BNP-A2833B-E

MITSUBISHI CNC

MELDAS AC SERVO MR-S Series

MAINTENANCE MANUAL

M0220-ES MR-S1 MAINT MAN BNP-A2833-B

ADVANCED AND EVER ADVANCING

MITSUBISHI ELECTRIC

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1. OUTLINE OF S SERIES AC SERVO SYSTEM

1.1 FEATURES OF THE S SERIES SERVO SYSTEM

(1) This system can be connected to the NC of the Meldas M300 series.

(2) Serialized for AC servo.
The AC servo motor HA series, featuring outstanding response and ease of maintenance, is used; it provides a wide range of output.

(3) Outstanding response and reliability with digital control
Control by means of volume controlwith analog circuit previously employed, have been completely replaced with TG race and digital control—realizing superb response repeatability and reliability (standard specification).

(4) The use of electronic gear.
The employment of the electronic·gear has reduced the number of different types of detectors, which had been previously used. The indexing angles of the motor can be commanded by the software thus simplifying the procedure for designating specifications.

(5) Compact converter and reduction of number of cables.
Compactness has been achieved by placing the converter (rectifier unit and condenser unit), used in the AC input circuit, in the amplifier container, while reducing the number of cables required.

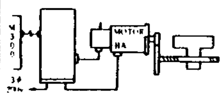
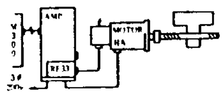
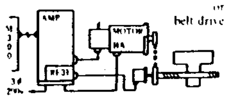
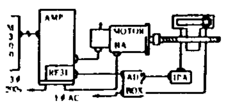
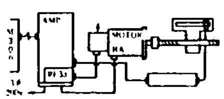
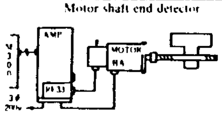
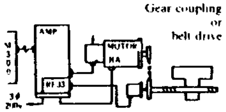
(6) Enhancement of reliability by reducing the number of parts (number reduced by one-half over previous model).
By digitalizing operation, the level of the system's integration has been raised, while the number of parts have been reduced and reliability increased.

(7) System's intelligence has been enhanced.
The servo side and the host (NC) is linked by a data path, thus, the reception of control parameters and transfer of self-diagnostics are possible.
The system is designed to be amenable to auto-tuning in the future; it will be able to adapt to control requirements under software command.

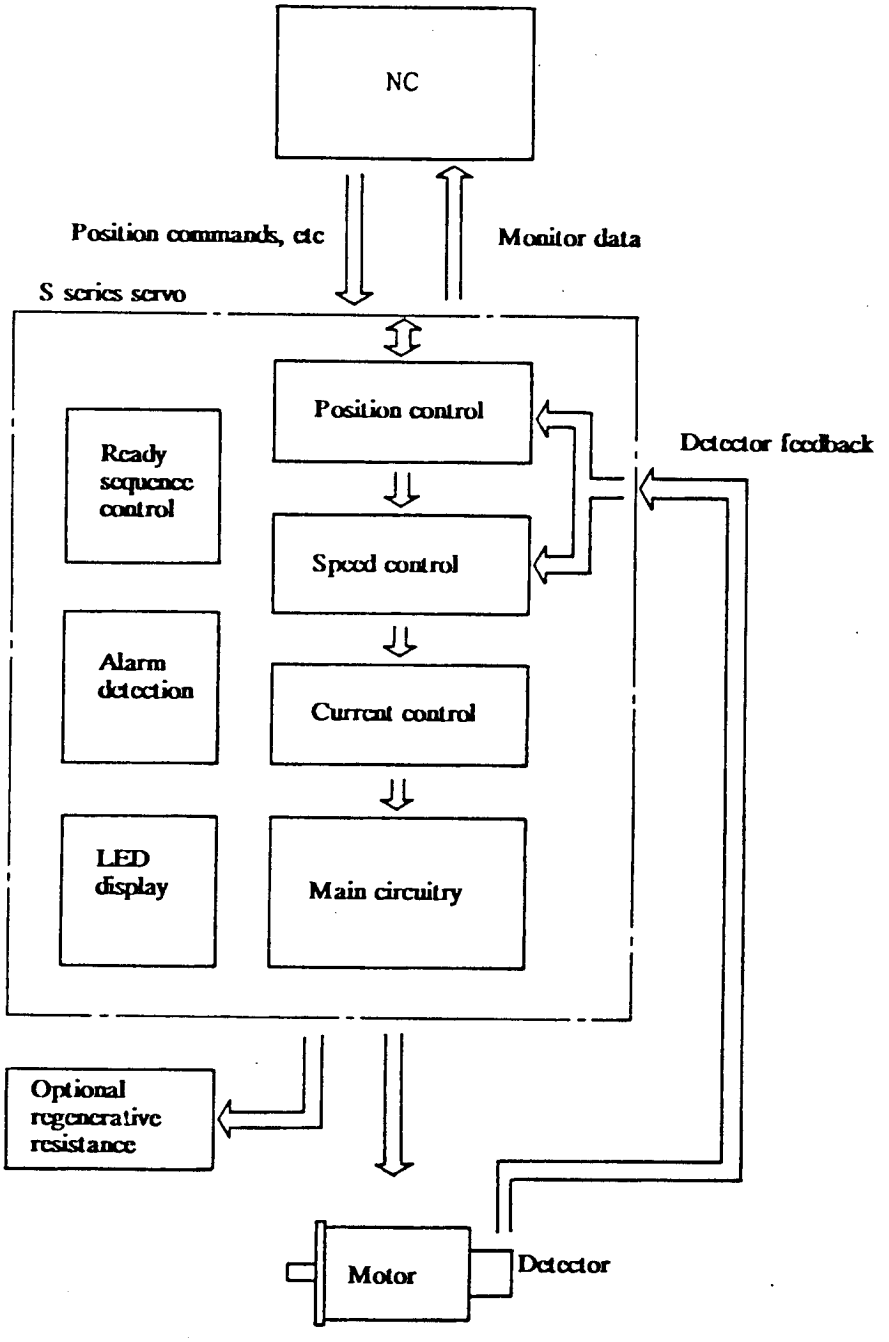
(8) Optional system for detecting absolute value.
An absolute value detection system, by which there is no need for return to zero point, when power is turned on, is optional.

(9) High precision assured with 0.1 μm/pulse commands.
In addition to the 1 μm/pulse commands which constitute the standard specification, the submicron (0.1 μm/pulse) optional specification is also available so that even higher levels of precision can be achieved.

1.2 LIST OF S SERIES SERVO SYSTEMS

System and system configuration figure		Command	System capacity	[illegible]				Cable name		Remarks
				Servo amplifier model	Optional unit	[illegible]	[illegible]	[illegible]	[illegible]	
Incremental detection Semi-closed loop	Motor shaft end detector 	Micron	Standard specifications Maximum follow-up capacity 1 Mpps Minimum resolution 0.018° p (motor shaft end) Maximum speed 3000 rpm Maximum speed is limited by motor used	MR-S□-E-01		OSE5K-□-□S (OSE5K)		CN2K Short wire L = 7.5m N541C583 L = 7.5m N541C582		As motor shaft end detector TS5132N82 will be used after November 1986
		Submicron	Optional specifications Maximum follow-up capacity 2 Mpps Minimum resolution 0.0036° p (motor shaft end) Maximum speed 1200 rpm	MR-S□-E-33	RF-33	OAER25K-3X 3-□-□S (OAER25K-3X)		CN33K□ L=□ 2m N541C616		
Incremental detection Closed loop Ball screw end detection	Motor shaft end detector Gear coupling or belt drive 	1 micron	Special specifications Maximum follow-up capacity 1 Mpps (ball screw end) Minimum resolution 0.018° p (ball screw end) Maximum speed 3000 rpm (ball screw end) Maximum speed is limited by motor used	MR-S□-E-31	RF-31	OAER25K-3X-3 S-10S (OSE5K)	OSE5K-ET [illegible] Connector [illegible]	CN2K	CN31R	
Closed loop Scale feesback	Motor shaft end detector 	1 micron	Special specifications Maximum follow-up capacity 1 Mpps Minimum resolution 1 μm or 0.5 μm Maximum speed 3000 rpm System capacity is limited by motor used and scale	MR-S□-E-31	RF-31	OSE5K-6-S-10S (OSE5K)	Scales with 1 μ 0.5μ specification pulse feedback output can be connected	CN2K□	CN31M□	
	Motor shaft end detector Interface unit 	Submicron	Special specifications Maximum follow-up capacity 2 Mpps Minimum resolution 0.1 μm Maximum speed 1200 rpm System capacity is limited by scale used	MR-S□-E-33	RF-33	OAER25K-3X-3 S-10S (OAER25K-3X)	Scales with 0.1μ specification pulse feedback output can be connected	CN33K□	CN31H□	
Absolute detection Semi-closed loop	Motor shaft end detector 	1 micron	Optional specifications Maximum follow-up capacity 1 Mpps Minimum resolution 0.018° p (motor shaft end) Maximum speed 3000 rpm Maximum speed is limited by motor used	MR-S□-Z-33	RF-33	OAER5K-3X-3-S-10S (OAER5K-3X)		CN33K□		
Absolute detection Closed loop Ball screw end detection	Motor shaft end detector Gear coupling or belt drive 	1 micron	Selected spedifications Maximum follow-up capacity 1 Mpps (ball screw end) Minimum resolution 0.018° p (ball screw end) Maximum speed 3000 rpm (ball screw end) Maximum speed is limited by motor used	MR-S□-Z-33	RF-33	OSE5K-6-S-10S (OSE5K)	OAER5K-3X-ET [illegible] Connector direction	CN2K□	CN33R□	

Given below is a block diagram of the servo system functions.



2. REGULAR MAINTENANCE

2.1 INSTRUMENTS AND TOOLS USED FOR MAINTENANCE

(1) Measuring instruments
Listed below are the measuring instruments required to verify that the power is being supplied properly to the servo amplifier and that the servo amplifier is properly connected.

Instrument	Conditions	Application
Tester		For verifying whether servo amplifier has been connected properly before power is switched on
Oscilloscope		For general measurements and troubleshooting
AC voltmeter	AC supply voltage measurement Tolerance: Less than ; ± 2%	For measuring AC supply voltage which is supplied to servo amplifier
DC voltmeter	Maximum scale graduation: 10 V, 30 V Tolerance: Less than ; ± 2%	For measuring DC supply voltage
AC ammeter		For measuring AC current supplied to motor

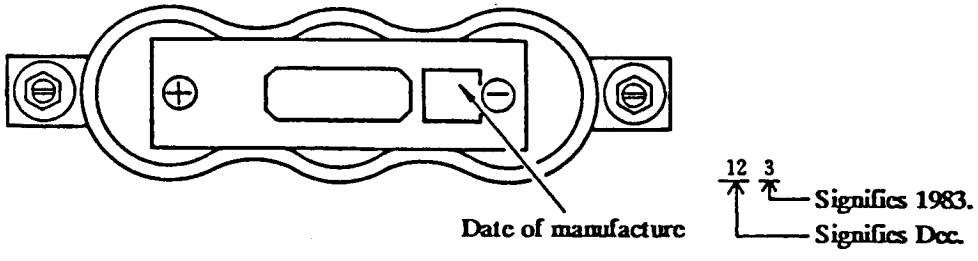
Table 2.1 Measuring instruments used for maintenance

(2) Tools
Large- and medium-sized Phillips head screwdriver Small flat-head screwdriver

2.2 Replacing the battery

The data in the absolute position detection system are retained by a battery which is mounted on the RF33 card.
A highly reliable button (storage) battery is employed and defective contact is eliminated by screwing it down to the circuit board. Battery back-up time: 1 month
Service life of battery: 3 years (depends on operating temperature) The service life of the battery extends for approximately 3 years and so it should be replaced at an early date before its service life is completed.
(When the battery alarm display appears, it means there is a danger that the absolute position data will be lost.)
Storage battery used: GB250-3FB2

Storage battery used: GB250-3FB2



This battery is made according to special specifications in order to ensure a high degree of reliability and, as such, it should be purchased from MELDAS. When the system is shipped from the MELDAS manufacturing plant, this battery is fully charged.

How to replace the battery.

1. Switch off the NC power and set the input AC 200/220 V power NF ON. (The input power is supplied to the servo amplifier.)

NOTE: The absolute position data will be erased if the battery is r eplaced with no input power (AC 200 V/220 V) supplied to the servo amplifier.

2. Use a screwdriver to remove the two screws which anchor the battery to the circuit board.
3. Mount the replacement battery using the screws, taking care to align its polarities correctly.

NOTE: The battery will be damaged if its polarities are not aligned properly. Remember that power is still being supplied and so the screwdriver should not be brought into contact with any other parts.

4. Switch the NC power back ON and check that everything is in order.

3. INSTALLATION AND ADJUSTMENT PROCEDURE

Bear in mind the following checkpoints when installing the servo amplifier.
If these checkpoints are neglected, the amplifier may not do full justice to its performance.

3.1 ENVIRONMENTAL CONDITIONS

The environmental conditions listed below are the conditions relating to the installation location of the cabinet or pendant control panel which is designed and manufactured by the machine builder. Therefore, in order for these conditions to be met, the checkpoints relating to the installation of the amplifier in Section 3.5 should be strictly adhered to.

(1) Ambient temperatures: 0 to 55°C during operation
-55 to 70°C during storage

(2) Ambient humidity
Max. 90% relative humidity during operation (no dew or condensation)
Max. 90% relative humidity during storage
High levels of humidity and moisture cause a deterioration in the insulation and accelerate parts deterioration. Although there is no need for special dehumidification measures, the system should not be installed in a location susceptible to humidity or moisture.

(3) Vibration
5 to 10 Hz, 2.5 mm amplitude
10 to 30 Hz, 1G
Shock: 5G, 10 to 12 ms

(4) Atmosphere
Avoid using the system in an environment characterized by high concentrations of dust or dirt and of spray type organic or corrosive gases.

3.2 INPUT POWER SUPPLY

(1) Input voltage: AC 200/220 V $^{+10\%}_{-15\%}$

(2) Power line frequency: 50/60 Hz ; ± 1 Hz, 3 phases

(3) Power consumption

Servo motor			3-phase power supply (servo amplifier input)	
Model Nominal (KW)		Max. speed (rpm)	Input KVA per axis with 100% output (1)	Input A per axis with 170V, 100% output (2)
HA40	0.5	2,000	1.0	3.4
HA43	0.5	3,000	1.0	3.4
HA80	1.0	2,000	1.6	5.4
HA83	1.0	3,000	1.6	5.4
HA100	2.0	2,000	2.7	9.2
HA200	3.5	2,000	4.7	16
HA300	4.5	2,000	5.9	20

NOTE: (1) The thermal KVA capacity of the power supply which is adequate is indicated in column (1) of the above table. However, when the motor accelerates, instantaneous power is required which is two to three times the power listed in the table. This means that the power supplied to the servo amplifier connector should be affected by minimal voltage fluctuation so that a voltage range of 170V to 242V can be maintained.
(2) See column (2) for the current capacity of the power supply.
(3) The power capacity applying when a multiple number of axes are used is equal to the sum of the capacities of each individual axis. For instance, the power requirement for using 3 axes, HA80 + HA100 + HA300, simultaneously is 10.2 KVA, 34.6A.

NOTE: (4) If it is clear that the motor cannot be operated at its maximum rpm due to limitation on the part of the machine or detector, the "nominal (KW)" listing of the motor will be reduced and, as a result, the values in columns (1) and (2) will be reduced. The values in column (3) remain unchanged.

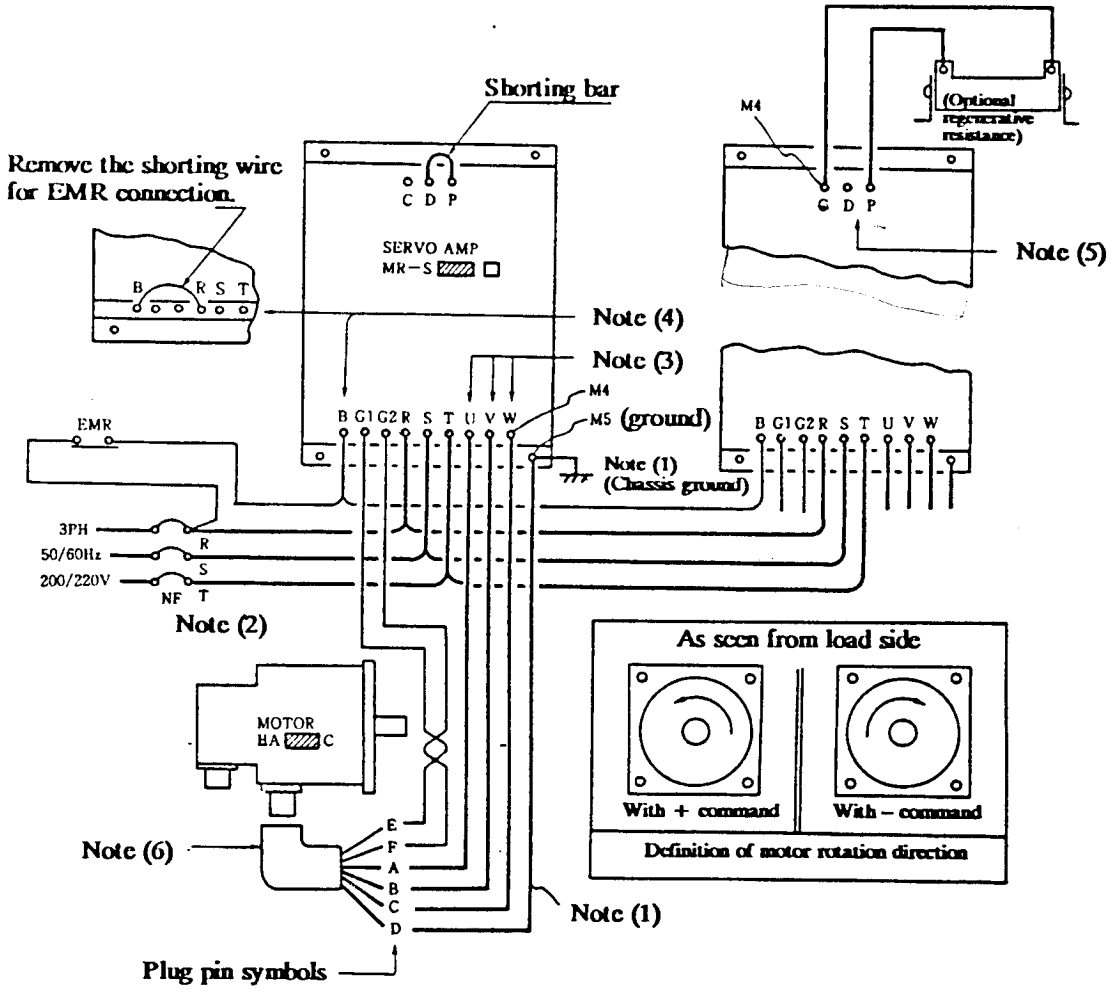
(5) If the duty rating of the machine is not known, use the values in column (3) for designing the thermal requirements of the power board and other cabinets. Depending on its duty, the heat dissipation of the actual machine will be somewhere between the values in column (3) and (4).

(4) Input transformer

Insert a power transformer into the input with any supply voltages which is not listed above.

3.3 MAIN CIRCUITRY WIRING

3.3.1 CONNECTIONS DIAGRAM



Notes:

(1) A 200V class of servo amplifier is used. There is no need for a power transformer provided that the power supply specifications are satisfied. A step-down insulating transformer should be used with a class 400V servo amplifier or above. A transformer is not provided in the main circuit area and so this area must be grounded. The above figure does not show the power transformer provided for export specifications.

(2) The power supply terminals R, S and T of the servo amplifier may have any phase sequence. However, when many axes are used, connection should not be made between terminals with different symbols.

(3) Precautions for connecting the servo amplifier terminals U, V, W

(a) The phase sequence relationship between the servo amplifier terminals U, V and W and the motor pins A, B and C must be strictly adhered to. An incorrect phase sequence can lead to motor vibration or rapid rotation, and is dangerous.
It is not possible to make the motor run in reverse by changing the phase sequence.

(b) Under no circumstances should the connections be made so that there is a danger of power being supplied to the U, V and W output terminals of the servo amplifier.
Also avoid connections where there is a danger of the U, V and W output terminals of the servo amplifier being grounded or connected to ground in error. This may damage the servo amplifier.

(4) Servo amplifier terminals B and R are connected by a shorting wire. This wire should be removed for EMR (emergency stop) connection. When the EMR contact opens, the servo operation will stop rapidly by the most reliable means.

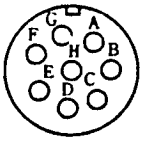
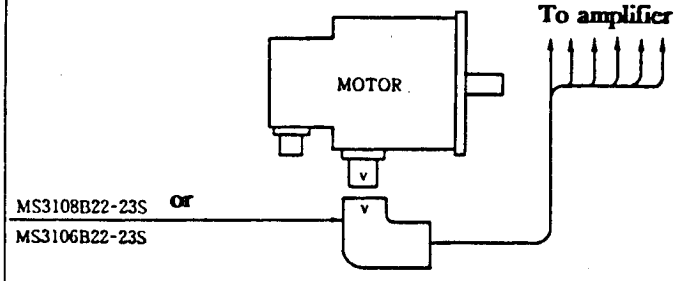
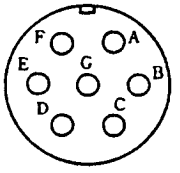
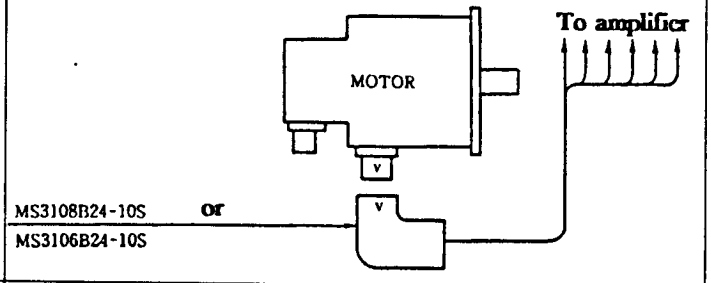
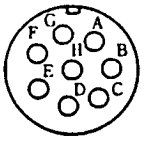
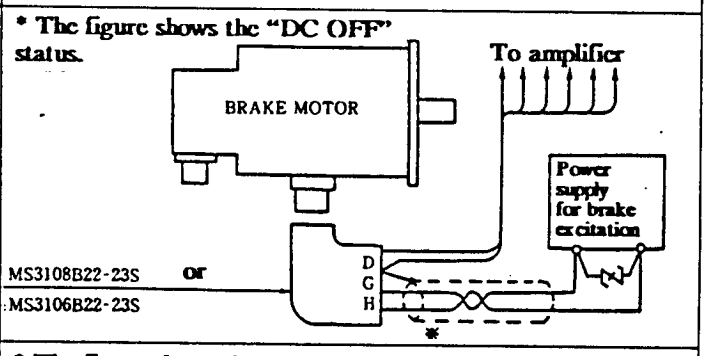
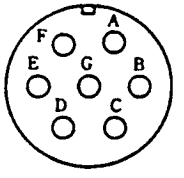
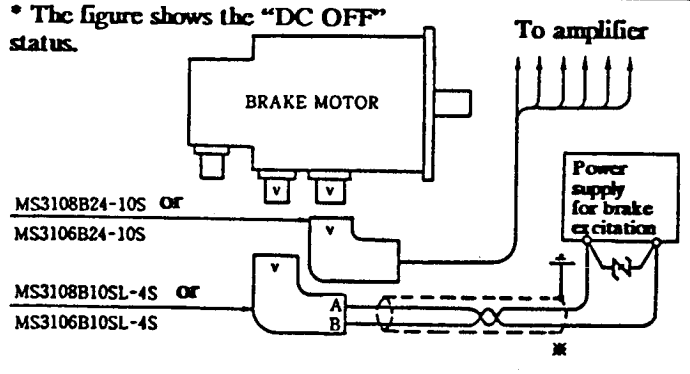
(5) Servo amplifier terminals D and C have been connected by a shorting bar. This bar should be removed and the connections made as shown in the figure when a regenerative option is employed. (Refer to Section 7.4.(6).)
The regenerative option will generate heat and so measures must be taken with the surrounding area and connected wires to safeguard against fire.

(6) The Cannon plugs which are used will differ according to the motor. If the motor has an electromagnetic brake, reference should be made to Section 5.2.2 for the connections diagram of the brake exciter circuit.
Reference should be made to Section 5.2.4 for the terminal box type of motor.

(7) The cautionary notes in Sections 4.1 and 4.2 should be strictly adhered to.

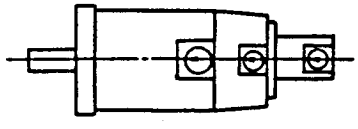
Connecting the EMR contact to the servo amplifier terminal B gives a 2-system configuration with different emergency stop functions (alarm codes 55 and 57). A current of approximately 30mA flows to the EMR contact per axis under 200V and 60 Hz power supply conditions. Once emergency stop occurs, it cannot be released unless resetting is performed at the NC unit even if the EMR contact opens again.

3.3.2 Cannon Plugs Used

Motor type	Motor end connector	Cannon plug used
HA40C HA43C HA80C HA83C	 MS3102A22-23P	
HA100C HA200C HA300C	 MS3102A24-10P	
HA40CB HA80CB	 MS3102A22-23P	
HA100CB HA200CB HA300CB	 MS3102A24-10P  MS3102A10SL-4P	

NOTE: (1) Select the MS 3108 angular plug, MS3106 straight plug cable clamp (MS3057) or a piping connector.

(2) The position of the Cannon connector key should be set in the motor flange direction.



3.3.3 CABLES USED

		Note (2)	Note (3)	Note (4)	Note (5)
	U, V, W (motor main circuit)	Grounding wire (motor ground)	G1, G2 (motor thermostat)	P, D (optional regenerative resistance)	For electromagnetic brake excitation
MR-S40 MR-S43	$2mm^2$ min ($3.5mm^2$ max)	$2mm^2$ min ($3.5mm^2$ max)	$0.5mm^2$ min ($3.5mm^2$ max)	$2mm^2$ min	$0.5mm^2$ min ($3.5mm^2$ max)
MR-S80 MR-S83	$2mm^2$ min ($3.5mm^2$ max)	$2mm^2$ min ($3.5mm^2$ max)	$0.5mm^2$ min ($3.5mm^2$ max)	$2mm^2$ min	$0.5mm^2$ min ($3.5mm^2$ max)
MR-S100	$3.5mm^2$ min ($8mm^2$ max)	$3.5mm^2$ min ($8mm^2$ max)	$0.5mm^2$ min ($3.5mm^2$ max)	$3.5mm^2$ min	$0.5mm^2$ min ($3.5mm^2$ max)
MR-S200	$5.5mm^2$ min ($8mm^2$ max)	$5.5mm^2$ min ($8mm^2$ max)	$0.5mm^2$ min ($3.5mm^2$ max)	$5.5mm^2$ min	$0.5mm^2$ min ($3.5mm^2$ max)
MR-S300	$5.5mm^2$ min ($8mm^2$ max)	$5.5mm^2$ min ($8mm^2$ max)	$0.5mm^2$ min ($3.5mm^2$ max)	$5.5mm^2$ min	$0.5mm^2$ min ($3.5mm^2$ max)

Notes:

(1) The cables siyes contained inside the parentheses in the above table indicate for reference purposes the restriction imposed by the dimension of the cap soldered to the Cannon plug cap.
(2) The "internal regulations" relating to the identification of the grounding wires are indicated for reference purposes.

140-14 Green marking for grounding wires

1. Except in the instances described below, the grounding wires for grounding work must be marked in green.

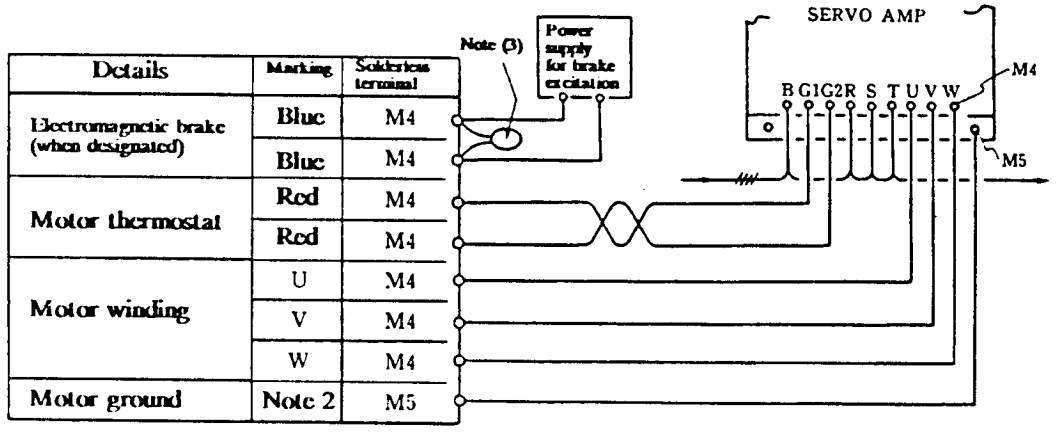
[1] When the cable can be identified at a glance as a grounding cable such as when, for instance, the grounding cable is connected separately from other wires or cables
[2] When, in cases where one conductor in a cable, tough rubber sheathed cable or cord each with a multiple number of conductors is used as the grounding wire, that conductor is a bare wire or it has a green or yellow striped pattern
Note:
In cases where one conductor in a calbe, tough rubber sheathed cable or cord each with a multiple number of conductors is used as the grounding wire, no other conductor except that with the green or yellow striped pattern must be used as the grounding wire.

2. If it is absolutely necessary that any other conductor except that with the green or yellow striped pattern must be used as the grounding wire, green-colored tape must be used at the end or in an appropriate location to identify that this is the grounding wire.

(3) Twist the G1 and G2 connecting wires.
(4) The regenerative option generates heat and so flame-resistant wires must be used or the wires must be subjected to some kind of flame-resistant treatment.
(5) Use shield wires for electromagnetic brake "DC OFF."
(6) Select wires with excellent beinding properties if the operating conditions of the motor are such that the motor will move.

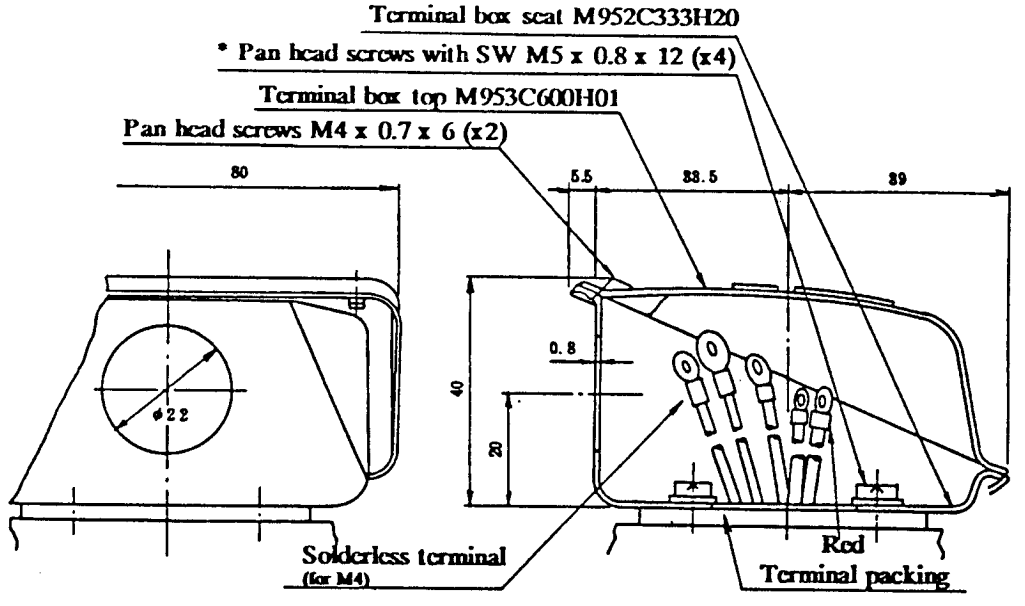
3.3.4 Terminal Box Motors (Special Models)

Details	Marking	Solderless terminal
Electromagnetic brake (when designated)	Blue	M4
	Blue	M4
Motor thermostat	Red	M4
	Red	M4
Motor winding	U	M4
	V	M4
	W	M4
Motor ground	Note 2	M5



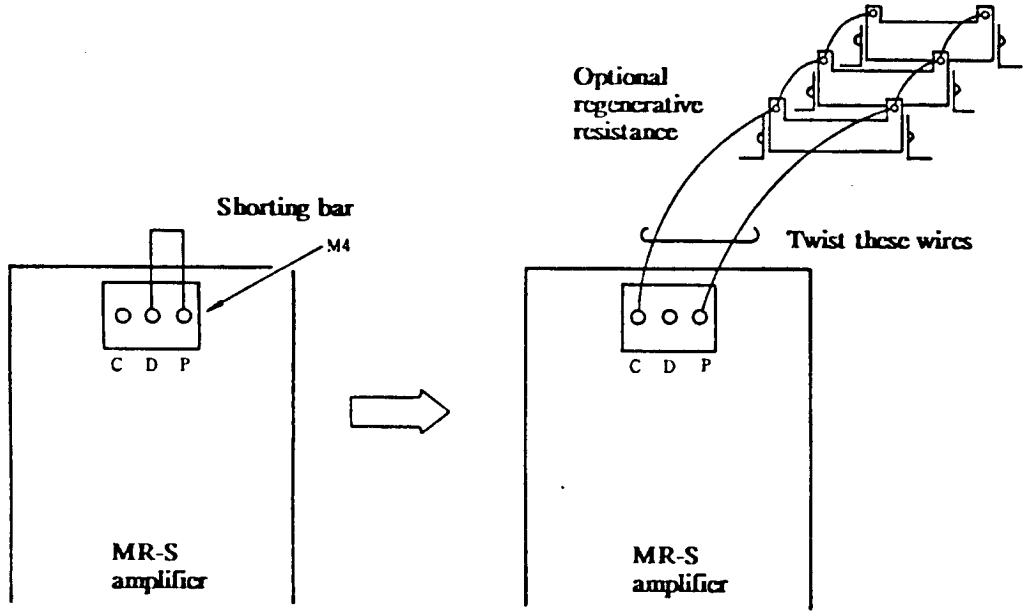
1) Pay attention to the model name of the servo motor since the terminal box type of servo motor is a special product.
(HA40 — HA300, HA40B — HA300B)
2) Use one of the screws marked with an asterisk * in the figure below as the grounding terminal.
3) When an electromagnetic brake is provided, a surge absorber (ECR-C10DK221) can be installed inside the motor terminal box. Installation procedure diagram N109D132.

Detail of motor terminal box



- The direction of the 22 mm diameter hole can be changed in 90° increments for this terminal box. The terminal box is shipped from the manufacturing plant in the state which is shown in the outline drawing. The direction can be changed by removing the screw shown in the figure by the asterisk.
- When a spare part is required because the corresponding part has been damaged, make a note of the parts number shown in the figure and order from your MITSUBISHI representative.

3.4 OPTIONAL REGENERATIVE RESISTANCE CONNECTIONS



Standard type

Optional regenerative resistance type

NOTE: 1. With the standard type of amplifier, remove the shorting bar connected to the D and P terminals, and connect the optional regenerative resistance to the P terminal.

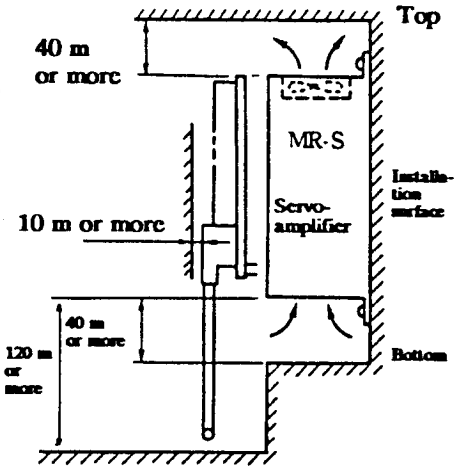
NOTE: 2. Change the servo parameter ORT (regenerative time constant) data.

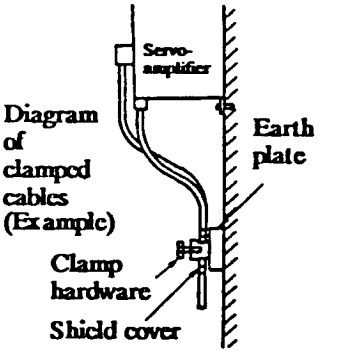
	Standard	Optional regenerative resistance
ORT	4680	3010

NOTE: 3. Use three optional regenerative resistances for one axis. Use wires which are at least 2.0 mm thick.

3.5 PRECAUTIONS ON INSTALLING THE SERVOAMPLIFIER

(1) The servoamplifier is designed to be installed in a cabinet for containing a high-voltage distribution panel. Do not install the cabinet where it will be directly exposed to sunlight, near heat-emitting bodies and outdoors.
(2) The ambient conditions within the cabinet (temperature, humidity, vibration, atmosphere) must conform to conditions listed in Item 3.1, "Specifications on the servoamplifier." The cabinet to be used with cutting machine tools must be the sealed type; the cabinet should be designed in accordance with "Meldas 300 series connection manual," for BNP-B3484.
(3) The servoamplifier is designed to hang on a wall; be sure to fasten it securely vertically (so that the printed circuit board is visible from the front of the cabinet) on the cabinet's wall with bolts. (See diagram below).
(4) Install the servoamplifier in a location, where it can be inspected and replaced easily. On the ambient space required for installing the servoamplifier, see the diagram of the external dimension for installing it.
(5) The servoamplifier will dissipate some heat; hence, other equipment and parts must be installed at a relevant distance above and below it so that heat will not accumulate in its immediate vicinity. (See illustration).
(6) When the interior of the cabinet is cleaned with compressed air in order to blow away adhering dusts, avoid blasting the servoamplifier.
(7) Since the regeneration option generates heat, when it is to be used frequently, its temperature will rise to a high degree. Therefore, do not install it against a weall that will be adversely affected by heat. Furthermore, in the case of models where two or more resistances are used in parallel, they must be spaced apart adequately—more than 70 mm apart.
(8) For noise abatement of the servoamplifier, see "Meldas 300 series connection manual."
(9) The bus cable connecting the servoamplifier (excepting the AMP-AMP cable that is less than one meter long), the detector cable, and the detector cable leading to the detector's I/F box must be clamped as illustrated. In addition to serving to securely support the cable, it also serves to shield the cable. The proper installation of the cables is necessary to prevent misoperation of the system from noises generated from ignoring this precaution. For details on the proper installation of the cables, refer to "Meldas 300 series connection manual."





3.6 PRECAUTIONS ON INSTALLATION OF SERVOMOTOR AND DETECTOR

(1) PRECAUTION AGAINST OIL AND WATER

a.) The servomotor is not strictly proof against oil and water. Therefore, adequate precautions must be taken to prevent cutting fluids and lubricants from contaminating the servomotor. If cutting fluids and lubricants invade the servomotor, the insulation of its coil may deteriorate; if the interior of the detector is contaminated, it may cause disfunction.

b.) If the cutting fluid, etc. are likely to contaminate the motor, a protective cover must be placed over the motor. Make sure that the protective cover is properly designed to adequately protect the motor.

c.) If the servomotor and detector are to be used in an environment where their large protective covers are inadequate to prevent them from being contaminated by a large quantity of cutting fluid, we recommend you to use the "P" type, which are designed to protect the servomotor and detector from contamination from liquid sprays.

d.) Do no install the servomotor where a part of it will be immersed in oil or water. If the motor is to be installed near the floor, constant drainage of the floor must be maintained; also pileup of chips on the floor must not be permitted.

e.) Adequate drainage of oil and water on the mobile table and slide cover must be maintained. Make sure that:

(1) The motor on a mobile mounting does not move under a drainage hole for draining oil and water.

(2) Oil and water accumulated on top of the slide cover or table do not splash on the motor when the slide cover or table moves.

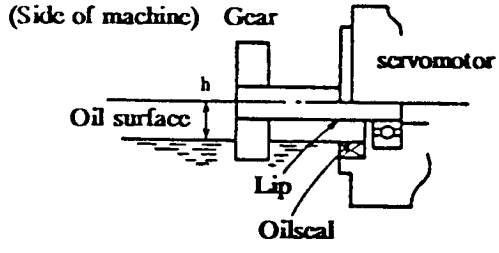
(3) Oil and water accumulated on the slide cover do not drip onto the motor from the wiper when the cover shrinks or stretches.

f.) The servomotor must be installed,where it is not exposed to contamination from oil and water, ventilation is good, its installation and removal can be done easily.

(2) PRECAUTION AGAINST GEAR OIL

a.) The servomotor can be installed with the shaft positioned horizontally or with the shaft positioned vertically. If the shaft is mounted facing up vertically, precautions must be taken to prevent oil of the machine's gear box dripping down into the motor. In this case, the oil seal on the shaft is not adequate for preventing contamination from the dripping oil.

b.) Regarding the oil level and pressure in the gear box: The oil level in the gear box must always be lower than the lip of the oil seal of the servomotor's shaft, while it is being installed, and likewise when it is in operation or stationary. When the oil level is above the level of the oil seal, oil may leak into the motor. Some servomotors are not equipped with oil seal on the shaft end; make sure you are ordering the required type of motor. Provide the gear box with a ventilation hole to prevent atmospheric pressure from buiulding up inside the box.

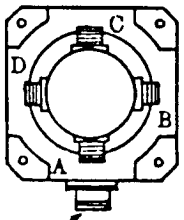


MODEL	HA40 HA80	HA100 HA200 HA300
Height from center of motor shaft. h = mm	20	25

(3) DETECTOR

a.) Take adequate preventions to avoid shocks on the servomotor's detector while it is being hauled and installed. Provide it with a protective cover against things banging against it, tools dropped on it, and workers sitting or mounting on it. Avoid a design of the machine that requires pounding a coupling on the motor shaft because it may damage the detector.

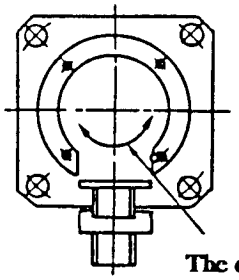
b.) The installation of the machine should be designed with the detector's connector connected on the "A" side, as illustrated.
The connector can be connected in the other three directions (B, C and D); however, then the installation of the servoamplifier becomes complicated and errors in installing it may occur. Therefore, installation other than in the "A" direction should be avoided as much as possible.



Symbols of direction in which the detector's connector can be connected. (The "A" side is standard.)

Terminal box or the motor's connector

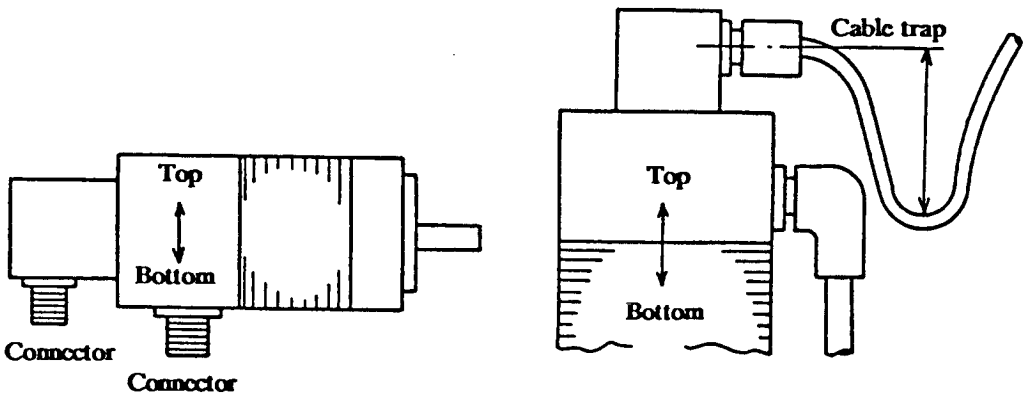
c.) The motor and the detector have been accurately matched (their polarities are matched) at the factory. If the detector is replaced with another kind or if the direction of the connector is changed, regulation of the motor may become impossible or cause overspeeding.
The factory matched relationship between the detector and the motor should not be changed.



The direction of the connection should not be changed.

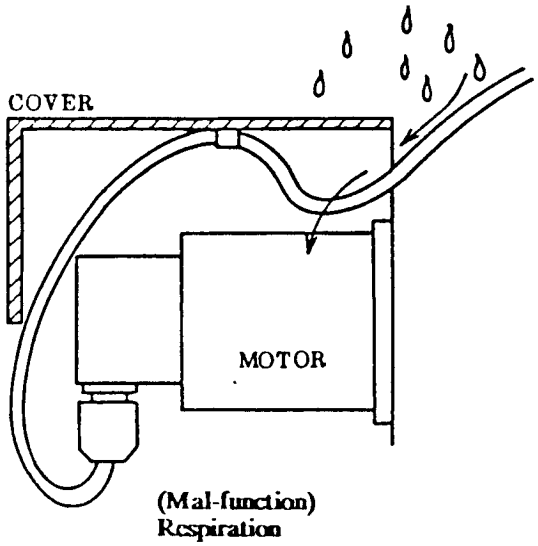
(4) CONNECTOR AND CABLE

a.) The connector should be faced downwards.
If the motor is to be installed vertically or slantwise, install a trap on the cable.

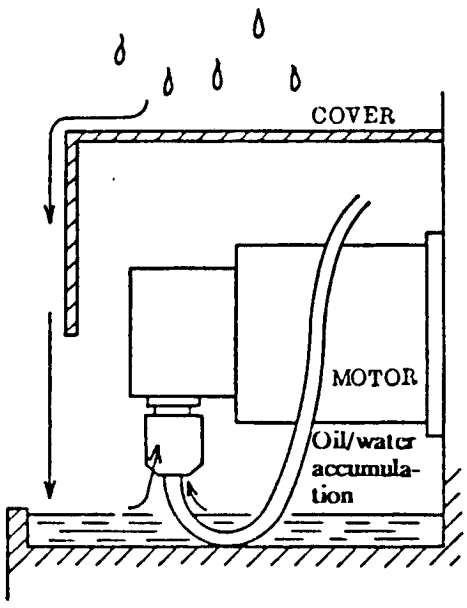


b.) The standard Canon plug is not waterproof.

c.) Oil and water may be conducted by the cable onto the motor and detector; as a result, they may be damaged. Make sure that oil and water are not conducted by the cable; also make sure that the cable is not immersed in pools of oil or water. (See following illustrations.)



(Mal-function)
Respiration



(Mal-function)
Capillary phenomenon

d.) The cable must be installed with great care to avoid twisitng the cable and to prevent the cable's weight from imposing a wrenching stress on the connector.
If the motor is used for mobile operation, the radius of the cable must be the type appropriate for such service with adequate life cycle.

e.) The cable must be installed so its insulation will not be subject to cut by sharp chips, not rub against angular parts of the machine, or stepped on by workers or run over by vehicles.

(5) CONNECTING AND DISCONNECTING THE CONNECTOR.

a.) The connecting and disconnecting of the connector is strictly prohibited while power is on. If this warning is disregarded, the motor may be damaged beyond repair; also this motor may suddenly turn or drop; there is the danger of a highvoltage arc also occurring. The Canon plug should be securely fastened with wire.

b.) Whenpower is off, the detector for detecting the absolute value r emains functional because it is powered by a battery. When the detector's cable is disconnected, the absolute position of the cable connection will be lost. Hence, in order to forestall the inadvertent disconnection of the cable's plug, it should be securely fastened with wire, and a sign must be posted besides it saying, "Do not disconnect even if power is off.

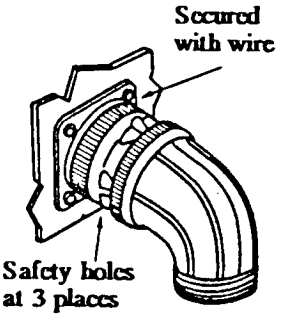
c.) The Canon plug is designed to be securely fastened by hand. Adequate space should be provided around it so that manual fastening can be performed easily.

(6) USAGE OF MOTOR AND DETECTOR WHERE THEY ARE SUBJECT TO CONSTANT VIBRATION

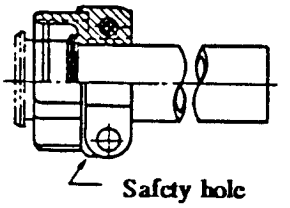
The Canon plug and cable clamp of the motor and detector must be securely fastened with wire. The cable's weight, as well as the diameter of its slack, size of the clamp, and other factors must be optimized to prevent vibrational stress from t ransmitting to the cables' connection. Make extra sure all connections are fastened securely.
The necessity for retightening of the Canon plug and cable clampduring periodical inspections should be clearly stated in the machine's maintenance manual.

- HOLES IN COUPLING TO SECURELY FASTEN IT WITH WIRE TO THE CONNECTOR.

In order to forestall uncoupling of the connection from vibration and shocks, the coupling nut is provided with three "safety holes" through which wire can be threaded for securely fastening the nut to the connection. When the machine is to be used under normal environmental conditions, this precaution is not necessary.
(The following is extracts from the catalogue referring to this safety precaution)



- The cable clamp is also provided with two holes (see illustration) for safely securing it with wire.
- The location of the safety holes of the connector may differ somewhat with different brands.



- The wire (0.813, annealed stainless wire) used for fastening the plug and clamp must have the mechanical strength and ease of handling, such as QQ-W-423, FORM-1, FS 304, CD-A, 0.032 inches.
- The optimum tightening torque of the coupling nut: This connector is designed for simple tightening by hand; no dedicated tool is needed for tightening. Where the connection is subject to vibration, it must be secured against vibration with wire. The torque is not specified by MIL standards. When the connection is for installation in aircraft, it must be secured with wire.

(7) The servomotor and detector must not be used in the design of a machine, which requires the motor's alteration for retrofitting it on the machine.

3.7 CHECKPOINTS FOR POWER ON AFTER INSTALLATION

(1) Before switching on the power.
After connecting the main circuitry wires and cables, check the points below before switching on the power.

[1] Has the 3-phase AC 200/220 V power supply been connected to the R, S and T terminals of the terminal board?

[2] Has the motor power line been connected properly in phase with the U, V and W terminals of the terminal board?

[3] When the optional regenerative resistance is not attached, are terminals D and P on the terminal board (top part) shortcircuited?
When the optional regenerative r esistance is attached, are terminals C and P on the terminal board (top part) connected properly?
When the optional regenerative resistance is attached, has the shorting bar between terminals D and P on the terminal board (top part) been removed?

[4] Have the cables from the NC system and cables from the CN1B of the other axes been connected to connector CN1A?
Has the cable from connector CN1A of the other axis or the termination connector been connected to connector CN1B?

[5] Has the cable from the detector been connected properly to the RF01 or RF31/33 card? (Refer to the cable system diagram in Appendix 2 for the correct connections.)

[6] Has the RF01 card been properly installed in the unit? (Do the projections which project from the small CON1, 2 and 3 holes project on the same surface as the top CON1, 2 and 3 surface?)

[7] Has CS1 (axis number setting) on the RF01 card been set properly?

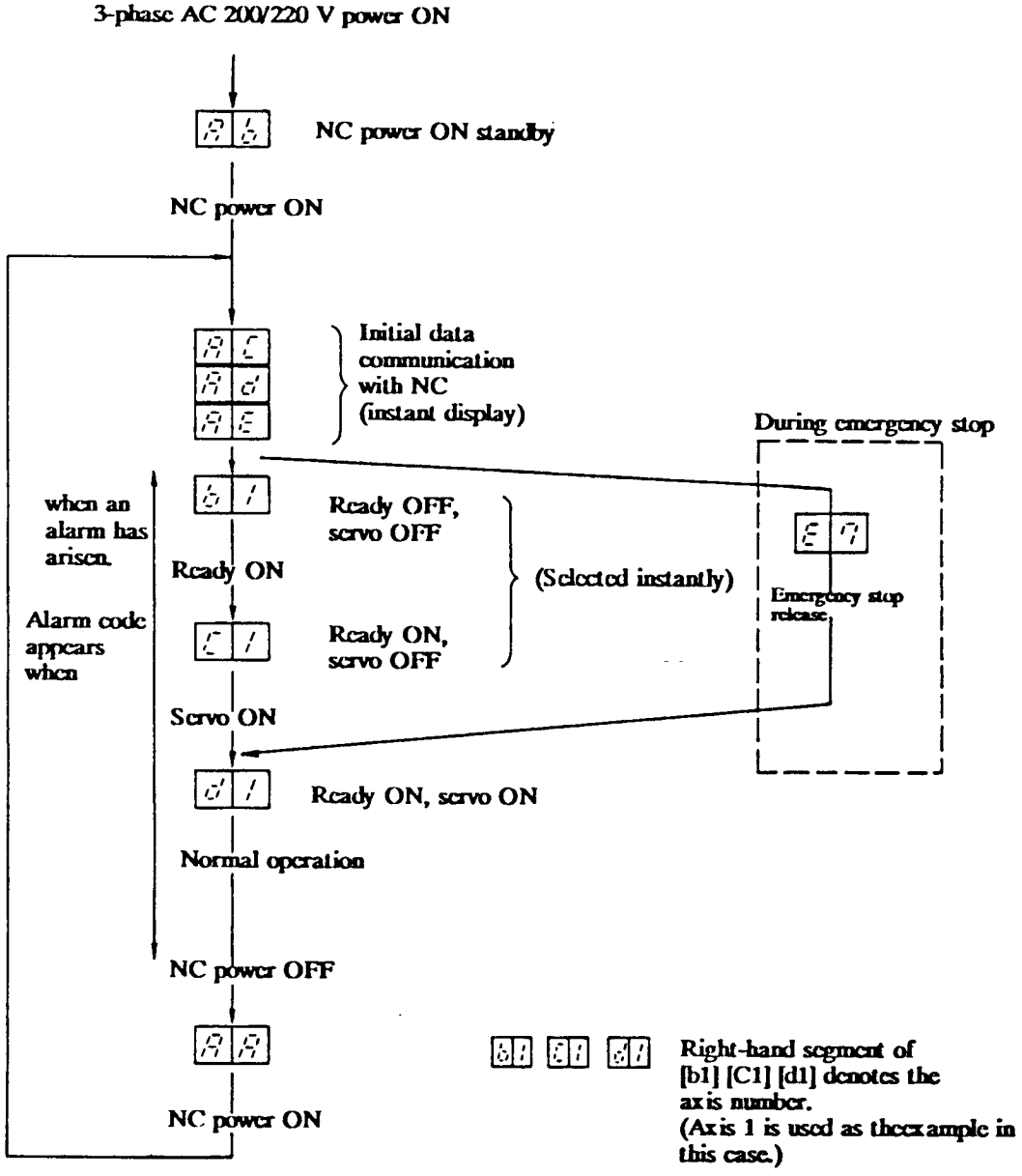
[8] Have the RF01 card and RF31/33 card settings been made properly?

[9] Have the servo parameters been set properly on the NC screen?

[10] If there is a fear of irregular running with the initial model, the effects can be reduced by switching on the NC power and limiting the motor torque by reducing the ILP and ILN servo parameters before the NC and servo amplifier are actually connected.
Example: 13. ILP 1230 → 500
14. ILN −1230 → −500

(2) After switching on the power

The normal 7-segment display appears after the power has been switched on.



4. TROUBLESHOOTING

4.1 7-SEGMENT DISPLAY

The status of the amplifier is indicated by the 7-segment display in the center of the amplifier. The alarm code appears when an alalrm has arisen.

MR-S amplifier status displays

Display	
AA	During initialization; NC power ON standby (when NC power is turned from ON to OFF)
Ab	During initialization; NC power ON standby (when NC power is turned from OFF to ON and when NC power is OFF)
AC	During initialization; start of communication between NC andamplifier
Ad	During initialization; termination of initial parameter reception
AE	Termination of initialization
b#	Ready OFF
C#	Servo OFF
d#	Servo ON
E*	Warning
**	Alarm
..	WD error

\# : Axis number
* : Warning number (see next page)
** : Alarm number (see next page)

SERVO-ALARM AND WARNINGS

**	ABBREVIATION NAME	NAME	Reset
10	UV	Under voltage	PR
11			
12	ME1	Memory error	AR
13	CE	external clock error	PR
14	WD	Watch dog error	PR
15	ME2	Memory error	PR
16	RD	Rotor position detect error	PR
17	BE	Board error	PR
			PR
20	NS1	No signal (main board)	PR
21	NS2	No signal (add on board Enc)	PR
22	NS3	No signal (add on board IX)	PR
23			
24	NS5	No signal	PR
25	BA	Battery alarm	PR
26			
27			
30	OR	Over regeneration	PR
31	OS	Over speed (2400/3600 rpm)	PR
32	OC	Over current	PR
33	OV	Over voltage	PR
34	DP	Data parity	PR
35	DE	Data error	PR
36	TE	Transfer error	PR
37	PE	Parameter error (initialize)	PR
40			
41			
42			
43			
44			
45	OHF	Fin over heat	NR
46	OHM	Motor over heat	NR
47			
50	OL1	Over load (150% 1 sec)	NR
51	OL2	Over load (C.LIMIT 0.5 sec)	NR
52	OD	Over droop	NR
53			
54			
55	EM	Emergency	NR
56	OA	Other axis alarm	NR
57			
E0	WOR	Warning over regeneration	*
E1	WOL	Warning over load	
E2			
E3			
E4	WPE	Warning parameter error	*
E5	WAB	Warning absolute detect error	
E6	WOT	Warning over travel	*
E7	NCE	NC emergency	

Warning on "resetting": Reset when power of PR:NC is OFF; reset is possible when NR:NC requires resetting.
* These are displays of warnings; the servosystem will not be turned off; reset when the display shows AR:MR-S and the power of the servoamplifier is OFF.

4.2 TROUBLESHOOTING

When trouble arises, refer to the following items and remedy the trouble.

4.2.1 Occurrence of servo alarm
4.2.2 No amplifier mounting (alarm at NC side)
4.2.3 Vibration or vibration noise
4.2.4 Poor cutting surface accuracy; poor ciricularity
4.2.5 Overshooting during positioning
4.2.6 Surge feed with 1 pulse feed
4.2.7 No segment display even when power is switched on; alternatively, 0 0 appears.
4.2.8 No change in segment display from A5 AA even when power is switched on; alternatively, AC , AJ , AE appear for an instant and then display returns to A5 AA .

4.2.1 Occurrence of servo alarm

(1) Alarm number [10]: Insufficient voltage
This detects a drop in the 3-phase AC 200/220V supply voltage. (S, T phases)

	Cause	Verification method	Remedy
1	3- phase AC 200/220V drops below 160V (±5%)	Check input voltage using voltmeter.	Re-examine power supply facilities.
2	Instant failure of 3-phase AC 200/220V	Check input voltage using synchroscope and verify whether it fails instantly. Approx. 25 msec or more with 200V input voltage	

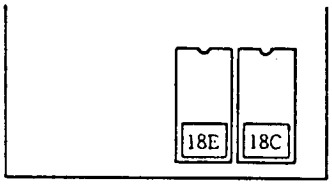
(2) Alarm number [12]: Memory error 1
This detects an EPROM check sum error as well as SRAM and 2-port RAM check errors during initialization.

	Cause	Verification method	Remedy
1	EPROM check sum error	Try replacing with problem-free EPROM of another axis.	Replace EPROM.
2	SRAM, 2-port RAM check error	Try replacing with problem-free RF01 card of another axis. CS1 SW must now be changed. → See replacement of servo amplifier control cards in Section 5.1.	Replace RF01 card.

(3) Alarm number [13]: External clock malfunction
There is something wrong with the clock pulses sent from the NC and the servo amplifier software does not finish processing within the specified time.

	Cause	Verification method	Remedy
1	Disconnected connector of cable between NC and amplifier or between amplifiers.	Conduct visual check. • 2RF01 card CN1A, CN1B • 2NC side	Connect properly.
2	Servo amplifier software is not functioning properly.		Replace RF01 card.
3	Defective cable between NC and amplifier or between amplifiers.	Replace cable with that of another axis. Does alarm result for that axis?	Replace cable.

(4) Alalrm number [14]: Watchdog
The servo amplifier software does not finish processing within the specified time.

	Cause	Verification method	Remedy
1	EPROM has not been mounted properly.	Check visually whether it has been mounted at location marked on EPRON. Have any of EPROM pins been bent? 	Mount properly.
2	Damaged EPROM.	Try replacing it with EPROM of other axis or problem-free EPROM.	Replace with problem-free EPROM.
3	Malfunction on RF01 card or add-on card (RF31/33)	Trying replacing it with other axis card. CS1SW on RF-01 card must now be changed. → See replacement of servo amplifier control cards in Section 5.1.	Replace with problem-free card.

(5) Alarm number [15]: Memory error 2
During initialization, there was a parity error or 2-port RAM malfunction when the initial data were communicated with the NC system.

	Cause	Verification method	Remedy
1	Defective cable between NC and amplifier or between amplifiers.	Replace cable with that of another axis. Does alarm result for that axis?	Replace cable.
2	High noise level in cables between NC and amplifier and between amplifiers.	Disconnect relays, connectors which go ON, OFF during initializing.	Remedy noise. → See amplifier installation cautions in Section 3.5

(6) Alarm number 16: Magnetic pole position detection error
Output signals of U, V and W phases of OSE5K-6-8-108 detector (mounted on non-load side of motor) are all high or low.

	Cause	Verification method	Remedy
1	Disconnected detector connector	Conduct visual check. (Any disconnections?) • CN2 of RF01 card • Cannon connector at detector side	Mount properly.
2	Defective cable between amplifier and detector	(1) Observe pins 4, 5 and 6 of RF01 card J4 in emergency stop status and check whether signals are allhigh or low. (What happens when cable is shaken?) (2) Try replacing cable with that of other axis.	Replace cable between amplifier detector.
3	Defective detector	Try replacing detector with that of other axis. (Remember that zero point will shift slightly.)	Replace detector.
4	Incorrect servo parameter STY setting	Parameter setting has been made for connection although detector has not been connected to RF01 card.	Set correctly. See details on servo parameters in Section 7.
5	Incorrect servo parameter MTY setting	Parameter speed detector setting (ENT) is 0 or 1 although standard encoder (OSE5K-6-8-108) has been connected to RF01 card.	Set correctly. See details on servo parameters in Section 7.

(7) Alarm number [17]: Circuit board malfunction
The A/D converter on the RF01 card did not operate properly during initializing.

	Cause	Verification method	Remedy
1	Defective RF01 card	Try replacing with RF01 of another axis. CS1SW of RF01 card must now be changed. → See replalcement of servo amplifier control cards in Section 5.1.	Replalce card.

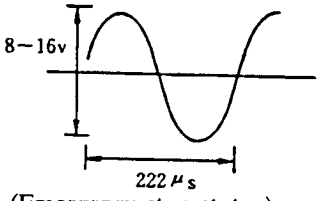
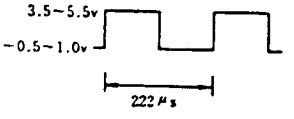
(8) Alarm number [20]: No signal 1
This is the differential signal of the encoder which is connected to the RF01 card, and it sets a pair of signals to high or low.

	Cause	Verification method	Remedy
1	Disconnected detector connector (or is becoming disconnected)	Conduct visual check. • CN2 of RF01 card • Cannon connector at detector side	Mount properly.
2	Defective cable between amplifier and detector	Try replacing cable with that of another axis.	Replace cable.
3	Defective detector	Try replacing detector with that of other axis. (Remember that zero point will shift slightly.)	Replace detector.

(9) Alarm number [21]: No signal 2
This is the differential signal of the encoder which is connected to the RF31/33 card, and it sets a pair of signals to high or low.

	Cause	Verification method	Remedy
1	Disconnected detector connector (or is becoming disconnected)	Conduct visual check. • CN3/33 of RF31/33 card • Cannon connector at detector side	Mount properly.
2	Defective cable between amplifier and detector	Try replacing cable with that of another axis.	Replace cable.
3	Defective detector	Try replacing detector with that of other axis. (Remember that zero point will shift slightly.)	Replace detector.

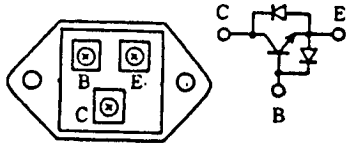
(10) Alarm number 22: No signal 3
The output of the resolver which is connected to the RF33 card is 0 V.

	Cause	Verification method	Remedy
1	Disconnected detector connector (or is becoming disconnected)	(1) Condust visual check. • CN33 of RF33 card • Cannon connector at detector side (2) Observe signal between RF33 check pin CP2-1 and 3 on synchroscope.  (Emergency stop status)	Mount properly.
2	Defective cable between amplifier and detector	Try replacing cable with that of another axis.	Replace cable.
3	Defective RF33 card	(1) Observe signal between RF33 check pin CP1-1 and 3 on synchroscope.  (2) See 1-(2). (Emergency stop status)	Replace RF33 card.
4	Defective detector	Try replacing detector with that of other axis.	Replace detector.

(11) Alarm number 25: Battery malfunction
The voltage of the RF33 card battery has dropped.

	Cause	Verification method	Remedy
1	Battery voltage drop	After switching power OFF, measure voltage at both ends of battery. Battery alarm if voltage drops below 3.20 V.	Switch ON power daily for 2 or 3 days. (Power ON for 8 hrs a day)
2	Defective battery	When malfunction persists even when above remedial action has been taken	Replace battery. See Section 2.2 for battery replacement. See Section 8.4 for procedure after replacement.

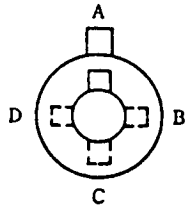
(12) Alarm number [30]: Excessive regeneration
This detects overheating in the regenerative resistance. (Since this is detected by the software, the calculated values will be cleared when the servo amplifier power is turned ON and OFF. As a result, the r esistance may be damaged if the power is repeatedly turned OFF and ON after this alarm has arisen.)

<table>
<tr><th></th><th>Cause</th><th>Verification method</th><th>Remedy</th></tr>
<tr><td>1</td><td>Incorrect servo parameter ORT setting</td><td>ORT = 4680 (no optional regenerative resistance)
= 3010 (optional regenerative resistance provided.</td><td>Set properly.</td></tr>
<tr><td>2</td><td>Acceleration/deceleration frequency has exceeded specification</td><td>Measure the number of acceleration/deceleration times with rapid traverse for 1 minute with operation program used when alarm occurred, and check whether this number agrees with allowable frequency.
→ Refer to checking the frequency of position repeatibility in Appendix 5.</td><td>(1) Reduce repeating frequency.
(2) Reduce r apid traverse rate.
(3) Add optional regenerative resistance if one has not been added.</td></tr>
<tr><td>3</td><td>Power transistor used for regeneration has been damaged by shortcircuiting</td><td>Use a tester to check resistance of power transistor.
<table>
<tr><th>+ terminal</th><th>- terminal</th><th>Proper resistance</th><th>Defect</th></tr>
<tr><td>C
E</td><td>E
C</td><td>Several hundred ohms
Infinity</td><td>Shortcircuit or infinity
Shortcircuit or several hundred ohms</td></tr>
<tr><td>C
B</td><td>B
C</td><td>Several hundred ohms
Infinity</td><td>Shortcircuit or infinity
Shortcircuit or several hundred ohms</td></tr>
<tr><td>B
E</td><td>E
B</td><td>Several hundred ohms
Several hundred ohms</td><td>Shortcircuit or infinity
Shortcircuit or several hundred ohms</td></tr>
</table>

</td><td>Replace power transistor or replace unit.</td></tr>
</table>

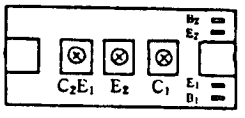
(13) Alarm number 31: Excessive speed
This detects any speed that exceeds the allowabale speed of the motor.

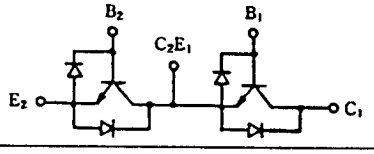
	Cause	Verification method	Remedy
1	Incorrect servo parameter MTY setting	Has setting been made for use of 2000 rpm specification motor although 3000 rpm specification motor is being used?	Set properly. See details on servo parameters in Section 7.
2	Incorrect servo parameter RNG setting	Has proper setting been made for detector which is being used as position detector?	Set properly. See details on servo parameters in Section 7.
3	Incorrect servo parameter PIT setting	Has setting been made properly in millimeter or degree units for ball screw lead? Setting does not necessarily agree with special gear ratio.	Set properly.
4	Rapaid traverse rate is too high	Value of speed (rpm) = rapid traverse rate (mm/min) / ball screw leaol (mm) exceed specifications of motor?	Reduce rapid traverse rate.
5	Acceleration/deceleration time constant is too low, overshooting results	Try increasing acceleration/deceleration time constant.	Re-examine this time constant.
6	Servo system is unstable and overshooting results	Try increasing speed loop gain VG1. Reduce position loop gain PGN. Note: When PGN is changed, OD1 & OD2 must be changed in inverse proportion.	Re-set gain.
7	Malfunction in cable between position detector and servo amplifier	Any erratic running even at low-speed feed?	Correct cable.
8	Malfunction in position detector	(1) Try replacing detector. (2) If position detector and speed detector are separate, try applying servo with speed detector used as position detector.	Replace detector.
9	0.1 μ has been set although least command increment is 1 μ.	Check system spepcifications.	Re-set parameter.

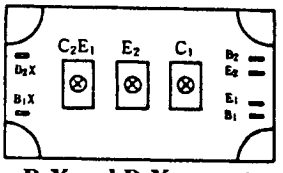
(14) Alarm number 32: Overcurrent
A current exceeding the permissible value has flowed to the DC bus inside the unit.

<table>
<tr><th></th><th>Cause</th><th>Verification method</th><th>Remedy</th></tr>
<tr><td>1</td><td>Servo amplifier output U, V, W phases mutually shortcircuited</td><td>Disconnect U, V and W wires from terminal board and disconnect Cannon connector of motor. Use a tester to check whether there is shortcircuiting between any of the cables.</td><td>Remedy shortcircuiting</td></tr>
<tr><td>2</td><td>Servo amplifier output U, V, W phases mutually g rounded</td><td>Use a tester to check between U, V and W of terboard and case.</td><td>Remedy grounding.</td></tr>
<tr><td>3</td><td>Defective dpeed detection cable</td><td>Try replacing with problem-free cable</td><td>Replace cable.</td></tr>
<tr><td>4</td><td>Mounting direction of speed detector and parameter design-ated do not match</td><td>Relationship between motor, mounting direction of detector and parameter is as shown below.
<table><tr><th>Bit 15</th><th>Mounting direction</th></tr><tr><td>0</td><td>AC</td></tr><tr><td>1</td><td>BD</td></tr></table> 
</td><td>Correct mounting.
Or correct parameter.
See #17 STY in details on servo parameters in Section 7.</td></tr>
<tr><td>5</td><td>Defective speed detector</td><td>Try replacing with problem-free detector.</td><td>Replace detector.</td></tr>
<tr><td>6</td><td>Defective RF01 card</td><td></td><td>Replace RF01 card.</td></tr>
</table>

If an overcurrent occurs, a failed transistor module may be to blame.
Before proceeding with restoration, check whether the transistor module is problem-free by following the procedure below.
Procedure for checking out the transistor module

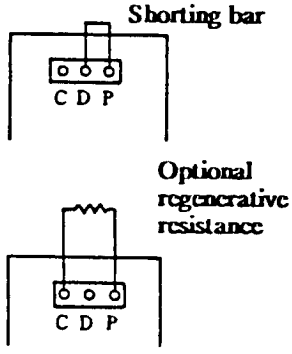
<table>
<tr><th>No.</th><th>Outline</th></tr>
<tr><td>1</td><td>Switch off the 3-phase AC 200/220V input power.</td></tr>
<tr><td>2</td><td>Remove the RF01 card, and unscrew the 4 screws of the metal plate at the front of the unit and the 6 screws that mount the connectors.</td></tr>
<tr><td>3</td><td>Use a tester to measure the resistance between the terminals of the transistor module.
<table>
<tr><th>+ terminal</th><th>- terminal</th><th>Proper resistance</th><th>Defect</th></tr>
<tr><td>C</td><td>E</td><td>Several hundred ohms</td><td>Shortcircuit or infinity</td></tr>
<tr><td>E</td><td>C</td><td>Infinity</td><td>Shortcircuit or several hundred ohms</td></tr>
<tr><td>C</td><td>B</td><td>Several hundred ohms</td><td>Shortcircuit or infinity</td></tr>
<tr><td>B</td><td>C</td><td>Infinity</td><td>Shortcircuit or several hundred ohms</td></tr>
<tr><td>B</td><td>E</td><td>Several hundred ohms</td><td>Shortcircuit or infinity</td></tr>
<tr><td>E</td><td>B</td><td>Several hundred ohms</td><td>Shortcircuit or infinity</td></tr>
</table>
(Tester: x10Ω range)
MR-S40/43/80/83/100




MR-S200/300


B1X and B2X are not used.</td></tr>
<tr><td>4</td><td>Proceed to restore in the order of steps 2 and 1.</td></tr>
</table>

(15) Alarm number 33: Overvoltage
The DC bus voltage inside the unit has exceeded the allowable level (approx. 400 V)

	Cause	Verification method	Remedy
1	Faulty terminal board connection	Connection without optional regenerative resistance 	Connect properly
2	Acceleration/deceleration frequency is too high; acceleration/deceleration time constant is low	(1) Try increasing time constant. (2) Reduce frequency. (3) Reduce rapid traverse rate.	(1) Increase time constant. (2) Reduce frequency. (3) Reduce rapid traverse rate.
3	Low acceleration/deceleration time constant with unblanced top/bottom axes	(1) Try increasing time constant. (2) Reduce frequency. (3) Reduce rapid traverse rate.	(1) Increase time constant. (2) Reduce frequency. (3) Reduce rapid traverse rate.
4	Damaged regerative resistance	Use tester to measure resistance across C and P of terminal board: Approx. 13 ohms at P(+), C(–). Measure about 3 minutes after charge lamp has gone out.	
5	Damage power transistor used for regeneration	Measure resistance following procedure described in (12)-4.	

(16) Alarm number 34: Data parity
Parity error has occurred in data received from the NC.

	Cause	Verification method	Remedy
1	Faulty connection of CN1A, CN1B connectors on RF01 card	Check connections.	Correct connections and screw down.
2	Defective cable between servo amplifier and NC	Try replacing cable.	Replace cable.
3	Noise in cable between NC and servo amplifier	(1) Take measures to counter noise. See checkpoints for installing amplifier in Section 3.5. (2) Noise arises with ON/OFF timing of particular contactor in power board.	(1) Take measures to counter noise. (2) Add spark killer, etc.
4	Defective NC card (MC611, etc)	Try replacing card with problem-free card.	Replace card.

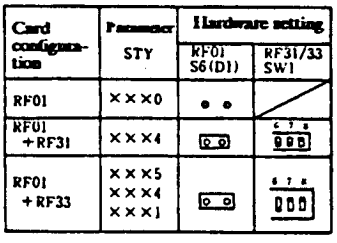
(17) Alarm number 35: Data error
Movement command from NC is abnormally high.

	Cause	Verification method	Remedy
1	Faulty connection of CN1A, CN1B connectors on RF01 card	Check connections.	Correct connections and screw down.
2	Defective cable between servo amplifier and NC	Try replacing cable.	Replace cable.
3	Noise in cable between NC and servo amplifier	(1) Take measures to counter noise. See checkpoints for installing amplifier in Section 3.5. (2) Noise arises with ON/OFF timing of particular contactor in power board.	(1) Take measures to counter noise. (2) Add spark killer, etc.
4	Defective NC card (MC611, etc)	Try replacing card with problem-free card.	Replace card.

(18) Alarm number [36]: Transfer error
The transfer of data periodically from NC has been interrupted.

	Cause	Verification method	Remedy
1	Faulty connection of CN1A, CN1B connectors on RF01 card	Check connections.	Correct connections and screw down.
2	Defective cable between servo amplifier and NC	Try replacing cable.	Replace cable.
3	Noise in cable between NC and servo amplifier	(1) Take measures to counter noise. → See checkpoints for installing amplifier in Section 3.5. (2) Noise arises with ON/OFF timing of particular contactor in power board.	(1) Take measures to counter noise. (2) Add spark killer, etc.
4	Defective NC card. (MC611, etc)	Try replacing card with problem-free card.	Replace card.

(19) Alarm number [37]: Parameter error
An illegal servo parameter has been transferred from NC during initializing.

	Cause	Verification method	Remedy
1	Illegal data range	Check upper and lower limits of settings, and illegal parameter numbers will be displayed by NC. → See details on servo parameters in Section 7.	Re-set and set power ON, OFF.
2	No correspondence between servo parameter STY and hardware setting	Relationship between STY and hardware settings is displayed below.  Illegal parameter number [17] is displayed by NC.	Re-set and set power ON, OFF.
3	Illegal combination of RNG, PIT, PC1, PC2 and PGN servo parameters	Check upper and lower limits of settings, and illegal parameter numbers will be displayed by NC as [34]. → See details on servo parameters in Section 7.	Re-set and set and power ON, OFF.
4	Unit conversion constant transferred from NC is 0.	Illegal parameter number [33] is displayed by NC.	Incorrect NC parameter setting

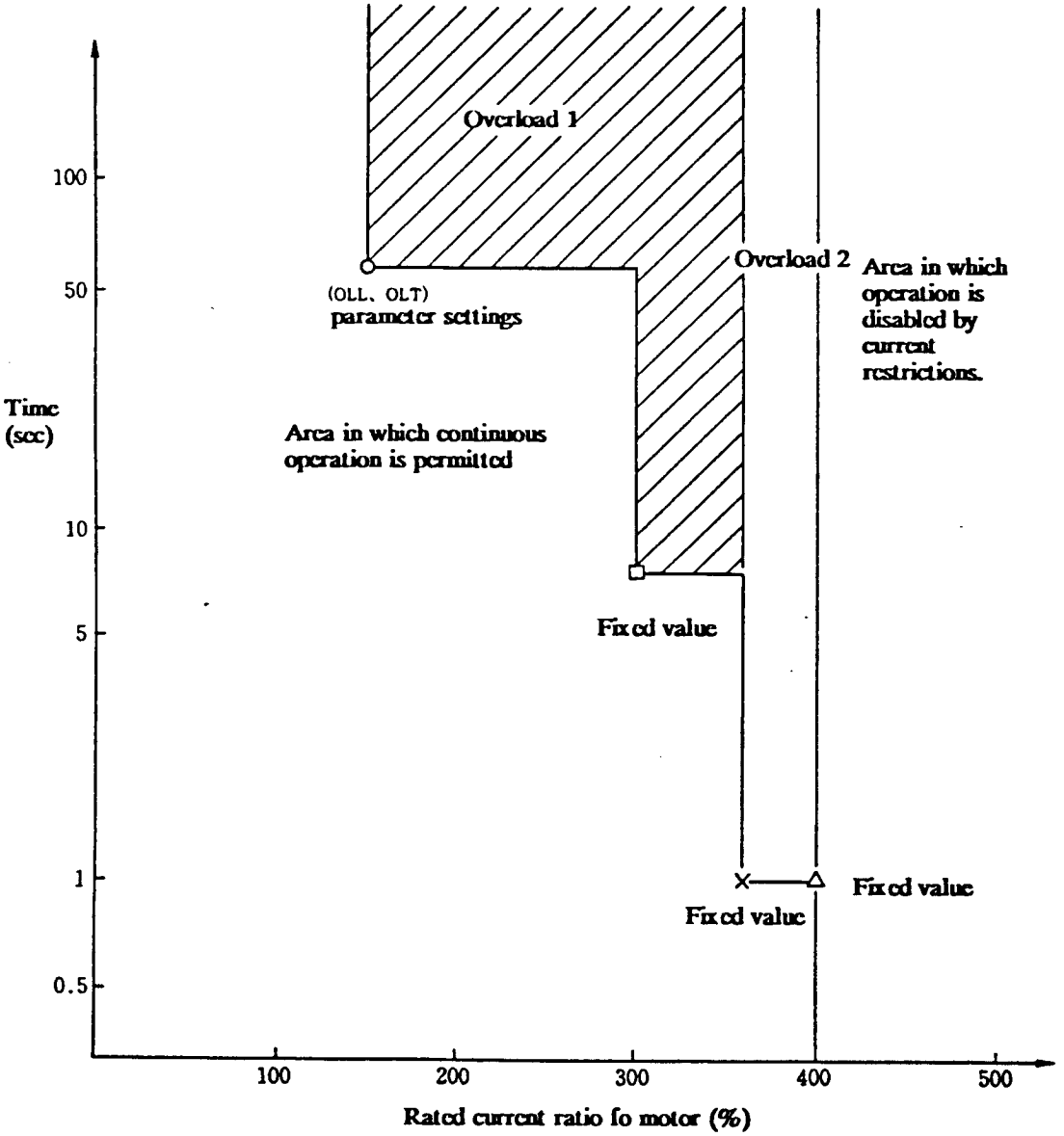
(20) Alarm number 45: Overheating of fins
The thermal protector of the fins inside the unit has bee tripped.

	Cause	Verification method	Remedy
1	Amplifier is being used at a continuous output current that exceeds its rating	Reduce load. Reduce acceleration/deceleration frequency. Reduce rapid traverse rate. Reduce heavy cutting time ratio.	Same as left.
2	Overloaded regenerative resistance or regenerative power transistor	Reduce acceleration/deceleration frequency. Reduce rapid traverse rate.	Same as left.
3	Defective thermal protector	Check whether it functions under no-load conditions.	Replace unit.

(21) Alarm number 46: Motor overheating
The thermal protector built into the motor has been tripped.

	Cause	Verification method	Remedy
1	Motor is being employed at an output which exceeds its continuous rating	Motor is hot to the touch. Try reducing the load. Reduce accleration/deceleration frequency. Reduce rapid traverse rate. Reduce heavy cutting time ratio.	Reduce load.
2	Faulty connection in terminal board	Motor is cold to the touch. • Faulty terminal board G1, G2 connection. • Faulty motor Cannon connector G1, G2. Check G1, G2 using tester.	Connect properly.
3	Defective thermal protector	Check G1, G2 inside motor using tester.	Replace motor.

(22) Alarm number [50]: Overload 1
Operation has been conducted within the shaded area of the thermal characteristics range int he figure below.



The values for the time and rated current ratio of the motor at ○, □, X, △ in the figure will differ according to the motor in question. Reference should be made to the table on the table ont he following page.

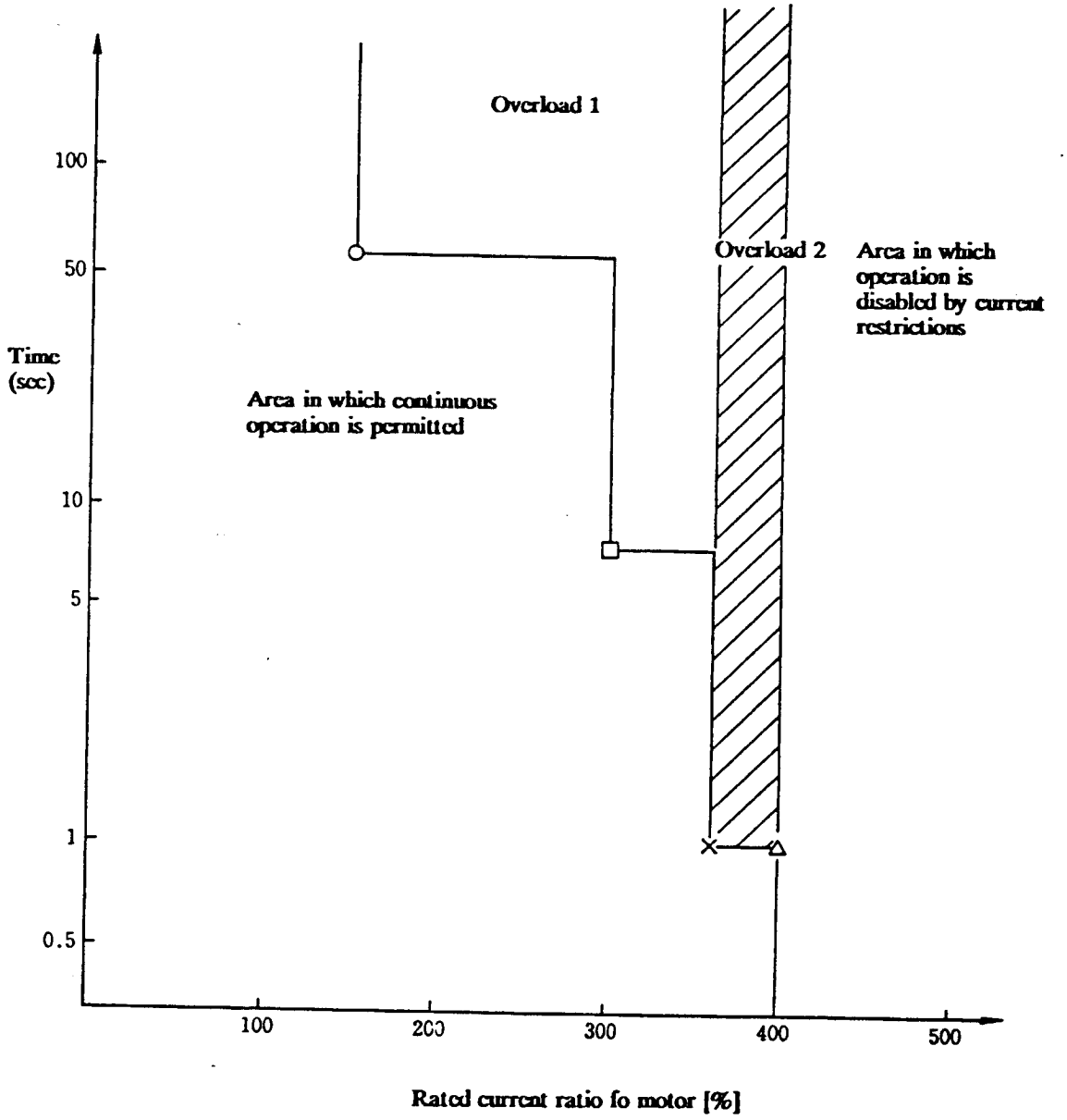
Motor	○		□		X		△
	Level	Time	Level	Time	Level	Time	Level
HA 40	OLL	OLT/10 sec.	250 %	10 sec.	500 %	1 sec.	555 %
43	OLL	OLT/10	250	10	360	1	400
80	OLL	OLT/10	250	10	410	1	455
83	OLL	OLT/10	250	10	305	1	340
100	OLL	OLT/10	250	10	290	1	320
200	OLL	OLT/10	200	5	270	1	300
300	OLL	OLT/10	180	5	245	1	270

NOTE 1: Standard setting of parameters: OLL = 150%
OLT/10 = 60sec.

NOTE 2: If the paraameters are changed when ILP = 1364 and ILN = 1364, the △ level will also change in proportion.

	Cause	Verification method	Remedy
1	Motor is being employed at an output which exceeds its continuous rating	Motor is hot to the touch. Try reducing the load. Reduce acceleration/deceleration frequency. Reduce rapid traverse rate. Reduce heavy cutting time ratio.	Reduce load.
2	Collision with machine	Collision with machine?	Distance from machine. (Check whether soft limit functions properly.)
3	Unsuitable OL, OLT servo parameter settings	Check whether they conform to standard settings. OLL: 150 OLT: 600	Correct as on left.
4	Hunting caused by reverse servo	1. Incorrect wiring of motor power line. 2. Incorrect STY servo parameter setting 3. Incorrect MTY servo parameter setting	Correct as on left. See details on servo parameters in Section 7.
5	Malfunction in detector system	1. Detector malfunction Try replacing with problem-free detector. 2. Malfunction in detector cable. Try replacing it with trouble-free cable.	Correct as on left. See details on servo parameters in Section 7.
6	Hunting caused by instability in servo system	1. Incorrect PGN servo parameter setting 2. Incorrect PC1 servo parameter setting 3. Incorrect PC2 servo parameter setting 4. Incorrect RNG servo parameter setting 5. Incorrect VG1 servo parameter setting	Correct as on left. See details on servo parameters in Section 7.

(23) Alarm number 51: Overload 2
Operation has been performed in the shaded area of the thermal characteristics shown in the figure below.



The values for the time and rated current ratio at ○, □, X, △ in the figure will differ according to the motor in question. Reference should be made to the table on the following page.

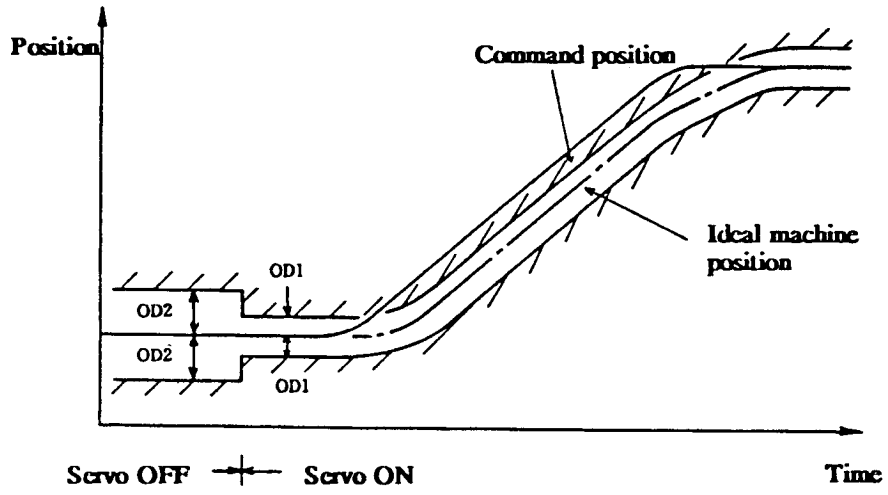
Motor	○		□		X		△
	Level	Time	Level	Time	Level	Time	Level
HA 40	OLL	OLT /10 sec	250 %	10 sec	500 %	1 sec	555 %
43	OLL	OLT/10 sec	250 %	10 sec	360 %	1 sec	400 %
80	OLL	OLT/10 sec	250 %	10 sec	410 %	1 sec	455 %
83	OLL	OLT/10 sec	250 %	10 sec	305 %	1 sec	340 %
100	OLL	OLT/10 sec	250 %	10 sec	290 %	1 sec	320 %
200	OLL	OLT/10 sec	200 %	5 sec	270 %	1 sec	300 %
300	OLL	OLT/10 sec	180 %	5 sec	245 %	1 sec	270 %

NOTE: 1) Standard setting of parameters: OLL = 150%
OLT/10 = 60 sec.

2) If the parameters are changed when ILP = 1364 and ILN = -1364, the △ level will also change in proportion.

	Cause	Verification method	Remedy
1	Collision with machine	Collision with machine?	Distance from machine.
2	Acceleration/deceleration time constant is too low	Observe current on servo monitor screen and check whether is exceeds level of "x" in table on previous page for 1 or more seconds.	Increase time constant.
3	Hunting caused by reverse servo motor	1. Incorrect wiring of power line. 2. Incorrect STY servo parameter setting 3. Incorrect MTY servo parameter setting	Correct as on left. See details on servo parameters in Section 7.
4	Malfunction in detector system	1. Detector malfunction Try replacing with problem-free detector. 2. Malfunction in detector cable. Try replacing it with trouble-free cable.	Correct as on left.
5	Hunting caused by instability in servo system	1. Incorrect PGN servo parameter setting 2. Incorrect PC1 servo parameter setting 3. Incorrect PC2 servo parameter setting 4. Incorrect RNG servo parameter setting 5. Incorrect VG1 servo parameter setting	Correct as on left. See details on servo parameters in Section 7.
6	Drop in DC bus voltage inside unit	Does left display lamp on unit terminal board light during ready ON status when 7-segment display shows [F.] or [d.] ?	Replace unit.

(24) Alarm number 52: Excessive error
The actual machine position is distanced from the ideal machine position vis-a-vis trhe command position by an amount equivalent to the distance set by OD1 and OD2.
The figure below shows a case where the actual machine position has entered within the shaded area.



	Cause	Verification method	Remedy
1	Acceleration/deceleration time constant is too low	Try increasing time constant and calculate minimum time constant from the formula below. $T_{s\ min} = \frac{2\pi N(J_m + J_L)}{60 \times (T_m - T_L)}$ When N : rapid traversespeed (rpm), J_m : motor inertia (kg · cm · sec^2), J_L : load inertia (kg · cm · sec^2), T_m : maximum torque of motor (kg · cm), T_L : maximum rapid traverse load torque (kg · cm) T_s min: minimum acceleration/deceleration time constant (S) See Appendix 7 for motor constants.	Increase time constant or reduce rapid traverse rate.
2	Current is restricted more than necessary	Check ILP, ILN servo parameters.	Correct as on left.
3	Collision with machine	Collision with machine?	Distance from machine.
4	Hunting caused by reverse servo	1. Incorrect wiring of motor power line. 2. Incorrect STY servo parameter setting. 3. Incorrect MTY servo parameter setting.	Correct as on left. See details on servo parameters in Section 7.
5	Malfunction in detector system	1. Detector malfunction Try replacing with problem-free detector. 2. Malfunction in detector cable. Try replacing it with trouble-free cable.	Correct as on left.
6	Hunting caused by instability in servo system	1. Incorrect PGN servo parameter setting. 2. Incorrect PC1 servo parameter setting. 3. Incorrect PC2 servo parameter setting. 4. Incorrect RNG servo parameter setting. 5. Incorrect VG1 servo parameter setting.	Correct as on left. See details on servo parameters in Section 7.

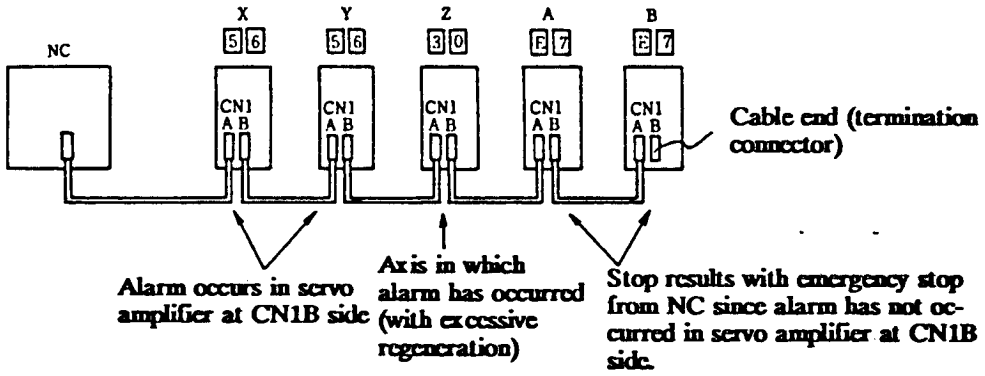
7	Drop in DC bus voltage inside unit	Does left display lamp on unit terminal board light during ready ON status (when 7-segment display shows [C], [d])?	Replace unit.
8	Improper servo system gain	1. Try increasing VG1 servo parameter in units of 20. 2. Try reducing PGN servo parameter in units of 5.	1. Correct as on left and see what happens. 2. Correct as on left. Simultaneous interpolation axis must have same value.

(25) Alarm number [55]: External emergency stop
The shortcircuit between terminal board B and R was released (coupled to emergency stop by the machine).
The standard specifications, however, apply to the type characterized by shortcircuiting inside the terminal board.

	Cause	Verification method	Remedy
1	Emergency stop	Are B and R released during emergency stop?	Normal operation
2	Drop in AC 200/220V input (R, S phases)	Check input voltage using voltmeter.	Re-examine power supply facilities.
3	Heavy vibration applied to unit	Over 5G? (Level at which bottom of unit is normally tapped with mallet?)	Remove source of vibration.
4	Defective contactor inside unit	Check continuity between contacts of contactor. (See figure of main circuitry configuration.)	Replace unit.

(26) Malfunctioning in other axis [56]
The alarm occurs in the unit connected to the CN1B side. Alternatively, the cable end (termination connector) has become disconnected.

Example



	Cause	Verification method	Remedy
1	Alarm has occurred in servo amplifier at CN1B side.		Normal operation
2	Disconnected cable end		Attach end properly.
3	No power supplied to amplifier(s) not being used.	Power input to B axis has been disconnected if, in example of figure above, B axis is not being used.	In example on left: 1. Supply B axis power. Or 2. Connect cable end to A axis CN1B.

* ALM 57 MAGNETIC CONTACTOR FAILURE

(27) Warning number [E0]: Excessive regeneration warning
This senses a level of excessive regneration which is 80% of the alarm level. This is not an alarm and so the servo OFF status does not result. However, if operation is continued regardless, there is a possibility that the excessive regeneration alarm will result.
See (12) excessive regeneration. It is particularly recommended that the remedies in 2 of (12) excessive regeneration be carried out.

NOTE: Check whether the regeneration load on the servo monitor screen while E0 is displayed has increased little by little. If it has increased, refer to (12) excessive regeneration.
Furthermore, actual use is not hindered when the regenerative load is constant.

(28) Warning number [E1]: Overload warning
This senses a level of overload 1 which is 80% of the alarm. This is not an alarm and so the servo OFF status does not result. However, if operation is continued regardless, there is a possibility that the overload 1 alarm will result. See (22) overload 1.

(29) Warning number [E4]: Parameter error warning
A parameter has been set which exceeds the setting range.
(Refer to the details on the servo parameters in Section 7 for the setting ranges.)
An illegal parameter is ignored and the value prior to the setting of the illegal parameter is retained.
The illegal parameter is released by setting the proper value. The servo OFF status does not result.

(30) Warning number [E5]: Absolute position detection warning
There is an error in the internal data for absolute position detection.
The servo OFF status does not result.

	Cause	Verification method	Remedy
1	Incorrect setting of grid intervals for machine parameters	Are parameter grid intervals set to [20]?	Correct as on left.
2	Error in resolver data at point of dog-type zero point return	Error if servo monitor screen 1 x value is as below: 278 < 1 x < 4722 5070 < 1 x (See absolute position system in Section 8.)	1. Perform dog-type zero point return again. 2. If value on left is still produced, replace detector and RF33 card.
3	Incorrect absolute value compensation data		Replace detector and RF33 card.

For warnings relating to the absolute position system, refer to the absolute position system in Section 8.

(31) Warning number [E6]: Overtravel warning
This warning occurs during speed loop control with overtravel when the speed loop step system has been selected by overtravel based on the limit switch. It may be possible for the speed loop control time to be set by parameters on the NC side.

	Cause	Verification method	Remedy
1	Overtravel	During overtravel?	Normal operation

(32) Warning number [E7]: NC emergency stop
The NC system is set to emergency stop.

	Cause	Verification method	Remedy
1	NC emergency stop		Normal operation

4.2.2 No amplifier mounting (alarm at NC side)

The "no amplifier mounted" alarm occurs from the NC system.

	Cause	Verification method	Remedy
1	No power supplied to servo amplifier	Does servo amplifier's 7-segment display light?	Switch power ON.
2	Servo amplifier power is switched on after NC power	Try switching on servo amplifier's power first.	Correct as on left.
3	Servo amplifier is not operating properly	7-segment display does not indicate [A] .	1. Replace EPROM. 2. Replace RF01 card.
4	Defective cable between MCP and amplifier, or between amplifiers.	Try replacing cable with problem-free cable.	Replace cable.
5	Defective cable end (termination connector)	Try replacing cable end.	Replace cable end.

4.2.3 Vibration or vibration noise

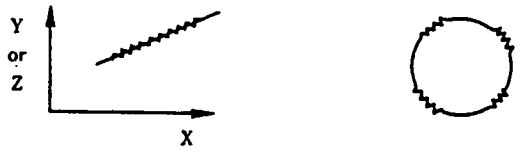
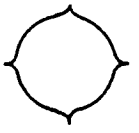
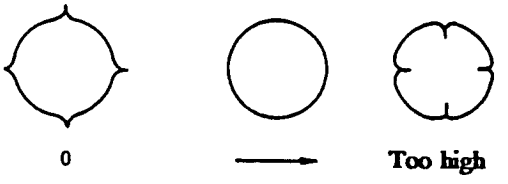
(1) Faint vibrations are felt when the machine is touched or the sound of vibration resembling a hum is heard.

	Verification and remedy method
1	Try adjusting the servo parameters.

Servo parameters	
5. VG1	Try reducing this in units of 20.
17. STY	Try raising FBC (bit 11). Try raising FBF (bit 10). Try raising both FBC and FBF.

Note 5: VG1 is the parameter for the responsiveness of the speed loop. The responsiveness will deteriorate if the parameter is set too low.

4.2.4 Poor cutting surface accuracy; poor circularity

	Verification and remedy method
1	When surface accuracy in 45 direction of taper, arc is poor.  Servo parameter 5. VG1 Try increasing this in units of 20. (Limit is reached if vibration or noise is generated during stop or rapid traverse)
2	Noticeable projections appear at point where arc quadrant cutting changes (joins are noticeable).  Servo parameter 5. VG1 Try increasing this in units of 20. 17. STY Try raising SMC (bit 14) and increasing from 16. TGN 0 in units of 20. If increased too much, indentation results. 

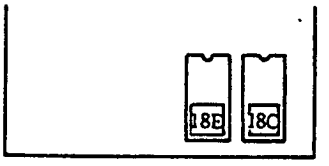
4.2.5 Overshooting during positioning; limit cycle occurs

<table>
<tr><th></th><th>Verification and remedy method</th></tr>
<tr><td>1</td><td>With semi-closed loop system
<table><tr><th>Servo parameter</th></tr><tr><td>5. VG1 Try increasing this in units of 20.
(Limit is reached if vibration or noise is generated during stop or rapid traverse)</td></tr></table>Note: If the overshooting amount is high (over 5 microns), check the droop on the servo monitor screen and try the above remedy if the overshoot is the approximately the same.
If there is no improvement, increase PGN by 20 or increase the acceleration/deceleration time constant of ther axis specifications.
If there is no overshooting, overshooting occurs not with the motor itself but with the machine system. → Check out the machine system.</td></tr>
<tr><td>2</td><td>With closed loop system
<table><tr><th>Servo parameters</th></tr><tr><td>5. VG1 Try increasing this in units of 20.
(Limit is reaqched if vibration or noise is generated during stop or rapid traverse)</td></tr><tr><td>3. PGN Try reducing this in units of 5. (Min. 20)
The simultaneous interpolation axis must be set to the same value.</td></tr><tr><td>27. SSF Try raising PID (bit 0)
7. VIL and reducing this in units of 5 from 10000.
(The positioning accuracy will deteriorate if the parameter is set too low.)</td></tr></table>Note: The same caution as that described in the Note for the semi-closed loop system applies to the closed loop system. When the servo monitor screen droop does not overshoot, there should be no overshooting at the scale location. Proceed with the measurement near in the scale vicinity using a dial gauge. Check out the machine system if there is no overshooting.</td></tr>
</table>

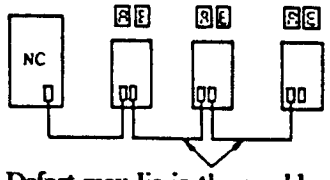
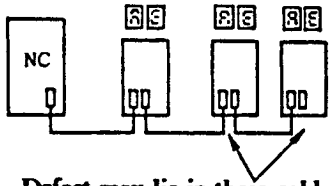
4.2.6 Surge feed with 1 pulse feed

	Verification and remedy method
1	When there is no movement even when several pulses are supplied, check the servo monitor screend roop and check whether about the same amount of droop has occurred. (1) When droop has occurred Servo parameter 5. VG1 Try increasing this in units of 20. (Limit is reached if vibration or noise is generated during stop or rapid traverse) Note: When closed loop 27. SSF PID (bit 0) is raised: Servo parameters 5. VG1 Try increasing this in units of 5. (Limit is reached if vibration or noise is generated during stop or rapid traverse) 7. VIL Try increasing this in units of 5. (Max. 10000) (Limit is reached if overshooting or limit cycle is generated with rapid traverse stop) (2) When droop has not occurred In the case of the motor or closed loop system, all the parts up to the ball screw end detector and scale are moving and so the subsequent machine system is responsible for the surge feed. → Check out the machine system.

4.2.7 No 7-segment display even when power is switched on; alternatively, [88] appears.

	Cause	Verification method	Remedy
1	Drop in AC 200/220V input (S, T phases)	Check input voltage using voltmeter.	Re-examine power supply facilities.
2	Control power supply on RF01 card is shorted by detector or detector cable.	Try disconnecting detector cable from RF01 card. (Do this in emergency stop status.)	Replace detector or detector cable.
3	Control power supply on RF01 card is shorted by add-on card (RF31/33).	Try disconnecting add-on card (RF31/33). (Do this in emergency stop status.)	Replace add-on card.
4	EPROM on RF01 card is not mounted properly.	Visually inspect whether it is mounted at location marked on EPROM. Also, check whether any of EPROM pins have been bent. 	Re-mount EPROM properly.

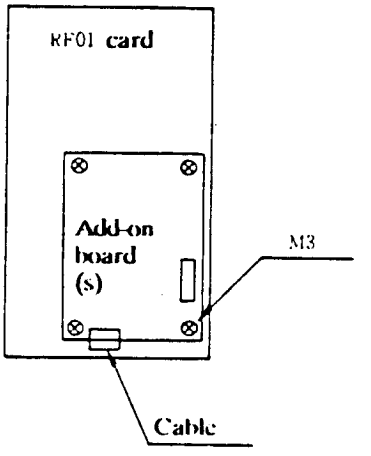
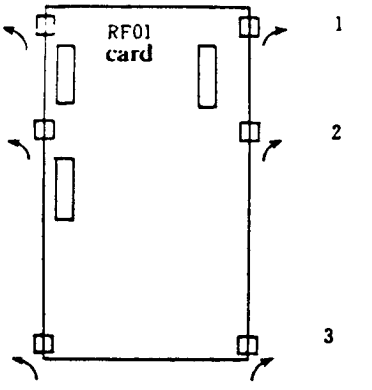
4.2.8 No change in segment display from [Ab] [AA] even when NC power is switched on; alternatively, [AC], [Ad], [AC] appears for an instant and then display returns to [Ab] [AC].

	Cause	Verification method	Remedy
1	Disconnected cable between NC system and amplifier or between amplifiers	Visual check • RF01 card CN1A, CN1B • NC side.	Connect properly.
2	Incorrect setting of RF01 card axis No. selector CS1	Check whether axis number is duplicated or whether it is incorrect.	Set properly.
3	Defective cable between NC system and amplifier or between ampliifiers	If [AE] appears momentarily up to a particular axis in the sequence of the cable connections from the NC system, the subsequent cables may be defective. Try replacing the cable. **Momentarily**  **Defect may lie in these cables.**	Replace cable.
4	Defective RF01 card	If [AE] appears momentarily up to a particular axis in the sequence of the cable connections from the NC system, the subsequenc cards are suspect. Try replacing the RF01 card. **Momentarily**  **Defect may lie in these cables.**	Replace RF01 card.
5	Problem in NC system software or hardware	(1) Does NC system start up normally? (2) Try replacing card to which cable to servo amplifier has been connected.	Repair NC side Replace NC card (MC611, etc)

5. UNIT REPLACEMENT METHODS

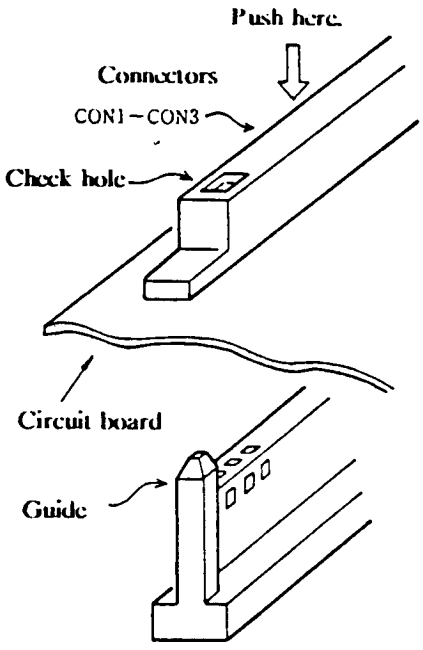
5.1 CONTROL CIRCUIT BOARD MOUNTING AND REMOVAL

5.1.1 Control circuit board removal

1	Removing the add-on circuit boards
	1) Switch off the power and disconnect the accessory connectors. Note: When the absolute value detection card is the position, do not disconnect the connectors. Dog-type zero point return must be performed whent he connectors have been disconnected.  2) Remove the 4 screws which attach the circuit boards. 3) Disconnect the connectors for each of the boards.
2	Removing the main card (RF01)
	1) Switch off the power and disconnect the accessoryc onnectors. 2) Remove the supports used to secure the card and draw the card forward. 3) Remove the supports in the order of 1, 2 and 3. 

5.1.2 Control circuit board mounting

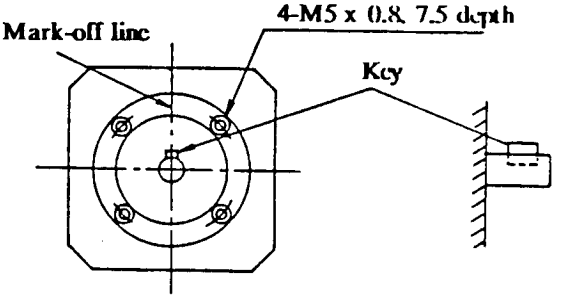
1	Mounting the base amplifier card (RF01)
	1) Insert connectors CON1 through CON3 on the circuit board along the connector guide at the main circuitry side. 2) After having inserted the connectors, look through the check hole to check whether the connectors below have been aligned properly. Note: If the connector below is not aligned, press down firmly on the top of the connector on the circuit board. 3) Check whether the support has been fitted in the 6 places. 4) Mount the accessory connectors. 5) Check the settings when the card has been replaced.
2	Mounting the add-on card
	1) Align the connectors of the add-on card with the connectors on the RF01 card and mount. 2) Tighten up the 4 mounting screws. 3) Mount the accessory connectors.



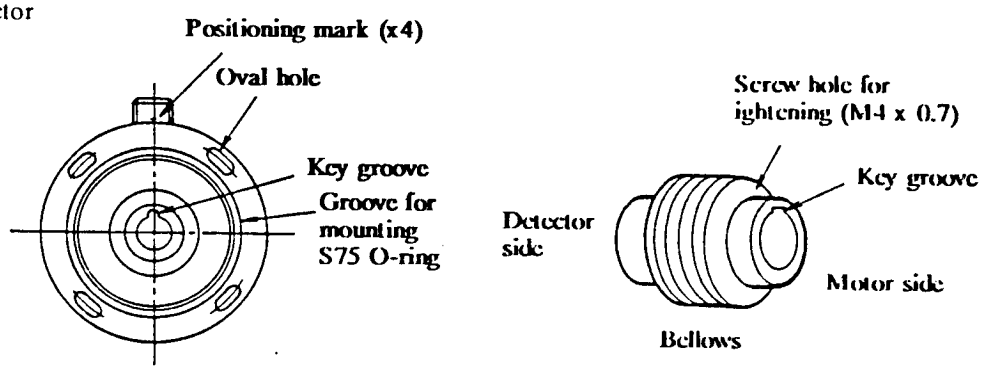
5.2 DETECTOR MOUNTING METHOD

In an AC servo system, the magnetic pole positions (positions of the magnets) in the motor must be detected.
Since this differs from when a DC servo system is used, proceed to mounht the detector in the following sequence.

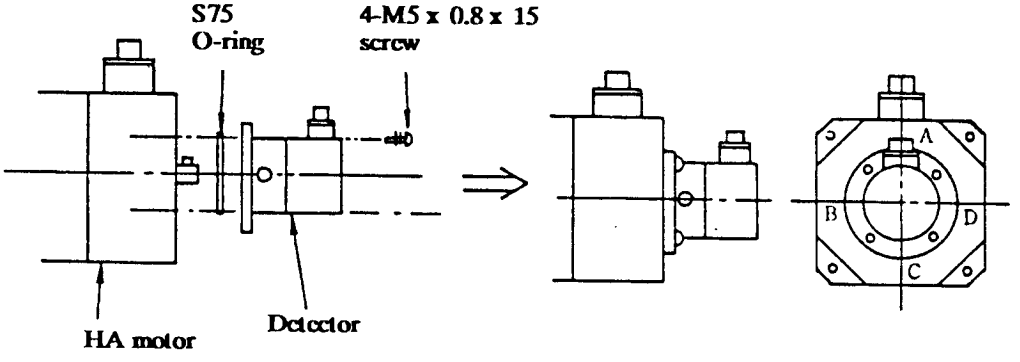
(1) Mounting surface of detector



(2) Detector



(3) Mounting (for "A" mounting direction of detector)



NOTE: When the mounting direction of the detector is B, C or D, the detector connector is brought to the B, C or D position in the above figure.

(4) Mounting procedure

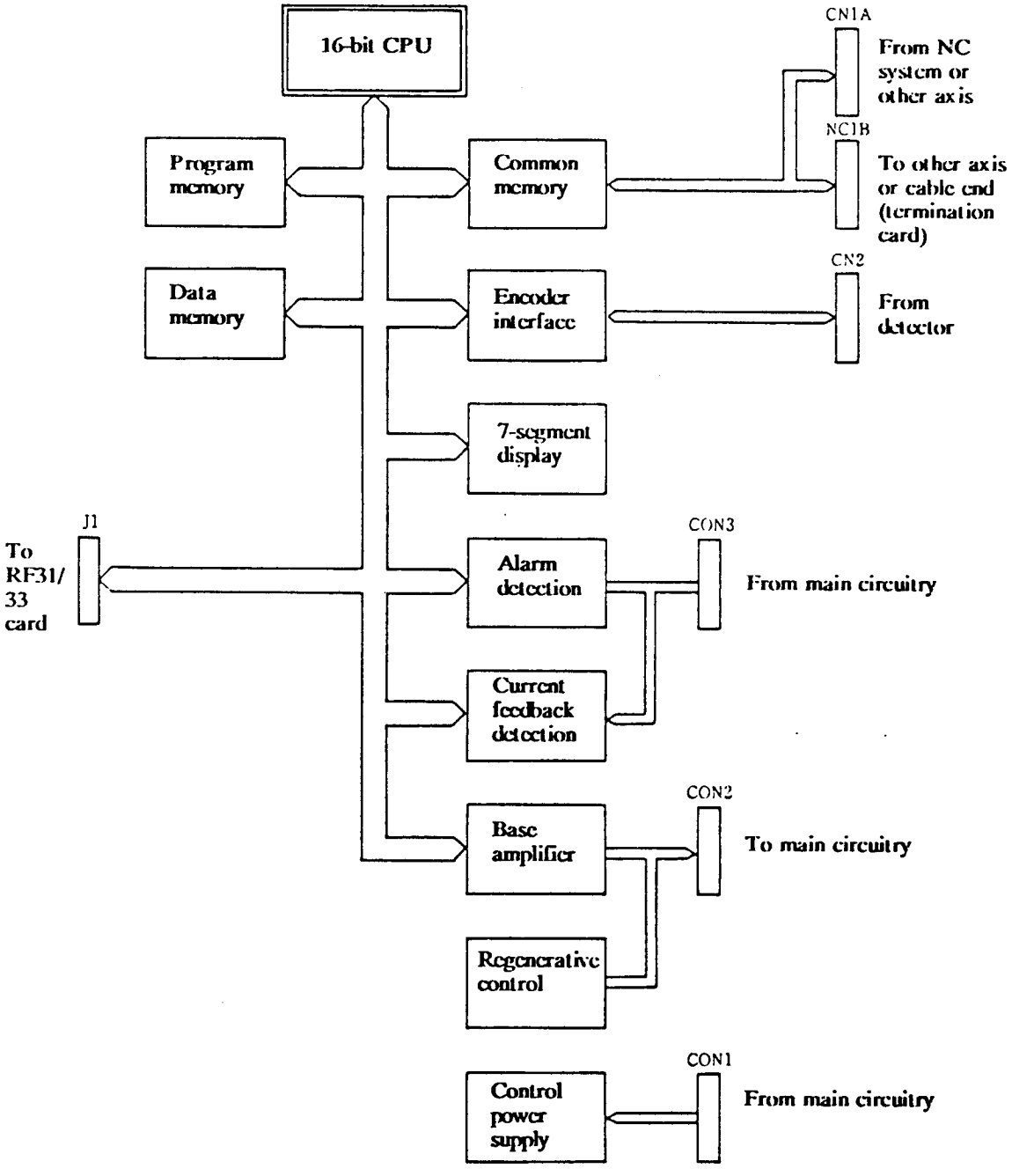
1) Mounting the O-ring (S75) onto the detector flange.
2) Mounting the M4 hexagon socket head screws onto the coupling.
3) Align the motor shaft key with the key groove on the detector bellows and fit together.
4) Align the positioning marks on the detector with the mark-off line on the motor.
5) Mount the detector onto the motor (using the M5 x 0.8 screws).
6) Tighten the screw on the key groove and secure it so that the key does not move.
7) Put the rubber cap of the detector in place.

NOTE: The positions of the detector and bellows stand in a fixed relationship to each other and so the bellows should not be removed from the detector.

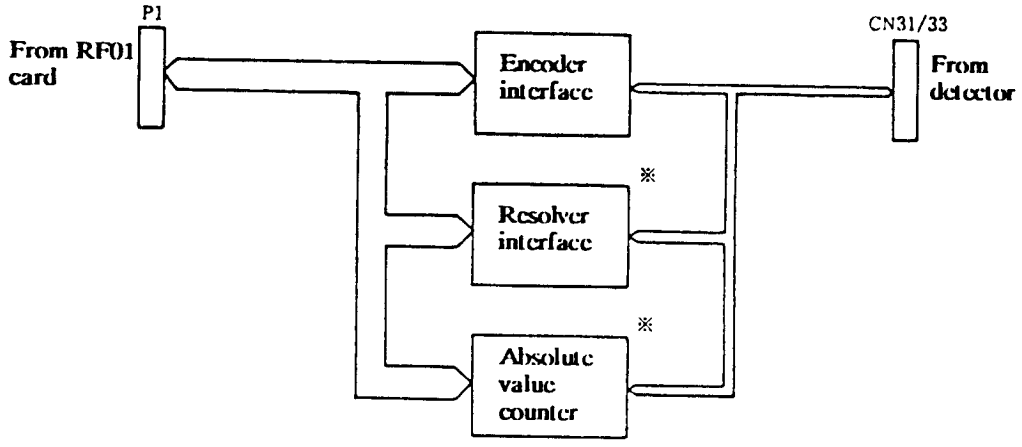
6. HARDWARE CHECK METHODS

6.1 CARD FUNCTIONS

(1) RF01



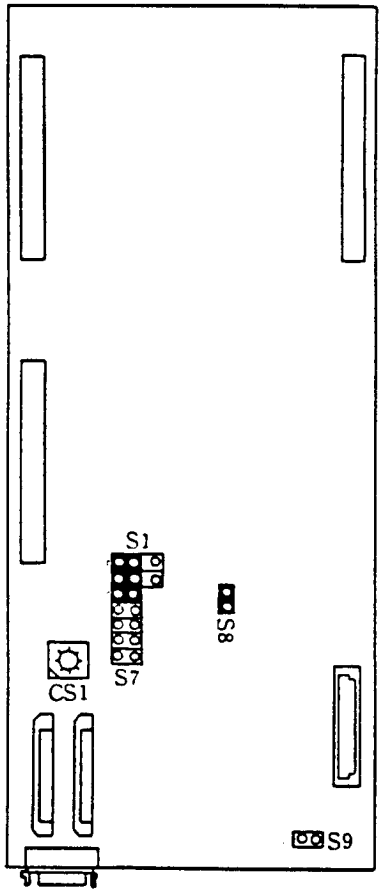
(2) RF31/33



* Not provided on RF31 card

6.2 SETTINGS AND CHECK PINS

Setting procedure for RF01



Standard settings are indicated in the figure.

■ : denotes ON setting

No.	Name	Function RE01B/C	Setting		Standard	Add-on	Remarks
			ON	OFF			
S1	SYN-ASY	IT clock selection	SYN: MCP clock	ASY: internal clock	SYN	SYN	
S2	SD-AD				SD	SD	Not used
S3	NSE	No encoder signal	Valid	Invalid	ON	Note 1	
S4	EXR	IT sync selection	Not synchronized with MCP	Synchronized with MCP	OFF	OFF	
S5	D0	Operation mode	Test mode	Normal mode	OFF	OFF	
S6	D1	Add-on card	Yes	No	OFF	ON	
S7	CB	Contactor block	Valid	Invalid	OFF	OFF	
S8	TCE	Td compensation	Valid	Invalid	ON	ON	
S9	EMG	Not used/emergency stop	/Ignored	/Valid	OFF	OFF	
CS1		Axis number selection	0-6: Axis number is selected in normal or test mode. 8-E: Cannot be used 7.F: Cannot be used		Axis 1 ... 0 Axis 2 ... 1 Axis 6 ... 5	-	

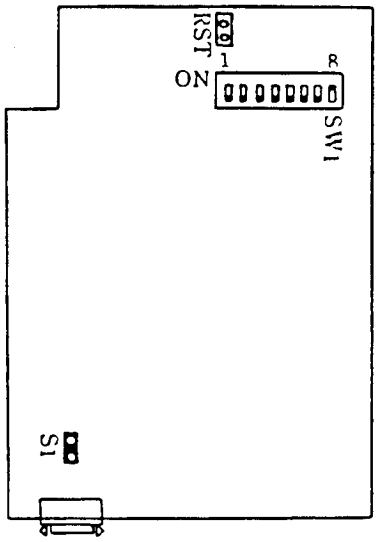
Even "not used" settings in the table should be set as indicated in the table.
Refer to the next page for Note 1.

NOTE: RF01C NSE (S3) setting procedure
The RF01C NSE setting basically makes the no-signal detection of the detector connected to CN2 of the RF01 card valid.
Consequently, make the setting when the detector is connected to CN2.

Setting examples

System		NSE setting	Configuration
E01	Incremental, semi-closed 1 micron	(Setting)	RF01 Motor end
E31	Incremental, closed, ball-screw end scale feedback 1 micron	(Setting)	RF01 Ball-screw end scale feedback RF31/33 Motor end
E33	Incremental, semi-closed submicron	(No setting)	RF01 RF31/33 Motor end
E33	Incremental, closed, scale feedback, submicron	(No setting)	RF01 Scale feedback RF31/33 Motor end
Z33	Absolute position, semi- closed 1 micron submicron	(No setting)	RF01 RF31/33 Motor end
Z33	Absolute position, closed, ball-screw end 1 micron	(Setting)	RF01 RF31/33 Ball-screw end Motor end

RF31 setting procedure



■■: denotes ON setting.

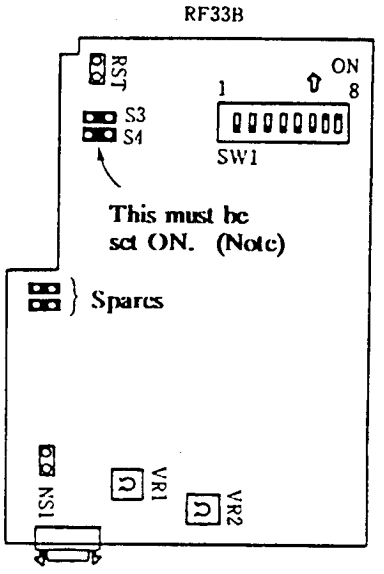
□■: denotes OFF setting.

Standard settings are indicated in the figure.

Name		Function	Setting		Standard	Remarks
			ON	OFF		
SW1	1	Function selection			OFF	Not used
	2	Function selection			OFF	Not used
	3	Function selection			OFF	Not used
	4	Function selection			OFF	Not used
	5	Function selection			OFF	Not used
	6	RF31 mounting check	Fixed		OFF	
	7				OFF	
	8				ON	
S1					ON	Not used
RST					OFF	Not used

Even "not used" settings in the table should be set as indicated in the table.

Setting procedure for RF33



: denotes ON setting

: denotes OFF setting

Standard settings are indicated in the figure.

Name	Function	Remarks
VR1	Amplitude fluctuation adjustment	Already adjusted
VR2	Amplitude fluctuation adjustment	Already adjusted

Name		Function	Setting		Standard		Remarks
			ON	OFF	33A	33B	
SW1	1	Function selection			OFF	←	Not used
	2	Function selection			OFF	←	Not used
	3	Function selection			OFF	←	Not used
	4	Function selection			OFF	←	Not used
	5	Function selection			OFF	←	Not used
	6	RF33 mounting check	Fixed		OFF	←	
	7				ON	←	
	8				ON	←	
A		Feedback gain selection (1x)	Standard	Gain increase	ON	–	
NS1		Resolver no-signal	Invalid	Valid	OFF	←	
S1		Function selection			OFF	–	Not used
S2		Function selection			OFF	–	Not used
S3		Battery connection	Connected	Disconnected	OFF	←	Must be ON when used (see Note)
S4		Battery connection	Connected	Disconnected	OFF	←	
RST		Absolute value counter reset	Reset valid	Reset invalid	OFF	←	

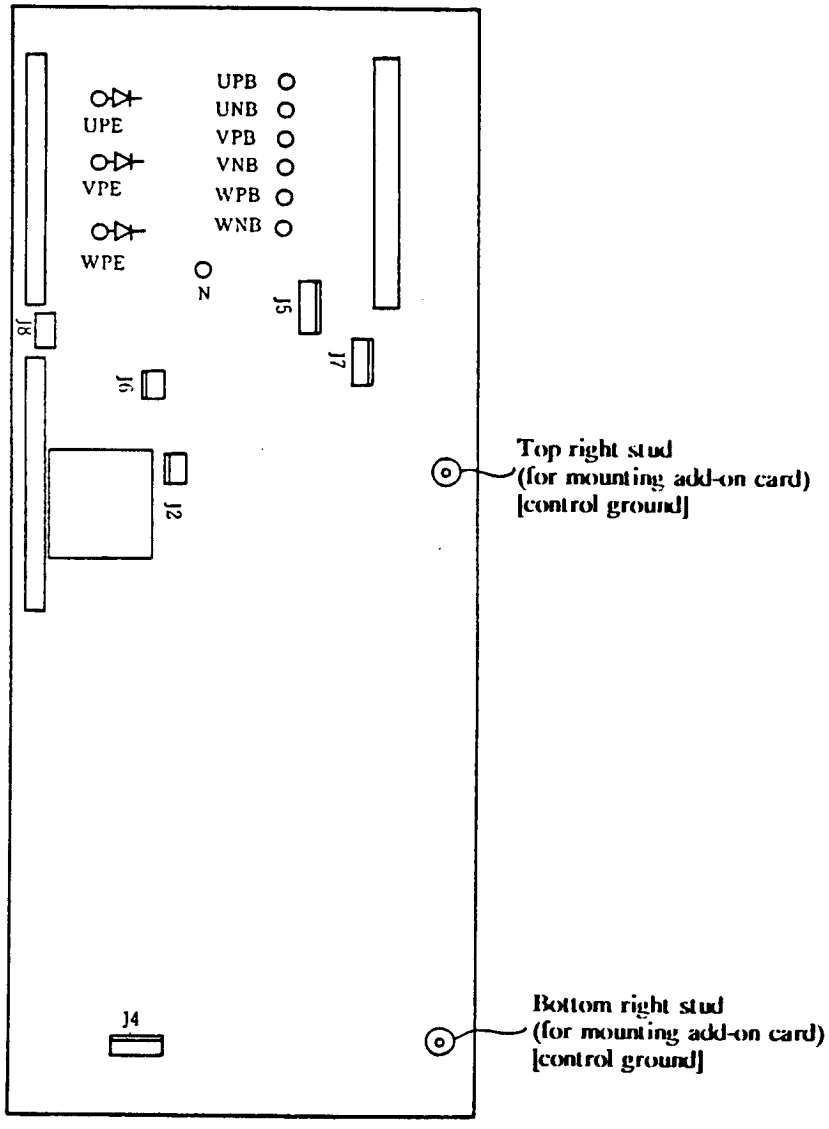
Even "not used" settings in the table should be set as indicated in the table.

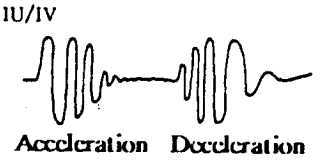
(Note) When the system is shipped from the manufacturing plant, S3 and S4 are set OFF. Set them to ON before switching on the power. (Use the spares below for the settings.) Bear in mind that the absolute positions will not be backed up by the battery unless S3 and S4 are set ON.

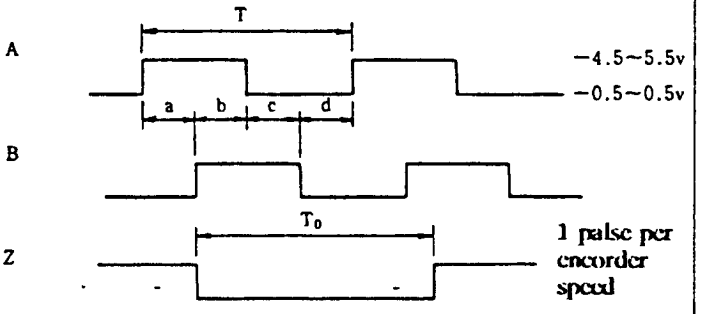
Check pins and waveforms

When connecting the synchroscope probe to the check pins, proceed during emergency stop.

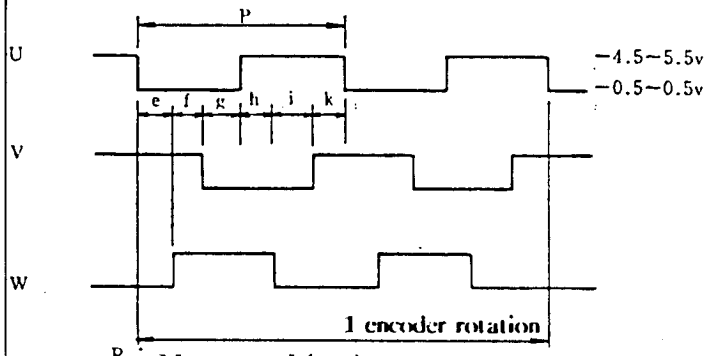
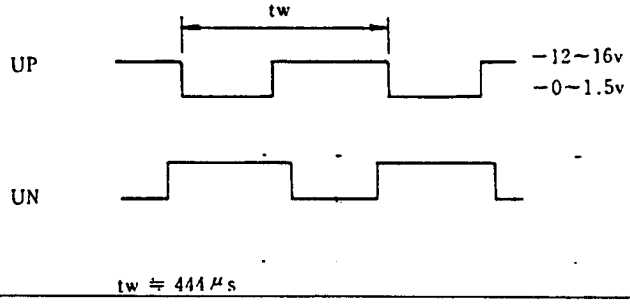
(1) RF01C

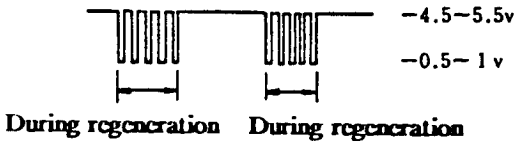
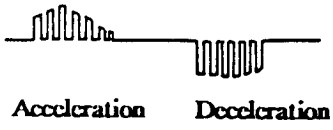


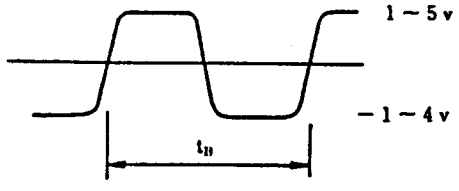
<table>
<tr><th>Pin</th><th>Signal</th><th>Ground terminal</th><th>Signal and waveform</th></tr>
<tr><td>J2-1
J2-2
J2-3</td><td>IV
IU
AG</td><td>J2-3</td><td>Motor phase V current
Motor phase U current
Control ground
Waveform examples: Waveforms differ according to load.
 

<table><tr><th>Motor</th><th>Current</th></tr><tr><td>HA40, 43</td><td>6.2 A/V</td></tr><tr><td>HA80, 83</td><td>10.4 A/V</td></tr><tr><td>HA100</td><td>15.6 A/V</td></tr><tr><td>HA200</td><td>20.8 A/V</td></tr><tr><td>HA300</td><td>31.2 A/V</td></tr></table></td></tr>
<tr><td>J4-1
J4-2
J4-3</td><td>A
B
Z</td><td>Bottom
right
stud</td><td>Encoder phase A
Encoder phase B
Encoder phase Z
Waveform examples: During counterclockwise rotation as seen from motor shaft load side
 

R : Motor speed (rpm)
Encoder : OSE5K−6−8−108 (5000p/r)
$T=\frac{60}{R\times5000}$ (sec)
$a,\ b,\ c,\ d=\frac{1}{4}T\pm\frac{1}{12}T$
$T_0=T-3T$</td></tr>
</table>

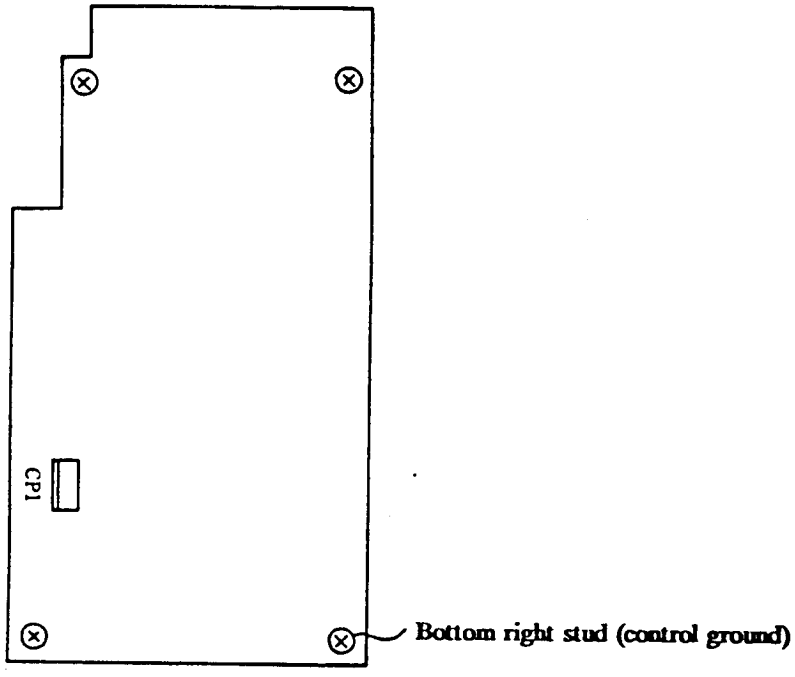
Pin	Signal	Ground terminal	Signal and waveform
J4-4 J4-5 J4-6	U V W	Bottom right stud	Encoder phase U Encoder phase V Encoder phase W **Waveform examples: During counterclockwise rotation as seen from motor shaft load side**  R : Motor speed (rpm) $P = \frac{60}{R \times 2}$ $e \cdot f \cdot g \cdot h \cdot j \cdot k = \frac{1}{6} p \pm \frac{1}{900} p$
J5-1 J5-2 J5-3 J5-4 J5-5 J5-6	UP UN VP VN WP WN	Bottom right stud	PWM output phase U, side P PWM output phase U, side N PWM output phase V, side P PWM output phase V, side N PWM output phase W, side P PWM output phase W, side N Waveform example: During servo ON stop  tw ≒ 444 μs

<table>
<tr><th>Pin</th><th>Signal</th><th>Ground terminal</th><th>Signal and waveform</th></tr>
<tr><td>J6-1
J6-2
J6-3</td><td>5G
None
OR</td><td>J6- 1</td><td>Analog ground
Regenerative transistor OFF signal
Waveform examples:
 
</td></tr>
<tr><td>J7-1
J7-2
J7-3
J7-4</td><td>P5
5G
P15
N15</td><td>J7-2</td><td>+5V, 4.75 - 5.25V
Control ground
+15V 14.25 - 15.75V
-15V -14.25 - - 15.75V</td></tr>
<tr><td>J7-5
J7-6</td><td>15G
AN</td><td>J7-5</td><td>Control ground
Analog speed input terminal (used only when testing)</td></tr>
<tr><td>J8-1
J8-2</td><td>OCE
OC</td><td>J8-1</td><td>OC detector ground
OC level detection
Waveform examples:
 

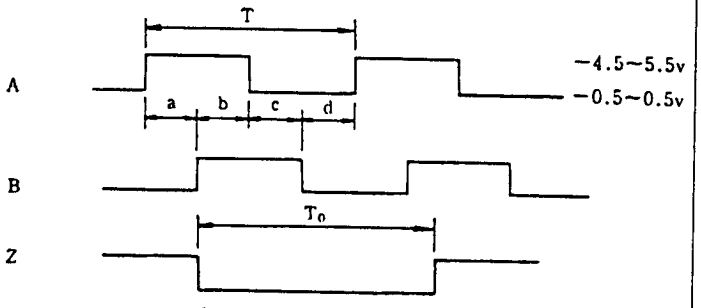
<table><tr><th>Motor</th><th>DC bus current</th></tr><tr><td>HA40, 43</td><td>4 A/V</td></tr><tr><td>HA80, 83</td><td>7.2 A/V</td></tr><tr><td>HA100</td><td>11.4 A/V</td></tr><tr><td>HA200</td><td>21.3 A/V</td></tr><tr><td>HA300</td><td>32.3 A/V</td></tr></table></td></tr>
<tr><td>UPB
UNB
VPB
VNB
WPB
WNB</td><td>UPB
UNB
VPB
VNB
WPB
WNB</td><td>UPE
N
VPE
N
WPE
N</td><td>U phase, side P base amplifier output
U phase, side N base amplifier output
V phase, side P base amplifier output
V phase, side N base amplifier output
W phase, side P base amplifier output
W phase, side N base amplifier output
Waveform example: With servo ON stop
 

$t_n \fallingdotseq 444\,\mu s$</td></tr>
</table>

(2) RF31



Pin	Signal	Ground terminal	Signal and waveform
CP-1 CP-2 CP-3	A B Z	Bottom right stud	Encoder phase A Encoder phase B Encoder phase Z Waveform examples: During counterclockwise rotation as seen from detector shaft side



R : Motor speed [rpm]

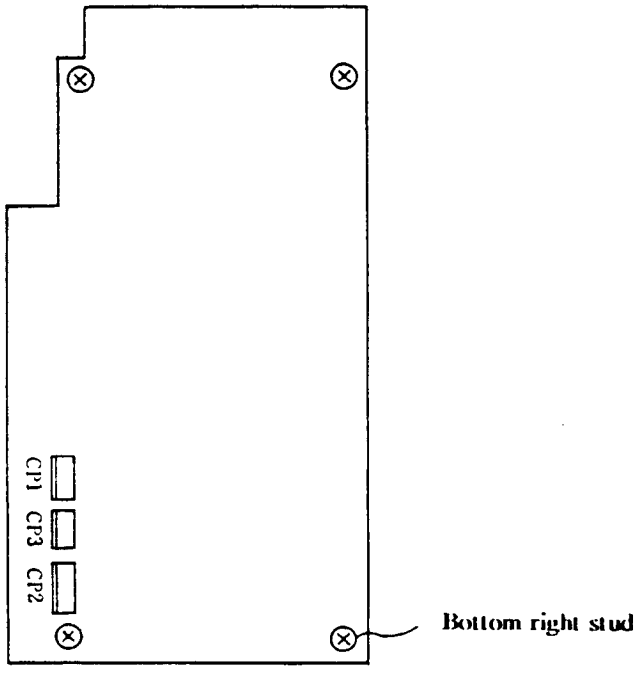
Encorder : OSE5K−ET (5000p/r)

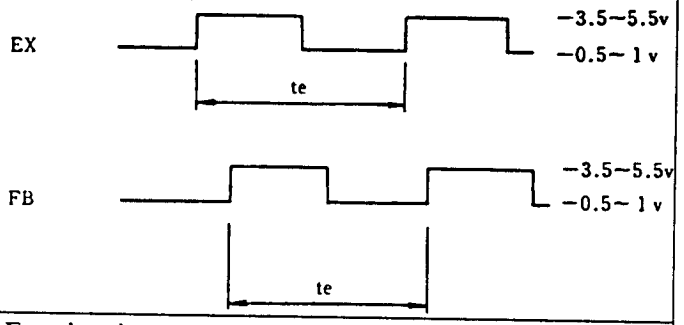
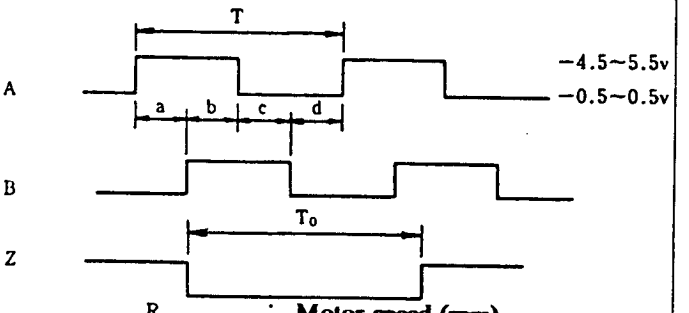
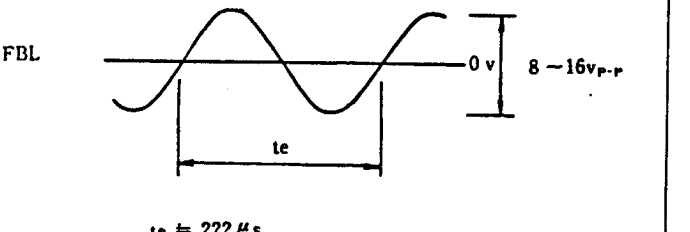
$$T = \frac{60}{R \times 5000} \text{ (sec)}$$

$$a,\ b,\ c,\ d = \frac{1}{4}T \pm \frac{1}{12}T$$

$$To = T - 3T$$

(3) RF33



Pin	Signal	Ground terminal	Signal and waveform
CP1-1 CP1-2 CP1-3	EX FB 15G	CP1-3	Square wave for resolver excitation Resolver FB square wave Control ground Waveform example: 
CP3-1 CP3-2 CP3-3	A B Z	Bottom right stud	Encoder phase A Encoder phase B Encoder phase Z Waveform examples: During counterclockwise rotation as seen from detector shaft side  R : Motor speed (rpm) Encoder : OAER−SK−1X (5000p/r) $T=\frac{60}{R\times 5000}$ [sec] $a,\ b,\ c,\ d=\frac{1}{4}T\pm\frac{1}{12}T$ To = T − 3T
CP2-1	FBL	CP2-3	Resolver FB level Waveform example:  te ≒ 222μs
CP2-2 CP2-3 CP2-4	P15 15G N15	CP2-3	+15V control power 14.25 - 15.75V Control ground -15V control power -14.25 - -15.75V

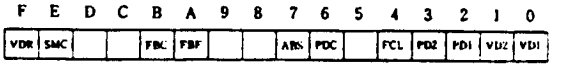
7. PARAMETER SETTING

There are 32 servo parameters and the method used for their display and setting varies in accordance with the NC unit used. Reference should therefore be made to the Operating Instructions.
Section 6.3 gives the parameter contents.

PARAMETER CONTENTS

	Item		Description	Setting range (unit)
1	PC1		This sets the number of gear teeth on the motor side. (Setting should be made so the PC1 and PC2 have the lowest possible integral ratio.)	1—30 (Note 1)
2	PC2		This sets the number of gear teeth on the machine side. (Setting should be made so the PC1 and PC2 have the lowest possible integral ratio.)	1—30 (Note 1)
3	PGN		This sets the position loop gain in gradations of 0.25. Normally, setting is made to 33.00.	1—100 (rad/sec)
4	LGN		This is usually set to 0.	Hexadecimal setting
5	VG1		Sets the velocity loop gain. The standard settting is 150. When set higher (approx. 200—300), the response is enhanced but this is accompanied by increased vibration and noise. (Equivalent to VR9 in conventional amplifiers.)	1—500
6	VG2		This is usually set to 0.	-32768—32767
7	VIL		Sets the velocity loop delay compensation. The delay is not compensated at 10000, and set when lower, the gain is reduced. If parameter SSF bit 0 is 0, however, the setting becomes invalid and is considered to be set at 10000. When the parameter is valid, this is normally set at 9800. (Equivalent to IND 1 or 2 in conventional amplifiers.)	9000—10000

<table>
<tr><th></th><th colspan="2">Item</th><th>Description</th><th>Setting range (unit)</th></tr>
<tr><td>8</td><td>VIA</td><td></td><td>Sets the frequency for velocity loop advance compensation. At a higher setting, the response improves but normally it is fixed at the standard setting. The response is controlled by VG1. Normally setting is made to 682.
(Equivalent to VR3 in a conventional amplifier.)</td><td>163-16348
(0.085 rad/sec)</td></tr>
<tr><td>9</td><td>IQA</td><td></td><td>This is the current loop internal compensation. It is normally set to the standard setting.
(Refer to the standard settings on the attached sheet.)</td><td>1- 7680</td></tr>
<tr><td>10</td><td>IDA</td><td></td><td>This is the current loop internal compensation. It is normally set to the standard setting.
(Refer to the standard settings on the attached sheet.)</td><td>1- 32767</td></tr>
<tr><td>11</td><td>IQG</td><td></td><td>This is the current loop internal compensation. It is normally set to the standard setting.
(Refer to the standard settings on the attached sheet.)</td><td>100-5000</td></tr>
<tr><td>12</td><td>IDG</td><td></td><td>This is the current loop internal compensation. It is normally set to the standard setting.
(Refer to the standard settings on the attached sheet.)</td><td>1-2560</td></tr>
<tr><td>13</td><td>ILP</td><td></td><td rowspan="2">This sets the current limit value. This should be set to the value obtained by multiplying the peak current value (A) by the corresponding magnification factor below. It cannot be set to a value higher than the maximum current value.
<table><tr><th>Motor model</th><th>Max. current</th><th>Magnification factor</th></tr><tr><td>HA40, 43</td><td>22 A</td><td>62.0</td></tr><tr><td>80, 83</td><td>40</td><td>34.1</td></tr><tr><td>100</td><td>60</td><td>22.7</td></tr><tr><td>200</td><td>80</td><td>17.0</td></tr><tr><td>300</td><td>120</td><td>11.3</td></tr></table></td><td>1- 1364</td></tr>
<tr><td>14</td><td>ILN</td><td></td><td>-1 -1364</td></tr>
<tr><td>15</td><td>FFC</td><td></td><td>Not used</td><td></td></tr>
<tr><td>16</td><td>TGN</td><td></td><td>This sets the lost motion correction gain. If bit 14 of parameter STY is 0, no correction results.
This is usually set to 0.</td><td>0-100 (%)
Hexadecimal setting:
100% = 64H</td></tr>
</table>

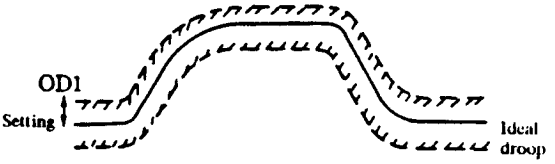
	Item		Description	Setting range (unit)
17	STY		This setting relates to the servo loop.  VDR: Velocity detector connector (usually set to 0) 0: Direction A or C (same as, or opposite to, direction of motor Cannon plug.) 1: Direction B or D (differs by 90o from direction A or C.) SMC: Lost motion compensation (usually set to 0) 0: No operation 1: Operation (gain by TGN) FBC: Speed feedback correction (usually set to 0) 0: Not corrected 1: Corrected (used to correct jitter with light loads) FBF: Speed feedback correction (usually set to 0) 0: Not corrected 1: Corrected (used to reduce machine vibration) ABS: Absolute value detection function 0: No operation 1: Operation (valid only with an absolute value system.) PDC: Position feedback polarity 0: Normal polarity (mounted on the no-load side of the motor or in the same direction.) 1: Reverse polarity (opposite to the above direction.) FCL: Servo loop 0: Semi-closed loop 1: Closed loop (includes ball screw end detection) PD2/PD1: Position detector connection destination cards VD2/VD1: Velocity detector connection destination cards Example) This sets one of the values in the table below according to the servo amplifier.	Hexadecimal setting

Connection destination card	PD2/VD2	PD1/VD1
RF01	0	0
RF31, RF33	0	1

Servo amplifier	PD2	PD1	VD2	VD1	
E-01	0	0	0	0	0
E-31	0	1	0	0	4
E-33	0	0	0	1	1
	0	1	0	1	5
Z-33	0	1	0	0	4
	0	1	0	1	5

<table>
<tr><th></th><th colspan="2">Item</th><th>Description</th><th>Setting range (unit)</th></tr>
<tr><td>18</td><td>PIT</td><td></td><td>This sets the ball screw pitch (lead) as is.</td><td>1—50 (mm)</td></tr>
<tr><td>19</td><td>RNG</td><td></td><td>This sets one of the values in the table below according to the position detector used.
<table>
<tr><th>Position detector</th><th>RNG</th></tr>
<tr><td>Encod 3000p/r</td><td>12</td></tr>
<tr><td>5000p/r (OSE5K-6080108
OAER5K-1X-3-8-108
OSE5K-ET-3-9.52-0
OAER5K-1X-ET
-3-9.52-0)</td><td>20</td></tr>
<tr><td>25000p/r (OAER25K-1X-3-8-108)</td><td>100</td></tr>
<tr><td>Linear scale Inductosyn</td><td>PIT x 1μ / Scale resolution (μ)</td></tr>
</table></td><td>1—1000</td></tr>
<tr><td>20</td><td>ORT</td><td></td><td>This sets the thermal time constant of the regnerative resistance over-heating detectors (OR, WOR).
<table>
<tr><td>Standard (no external regenerative resistance)</td><td>4680</td></tr>
<tr><td>External regenerative resistance present</td><td>3010</td></tr>
</table></td><td>51—18000 (100ms)</td></tr>
<tr><td>21</td><td>OLT</td><td></td><td>This sets the detection time constant of the motor overload detectors (OL1, WOL).
60 sec. is the standard setting. (Setting: 600)</td><td>1—18000 (100ms)</td></tr>
<tr><td>22</td><td>OLL</td><td></td><td>This sets the detection level of the motor overload detectors (OL1, WOL).
150% is the standard setting.</td><td>1—500 (%)</td></tr>
</table>

	Item		Description	Setting range (unit)
23	OD1		This sets the range for excessive errors during servo ON. The maximum deviation from the ideal droop (when the load is small for the command) is used for the setting. Ideally, there should be no deviation but, in reality, errors in the ideal droop calculation and the effects of the load together result in deviation. Set it to over 20% of the max. droop during trapid traverse, as a guideline for setting.	1-32767 (interpolation unit)



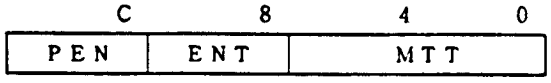
An excessive error alarm will result unless the droop is within the shaded area above.

Example: Rapid traverse 15 m/min
Position loop gain 33
Interpolation unit 0.5 μ

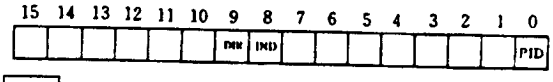
$$\frac{15\times10^6}{60\times33\times0.5}\times 0.2=3030\fallingdotseq3100$$

Rapid traverse	Setting
1m/min	300
2 m/min	500
3 m/min	700
4 m/min	900
5 m/min	1100
6 m/min	1300
8 m/min	1700
10 m/min	2100
12 m/min	2500
15 m/min	3100
16 m/min	3300
18 m/min	3700
20 m/min	4100
24 m/min	4900

Position loop gain 33
Interpolation unit 0.5 μ

<table>
<tr><th></th><th colspan="2">Item</th><th>Description</th><th>Setting range (unit)</th></tr>
<tr><td>24</td><td>ZRZ</td><td></td><td>This sets the in-position judgment value. The servo parameter is not changed except during in-position.
Units of 100 are the normal guideline for setting.</td><td>0-32767
(interpolation unit)</td></tr>
<tr><td>25</td><td>MTY</td><td></td><td>This sets the model names of the motor and detector.
 

PEN: This is set for the position detector as indicated below.
ENT: This is set for the velocity detector (mounted on the no- load side of the motor) as indicated below.
With a semi- closed system: PEN = ENT
<table><tr><th>Detector</th><th>PEN/ENT</th></tr><tr><td>3000p/r encoder</td><td>0</td></tr><tr><td>5000p/r encoder (OSE5K-6-8-108, OSE5K-ET -3- 9.52-0)</td><td>1</td></tr><tr><td>5000p/r encoder + absolute value (OAER5K-1X-3-8-108, OAER5K-1X-ET -3-9.52)</td><td>9</td></tr><tr><td>25000p/r encoder (OAER25K-1X-3-8-108)</td><td>A</td></tr><tr><td>Linear scale (inductosyn + A/D converter, optical scale magnescale)</td><td>4</td></tr></table>
MTT This is set for the motor type as below.
<table><tr><th>Motor type</th><th>MTT</th></tr><tr><td>HA33</td><td>8F</td></tr><tr><td>HA40</td><td>0</td></tr><tr><td>43</td><td>80</td></tr><tr><td>80</td><td>1</td></tr><tr><td>83</td><td>81</td></tr><tr><td>100</td><td>2</td></tr><tr><td>200</td><td>3</td></tr><tr><td>300</td><td>4</td></tr></table></td><td>Hexadecimal setting</td></tr>
<tr><td>26</td><td>OD2</td><td></td><td>This sets the range of excessive error during servo OFF. The setting is made in accordance with OD2. If 0 is set, excessive errors will not be detected.</td><td>0-32767
(interpolation unit)</td></tr>
</table>

<table>
<tr><th></th><th colspan="2">Item</th><th>Description</th><th>Setting range (unit)</th></tr>
<tr><td>27</td><td>SSF</td><td></td><td>This selects the special servo function.
 

PID: Velocity loop delay compensation (normally set to 0)
0: No operation
1: Operation
IND, DIR: Set these with a large scale feedback Z phase width (with inductosyn + magnescale, etc.)
<table><tr><th></th><th>DIR</th><th>IND</th></tr><tr><td>Zero point return direction +</td><td>0</td><td>1</td></tr><tr><td>Zero point return direction -</td><td>1</td><td>1</td></tr></table></td><td>Hexadecimal setting</td></tr>
<tr><td>28
29
30
31
32</td><td>SP1
SP2
SP3
SP4
SP5</td><td></td><td>Not used; normally set to 0.</td><td></td></tr>
</table>

Standard settings (by individual motor)

Parameter		HA40	80	100	200	300	43	83	33	
1	PC1									
2	PC2									
3	PGN	33.00	←	←	←	←	←	←	←	
4	LGN	0	←	←	←	←	←	←	←	
5	VG1	150	←	←	←	←	←	←	←	
6	VG2	0	←	←	←	←	←	←	←	
7	VIL	10000	←	←	←	←	←	←	←	
8	VIA	682	←	←	←	←	←	←	←	
9	IQA	2048	←	1024	←	←	←	←	256	
10	IDA	2048	←	←	←	←	←	←	256	
11	IQG	512	←	256	←	←	←	←	256	
12	IDG	512	←	←	←	←	←	←	256	
13	ILP	1230	←	←	←	←	←	←	←	
14	ILN	-1230	←	←	←	←	←	←	←	
15	FFC	0	←	←	←	←	←	←	←	
16	TGN	0	←	←	←	←	←	←	←	
17	STY									
18	PIT									
19	RNG									
20	ORT	4680	←	←	←	←	←	←	←	3010 with external regenerative resistance
21	OLT	600	←	←	←	←	←	←	←	
22	OLL	150	←	←	←	←	←	←	←	
23	OD1									
24	ZRZ	100	←	←	←	←	←	←	←	
25	MTY	00	01	02	03	04	80	81	8F	
26	OD2									
27	SFF	0	←	←	←	←	←	←	←	
28	SP1	0	←	←	←	←	←	←	←	
29	SP2	0	←	←	←	←	←	←	←	
30	SP3	0	←	←	←	←	←	←	←	
31	SP4	0	←	←	←	←	←	←	←	
32	SP5	0	←	←	←	←	←	←	←	

The machine specifications are followed for the settings in the blank columns.

NOTE 1. Restrictions placed on PC1 and PC2
Settings 1 through 30 are used as a rule for PC1 and PC2 and if the following restrictions are satisfied, other settings can also be made.

1. With a semi-closed system
   (1) PC1 < 2730 / (PIT x RNG)
   (2) PC2 < 32767 / (RNG x U)
   Where U is the interpolation unit
2. With a closed system (including ball screw end)
   (1) PC1 < 2730 / (PIT x RNG)
   (2) PC2 < 8190 / PGN
   U: interpolation unit

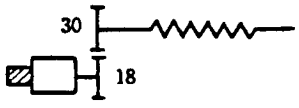
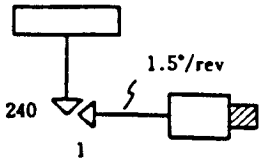
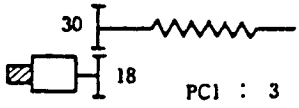
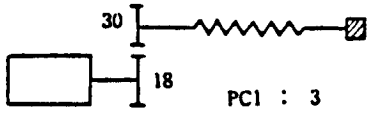
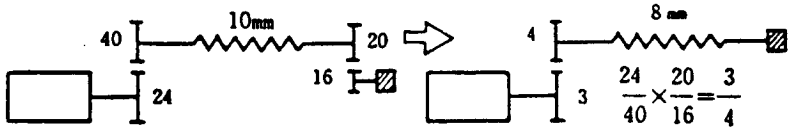
The value of PIT produced by turning PIT and RNG into the minimum integral ratio can be substituted in the above formula. The unchanged value of RNG is substituted as its setting.
Example: When PIT = 10, RNG = 20, U = 0.5 and PGN = 33 in a closed system
1 can be substituted for PIT when PIT and RNG are turned into the minimum integral ratio.
PIT:RNG = 10:20 = 1:2
   (1) PC1 ≤ 2730 / (1 x 20) = 136
   (2) PC2 < 8190 / 33 = 248
Therefore, PC1 ≤ 136, PC2 ≤ 248

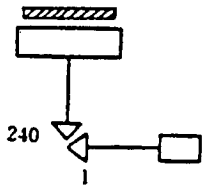
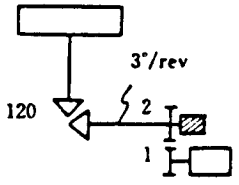
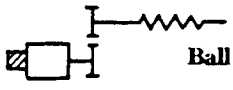
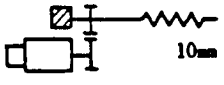
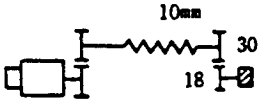
NOTE 2 Interpolation unit (U)
This is the NC internal unit. It is one of the values below, depending on the command unit (input unit).

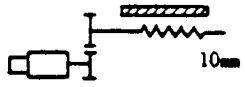
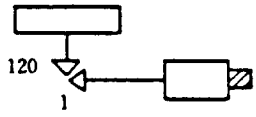
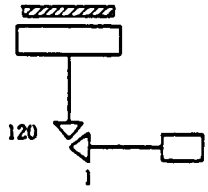
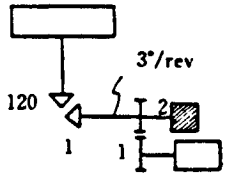
Command (input) unit	Interpolation unit (U)
10 μ/5 μ	5
1 μ/0.5 μ	0.5
0.1 μ/0.05 μ	0.05

NOTE 3 Parameters 1 through 16 are valid immediately if their settings are changed; the settings should be changed during emergency stop. Parameters 17 through 32 are not valid unless the power is switched off once.

(Note 4) Setting examples for PC1, PC2 and PIT

	Item	Description
1	PC1 PC2	(1) When detector is on motor no-load side ○ With ball screw The gear ratio between the motor and machine sides is reduced and set. Example: Deceleration ratio of 18/30 is reduced and 3/5 is set.  PC1 : 3 PC2 : 5 ○ With rotary axis The gear ratio between the motor and machine sides is reduced and set. Example: When rotary angle is 360o.  PC1 : 1 PC2 : 240 (PIT : 360) (2) When detector is on machine (including ball screw end) ○ With ball screw Same as with linear scale (1)  PC1 : 3 PC2 : 5 In the case of a rotary type, the gear ratio from the motor to the detector is set. In the case of a rotary type, the gear ratio from the motor to the detector is set.  PC1 : 3 PC2 : 5 Exception: With a special gear configuration  PC1 : 3 PC2 : 4 PIT : 8

	Item	Description
	PC1, PC2 cont.	○ With rotaty axis The gear ratio from the motor to detector is set. **Example:**  P C 1 : 1 (P I T : 360) P C 2 : 240 **Exception: With a special gear configuration**  P C 1 : 1 P C 2 : 2 P I T : 3 **Set as shown here.**
18	PIT	(1) With ball screw ○ When detector is on motor no-load side The ball screw pitch is set as is. **Example:**  **Ball screw pitch (lead): 10 mm** P I T : 10 Detector: machine side Setting is made to the detector equivalent ball screw pitch.  Exception: With a special gear configuration P I T : 10  $10 \times \frac{18}{30} = 6$ P I T : 6

	Item	Description
	PIT cont.	○ When detector is on machine side (linear scale) The ball screw pitch is set as is. **Linear scale and inductosyn**  P I T : 10 (2) With a rotary axis ○ When detector is on motor no-load side The rotary angle of a single rotation at the machine side is set. This is normally set as 360.  P I T : 360 ○ When detector is on machine side (rotary inductosyn, etc.) **The rotary angle of a single rotation at the machine side is set.**  P I T : 360 **Exception: With a special gear configuration**  P C 1 : 1 P C 2 : 2 P I T : 3

Note 5: Examples of settings by units and detectors

Amplifier model		E-01	E-31					E-33		Z-33		
Velocity detector		OSE5K	OSE5K					OAER25K-1X		OAER5K-1X	OSE5K	
Position detector			OSE5K-ET (ball screw end)	Linear scale (1μ)	Inductosyn A/D converter 1/2000	Rotary inductosyn 360° A/D converter 1/2000	Linear scale (0.1μ)		Linear scale (0.1μ)		OAER5K-1X-ET	
Servo parameter	17 STY	xx00	xx14 xx54	xx14 xx54	xx14 xx54	xx14 xx54	xx14 xx54	xx05	xx11 xx51	xx85	xx94 xxD4	
	19 RNG	20	20	PIT	PIT	360	PITx10	100	PITx10	20	20	
	25 MTY	11xx	11xx	41xx	41xx	41xx	41xx	AAxx	4Axx	99xx	91xx	
	2 SSE	0000	0000	0000	0100( ) 0300( )	0100( ) 0300( )	0000	0000	0000	0000	0000	
	Others					Example with 1/90 gear ratio PC1 1 PC2 90		OD1 OD2 x10 ZR2				
Zero point return parameter	4 grsps	20, 10, 5, 4, 2, 1	20, 10, 5, 4, 2, 1	Note)	2, 1	2, 1	Note)	100, 50, 25, 20, 10, 5, 4, 2, 1	Note)	20	20	

Note) Any value may be used if the quotient produced by dividing (number of output pulses of phase A from phase Z to phase Z) x 4/1000 by an integer is a value which represents an integer; in the case of a scale with only 1 pulse for the Z phase, any value may be used if it is an integer.

8. ABSOLUTE POSITION SYSTEM

(T20/T30 system and M300 series)

8.1 PARAMETERS FOR CONFIGURATING ABSOLUTE POSITION SYSTEM

(1) Absolute position function valid parameter:
[NC basic specifications] Axes

M3	absen	1
T20/T30	None	

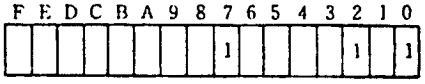
(2) Zero point return parameter

M3	grspc	20
T20/T30	AU	0 OR 20

(3) Absolute position detection system parameter: [Servo parameter]

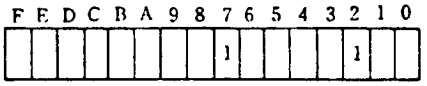
i) Motor end detection

M3	#17	STY	85H
T20/T30	#17		133H



ii) Ball screw end detection

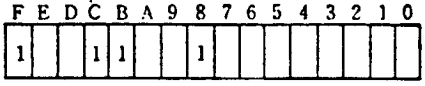
M3	#17	STY	84H
T20/T30	#17		132H



(4) Absolute position detector parameter: [Servo parameter]

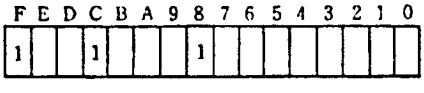
i) Motor end detection

M3	#25	MTY	9900H
T20/T30	#25		39168H

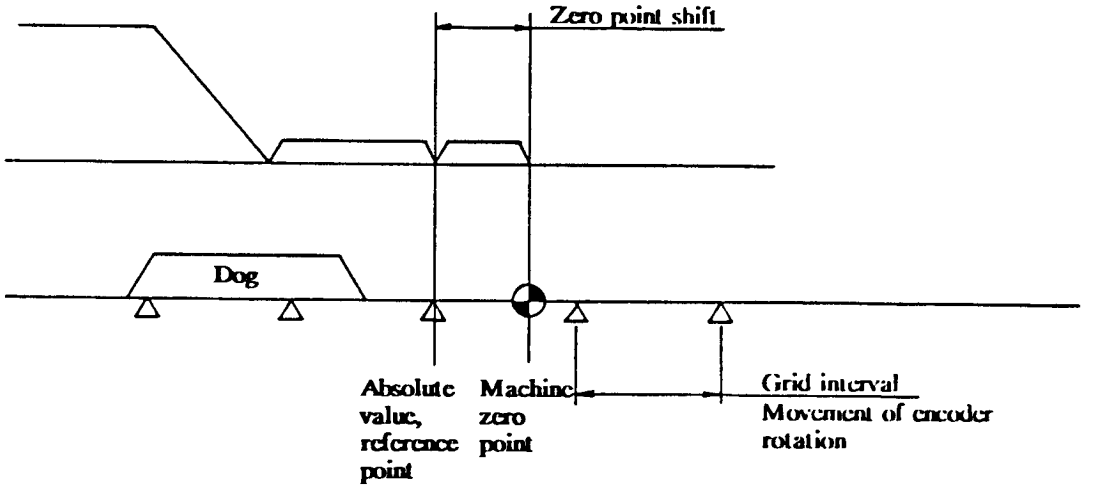


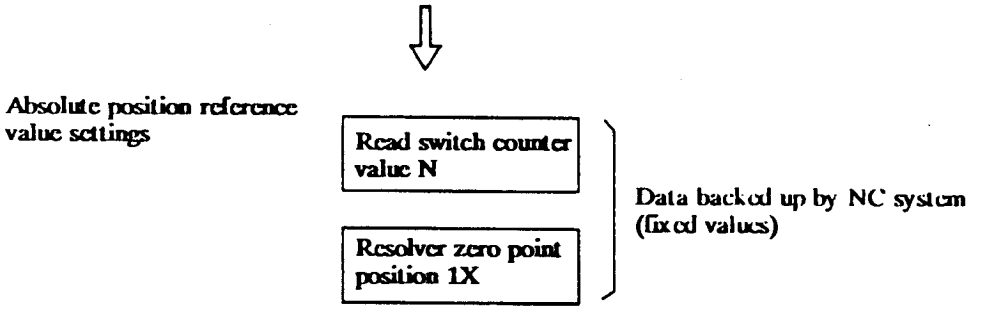
ii) Ball screw end detection

M3	#25	MTY	9100H
T20/T30	#25		37120H



8.2 PARAMETERS FOR DOG-TYPE ZERO POINT RETURN





NOTE: 1. Unless dog-type zero point return is performed, the reference values applying for the previous dog-type zero point return are retained as the above N and 1X reference absolute values.
2 The N and 1X data are displayed on the servo monitor screen for the M3 system and on the interface diagnosis screen for the T20/T30 system.

8.3 CHECK PROCEDURE FOR ABSOLUTE POSITION DATA

(1) Set the zero point shift to zero.
(2) Conduct high-speed zero point return. (The machine stops above the absolute value reference point.)

NOTE: When dog-type zero point return is performed, the N and 1X values backed up by the NC system are also reset.

(3) On the diagnosis screen, check whether the current reed switch value ni and 1X data are the same as the N and 1X reference values.

(4) As the check for the grid, check on the diagnosis screen whether the value on the cyclic counter is near 0 or 20,000.

8.4 WHEN THERE IS SOMETHING WRONG WITH THE ABSOLUTE POSITION COORDINATE SYSTEM

(1) Check the present N and 1X reference values.
(2) Conduct dog-type zero point return. (Alarm release)
(3) Check the N and 1X reference values applying with the present dog-type zero point return.

8.5 CHECKING THE ABSOLUTE POSITION DATA (THE ADDRESSES MAY DIFFER ACCORDING TO THE ROM VERSION)

M3 (1) Standard values N, 1X (displayed for all axes) — Servo monitor screen

(2) Servo data window — Interface diagnosis screen

1) Addressing

1st axis	(A10009)	(address L)	(B)
	(A10008)	(address H)	(B)
2nd axis	(A10109)	(address L)	(B)
	(A10108)	(address H)	(B)
3rd axis	(A10209)	(address L)	(B)
	(A10208)	(address H)	(B)

2) Data

1st axis A10008

	9
A	Data 1
B	Data 2
C	Data 3
D	Data 4

2nd axis A10108

	9
A	Data 1
B	Data 2
C	Data 3
D	Data 4

(3) Servo window addresses

	Address H	Address L	Data L/H
Present reed switch value ni	20	08	Data 2, 4
Present resolver value 1XZi	00	CE	Data 3, 4
Cyclic counter value	20	24	Data 2, 4

T20/T30 (1) Standard values N, 1X Diagnosis screen

1st axis
N: 1CB102 (data L)
3 (data H)
1X: 1CB104 (data L)
5 (data H)

2nd axis
N: 1CB112 (data L)
3 (data H)
1X: 1CB114 (data L)
5 (data H)

(2) Servo data window Diagnosis screen
1) Addressing The addresses are set on the diagnosis screen.
181FF2 03 INPUT (addressing valid)
1st axis
181F00 (address L)
F01 (address H)
2nd axis
181F10 (address L)
F11 (address H)
2) Data
1st axis 2nd axis

181F02	Data 1
03	Data 2
04	Data 3
05	Data 4

181F12	Data 1
13	Data 2
14	Data 3
15	Data 4

(3) Servo window addresses

	Address H	Address L	Data L/H
Present reed switch value ni	20	08	Data 1, 3
Present resolver value 1Xi	00	CE	Data 1, 2
Cyclic counter value	20	24	Data 1, 3

M310 (1) Reference values N, 1X Servo monitor screen
(Displayed for all axes)
(2) Servo data window Interface diagnosis screen
1) Addressing

1st axis	(9689)	(address L)	(B)
	(9688)	(address H)	(B)
2nd axis	(9989)	(address L)	(B)
	(9988)	(address H)	(B)
3rd axis	(9C89)	(address L)	(B)
	(9C88)	(address H)	(B)
	(9F89)		
	(9F88)		

Address

950C
980C
9B0C
9E0C

When bit 7 is set to "1," monitoring proceeds; when it is set to "0," it is suspended.

2) Data
1st axis 9688 2nd axis 9988

9A	Data 1
B	Data 2
C	Data 3
D	Data 4

9A	Data 1
B	Data 2
C	Data 3
D	Data 4

(3) Servo window addresses

	Address H	Address L	Data L/H
Present reed switch value ni	20	08	Data 2, 4
Present resolver value 1Xi	00	CE	Data 3, 4
Cyclic counter value	20	24	Data 2, 4

Window function for MR-S amplifier in M310L/M system

(1) The amplifier addresses are set in the window addresses (W).
(2) The window monitor start bit is set when monitoring the data of the addresses set in (1). When this is done, the amplifier data are sampled and monitored in 3.5 ms cycles in the window data.
Monitoring is cancelled when the monitor start bit is reset (to zero).

		Address			
		Axis 1	2	3	4
Address for setting	7 0 Window monitor start	950C	980C	9B0C	9E0C
	Window address	9688	9988	9C88	9F88
Address for monitoring data	Window data	968A	998A	9C8A	9F8A

8.6 ABSOLUTE POSITION DETECTION ALARMS

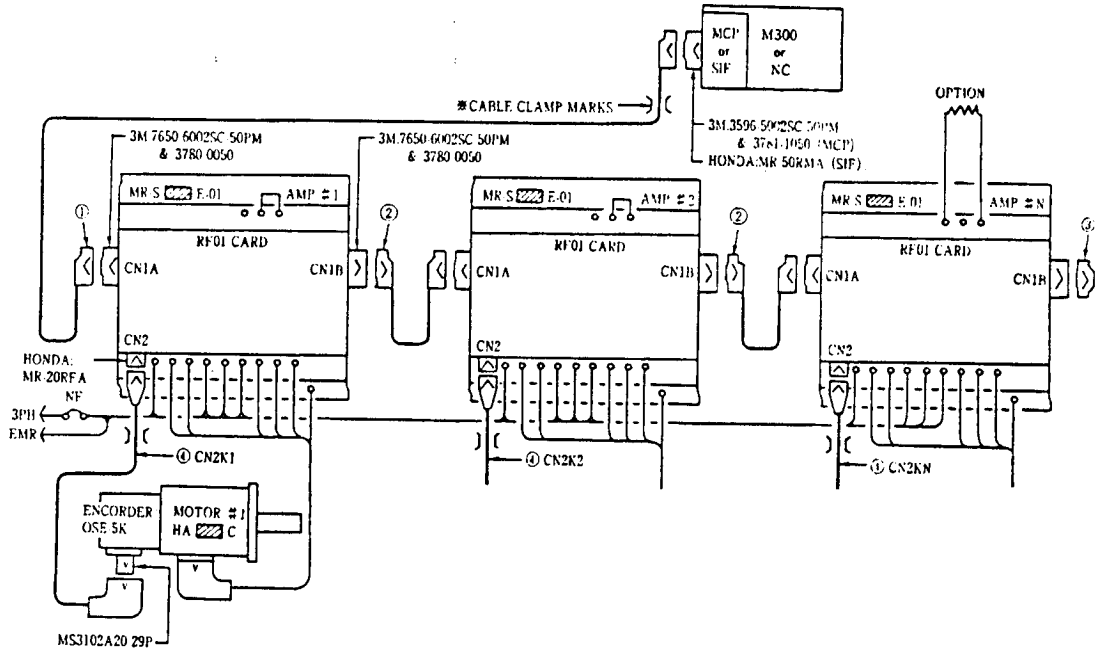
The following errors relating to absolute position detection are indicated.

No.	Abbreviation	Name	Description
25	BA	Battery malfunction	Voltage drop in battery used to back up absolute position detector circuit on RF33 card. Replace or recharge battery. Absolute position data may be lost.
26	WAB	Absolute position detection error warning	Incorrect encoder/resolver error or reference 1X value backed up by NC system. 20° < 1x < 340° or 365° < 1 or ERE > 50. Absolute position data may be lost.

APPENDIX 1. SYSTEM DIAGRAMS OF CABLE CONNECTIONS

Appendix 1.1 System diagram of E-01 cables for MR-S system

* See Section 4.1 (9).

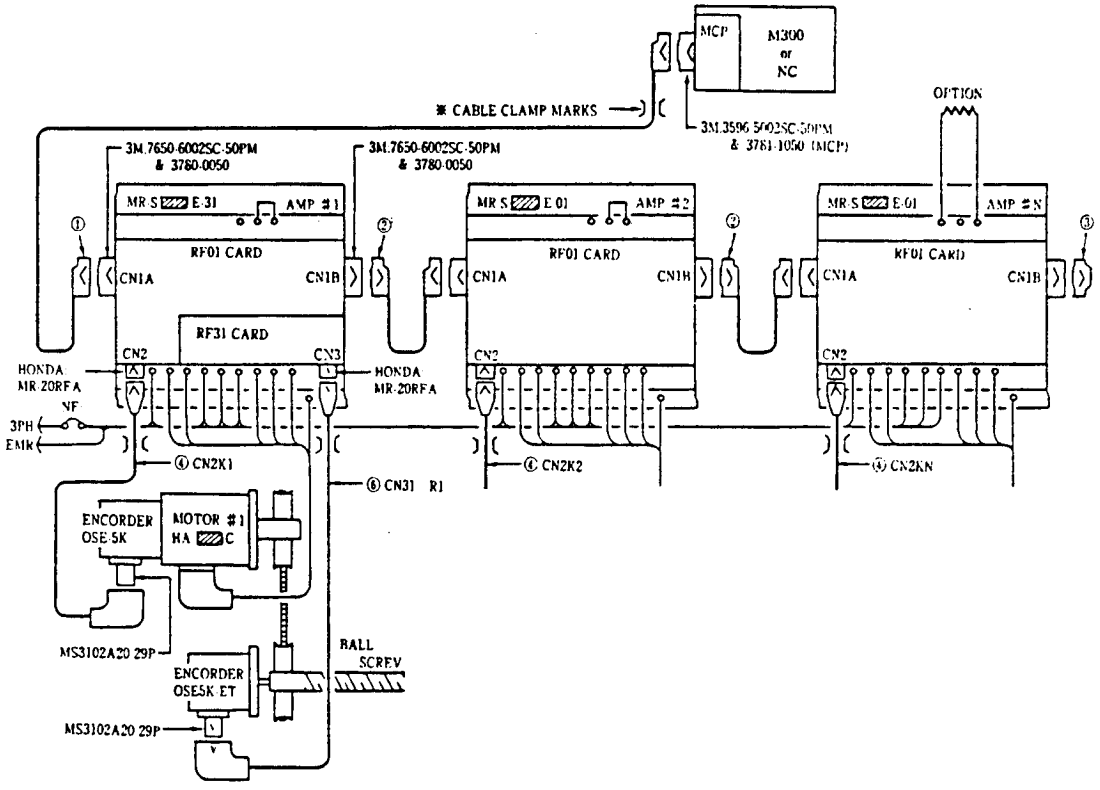


Parts no.	Name	No. used	Standard length	Max. length	Section to be referred to	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	Max. length 30 m	Section 5.3	CAM11 or CAM21
2	AMP-AMP CABLE	N-1	0.5 m			CAM11
3	CABLE END	1	—	—		RF54
4	AMP-ENC CABLE	N-1	5 m	50 m	Section 5.4.1	CN2K1-CN2KN

NOTE: (1). N: total number of axes; but N ≦ 6 (N ≦ 4 with M310 system)
(2). Example of total length for cables with cat. no. (1) and (2): Standard length with 6 axes is 1 x 5 + (5 x 0.5) = 7.5 m.

Appendix 1.2 MR-S E-31 CABLE DIAGRAM (detection of ball-thread shaft's end).

The example given is for the case where the first shaft is MR-S E-31, and the second shaft is MR-S E-01.



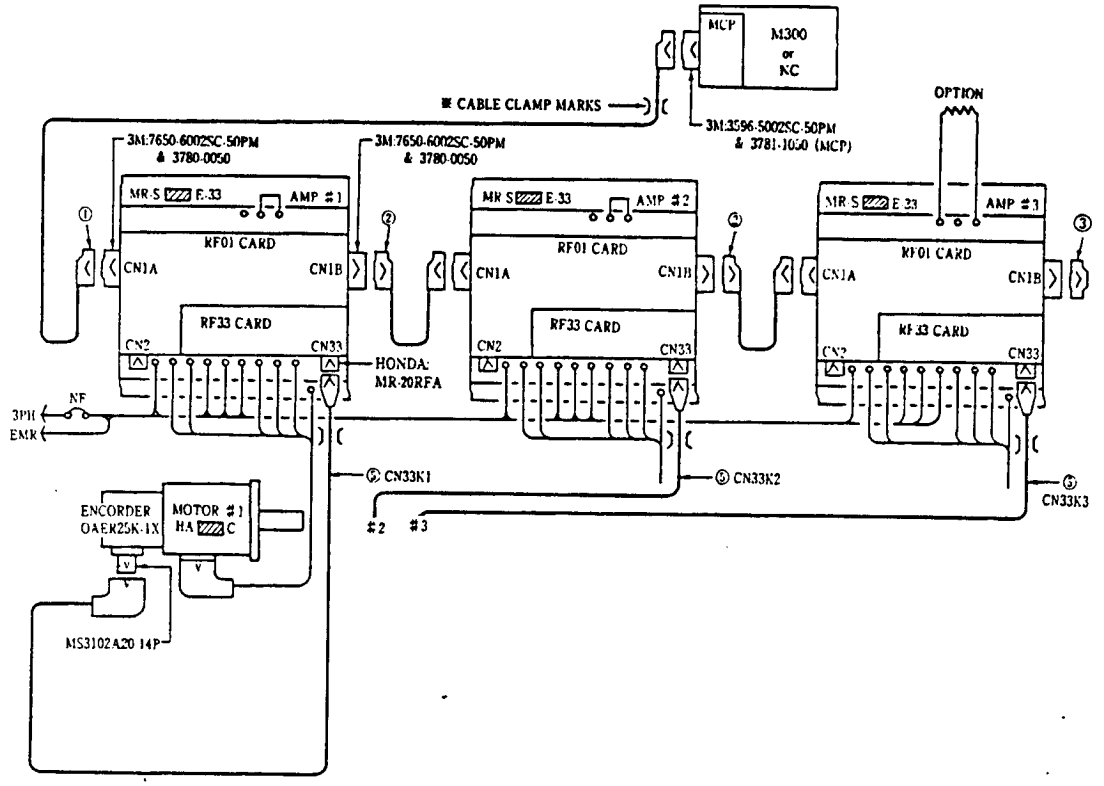
Catalogue no.	Name	No. used	Standard length	Max. length	Refer to Item no.	Remarks
1	MCP-AMP CABLE	1	5 m	Max. length 30 m	Item 5.3	CAM11
2	AMP-AMP CABLE	N-1	0.5 m			CAM11
3	CABLE END	1	—	—		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Item 5.4.1	CN2K1-CN2KN
6	AMP-ENC CABLE	n	5 m	50 m	Item 5.4.2	CN31R1

NOTE: (1) N: total number of axes; n: number of MR-S E-31 axes, but $N \leqq 6$, $N \geqq n$ ($n = 1$ in this figure)

(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 6 axes is $1 \times 5 + (5 \times 0.5) = 7.5$ m.

APPENDIX 1.3 MR-S E-33 CABLE DIAGRAM (SEMI- CLOSED, SUBMICRON)

The diagram indicates a case where a submicron semi-closed configuration applies to all 3 axes.

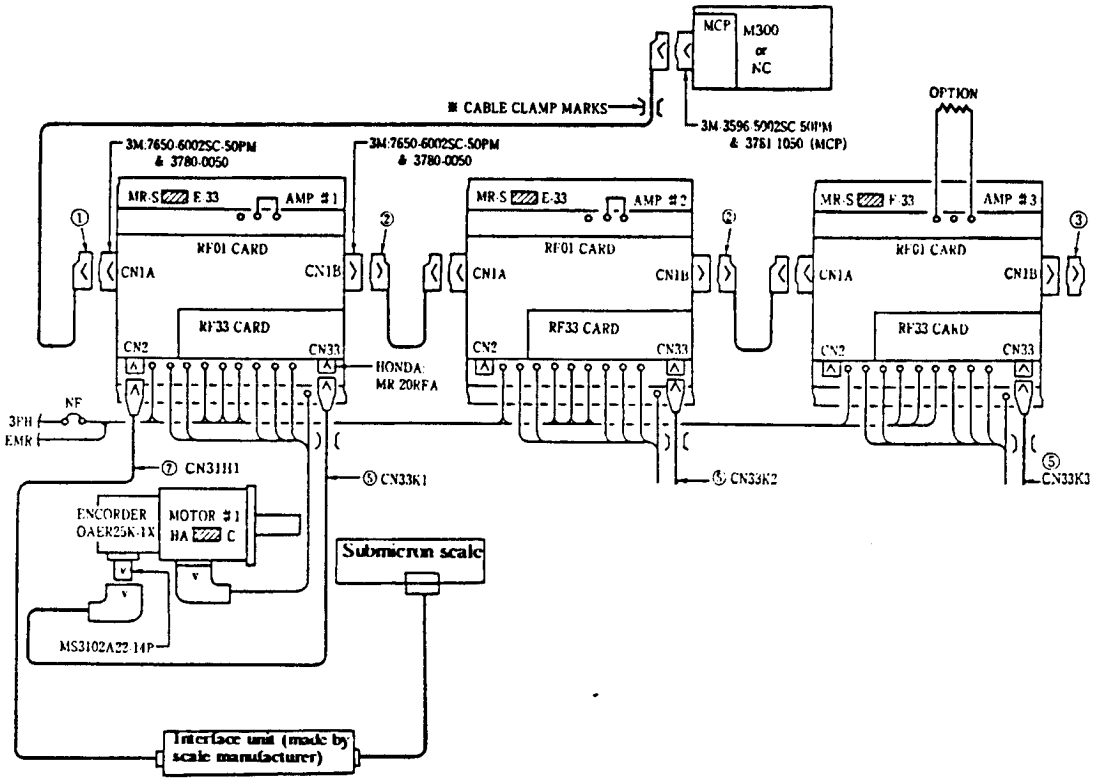


Catalogue no.	Part name	No. used	Standard length	Max. length	Reference section no.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	N-1	0.5			CAM11
3	CABLE END	1	—	—		RF54
5	AMP-ENC CABLE	N-1	5 m	20 m	Section 5.4.3	CN33K1-CN33K3

NOTE: (1) N: total number of axes; but $N \leqq 6$
(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 3 axes is 1 x 5 + (3 x 0.5) = 6.5 m.

APPENDIX 1.4 MR-S E-33 CABLE DIAGRAM (SCALE FEEDBACK, SUBMICRON)

The diagram indicates a case where a submicron scale feedback configuration applies to 1 axis and a submicron semi-closed loop configuration applies to 2 axes.



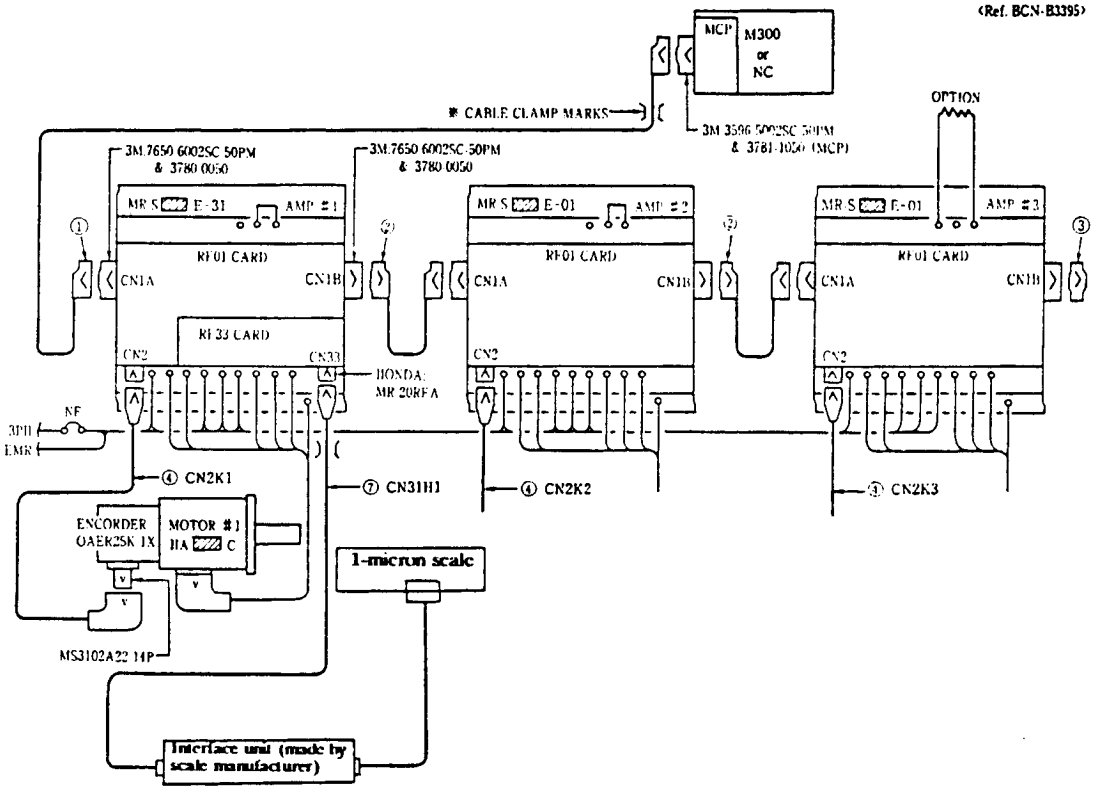
Catalogue no.	Part name	No. used	Standard length	Max. length	Reference section no.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	N- 1	0.5			CAM11
3	CABLE END	1	—	—		RF54
5	AMP-ENC CABLE	N	5 m		Section 5.4.3	CN33K1-CN33K3
7	AMP-I/F UNIT CABLE	n			Details available separately	CN31H1

NOTE: (1) N: total number of axes; n: number of scale feedback axes; but $N \leqq 6$, $N \geqq n$ ($n = 1$ in this figure)

(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 3 axes is 1 x 5 + (3 x 0.5) = 6.5 m.

APPENDIX 1.5 MR-S E-31 CABLE DIAGRAM (SCALE FEEDBACK, 1-MICRON SCALE)

The diagram indicates a case where a 1-micron scale feedback configuration applies to 1 axis and a 1-micron semi-closed loop configuration applies to 2 axes.

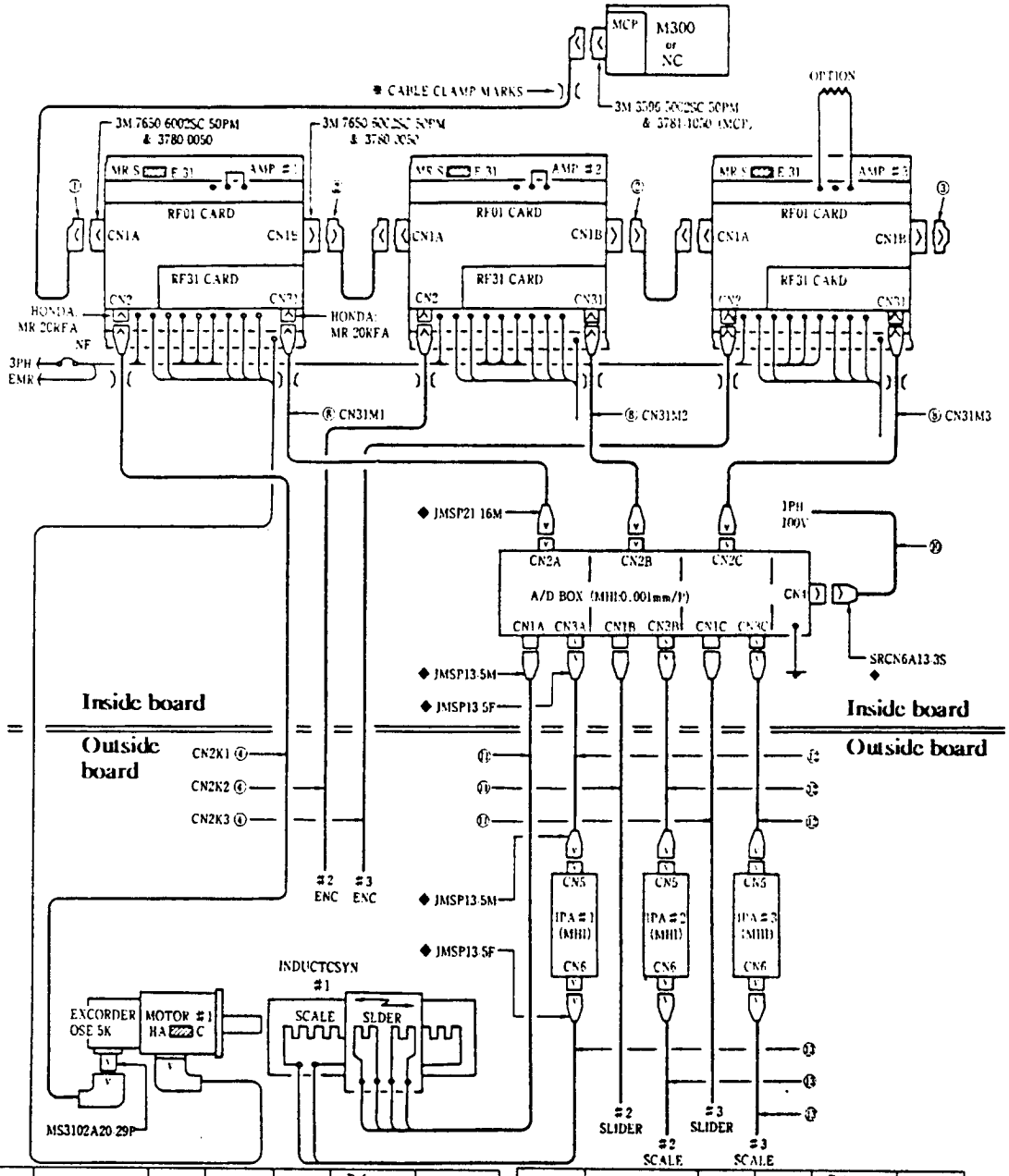


Catalogue no.	Part name	No. used	Standard length	Max. length	Reference section no.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	N- 1	0.5			CAM11
3	CABLE END	1	—	—		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2K3
7	AMP-I/F UNIT CABLE	n			Details available separately	CN31H1

NOTE: (1) N: total number of axes; n: number of scale feedback axes; but $N \leqq 6$, $N \geqq n$ ($n = 1$ in this figure)
(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 3 axes is 1 x 5 + (3 x 0.5) = 6.5 m.

APPENDIX 1.6 MR-S E-31 CABLE DIAGRAM (SCALE FEEDBACK 1-MICRON INDUCTOSYN)

The diagram indicates an example of a 1-micron/pulse inductosyn scale feedback configuration for all 3 axes.



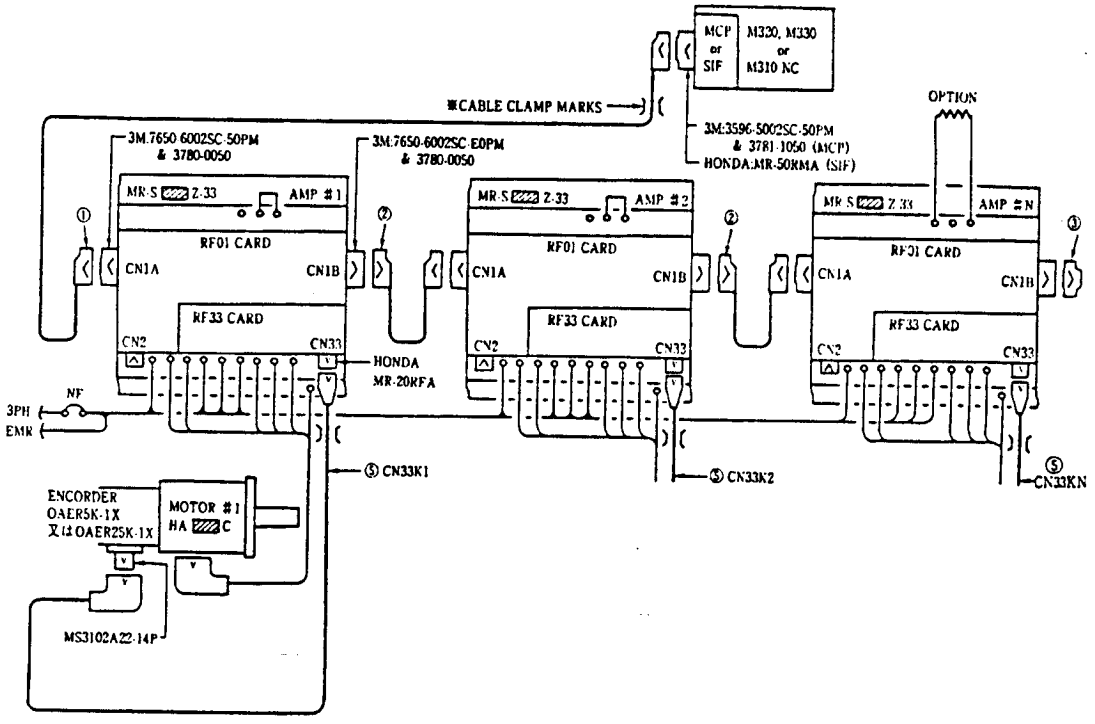
Catalogue no.	Part name	No. used	Standard length	Max. length	Reference section no.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5			CAM11
3	CABLE END	1	—	—		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2K3
5	AMP-A/D CABLE	N	5 m	15 m	Section 5.4.5	CN31M1-CN31M3

Catalogue no.	Part name	No. used	Max length	Reference section no.	Remarks
10	A/D POWER CABLE	1	20 m	Operating Instruction manual No.I-134 dated November 1985 and published by Mitsubishi Heavy Industries	
11	A/D-SLIDER CABLE	N	20 m		
12	A/D-IPA CABLE	N	20 m		
13	IPA-SCALE CABLE	N	0.5 m		

NOTE: (1) N: total number of axes; but N ≦ 6 (N = 3 in this figure)
(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 3 axes is 1 x 5 + (3 x 0.5) = 6.5 m.
(3) The plugs with a ◆ mark are accessories of the inductosyn system.

APPENDIX 1.7 MR-S Z-33 CABLE DIAGRAM (ABSOLUTE VALUE, SEMI-CLOSED)

The diagram indicates a case where MR-S Z-33 applies to all axes.

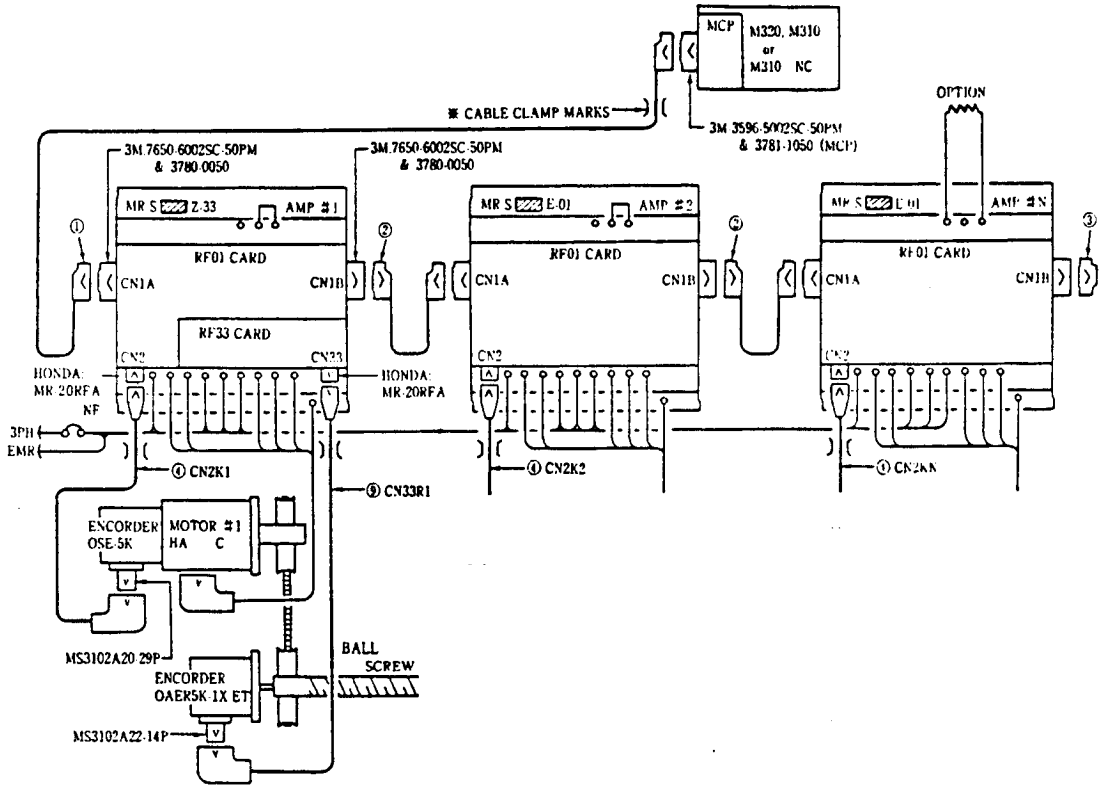


Catalogue no.	Part name	No. used	Standard length	Max. length	Reference section no.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11 or CAM21
2	AMP-AMP CABLE	K- 1	0.5			CAM11
3	CABLE END	1	—	—		RF54
5	AMP-ENC CABLE	N-1	5 m	50 m	Section 5.4.3	CN33K1-CN33KN

NOTE: (1) N: total number of axes; but N ≦ 6 (N ≦ 4 with M310 system), K: number of amplifiers
(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 6 axes is 1 x 5 + (5 x 0.5) = 7.5 m.
(3) Maximum cable length with cat. no. (5) is 20 meters for the OAER25K-1X encoder.

APPENDIX 1.8 MR-S Z-33 CABLE DIAGRAM (ABSOLUTE VALUE, BALL-SCREW END)

The diagram indicates a case where MR-S Z-33 applies to the first axis and MR-S E-01 applies to the second and nth axes.

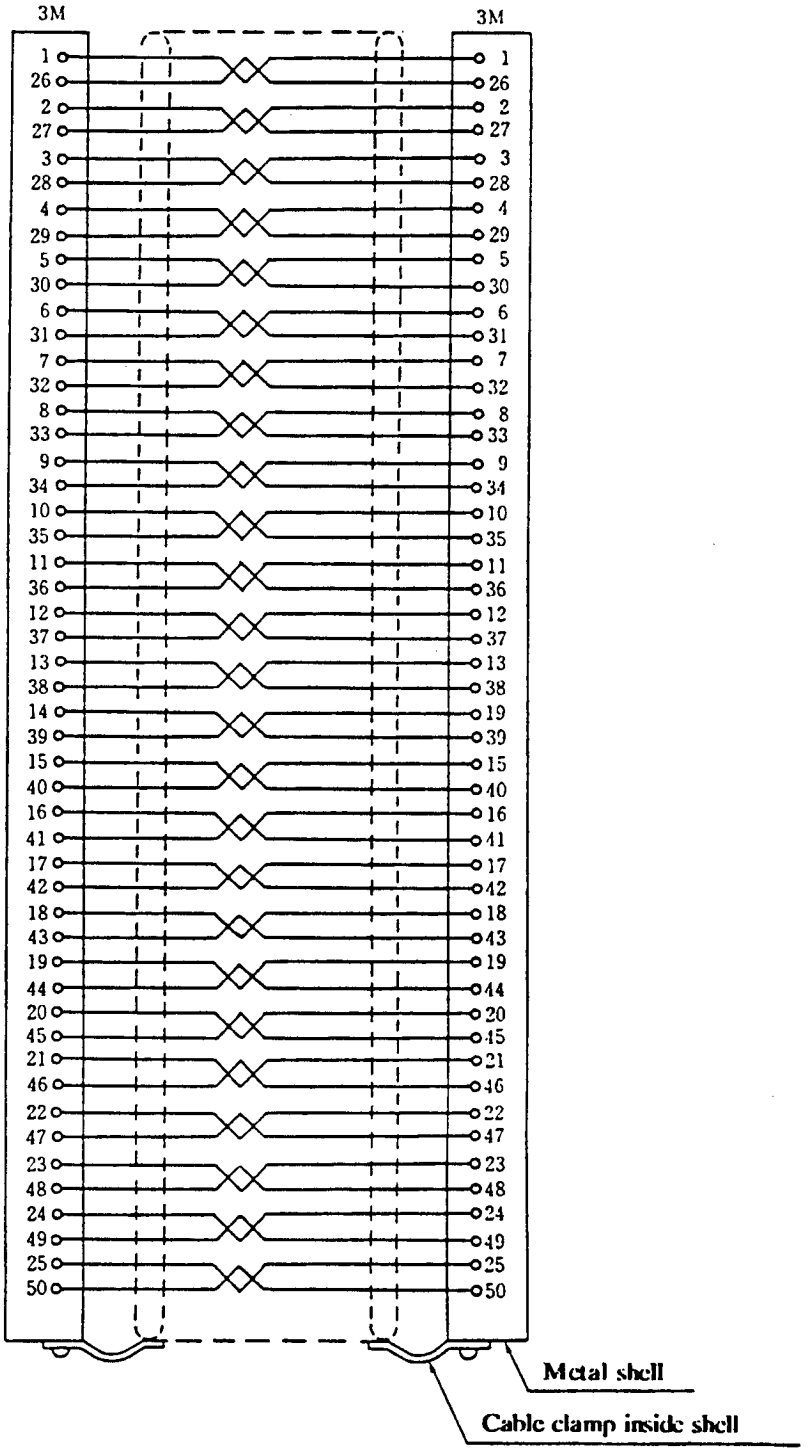


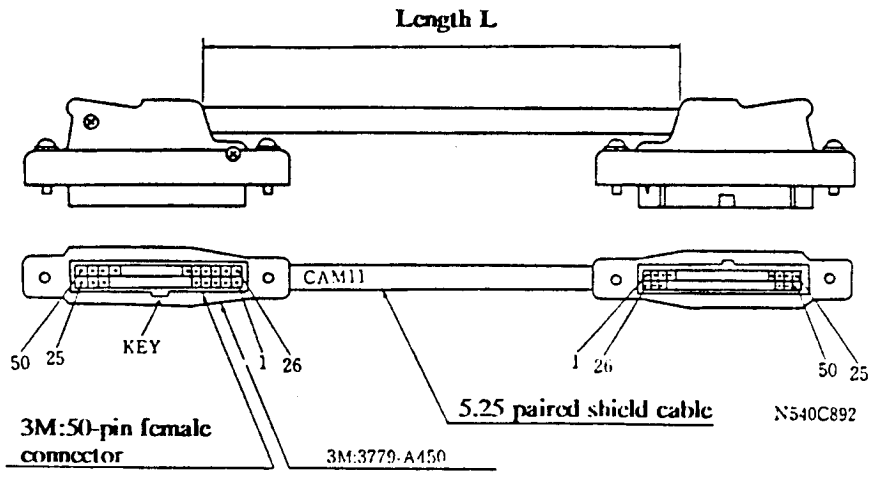
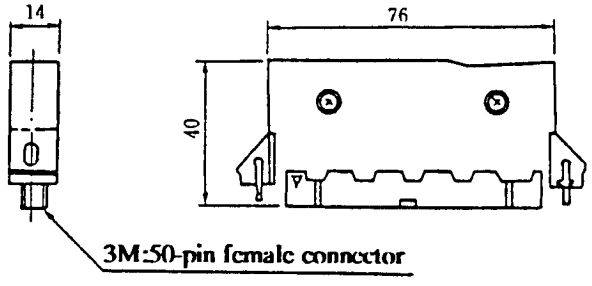
Catalogue no.	Part name	No. used	Standard length	Max. length	Reference section no.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5			CAM11
3	CABLE END	1	—	—		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.3	CN2K1-CN2KN
9	AMP-ENC CABLE	n	5 m	50 m	Section 5.4.2	CN33R1

NOTE: (1) N: total number of axes; n: number of MR-S Z-33 axes; but $N \leqq 6$, $N \geqq n$ ($n = 1$ in this figure)

(2) Example of total length for cables with cat. no. (1) and (2): Standard length with 6 axes is 1 x 5 + (5 x 0.5) = 7.5 m.

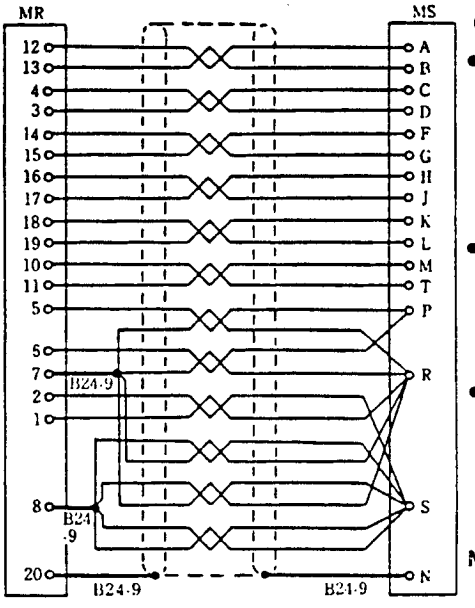
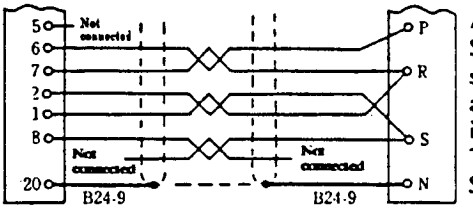
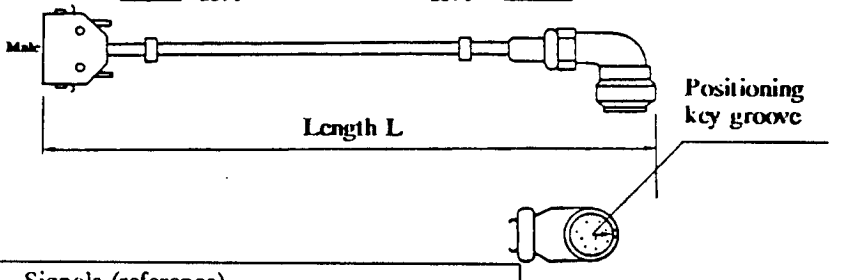
APPENDIX 2. BUS COUPLING CABLES

Cable	Specifications
CAM11 MCP-AMP CABLE ‖ For connecting CN1A on amplifier with CAM11 on MCP Amp-AMP CABLE ‖ For connecting CN1A on next amplifier with CN1B on amplifier	

Cable	Specifications
(CAM11 cont.)	 Notes: (1) Refer to the cable system diagram for the standard and maximum lengths. (2) No distinction is made between the left and right ends of the CAM11 cable.
RF54 CABLE END For insertion into CN1B on the final amplifier	

DETECTOR CABLES

AMP-ENC Cable

Cable	Description
CN2K1 〉 CN2K6 CN31R1 〉 CN31R6 AMR-ENC CABLE	AMP end / Detector end  When cable length is more than 7.5 m and under 50 m Connector model • MR connector Case MR-20L5 Housing MPR-20M01 Contact MRP-M102 • Cannon connector Connector MS3108B20-29S Clamp MS3057-12A • Cable type F-DPEVSB 12P×0.2SQ Maximum length = 50 m When cable length is less than 7.5 m  Apart from pins P, R and S, the connections are the same as in the figure above. However, this applies only to a length L of 7.5 m or less. Standard length = 5 m 

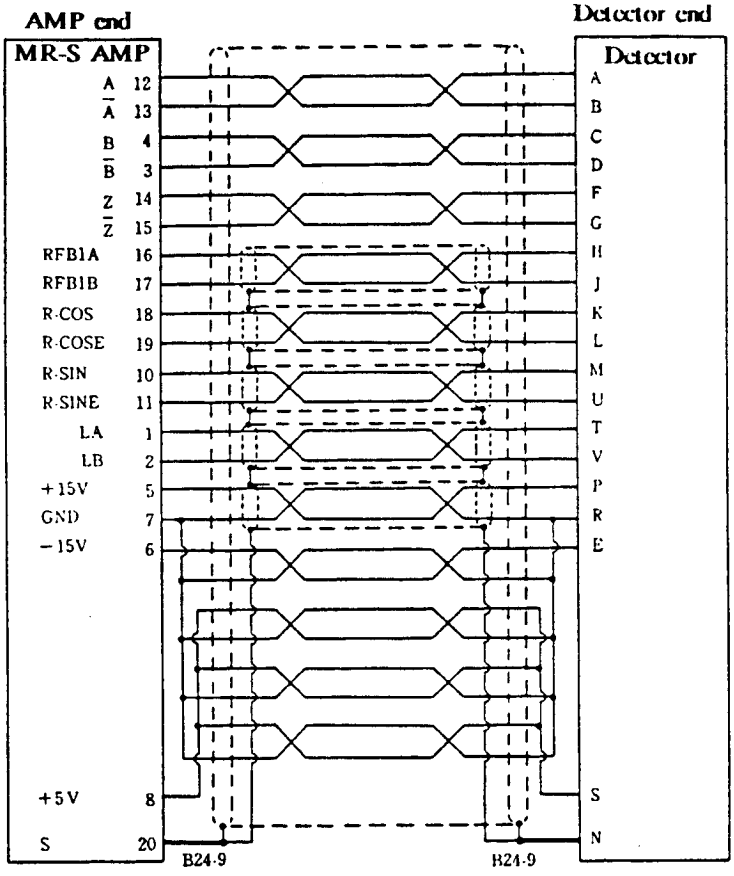
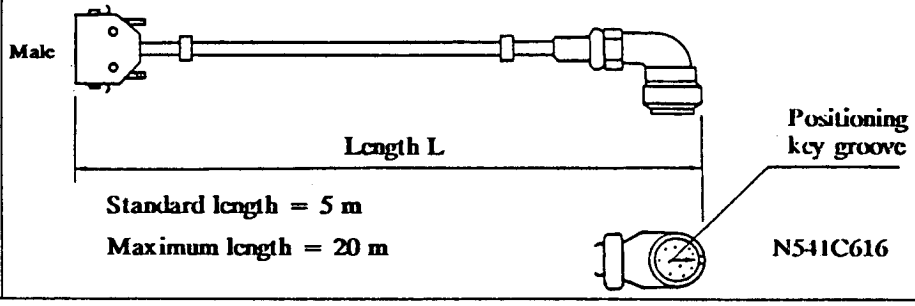
Signals (reference)

RF01 card CN2→OSE5K

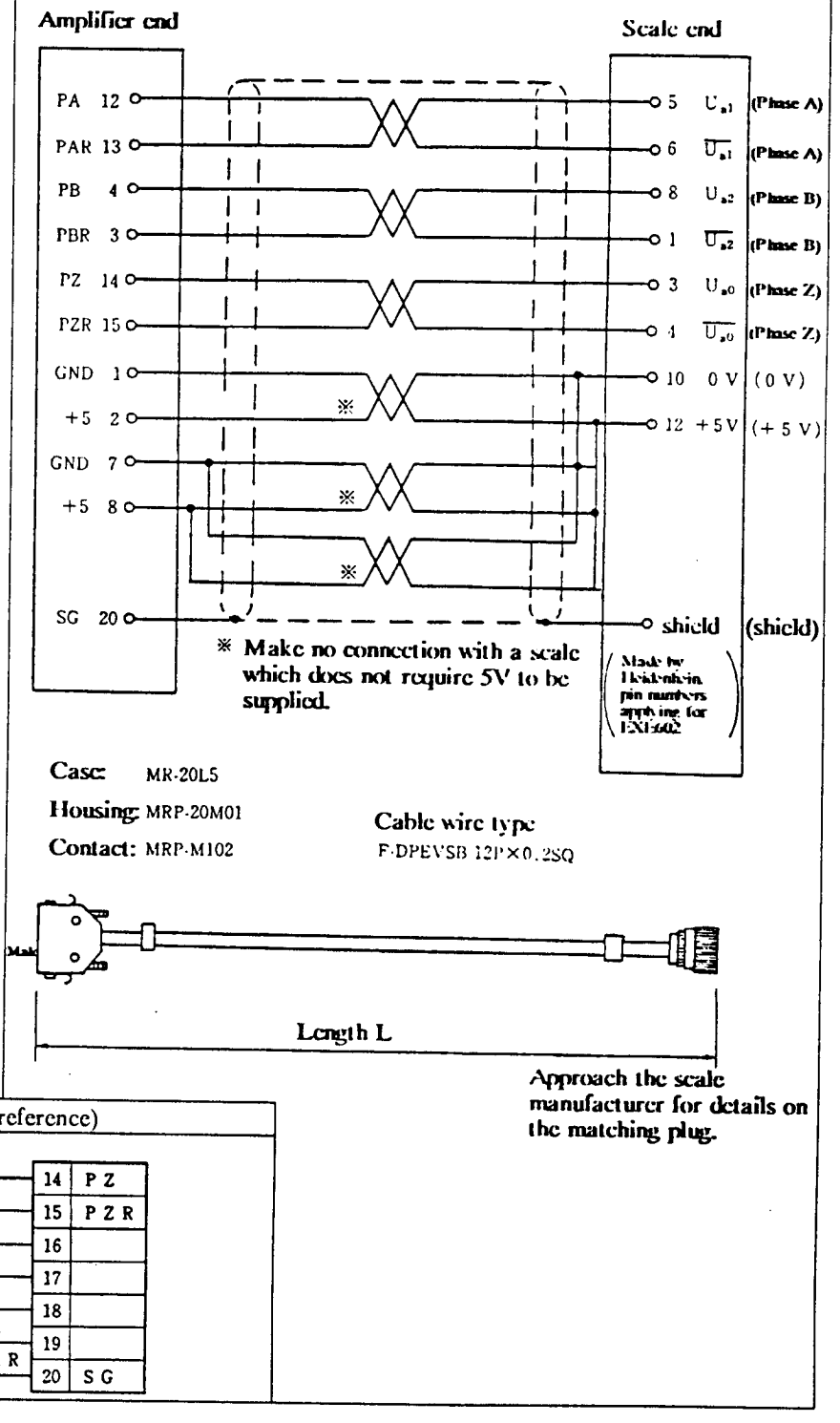
1	GND	8	+5	14	PZ	1		8		14	
2	+5	9		15	PZR	2		9		15	
3	PBR	10	PW	16	PU	3		10		16	
4	PB	11	PWR	17	PUR	4		11		17	
5	+15	12	PA	18	PV	5		12		18	
6	+15	13	PAR	19	PVR	6		13		19	
7	GND			20	SG	7				20	

N541C582
N541C583

AMP-ENC Cable

Cable	Description
CN33K1 ↓ CN33K6 CN33R1 ↓ CN33R6 AMP DETECTOR CABLE	 **Case** MR-20L5 **Connector** MS3108B22-14S **Housing** MRP-20M01 **Clamp** MS3057-12A **Contact** MRP-M102 **Cable type** F-DPVVSBS5P/7P×0.2SQ 

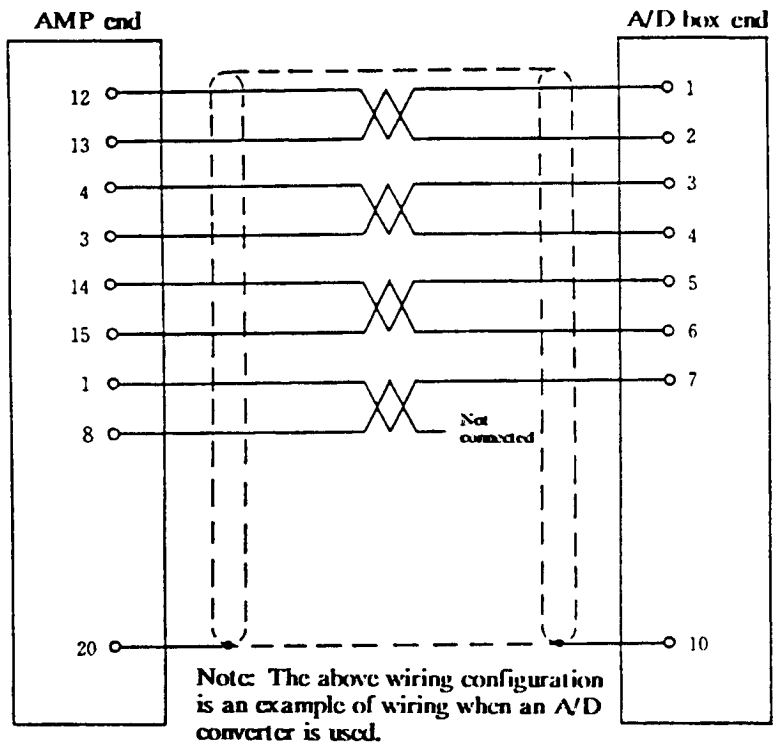
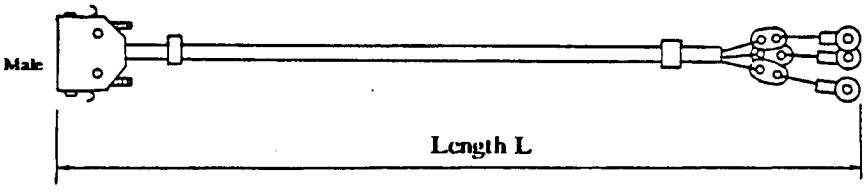
AMP-I/F UNIT CABLES

Cable	Cable connections
CN31H1 ⟩ CN31H6 AMP-I/F UNIT CABLE	

Signals (reference)

1	GND	8	+5	14	PZ
2	+5	9		15	PZR
3	PBR	10		16	
4	PB	11		17	
5		12	PA	18	
6		13	PAR	19	
7	GND			20	SG

AMP-A/D Cable

Cable	Description
CN331M1 ~ CN31M6 AMP-A/D CABLE	 **Note:** The above wiring configuration is an example of wiring when an A/D converter is used. **Case** MR-20L5 **Housing** MRP-20M01 **Contact** MRP-M102 **Cable type** F-DPEVSB 12P×0.2SQ  Since the plug JMSP21-16M at the other end is an accessory of the inductosyn system, no plug is supplied. Standard length L = 5 m Maximum length = 20 m

Signals (reference)

- RF31 card CN31

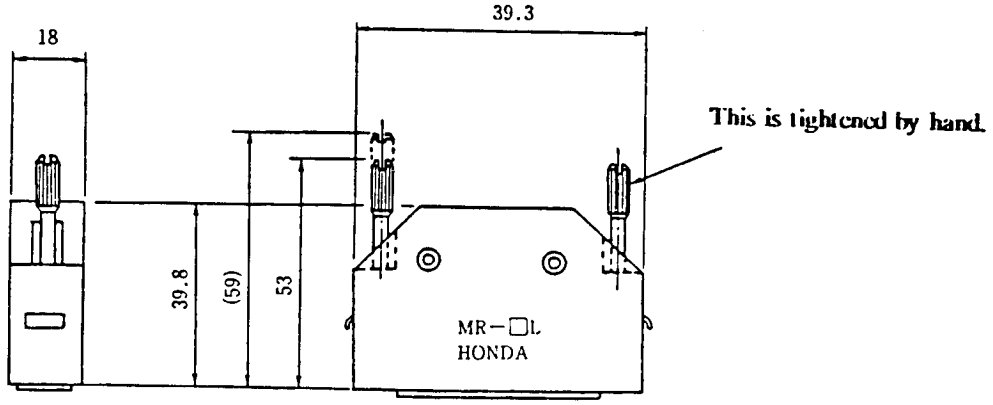
1	GND			14	PZ
2	+5	8	+5	15	PZR
3	PBR	9		16	
4	PB	10		17	
5	+15	11		18	
6	+15	12	PA	19	
7	GND	13	PAR	20	SG

Inductosyn A/D CN2

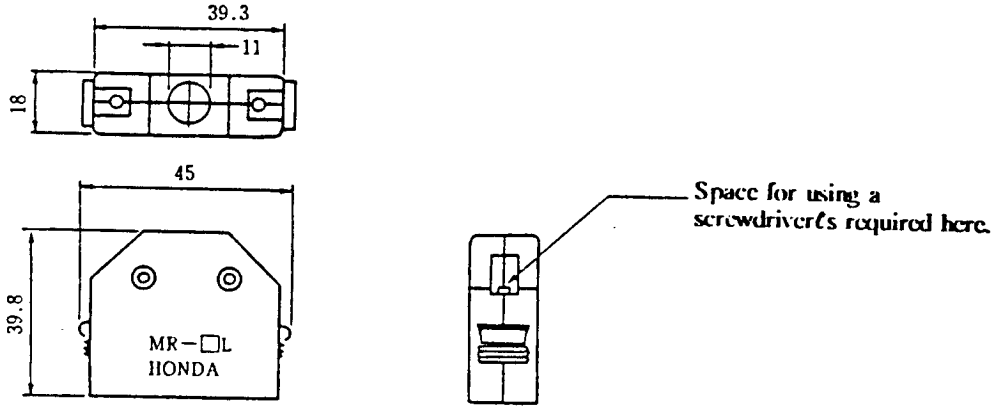
(1) PA	(2) PA
(3) PB	(4) PB
(5) PZ	(6) PZ
(7) GP	(10) SE
(12) TSA	(13) TSB
(15) OH1	(16) OH2

20-pin Square Connector (Honda)

(1) Connector case MR20L5

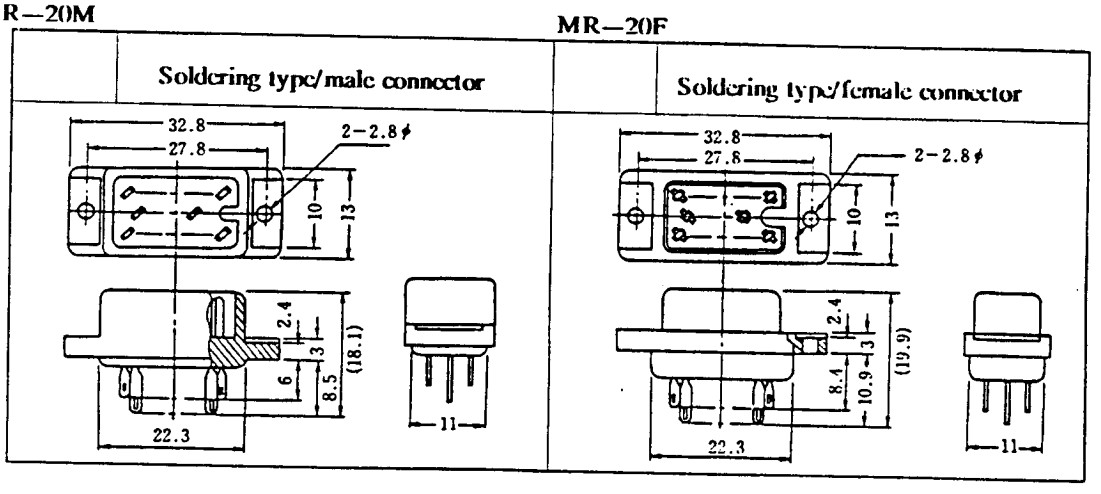


(2) Connector case MR-20L



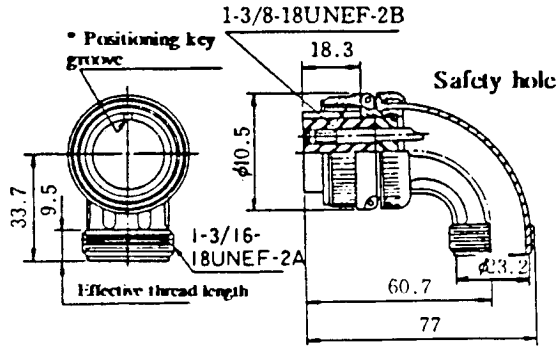
(3) Soldering type of connectors

MR−20M **MR−20F**

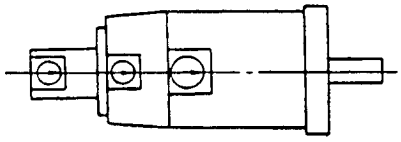


Cannon Plugs for Detectors (Japan Aviation Electronics)

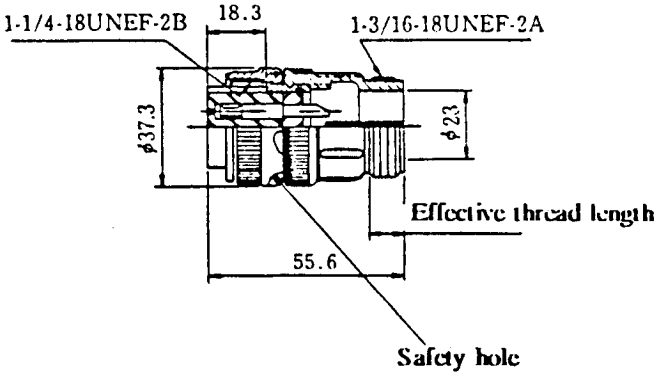
(1) Angular plugs MS3108B20-29S

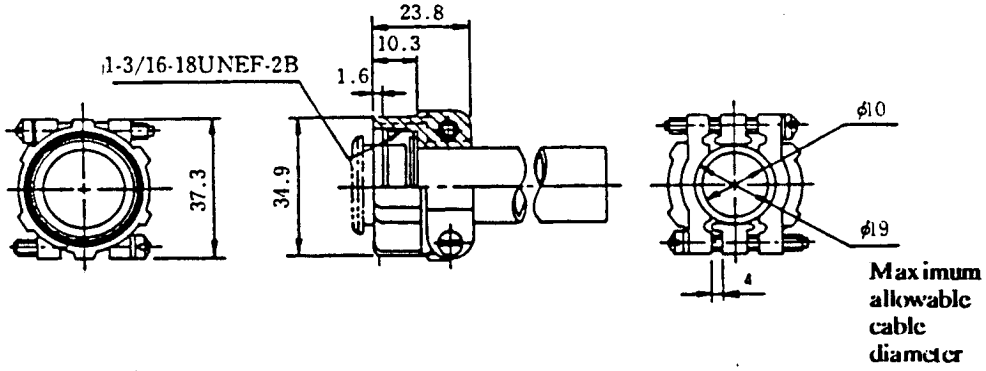


* The Cannon connector key is positioned in the motor flange direction.



(2) Straight plugs MS3106B20-29S

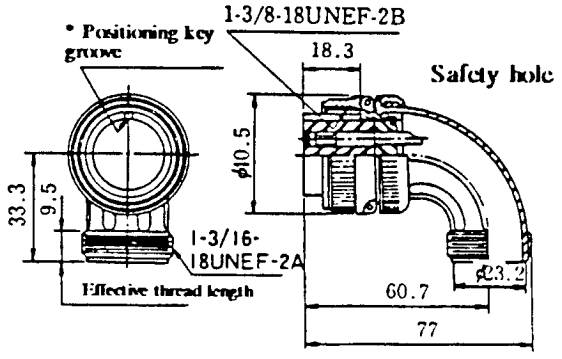




The connectors and cables are not provided with the servo amplifiers and motors.

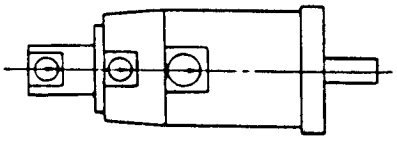
Cannon Plugs for Detectors (Japan Aviation Electronics)

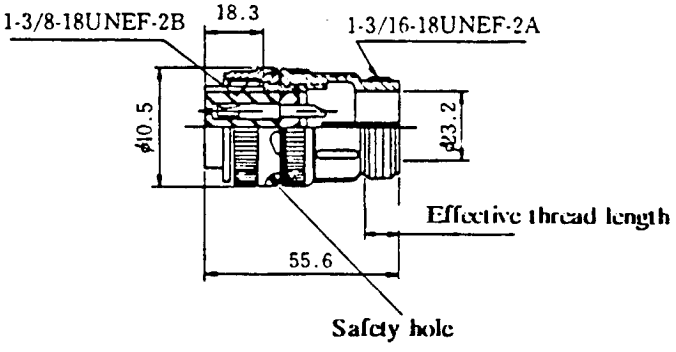
(3) Angular plugs MS3108B22-14S



* The Cannon connector key is positioned in the motor flange direction.

(4) Straight plugs MS3106B22-14S





The connectors and cables are not provided with the servo amplifiers and motors.

Protective Tubes for Cables

If the effects of noise cannot be avoided or if the noise immunity properties are to be increased, the metal tubes listed below should be selected and the signal cables passed through them.
These protective tubes should also be used if there is a danger that the outer covering of the cable will be cut or rubbed by metal chips.
Since the MS3057 cable clamp cannot be attached at the detector end, the cable may break particularly in applications involving bending and vibration. The 0.2SQ cable cannot be used and so a cable with a proven record and a larger conductor cross section area should be employed instead. The instructions given by MITSUBISHI should be followed for the classification into shield and twisted cables.

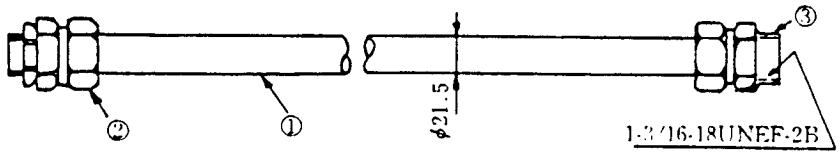
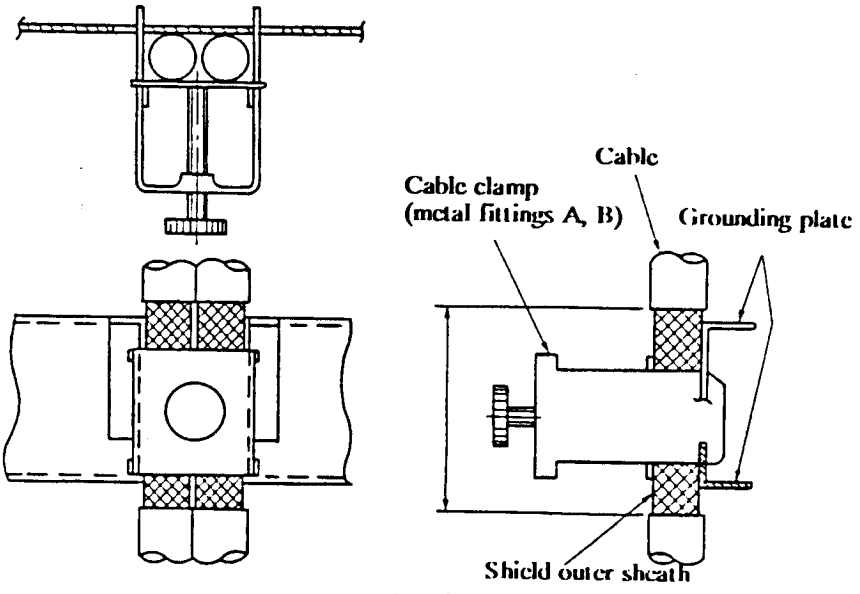
Application	Example of assembly
For motor detector	

Table 5.4 Cable selection examples

(1) Tube	Connector			Manufacturer
	(2) Amplifier	Mounting screw	(3) Motor detector end	
FBA-4 (FePb wire braid covering)	RBC-104 (straight) RBC-204 (45o) RBC-304 (90o)	G16 G16 G16	RCC-104-CA2022	Japan Flex KK
PA-2 #17 (FePb covering)	BC-17 (straight)	Conduit thread 15	PDC20-17	Sankei SS
PT #17 (FePB covering)	PSG-17 (straight) PLG-17 (90o) PS-17 (straight)	Thread dia. 26.4 Thread dia. 26.4 PF 1/2	PDC20-17	Daiwa Dengyo KK

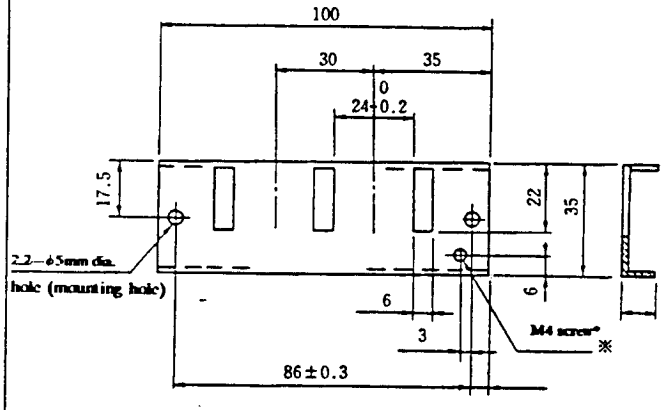
Cable Clamps

A grounding plate for the detector cable should be installed near the servo amplifier and, as shown in the figure, part of the cable covering should be stripped away to leave the outer sheath exposed and this part should be pressed against the grounding plate using the cable clamp. If the cables are thin, several should be clamped together. (Refer to Section 4.1 (9).)



Grounding plate D as well as cable clamps A and B can be obtained from your MITSUBISHI representative.

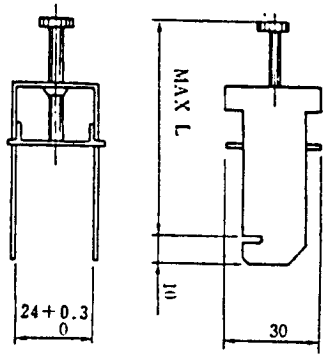
Outline drawing of grounding plate (D)



- The grounding wire must be connectedfrom the grounding plateto the grounding plate on the cabinet.
- Two metal fittings A can be used.

* Screw hole for connecting grounding wire to grounding plate on cabinet

Outline drawing of cable clamp



	L
Metal fitting A	70
Metal fitting B	45

Cable Materials

When the cables connecting the motor amplifiers are lengthy and the motor moves, use cables with a superior resistance ot bending.
The tables below show the typical types of cables as manufactured by MITSUBISHI.

Shield cables
Name:

No. Size (mm^2)	Finished outer diameter (mm)	Cable characteristics Color				Color		Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	–	–			

Name: F-DPEVSB 12Px0.2Q

No. Size (mm^2)	Finished outer diameter (mm)	Cable characteristics Color				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	–	–			
12x0.2	11.0	40/0.08	100.5	–	–	Black	Approx. 220×10^4 times at R200	

Paired shield cable with 7 twisted pairs of conducting wires
Name: F-DPVVSBS 7Px0.2Q

No. Size (mm^2)	Finished outer diameter (mm)	Cable characteristics Color				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	–	–			
7x0.2	12.3	26/0.1	107	–	–	Black	Approx. 24×10^4 times at R200	

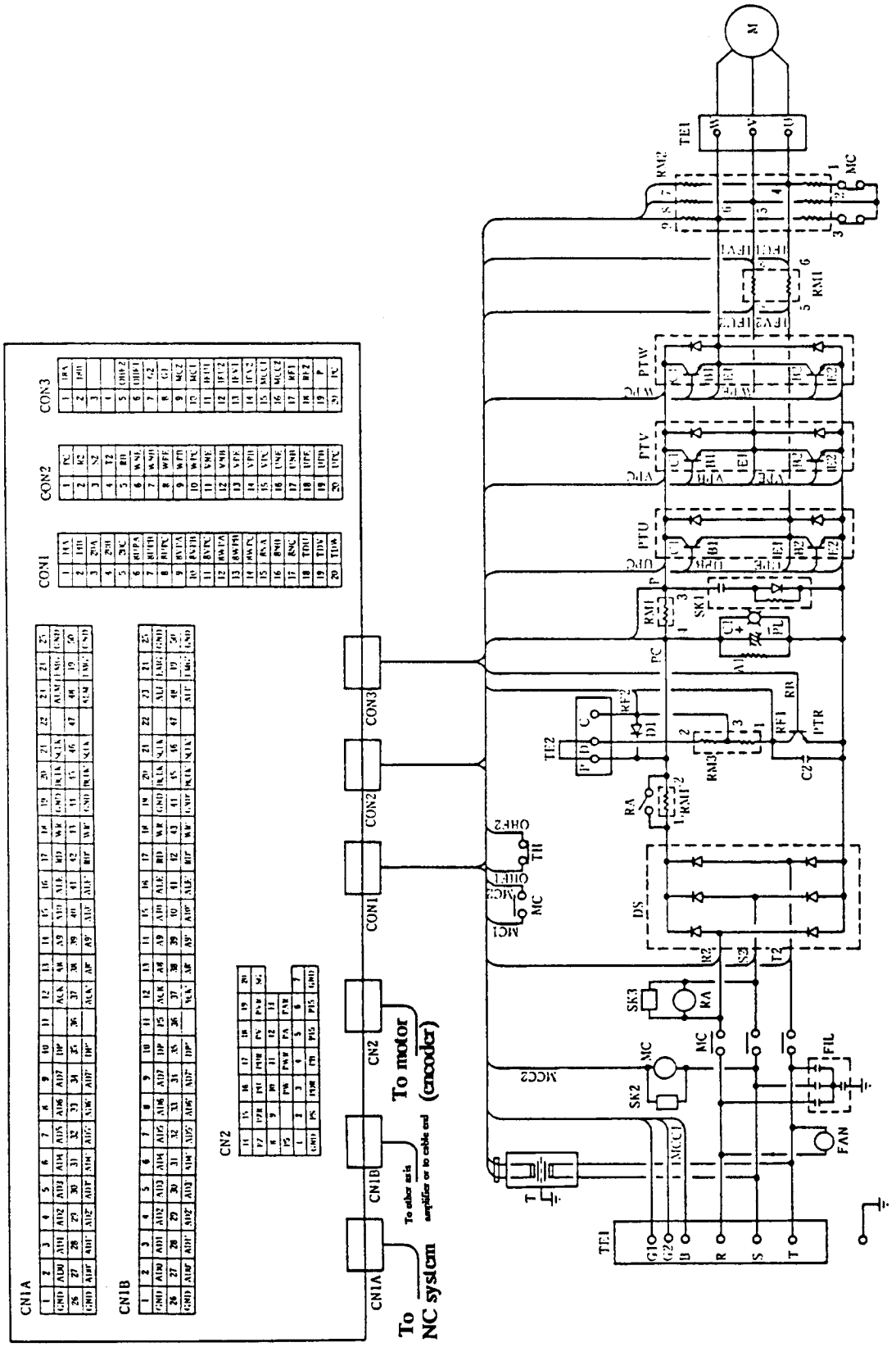
Paired shield cable with 7 twisted pairs of conducting wires + bundle of non-pairs wires
Name: JPVV-SBS-SB 7Px0.2SQ

No. Size (mm^2)	Finished outer diameter (mm)	Cable characteristics Color				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	–	–			
7x0.2	13.0	26/0.1	107	–	–	Black		Jst electrical work specifications TS-86062

Special shield cable
Name: F-DPVVSBS5P/7Px0.2SQ

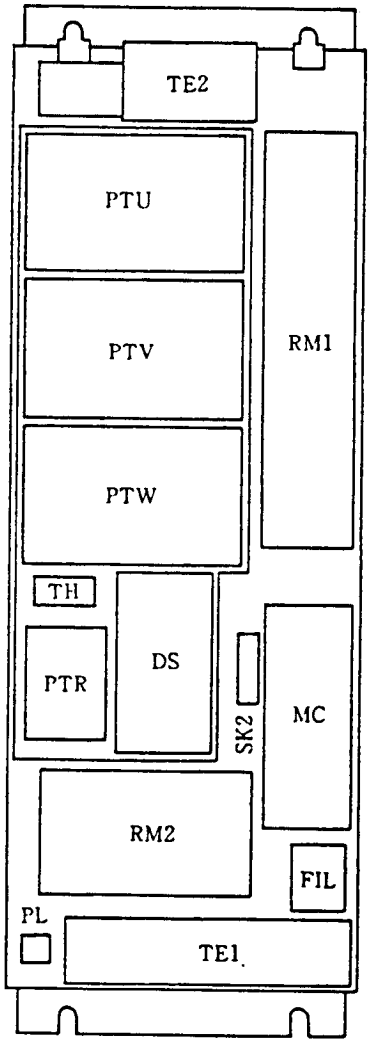
No. Size (mm^2)	Finished outer diameter (mm)	Cable characteristics Color				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	–	–			
5x0.2 7x0.2	14.4	26/0.1	93.9			Black	Approx. $40x10^4$ times at R200	Shield cable with 12 pairs including 5 pairs in each shield BKO-NC6265

APPENDIX 3. MAIN CIRCUITRY CONFIGURATION

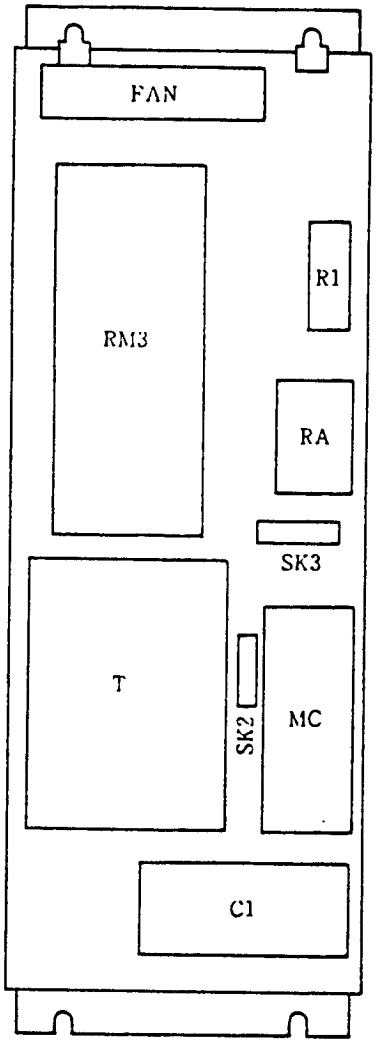


MAIN CIRCUIT PARTS LAYOUT

Top side



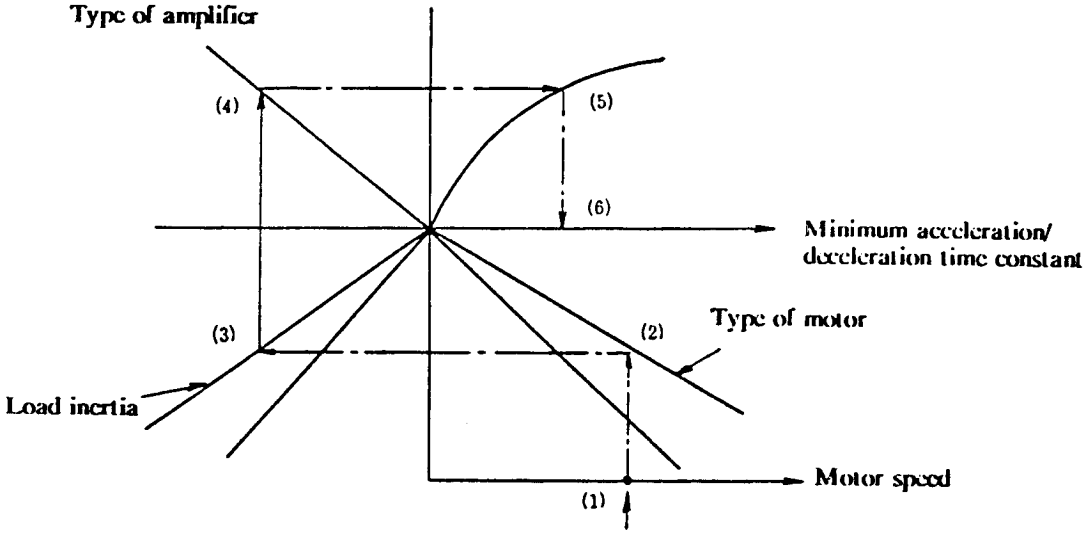
Bottom side



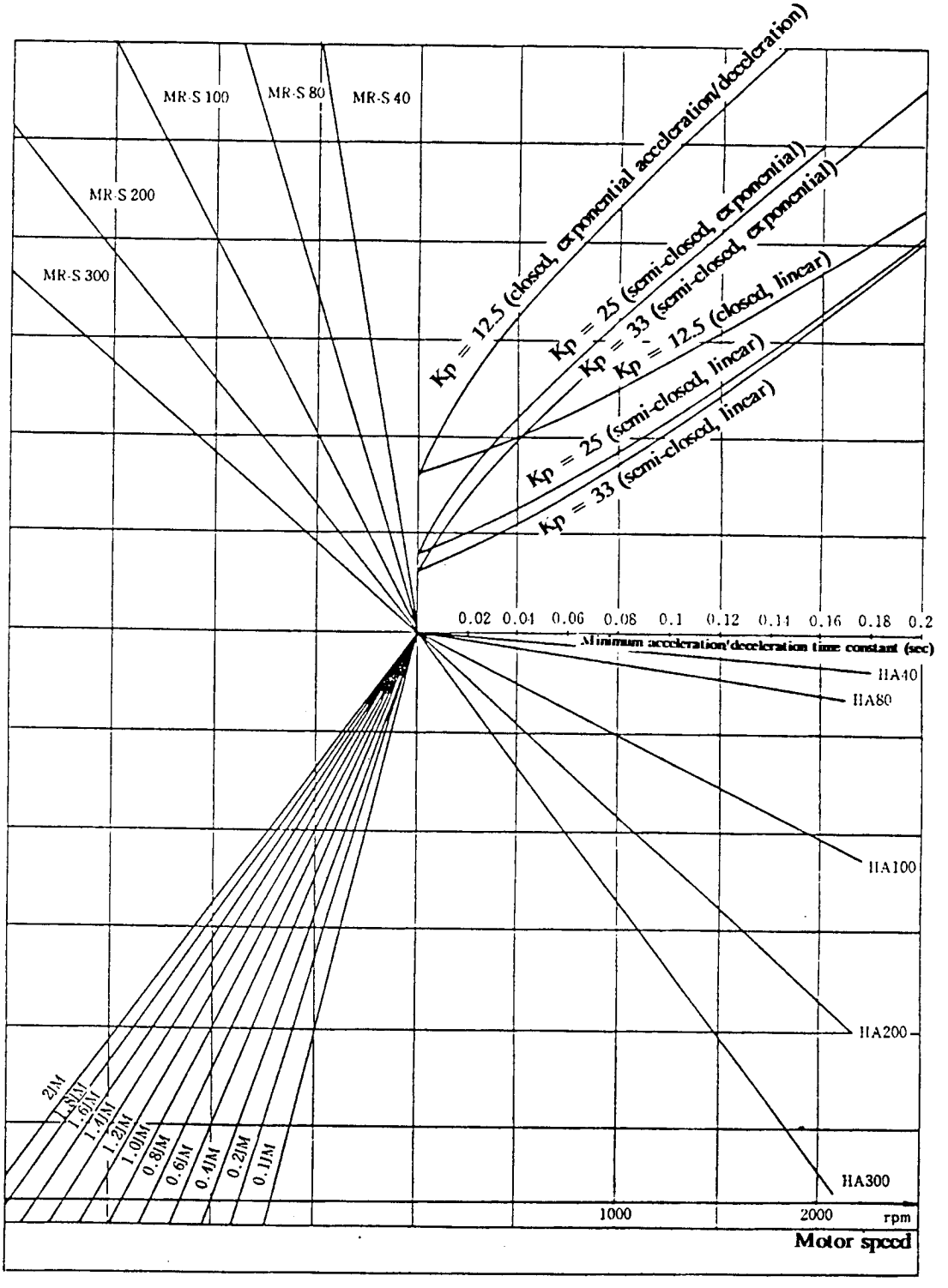
APPENDIX 4. CHECKING THE MINIMUM ACCELERATION/DECELERATION TIME CONSTANT

When the machine is accelerated or decelerated, the output torque of the motor is limited by the motor and amplifier. This means that the machine must be operated above a particular time constant. Take care not to make the time constant too low since this will increase the error between the command value and machine position and result in an excessive error alarm.

(1) Checking the minimum acceleration/deceleration time constant
The minimum acceleration/deceleration time constant is checked in the sequence shown in the graph below.



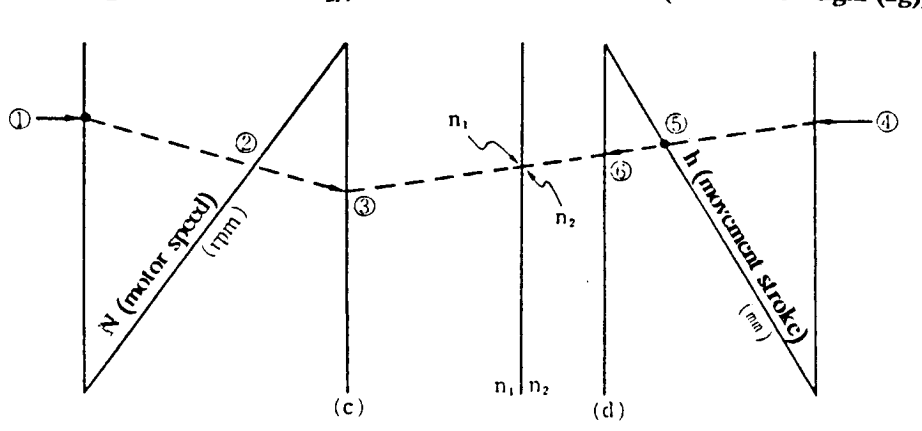
I) Determine the motor speed at the rapid traverse and cutting feed rates.
II) Select the type of motor at (2).
III) Select the load inertia at (3).
IV) Select the type of amplifier used at (4).
V) At (5), select whether exponential function commands or linear acceleration commands are to be used and whether the semi-closed, closed or dual feedback system is to be used.
VI) The minimum acceleration/deceleration time constant is produced at (6). Set a value which is higher than that produced when actually operating the machine.


MR-S 100
MR-S 80
MR-S 40
MR-S 200
MR-S 300
Kp = 12.5 (closed, exponential acceleration/deceleration)
Kp = 25 (semi-closed, exponential)
Kp = 33 (semi-closed, exponential)
Kp = 12.5 (closed, linear)
Kp = 25 (semi-closed, linear)
Kp = 33 (semi-closed, linear)
0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2
Minimum acceleration/deceleration time constant (sec)
HA40
HA80
HA100
HA200
HA300
2/M
1.8/M
1.6/M
1.4/M
1.2/M
1.0/M
0.8/M
0.6/M
0.4/M
0.2/M
0.1/M
1000
2000
rpm
Motor speed

APPENDIX 5. CHECKING THE POSITION REPETABILITY

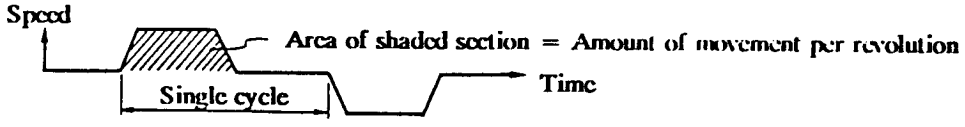
Once the machine has been installed properly, an axis moving vertically will cause a regenerative energy to be generated. As a result, the construction has been designed to enable the regeneration resistance built into the amplifier or an externally attached resistance to dissipate this energy.
A particular point to bear in mind is that this energy will be great for a machine in which the vertical axis is unbalanced and that it will consequently act to restrict the position repeatability. A check must therefore be exercised following the checking procedure given below.

(1) Checking the position repeatability
The position repeatability is checked in sequence, as shown in the graph below.

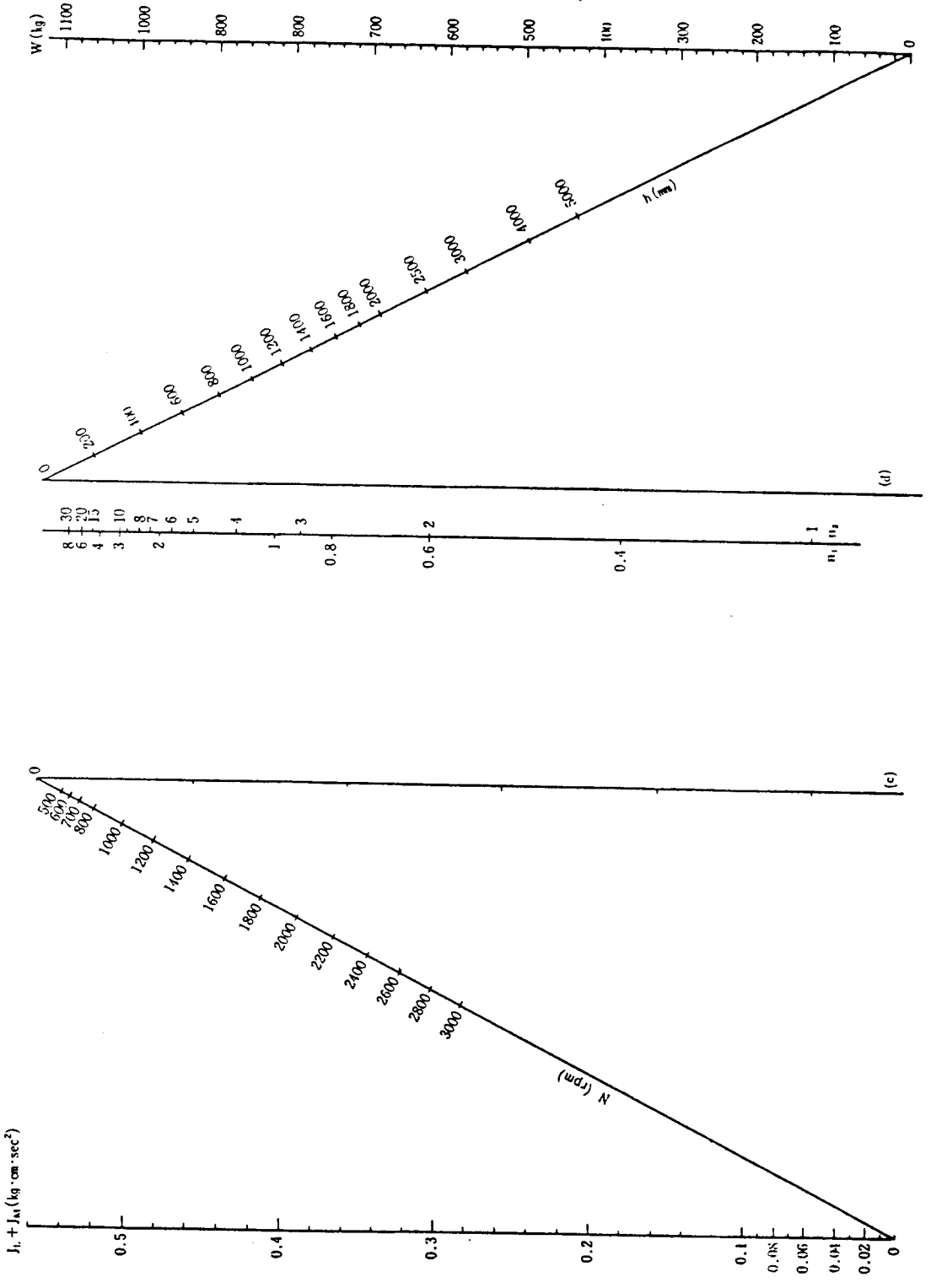


[1] Calculate the combined total J of the inertia of the motor used and motor shaft equivalent load inertia.
[2] Find motor speed N [2] for the rapid traverse rate.
[3] Find the point [3] at which line (c) and the extended lines of [1] and [2] intersect.
[4] Find the unbalanced weight W [4] of the vertical axis.
[5] Find the movement stroke (maximum) h [5] of the vertical axis.
[6] Find the point [6] at which line (d) and the extended lines of [4] and [5] intersect.
[7] Connect [3] and [6] and the point where the n1 and n2 axes intersect is the repeatability (times/minute) value.
Where n_1: Repeatability when resistance is built into MR-S amplifier
n_2: Repeatability when external optional regeneration resistance is mounted

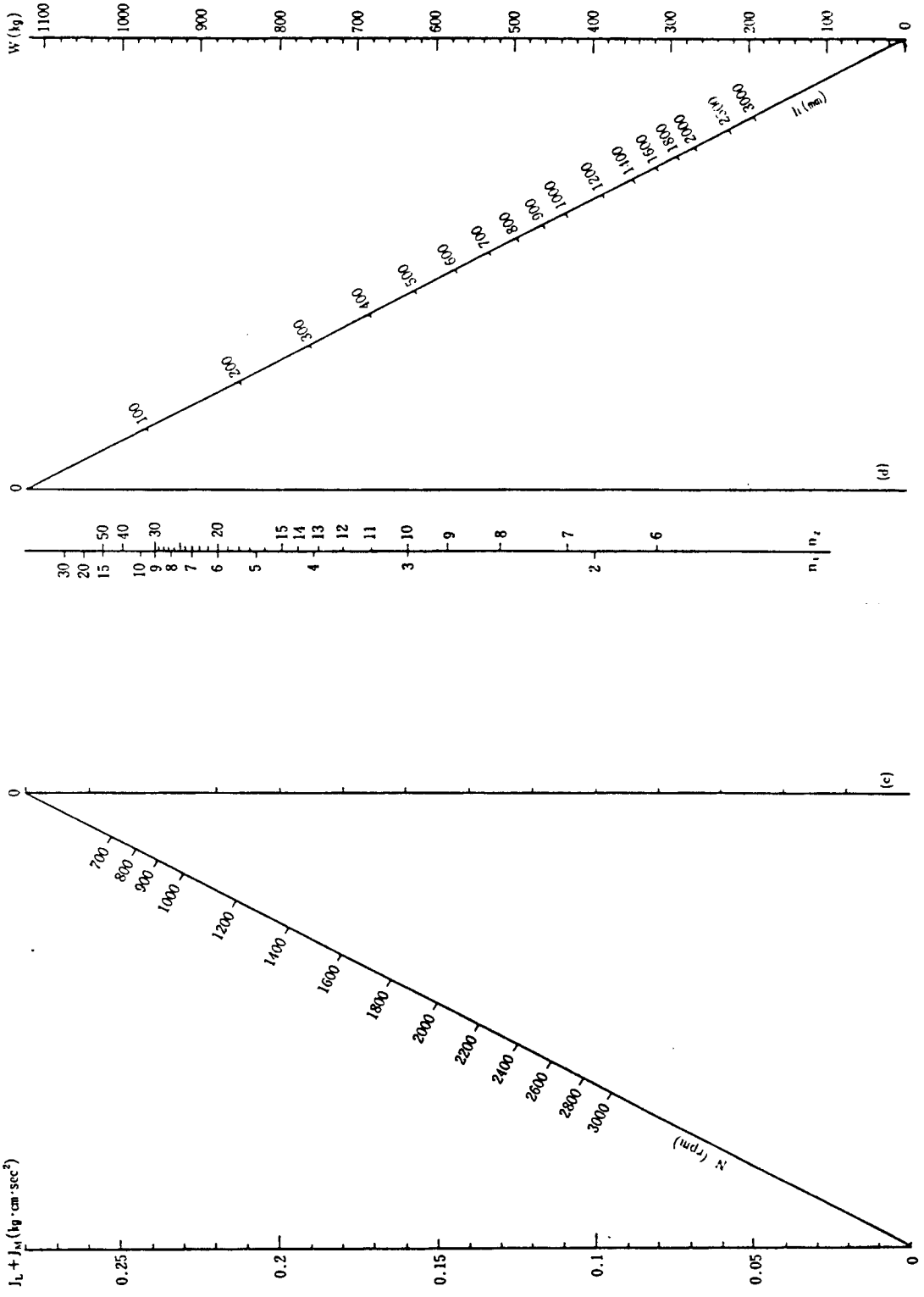
NOTE: Above repeatability n_1 and n_2 are limited to less than n_1, n_2 = F/N (times/minute) by the movement stroke (maximum value) and rapid traverse rate F (mm/min) of the vertical axis.



(2) **Computation graphs ($J = 0$—$0.56\ kg \cdot cm \cdot sec^2$)**



(3) Computation graphs (J = 0—0.28 kg · cm · scc²)



(4) Check method using calculation formula

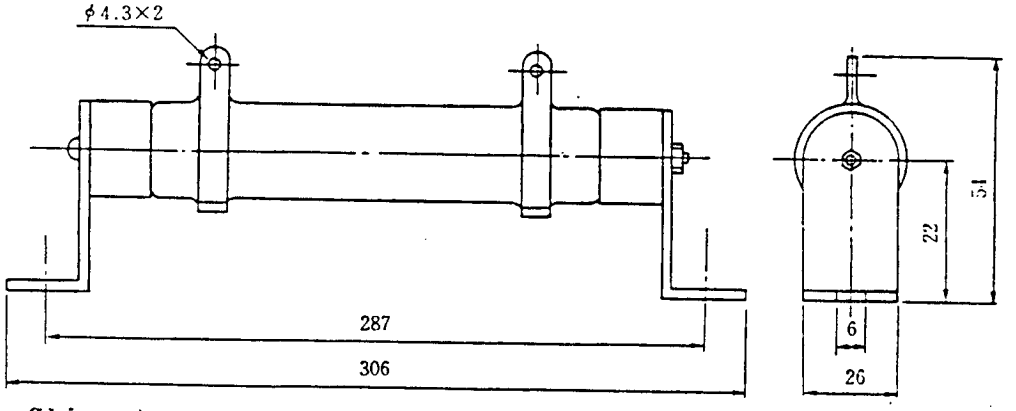
Use the following formula when employing a formula to check the position repeatability.

$$n = \frac{120 \cdot W_R}{\frac{J}{100} \cdot \left(\frac{2\pi N}{60}\right)^2 \cdot g + w \cdot g \cdot \frac{h}{1000} \cdot 0.8}$$

Where

- n : Position repeatability (times/min)
- J : Motor shaft equivalent inertia (kg · cm · sec²)
  - $J = J_L + J_M$
  - J_L: Motor shaft equivalent load inertia (kg · cm · sec²)
  - J_M: Rotor inertia of motor used (kg · cm · sec²)
- N : Motor speed (rpm)
- g : 9.8 m/sec²
- W : Unbalanced weight (kg)
  - When the frictional force Wf (kg) is exerted upwards:
  - $W = W_H - W_f$
  - W_H: Total weight of unbalanced area (kg)
- h : Total stroke for vertical axis (mm)
- W_R : Allowable heat generation of regeneration resistance (W)
  - When resistance built into MR-S amplifier is used: W_R = 75W
  - When optional regeneration resistance is mounted: W_R = 250W

(5) Outline drawing of regeneration resistance



(Unit: mm)

Resistance	Rated power	Resistance
GZG200W390HNK	200W	39 ohms

APPENDIX 6. DETERMINING THE COASTING WITH EMERGENCY STOP

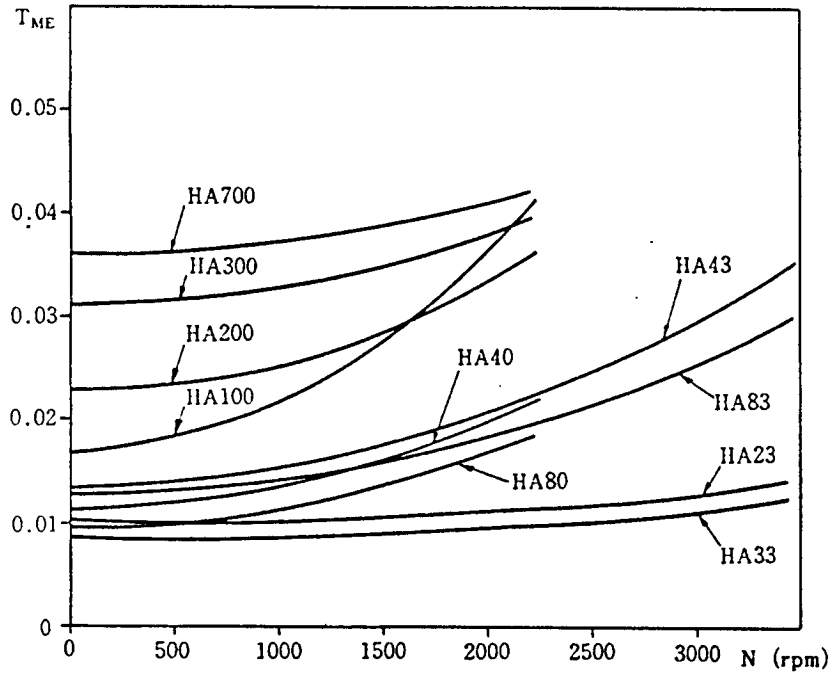
When a malfunction is detected by the system, the motor uses a dynamic brake to stop the machine. The amount by which the machine coasts at times like these can be calculated using the formula below.

$$Lmax = \frac{F_{GO} \times 10^3}{60}(T_e + 0.03)\text{mm}$$

$$T_e = T_{ME}\left(1 + \frac{J_L}{J_M}\right) \times 1.1$$

Where F_{GO} : Rapid traverse rate (m/min)
J_L : Motor shaft equivalent load inertia (kg · cm · sec²)
J_M : Rotor inertia of motor shaft (kg · cm · sec²)
T_{ME} : Motor constant

NOTE: There may be fluctuations of ±10% in the value of L_{max} depending on the induced voltage constant of the motor.
T_{ME} changes in accordance with the motor speed and it should be determined from the maximum operating speed in the figure below.



Type of motor	J_M (kg · cm · sec²)
HA23	0.001
HA33	0.002
HA40	0.01
HA43	0.01
HA80	0.02
HA83	0.02
HA100	0.07
HA200	0.134
HA300	0.196
HA700	0.259

APPENDIX 7. SERVO MOTOR SPECIFICATIONS

Model name	Shaft end without oil seal	–	–	–	–	HA100C	HA200C	HA300C	–	–	HA100 CB	HA200 CB	HA300B
	Shaft end with oil seal	HA40 C-S	HA43 C-S	HA80 C-S	HA83 C-S	HA100 C-S	HA200 C-S	HA300 C-S	HA40 CB-S	HA80 CB-S	HA100 CB-S	HA200 CB-S	HA300 CB-S
Classification (1) (2)		○	•	○	•	○/*	○/*	○/*	•	•	*/*	*/*	*/*
Rated output KW	At 3,000 rpm	–	0.5	–	1.0	–	–	–	–	–	–	–	–
	At 2,000 rpm	0.5	0.43	1.0	0.86	2.0	3.5	4.5	0.5	1.0	2.0	3.5	4.5
	At 1,000 rpm	0.28	0.26	0.56	0.52	1.22	2.05	3.07	0.28	0.56	1.22	2.05	3.07
Rated torque kg cm	At 3,000 rpm	–	16.3	–	32.5	–	–	–	–	–	–	–	–
	At 2,000 rpm	24.4	20.9	48.7	41.7	97.4	170	219	24.4	48.7	97.4	170	219
	At 1,000 rpm	27.2	25.4	54.4	50.8	118.7	200	300	27.2	54.4	118.7	200	300
	When stalled	30	30	60	60	140	230	380	30	60	140	230	380
Maximum speed, rpm		2000	3000	2000	3000	2000	2000	2000	2000	2000	2000	2000	2000
Rotor inertia	J_M kg • cm • sec^2	0.010	0.010	0.020	0.020	0.070	0.134	0.196	0.011	0.021	0.074	0.138	0.200
	GD^2_M kg • cm^2	39.2	39.2	78.4	78.4	274	525	768	41.9	81.1	291	542	785
Weight (incl. detector) kg		8	8	12	12	21	32	43	10	14	27	38	49
Ambient temperature		0-40							0-40				
Equipment: Thermal protector		Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided
Equipment: Shaft end oil seal		Provided	Provided	Provided	Provided	Optional	Optional	Optional	Provided	Provided	Optional	Optional	Optional
Equipment: Motor end detector		(3) User must designate brand of detector separately; (4) standard direction A applies for Cannon connector of detector							Same as left				
Equipment: Electromagnetic brake (6)		None	None	None	None	None	None	None	DC24V15W60 kg • cm		C D 24 V 25 W 300kg • cm		
Outline drawing no.		Z 636834		Z 636836		Z 636837			Z 636835		Z 636838		
Tm for calculating TS.min		144	103	264	198	432	608	888	144	264	432	608	888

NOTE: (1) Significance of classification symbols: ○ = standard specifications; * = optional specifications; ○/*: standard specifications without oil seal at shaft end

(2) Special specifications apply to those motors which are not listed in this table. (The terminal box and other such parts are recommended if the system will be used where it will be exposed to dripping oil or water.)

(3) The user is requested to specify the motor and motor end detector separately. MELDAS is responsible for the coupling. The user cannot perform or change the coupling.

(4) Refer to Section 4.2 (3) for the direction of the Cannon connector which is used for the motor end detector and which is connected with the Cannon connector for the motor.

(5) Connecting cables and wiring plugs are not provided with the motors as accessories.

(6) Refer to Section 3.2 for details on motors equipped with an electromagnetic brake.

APPENDIX 8. DETECTOR SPECIFICATIONS

Classification	Type	Model name	Max. rpm	Power supply	Detector output	Application classification of output signal
Motor shaft end detector	Standard encoder	OSE5K-6-8-108	3000	DC5V +0.25V −0.5V	A phase, B phase, 5000 P/R	Detection of machine's position (gradual increase to 4-fold, 20000 P/R)
					Z phase, 1 P/R	Zero point indexing
					U phase, V phase, W phase, 2 P/R	Detecting motor's magnetic pole
	Ultra-precision encoder	OAER25K-1X-3-8-108	1200	DC5V +0.25V −0.5V DC ± 15V ± 1.5V	A phase, B phase, 25000 P/R	Detecting machine's position (After gradual increase to 4-fold, 100000 P/R)
					Z phase, 1 P/R	Zero-point indexing
					1 x resolver	Detecting motor's magnetic pole
	Absolute value encoder	OAER5K-1X-3-8-108	3000	DC5V +0.25V −0.5V	A phase, B phase, 5000 P/R	Detecting machine's position (After gradual increase to 4-fold, 200000 P/R)
					Z phase, 1 P/R	Zero-point indexing
					1 x resolver	Detecting motor's magnetic pole and absolute value
					LA phase, LB phase, 1 P/R	Absolute value of multiple rpm (max. 32000 rev.)
Ball screw end detector	Encoder	OSE5K-ET -3-9.52-0	3000	DC5V +0.25V −0.5V	A phase, B phase, 5000 P/R	Detecting machine's position (after gradual increase to 4-fold, 200000 P/R)
					Z phase, 1 P/R	Zero-point indexing
	Absolute value encoder	OAER5K-1X-ET -3-9.52-0	3000	DC5V +0.25V −0.5V	A phase, B phase 5000 P/R	Detecting machine's position (After gradual increase to 4-fold, 200000 P/R)
					Z phase, 1 P/R	Zero-point indexing
					1 x resolver	Detecting absolute value
					LA phase, LB phase, 1 P/R	Absolute value of multiple rpm (max. 32000 rev.)
Inductosyn system (ref.) • Product of Mitsubishi Heavy Industry: See (4) below • Manual no. I-134 (1985. 11)			30m/min	Signal phase 100/110V	A phase, B phase, 0.004 mm/P	Detecting machine's position (After gradual increase to 4-fold, 0.001mm P/R)
					Z phase, 2mm/P	Zero-point indexing (grid width = 2mm)

NOTE: 1. Regarding the servosystem's capacity, see Item 1.2.
2. A special protective unit must be specified if the detector is to be used where oil and water will drip on it.
3. Wiring plugs and cables do not come with the detector as accessories.
4. The user is requested to purchase from the manufacturer the following items: inductosyn (INDUCTOSYN) system, IPA (1 preamplifier/axis), A/D converter (resolution, 1/2000, 1-3 axes in a unit), and accessories (plugs for wiring, etc.).

APPENDIX 9		Servo motor	Motor end detector	Connector position	Machine end detector	Servo amplifier	Regenerative resistance	X ( )	Y ( )	Z ( )	4 ( )	5 ( )	6 ( )
AC servo S series	Standard types	HA-40C-S		A	-	MR-S40E-01	-						
		HA-80C-S		A	-	MR-S80E-01							
		HA-100C	OSE-5K -6-8-108	A	-	MR-S100E-01							
		HA-200C		A		MR-S200E-01							
		HA-300C		A		MR-S300E-01							
	Handwritten notes on non-standard types												
	Special comments												
	(Note) When entering information, refer to the BNP-B3418 specifications manual for the servo systems							Enter a circle where appropriate					

	Item			Axis	X ( )	Y ( )	Z ( )	4 ( )	5 ( )	6 ( )
1	Servo mechanism classification (using symbols on next page)									
2	Effective stroke (mm)									
3	Table support (side, rolling, static pressure)									
4	Linear feed range	Ball screw (B)	Diameter (mm)							
			Lead (mm/rev)							
			Length (mm/rev)							
		Rack and pinion (P)	Module (mm)							
			No. of pinion teeth							
			Machine movement (mm/pinion rotation)							
5	Total deceleration ratio									
6	Maximum load inertia (motor shaft equivalent) (kg·cm·sec²)									
7	Motor shaft equivalent load torque (kg·cm)		When stopped							
			When stopped, unbalanced component							
			During rapid traverse							
			During maximum cutting							
8	Maximum cutting duty (%, min)									
	Maximum rapid traverse repeatability (times/min)									
9	NC		Least input increment (mm, degree)							
			Least command increment (mm, degree)							
			Rapid traverse rate (mm/min)							
			Rapid traverse acceleration/deceleration time constant (msec)							
			Rapid traverse deceleration time constant (exponential function) (msec)							
			Maximum cutting rate (msec)							
			Cutting feed acceleration deceleration time constant (msec)							
			Initial speed for reference point return (mm/min)							
10	Motor		Type							
			Speed during rapid traverse (rpm)							
			Amount of movement per motor revolution (mm, degree)							
11	Coasting		Reference point return dog length (mm)							
			At stroke end (deceleration and stop) (mm)							
			At stroke end (speed loop time) (m/sec)							
			During emergency stop (mm)							
12	Settings (1) Figures in parentheses represent the standard values. Items marked with an asterisk (*) must be entered. A zero is entered for all other empty columns. For items marked with ( ), supply the entry as well as a mechanism diagram in the case of a closed loop system.		Tau selection		•					
			Linear zone		•					
			Basic machine coordinate system offset amount (mm, degree)							
			Effective stroke (+) (from machine zero point) (mm, degree)		•					
			Effective stroke (-) (from machine zero point) (mm degree)		•					
			Deceleration ratio between motor and machine end detector		•					
			Mounting polarity of machine end detector		•					
		Reference return point	Mode (SP,SN,CP,CN, none)		•					
			Rapid traverse rate (mm, degree/min)							
			Approach rate (mm, degree/min)		100					
			Shift amount (mm, degree)							
			2nd reference point position (mm, degree)							
			3rd reference point position (mm, degree)							
			4th reference point position (mm, degree)							