with parameter No. 9. Input impedance is approximately 10k $\Omega$	Analog input
Torque limit command	TLA	3	Input the motor torque limit value when the external torque limit signal is switched ON. The relation is 0 to +10V/0 to maximum torque, as noted in Section 10-2. Input impedance is approximately 10k $\Omega$	
15V power supply	P15R	1	+15V $\pm 10\%$ is output between P15R and the control common LG. The maximum current available is 30mA.	—
Control common	LG	6, 7, 8	This is the common terminal for the torque limit command TLA, monitor MO, A, B, and Z-phase PLG pulse FPA, FPB, OP signals.	
24V power supply	VDD	35, 36	+24V $\pm 10\%$ is output between VDD and common SG. The maximum current available is 80mA.	

Continued on the next page.

## 4. Start Up and Operation of Speed Servo

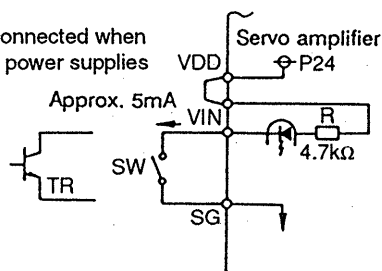
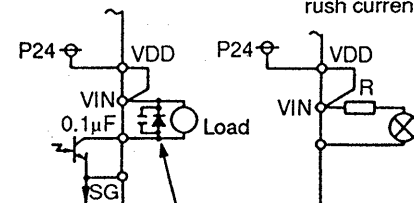
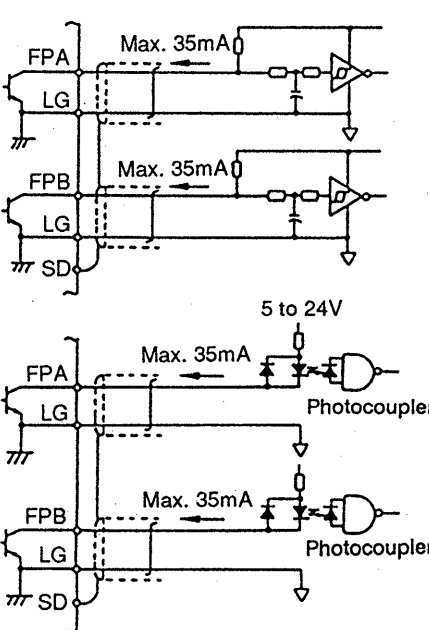
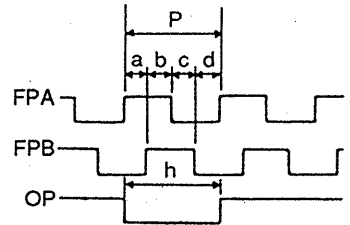
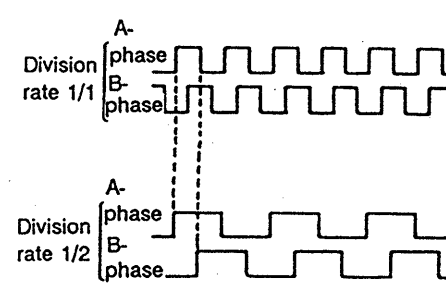
Signal name	Symbol	Pin No.	Explanation	I/O class
24V common	SG	13, 14, 15, 16	This is the common terminal for the 24V power supply.	—
Digital I/F power supply input	VIN	34	A 24V power supply is input for the digital I/F. Connect between VIN and VDD when using the 24V power supply in the servo amplifier.	—
Shield	SD	18	Connect one end of the shielded wire.	—
Ready	RD	24	The ready signal switches ON when the servo ON signal is input and the servo can be run.	DO-1
Trouble	ALM	27	The trouble signal will switch OFF when an alarm occurs in the servo. The trouble signal will switch ON approx. 0.8 seconds after the power is switched ON.	
Speed reached	PF	25	The speed reached signal switches ON when the motor speed reaches the speed set in the speed command (VC) or parameter (SC1, SC2, SC3).	
Zero speed	ZSP	26 Select ZSP or TLC with the parameter.	The zero speed signal switches ON when the servo motor speed drops below the zero speed set in the parameter.	
Limiting torque	TLC		The limiting torque signal switches ON when the torque output reaches the torque limit value.	
A-phase PLG pulse	FPA	10	The feedback pulse from the encoder mounted onto the servo motor is output. The feedback pulse can be divided from 1/1 to 1/32 with the corresponding parameter.	DO-2
B-phase PLG pulse	FPB	11	When the motor is rotating in the forward direction, the FPA will be the pulse that is a 90° phase forward from FPB.	
Z-phase PLG pulse	OP	12	One pulse will be output with one servo motor rotation.	
Monitor	MO	4	The motor speed or torque is output as an analog voltage. Select whether to output the speed or torque with the corresponding parameter. When outputting the speed, this is maximum speed (8V), and when outputting the torque, this is the maximum torque (8V). Use parameter No. 15 to select.	Analog output

- \*1: Assign speed I, speed II, external torque limit, or proportional control to pins 32 or 33. Select with parameter NO. 19. The initial setting value is DI1-32, DI2-33.
- \*2: Assign speed reached, zero speed, or limiting torque to pins 25 and 26. Select with parameter NO. 19. The initial setting value is PF-25, ZSP-26.

## 4. Start Up and Operation of Speed Servo

### (2) Interface

The details of each interface noted in Table 4-3 (I/O class) are shown below. Refer to this, and connect with external equipment.

Digital input interface (DI-1)	Digital input interface (DO-1)	
<p>Apply a signal with a miniature relay or open collector TR.</p> <p>To be connected when internal power supplies used.</p> 	<p>The lamp, relay or photocoupler can be driven.</p> <p>Allowable current: 50mA or less In-rush current: 100mA or less</p> <p>Note: For an inductive load install a suppressor (D.C.), and for lamp load install a resistor (R) for in-rush current suppression.</p>  <p><b>CAUTION</b> The servo amplifier will be damaged if the diode is not connected as shown.</p>	
Pulse train output interface (DO-2)		
<p>• Interface example</p> 	<p>• Phase relation</p> <p>During motor CCW rotation</p>  <p>1. <math>a, b, c, d = P/4 \pm P/8 \pm 1\mu s</math>          (This is established regardless of the output division rate.)</p> <p>2. <math>h = P' \pm P'/2 \pm 1\mu s</math>          (P' equals to the duration of one FPA pulse when the output division rate is 1/1.)</p>	<p>• Division waveform</p> <p>Either ON or OF width is a multiple of each division. (50% duty)</p> 



## 4. Start Up and Operation of Speed Servo

### (3) Explanation of signals

#### 1) Speed command input (VC):

##### (a) Speed command level:

The relation of the speed command level and motor speed is shown on the right.

**Note:** The figure shows the example when the motor has a rated speed of 3000r/min. When the servo motor has a rated speed of 2000r/min., this will be 2000r/min at  $\pm 10V$ .

By changing Pr. 9 (the speed at 10V command), the speed when 10V is applied can be changed.

When using a servo motor with 4000r/min, the setting of Pr. 9 must be changed.

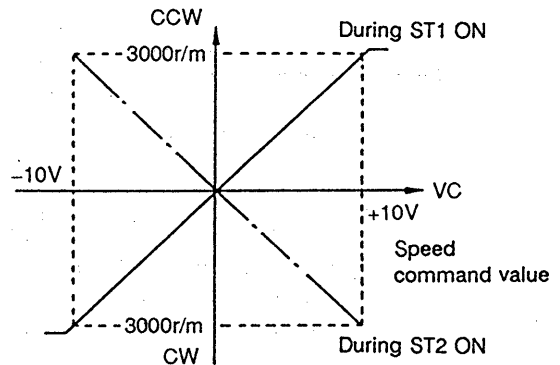
A negative power supply is not built into the servo amplifier, so when using both a positive and negative command, also use an external negative power supply.

##### (b) Speed command circuit:

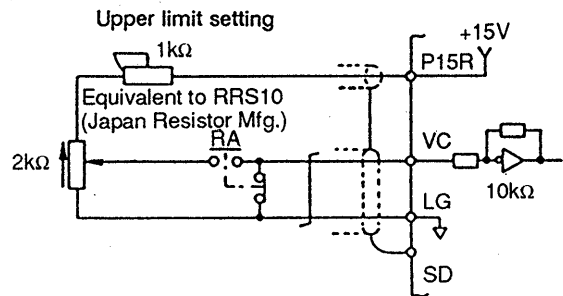
When a speed command is given using the +15V (P15R) power supply in the servo amplifier, there will be a  $\pm 2\%$  temperature fluctuation in the command voltage. Use a rotary coil type potentiometer to raise the speed setting resolution.

#### 2) Start signals (ST1, ST2):

The servo motor is started and stopped with forward/reverse start signals (ST1, ST2). The relation of the external speed command (VC) polarity, (ST1, ST2) and the motor's forward/reverse direction is noted on the right.



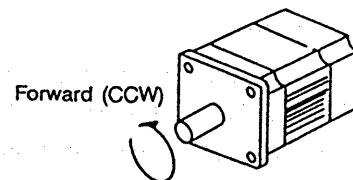
**Fig. 4-2 External speed command level**



**Fig. 4-3 External speed command circuit**

**Table 4-4 Servo motor rotation direction**

External speed command (VC) polarity	Forward start signal ST1 ON	Reverse start signal ST2 ON
+ Positive polarity	Forward	Reverse
- Negative polarity	Reverse	Forward



When ST1 and ST2 are both switched ON or OFF, the motor will decelerate and stop with the deceleration time constant set in parameter (STB), and will be servo locked.

If either ST1 or ST2 is ON and VC=0, Pr. 7 can be used to make servo lock invalid.

For details, refer to Section 4-5.5 Parameters.

## 4. Start Up and Operation of Speed Servo

### 3) Speed selection (DI1, DI2):

One of four speed commands is selected by the inputs DI1 and DI2 according to the following table. The rotation direction is set with either ST1 or ST2.

**Table 4-5 Internal speed selection signal**

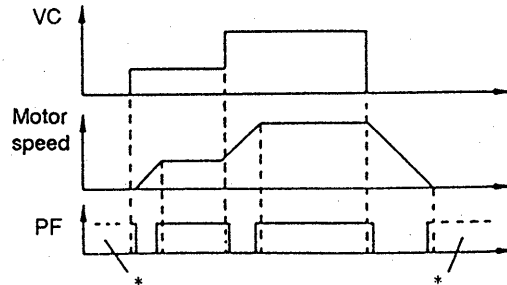
Speed command source		DI1	DI2
Parameter setting speed	1st speed (SC1)	ON	OFF
	2nd speed (SC2)	OFF	ON
	3rd speed (SC3)	ON	ON
External speed command (VC)		OFF	OFF

Note 1: When operating with the internal speed command, there will be no fluctuation in the speed caused by changes in the ambient temperature.

### 4) Speed reached (PF):

PF will remain ON when the speed command (VC, SC1, SC2, and SC3) is 30r/min or less.

PF will remain OFF when ST1 and ST2 are both OFF.



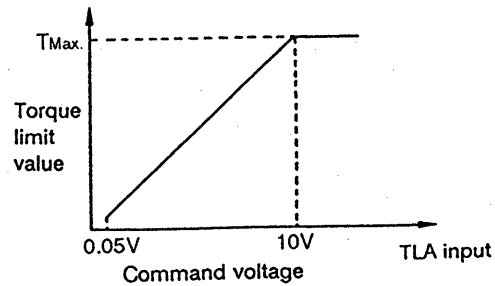
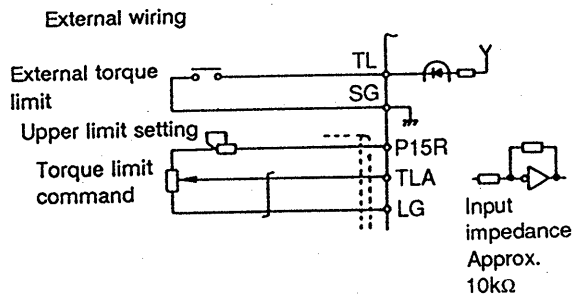
\* PF will not switch ON when ST1 and ST2 are both OFF

### 5) Torque limit

Normally the torque is limited in the servo amplifier to the value set in parameter No. 15. If there are mechanical system limits such as with the gear capacity, the Max. torque can be set smaller with Pr. 15. To change the torque limit value from an external source, wire as shown in the diagram (at right), and switch ON the external torque limit command TL. The torque limit value will be the smaller of the TLA level or Pr. 15 level.

**Torque limit command and motor torque:**  
The relation of the TLA voltage level and the motor generated torque is shown on the right. The servo motor generated torque will have a difference of about 5% depending on the servo motor.

If the speed command is low such as 50mV or less, a proper limit will not be applied, and the torque will fluctuate. If there are problems, increase the limit value.



## 4. Start Up and Operation of Speed Servo

- 6) Limiting torque (TLC):  
 This switches ON when the servo motor torque reaches the set torque limit value such as during acceleration or deceleration.  
 If the external torque limit is not applied, this will switch ON at the output of torque whose torque limit has been set with Pr. 15.

- 7) Zero speed (ZSP):  
 This switches ON when the motor speed drops to or below that set with Pr. 11. The detection has a hysteresis as shown in Fig.4-4.

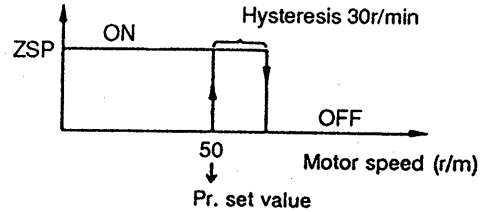


Fig. 4-4 Zero speed detection level

- 8) Analog monitor output (MO):  
 Any of the following four levels can be selected with parameter No. 20.

Table 4-6 Monitor output pattern

Monitor	Speed		Torque (motor current)	
	Factory default value 0□□	8□□	4□□	c□□
MO output details	(+8V/maximum speed)  8V 0 CW 0 CCW Speed	(5±4V/maximum speed)  9V 5V 1V 0 CW 0 CCW Speed	(+8V/Pr. 15 setting Max. torque)  8V 0 CCW Forward Torque Forward CW	(5±4V/Pr. 15 setting Max. torque)  9V 5V 1V 0 CCW Forward Torque Forward CW