

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

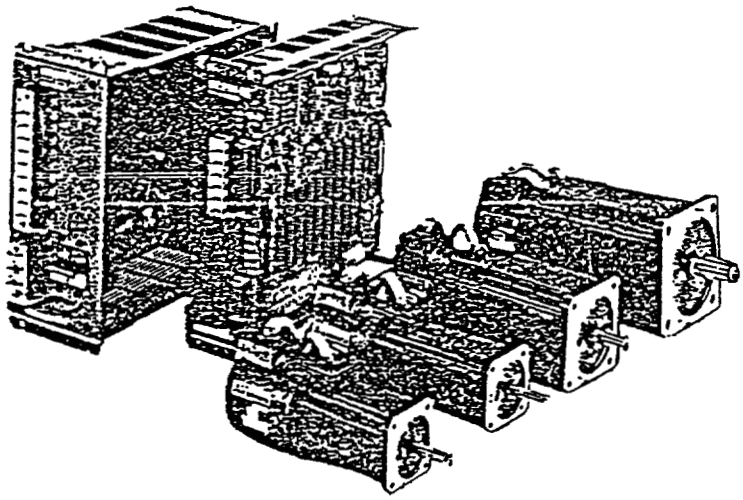
MITSUBISHI

MITSUBISHI GENERAL-PURPOSE AC SERVO SYSTEM

MELSERVO-SO

Position Control MR-SO□P

- Instruction Manual -



BNP-B3413-30* (89.3)

Thank you for your purchase of MITSUBISHI general-purpose servo-system "MELSERVO-SO".

This manual describes the installation, operation, maintenance, troubleshooting and other important information necessary for successful use of your MELSERVO-SO.

For trouble-free, long use of your MELSERVO-SO, please read this manual carefully.

- C O N T E N T S -

1. CHECK UPON UNPACKING 1

2. TRANSFERENCE 1

3. INSTALLATION 1

   3.1 Servo-amplifier and power unit 1
   3.2 Servo-motor 2

4. WIRING 4

   4.1 Main (power) circuit 4
   4.2 Control circuit 6
   4.3 Standard wiring diagram 9
   4.4 Input/output terminals 10
   4.5 Connector pin arrangement 16
   4.6 Encoder extension cable 17
   4.7 Capacity of power supply unit 17

5. INITIAL SETTINGS 18

6. OPERATION 23

   6.1 Check to be accomplished before starting operation 23
   6.2 Initial operation 23
   6.3 Safety against power failure 25
   6.4 Indicator lamps 25

7. ADJUSTMENT 28

8. MAINTENANCE 31

   8.1 Caution on inspection 31
   8.2 Parts and devices to be checked 31
   8.3 Consumable parts 31

1. CHECK UPON UNPACKING

When you receive MELSERVO-SO, check it to identify.

(1) See the nameplate to make sure the models of the servo-amplifier and the servo-motor, and the output ratings meet your order.

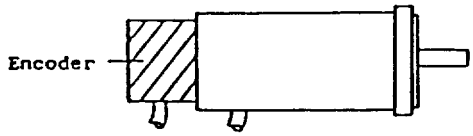
(2) Check all components if they were not damaged during the transport.

If any damage is found, or any question arises, please address to our service agency.

2. TRANSFERENCE

The servo-amplifier, power unit and servo-motor should be carefully handled when they are transferred and located.

During transfer, care should be exercised not to damage the encoder installed on the servo-motor .... DO NOT HOLD THE ENCODER BY HAND, NOR APPLY A ROPE TO THE ENCODER WHEN THE SERVO-MOTOR IS LIFTED OR TRANSFERRED.



3. INSTALLATION

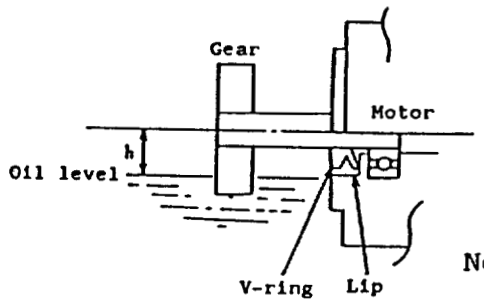
3.1 Servo-amplifier and power unit

1) The servo-amplifier and power unit should be located to a clean and dry place where they are not exposed to the direct sunlight, moisture, dense dust and detrimental gases.

Ambient conditions

Ambient temperature	0 to 55°C (to be free from icing)
Ambient humidity	Max. 90% (to be free from condensation)
Vibration	Max. 0.5G

go up excessively.



Model	Dimension "h" (mm)
HA-S053, -S0103	8 (11)
HA-S0203	12 (13)
HA-S0403	14 (18)

Note: ( ) is applied to motor equipped with brake.

2) The motor should not be located, where is at high temperature and high humidity.

If it is likely that the motor is exposed to splashing oil or water, a suitable cover should be installed and the leads should be led downward so that oil or water does not run into the motor along the leads.

Ambient conditions

Ambient temperature	0 to 40°C (to be free from icing)
Ambient humidity	20 to 80%RH (to be free from condensation)
Vibration	Max. 2G

3) When the motor shaft is directly coupled with a machine shaft, it is recommeded to use a "flexible coupling" capable of offsetting alighnment error between the two shafts.

4) The motor should not be overhauled and the encoder should not be relocated.

If any foreign sound arises during motor operation, consult our service agency.

5) The motor with magnetic brake should not be used for deceleration.
It should be used for prevention of fall in case of power failure or emergency stop.

6) The shaft of motor with magnetic brake may cause flux leakage.

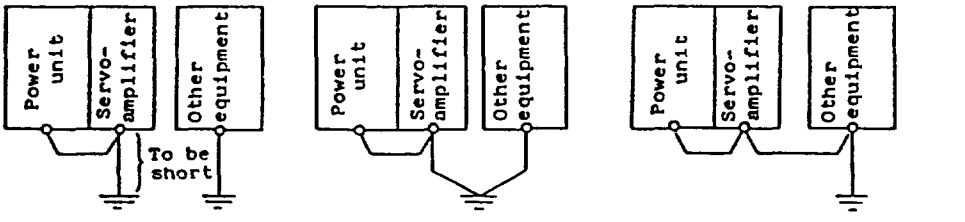
tation cannot be reversed (the system differs from conventional motor control systems and inverter-controlled systems), by changing power phase sequence.

9) <u>The input power source circuit should be such that the power source cannot be directly applied to the output terminals (U, V, W).</u>

Although the servo-amplifier is protected from short-circuiting between servo-amplifier output lines (terminals U, V and W) by the overcurrent preventive function, the system is not protected from ground fault or any leak trouble. Therefore, care should be exercised to prevent contact of any conductor with case or other metallic part.

10) A grounding wire should be connected to the ground terminal (⏚) without fail (see Fig. 1).

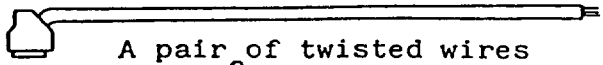
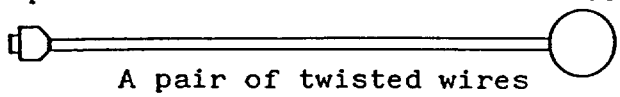
The grounding should be of "class 3" (resistance to ground: maximum 100Ω) with grounding wire of 2mm^2 in size. The grounding wire should be as short as possible.



(1) Exclusive grounding line .... BEST

(2) Common grounding line .... GOOD

(3) Common grounding line ... NOT ACCEPTABLE

Application	Symbol	Illustration
Control signal line	CN1	Amplifier side — Machine side  A pair of twisted wires ($0.3mm^2$) shorter than 2m HONDA MR-50F
Motor encoder cable (leads)	CN2	Amplifier side — Encoder  A pair of twisted wires Max. 30m long is possible when an extension cable is used. HONDA MR-20M

② Wiring

o The signal lines should be laid down away from (at least 20cm) the power lines at voltage higher than AC 100V ..... Do not place signal line and power line together in the same wire way or duct).

o If signal line cannot be separated from power line properly, they should not be laid down in parallel with each other.

③ Termination of shield wires

o The armor of each shield wire should be connected to connector terminal FG of servo-amplifier (SG for encoder cable) at one end. The other end of the armor should be kept open.

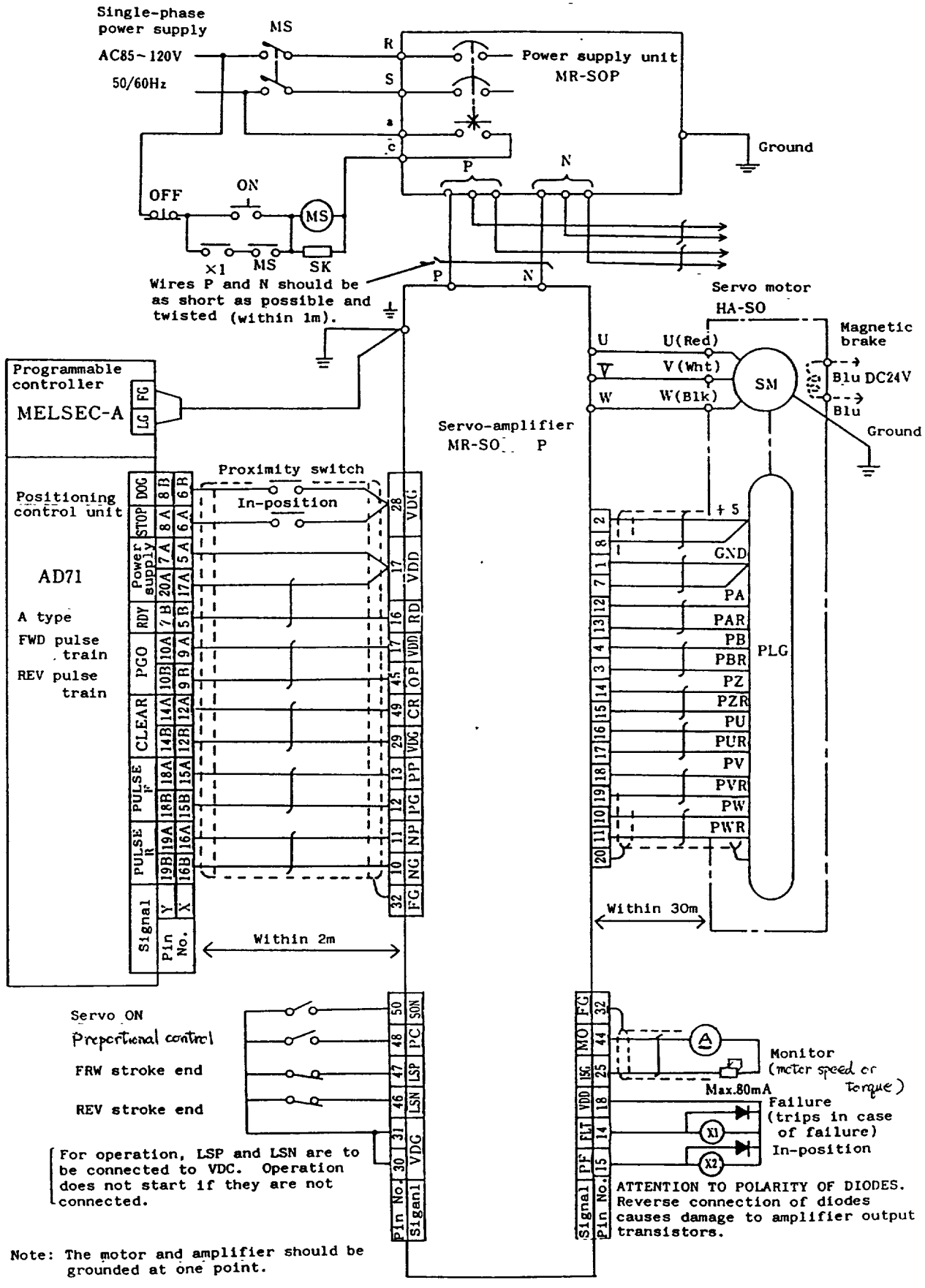
④ Surge killer

o Installation of surge killer

AC relay, AC solenoid valve and AC magnetic brake around the servo-amplifier should be equipped with a surge killer.

DC relay and DC solenoid valve externally connected to the servo-amplifier should be equipped with a diode (its withstand voltage should be 4 times the drive vol-

4.3 Standard wiring diagram



Signal name	Symbol	CON pin No.	Function/application	I/O
FWD SROKE END	LSP	47	Forward run stroke end limit switch terminal When the terminal is disconnected from terminal VDG, "FWD run" pulse signal is interrupted and motor stops. After that, motor operation can be reversed. With stroke end limit switch, LSP - VDG should be closed for operation.	I
REV STROKE END	LSN	46	Reverse run storke end limit switch terminal When the terminal is disconnected from terminal VDG, "REV run" pulse signal is interrupted and motor stops. After that, motor can be be run forward. With stroke end limit switch, LSN - VDG should be closed for operation.	I
ZERO PULSE	OP	45	Zero pulse output terminal When detector is at predetermined position, VDG is closed. This signal is used for home position return, etc. (1 signal per revolution of motor)	O
CLEAR	CR	49	Clear signal terminal When this terminal is con-	O

Signal name	Symbol	CON pin No.	Function/application	I/O
COMMON	VDG	27,28,29, 30,31	Contact input signal common terminals. They are not connected to the control circuit common line.	
FWD PULSE TRAIN	PP	13	FWD pulse train input signal terminal Pulse train output from pulse generator such as AD71 is input.	I
	PG	12	FWD pulse train input signal common terminal	
REV PULSE TRAIN	NP	11	REV pulse train input signal terminal	I
	NG	10	REV pulse train input signal common terminal	
SPEED COMMAND (speed reference)	VC	43	Speed command signal input terminal When signal at +10V is input, the motor runs at the rated speed (3000rpm) in CCW direction. The input resistance is 10 ~12 KΩ.	Analog input
MONITOR	MO	44	Either motor speed signal or motor torque signal is output (internally selectable). Max. ±10V, 1mA	Analog output
DC POWER SUPPLY	+15V	9	+15V DC power supply terminal	

Signal name	Symbol	CON pin No.	Function/application	I/O
ENCODER OUTPUT (Open collector type)	OA OB OZ	33 34 35	2000 pulses per revolution of motor (selectable) can be output from OA and OB. When OZ is used, one pulse per revolution of motor is output. Phase of output from OA is in advance of phase of output from OB by $\pi/2$ phase.	O
COMMON	OG	19, 20	Open collector output common terminals	
ENCODER OUTPUT SIGNAL		CN2	This is connected to the motor encoder.	

(2) Power supply unit

Table 2 Power supply unit I/O terminals

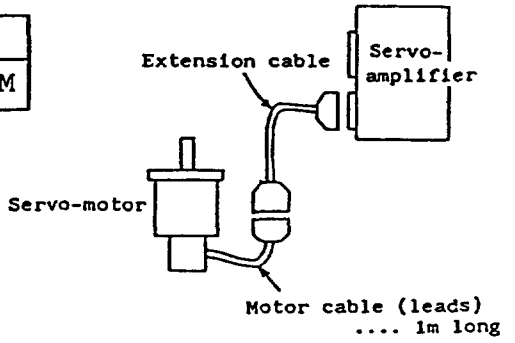
Signal name	Symbol	Function/application
AC POWER SUPPLY	R, S	To be connected to commercial power AC100V 50/60Hz.
DC OUTPUT	P, N	To be connected to servo-amplifier input terminals P and N.
CONTACT OUTPUT	a, c	Auxiliary contact output terminals for external NF, used when protective circuit is built up
GROUND	⏚	To be connected to grounding line.

4.6 Encoder extension cable

The motor encoder has a cable of 1m long (with a connector) and can be immediately connected to the servo-amplifier.

If the distance between the servo-motor and the servo-amplifier is longer than 1m, use an extension cable specified by us.

Cable length	Model
5m	MR-SOCBL5M



4.7 Capacity of power supply unit

Make sure the capacity of the power supply unit is large enough for the rated output of the servo-amplifier, or for the total rated output of the servo-amplifiers (when two or more servo-amplifiers are fed with one power supply unit).

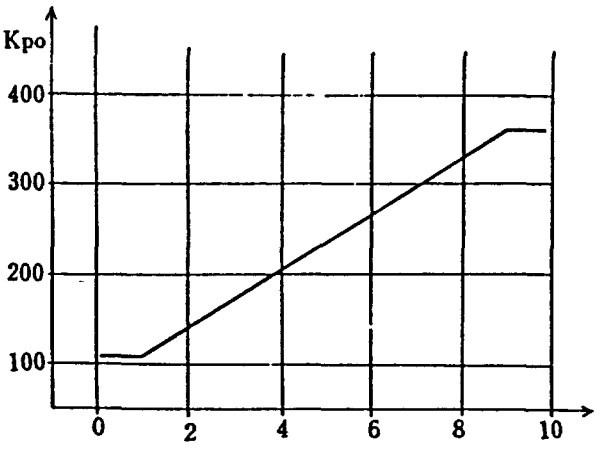
(3) Jumper pins

Jumper pins should be set in accordance with the table shown below. For location of each jumper pin, refer to Fig. 3 (8.3).

Table 3

Function		Abbre-viation	Description		Factory setting
In-position range magnifi-cation		X8	When this pin is set, in-position range set by "IN-P" dial is magni-fied 8 times.		No.
High SPM gain		KP	When this pin is removed, gain dur-ing operation increases. When high SPM gain is required, re-move the pin and set "R-GN" VR (po-tentiometer) properly.		Yes.
Positioning control loop gain		GNA	They are set so that positioning control gain is within a range from 25 to 50. Refer to 5(4).		Yes.
		GNB			Yes.
Level clear		LCR	When this pin is set, residual pulses in the deviation counter is set to zero (while "clear" signal is on). The pin is set when analog speed reference signal is used.		No.
Monitor	Speed	SPMO	This pin is set for use of speed monitor function. Output is ±10V/3000rpm.	Either one to be selected.	Yes.
	Torque	TOMO	This pin is set for use of torque monitor function. Output is ±9V/300%.		No.
Speed amplifier integral compen-sation time constant		IT1	This pin is set for $\frac{\text{Load GD}^2}{\text{Motor GD}^2} > 3$.	Over-shoot can be minimized for large load GD^2 when pin is set properly.	No.
		IT2	This pin is set for $\frac{\text{Load GD}^2}{\text{Motor GD}^2} > 5$.		

f_0 : Pulse frequency of speed reference signal



Relationship between VR "P-GN" setting and Kpo

Jumper pin setting		Ks
GNA	GNB	
×	×	4
×	○	2
○	×	1.33
○	○	1

○ : Jumper pin set

× : Jumper pin not set

Relationship between Ks and jumper pin setting

Example of setting:

When "P-RATE" is set to "4", "P-GN" to "3", and both jumper pins "GNA" and "GNB" are set, the positioning control loop gain is,

$$Kp = \frac{170}{4} \times 1 = 42.5 \quad S^{-1}$$

When motor is operated at 3000rpm, the number of residual pulses is as follows:

$$f_0 = \frac{P_f}{\text{P-RATE}} \cdot \frac{N_0}{60} = \frac{8000}{4} \times \frac{3000}{60} = 100 \times 10^3 \quad \text{PPS}$$

P_f : Number of positioning feedback pulses (8000 pulses)

N_0 : Motor speed (rpm)

$$\varepsilon = \frac{100 \times 10^3}{42.5} = 2353 \quad \text{pulses}$$

② For application where positioning is repeated frequently

o Remove jumper pin "Kp".

o Set VR "R-GN" to 0/10 position and set "P-GN" and jumper pins "GNA" and "GNB".

6. OPERATION

6.1 Check to be accomplished before starting operasion

After the completion of installation and wiring, perform the following check:

(1) Check the wiring again.

- o Are the DC supply lines P and N wired properly?
- o Is the motor phase sequence (U: red, V: white and W: black) correct?
- o Is AC power supply not connected to the servo amplifier output?

(2) Is short-circuiting not caused by wire chip, swarf or any other metal chip?

(3) Are terminal screws and other screws not loose? Tighten loose screw if found.

(4) Is any conductor or cable not tense excessivly?

(5) Are the motor and machine ready for operation?

(6) Are jumper pins in the servo-amplifier set properly?

6.2 Initial operation

(1) Normal operation

① After making sure "SERVO ON" signal is not given, turn on the power.

[CHARGE] lamp on the power unit and [PWR] lamp on the servo-amplifier will light.

② After making sure positioning command signal is not input, turn on "SERVO ON" signal.

[SON] lamp will light and the motor is energized, but held locked in the current position (servo lock condition).
Check that "INP" lamp lights brilliantly. If the lamp

6.3 Safety against power failure

(1) The input power circuit (power unit primary circuit) should have a "holding function" that prevents automatic restart when the power is restored after power failure.

(2) For use of a motor equipped with magnetic brake, start signal must be turned on after the magnetic brake is released.

(3) The magnetic brake is used for prevention of fall of load. Therefore, use it only for braking in case of power failure or emergency stop.

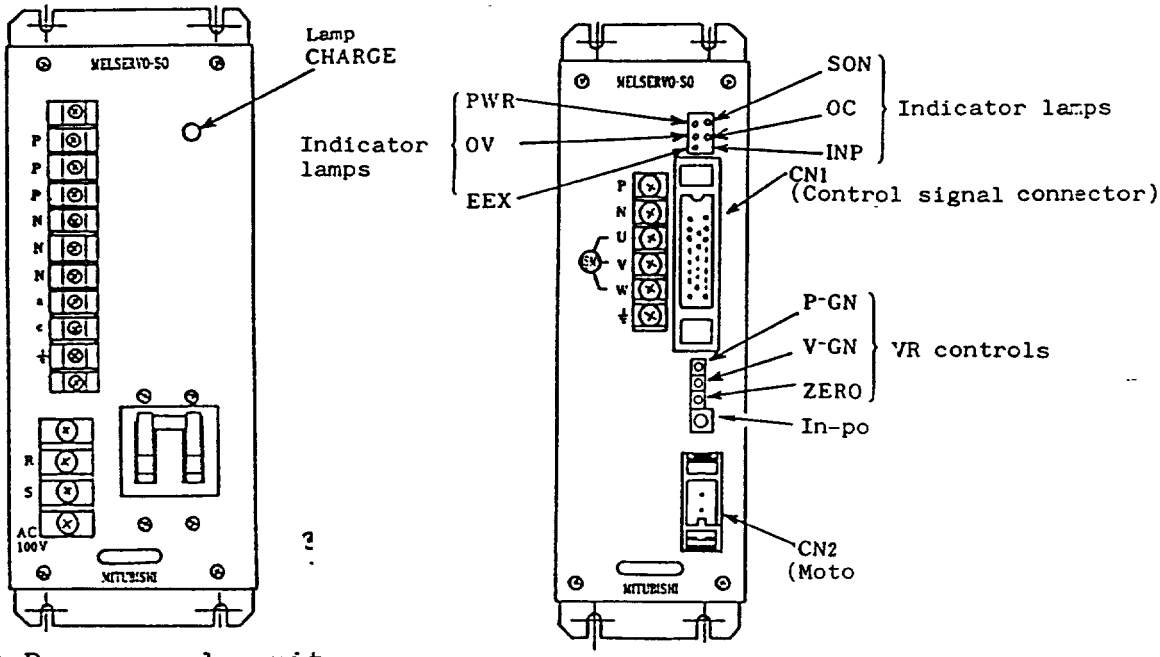
6.4 Indicator lamps

The servo-amplifier and the power unit have the indicator lamps listed in Table 4.

To monitor operation of the servo-amplifier and the power, or to trace back trouble to the cause, see these lamps. For location of each lamp, see Fig. 2.

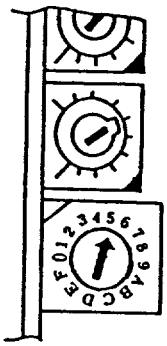
Table 4 Indicator lamps

Name	Symbol	Description	Unit
POWER	PWR	Lights when the power is turned on and the system is fed with the power.	Servo-amplifier
SERVO ON	SON	Lights when "SERVO ON" signal is given. The lamp becomes brighter when speed reference pulses are input.	
IN-POSITION	INP	Lights when motion reaches the in-position range, or when speed reference pulses is reduced to ±3 pulses. The lamp becomes brighter when positioning is completed and residual pulses are ±3 pulses.	



(a) Power supply unit

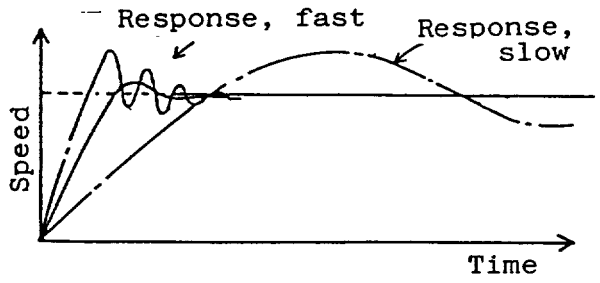
(b) Servo amplifier



VR controls have a scale of 10 graduations (0, 1, 2 .... 10).
Setting is "0" when it is turned counter-clockwise unti it stops, and "10" when fully turned clockwise.

The dial shown to the left has a scale of 16 graduations (0, 1, 2 .... F).

Fig. 2 Unit panel front view

Name	Sym-bol	Function and adjustment	Setting at shipment
			
Position control ZERO adjustment	ZERO	In normal operation, readjustment of this VR is not required. It is set so that "INP" lamp becomes brightest when motor is in "servo lock" condition.	"5"
GAIN adjustment during operation	R-GN	This adjustment can be made when jumper pin "Kp" is removed. Positioning motion becomes faster when it is turned clockwise. Note that excess setting may cause hunting. Standard setting: "3" - "5"	"0"

Note: If load inertia is too large and desired response cannot be obtained by changing setting of V-GN, set P-GN to slightly larger gain and decrease setting of P-GN.

Note: To check signal waveform, use an synchroscope placed above the ground (insulated from the ground).
When checking, use care not to allow the synchroscope probe to come into contact with a live part other than check pin.

To check speed feedback signal, connect the synchroscope across check pins [VF] and [AG].

For location of each check pin, refer to Fig. 3 "P.C.

8. MAINTENANCE

Since the servo-amplifier is of solid state type, daily check and maintenance is not required.

It is, however, recommended that it is inspected at least yearly.

The brush-less servo-motor does not require periodic maintenance.

8.1 Caution on inspection

To check the servo-amplifier under operation, measure voltages and currents referring to the instruction described under paragraph 9.2, and using care to avoid electric shock (refer to para. 9.1).

8.2 Parts and devices to be checked

① See the servo-amplifier interior if dust is deposited and remove the dust if found.

② Check terminal screws on terminal blocks for looseness and retighten loose screws if found.

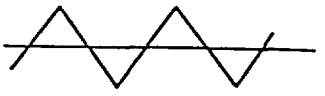
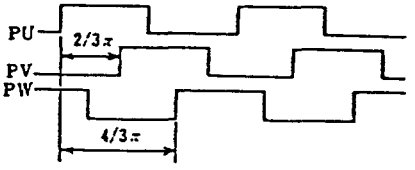
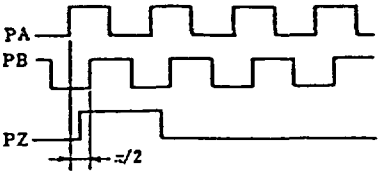
③ Check the parts and devices for condition (discoloration due to heat, damage, breakage of conductor, etc.).

8.3 Consumable parts

The servo-amplifier uses the fuse shown in the following list. If the fuse is blown out, replace it with the listed one or equivalent (the servo-amplifier is furnished with one spare fuse).

Amplifier model	Fuse	Rating	Manufacturer
MR-S053P	MF60NR10AS	10A	TOYO FUSE CO., LTD.
MR-S0103P			
MR-S0203P			
MR-S0403P	MF60NR15AS	15A	

GTX series, ASAHI, is also applicable.

Signal	Function	Voltage/waveform	CON1
CARRY	PWM control carrier	About 6Vp-p 3kHz 	Without
IFU,IFW	Current feed-back signal	1Vp-p/Rated current	Without
PU,PV, PW	Encoder out-put	PU, PV and PW outputs are in the following phase sequence when the motor runs counter-clockwise. 2p/rev, 5Vo-p 	Without
PA,PB, PZ	Encoder output	PA, PB and PZ outputs are in the following phase sequence when the motor runs counter-clockwise. PA and PB outputs are 2000p/rev, and at 100kHz when the motor runs at 3000rpm. PZ output is 1p/rev, 5Vo-p. 	Without

9. TROUBLESHOOTING

9.1 Cautions on troubleshooting

If any trouble or failure occurs, perform check and repair with the cautions described below.

> THE SERVO-AMPLIFIER HAS A LARGE-CAPACITY CAPACITOR THAT HOLDS DC VOLTAGE FOR ABOUT 5 MIN. AFTER THE POWER IS TURN-OFF. WHILE THE SERVO-AMPLIFIER IS UNDER "LIVE" CONDITION, [CHARGE] LAMP (RED) ON THE POWER UNIT REMAINS LIGHTING. THEREFORE, BE CAREFUL TO PREVENT ACCIDENT SUCH AS ELECTRIC SHOCK.

> THE PORTIONS WHERE WARNING [HIGH-VOLTAGE] ARE GIVEN ARE AT HIGH VOLTAGE. CARE SHOULD BE EXERCISED TO PREVENT ELECTRIC SHOCK OR SHORT-CIRCUITING WHEN YOU GAIN ACCESS TO THESE PORTIONS.

> WHEN THE CONTROL CIRCUIT IS CHECKED FOR CONTINUITY, USE A MULTIMETER, BUT DO NOT USE A MEGGER OR BUZZER.

> DO NOT USE A MEGGER TO CHECK. OTHERWISE, THE SERVO-AMPLIFIER MIGHT BE SERIOUSLY DAMAGED.

Check:

(1) Does any alarm or warning lamp light?

(2) If alarm or warning lamp lights, identify the lamp.

(3) Is the failure or trouble reproducable?

(4) Are motor and servo-amplifier temperatures and ambient temperature normal?

(5) Did the failure or trouble occur during acceleration, or deceleration or constant-speed operation?
What was the speed when the failure or trouble occurred?

(6) Does the motor run in correct direction?

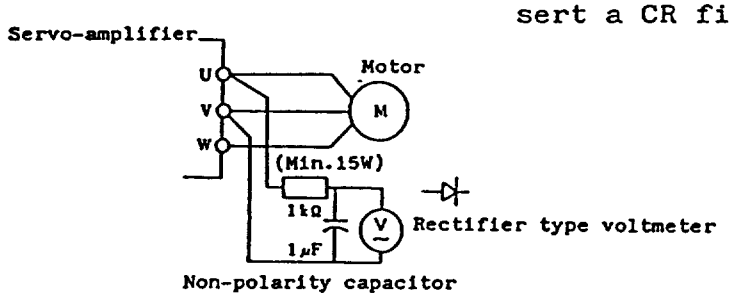
(7) Did instantaneous power failure occur?

9.2 Instruments used in check

The following instruments should be used to measure voltages, currents and wattages.

Ⓥ Power supply voltage ..... Moving-iron type or rectifier type voltmeter

Output voltage ..... Rectifier type voltmeter (insert a CR filter as shown below).



Ⓐ Output current ..... Moving-iron type

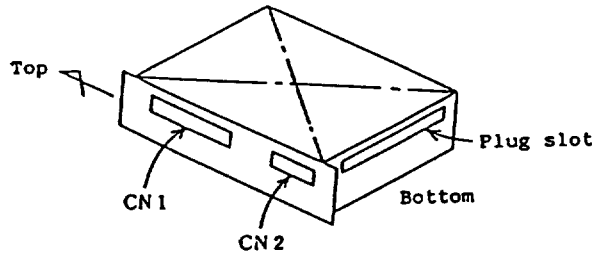
Ⓦ Wattage ..... Electrodynamometer

For measurement of voltages on control circuit terminals, use a multimeter.
When a synchroscope or digital voltmeter is used, its input current should be smaller than 1mA and it should not be grounded.

9.3 Control signal waveform check

To check waveforms of control signals, connect a synchroscope to pins of connector "CON1" (5046-12A, MOLEX).

For waveforms on check pins and location of each check pin, refer to Table 6 and Fig. 3 respectively.



Alarm lamp	Function	Cause	Check	Remedy
OC	Overcurrent protection	External noise	amplifieris equipped with surge absorber.	
	Overload protection	Excessively large load torque	o Measure motor temperature rise. o Measure the motor input current. o Check the load torque.	o Lighten the load. o Use a motor having larger capacity.
		Excessively heavy duty	o Measure motor temperature rise. o Check the operation pattern.	o Reduce the load torque and load inertia GD^2. o Change the operation pattern.
		Too long acceleration time	o Check the load.	o Reduce the load torque and load inertia GD^2. o Use a motor having larger capacity.
		Unstable control	o The detector (encoder) is defective. o The motor is connected to the servo-amplifier in wrong phase sequence.	o Replace the detector (consult the manufacture). o Connect in correct phase sequence.

Alarm lamp	Function	Cause	Check	Remedy
EEX		nected or short-circuited cable.		
	Overspeed protection	Motor speed is over 115% of rated voltage.	o Speed setting is improper. o Speed reference signal voltage is not within ±10V. o Overshoot is excessive. o Load causes rotation to motor.	o Properly set speed. o Change setting of [V-GN]. o Change operating conditions or use a motor having larger capacity.
	Excess error	Difference in number of pulses between input pulses and feed back pulses is more than 4096.	o Acceleration/deceleration time o Other protective function trips.	o Prolong acceleration deceleration time, or reduce load torque. o Use a motor having larger capacity. o See indicator lamp.

Model		MR-S053P	MR-S0103P	MR-S0203P	MR-S0403P
	Altitude	Max. 1000m above sea			
	Vibration	Max. 0.5G			
Weight		2.2	2.4	2.4	2.6

(2) Servo-motor

Model		HA-S053	HA-S0103	HA-S0203	HA-S0403
Rated output (W)		50	100	200	400
Rated torque (kg.cm)		1.62	3.25	6.5	13.0
Rated speed (rpm)		3000			
Permissible maximum speed (rpm)		3500			
Max. torque (kg.cm)		4.86	9.75	19.5	39.0
Power rate (kW/S)		3.9(3.1)	9.2(8.1)	9.1(7.0)	13.6(10.4)
Inertia	J ($kg.cm.S^2$)	0.066×10^{-3} (0.084×10^{-3})	0.11×10^{-3} (0.128×10^{-3})	0.45×10^{-3} (0.59×10^{-3})	1.2×10^{-3} (1.6×10^{-3})
	GD^2 ($kg.cm^2$)	0.26(0.33)	0.44(0.51)	1.77(2.30)	4.8(6.2)
Weight (kg)		1.6(2.1)	1.9(2.4)	3.0(3.8)	5.0(6.2)
Ambient temperature		0 to 40°C			
Magnetic brake	Rated voltage (V)	DC24V			
	Capacity (W)	7		8	10
	Static friction torque (kg.cm)	4.0		9.0	17
	Inertia J ($kg.cm.S^2$)	0.018×10^{-3}		0.14×10^{-3}	0.40×10^{-3}
	Inertia GD^2 ($kg.cm^2$)	0.07		0.53	1.4

Note: Value in ( ) shows that for motor equipped with magnetic brake.

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP