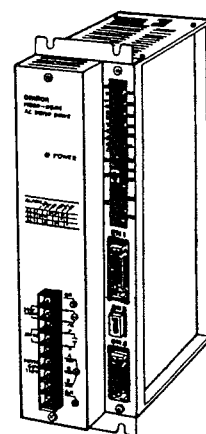




USER'S MANUAL



OMNUC R SERIES

MODEL : R88D-RR04/RR05/RR10/RR15/RR20
(POWER UNIT SEPARATED PULSE TRAIN INPUT TYPE)

AC SERVO DRIVER

Notes About Using This Manual

- (1) This manual describes in as much detail as possible the functions of the unit and relations with other units. Items not described in this manual should be understood as “unavailable.”
- (2) Though we have tried to create the manual optimum, do not hesitate to contact our agent if you find anything difficult to understand.
- (3) Inside the cover, there are potentially dangerous parts. If you open the cover, serious problems may arise. Never repair or disassemble the unit.
- (4) We recommend adding the following precautions to your instruction manuals for unit-installed systems.
 - High voltage equipment is dangerous.
 - Do not touch terminals of the unit after power is switched OFF as voltage remains.
- (5) Specifications and functions may change without notice in order to improve performance.

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1.1 Features and Configuration

This unit is an AC servo driver that performs fine positioning by controlling power to AC servo motor in compliance with pulse train input signal.

This series consists of AC servo drivers operative 60W to 1,100W motors.

Two models of power unit: 200 VAC, 3-phase input model and 100 VAC, single phase, are provided. The regenerative unit can absorb up to 40 W energy.

AC servo systems controlled by RB series drivers have the following features:

- Compactness and light weight.
- High speed pulse train input up to 270 kpps max. response pulse rate.
- Shockproof, durable in any environmental condition.
- Electromagnetic encoders are applied for detection.
- AC servo motors are able to rotate up to instant rate 4,000 rpm.
- Smooth and vibrationless rotation with minimized ripple by sinusoidal wave method.
- Dynamic brake is installed.
- Extendable distance between the motor and driver up to 30 m when the standard cable is used.

Note: As for the power unit and regenerative unit, see the separate instruction manuals for each.

1. GENERAL

1.2 Outline of Configuration

System configuration example using a unit is shown below.

- Using 200 VAC, 3-phase power

Power unit	Servo driver	Servo motor	Motor output	Regenerative unit
R88S-R305 R88S-R310 R88S-R310G R88S-R315	R88D-RR05	R88M-R10030	100W	R88A-RG50
	R88D-RR10	R88M-R20030	200W	
		R88M-R30030	300W	
	R88D-RR15	R88M-R45030	450W	
		R88M-R60030	600W	
	R88D-RR20	R88M-R82030	820W	
		R88M-R1K130	1,100W	
	R88D-RR04	R88M-R06030	60W	
		R88M-R11030	110W	

- Using 100 VAC, single phase power

Power unit	Servo driver	Servo motor	Motor output	Regenerative unit
R88S-R203 R88S-R205	R88D-RR05	R88M-R10030	100W	R88A-RG50
	R88D-RR10	R88M-R20030	200W	
		R88M-R30030	300W	
	R88D-RR15	R88M-R45030	450W	
		R88M-R60030	600W	
	R88D-RR20	R88M-R82030	820W	
	R88D-RR04	R88M-R06030	60W	
		R88M-R11030	110W	

Note: R88S-R310G has a built-in regenerative absorption circuit.

Motors for the R88M-R60030 (600 W) are also applicable with the R88D-RR20 driver.

For details, see Chapter 2: AC servo motor specification.

For selection of power unit, see the instruction manual for power units.

1. GENERAL

☐ AC servo motor

- AC servo motors are available in 9 models: 60 W, 100 W, 110 W, 200 W, 300 W, 450 W, 600 W, 820 W and 1,100 W. Be sure to use proper servo motor suitable to the AC servo driver. (See previous page, item 1-2.)

☐ AC servo driver

- AC servo drivers of 5 models can control AC servo motors of 60 W to 1,100 W. Types of AC servo drivers should be in accordance with each AC servo motor. (See previous page, item 1-2.)

☐ Power unit

- This unit supplies power to a AC servo driver taking 100 VAC input power. The following models of power units are available.

R88S-R203	3A output
R88S-R205	5A output

- This unit supplies power to a AC servo driver taking 200 VAC input power. The following power unit models are available.

R88S-R305	6A output
R88S-R310	10A output
R88S-R310G	10A output with regenerative energy absorption circuit.
R88S-R315	15A output

☐ Regenerative unit

- This is a unit to absorb regenerative energy. The following model is available.

R88A-RG50

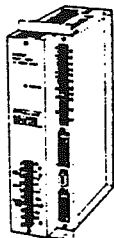
Note: For the power unit and regenerative unit, see separate instruction manuals.

1. GENERAL

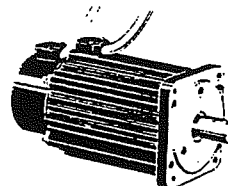
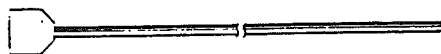
□ Exclusive cable

- Encoder cable for 100 to 450 W motors (R88A-CRR□□□S)

This is a cable to connect R series AC servo motors (100 to 450 W) with R series AC servo drivers.



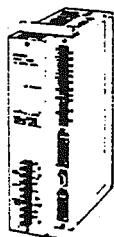
R88D-R
AC servo driver



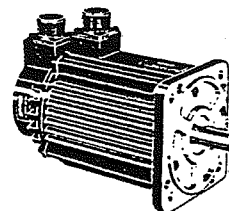
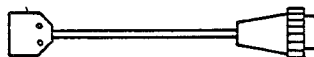
R88M-R
AC servo motor 100 - 450 W

- Encoder cable for 600 to 1,100 W motor (R88A-CRR□□□N)

This cable is to connect R series AC servo motors (600 to 1,100 W) and R series AC servo drivers.



R88D-R
AC servo driver



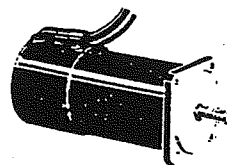
R88M-R
AC servo motor 600 - 1100 W

- Encoder line extension cable (R88A-CRR□□□C)

This cable is to connect a connector cable assembled R series AC servo motors and AC servo drivers.



R88D-R
AC servo driver

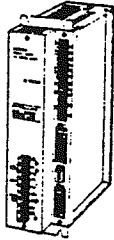


R88M-R
AC servo motor 60 / 110 W

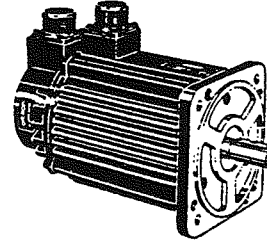
1. GENERAL

- Power cable for 600 to 1,100 W motor (R88A-CAS□□□S)

This cable is to connect armature connectors of 600 to 1,100 W AC servo motors and AC servo drivers.



R88D-R
AC servo driver



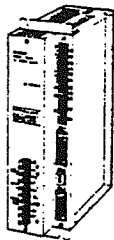
R88M-R
AC servo motor 600 - 1,100 W

- Power cable for 60 W and 110 W motor (R88A-CAR□□□S)

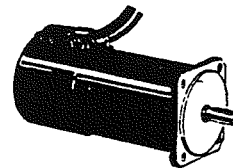
This cable is to connect armature connectors of 60 W and 110 W AC servo motors and AC servo drivers.

- Power cable for 60 W and 110 W motor (R88A-CAR□□□B)

This cable is to connect armature connectors of 60 W and 110 W brake-installed AC servo motors and AC servo drivers.



R88D-R
AC servo driver



R88M-R
AC servo motor 60/110 W

- Encoder cable

Specifications	Length	Models
Motor capacity: 100 W, 200 W, 300 W, 450 W (single-side connector)	3 m	R88A-CRR003S
	5 m	R88A-CRR005S
	10 m	R88A-CRR010S
	15 m	R88A-CRR015S
	20 m	R88A-CRR020S
	30 m	R88A-CRR030S
Motor capacity 600W, 820W, 1,100W (dual-side connector)	3 m	R88A-CRR003N
	5 m	R88A-CRR005N
	10 m	R88A-CRR010N
	15 m	R88A-CRR015N
	20 m	R88A-CRR020N
	30 m	R88A-CRR030N
Motor capacity 60 W, 110 W, (dual-side connector)	3 m	R88A-CRR003C
	5 m	R88A-CRR005C
	10 m	R88A-CRR010C
	15 m	R88A-CRR015C

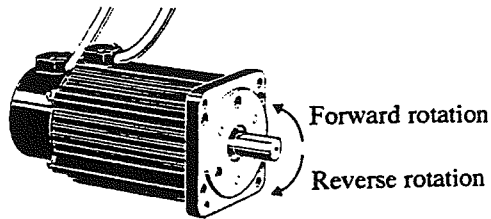
- Power cable

Specifications	Length	Models
Motor capacity: 600 W, 820 W, 1,100 W (single-side connector)	3 m	R88A-CAS003S
	5 m	R88A-CAS005S
	10 m	R88A-CAS010S
	15 m	R88A-CAS015S
	20 m	R88A-CAS020S
	30 m	R88A-CAS030S
Motor capacity 60W, 110W, (single-side connector)	3 m	R88A-CAR003S
	5 m	R88A-CAR005S
	10 m	R88A-CAR010S
	15 m	R88A-CAR015S
Motor capacity 60 W, 110 W with brake. (single-side connector)	3 m	R88A-CAR003B
	5 m	R88A-CAR005B
	10 m	R88A-CAR010B
	15 m	R88A-CAR015B

1. GENERAL

1.3 Before Reading This Manual

Read this manual carefully before using the unit. In this manual, AC servo motor rotation directions are defined as “Forward” and “Reverse.” “Forward” rotation means to rotate motor shaft in an counter-clockwise (CCW) direction, “Reverse” rotation means clockwise (CW) direction looking at the motor from the shaft side.

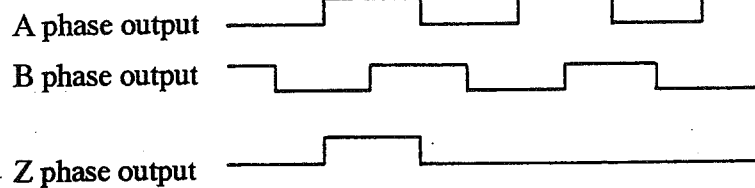


AC servo motor

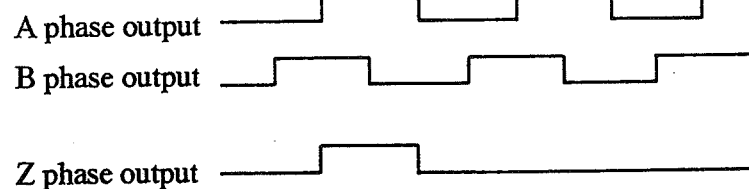
□ Encoder output phase

The encoder output signal from the servo driver is as follows.

- At forward rotation



- At reverse rotation



2. SPECIFICATION

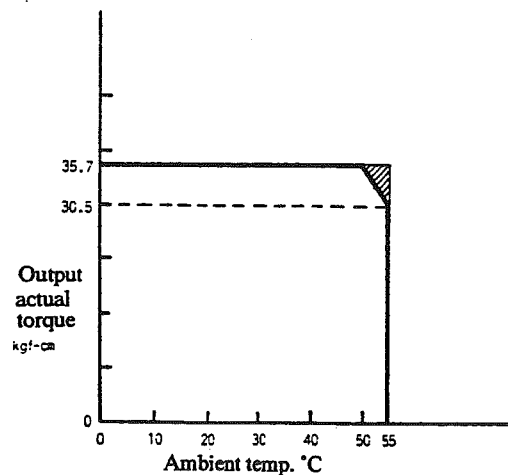
The system consists of an AC servo driver and an AC servo motor.

Specifications of AC servo driver and AC servo motor are shown below.

2.1 General Specifications of Servo Driver

Item	Standards	
Ambient operating temperature	0 to +55°C <Note>	
Ambient operating humidity	35 to 85% RH (without dew condensation)	
Storage temperature	-10 to +75°C, 35 to 85%RH (without dew condensation)	
Ambient condition	Without corrosive gases	
Vibration proof	Less than 2G or the acceleration of 10-150 Hz with half amplitude of 0.15 mm.	
Shock proof	Less than 10G in peak acceleration (tested each 3 times in X, Y, Z directions).	
Insulating resistance	More than 5 MΩ at 1,000 VDC, between power terminal and box.	
Voltage proof capacity	1 minute at 1,500 VAC 50/60 Hz, between power terminal and box.	
Structure	Installation inside a box type	
Weight	R88D-RR04/RR05/ RR10/RR15	Approx. 2.7 kgf
	R88D-RR20	Approx. 3.0 kgf

<Note> When the R88D-RR20(AC servo driver) is used with the R88M-R1K130 (1,100 W AC servo motor), it cannot operate in the area shown in slanting lines, below.



2. SPECIFICATION

2-2 Performance Specifications

2-2-1 AC servo driver

□ Specifications of the speed control section and control input/output signals

Item		Specifications
Max. response pulse frequency		270 kpps
Max. amount of error counter		Selectable between 9, 10, 11, 12 bit
Multiplication figures of position command pulse		1 to 16
Setting on in-position range		± 1 to ± 31 pulse
Input signal of position detector		90° phase difference signal A, B, and Z , 70 kpps max.
Multiplication figures of encoder input signal		$\times 1$, $\times 2$, $\times 4$
Feed forward control		Switchable on the inside
Input signal	Position feedback	A, B, Z phase signal
	Command pulse	TTL line driver input, photo isolation
	Operation command	+5V -10 mA, photo isolation
	Zero positioning command	+5V -10 mA, photo isolation
	Pulse prohibition	+5V -10 mA, photo isolation
	Emergency stop	+5V -10 mA, photo isolation
	Error counter reset	+5V -10 mA, photo isolation
	Abnormal reset	+5V -10 mA, photo isolation
	Torque limit	+5V -10 mA, photo isolation
	Gain minimisation	+5V -10 mA, photo isolation
Output signal	Alarm output	Contact output 24 VDC -0.5 A
	Positioning completion output	Open collector output, max. 24V,-10 mA
	Position feedback output	A, B, Z phase (line driver) output.

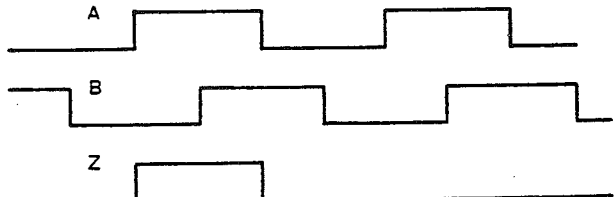
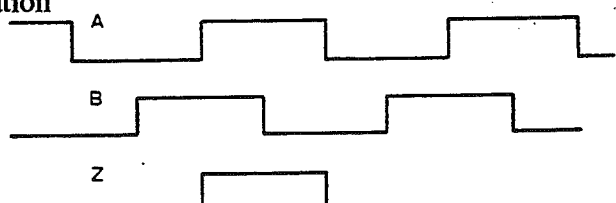
2. SPECIFICATION

□ Specifications of servo driver

Item		Unit	Standard				
Power source	Main circuit	V	220 - 360VDC				
	Control circuit	V	170 - 253VAC, 65VA, 50/60 Hz, (220 - 360VDC)				
Output	Model		R88D-RR04	R88D-RR05	R88D-RR10	R88D-RR15	R88D-RR20
	Continuous	AO-P	1.7	1.7	3.3	5.0	7
	Maximum	AO-P	5.5	5.5	10	15	20
Speed feedback			Magnetic encoder 1000 PPR (Pulse Per Revolution)				
Protection functions			Overcurrent, overload, overvoltage, and abnormal speed.				

Note : Prepare main power supply approx. 200% of used motor output capacity. For example, 1.2 kVA main power supply for 600W motor.

□ Encoder output

Item	Standard
Output pulse	A, B phase: 1,000 PPR Z phase: 1 PPR
Output phase	<p>At forward rotation</p>  <p>At reverse rotation</p>  <p>Serial transfer delay of Z phase is 5 to 21 μs.</p>
Output system	EIA-RS-422A or equivalent
Insulation resistance	5 M Ω or up
Durability of sensor	1 minute at 50 VDC between the case and the ground.

Note: Do not practise insulation test on encoders. It may damage the encoder.

2. SPECIFICATION

2-2-2 AC servo motor

□ Specification of AC servo motor (1)

Item	Unit	R88M -R10030	R88M -R20030	R88M -R30030	R88M -R45030
Output power	W	100	200	300	450
Rated torque	kgf·cm	3.25	6.49	9.74	14.6
Rated speed	rpm	3,000	3,000	3,000	3,000
Instantaneous max. speed	rpm	4,000	4,000	4,000	4,000
Instantaneous max. torque	kgf·cm	9.7 or up	24 or up	28 or up	36 or up
Rotor inertia	kgf·cm·s ²	1.89x10 ⁻⁴	5.31x10 ⁻⁴	7.70x10 ⁻⁴	1.60x10 ⁻³
Torque constant.	kgf·cm/A	2.02	4.13	3.76	3.32
Induction voltage constant	V/rps	1.25	2.54	2.32	2.04
Power rate	kW/s.	5.48	7.62	11.9	12.8
Mechanical time constant	ms	1.98	1.98	1.6	1.9
Coil resistance	Ω	4.2	6.24	2.9	1.28
Coil inductance	mH	9	18.5	11.5	14.3
Electrical time constant	ms.	2.14	2.96	3.97	11.2
Weight	kg	1.3	2.0	2.6	4.5
Ambient operating condition	°C, %RH	Temperature: 0 to +40°C, Humidity: 35 to 85 % (without dew condensation)			
Storage condition	°C, %RH	Temperature: -10 to +75°C, Humidity: 35 to 85% RH (without dew condensation)			
Operating atmosphere		Without corrosive gases			
Installation direction		Each direction			
Insulation class		Item B			
Structure		Full-close, self-cooling			
Dustproof structure		IP-52 (in the case of oil seal is applied as option, IP-54)			

Note : See Section 1-3 in Chapter 4 about oil seal.

2. SPECIFICATION

□ Specification of AC servo motor (2)

Item	Unit	R88M -R60030	R88M -R82030	R88M -R1K130
Output power	W	600	820	1100
Rated torque	kgf•cm	19.5	26.6	35.7
Rated speed	rpm	3,000	3,000	3,000
Instantaneous max. speed	rpm	4,000	4,000	4,000
Instantaneous max. torque	kgf•cm	50 or up	78 or up	88 or up
Rotor inertia	kgf•cm•s ²	2.03x10 ⁻³	2.5x10 ⁻³	3.66x10 ⁻³
Torque constant	kgf•cm/A	5.12	5.34	5.43
Induction voltage constant	V/rps	3.15	3.29	3.34
Power rate	kW/s.	18.4	27.7	34.1
Mechanical time constant	ms	1.54	1.12	0.91
Coil resistance	Ω	1.95	1.25	0.72
Coil inductance	mH	20	16.2	11.1
Electrical time constant	ms	10.3	13	15.4
Weight	kg	5.5	7.1	8.5
Ambient operating conditions	°C, %RH	Temperature: 0 to +40°C, Humidity: 35 to 85 % (without dew condensation)		
Storage condition	°C, %RH	Temperature: -10 to +75°C, Humidity: 35 to 85% RH (without dew condensation)		
Operating atmosphere	Without corrosive gases			
Installation direction	Each direction			
Insulation class	Item B			
Structure	Full-close, self-cooling			
Dust proof structure	IP-52 (in the case of applying an oil seal and a water proof connector, IP-54)			

Note 1: Servo motor model R88M-R60030 (600W) can be used with the servo driver model R88D-RR20. In this case, max. torque becomes 60 kgf·cm or over.

Note 2 : See Section 1-3 in Chapter 4 about oil seal.

2. SPECIFICATION

□ Specification of AC servo motor (3)

Item	Unit	R88M -R06030	R88M -R11030
Output power	W	60	110
Rated torque	kgf·cm	1.95	3.58
Rated speed	rpm	3,000	3,000
Instantaneous max. speed	rpm	4,000	4,000
Instantaneous max. torque	kgf·cm	6.5 or up	12 or up
Rotor inertia	kgf·cm·s ²	1.26x10 ⁻⁴	2.0x10 ⁻⁴
Torque constant	kgf·cm/A	1.22	2.54
Induction voltage constant	V/rps	0.75	1.57
Power rate	kW/s.	2.96	6.35
Mechanical time constant	ms	3.72	3.62
Coil resistance	Ω	4.3	11.5
Coil inductance	mH	8.5	25
Electrical time constant	ms	1.98	2.18
Weight	kg	0.95	1.25
Ambient operating conditions	°C, %RH	Temperature: 0 to +40°C, Humidity: 35 to 85 % (without dew condensation)	
Storage condition	°C, %RH	Temperature: -10 to +75°C, Humidity: 35 to 85% RH (without dew condensation)	
Operating atmosphere	Without corrosive gases		
Installation direction	Each direction		
Insulation class	Item B		
Structure	Full-close, self-cooling		
Dust proof structure	(available to apply oil seal)		

Note: As for oil seal, see Chapter 4, item 1-3: Installation condition.

2. SPECIFICATION

□ Specifications of built-in brake motor

Brake release voltage is 24VDC without polarity.

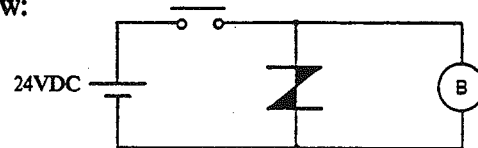
The brake releases when 24VDC is applied to the line.

The purpose for this brake is to hold axis at stop condition, not to stop the axis. Thus, release the brake with the release voltage ON while in operation of the motor.

Be careful that the brake inertia should be added to the load inertia.

• Brake circuit

In order to protect the circuit from surge noise at brake excitation OFF, be sure to insert a surge killer. To select surge killer, see the table below:



Type	Model	Mfg.	Application
Thyrister	C-5A3	ISHIZUKA ELECTRONICS CORP.	24VDC
Thyrister	V-3		24VDC
Varistor	Z15L470		24 VDC
Varistor	ERZ-C14DK470	MATSUSHITA ELECTRONICS COMPONENTS CO., LTD.	24 VDC
Spark killer	CR50500	OKAYA ELECTRIC INDUSTRIES.CO., LTD.	Compatible AC and DC

□ Specifications of built-in brake motor (1)

• Brake specification

Item	Unit	R88M -R10030-B	R88M -R20030-B	R88M -R30030-B	R88M -R45030-B
Brake inertia	kgf·cm·sec ²	7.7x10 ⁻⁵	1.0x10 ⁻⁴	1.0x10 ⁻⁴	3.0x10 ⁻⁴
Excitation voltage	V	24 VDC			
Power consumption	W	7.2	10	10	19.5
Static friction torque	kgf·cm	5 or up	10 or up	15 or up	25 or up
Braking time constant	msec	30 or less	40 or less	50 or less	50 or less
Release time constant	msec	20 or less	30 or less	30 or less	100 or less
Allowable work (1)	kgf·m/time	13	25	25	60
Allowable work (2)	kgf·m/life	1.3x10 ⁴	2.5x10 ⁴	2.5x10 ⁴	5x10 ⁴
Backlash	axis angle	0.75° or less	0.63° or less	0.63° or less	0.61° or less
Rated		Continuous rating			
Insulation class		Item F			

• Weight

Item	Unit	R88M -R10030-B	R88M -R20030-B	R88M -R30030-B	R88M -R45030-B
Weight with brake	kgf	1.8	2.7	3.4	5.8

2. SPECIFICATION

□ Specifications of built-in brake motor (2)

• Brake specification

Item	Unit	R88M -R60030-B	R88M -R82030-B	R88M -R1K130-B
Brake inertia	kgf·cm·sec ²	3.0x10 ⁻⁴	3.0x10 ⁻⁴	5.0x10 ⁻⁴
Excitation voltage	V	24 VDC		
Power consumption	W	19.5	19.5	18
Static friction torque	kgf·cm	25 or up	40 or up	55 or up
Braking time constant	msec	50 or less	50 or less	50 or less
Release time constant	msec	100 or less	100 or less	100 or less
Allowable work (1)	kgf·m/time	60	60	60
Allowable work (2)	kgf·m/life	5x10 ⁴	5x10 ⁴	5x10 ⁴
Backlash	axis angle	0.61° or less		
Rated		Continuous rating		
Insulation class		Item F		

• Weight

Item	Unit	R88M -R60030-B	R88M -R82030-B	R88M -R1K130-B
Weight with brake	kgf	6.8	8.4	10.5

□ Specifications of built-in brake motor (2)

• Brake specification

Item	Unit	R88M -R06030-B	R88M -R11030-B
Brake inertia	kgf·cm·sec ²	2.0x10 ⁻⁵	2.0x10 ⁻⁵
Excitation voltage	V	24 VDC	
Power consumption	W	6	6
Static friction torque	kgf·cm	5 or up	5 or up
Braking time constant	msec	50 or less	50 or less
Release time constant	msec	100 or less	100 or less
Allowable work (1)	kgf·m/time	16	16
Allowable work (2)	kgf·m/life	2x10 ⁴	2x10 ⁴
Backlash	axis angle	1.2° or less	
Rated		Continuous rating	
Insulation class		Item F	

• Weight

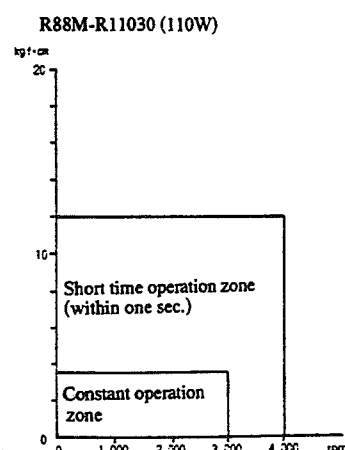
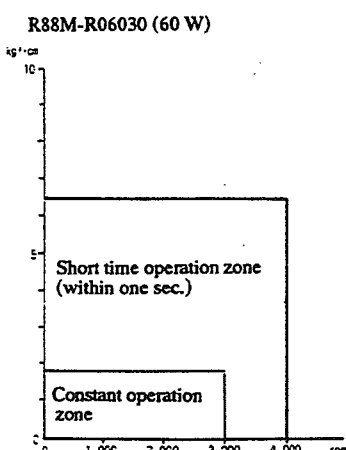
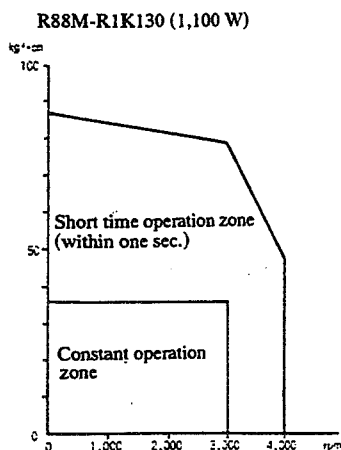
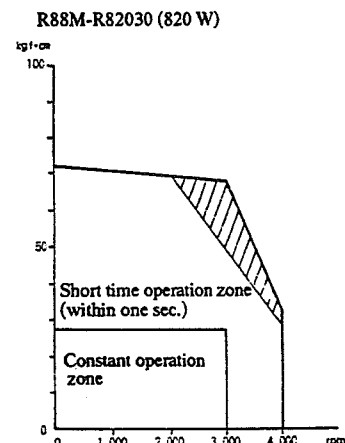
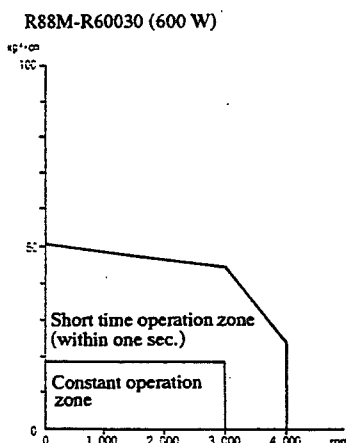
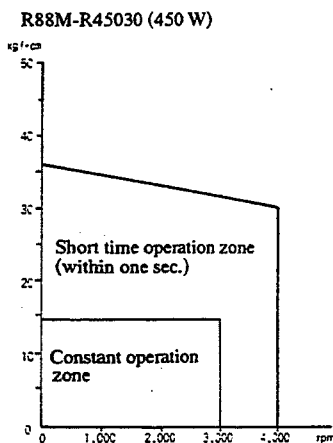
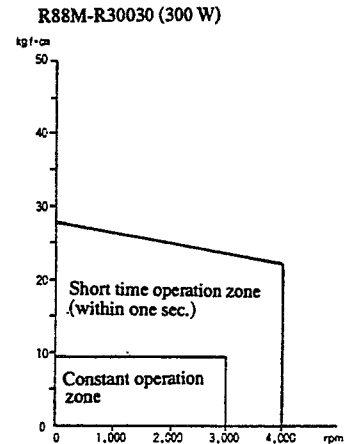
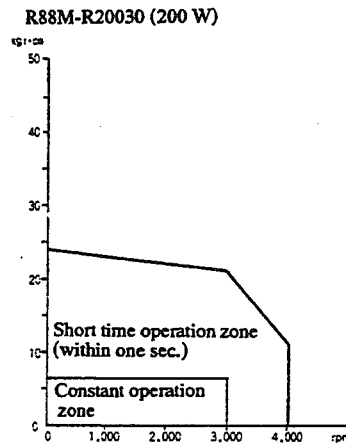
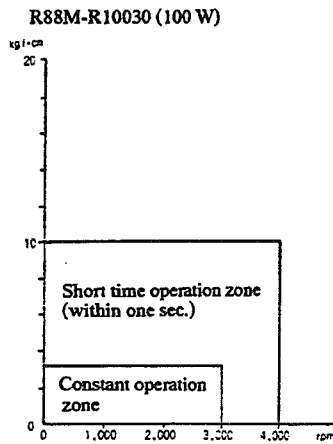
Item	Unit	R88M -R06030-B	R88M -R11030-B
Weight with brake	kgf	1.3	1.6

2. SPECIFICATION

□ Characteristic curve (tested with the standard cable 3m)

The characteristic curves below shows operation zones when 200VAC in 3-phase has been input.

Using the motor within the slanting line zone at 100 VAC is not available.



2. SPECIFICATION

□ Radiation condition of AC servo motors

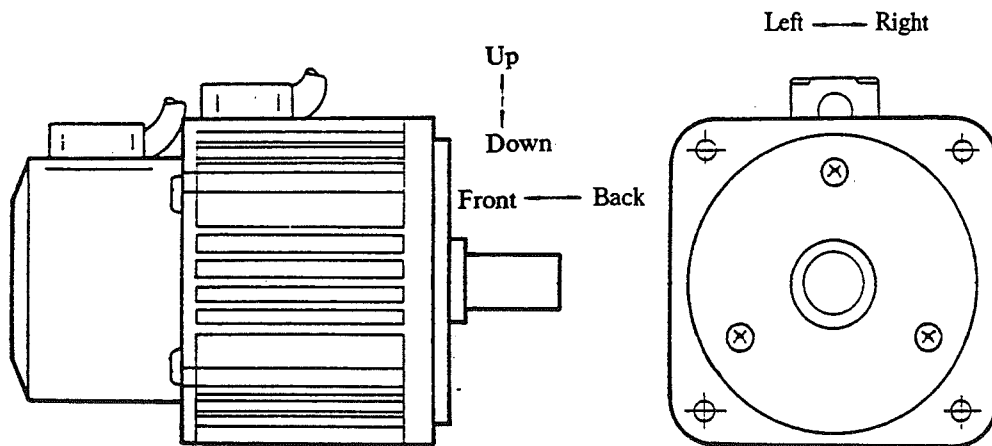
In case of continuous operation at the rated torque, the following radiation fins are necessary on the motor flange.

- R88M-R20030 Thickness: 6 mm, area: 200 mm² metal board or equivalent.
- R88M-R30030 Thickness: 6 mm, area: 250 mm² metal board or equivalent.
- R88M-R45030 Thickness: 12 mm, area: 250 mm² metal board or equivalent.
- R88M-R60030 Thickness: 12 mm, area: 250 mm² metal board or equivalent.
- R88M-R82030 Thickness: 12 mm, area: 250 mm² metal board or equivalent.
- R88M-R1K130 Thickness: 12 mm, area: 250 mm² metal board or equivalent.
- R88M-R06030 Thickness: 6 mm, area: 150 mm² metal board or equivalent.
- R88M-R11030 Thickness: 6 mm, area: 200 mm² metal board or equivalent.

Note: Above recommendation are at condition of horizontal installation without blockage obstacles around the motor.

□ Vibration proof characteristics

OMNUC R series AC servo motor allowable against 2G every directions installed in a horizontal axis positions.



□ Shockproof characteristics

OMNUC R series AC servo motor can withstand a 50G vertical shock three times when it is installed in a horizontal axis position.

Note : Do not remove the encoder cover nor disassemble the AC servo motor.

2. SPECIFICATION

• Allowable load to motor axis

Allowable radial and thrust load to motor axis are as follows:

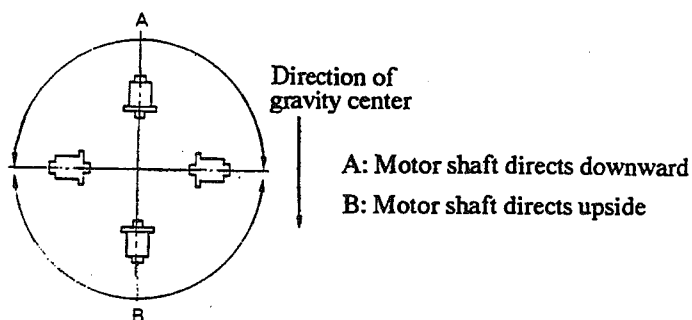
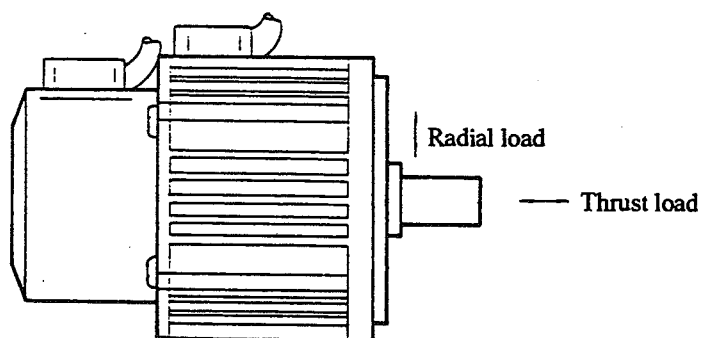
(unit : kgf)

Type	Output	Radial load	Thrust load A	Thrust load B
R88M-R10030	100 W	11.5	3	3
R88M-R20030	200 W	19	8	7.5
R88M-R30030	300 W	20	8	7.5
R88M-R45030	450 W	34	12	11
R88M-R60030	600 W	36	12	11
R88M-R82030	820 W	38	12	11
R88M-R1K130	1,100 W	45	15	13
R88M-R06030	60 W	11.5	3	3
R88M-R11030	110 W	11.5	3	3

Note 1: Above allowable radial load are values at the center of the axis (one second of shaft length).

Note 2: Thrust load value differs from load directions.

Note 3: The above load values are defined according to the target life of 30,000 hours.



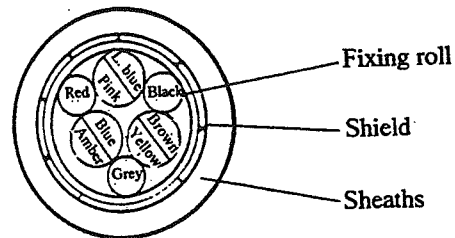
2. SPECIFICATION

□ Motor lead wire

• Signal wire (signal and power lines of encoder)

UL2589(105°C,30V) 24AWG x 3P + 22AWG x 3C or equivalent.

Sectional view

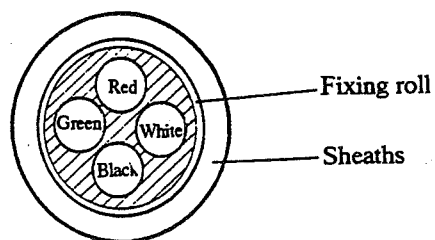


Item		Specification	
		24AWG	22AWG
Outside diameter	mm	$\varnothing 8 \pm 0.2$	
Conductor resistance	Ω/km	58.7 or less	42.5 or less
Voltage proof	V/sec.	500	
Insulation resistance	$\text{M}\Omega/\text{km}$	1.0	
Min. bending radial	mm	30	

• Armature wire (wires to supply power to stator winding of motor and to grounding.)

UL2517 (105°C,300V) 18AWG x 4C or equivalent.

Sectional view



Item		Specification
Outside diameter	mm	$\varnothing 8 \pm 0.2$
Conductor resistance	Ω/km	24.2 or less
Voltage proof	V/sec.	2,000
Insulation resistance	$\text{M}\Omega/\text{km}$	3.5
Min. bending radial	mm	40

3. MODEL DENOMINATION

□ AC servo driver

Model R88D-R R 05

Output current of nominal value.

Sign	04	05	10	15	20
Max. output current	5.5A	5.5A	10A	15A	20A

Means power unit separated pulse train input model.

Means "R" series.

Means servo driver.

□ AC servo motor

Model R88M-R 100 30 - □□□□

Special specification

Rated rotation speed is 3,000 rpm

Output

060 : 60W
100 : 100W
110 : 110W
200 : 200W
300 : 300W
450 : 450W
600 : 600W
820 : 820W
1K1 : 1100W

Means "R" series.

Means servo motor.

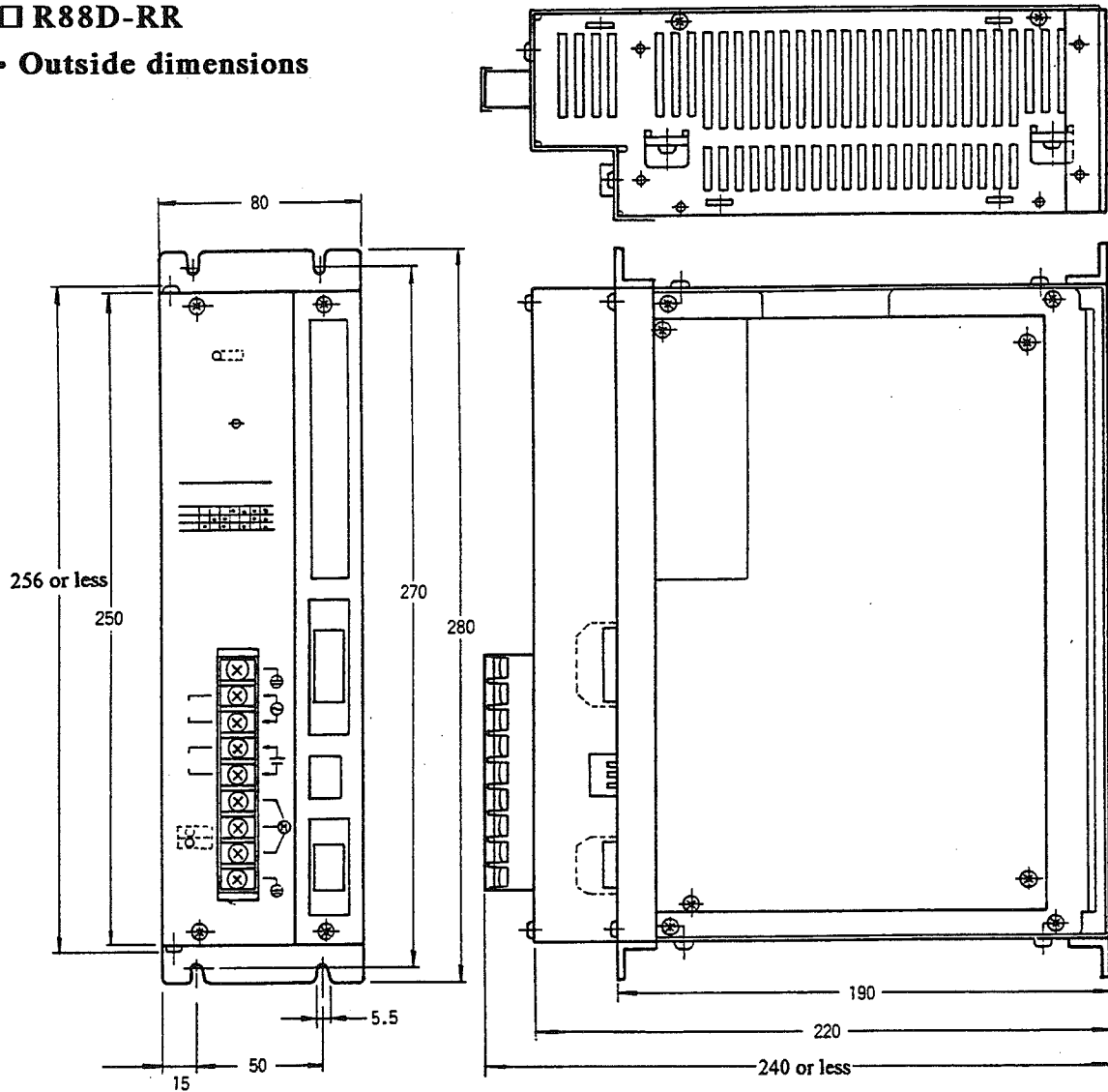
4. DESIGN

4.1 Installation and Mounting

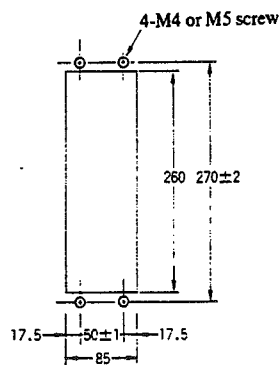
4.1.1 Outside and installation dimensions of AC servo driver

□ R88D-RR

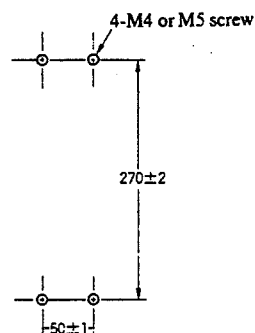
• Outside dimensions



• Panel installation dimensions



• Installation dimensions



4. DESIGN

4.1.2 Outside dimensions of AC servo motor

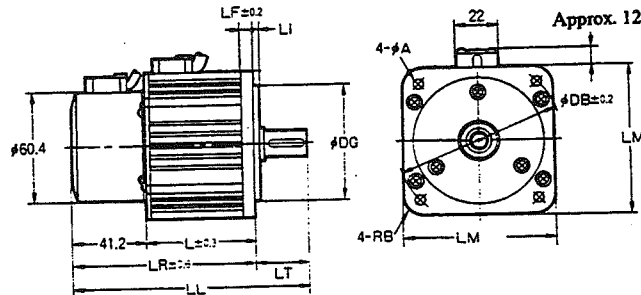
□ Standard model

- Models R88M-R10030, R88M-R20030, R88M-R30030, and R88M-R45030, (100W to 450W)

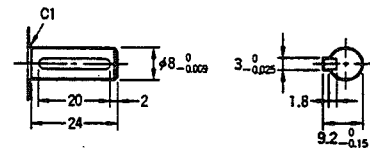
Dim. (mm) Type	LL	LR	L	LF	LI	LT	LM	DB	DG	A	B
R88M-R10030	151.7	122.7	81.5	8	3.5 ^{+0.3} _{-0.1}	29 ^{+0.5} _{-0.1}	66 ^{+0.4} _{-0.1}	80	50 ⁰ _{-0.025}	5	4
R88M-R20030	160.7	131.7	90.5	9	3.5 ^{+0.3} _{-0.1}	29 ^{+0.5} _{-0.1}	80 ^{+0.4} _{-0.1}	90	70 ⁰ _{-0.03}	6	10
R88M-R30030	182.7	153.7	112.5	9	3.5 ^{+0.3} _{-0.1}	29 ^{+0.5} _{-0.1}	80 ^{+0.4} _{-0.1}	90	70 ⁰ _{-0.03}	6	10
R88M-R45030	201.2	161.2	120.0	12	4.0 ^{+0.1} _{-0.1}	40 ^{+0.5} _{-0.1}	120 ^{+1.5} _{-0.5}	130	110 ⁰ _{-0.035}	9	15

Note: Lengths of armature wire and signal wire of standard motor are 500 mm.

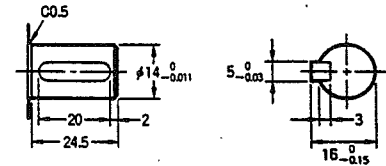
Connectors are not installed at the ends of each cable.



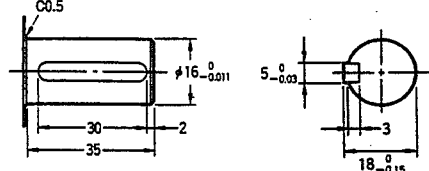
Shaft shape
R88M-R10030



R88M-R20030
R88M-R30030

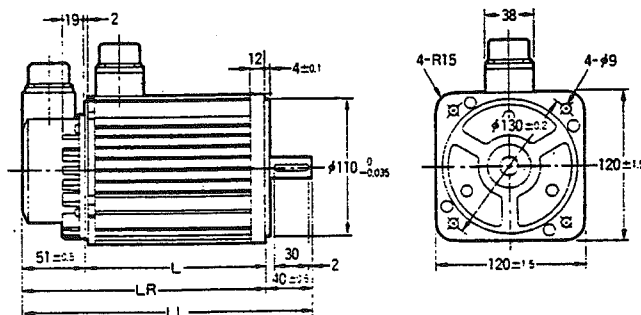


R88M-R45030

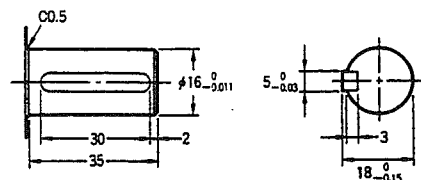


- Models R88M-R60030, R88M-R82030, R88M-R1K130, (600W to 1,100 W)

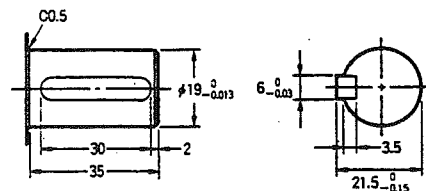
Dim. (mm) Type	LL	LR	L
R88M-R60030	242	202	151
R88M-R82030	277	237	186
R88M-R1K130	309	269	218



Shaft shape
R88M-R60030
R88M-R82030



R88M-R1K130



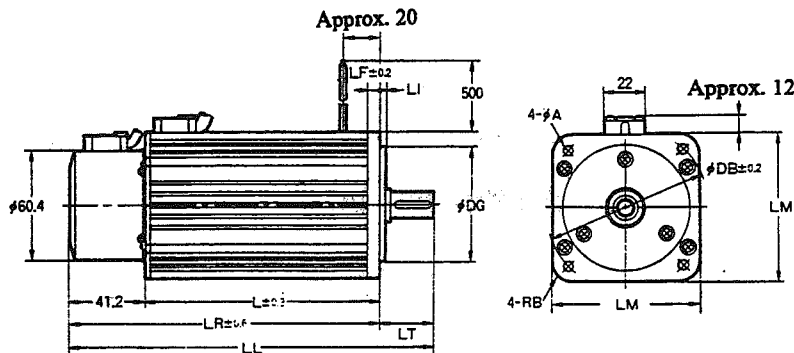
4. DESIGN

□ Built-in brake model

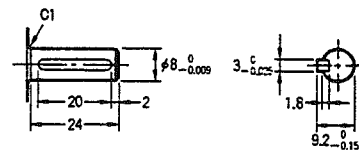
- Models R88M-R10030-B, R88M-R20030-B, R88M-R30030-B, and R88M-R45030-B (100W to 450W)

Type	Dim. (mm)	LL	LR	L	LF	LI	LT	LM	DB	DG	A	B
R88M-R10030-B		187.7	158.7	117.5	8	3.5 ^{+0.3} _{-0.3}	29 ^{+0.5} _{-0.5}	66 ^{+0.4} _{-0.4}	80	50 ⁰ _{-0.025}	5	4
R88M-R20030-B		192.7	163.7	122.5	9	3.5 ^{+0.3} _{-0.3}	29 ^{+0.5} _{-0.5}	80 ^{+0.4} _{-0.4}	90	70 ⁰ _{-0.03}	6	10
R88M-R30030-B		219.7	190.2	149.0	9	3.5 ^{+0.3} _{-0.3}	29 ^{+0.5} _{-0.5}	80 ^{+0.4} _{-0.4}	90	70 ⁰ _{-0.03}	6	10
R88M-R45030-B		227.7	187.7	146.5	12	4.0 ^{+0.1} _{-0.1}	40 ^{+0.5} _{-0.5}	120 ^{+1.5} _{-1.5}	130	110 ⁰ _{-0.035}	9	15

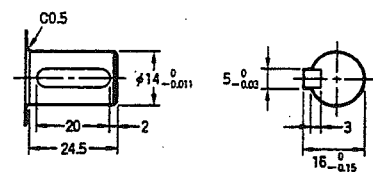
Note) Lengths of armature wire and brake wire of built-in brake AC servo motors are 500 mm.



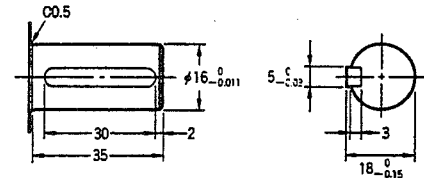
Shaft shape
R88M-R10030-B



R88M-R20030-B
R88M-R30030-B



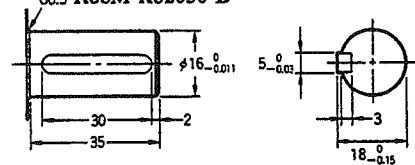
R88M-R45030-B



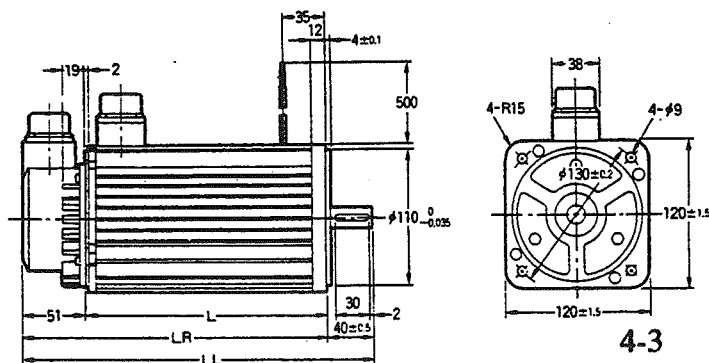
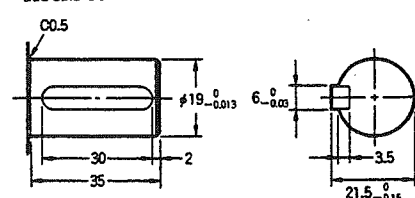
- Models R88M-R60030-B, R88M-R82030-B, R88M-R1K130-B, (600W to 1,100 W)

Type	Dim. (mm)	LL	LR	L
R88M-R60030-B		268.5	228.5	177.5
R88M-R82030-B		306.5	265.5	214.5
R88M-R1K130-B		350.5	310.5	259.5

Shaft shape
R88M-R60030-B
R88M-R82030-B



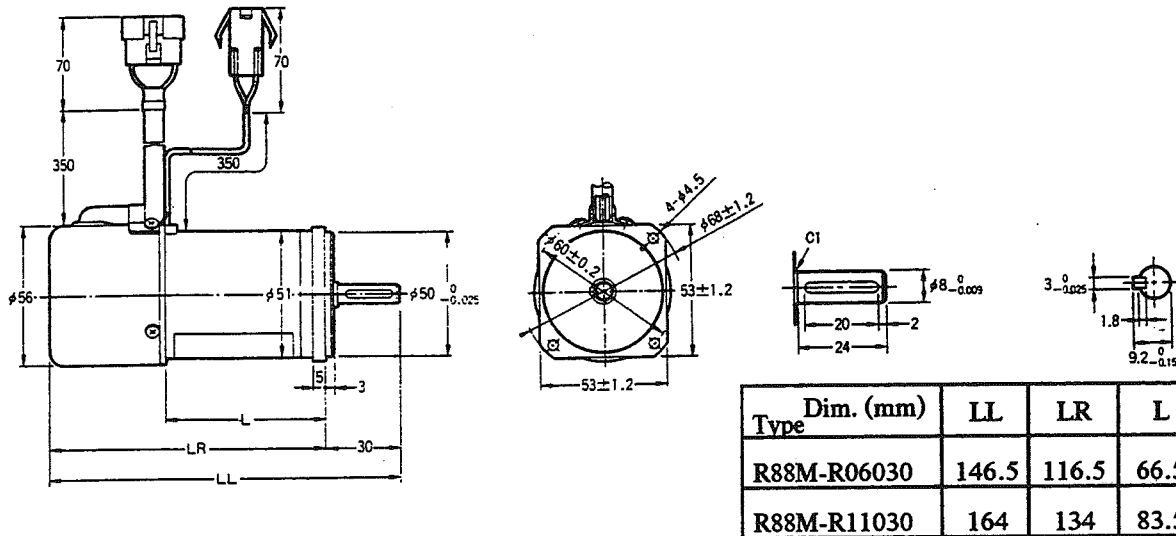
R88M-R1K130-B



4. DESIGN

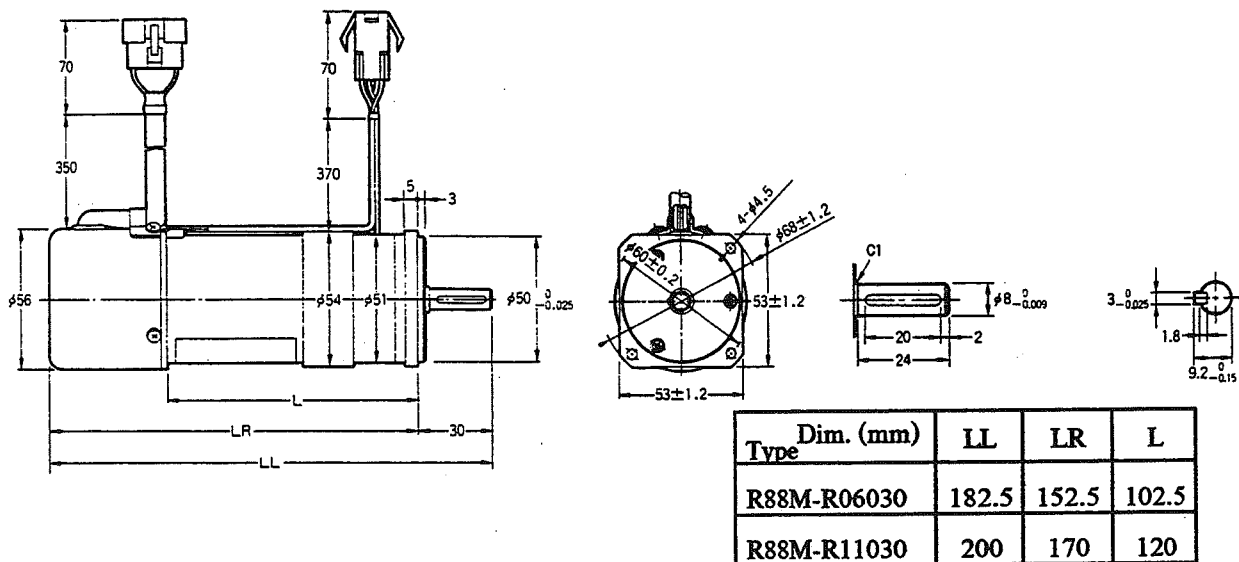
□ Standard model

- Models R88M-R06030, R88M-R11030,
(60/110W)



□ Built-in brake model

- Models R88M-R06030-B, R88M-R11030-B,
(60/110W)

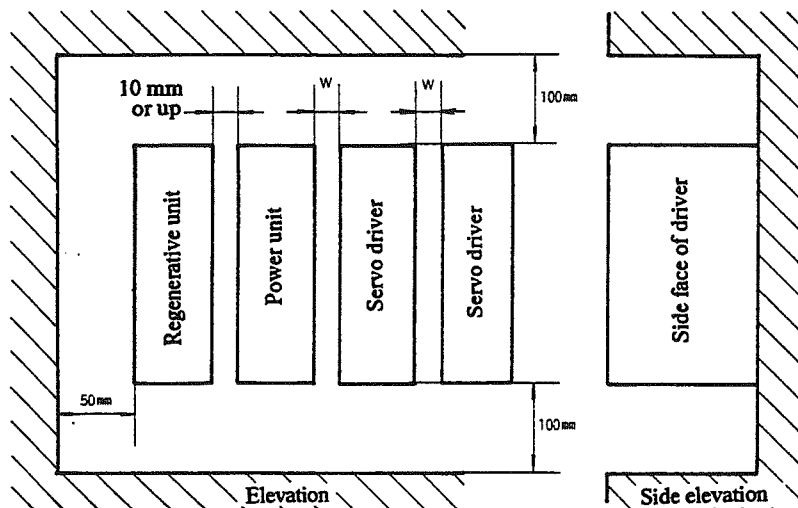


4. DESIGN

4.1.3 Installation conditions

□ AC servo driver

(1) Follow the installation diagram below while installing the unit.



Model	W
R88D-RR04/RR05/RR10	0 mm or up (closed installation available)
RRD-RR15/RR20	10 mm or up

- (2) Install the AC servo driver in a vertical direction.
- (3) The inside temperature of the unit may increase by approx. 30°C. Therefore, keep away from other equipment and wirings which are thermally affecting.
- (4) While installing the servo driver in a box, take measures such as installing forced-cooling fan or air conditioner in order not to increase environmental temperature by more than +55°C.
- (5) If noise-producing equipment such as an electro-magnetic contactor, a relay, or a solenoid is placed near the AC servo driver, take measures to protect the unit from these noise.
- (6) Operating environmental conditions
 - Operating environmental temperature : 0 to 55°C
 - Operating environmental humidity : 35 to 85% RH (without dew condensation)
 - Storage environmental temperature : -10 to +75°C
 - Storage environmental humidity : 35 to 85% RH (without dew condensation)
- (7) Be careful to install the AC servo driver in the environment without increasing temperature.
- (8) Be careful not to let metal powder, oil mist, nor water enter the unit.
- (9) Be careful not to let metal powder enter the unit, while installing.

□ AC servo motor

- (1) Do not give any excessive shock to the servo motor while transportation, installation, and removing.

Also, do not hold the encoder section, cable section, and connector sections for loading and unloading the AC servo motor.

- (2) When installing a coupling on the motor shaft, do not give shock to the shaft by a hammer. This shock may damage plated part of the shaft and result in problems with the encoder. To remove couplings, be sure to use a special tool, such as pulley remover.

- (3) Operating environmental conditions

Operating environmental temperature : 0 to 40°C

Operating environmental humidity : 35 to 85% RH (without dew condensation)

Storage environmental temperature : -10 to +75°C

Storage environmental humidity : 35 to 85% RH (without dew condensation)

- (4) Do not cover the servo motor with any materials as the motor temperature rise and a sensor inside the encoder detect "encoder error" (REE).

When this error occurs, decrease load torque and cool the servo motor using a forced cooling fan.

Be sure not to exceed the motor center part temperature by more than 45°C with the rated operation cycle (see Chapter 2: Radiation of AC servo motor).

Do not use the servo motor where much dust, corrosive gas, flammable gas are evident, outside, in vacuum condition, place higher than 1,000 m.

- (5) Conjunction with mechanism

- Be sure to use a flexible coupling to connect the motor shaft and mechanical parts such as ball screws. Plan and process mechanism to keep both shaft center precisely match in the same line. When the motor shaft is connected with high rigidity parts, slight difference of shaft center may give excessive radial load to the motor shaft and damage the motor shaft or the ball bearing.

In case of straight shaft, use "clamp type coupling" Oldam Coupling made by Myty Co., Ltd., "ETP bush" made by Miki Pulley Co., Ltd., Shupan Ring made by Shoda Shoji Co., Ltd.

- Deviation, pitch difference, gear shape differences etc. should be as small as possible to adjust backlash amount to proper level. Make a mechanism to adjust backlash amount. When bevel gear is used, it may give thrust load to the motor shaft. Check this thrust load together with backlash amount.

4. DESIGN

- When a timing belt is used, the motor shaft receives excessive radial load due to tension strength of the timing belt, temperature variation, and aging. This will cause damage to the motor shaft and the ball bearing.

Use the timing belt below the value shown in Chapter 2, Specification, “allowable load of AC servo motor output.”

Install the pulley so that it makes the timing belt straight. When the difference arises, a great thrust load may occur. Prior to using the timing belt, see the instruction manual provided by the timing belt manufacturer for proper use.

In some cases, use of the timing belt makes vibration of mechanical part and damage of the shaft due to mechanical resonance point of the belt length and tension.

(6) Water-proof

As the servo motor is not provide water-proof feature, cutting oil, especially coolant oil, may enter and cause malfunction due to insulation error and short circuit. Thus, prepare measures so as not to drop cutting oil on the servo motor body. Cables of the servo motor are another case of oil entry. Direct the lead wire downward and slacken. When intrusion of oil through the shaft is possible, fix the optional oil seal.

(7) Oil seal

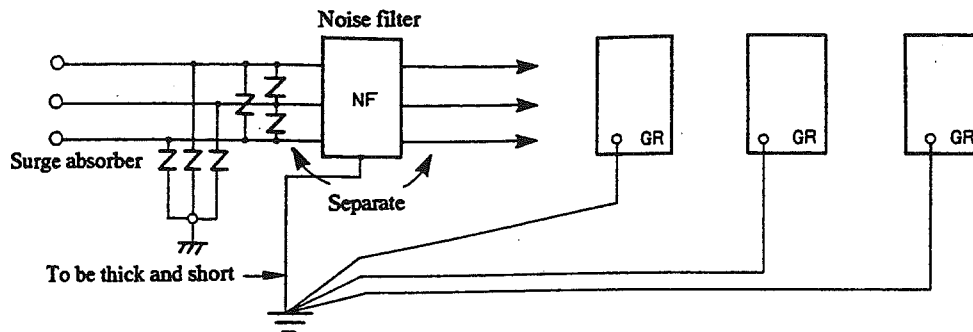
Our servo motors are designed to connect mechanism by coupling as a whole so that oil seal is not installed. The following oil seals are available installation. Replace interval of oil seals are approx. 5,000 hours with lubrication.

Model of servo motor	Model no. of oil seal	Mfg.
R88M-R10030	OS10173	IKO Tomson
R88M-R20030/R30030	OS15223	
R88M-R45030/R60030	AC0760AO	NOK
R88M-R82030		
R88M-R1K130	AC1013AO	
R88M-R06030/R11030	OS10173	IKO Tomson

- (8) OMNIC AC servo motors are synchronous type motors using permanent magnets. They do not rotate even impressed commercial 3-phase power. But it will immediate burn out motor coil.
- (9) Though the motor is painted corrosive-preventing oil, put oil or grease on the shaft after installing a coupling.

4.1.4 Wiring

Noiseproof characteristics of the total system are influenced by how it is wired.



- Apply one-point earthing. Do not insert earthing line into the some ducts of filter output lines, motor power lines, and signal lines.
- In case of wiring in metal conduits and ducts, connect metal body with one point earthing as on the figure above.
- Insert surge absorber and noise filter on the AC lines.

□ Terminal block for power and motor

Terminal block	Contents	Cable diameter	
		R88D-RR04/RR05/RR10	R88D-RR15/RR20
AC	Input for control power	0.75 mm ²	0.75 mm ²
DC (P, N)	Input for main circuit power	1.25 mm ²	1.25 mm ²
A, B, C	Output terminal for motor	0.75 mm ²	1.25 mm ²
GR	Earthing terminal	2 mm ²	2 mm ²

Note : Above values are examples using HIV thermal proof vinyl wire (75°C) at an ambient temperature of 55°C.

□ Connector terminal for control

Use MR series connectors by HONDA TSUSHIN for each connector. Plugs and cases for connectors are supplied together with the unit.

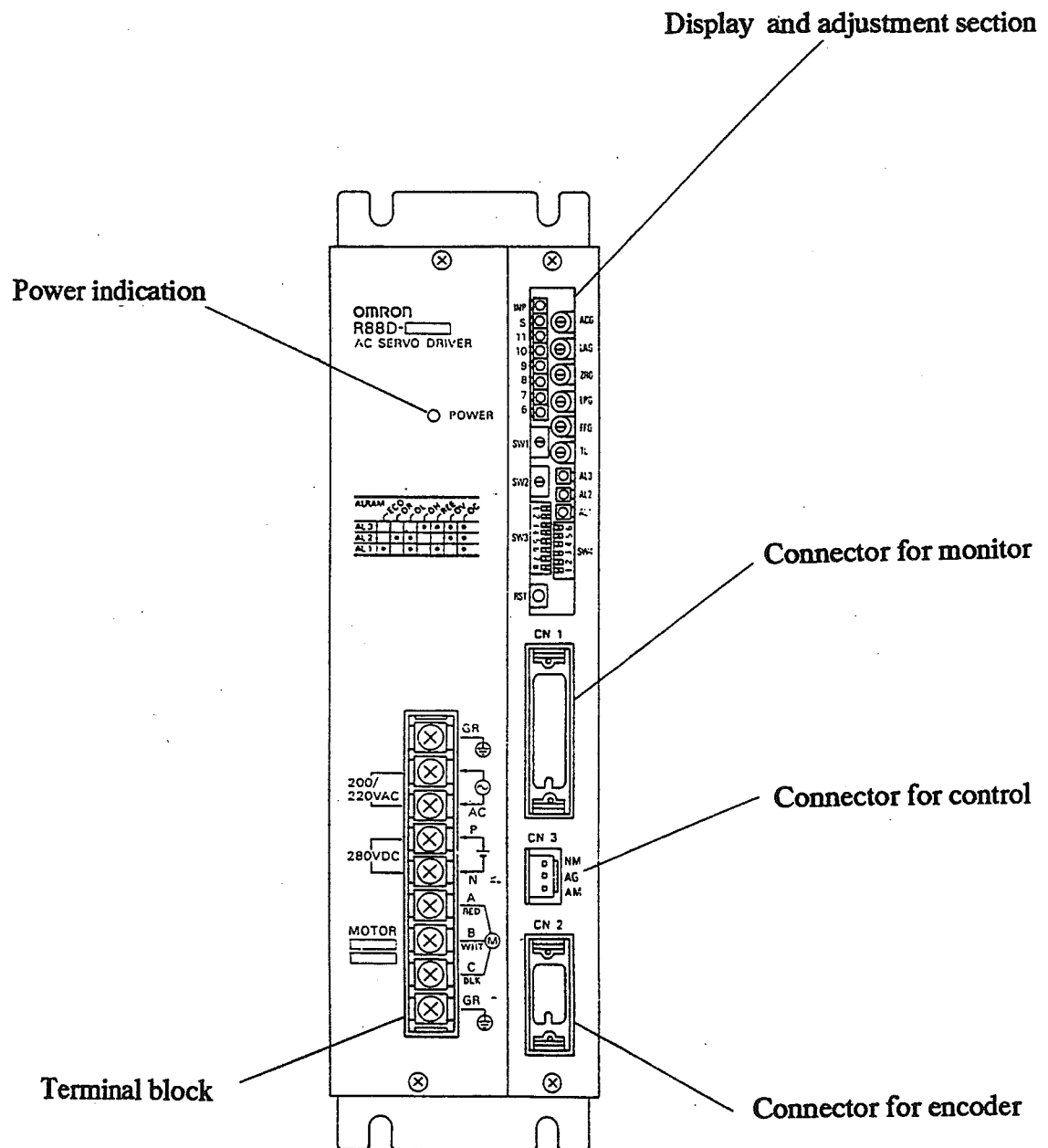
Use shielded twisted-pair cable for control line connector.

Shield wire should be connected to the designated terminal.

4. DESIGN

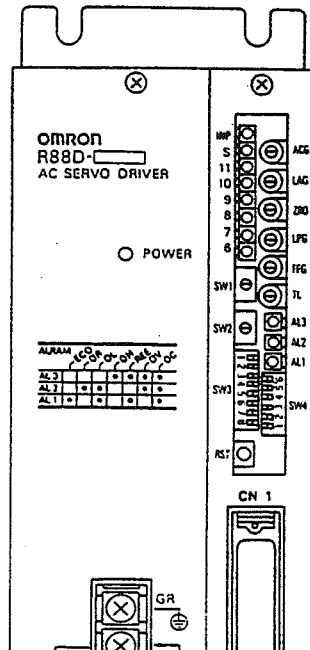
4.2 Details of Each Section

4.2.1 Front panel



4.2.2 Display, adjustment, and setting sections

□ Display section

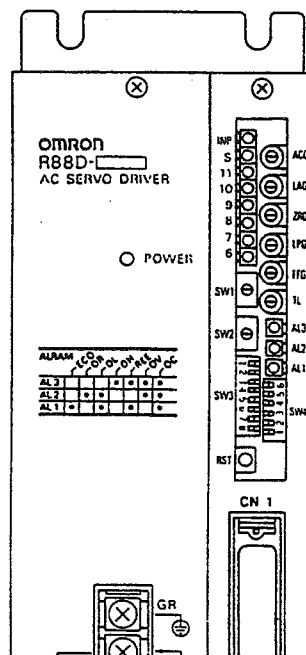


Indication			Function	Lighting condition
POWER			Control power indication	Control power (200 VAC) is input.
INP			Indicate completion of positioning	By positioning command, the motor is within position completion range. This LED lights, in case of RUN command (CN1) is input.
S			Indicate sign of error counter.	Light at forward, light OFF at reverse.
11 - 6			Value of error counter	2 ¹¹ pulse to 2 ⁶ pulse (SW3-6 OFF) 2 ⁵ pulse to 2 ⁰ pulse (SW3-6 ON)
AL			Alarm display	
3	2	1		
●	●	●	OC Overcurrent	Motor current value exceeds the current limit value.
●	●	○	OV Overvoltage	Abnormal increase of main circuit DC voltage.
●	○	●	REE Encoder error	Encoder trouble. Disconnection of signal lines.
●	○	○	OH Temperature rise	Temperature of the driver radiation panel temperature abnormally rise.
○	●	●	OL Overload	Load to motor is too heavy.
○	●	○	OR Overspeed	Motor speed exceeds the limit (4,000 rpm).
○	○	●	ECO Error counter over	The error counter exceeds setting value.
○	○	○	EM Emergency stop input (Blinking)	Emergency stop input signal (EM) switched to OFF (open).

● means light ON. ○ means light OFF. ○ means light OFF.

4. DESIGN

□ Adjustment section



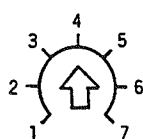
Indication	Volume	Function	Set value at factory
ACG	AC gain	Volume to adjust response characteristics. Adjust in compliance with load inertia.	"1"
LAG	Start correction	Volume to adjust overshoot and undershoot at start and stop.	"7"
ZRO	Zero balance	Volume to turn the error counter to 0 at stop position command pulse.	Already fixed.
LPG	Loop gain	Volume to adjust position loop gain in accordance with mechanical system.	Fixed that the error counter becomes max. value with maix. command frequency
FFG	FF gain	Volume to improve acceleration/ deceleration characteristics.	"4" Approx. 30 %
TL	Torque limit	Volume to adjust current limit value for torque limit input.	"4" Approx. 150 % of the rated torque.

Note 1: As for details of each adjustment, set item 5-3 "Adjustment."

Note 2: ACG, LAG, and FFG are set so as not to vibrate at no load condition.

Note 3: Adjustment to optimum in compliance with load condition is required together with AG gain changeover (SW4-3, 4).

Note 4: Scale of adjustment volume dials are shown below.



Setting of variable resistance and notch number.

4. DESIGN

Switch No	Function	Preset value at factory																																				
SW2	<p>• Position completion range setting switch. The unit outputs completion signal when the error counter is less than this fixed value.</p> <table><tr><th>Fixed value</th><th>Completion value (pulse)</th><th>Fixed value</th><th>Completion value (pulse)</th></tr><tr><td>0</td><td>± 1</td><td>8</td><td>± 17</td></tr><tr><td>1</td><td>± 3</td><td>9</td><td>± 19</td></tr><tr><td>2</td><td>± 5</td><td>A</td><td>± 21</td></tr><tr><td>3</td><td>± 7</td><td>B</td><td>± 23</td></tr><tr><td>4</td><td>± 9</td><td>C</td><td>± 25</td></tr><tr><td>5</td><td>± 11</td><td>D</td><td>± 27</td></tr><tr><td>6</td><td>± 13</td><td>E</td><td>± 29</td></tr><tr><td>7</td><td>± 15</td><td>F</td><td>± 31</td></tr></table> <p>Too small completion range takes much time to output completion signal. Fix the range in accordance with feed speed of the system, load condition, or mechanical precision. Too small completion range may not give completion signal. <Note> "E" and "F" are also used as input signal display mode changeover. See description of SW3, No.8.</p>	Fixed value	Completion value (pulse)	Fixed value	Completion value (pulse)	0	± 1	8	± 17	1	± 3	9	± 19	2	± 5	A	± 21	3	± 7	B	± 23	4	± 9	C	± 25	5	± 11	D	± 27	6	± 13	E	± 29	7	± 15	F	± 31	"1"(± 3)
Fixed value	Completion value (pulse)	Fixed value	Completion value (pulse)																																			
0	± 1	8	± 17																																			
1	± 3	9	± 19																																			
2	± 5	A	± 21																																			
3	± 7	B	± 23																																			
4	± 9	C	± 25																																			
5	± 11	D	± 27																																			
6	± 13	E	± 29																																			
7	± 15	F	± 31																																			
SW3	<p>No.1 No.2</p> <p>• Multiplication value setting of encoder feedback pulse. This switch sets multiplication value of position feed back pulse from the encoder.</p> <table><tr><th>No.1</th><th>No.2</th><th>Multiplication value</th></tr><tr><td>ON</td><td>OFF</td><td>$\times 1$</td></tr><tr><td>OFF</td><td>ON</td><td>$\times 2$</td></tr><tr><td>ON</td><td>ON</td><td>$\times 4$</td></tr></table> <p><Note> Never turn both No.1, No.2 OFF as it will prohibit input of command pulse.</p>	No.1	No.2	Multiplication value	ON	OFF	$\times 1$	OFF	ON	$\times 2$	ON	ON	$\times 4$	No.1 "ON" No.2 "ON" (Multiplied by 4)																								
No.1	No.2	Multiplication value																																				
ON	OFF	$\times 1$																																				
OFF	ON	$\times 2$																																				
ON	ON	$\times 4$																																				
No.3 No.4	<p>• Changeover of bit number in the error counter. This switch changes number of bit of the error counter.</p> <table><tr><th>No.3</th><th>No.4</th><th>No. of bit at deflection</th></tr><tr><td>OFF</td><td>OFF</td><td>12 bit (4,096)</td></tr><tr><td>ON</td><td>OFF</td><td>11 bit (2,048)</td></tr><tr><td>OFF</td><td>ON</td><td>10 bit (1,024)</td></tr><tr><td>ON</td><td>ON</td><td>9 bit (512)</td></tr></table> <p>Set in accordance with command pulse frequency. In general, refer to the formula below: Position loop gain $K_p = \frac{\text{Command pulse frequency}}{\text{Value of error counter}}$ In case of normal load : $K_p < 30$ In case of lighten load and high response : $K_p < 50$ Ex.: Command pulse frequency : 50 kpps When stored amount of the error counter bit number is 11 bit $K_P = \frac{50000}{2048} \approx 24$ This equality is conditioned. Then, fix to 11 bit.</p>	No.3	No.4	No. of bit at deflection	OFF	OFF	12 bit (4,096)	ON	OFF	11 bit (2,048)	OFF	ON	10 bit (1,024)	ON	ON	9 bit (512)	No. 3 "OFF" No. 4 "OFF" (12 bit)																					
No.3	No.4	No. of bit at deflection																																				
OFF	OFF	12 bit (4,096)																																				
ON	OFF	11 bit (2,048)																																				
OFF	ON	10 bit (1,024)																																				
ON	ON	9 bit (512)																																				

Switch No		Function	Preset value at factory																										
SW3	No.5 No.6	<div>• Command pulse input mode changeover</div> <div>This is a switch to select input 'mode of command pulse.</div> <table><thead><tr><th>No.5</th><th>No.6</th><th>No.7</th><th>Multi- plication</th><th>Input signal mode (CNI) Forward : Reverse</th></tr></thead><tbody><tr><td>OFF</td><td>OFF</td><td>ON or OFF</td><td>× 1</td><td><div><div>CW</div><div>CCW</div></div></td></tr><tr><td>OFF</td><td>ON</td><td>ON or OFF</td><td>× 1</td><td><div><div>CW</div><div>CCW</div></div></td></tr><tr><td rowspan="3">ON</td><td>ON</td><td>ON</td><td>× 4</td><td rowspan="3"><div><div>CW (A axis)</div><div>CCW (B axis)</div></div></td></tr><tr><td>OFF</td><td>ON</td><td>× 2</td></tr><tr><td>ON</td><td>OFF</td><td>× 1</td></tr></tbody></table> <div><Note> Do not turn No. 5, No. 6, and No. 7 switches as ON/OFF/OFF. These settings prohibit position command pulse.</div>	No.5	No.6	No.7	Multi- plication	Input signal mode (CNI) Forward : Reverse	OFF	OFF	ON or OFF	× 1	<div><div>CW</div><div>CCW</div></div>	OFF	ON	ON or OFF	× 1	<div><div>CW</div><div>CCW</div></div>	ON	ON	ON	× 4	<div><div>CW (A axis)</div><div>CCW (B axis)</div></div>	OFF	ON	× 2	ON	OFF	× 1	<div>No. 5 "OFF"</div> <div>No. 6 "OFF"</div> <div>No. 7 "OFF"</div>
	No.5	No.6	No.7	Multi- plication	Input signal mode (CNI) Forward : Reverse																								
OFF	OFF	ON or OFF	× 1	<div><div>CW</div><div>CCW</div></div>																									
OFF	ON	ON or OFF	× 1	<div><div>CW</div><div>CCW</div></div>																									
ON	ON	ON	× 4	<div><div>CW (A axis)</div><div>CCW (B axis)</div></div>																									
	OFF	ON	× 2																										
	ON	OFF	× 1																										
No.8	<div>• Display changeover</div> <div>This switch is to change display mode of LED 11 to 6.</div> <div>Set SW2 as "E" and "F" makes display input condition of CN1 and CN2 signals</div> <table><thead><tr><th>SW3 No.8</th><th>SW2</th><th>LED display</th></tr></thead><tbody><tr><td>OFF</td><td rowspan="2">0 - D</td><td>Display upper 11 to 6 bit of the error counter</td></tr><tr><td>ON</td><td>Display lower 5 to 0 bit of the error counter.</td></tr><tr><td>ON</td><td>E</td><td>8: Display encoder A phase. 7: Display encoder B phase. 6: Display encodr Z phase.</td></tr><tr><td>ON</td><td>F</td><td>11 (CW): Display reverse command pulse input. 10 (CCW): Display forward command pulse input 9.: Normally light ON. 8 (IPG): Display command pulse prohibition input. 7 (H.RET): Display zero positioning command input. 6 (RESET) : Display the error counter reset input.</td></tr></tbody></table> <div><Note> When SW4 No. 8 is "ON" and SW2 is "E" and "F," positioning completion range becomes ±7 pulse.</div>	SW3 No.8	SW2	LED display	OFF	0 - D	Display upper 11 to 6 bit of the error counter	ON	Display lower 5 to 0 bit of the error counter.	ON	E	8: Display encoder A phase. 7: Display encoder B phase. 6: Display encodr Z phase.	ON	F	11 (CW): Display reverse command pulse input. 10 (CCW): Display forward command pulse input 9.: Normally light ON. 8 (IPG): Display command pulse prohibition input. 7 (H.RET): Display zero positioning command input. 6 (RESET) : Display the error counter reset input.	<div>No.8 "OFF"</div>													
SW3 No.8	SW2	LED display																											
OFF	0 - D	Display upper 11 to 6 bit of the error counter																											
ON		Display lower 5 to 0 bit of the error counter.																											
ON	E	8: Display encoder A phase. 7: Display encoder B phase. 6: Display encodr Z phase.																											
ON	F	11 (CW): Display reverse command pulse input. 10 (CCW): Display forward command pulse input 9.: Normally light ON. 8 (IPG): Display command pulse prohibition input. 7 (H.RET): Display zero positioning command input. 6 (RESET) : Display the error counter reset input.																											

4. DESIGN

Switch No		Function	Preset value at factory														
SW4	No.1	• Switch to select dynamic brake operation. The brake does not function at turning ON this switch.	“ON”														
	NO.2	• High range filter frequency changeover Turn ON this switch when the machine does not stop vibration and abnormal sound even if AC gain is adjusted.	“OFF”														
	No.3 No.4	• AC gain changeover This is a changeover switch to adjust response characteristics. Adjust it as per the table below in compliance with load inertia. <table border="1"><thead><tr><th>Load inertia</th><th>No.3</th><th>No.4</th></tr></thead><tbody><tr><td>0 to 3 times of motor inertia</td><td>OFF</td><td>OFF</td></tr><tr><td>2 to 5 times of motor inertia</td><td>ON</td><td>OFF</td></tr><tr><td>4 to 7 times of motor inertia</td><td>OFF</td><td>ON</td></tr><tr><td>6 to 10 times of motor inertia</td><td>ON</td><td>ON</td></tr></tbody></table>	Load inertia	No.3	No.4	0 to 3 times of motor inertia	OFF	OFF	2 to 5 times of motor inertia	ON	OFF	4 to 7 times of motor inertia	OFF	ON	6 to 10 times of motor inertia	ON	ON
Load inertia	No.3	No.4															
0 to 3 times of motor inertia	OFF	OFF															
2 to 5 times of motor inertia	ON	OFF															
4 to 7 times of motor inertia	OFF	ON															
6 to 10 times of motor inertia	ON	ON															
	No.5 No.6	• FF (feed forward) amount changeover These switches are used to make high speed positioning by FF control. <table border="1"><thead><tr><th>No.6</th><th>No.5</th><th>FF value</th></tr></thead><tbody><tr><td>OFF</td><td>ON or OFF</td><td>0 %</td></tr><tr><td>ON</td><td>OFF</td><td>10 to 50 %</td></tr><tr><td>ON</td><td>ON</td><td>10 to 90 %</td></tr></tbody></table> ◁Note> Normally, the system should be used with FF amount 10 to 30%. To adjust FF amount, use “FFG” volume.	No.6	No.5	FF value	OFF	ON or OFF	0 %	ON	OFF	10 to 50 %	ON	ON	10 to 90 %	No.5 “OFF” No.6 “OFF”		
No.6	No.5	FF value															
OFF	ON or OFF	0 %															
ON	OFF	10 to 50 %															
ON	ON	10 to 90 %															
RST		Switch to release abnormal condition of the servo driver.															

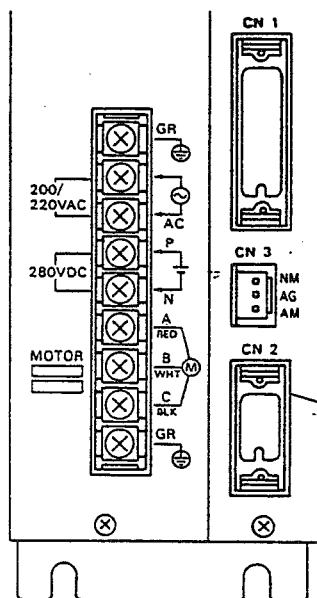
□ Terminal blocks for power source and motor

Sign	Name	Contents
GR	Ground	Case ground of the servo driver. Connect ground (earth) item 3 or up to improve noise-proof characteristics and secure safety.
200/220VAC	Power for control	Input terminal for control power.
280 VDC P N	Main circuit power	Input terminal for main circuit DC power. Supply DC voltage from a power unit.
MOTOR ABC	Connecting terminal for motor	Terminals to connect motor lines. Be sure not to misconnect any line. A: red B: white C: black
GR		Connect GR of the motor. GR: green

□ Connector for motor signal

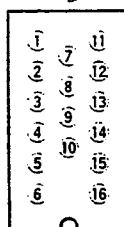
- Connector for motor signal (CN2)

Connector CN2 has terminals to input encoder and pole sensor signals.



Connector for driver			Cable for motor		
No	Sign	Function	No	Cable dia.	Cable color
1	+5V	Encoder supply power +5VDC	H	AWG22	Red
2	+5V				
3	0V	GND terminal of encoder power	G	AWG22	Black
4	0V				
5	RG	Encoder return ground	A	AWG22	Gray
6	SG	Shield ground		Shield	
7	-	Note 1			
8	-	Note 1			
9	-	NC			
10	-	NC			
11	A+	Encoder A phase +	D	AWG24	Blue
12	A-	Encoder A phase -	N	AWG24	Orange
13	B+	Encoder B phase +	M	AWG24	Pink
14	B-	Encoder B phase -	B	AWG24	Light blue
15	S+	Encoder S phase +	L	AWG24	Yellow
16	S-	Encoder S phase -	C	AWG24	Brown

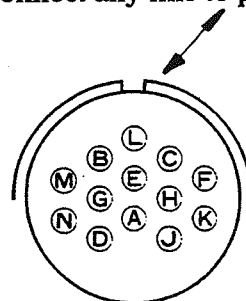
Note 1: Do not connect any line to pin No.7 and 8.



made by HONDA TSUSHIN
KOGYŌ CO., LTD.

MR-16M (cable side)

MR-16L (cover)



made by AMPHENOL

MS3106A20-11S (cable side)

MS3057A-12A (clamp)

□ Connector for monitor CN3

- Monitor terminal for motor rotation speed and current value.

JAPAN SOLDERLESS TERMINAL CO.,LTD.

VHR-3N (connector case)

LVH-21T (contact)

Sign	Function
NM	Speed monitor output
AG	Analog ground
AM	Current monitor output

4. DESIGN

4.2.4 Connector of motor

□ Connector for 600 - 1,100W motors

Connector for motor signal

Made by AMPHENOL

MS3106A20-11S

(Cable side)

MS3057A-12A

(Cable clamp)

Connector for armature

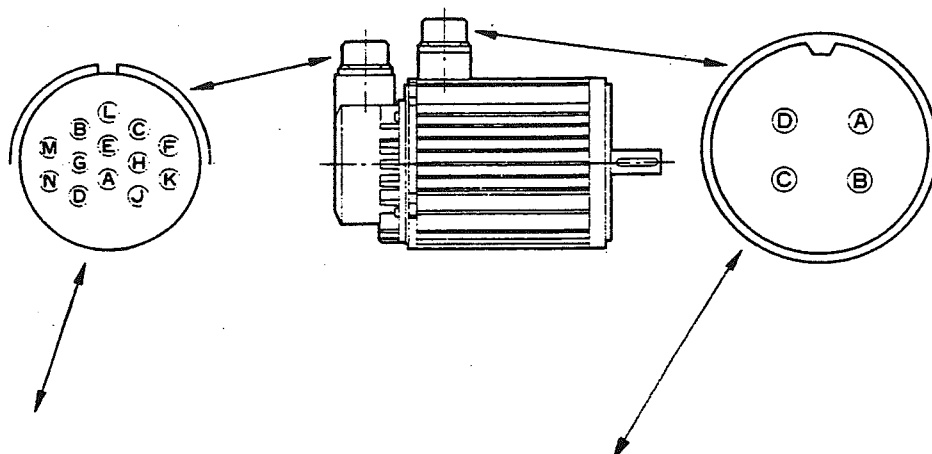
Made by AMPHENOL

MS3106A20-4S

(Cable side)

MS3057A-12A

(Cable clamp)



Connector No.	Sign	Function	Cable	
			Cable size	Cable color
A	RG	Encoder return ground	AWG22	Gray
B	B-	Encoder B phase -	AWG24	Light blue
C	S-	Encoder S phase -	AWG24	Brown
D	A+	Encoder A phase +	AWG24	Blue
E				
F				
G	0V	Terminal GND of encoder power	AWG22	Black
H	+5V	Encoder supply power +5VDC	AWG22	Red
J				
K				
L	S+	Encoder S phase +	AWG24	Yellow
M	B+	Encoder B phase +	AWG24	Pink
N	A-	Encoder A phase -	AWG24	Orange

Connector No.	Sign	Function	Cable	
			Cable size	Cable color
A	A	Armature A phase input	AWG16 or up	Red
B	B	Armature B phase input	AWG16 or up	White
C	C	Armature C phase input	AWG16 or up	Black
D	GR	Motor frame ground	AWG16 or up	Green

4. DESIGN

□ Motor connector for 60W, 110W

Connector for motor signal

Made by JAPAN SOLDERLESS

TERMINAL MFG. CO., LTD

SMP-10V-NC

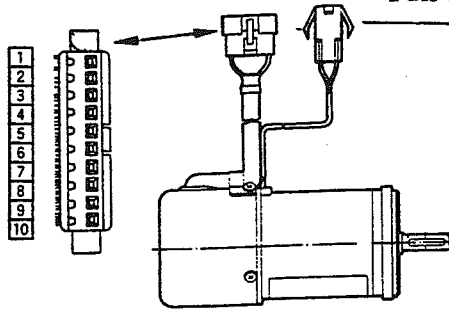
(Extension cable side: plug housing)

BHG-001GI-0.8BS (Contact socket)

Clamping tool: YC-12

Pull out tool: SMJ-06

Pin No.	Cable color	Signal	Cable type
1	Red	+5V	AWG22
2	Black	0V	
3	Gray	RG	
4	Green	SG	
5	Blue	A+	AWG24
6	Orange	A-	
7	Pink	B+	
8	L. blue	B-	
9	Yellow	S+	
10	Brown	S-	



Connector for amateur

Made by JAPAN SOLDERLESS

TERMINAL MFG. CO., LTD

MLP-04

(Extension cable side: plug housing)

LLF-41T-1.3 (Contact socket)

Clamping tool: YC-7A

Pull out tool: LEJ-13

Pin No.	Cable color	Signal	Cable type
1	Red	A phase	AWG18 or up
2	White	B phase	
3	Black	C phase	
4	Green	GR	

□ Connector for 60W, 110W motors with brake

Connector for motor signal

Made by JAPAN SOLDERLESS

TERMINAL MFG. CO., LTD

SMP-10V-NC

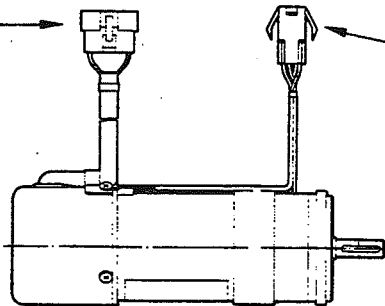
(Extension cable side: plug housing)

BHF-001GI-0.8BS (Contact socket)

Clamping tool: YC12

Pull out tool: SMJ-06

Pin No.	Cable color	Signal	Cable type
1	Red	+5V	AWG22
2	Black	0V	
3	Gray	RG	
4	Green	SG	
5	Blue	A+	AWG24
6	Orange	A-	
7	Pink	B+	
8	L. blue	B-	
9	Yellow	S+	
10	Brown	S-	



Connector for amateur

Made by JAPAN SOLDERLESS

TERMINAL MFG. CO., LTD

MLP-06

(Extension cable side: plug housing)

LLF-41T-1.3 (Contact socket)

Clamping tool: YC-7A

Pull out tool: LEJ-13

Pin No.	Cable color	Signal	Cable type
1	Red	A phase	AWG18 or up
2	White	B phase	
3	Black	C phase	
4	Green	GR	
5	Blue	Brake	
6	Yellow	Brake	

4. DESIGN

4.3 Connection with Support Devices and External Devices

4.3.1 Input/output interface

Note 1: The figure below is for reference. Follow designated time chart of upper master controller. (See section 6-3.)

Note 2: Wait one second or more after control power and main power are turned ON, to input RUN operation ready command input.(RUN)

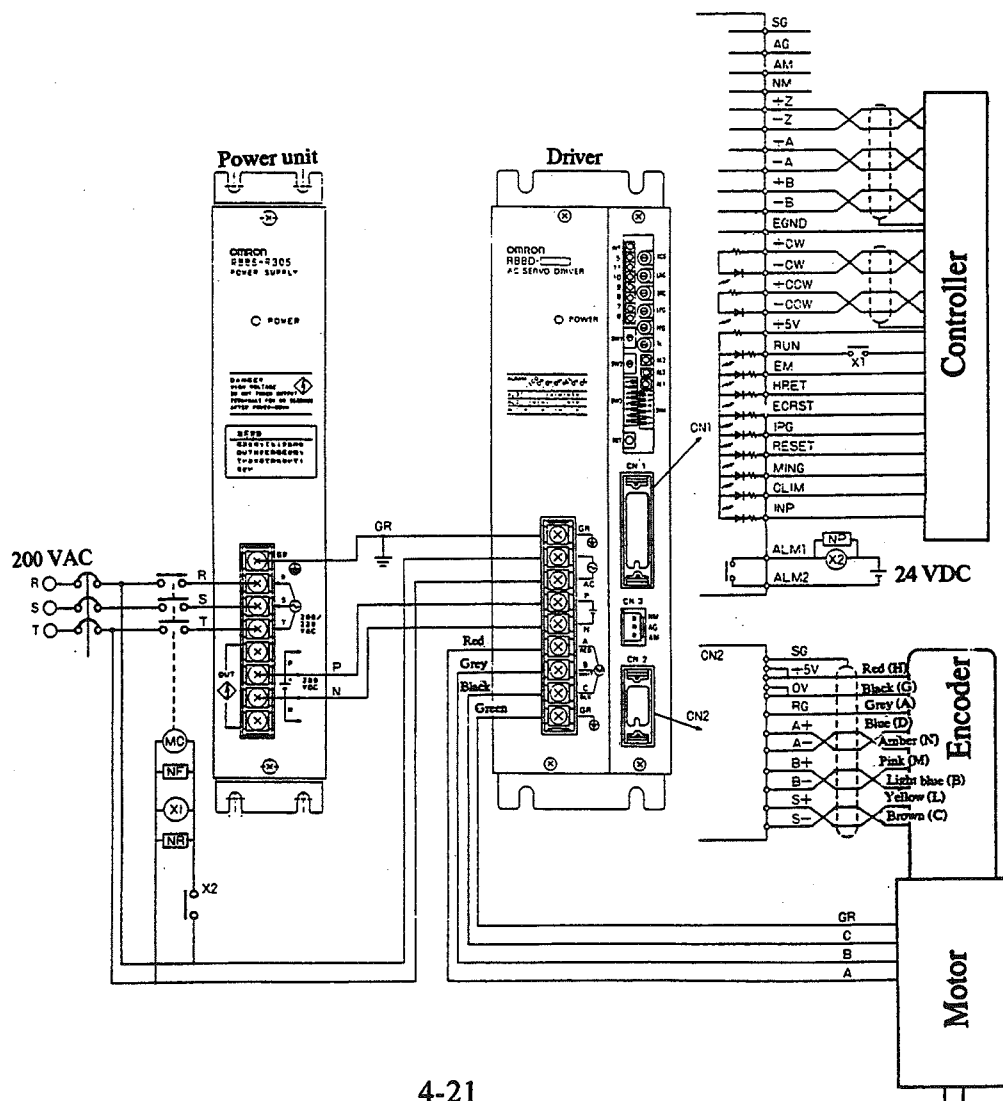
Note 3: Signs in () mean connector signs on R88M-R60030, R82030 and R1K130.

Note 4: Use insulation soldering iron or soldering.

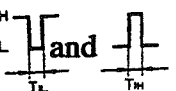
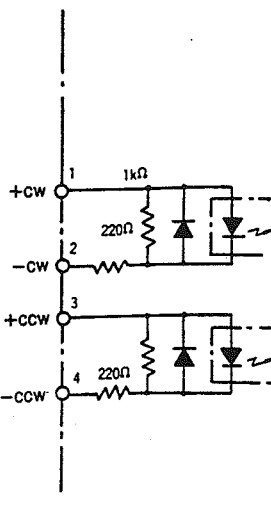
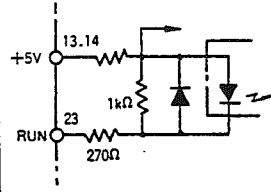
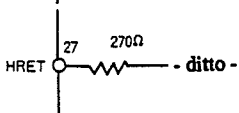
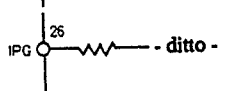
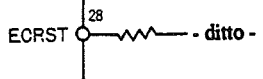
Note 5: Use thermal proof vinyl covered wire (HIV, 75°C or up) for DC power and motor power lines.

Note 6: After switching power OFF, residual voltage remains in a terminal block.
Do not touch terminals within 1 minute after power OFF.

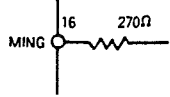
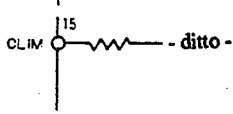
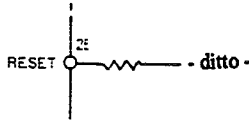
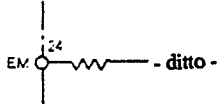
Note 7: Do not install contactors in the main circuit DC power (between the power unit and the driver).



□ Control input interface

Name of signal	Function	Specification	Interface
Reverse command pulse (CW)	Reverse side (CW) command pulse input. Switching SW3-5 and 3-6, this pulse turns to feed command, 90° phase input. Seet 4-2-2, description about SW3-5, 3-6, and 3-7.	Input pulse width  $T_{LH} \geq 1.5 \mu \text{ sec.}$ $T_{HL} \geq 1.5 \mu \text{ sec.}$ 16 mA at input voltage 5 V.	
Forward command pulse (CCW)	Forward side (CW) command pulse input. Switching SW3-5 and 3-6, this pulse turns to forward/reverse command, 90° phase input. Seet 4-2-2, description about SW3-5, 3-6, and 3-7.	8 mA at input voltage 3 V. Accept pulse train after 25 msec. from Run command input.	
Run command (RUN)	ON: This signal turns the unit to operative condition with supplying current to servo motor. OFF: The error counter is cleared and the motor shaft is set free.	10 mA at input voltage 5 V.	
Zero positioning command (HRET)	Motor speed is decelerated at the limit switch in front of zero position, and HRET signal turns ON by turning this L/S signal. Next coming Z phase makes the error counter clear and prohibit input command pulse to the unit simultaneously.	10 mA at input voltage 5 V.	
Pulse prohibition (IPG)	ON: This signal prohibits input of command pulse.	- ditto -	
Error counter reset input (ECRST)	ON: This signal resets the error counter and prohibits input of command pulse.	- ditto -	

4. DESIGN

Name of signal	Function	Specification	Interface
Minimizing gain (MING)	ON: This signal is used for minimizing the vibration of servo motor. However, this signal decreases servo lock power.	10 mA at input voltage 5 V.	
Torque limit (CLIM)	ON: This signal limits supply current to motor to preset value by "TL volume."	- ditto -	
Alarm reset (RESET)	This is used to release alarm condition of servo driver.	- ditto -	
Emergency stop (EM)	This signal stops the unit at emergency. Make a circuit to close at normal condition.	- ditto -	

4. DESIGN

□ Control output interface

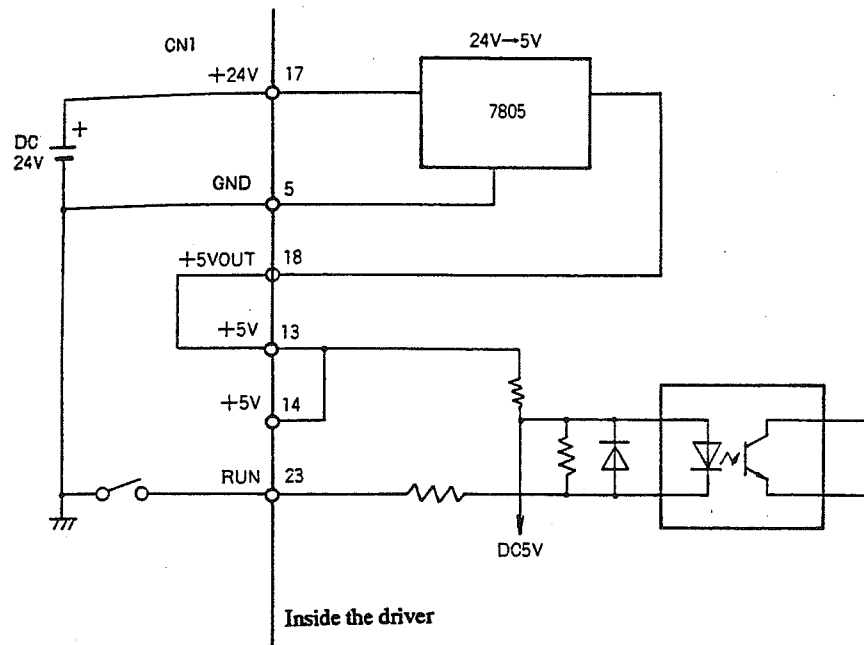
Name of signal	Function	Specification	Interface
Speed monitor output (NM)	This is an output to monitor the speed of servo motor and comes from F/V voltage. Take care that this output has approx. $\pm 10\%$ allowance.	CCW +7.5 V CW - 7.5 V at 3,000 rpm	
Current monitor terminal (AM)	An output to monitor supplied current to servo motor. This is output as voltage converting from supply current of servo motor armature line. Take care that this output has approx. $\pm 20\%$ allowance.	+12 V at the instantaneous max. torque.	
Encoder feedback output (A, B, Z)	Line driver output after receiving encoder signal from servo motor. For TTL level use, connect EGND and one of the lines according to its polarity.	EIA-RS-422 or equivalent	
Positioning completion output (INP)	This signal comes when the error counter is within the designated positioning range.	24 VDC 10 mA	
Alarm output (ALM1) (ALM2)	The contact opens when emergency stop (EM) is input or inside abnormal occurs. For resetting, input alarm reset (RESET) signal or press reset button (RESET). This contact also opens while reset signal is input.	Rated contact load: 24 VDC, 0.5A	

4. DESIGN

4-3-2 Control input power

Control input interface power is 5 VDC.

When it is used with 24 VDC power, arrange the cuircuit as follows:

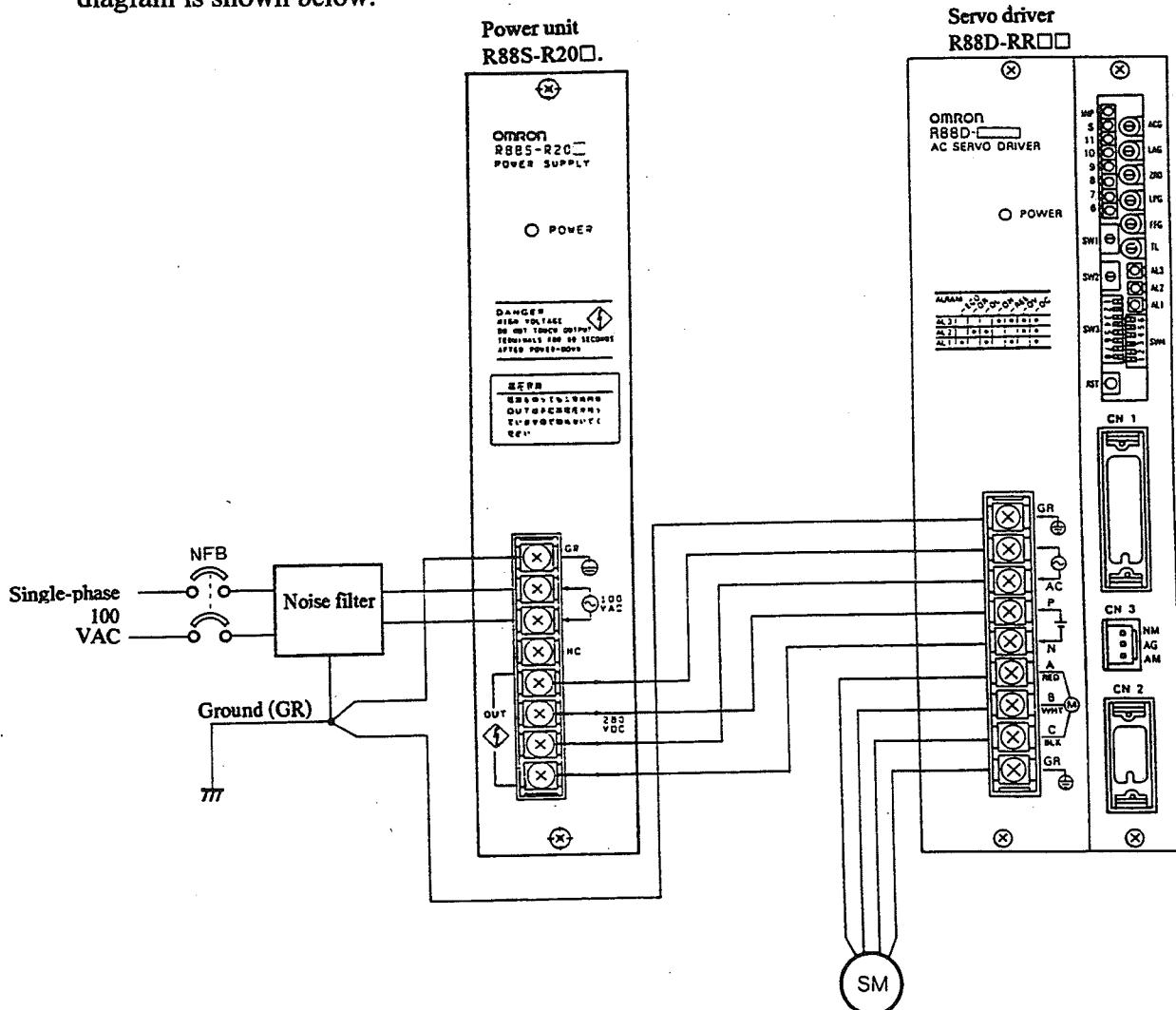


Note 1: When it is used with 24 VDC, 5 VDC power is not required.

Note 2: + 5 V output of the unit is for the interface of this unit and cannot be used for other equipment.

4-3-3 Usage at 100 VAC input

Input power voltage of servo drivers are unified to 200 V. However, operation with 100 VAC using R88S-R203 and R88S-R205 power units is available. Then connection diagram is shown below.



When an alarm occurs at the servo driver with the connection above, be sure to turn OFF RUN command.

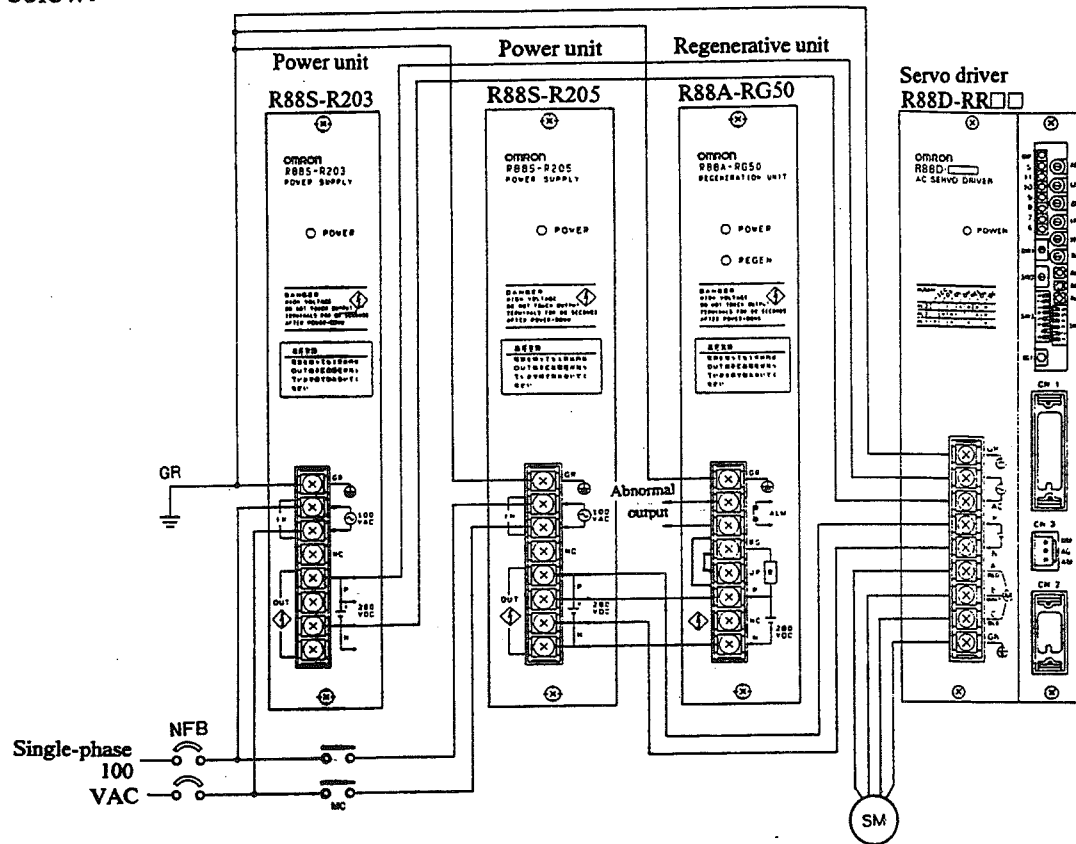
Model	Allowable regenerative energy	Average regenerative power
R88S-R203	28J	8W
R88S-R205	55J	12W

Note 1: Control power input is usable 220 to 360 VDC.

Note 2: Use servo drivers not to exceed control power input voltage more than 360 VDC.

4. DESIGN

When regenerative energy exceeds the values shown in the table at previous page, use R88S-R203, R88S-R205, or R88A-RG50, and connect referring the connection figure below.



Note: Input the alarm output from the regenerative unit to the upper controller, and use as MC control of main circuit power input together with the servo driver alarm output.

4.3.4 Selection example of outer connecting parts

(1) No fuse breaker (NFB)

Use a breaker having applicable current value for your system. Never use one for semiconductor and one having characteristics for immediate response.

Use one with delay characteristics 62 (2.2 to 20 s. at 200% load).

(2) Noise filter (NF)

Phase	Model	Rated	Mfg.
Single phase	GT-205U	5A	TOKIN
	GT-210U	10A	
	ZAC2206-11	6A	TDK
	ZAC2210-11	10A	
	SUP-E3H-EP	3A	OKAYA ELECTRIC IND
	SUP-E5H-EP	5A	
Three phase	LF-315K	15A	TOKIN
	LF-325K	25A	
	LF-305	5A	
	LF-310	10A	
	LF-315	15A	
	LF-320	20A	
	ZCW2205-01	5A	TDK
	ZCW2210-01	10A	
	ZCW2220-01	15A	
	3SUP-A5J-E	5A	OKAYA ELECTRIC IND
	3SUP-A10J-E	10A	
	3SUP-A15J-E	20A	

(3) Magnet relay (MC)

Model	Current	Mfg.
MA415A	15A	OMRON
LC1-D173A60	18A	
LC1-D253A60	26A	

4. DESIGN

(4) Surge absorber (ZNR)

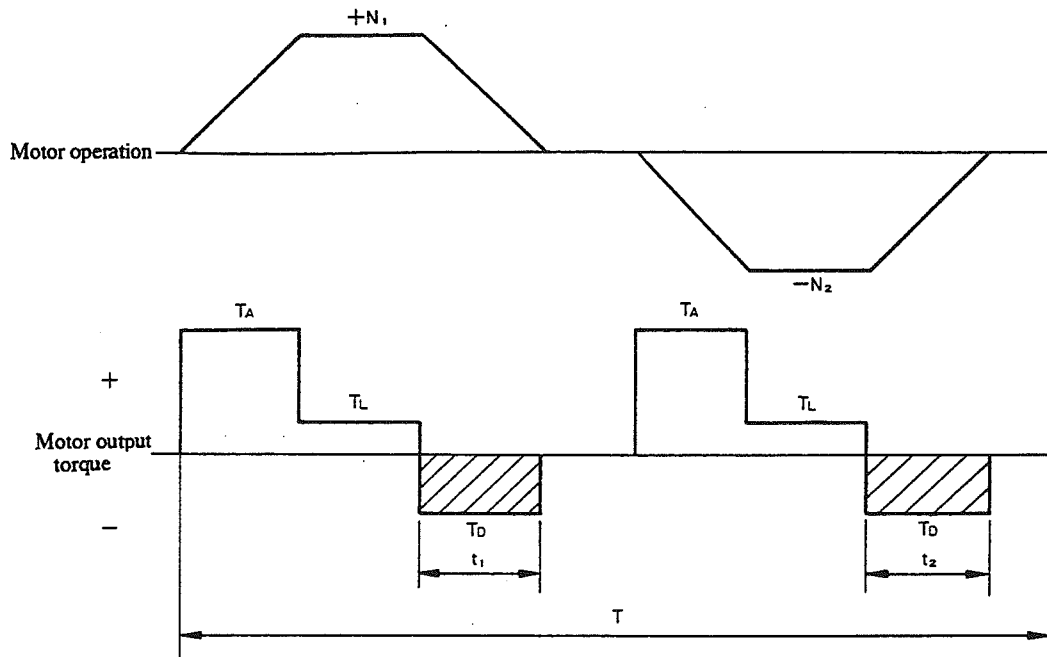
Model	Current	Mfg.
EZR-A20EL471	5 kA	MATSUSHITA ELECTRIC
EZR-A25EL471	10 kA	
EZR-A32EL471	20 kA	

(5) Surge killer

Model	Current	Mfg.
CR-50500	50 Ω - 0.5 μ F	OKAYA ELECTRIC IND
S2-A-0	200 Ω - 0.1 μ F	
CRE-50500	50 Ω - 0.5 μ F	

4.3.5 Calculation of regenerative energy

(1) In case of horizontal axis



As shown above, regenerative energy occurs when motor output torque becomes negative.

Regenerative energy in each section is given in the formula below:

$$Eg1 \approx \frac{1}{2} \times N1 \times TD \times t1 \times 1.027 \times 10^{-2} \text{ [J]}$$

$$Eg2 \approx \frac{1}{2} \times N2 \times TD \times t2 \times 1.027 \times 10^{-2} \text{ [J]}$$

N : Number of motor revolutions at triggering deceleration (rpm)

TD : Required deceleration torque (kgf·cm)

$t1, t2$: Deceleration interval (s)

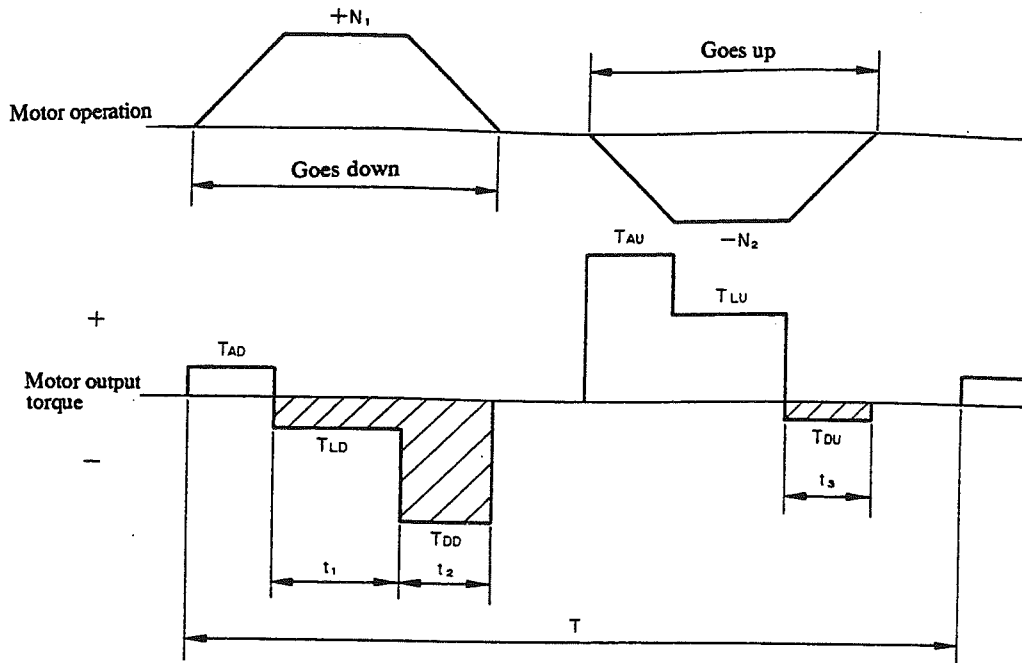
Average regenerative power is given in the formula below:

$$Eg = \frac{(Eg1 + Eg2)}{T} \text{ (W)} \quad T: \text{ operation cycle (s)}$$

Generally, there is energy loss by motor coiling resistance and actual value is approx. 90% of above figure.

4. DESIGN

(2) In case of vertical axis



In the above movement, regenerative energy occurs while motor output torque becomes negative. Regenerative energies in each section is given by the formula below:

$$Eg1 \approx N1 \times TLD \times t1 \times 1.027 \times 10^{-2} \text{ [J]}$$

$$Eg2 \approx \frac{1}{2} \times N1 \times TDD \times t2 \times 1.027 \times 10^{-2} \text{ [J]}$$

$$Eg3 \approx \frac{1}{2} \times N2 \times TDU \times t3 \times 1.027 \times 10^{-2} \text{ [J]}$$

N : Number of motor revolutions at triggering deceleration (rpm)

TD : Required deceleration torque (kgf·cm)

t2, t3 : Deceleration interval (s)

Average regenerative power is given in the formula below:

$$Eg = \frac{(Eg1 + Eg2 + Eg3)}{T} \text{ (W)} \quad T: \text{ operation cycle (s)}$$

Generally, there is energy loss by motor coiling resistance and actual value is approx. 90% of above figure.

4.3.6 Absorption of regenerative energy

To absorb regenerative energy, use the exclusive regenerative units or regenerative power absorption circuit integrated power units.

• Power unit

Model	Input voltage	Allowable regenerative energy	Average regenerative power	Output current
R88S-R203	100 VAC	30 J	8 W	3 A
R88S-R205	100 VAC	60 J	12 W	5 A
R88S-R305	200 VAC	20 J	5 W	6 A
R88S-R310	200 VAC	40 J	10 W	10 A
R88S-R310G	200 VAC	200 J	20 W	10 A
R88S-R315	200 VAC	65 J	15 W	15 A

• Regenerative unit

Model	Allowable regenerative energy	Average regenerative power
R88A-RG50	250 J	40 W

Power units other than R88S-R310G, which has built-in regenerative power absorption circuit, are equipped with condensers to absorb regenerative energy.

When regenerative energy exceeds the allowable amount, speed down motor rotation or make longer deceleration interval.

Note: 1W = 1 J/S, 1 cal. = 4.2 J

5. USAGE

5.1 Unpacking

□ AC servo driver

- Check the following items soon after opening the package.

Check whether the delivered goods are different from those ordered.

Check whether the combination of servo motors and servo drivers are correct by referring to Item 1, 1-2.

Check for possible transportation damage, and check that screws have not been loosened.

Accessories

CN1 connector plug	MR-34M	1 pc.
CN1 connector case	MR-34L	1 pc.
CN2 connector plug	MR-16M	1 pc.
CN2 connector case	MR-16L	1 pc.
CN3 Connector terminal	LVH-21T-P1.1	3 pcs.
CN3 Connector case	VHR-3N	1 pc.
Fixing metal		2 pcs.
Fixing screw	M4x6	4 pcs.
Instruction Manual		1 set

□ AC servo motor

Installation Manual	1 set
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5.2 Trial Operation

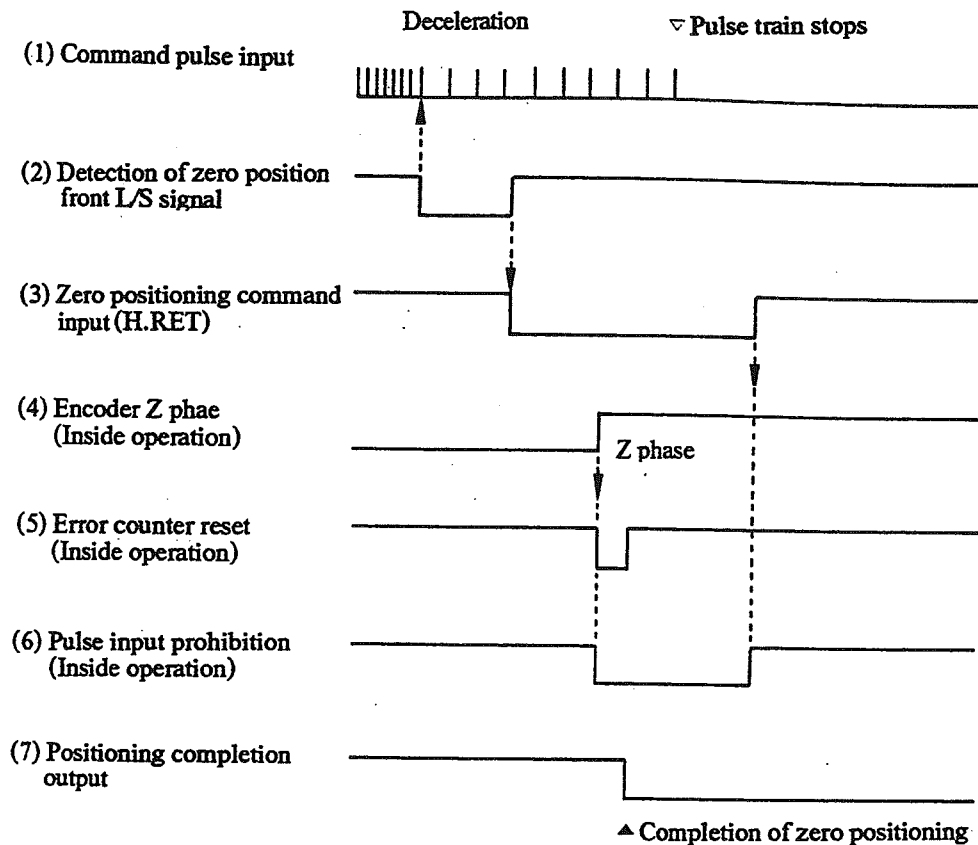
□ Check items before operation.

Confirm the following before start operations

1	Supplied power should be 170 to 242 VAC, 50/60 Hz.
2	Prepare a circuit to turn OFF 200 VAC of the power unit automatically when the servo driver or the power unit supplies alarm signals.
3	Remove the motor from machine during the trial operation. When it is installed, be ready to stop the motor anytime. Confirm that no one is near the machine.

- (1) Check that operation ready signal (RUN) and command pulse are not be input.
Otherwise, the motor rotates soon after power is supplied.
- (2) Put ON control power
- (3) Confirm the power indication LED (POWER) is ON. When the LED does not light, check the voltage on control power input terminal (AC).
- (4) Confirmation of abnormal circuits
Confirm that the system has a circuit to switch OFF main power automatically when abnormal signals are supplied.
- (5) Supply main circuit power.
- (6) Input RUN (ready for operation) signal one sec. after turn ON main circuit power.
With inputting RUN signal, the motor has holding torque.
Be careful that if command pulse is supplied, motor rotates soon after inputting RUN signal.
Adjust zero balance volume to light OFF all indications of the error counter.
- (7) Input command pulse.
Input command pulse and confirm that the motor rotates smoothly. With forward command pulse, the motor should rotate forward direction (CCW) looking at the motor from the shaft side. With reverse command pulse, the motor should rotate reverse direction (CW) looking at the motor from the shaft side.
- (8) When there are problems such as no rotation and rotation without control of the motor, check red LED and see item 6-3, "Troubleshooting."
- (9) Confirm zero positioning function.
Input zero positioning command (HRET) in the following sequential process and confirm the function.

5. USAGE



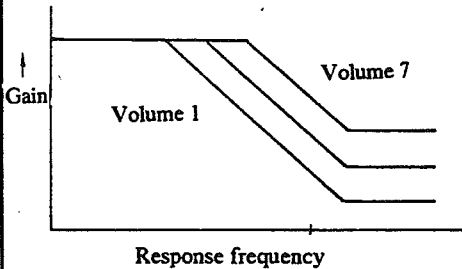
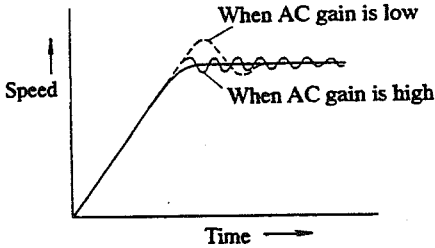
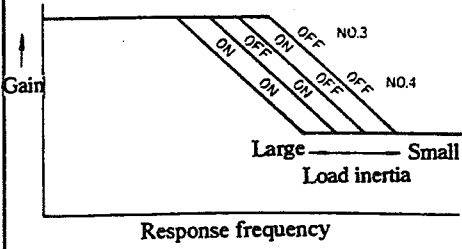
(10) Also confirm the following functions:

- | | |
|----------------------------------|---|
| • Emergency stop
(EM) | The motor stops and alarm indication LED lights. |
| • Error counter reset
(ECRST) | Reset the error counter and light OFF 11-6 on the display section. |
| • Pulse prohibition
(IPG) | Prohibit input pulse command and hold the axis (servo lock). |
| • Minimizing gain
(MING) | Decrease vibration of servo motor.
Decrease servo lock power. |
| • Torque limit
(CLIM) | Turn torque limit adjustment volume (TL) to CCW direction and confirm decrease of motor torque. |
| • Alarm reset
(RESET) | Confirm release from alarm condition by inputting RESET after triggered protection circuit. |

After the completion of confirmations above, operate the system with the required cycle. Check heat condition of the motor and the driver after 2 to 3 hours of cycle operation.

5.3 Adjustment

The servo driver is adjusted with no load at delivery. Adjust and get the optimum condition by referring to the following chart.

Name of volume SW	Functions	Vibration by adjustment															
AC gain (ACG)	<p>AC gain adjustment</p> <p>This is used to adjust response characteristics.</p> <p>Adjust in accordance with load inertia.</p> <p>To monitor response characteristics, use speed monitor signal.</p> 	<p>AC gain increase and improves frequency characteristics by turning the volume in a clockwise direction.</p> <p>In case of a small load inertia, decrease the AC gain and vice-versa to minimize overshoot and undershoot. Too much AC gain causes vibration and an unstable condition for the motor.</p> 															
AC gain changeover SW-4 No.3 No.4	<p>This is a switch to adjust response characteristics. Adjust with load inertia. See the table at right for reference.</p> 	<table border="1"> <thead> <tr> <th>Load inertia</th><th>No.3</th><th>No.4</th></tr> </thead> <tbody> <tr> <td>0-3 times of motor inertia</td><td>OFF</td><td>OFF</td></tr> <tr> <td>2-5 times of motor inertia</td><td>ON</td><td>OFF</td></tr> <tr> <td>4-7 times of motor inertia</td><td>OFF</td><td>ON</td></tr> <tr> <td>6-10 times of motor inertia</td><td>ON</td><td>ON</td></tr> </tbody> </table> <p>For finer adjustment, use the AC gain volume.</p>	Load inertia	No.3	No.4	0-3 times of motor inertia	OFF	OFF	2-5 times of motor inertia	ON	OFF	4-7 times of motor inertia	OFF	ON	6-10 times of motor inertia	ON	ON
Load inertia	No.3	No.4															
0-3 times of motor inertia	OFF	OFF															
2-5 times of motor inertia	ON	OFF															
4-7 times of motor inertia	OFF	ON															
6-10 times of motor inertia	ON	ON															
Zero balance (ZRO)	<p>Zero adjustment</p> <p>Adjust to light OFF all LED of the error counter.</p>	<p>Not balanced condition shows steady lighting ON or OFF "S" LED, and the lower bits of the deflection counter light ON.</p>															

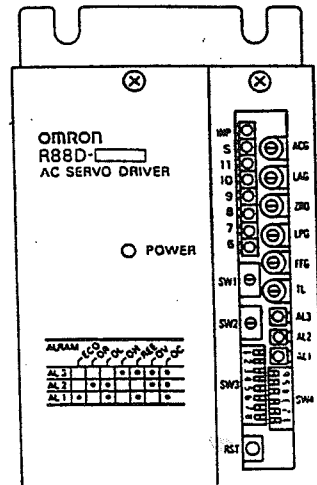
5. USAGE

Name of volume SW	Functions	Vibration by adjustment
Loop gain (LPG)	<p>Loop gain adjustment</p> <p>This is a volume to adjust acceleration/deceleration response smooth.</p> <p>When overshoot/undershoot is not eliminated, make longer acceleration/deceleration time or minimize feedback multiplication figure.</p>	
FF gain (FFG) SW-4 No.5 No.6	<p>Feed forward adjustment</p> <p>This turns to effective after turning No.6 of SW4 ON. This volume adjusts feed forward value.</p> <p>Generally, set between 10 to 30 %.</p> <p>(See Item 4-2, setting section SW4)</p>	
Torque control (TL)	<p>This torque control turns to effective by CLIM signal, and the maximum current value is limited by this setting value.</p>	<p>Increase the setting value by turning the volume in the CW direction.</p> <p>Maximum setting is instantaneous maximum torque.</p>
Acceleration correction (LAG)	<p>Acceleration correction</p> <p>Together with AC gain, adjust acceleration characteristics.</p> <p>It adjust phase and gain at high range.</p>	<p>This volume improves response characteristics by increasing this value when load rigidity is high enough. However, this is not effective when load rigidity is low. Adjust within a range that does not cause vibration during rotation.</p>
Dynamic brake SW-4 No.1	<p>Select dynamic brake function between effective and ineffective.</p>	<p>SW4, No.1</p> <p>ON: Ineffective brake function</p> <p>OFF: Effective brake function</p>
Frequency changeover of high range filter SW-4 No.2	<p>Turn ON when mechanical vibration and gain abnormal sound do not stop after adjusting AC gain.</p>	<p>SW4, No.2</p> <p>ON: Effective high range filter</p> <p>OFF: Ineffective high range filter</p>

6. MAINTENANCE

6.1 Protective and Check Functions

LED on the display section indicates operation and abnormal conditions of the servo driver.



□ Green LED

Display	Function	Condition
POWER	Indicate control power	Control power (200 VAC) is input.

□ Orange LED

Display	Function	Condition
INP	Completion of positioning	With RUN command input, this LED lights when amount of the deflection counter is less than positioning completion range.

6. MAINTENANCE

□ Red LED

Protective	Indicating LED			Function	Causes
	3	2	1		
Main circuit fuse (OC)	●	●	●	When an overcurrent is supplied to the main circuit, FUSE blows and opens circuit connection.	Short circuit inverter output.
Overcurrent detection (OC)	●	●	●	The driver detects when the DC main circuit receives overcurrent and shut off the inverter.	Short circuit inverter output.
Overvoltage protection (OV)	●	●	○	When main circuit voltage exceeds the rated value due to regenerative energy at motor deceleration, the inverter is shut off.	Much load inertia
Encoder signal disconnection detection (REE)	●	○	●	When encoder signal line or power line is disconnected, or motor overheats, the inverter is shut off.	Signal mis-wiring Signal line disconnection Motor overload
Temp. rise of radiation fin (OH)	●	○	○	The driver opens the inverter when temperature of the inverter radiation fin raise over the rated value	High driver environmental temperature. Too much load torque.
Overload protection (OL)	○	●	●	When much current due to overload flows longer than the rated time, the inverter is shut off.	Too much load torque.
Overspeed detection (OR)	○	●	○	The driver opens the inverter when the motor exceeds the rated speed.	The motor rotates with more than the rated speed. Disconnection of encoder signal lines.
Error counterover (ECO)	○	○	●	When the error counter exceeds the designated number of bit, the driver clears the error counter, release servo lock, and the inverter is shut off.	Too high pulse frequency. Missetting of encoder multiplication value.
Emergency stop input (EM)	○	○	●	Emergency stop input signal (EM) switched to OFF (open).	
Abnormal power	-	-	-	The driver opens the inverter when power is lower it voltage than the rated value.	Voltage down of supplied power.
Instantaneous stoppage of the power supply	-	-	-	The driver opens the inverter at the power failure for more than 40 ms.	Instantaneous power failure of control circuit.
Control power FUSE	-	-	-	The temp. FUSE is brown with high current to the control circuit. All indication turns OFF.	Malfunction in the control circuit.

● means light ON. ● means blinking. ○ means light OFF.

In order to protect the servo driver and servo motor, the above protective circuits are integrated. When a protective circuit works, the driver stops operation and supplies servo abnormal signal.

6. MAINTENANCE

□ Alarm contactor output

• Contactor section

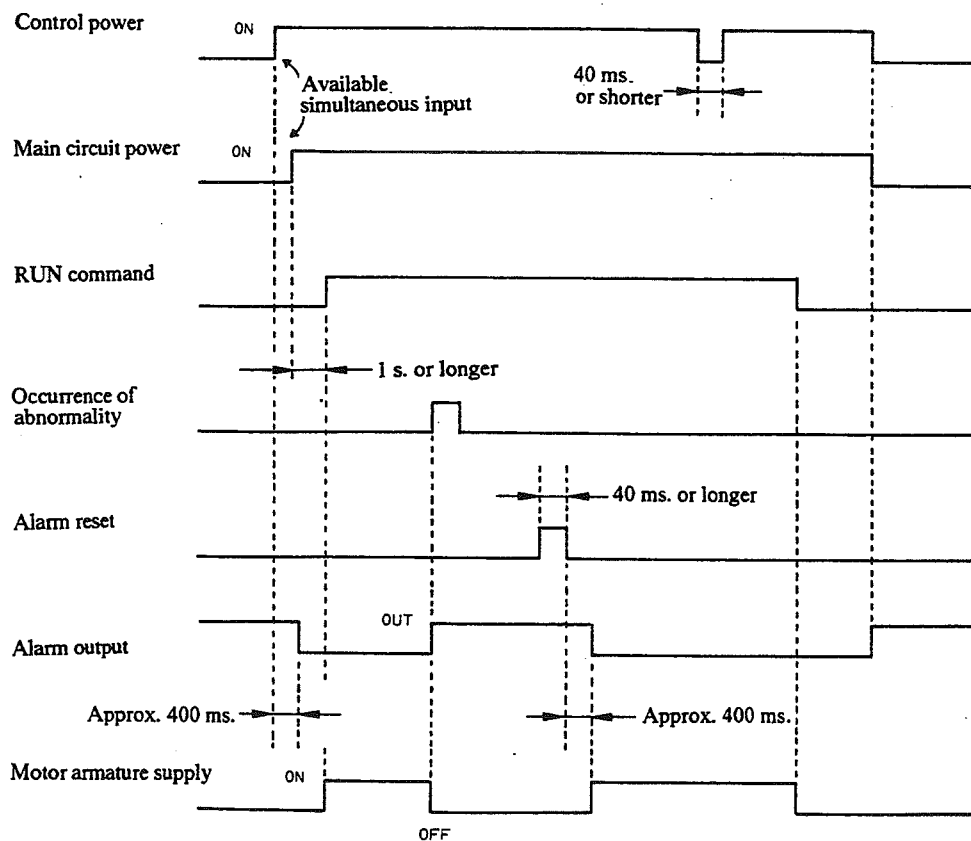
Load condition	Resistance load $\cos\phi = 1.0$	Induction load $\cos\phi = 0.4$ Load L/R = 7 ms
Rated load	24 VDC, 0.5 A	24 VDC, 0.3A

Note: Never connect 100 VAC line to the contactor output.

Time chart of servo driver power and at abnormal condition are shown below:

- 1) When power is input, the driver shut off RUN signal inside the unit until each power becomes normal level. This shut off interval is 400 to 500 ms.
- 2) When power failure interval is more than 40 ms., the unit detects and shut off RUN signal. Recovery interval is 400 to 500 ms.

3) Timing chart



Alarm signals output through relay contacts. It takes approx. 10 ms. to supply alarm output as relay output after the alarm occurs inside of the unit.

Be sure to secure 1 sec. interval to put ON RUN signal after turning ON.

6. MAINTENANCE

□ Cautions at alarm output

1. The unit outputs abnormal alarm as relay contact simultaneously at abnormal indication on LED.

This output is available even if the power of the servo driver is OFF.

The contactor closes after approx. 400 ms. of control power ON.

2. The unit shuts off RUN signal together with alarm output.

Do not actuate the inside dynamic brake more than one time within 5 minutes, or the inside resistance may burn out.

3. Alarms are released by reset button, reset signal, and the re-input of control power.

When the unit receives reset signal or power ON while inputting RUN command, make sure it has been in operation for approx. 400 ms.

4. When an abnormal signal outputs, turn OFF the driving power input and operation command input.

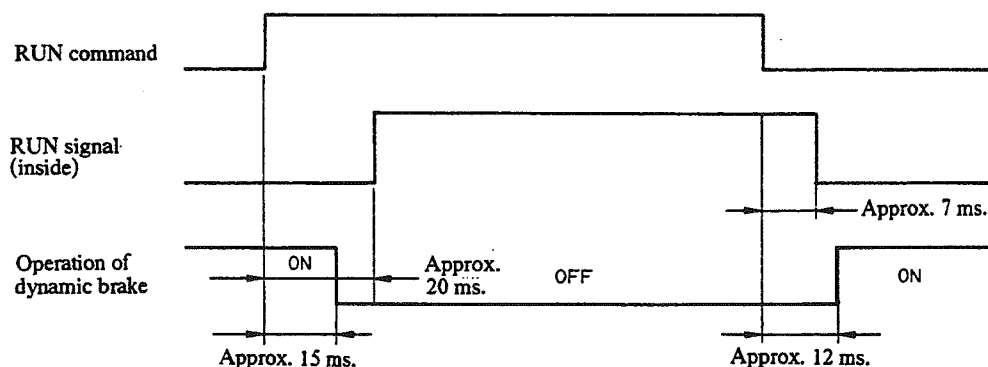
Keep control power ON, and check the abnormal condition with LED. Remove causes of the abnormal condition and restart operation.

When an overload (OL) occurs, an abnormality in the mechanical section may be the cause. Check the mechanical section. Do not supply power more than 10 minutes after this alarm condition. Repeated overload may cause burnout in the motor coil.

5. When an alarm signal is output, check wiring and the installation of the system.

□ Dynamic brake sequence

Operation time of the dynamic brake is shown below:



6.2 Maintenance

☐ Daily check

Confirm for abnormal noise, loose screws, or abnormal heat in the motor, and operating ambient temperature while in operation.

There is no daily check item for the servo driver. Check ambient temperature and dust on the forced cooling fan.

☐ Periodical check

● Servo motor

- Abnormal noise from the motor.
- Looseness of retention screws.
- Outside look.

● Servo driver

- Looseness of terminals, connectors, and retention screws.
- Dust in ventilation holes of the servo driver.

6. MAINTENANCE

6.3 Troubleshooting

When trouble occurs while in operation, confirm the cause and return to normal condition by referring to the following chart:

□ Check by LED

LED lights	Protection function	Conditions	Causes
OC operation	Fuse in main circuit	Blow fuse with overcurrent in DC main circuit.	Short circuit or ground between driver and motor.
	Detect overcurrent	Inverter opens with overcurrent in DC main circuit.	Short circuit or ground between driver and motor.
OV operation	Overvoltage protection	Inverter opens with more than 380 VDC in main circuit power due to regenerative energy.	Too much load inertia. Too high input voltage. Miswiring of A, B, C phase, and GR.
OL operation	Electronics thermal protection	Inverter opens when overcurrent than the rated is supplied to the motor longer than the rated interval.	Too much load inertia. Mechanical lock of motor shaft. Miswiring between A, B, and C phase.
Note) Prior to release from over load alarm condition, cool down the servo driver and motor more than 10 minutes. Immediate releases from the alarm and repeated restart may damage the motor coil.			
OH operation	Temp rise of radiation fin	Inverter opens with rising temp. of inverter radiation fin.	Too much load torque. High temperature around the servo driver.
ECO operation	Error counter over	Reset error counter, and inverter is shut off.	Too high command pulse frequency. Missetting of encoder multiplication value. Mechanical lock of motor output shaft.
OR operation	Overspeed detection	Inverter opens with more than rated value of motor speed.	Motor rotates exceeding the rated speed (4,000 rpm).
	Encoder line	Inverter opens with disconnection of encoder signal lines or power lines.	Encoder line disconnected. Miswiring. servo driver.
REE operation	Encoder line	Inverter opens with disconnection of encoder signal lines or power lines.	Encoder line disconnected. Miswiring. servo driver.
	Motor overload protection	Inverter opens by encoder inside temp. rises exceeding 85°C.	Too much load torque. Increasing of motor temp.

— Contact our service department.

6. MAINTENANCE

☐ Check motor conditions

Check abnormal condition due to mismatch of coupling center.

Noise: Confirm that AC gain is not excessive.

Confirm that the motor rotor is rotating smoothly.

Confirm that there is no abnormal sound to indicate wear in ball bearings.

Thermal: Check that load actual torque is within the motor rated torque.

When OL lights, wait at least 10 minutes to cool. Repeated alarm condition without cooling may damage the motor.

Vibration: Vibration occurs at following conditions:

(1) When AC gain increases too much.

(2) When LAG gain increases too much.

(3) When resonance point of mechanical section is within servo loop response range.

☐ The motor does not rotate even there is no alarm condition.

Confirm that the following signals of CN1 are set as shown below:

Turn ON SW3-NO.8 of SW2-"F," then you can check by LED.

The motor cannot rotate even if one of above signals is ON.

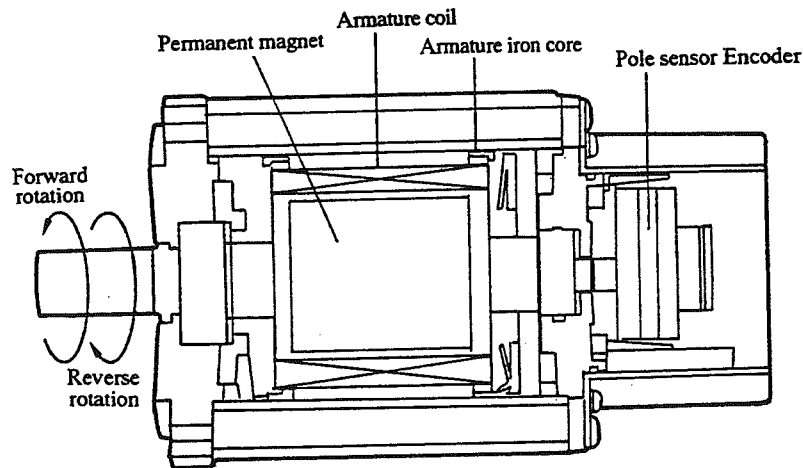
Signal name	LED No.	
IPG	8	OFF
H.RET	7	OFF
ECRST	6	OFF

7. CONFIGURATION, CONSTRUCTION AND OPERATION PRINCIPLE

7.1 Structure of Motor and Driver

□ Structure of motor

AC servo motor is a synchronous motor having rotating core of permanent magnet. Fields consist of 3-phase coiling wires on iron core. Pole change in accordance with the position of a rotor is required for coiling wires which is not required for DC servo motors. Therefore, a pole sensor is installed together with an encoder.



□ Structure of servo driver

