BNP-A-2867D-E

MITSUBISHI CNC

MELDAS AC SERVO MR-S SERIES

MR-S2 & MR-S3
MAINTENANCE MANUAL

ADVANCED AND EVER ADVANCING
MITSUBISHI ELECTRIC

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II. MAINTENANCE MANUAL FOR MELDAS MR-S3 SERIES OF AC SERVO AMPLIFIERS

APPENDIX

I. MAINTENANCE MANUAL FOR MELDAS MR-S2 SERIES OF AC SERVO AMPLIFIERS

(2-axis integrated AC servo amplifiers)

1. OUTLINE OF S2 SERIES AC SERVO SYSTEM

1.1 FEATURES OF THE S2 SERIES SERVO SYSTEM

(1) The MELDAS MR-S2 series is a line-up of 2-axis integrated AC servo amplifiers.
It includes a total of 6 models which enable combinations of motors with varying capacities (0.2kW to 2.0kW) and which make it possible to configure systems with compact dimensions.

(2) This system can be connected to the NC of the MELDAS M300 series.

(3) 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.

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

(5) 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.

(6) 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.

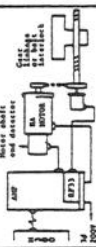
(7) Enhancement of reliability by reducing the number of parts (number reduced by one-half over previous model).
By digitalizing operation, the level of the system's integration has been raised, while the number of parts have been reduced and reliability increased.

(8) 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.

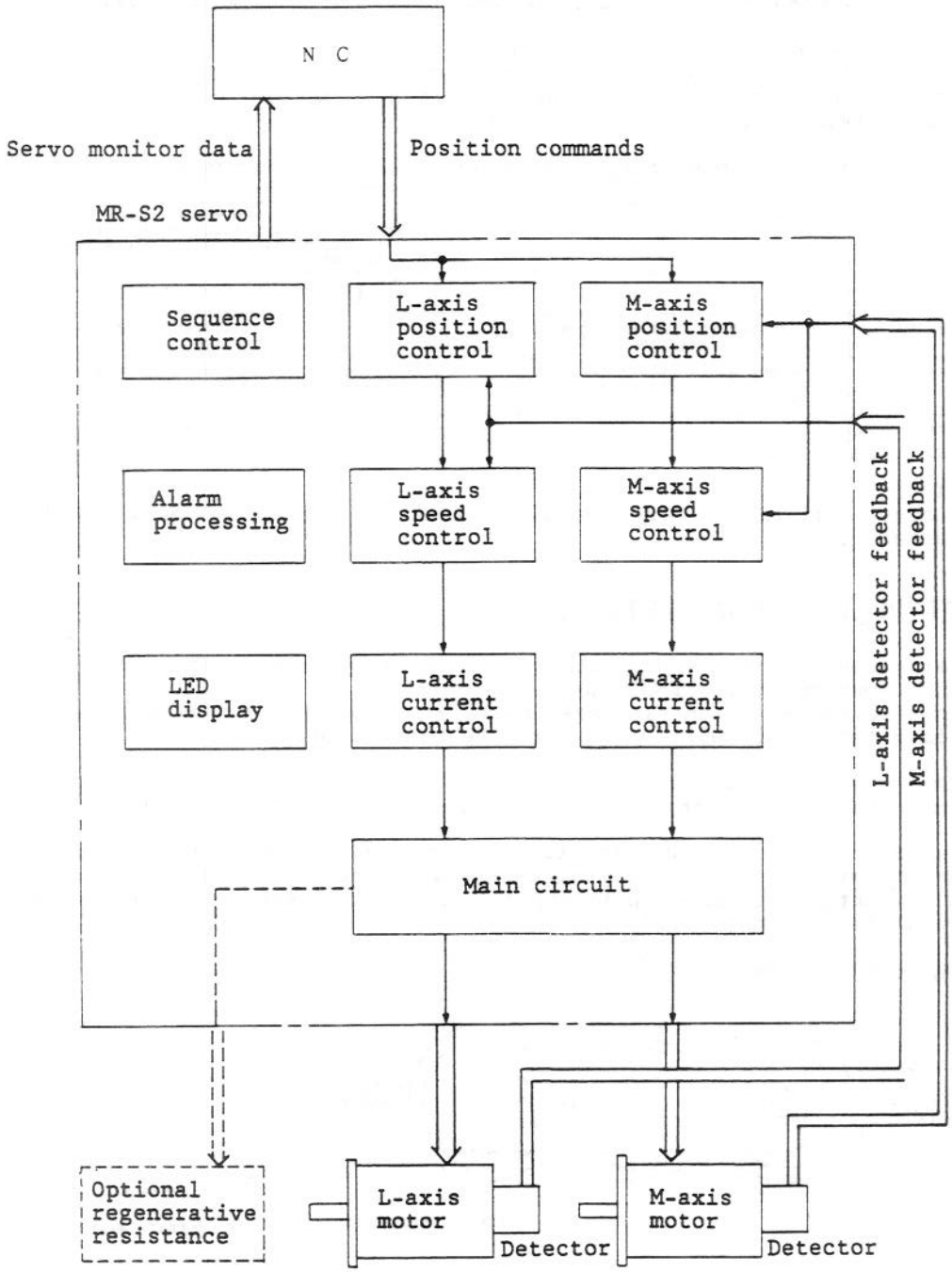
(9) Optional system for detecting absolute value.
An absolute value detection system, by which there is no need for return to zero point, when power is turned on, is optional.

Note: For any particulars not mentioned, reference should be made to the Specifications Manual (BNP-B3501) covering the MR-S2 series of AC servo amplifiers.

1.2 LIST OF S2 SERIES SERVO SYSTEMS

System		Command	System structural drawing	System performance	Unit format: Servo amplifier model	Unit model: Option card	Unit model: Motor shaft end detector	Unit model: Machine end /ball screw end detector	Cable name: Amplifier–motor shaft end detector cable	Cable name: Amplifier – ball screw end detector – machine end detector cable	Remarks
Absolute position detection	Semi-closed loop	1 micron		Standard type • Maximum follow-up performance: 1 Mpps • Minimum resolution : 0.018 o/p (Motor shaft end) • Maximum speed : 3000 rpms The maximum speed depends on the motor being used.	MR-S2-□-E01	-	OSE5K-6-12-108 (OSE5K)	-	CN2KO ↓ Axis number L<7.5m-N541C583 L>7.5m-N541C582	-	
	Closed loop: Ball screw end detection	1 micron		Optional specification • Maximum follow-up performance: 1 Mpps (Ball screw end) • Minimum resolution : 0.018 o/p (Ball screw end) • Maximum speed : 3000 rpm The maximum speed depends on the motor being used.	MR-S2-□-233	RF-332	OSE5K-6-12-108 (OSE5K)	OSE5K-□-3-9.52-0 ↓ Connector direction	CN2KO	CN33RO	
Incremental detection	Semi-closed loop	1 micron		Standard type • Maximum follow-up performance: 1 Mpps • Minimum resolution : 0.018 o/p (Motor shaft end) • Maximum speed : 3000 rpms The maximum speed depends on the motor being used.	MR-S2-□-E01	-	OSE5K-6-12-108 (OSE5K)	-	CN2KO ↓ Axis number L<7.5m-N541C583 L>7.5m-N541C582	-	
	Closed loop: Ball screw end detection	1 micron		Special specification • Maximum follow-up performance: 1 Mpps (Ball screw end) • Minimum resolution : 0.018 o/p (Ball screw end) • Maximum speed : 3000 rpm (Ball screw end) The maximum speed depends on the motor being used.	MR-S2-□-E31	RF-312	OSE5K-6-12-108 (OSE5K)	OSE5KN-ET□-3-9.52-0 ↓ Connector direction	CN2KO	CN31NRO	
	Closed loop: Scale F/B	1 micron		Special specification • Maximum follow-up performance: 1 Mpps • Minimum resolution : 1μm or 0.5μm • Maximum speed : 3000 rpm System performance depends on the motor and scale being used.	MR-S2-□-E31	RF-312	OSE5K-6-12-108 (OSE5K)	Various scales of pulse F/B outputs of 1 μ and 0.5 μ specification can be connected.	CN2KO	CN31NO	

1.3 BLOCK DIAGRAM OF MR-S3 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.

Table 2.1 Measuring instruments used for maintenance

Instrument	Conditions	Application
Tester		For verifying whether servo amplifier has been connected properly before power is switched on
Oscilloscope		For general measurements and trouble-shooting
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

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

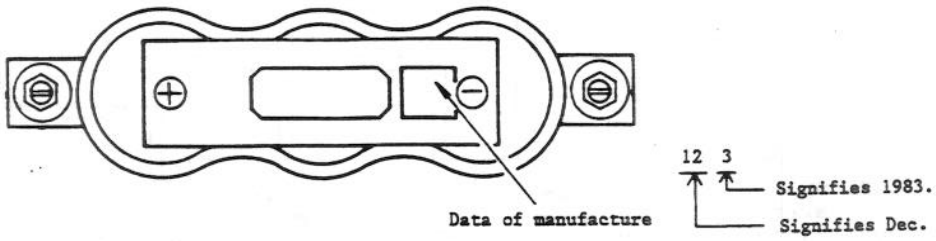
2.2 REPLACING THE BATTERY

The data in the absolute position detection system are retained by a battery which is mounted on the RF332 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



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 AC200/220 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 replaced 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

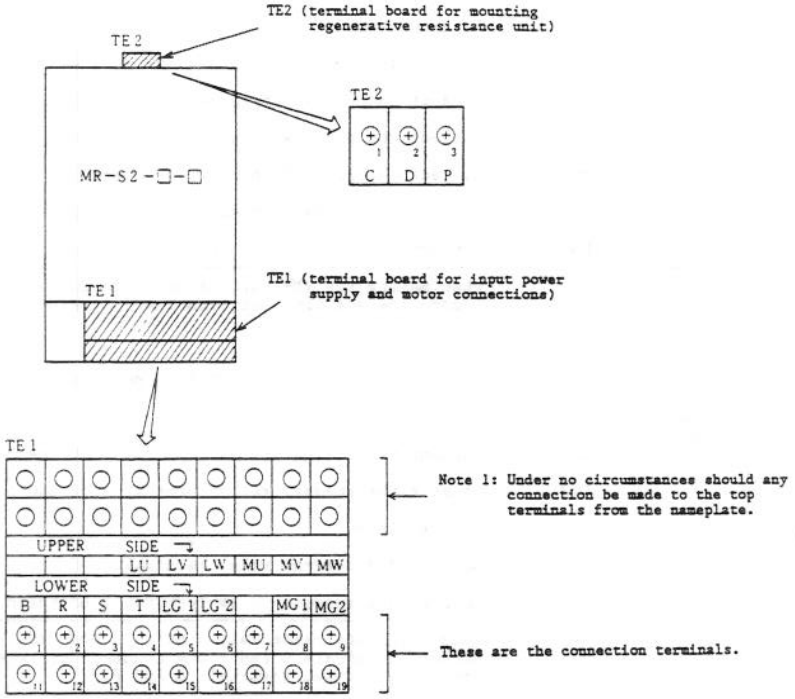
(2) Power line frequency: 50/60 Hz; ±1 Hz, 3 phases

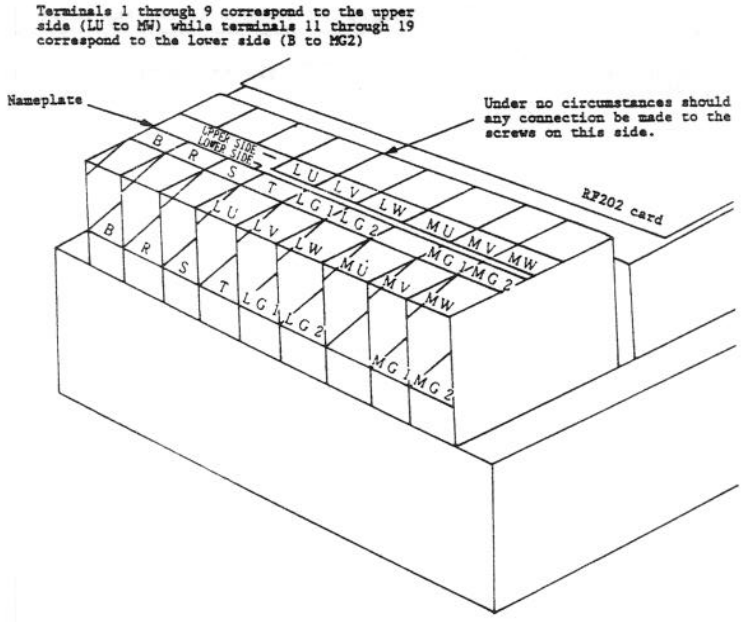
(3) Power consumption

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

3.3 MAIN CIRCUIT CONNECTION

3.3.1 EXTERNAL CONNECTED TERMINALS (MR-S2-□-□ type)



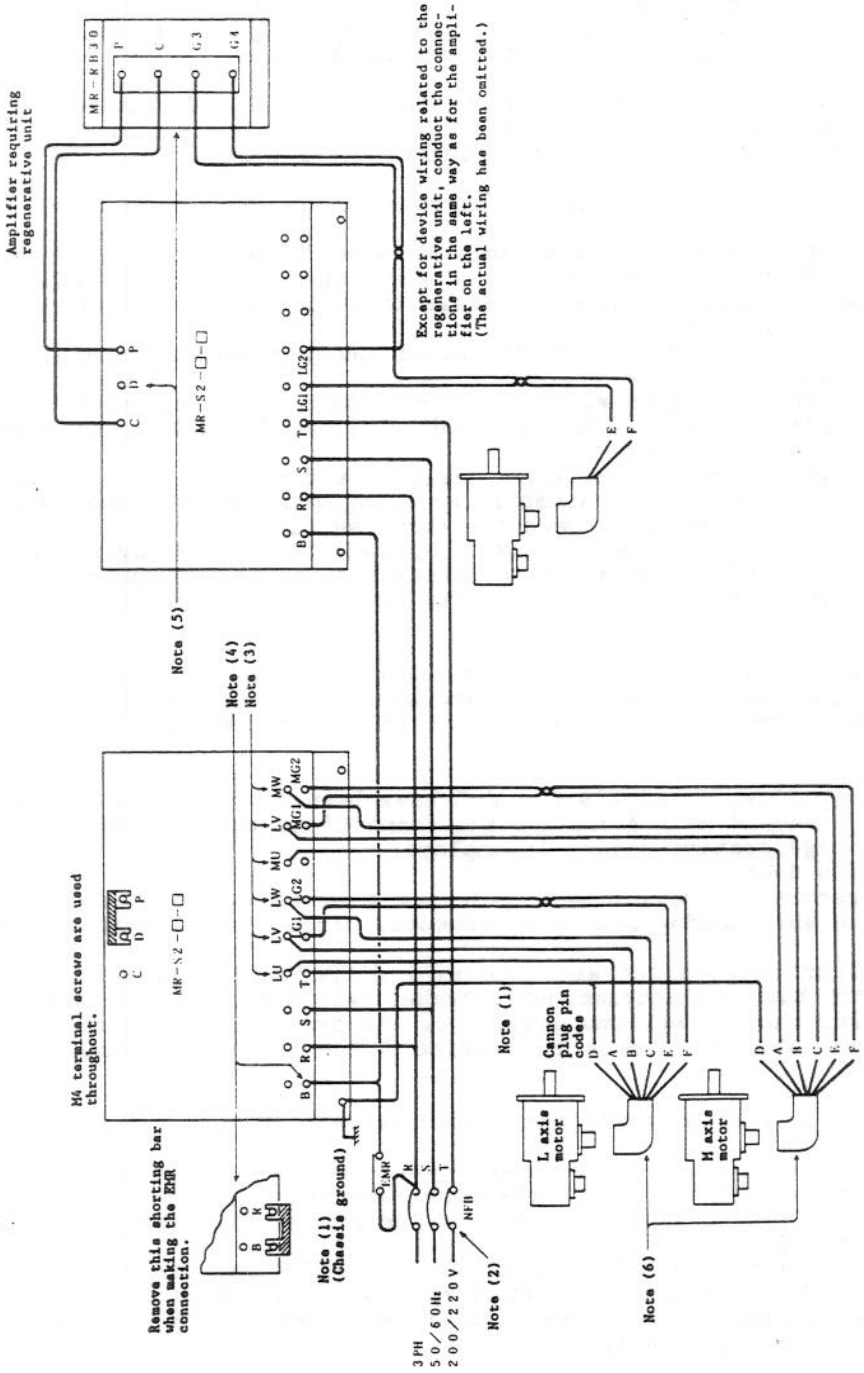


3.3.2 TERMINAL BOARD CONNECTIONS

Terminal board	Terminal board No.	Terminal position	Terminal name	Details of connection
TE1	1		-	No connection
	2		-	No connection
	3		-	No connection
	4		LU	Connect the phase U terminal of the L axis motor.
	5	Upper side	LV	Connect the phase V terminal of the L axis motor.
	6		LW	Connect the phase W terminal of the L axis motor.
	7		MU	Connect the phase U terminal of the M axis motor.
	8		MV	Connect the phase V terminal of the M axis motor.
	9		MW	Connect the phase W terminal of the M axis motor.
	11		B	When making the EMR connection (external emergency stop), remove the shorting bar from the R terminal.
	12		R	
	13		S	Connect the 3-phase AC 200/220V power supply.
	14	Lower side	T	
	15		LG1	Connect the thermal relay terminal 1 of the L axis motor.
	16		LG2	Connect the thermal relay terminal 2 of the L axis motor.
	17		-	No connection
	18		MG1	Connect the thermal relay terminal 1 of the M axis motor.
	19		MG2	Connect the thermal relay terminal 2 of the M axis motor.
TE2	1		C	When using the regenerative unit, remove the shorting bar between terminals D and P and connect the regenerative unit terminals between terminals C and P.
	2		D	
	3		P	
			E	Connect the chassis ground and motor ground.

Note: The connections differ slightly for the MR-S2S-□-□ type and so reference should be made to the MR-S2 Specifications Manual.

3.3.3 CONNECTION 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) Any phase sequence may be adopted for the R, S and T power terminals on the servo amplifier. However, when connecting a multiple number of amplifiers, avoid connecting different signs together.

(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.
c. Do not reverse the L axis (LU, LV, LW) and M axis (MU, MV, MV) connections for the output terminals on the servo amplifier. Make sure that the L axis motor capacity is equal to, or greater than, the M axis motor capacity.

(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 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 3.4)
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 3.3.7 for the terminal box type of motor.

(7) Finally, follow the cautionary notes in Sections 3.5 and 3.6.

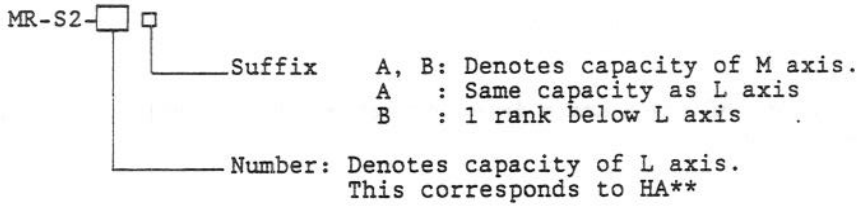
Connecting the EMR contact to the servo amplifier terminal B gives a 2-system configuration with different emergency stop functions (alarm codes 55 and E7).
A current of approximately 30mA flows to the EMR contact per axis under 200V and 60 Hz power supply conditions. Once emergency stop occurs, it cannot be released unless resetting is performed at the NC unit even if the EMR contact opens again.

3.3.4 CONNECTED MOTORS

The MR-S2 series breaks down by capacity into 5 types, and it should be borne in mind that there are restrictions on each L axis and M axis governing the motors which can be used.

Amplifier model name	L axis drive motor	M axis drive motor
MR-S2-13A- □	HA053/13	HA053/13
MR-S2-33A- □	HA23/33	HA23/33
MR-S2-40A- □	HA40/43	HA40/43
MR-S2-80B- □	HA80/83	HA40/43
MR-S2-80A- □	HA80/83	HA80/83
MR-S2-100B- □	HA100	HA80/83
MR-S2-100A- □	HA100	HA100

(1) The L axis motor must not have a smaller capacity than the M axis motor. For instance, the MR-S2-80B- □ is an amplifier which corresponds to the HA80 motor for the L axis and since its suffix is "B", it means that for the M axis it is an amplifier which corresponds to the HA40, which is one rank below the motor (HA80) for the L axis. Similarly, the MR-S2-80A- □ has the suffix "A" which corresponds to HA80 for the M axis and so it is the amplifier which corresponds to the same HA80 for the L axis.



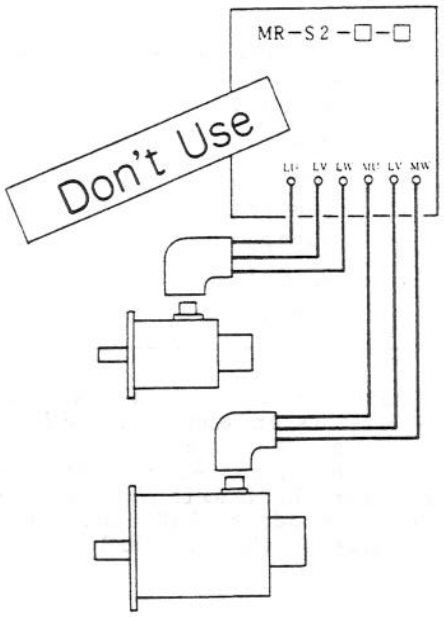
(2) If the HA40 motor is mistakenly connected to the L axis and the HA80 motor is connected to the M axis when using the MR-S2-80B- □, there is a danger that the HA40 mounted on the L axis will demagnetize when the motors are driven. A thorough check should be undertaken to prevent this from happening.

(3) LCN2 (semi-closed) is the feedback connector on the L axis motor; for the M axis motor, it is MCN2 (semi-closed).

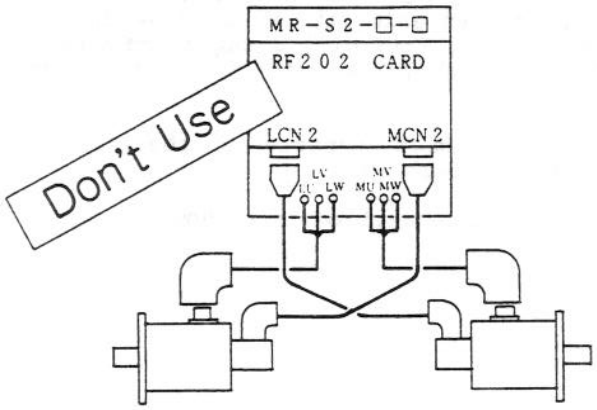
(4) Typical examples of incorrect connections are shown on the following page.

Examples of incorrect connections

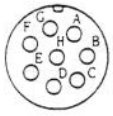
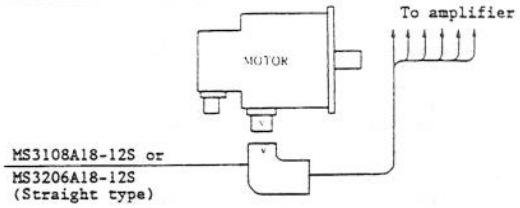
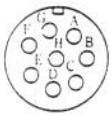
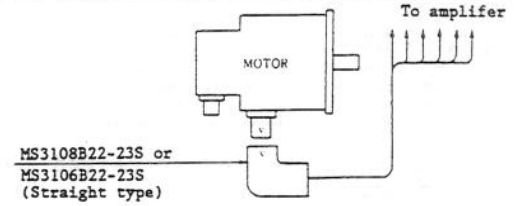
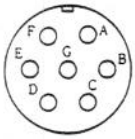
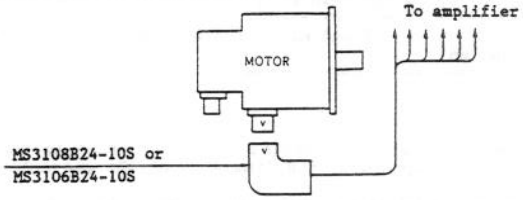
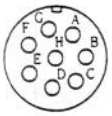
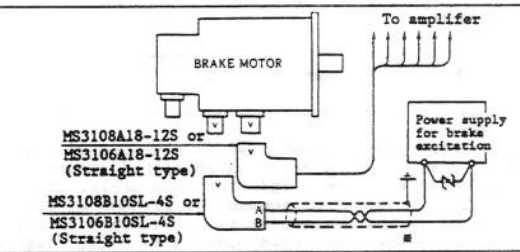
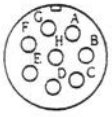
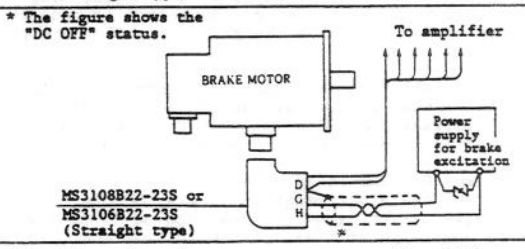
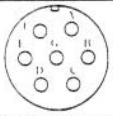
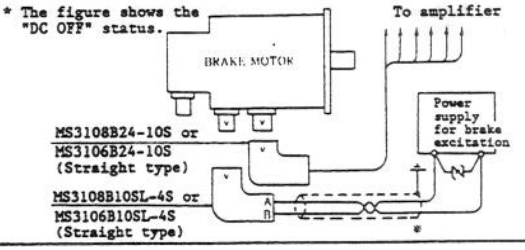
(1) A motor with a smaller capacity must not be connected to the L axis.



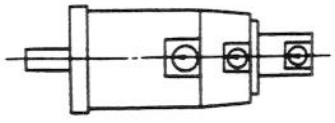
(2) **The connections of the L and M detector cables and UVW phase terminals must not be mixed up.**



3.3.5 CANNON PLUGS USED

Motor type	Motor end connector	Cannon plug used
HA23C HA33C	 MS3102A18-12P	
HA40C HA43C HA80C HA83C	 MS3102A22-23P	
HA100C	 MS3102A24-10P	
HA23CB HA33CB	 MS3102A18-12P  MS3102A10SL-4P	
HA40CB HA80CB	 MS3102A22-23P	
HA100CB	 MS3102A24-10P  MS3102A10SL-4P1	

Note: (1) Select the MS3108 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.



3.3.6 CABLES USED

(1) Standards for power cables connected between amplifiers and motors

	U, V, W (Motor main circuit)	Grounding wire Note (2) (Motor ground)	G1, G2 Note (3) (Motor thermostat)	Electromagnetic brake Note (4) For excitation
HA053 HA13 HA23 HA33	2 mm² min (3.5 mm² max) Note (1)	2 mm² min (3.5 mm² max)	0.5 mm² min (3.5 mm² max)	0.5 mm² min (3.5 mm²max)
HA40 HA13	2 mm² min (3.5 mm² max)	2 mm² min (3.5 mm² max)	0.5 mm² min (3.5 mm² max)	0.5 mm² min (3.5 mm²max)
HA80 HA83	2 mm² min (3.5 mm² max)	2 mm² min (3.5 mm² max)	0.5 mm² min (3.5 mm²max)	0.5 mm² min (3.5 mm²max)
HA100	3.5 mm² min (8 mm² max)	3.5 mm² min (8 mm² max)	0.5 mm² min (3.5 mm² max)	0.5 mm² min (3.5 mm²max)

(2) Standards for power cables connected between amplifier and regenerative option (terminals P, D)

	MR-S2-100A	MR-S2-100B	MR-S2-80A	MR-S2-80B	MR-S2-40A	MR-S2-33A
P, D (Note 5) (regenerative option)	3.5 mm² min	3.5 mm²min	3.5 mm² min	2 mm²min	2 mm²min	2 mm²min

Notes:

(1) The cables sizes 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.

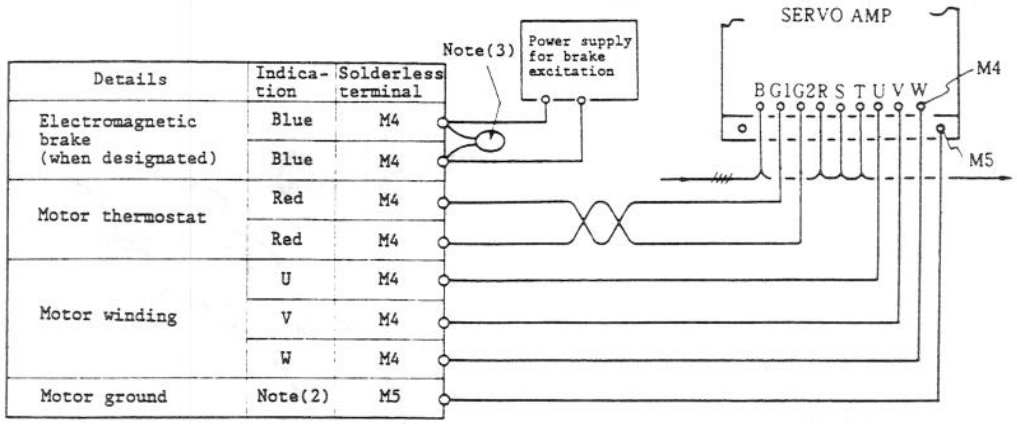
140-14 Green marking for grounding wires

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 cable, 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) Use shield wires for electromagnetic brake "DC OFF."
(5) 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.
(6) Select wires with excellent bending properties if the operating conditions of the motor are such that the motor will move.

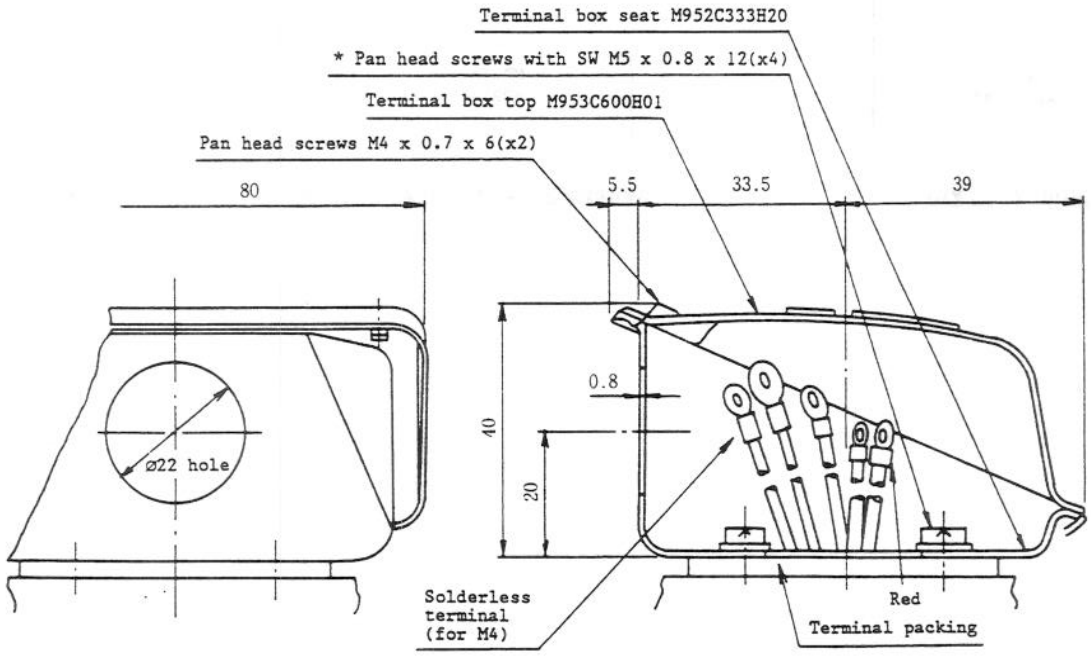
3.3.7 MOTORS (SPECIAL MODELS) OF TERMINAL BOX TYPE

Details	Indication	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



Notes:
(1) Pay attention to the model name of the servo motor since the terminal box type of servo motor is a special product.
(HA23 - HA100, HA23B - HA100B)
(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.

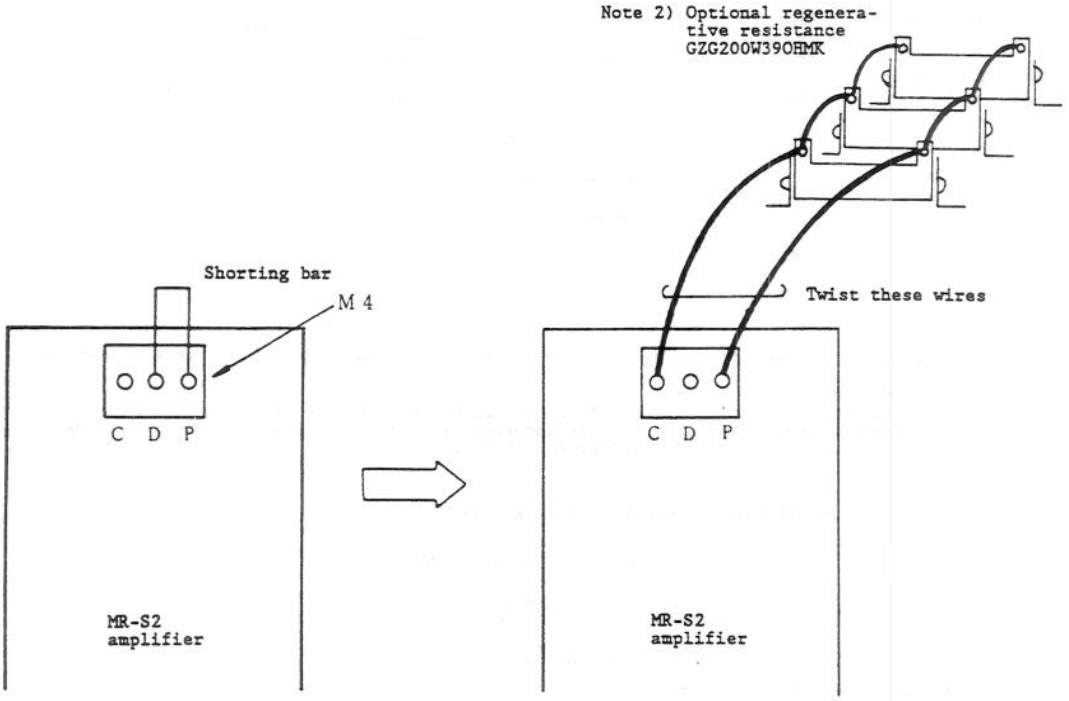
Detail of motor terminal box



* 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

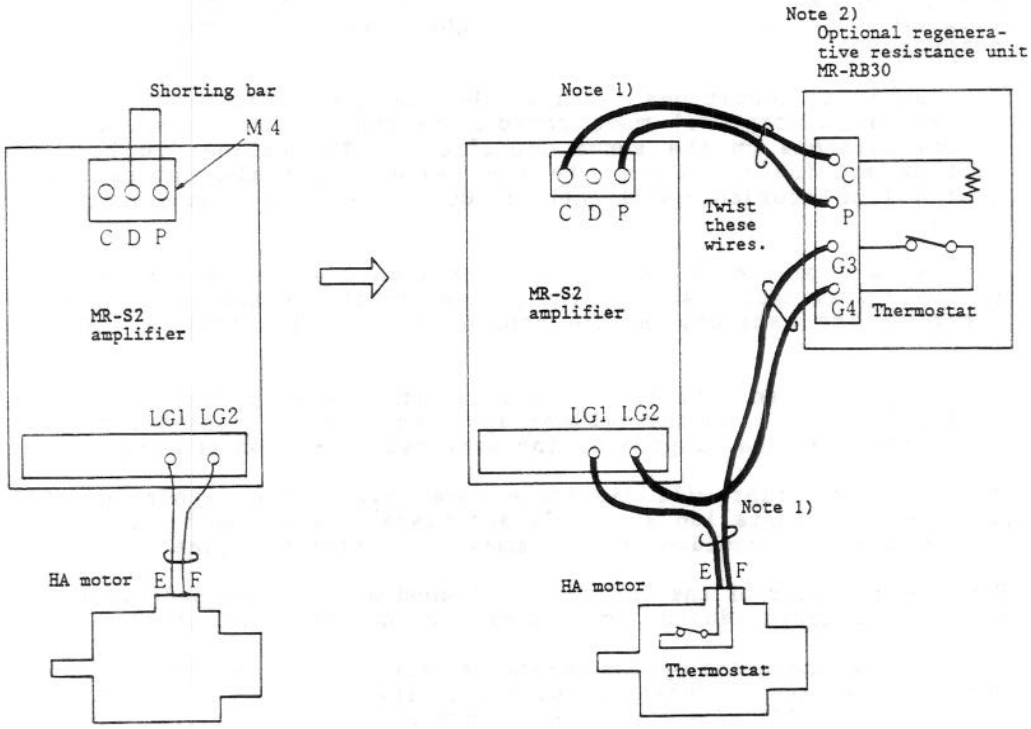
(1) When using the GZG200W390HMK optional regenerative resistance.



Standard type

Regenerative option type

(2) When using the MR-RB30 optional regenerative resistance



Standard type

Regenerative option 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 C and P terminals. When the MR-RB30 is used, connect the motor and the thermostat of the regenerative unit in series.

Note 2. Use three GZG200W390HMK optional regenerative resistance units for each amplifier and use one MR-RB30 unit for each amplifier.

Note 3. Change the servo parameter No.20 ORT (regenerative time constant).

	Standard	Additional option present
OR time constant	4680	3010

Note 4. The optional regenerative units generate heat. If they are used very frequently, they will heat up and thus should not installed on the surface of an insufficiently strong wall. Sufficient clearances (at least 70 mm) should be left with models for which two or more resistances are used side by side.

Note 5. Use flame-resistant cables for the cables which connect the regenerative options or make the cables flame-resistant. Reference should be made to Section I-14-3-3-6 for details on the thickness of the cables.

3.5 PRECAUTIONS ON INSTALLING THE SERVO AMPLIFIER

(1) The servo amplifier 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 servo amplifier." 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-B3341.

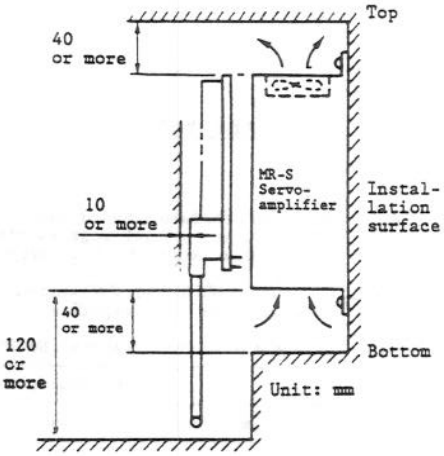
(3) The servo amplifier is designed to hang on a wall; be sure to fasten it securely vertically (so that the printed circuit board is visible from the front of the cabinet) on the cabinet's wall with bolts. (See diagram below).

(4) Install the servo amplifier in a location, where it can be inspected and replaced easily. On the ambient space required for installing the servo amplifier, see the diagram of the external dimension for installing it.

(5) The servo amplifier 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).

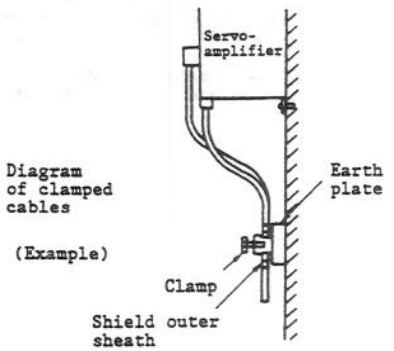
(6) When the interior of the cabinet is cleaned with compressed air in order to blow away adhering dusts, avoid blasting the servo amplifier.

(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 servo amplifier, see "MELDAS 300 series connection manual."

(9) The bus cable connecting the servo amplifier (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 SERVO MOTOR AND DETECTOR

(1) Precaution against oil and water

(a) The servo motor is not strictly proof against oil and water. Therefore, adequate precautions must be taken to prevent cutting fluids and lubricants from contaminating the servo motor. If cutting fluids and lubricants invade the servo motor, 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 servo motor 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 servo motor and detector from contamination from liquid sprays.

(d) Do not install the servo motor 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.

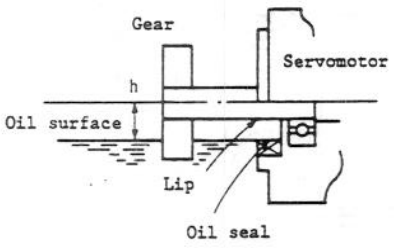
(f) The servo motor must be installed, where it is not exposed to contamination from oil and water, ventilation is good, its installation and removal can be done easily.

(2) Precaution against gear oil

(a) The servo motor 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 servo motor'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 servo motors 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 building up inside the box.

(Side of machine)



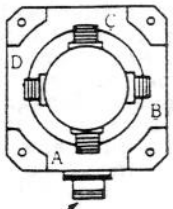
Model	HA23,HA33	HA40,HA80	HA100
Height from center of motor shaft. h (mm)	10	20	25

(3) Detector

(a) Take adequate preventions to avoid shocks on the servo motor'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.

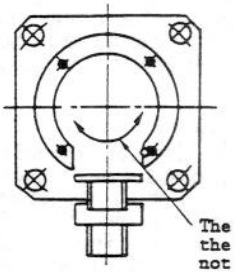
(b) The installation of the machine should be designed with the detector's connector connected on the "A" direction, as illustrated.
The connector can be connected in the other three directions (B, C and D); however, then the installation of the servo amplifier becomes complicated and errors in installing 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

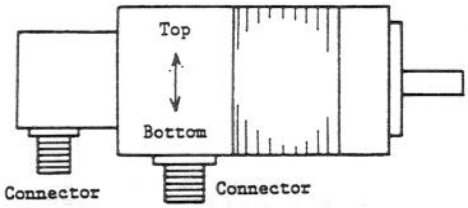
(c) The motor and the detector have been accurately matched (their polarities are matched) at the factory. If the detector is replaced with another kind or if the direction of the connector is changed, regulation of the motor may become impossible or cause overspeeding.
The factory matched relationship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

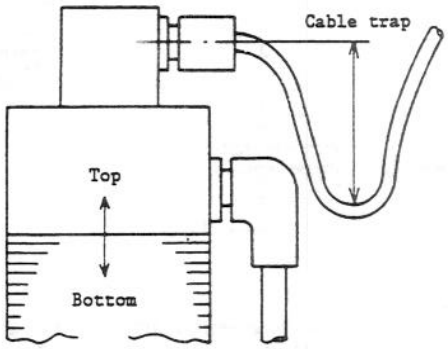


The direction of the connection should not be changed.

(4) Connector and cable

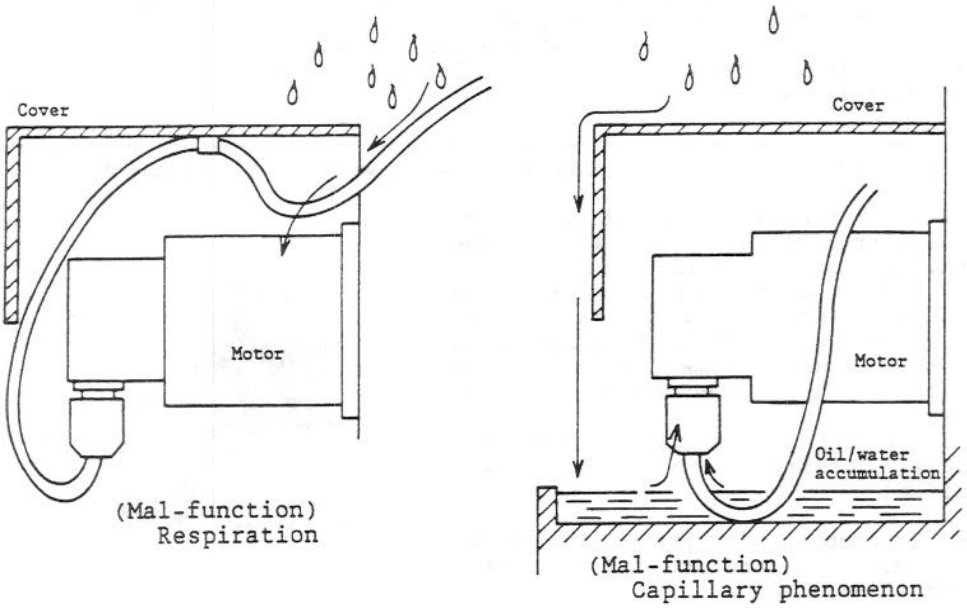
(a) The connector should be faced downwards.
If the motor is to be installed vertically or slantwise, install a trap on the cable.





(b) The standard Cannon 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.)



(d) The cable must be installed with great care to avoid twisting 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 high voltage arc also occurring. The Cannon plug should be securely fastened with wire.

(b) When power is off, the detector for detecting the absolute value remains 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.

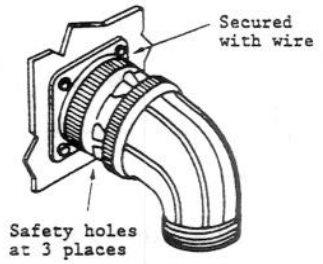
(c) The Cannon plug is designed to be securely fastened by hand. Adequate space should be provided around it so that manual fastening can be performed easily.

(6) Usage of motor and detector where they are subject to constant vibration

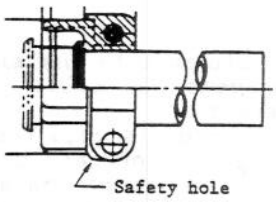
The Cannon plug and cable clamp of the motor and detector must be securely fastened with wire. The cable's weight, as well as the diameter of its slack, size of the clamp, and other factors must be optimized to prevent vibrational stress from transmitting to the cables' connection. Make extra sure all connections are fastened securely.
The necessity for retightening of the Cannon plug and cable clamp during 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 servo motor 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

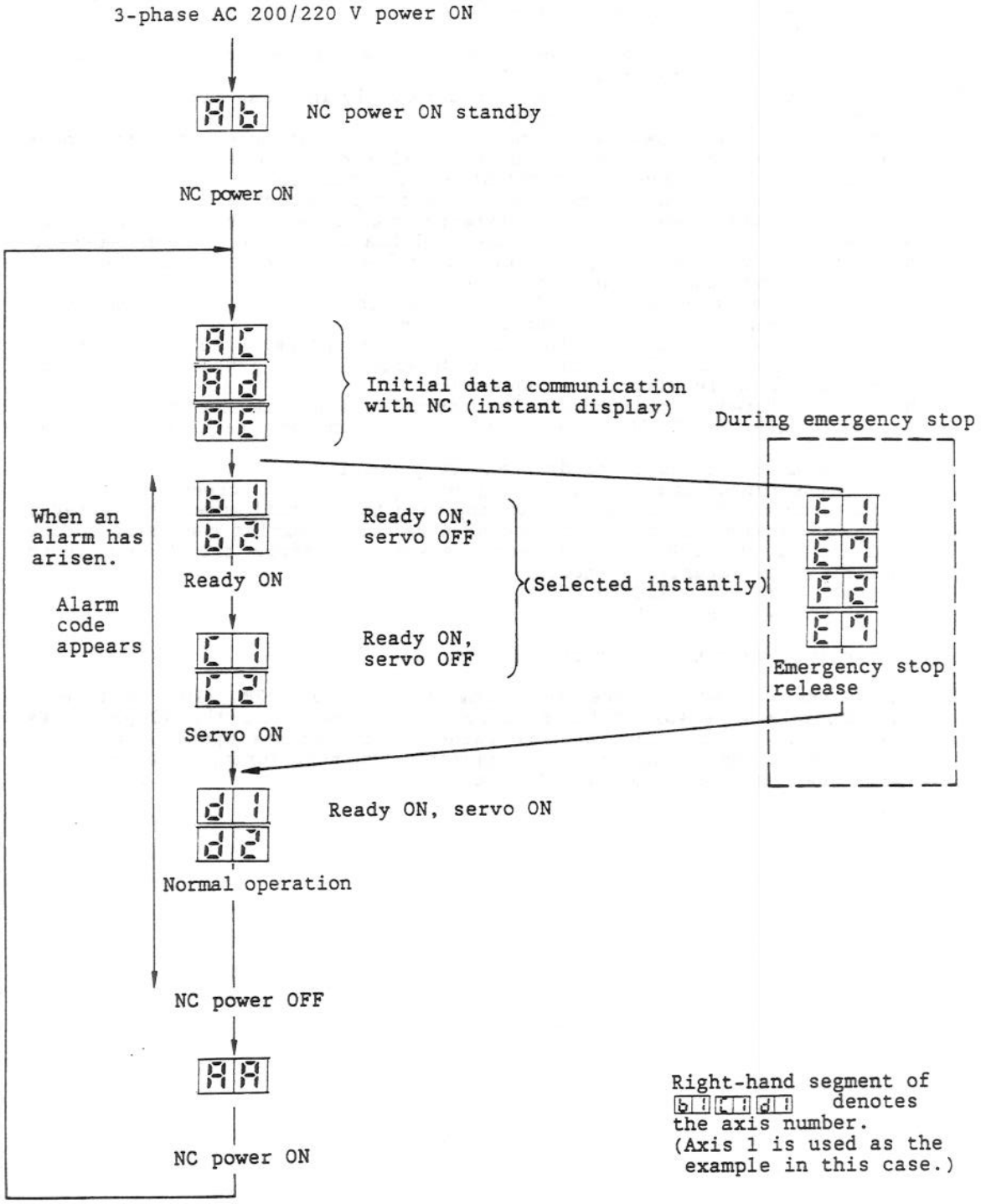
(1) Before switching on the power.
After connecting the main circuitry wires and cables, check the points below before switching on the power.

[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 resistance is attached, are terminals C and P on the terminal board (top part) connected properly?
When the optional regenerative resistance is attached, has the shooting 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 connector on the printed circuit board? (For details on the proper connections, refer to the Cable Diagrams in Appendix 2.)
[6] Have the printed circuit boards been properly installed in the units?
[7] Has the AXES SELECTION rotary switch (axis number setting) been set properly?
[8] Have the main and add-on cards been set 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) Checkpoints when the power is switched off.

[1] Ensure that the main breaker supplying the 3-phase AC 200/220 V voltage to the amplifiers is switched off at least 1 second after the NC power has been set off. When the absolute value specifications apply, control is exercised to reduce the battery consumption current during this interval. (This does not apply to the RF332A card.)

(3) Checkpoints after switching on the power
The normal 7-segment display appears after the power has been switched on. (This is located on the RF202 card.)



4. TROUBLESHOOTING

4.1 7-SEGMENT DISPLAY

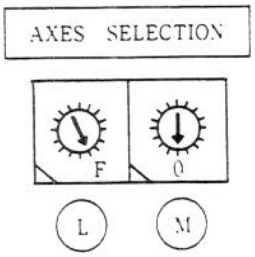
The status of the amplifier is indicated on the 7-segment display at the top left of the amplifier.

MR-S amplifier status displays

Display	Status	Description
AA	INITIALIZE	NC power ON standby (when NC power is turned from ON to OFF)
Ab	INITIALIZE	NC power ON standby (when NC power is turned from OFF to ON and when NC power is OFF)
AC	INITIALIZE	Requesting to send parameters
Ad	INITIALIZE	Requesting to convert parameters
AE	INITIALIZE	Standing by for main servo IT start
b#	READY OFF	Ready off
C#	SERVO OFF	Servo off
d#	SERVO ON	Servo on
E# → E*	WARNING	Warning now generated
F# → **	ALARM	Alarm now generated
.	WATCH DOG ALM	Watchdog alarm
FA	NO CONTROL L	L axis not being controlled (Note 1)
Fb	NO CONTROL M	L axis not being controlled (Note 2)

Note: 1. When the AXES SELECTION switch at the top left of the RF202 card is set to "F" while the amplifier power is off and then the servo amplifier's power is switched on, total control will not be exercised over that axis.
(There will be no communication between the NC system in the initialized status and no alarm will be generated.)
In the case of the figure below, the L axis is the axis which is not controlled.

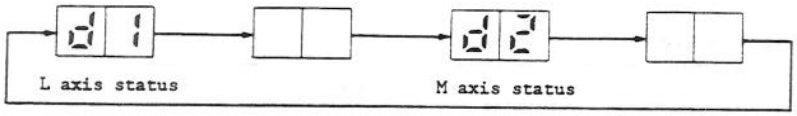
(Example)



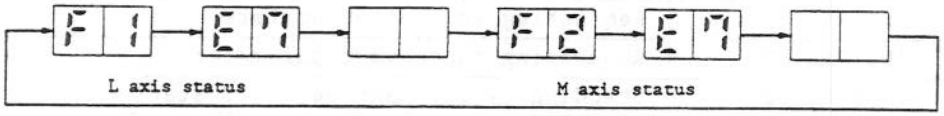
\# : Axis number
* : Warning number
** : Alarm number (Refer to the section on servo alarms and warnings)

The display of the statuses starting with **INITIALIZE** is indicated in sequence for each axis by the segments which repeatedly light up and go out. Examples are given below.

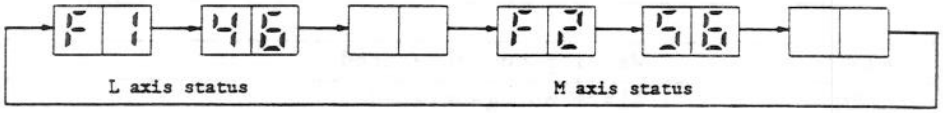
(Example 1) Display which appears when the L axis is the 1st axis (X axis) and the M axis is the 2nd axis (Y axis), and the servo ON status applies to both axes.



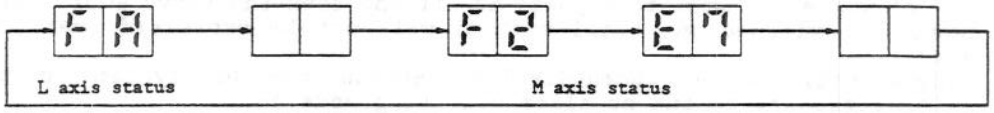
(Example 2) Display which appears while the emergency stop signal is being input from the NC system with the above axis numbers.



(Example 3) Display which appears when the motor overheating alarm (No.46) occurs in the L (X) axis with the above axis numbers (The other axis malfunction alarm applies to the M (Y) axis.)



(Example 4) Display which appears when the AXES SELECTION switch L is set to "F" because the L axis is not used, when the power is switched on and when the emergency stop input signal is being input from the NC system for the M axis.



Servo-alarm and warnings

**	ABBREVIATION NAME	NAME	Reset	Axis/Cm
10	UV	Under Voltage	PR	C
11	AE	Axis Error		A
12	ME1	Memory Error 1	AR	C
13	CE	external Clock Error	PR	C
14	WD	Watch Dog error	PR	C
15	ME2	Memory Error 2	PR	A
16	RD	Rotor position Detect error	PR	A
17	BE	Board error	PR	
20	NS1	No Signal 1 (main board)	PR	A
21	NS2	No Signal 2 (add on board enc)	PR	A
22	NS3	No Signal 3 (add on board 1X)	PR	A
23				
24				
25	BA	Battery Alarm	PR	C
26	NA	No control Axis error	PR	C
27	ICE	Internal Clock Error	PR	C
30	OR	Over Regeneration	PR	C
31	OS1	Over Speed 1 (2400/3600 rpm)	PR	A
32	OC	Over Current	PR	A
33	OV	Over Voltage	PR	C
34	DP	Data Parity	PR	C
35	DE	Data Error	PR	A
36	TE	Transfer Error	PR	C
37	PE	Parameter Error (initialize)	PR	A
40				
41				
42				
43				
44				
45	OHF	Fin Over Heat	NR	C
46	OHM	Motor over heat	NR	A
47				
50	OL1	Over Load 1 (parameter settings)	NR	A
51	OL2	Over Load 2 (C.LIMIT 1 sec)	NR	A
52	OD	Over Droop	NR	A
53				
54	AOL	Amp Over Load	NR	C
55	EM	EMergency	NR	C
56	OA	Other Axis alarm	NR	C
57				
E0	WOR	Warning Over Regeneration	*	C
E1	WOL	Warning Over Load	*	A/C
E2				
E3				
E4	WPE	Warning Parameter Error	*	A
E5	WAB	Warning Absolute Detect	*	A
E6	WOT	Warning Over Travel	*	A
E7	NCE	NC Emergency	*	C

Warning on "resetting": Reset when power of PR:NC is OFF; reset is possible when NR:NC requires setting.
* 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.
In the Axis/Cm column "A" denotes an alarm which is generated independently for each axis and "C" denotes an alarm which is common among the amplifiers.

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 circularity
4.2.5 Overshooting during positioning
4.2.6 Surge feed with 1 pulse feed
4.2.7 No.7 segment display even when power is switched on; alternatively, when a number appears which is not applicable to a status or alarm
4.2.8 No change in segment display from [8b][88] even when power is switched on; alternatively, [8C] , [8d] , [8E] appear for an instant and then display returns to [8b] [88] .

Note: Depending on the type of alarm, some alarms may concern a specific axis only, while others may concern all the axes. In the troubleshooting procedures, an asterisk (*) denotes an alarm which relates to an axis, in which case every effort should be made to ensure that the proper axis is checked.
In cases like this, bear in mind that alarm [56] signifying a malfunction in another axis will occur for the problem-free axes.

Note: The card names for the MR-S2 are as follows:

Main card	:	RF202
Base amplifier card	:	RF22
Add-on cards		
For closed loop	:	RF312
For absolute value detection	:	RF332

4.2.1 OCCURRENCE OF SERVO ALARM

(1) Alarm number [10] : Under voltage

This detects a drop in the 3-phase AC 200/220V supply voltage. (S, T phases)

	Cause	Check method	Remedy
1	3-phase AC 200/220 V drops below 160V (±5%) or the voltage has exceeded 260 V.	Check input voltage using voltmeter.	Re-examine power supply facilities.
2	Instant failure of 3-phase AC 200/220 V	Check input voltage using synchroscope and verify whether it fails instantly. Approx. 25 msec or more with 200V input voltage.	

(2) Alarm number [11] : Axis error

An error in the setting position of the rotary switch inside the amplifier has been detected.

	Cause	Check method	Remedy
1	Rotary switch has been set 6-E.	Check rotary switch setting.	Reset properly.
2	Same axis has been selected with L and M axes.	Check rotary switch setting. (Setting to same number?)	Reset properly.

(3) Alarm number [12] : Memory error 1

The detects an EPROM check sum error as well as SRAM and 2-port RAM check errors during initialization.

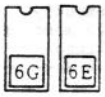
	Cause	Check method	Remedy
1	EPROM check sum error	Try replacing with problem-free EPROM of another axis.	Replace EPROM.
2	SRAM, 2-port RAM check error.	Try replacing with problem-free main card of another axis. AXES SELECTION must now be changed. → See replacement of servo amplifier control cards in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

(4) Alarm number [13] : External clock error

This alarm occurs when 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	Check method	Remedy
1	Disconnected connector of cable between NC and amplifier or between amplifiers.	Conduct visual check. • Main card CN1A, CN1B • NC side	Connect properly.
2	Servo amplifier software is not functioning properly.		Replace main 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	Strong noise in cables between NC system and amplifier and between amplifier and amplifier.	Have any measures been taken to deal with the noise?	Deal with the noise (by shielding the cables, etc.)

(5) Alarm number [..] or [14] : Watchdog error (a watchdog alarm is indicated when the 7-segment points have lighted up).
The servo amplifier software does not finish processing within the specified time.

	Cause	Check method	Remedy
1	EPROM has not been mounted properly.	Check visually whether it has been mounted at location marked on EPROM. 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 main card or add-on card (for closed loop/absolute value detection)	Trying replacing it with other axis card. AXES SELECTION on main card must now be changed. → See replacement of servo amplifier control cards in Section 5.1.	Replace with problem-free card.

(6) 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	Check 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

(7) Alarm number 16 * : Rotor position detect 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	Check method	Remedy
1	Disconnected detector connector	Conduct visual check. (Any disconnections?) • Main card on amplifier side • Cannon connector at detector side	Mount properly.
2	Defective cable between amplifier and detector	(1) Observe pins 4, 5 and 6 of main card J4 in emergency stop status and check whether signals are all high 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 main 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 main card.	Set correctly. See details on servo parameters in Section 7.

(8) Alarm number 17 * : Board error

During initialization, the A/D converter and its peripheral circuitry on the main card did not operate properly.

	Cause	Check method	Remedy
1	Defective RF202 card	Try replacing with RF202 of another axis. AXES SELECTION SW of RF202 card must now be changed. → See replacement of servo amplifier control cards in Section 5.1.	Replace card.
2	Defective RF22 card	Try replacing it with the RF22 card of another axis.	Replace card.
3	Defective detector cable (±15V line shortcircuits with shield, etc.)	Try replacing it with the cable of another amplifier.	Replace cable.

(9) Alarm number 20 * : No signal 1

This is the differential signal of the encoder which is connected to the main card, and it sets a pair of signals to high or low.

	Cause	Check method	Remedy
1	Disconnected detector connector (or is becoming disconnected)	Conduct visual check. • LCN2, MCN2 of RF202 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.

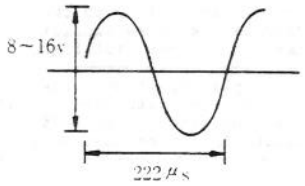
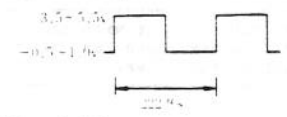
(10) Alarm number 21 * : No signal 2

This is the differential signal of the encoder which is connected to the add-on card, and it sets a pair of signals to high or low.

	Cause	Check method	Remedy
1	Disconnected detector connector (or is becoming disconnected)	Conduct visual check. • LCN31/33, MCN31/33 of RF312/332 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.

(11) Alarm number 22 * : No signal 3

The output of resolver connected to add-on card for absolute value detection is 0V.

	Cause	Check method	Remedy
1	Disconnected detector connector (or is becoming disconnected)	(1) Conduct visual check. • LCN33, MCN33 of RF332 card • Cannon connector at detector side. (2) Observe signal between RF332 check pin CP3-1 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 add-on card	(1) Observe signal between RF332 check pin CP2-1 and 2 on synchroscope.  (2) See 1-(2). (Emergency stop status)	Replace RF332 card. When waveform (1) is not normal, this alarm applies to both the L and M axes.
4	Defective detector	Try replacing detector with that of other axis.	Replace detector.

(12) Alarm number 25 : Battery alarm

The voltage of the add-on card for absolute value detection battery has dropped.

	Cause	Check 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.

(13) Alarm number 26 : No control axis error

The rotary switch on the main card has been set to "F" and an overcurrent has flowed to the DC bus of the corresponding axis which is not being controlled.

	Cause	Check method	Remedy
1	Rotary switch has been set incorrectly.	Conduct visual inspection (switch is at top left of main card).	Set properly. Alarm is not generated by this error alone.
2	Failure in power section of axis which is not being used.	Proceed as for check method described for alarm 32.	
3	Defective base amplifier card	Try replacing it with the trouble-free base amplifier card of another amplifier.	Replace base amplifier card.
4	Defective main card.	Try replacing it with the trouble-free main card of another amplifier. The AXES SELECTION switch must be set.	Replace card.

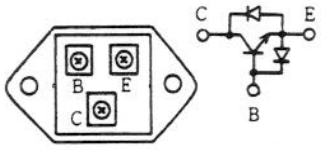
(14) Alarm number 27 : Internal clock error

This alarm occurs when the clock inside the main card has stopped.

	Cause	Check method	Remedy
1	Defective main card.	Try replacing it with the trouble-free main card of another amplifier.	Replace card.

(15) Alarm number 30 : Over 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 resistance 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>Check 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 repeatability in Appendix 8.</td><td>(1) Reduce repeating frequency.
(2) Reduce rapid 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</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 several hundred ohms</td></tr>
</table>

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

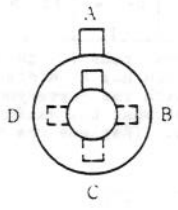
(16) Alarm number [31] * : Over speed 1 (2400/3600 rpm)

This detects any speed that exceeds the allowable speed of the motor.

	Cause	Check 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	Rapid traverse rate is too high	Value of speed (rpm) = $\frac{\text{rapid traverse rate (mm/min)}}{\text{ball screw lead(mm)}}$ 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	0.1μ has been set although least command increment is 1μ.	Check system specifications.	Re-set parameter.

(17) Alarm number 32 * : Overcurrent

A current exceeding the permissible value has flowed to the DC bus inside the unit.

	Cause	Check method	Remedy
1	Servo amplifier output U, V, W phases mutually short-circuited	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.	Remedy shortcircuiting.
2	Servo amplifier output U, V, W phases mutually grounded	Use a tester to check between U, V and W of terminal board and case.	Remedy grounding.
3	Defective speed detection cable	Try replacing with problem-free cable.	Replace cable.
4	Mounting direction of speed detector and parameter designated do not match	Relationship between motor, mounting direction of detector and parameter is as shown below. Bit 15 | Mounting direction 0 | AC 1 | BD 	Correct mounting. Or correct parameter. See #17 STY in details on servo parameters in Section 7.
5	Defective speed detector	Try replacing with problem-free detector.	Replace detector.
6	Defective base amplifier card.		Replace base amplifier card.
7	Defective main card		Replace main card

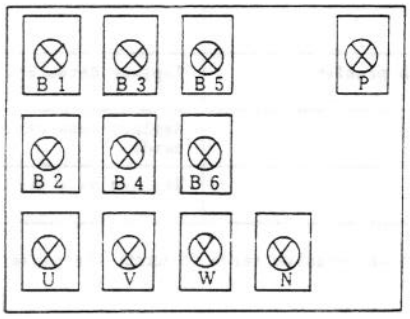
Note: In case of occurrence of an overcurrent alarm, do not execute servo ON until the cause has been clarified.

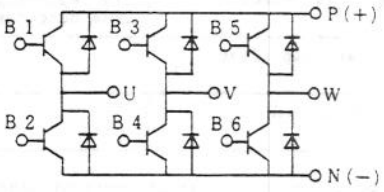
If an overcurrent occurs, a failed transistor module may be to blame. Before proceeding with restoration, check whether the transistor module is problem-free by following the procedure below.
Procedure for checking out the transistor module.

No.	Outline
1	Switch off the 3-phase AC 200/220V input power.
2	Remove the card.
3	Use a tester to measure the resistance between the terminals of the transistor module. (Multimeter range x 10 ohms)
4	Proceed to restore in the order of steps 2 and 1.

Transistor module No.	(1)		(2)		(3)		(4)		(5)		(6)		Normal resistance	Defect status
Multimeter	+	-	+	-	+	-	+	-	+	-	+	-		
Check terminal	P	U	U	N	P	V	V	N	P	W	W	N	Several 100 ohms	Shortcircuit or infinity
	U	P	N	U	V	P	N	V	W	P	N	W	Infinity	Shortcircuit or several 100 ohms
	P	B1	U	B2	P	B3	V	B4	P	B5	W	B6	Several 100 ohms	Shortcircuit or infinity
	B1	P	B2	U	B3	P	B4	V	B5	P	B6	W	Infinity	Shortcircuit or several 100 ohms
	B1	U	B2	N	B3	V	B4	N	B5	W	B6	N	Several 100 ohms	Shortcircuit or infinity
	U	B1	N	B2	V	B3	N	B4	W	B5	N	B6	Infinity	Shortcircuit or several 100 ohms

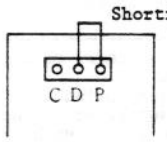
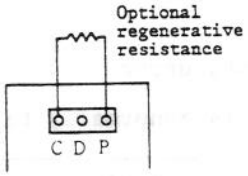
When above items (1) through (6) are checked in sequence and a malfunction has been discovered, it means that the transistor module with the corresponding number has failed.
No matter what the malfunction, the transistor module must be replaced. (Replace the amplifier.)





(18) Alarm number 33 : Over voltage

The DC bus voltage inside the unit has exceeded the allowable level (approx. 400 V).

	Cause	Check method	Remedy
1	Faulty terminal board connection.	Connection without optional regenerative resistance  Connection with 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 unbalanced 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 regenerative 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.	

Note: Take care with the connections for the MR-S2S type since the C, D and P terminals in the above figure are located underneath the card.

(19) Alarm number 34 : Data parity

Parity error has occurred in data received from the NC.

	Cause	Check method	Remedy
1	Faulty connection of CN1A, CN1B connectors on main 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.

(20) Alarm number 35 * : Data error

Movement command from NC is abnormally high.

	Cause	Check method	Remedy
1	Faulty connection of CN1A, CN1B connectors on main 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.

(21) Alarm number [36] : Transfer error

The transfer of data periodically from NC has been interrupted.

	Cause	Check method	Remedy
1	Faulty connection of CN1A, CN1B connectors on main 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.

(22) Alarm number [37] * : Parameter error

All illegal servo parameter has been transferred from NC during initializing.

	Cause	Check 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	Servo parameter STY and hardware (add-on cards)	Relationship between STY and hardware settings is displayed below. Card configuration / Parameter STY RF202 — XXX0 RF202 + RF312 — XXX4 RF202 + RF332 — XXX5, XXX4, XXX1 Illegal parameter number [17] is displayed by NC. (STY is the 17th servo parameter.)	Re-set and set power ON, OFF. Note) No DIP switches are provided on add-on cards.
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 [33]. → See (Note 1) details on servo parameters in Section 7.	Re-set and set and power ON, OFF.

	Cause	Check method	Remedy
4	Defective insertion of CN1A, CN1B connectors on main card.	Check connections.	Correct connections and screw into place.
5	Defective cable between NC system and servo amplifier.	Try replacing cable.	Replace cable.
6	Noise in cable between NC system and servo amplifier.	(1) Deal with noise. See cautions related to installation of amplifier in Section 3.5. (2) Noise is generated at timing when specific relay connector inside power board is set ON/OFF.	(1) Deal with noise. (2) Add a spark killer, etc.
7	Defective NC card (MC611, etc.)	Try replacing with a trouble-free card.	Replace card.

(23) Alarm number [45] : Fin overheat

The thermal protector of the fins inside the unit has been tripped.

	Cause	Check 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.

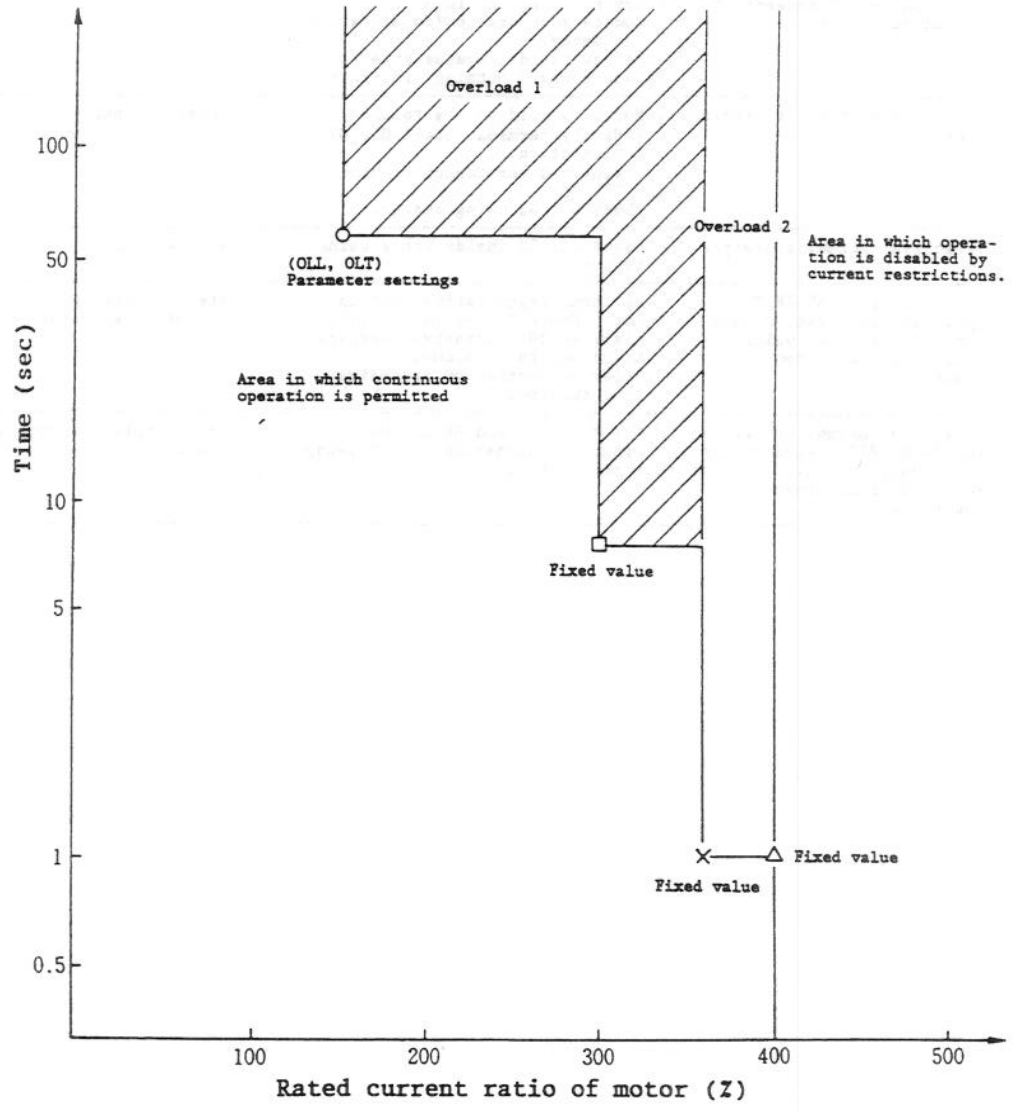
(24) Alarm number 46 * : Motor overheat

The thermal protector built into the motor has been tripped.

	Cause	Check 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	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.
4	Overheating of MR-RB30 optional regenerative unit (only for axis on which such a unit has been mounted).	Optional regenerative unit is hot. Cause (2) or (3) of (15) alarm No.30 (excessive regeneration) may be to blame. Refer to section on excessive regeneration.	Refer to section on excessive regeneration.
5	Defective thermal protector inside MR-RB30 regeneration unit (only for axis on which such a unit has been mounted).	Check out G3 and G4 inside optional regenerative unit using a multimeter.	Replace optional regenerative unit.

(25) Alarm number 50 * : Overload 1

Operation has been conducted within the shaded area of the thermal characteristics range in the figure below.



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

Motor	○		□		×		△
	Level	Time	Level	Time	Level	Time	Level
HA 23	OLL	OLT/10 sec.	250 %	10 sec.	355 %	1 sec.	375 %
33	OLL	OLT/10	250	10	355	1	375
40	OLL	OLT/10	250	10	500	1	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

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

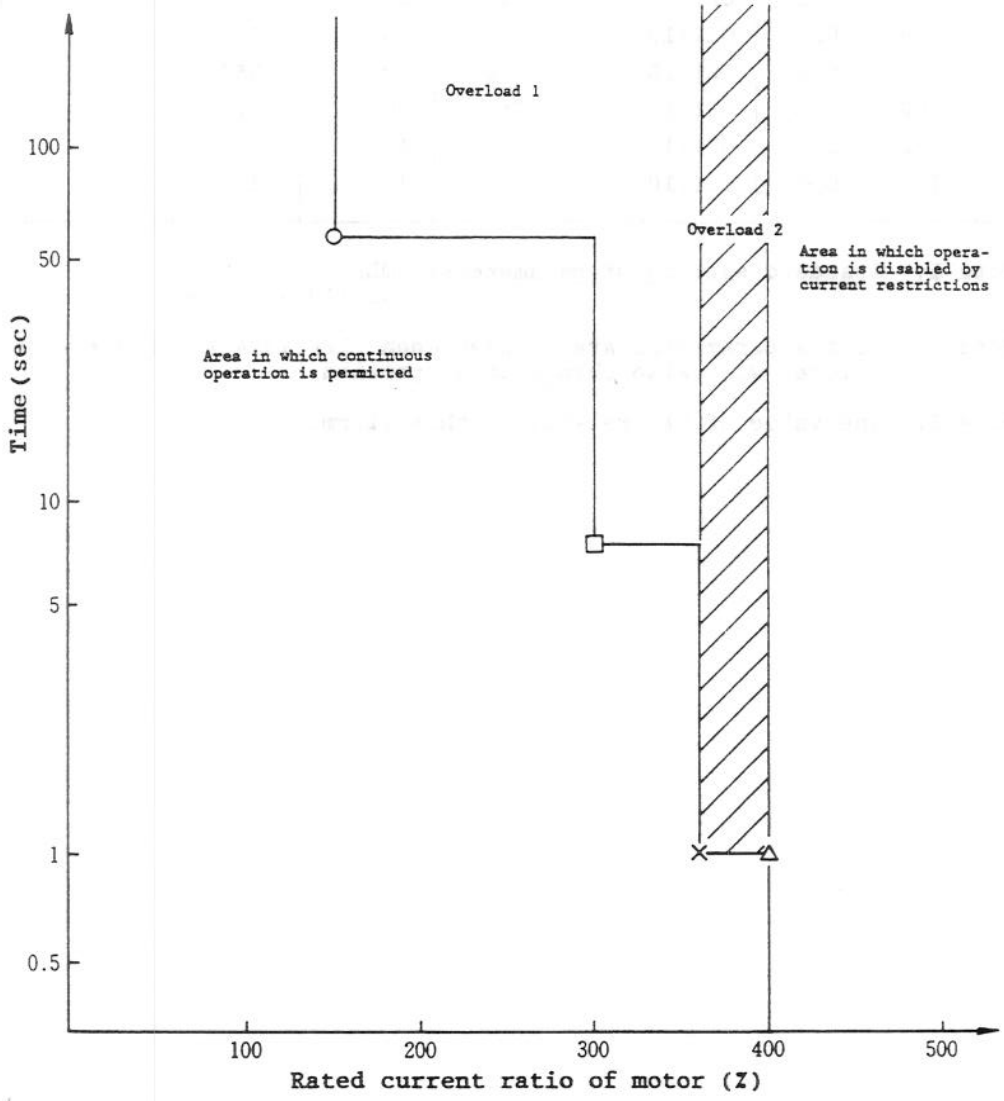
Note 2: If the parameters are changed when ILP= 1364 and ILN = -1364, the △ level will also change in proportion.

Note 3: "○" and "□" relate to this alarm.

	Cause	Check 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 OLL, 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.

(26) 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 ○, □, ×, △ in the figure will differ according to the motor in question. Reference should be made to the table on the following page.

Motor	○		□		×		△
	Level	Time	Level	Time	Level	Time	Level
HA 23	OLL	OLT/10 sec.	250 %	10 sec.	355 %	1 sec.	375 %
33	OLL	OLT/10	250	10	355	1	375
40	OLL	OLT/10	250	10	500	1	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

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

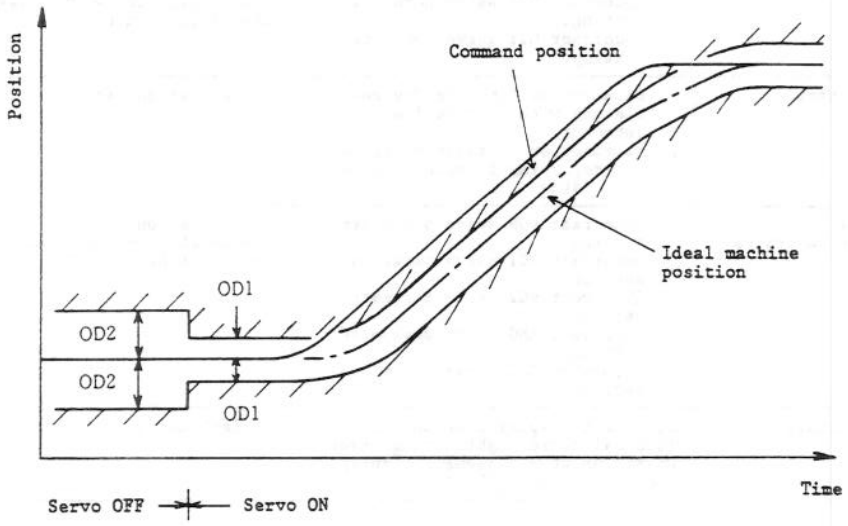
Note 2: If the parameters are changed when ILP= 1364 and ILN = -1364, the △ level will also change in proportion.

Note 3: The value of "X" relates to this alarm.

	Cause	Check 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 [ ] or [ ] ?	Replace unit.

(27) Alarm number 52 * : Over drop

The actual machine position is distanced from the ideal machine position vis-a-vis the 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	Check 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 traverse speed (rpm) J_m : motor inertia (kg•cm•sec²) J_L : load inertia (kg•cm•sec²) T_m : maximum torque of motor (kg•cm•sec²) 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 [ ], [ ])?	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.

(28) Alarm number 54 : Amp overload

The total current of the motor connected to the amplifier has exceeded the level given below and operation has gone beyond the fixed time duration. The current levels and time duration are shown in the table below.

Amplifier	Current level (A)	Time duration (min)
MR-S2-33A	21	12
MR-S2-40A		
MR-S2-80B		
MR-S2-80A		
MR-S2-100B	32	
MR-S2-100A		
MR-S3-80AA	32	12
MR-S3-100BB		
MR-S3-100AB		
MR-S3-100AA		

	Cause	Check method	Remedy
1	Amplifier has been used at a level exceeding continuous rating.	Try reducing load. • Reduce acceleration/ deceleration frequency. • Reduce rapid traverse rate • Reduce heavy cutting time proportion.	Reduce load.
2	Incorrect setting of servo parameter MTY.	Does servo parameter MTY coincide with connected motor?	Correct as described on left.
3	Hunting caused by inverse servo.	1. Connection of motor power cable 2. Incorrect setting of servo parameter STY 3. Incorrect setting of servo parameter MTY	Correct as described on left. Refer to servo parameter details in Section 7.
4	Hunting caused by instability in servo system.	1. Incorrect setting of servo parameter PGN 2. Incorrect setting of servo parameter PC1 3. Incorrect setting of servo parameter PC2 4. Incorrect setting of servo parameter PNG 5. Incorrect setting of servo parameter VG1	Correct as described on left. Refer to servo parameter details in Section 7.

(29) Alarm number 55 : Emergency

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	Check method	Remedy
1	Emergency stop	Are B and R released during emergency stop?	Normal operation
2	Heavy vibration applied to unit	Over 5G? (Level at which buttom of unit is normally tapped with mallet?)	Remove source of vibration.
3	Defective contactor inside unit	Check continuity between contacts of contactor. (See figure of main circuitry configuration.)	Replace unit.
4	R phase input is missing, or connecting wire	Check R terminal connections.	Connect properly or replace cable.

(30) Other axis alarm 56

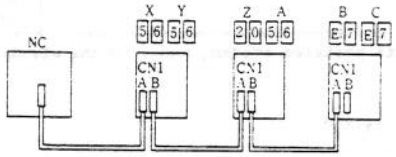
An alarm has occurred in one of the axes in the same amplifier or the alarm occurs in the unit connected to the CN1B side. Alternatively, the cable end (termination connector) has become disconnected.

Example)

Other axis malfunction alarm occurs in the amplifier at the CN1A side of the amplifier in which an alarm has occurred.

Axis in which alarm has occurred; no-signal alarm

Emergency stop signal from NC system stops the amplifier at the CN1B side of the amplifier in which an alarm has occurred.



Cable end; termination connector

When an alarm occurs in one axis inside the amplifier, the other axis malfunction alarm occurs in the other axes.

	Cause	Check 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.

(31) Warning number [E0] : Warning over regeneration

This senses a level of excessive regeneration 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 (15) excessive regeneration.
It is particularly recommended that the remedies in 2 of (15) 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 (15) excessive regeneration. Furthermore, actual use is not hindered when the regenerative load is constant.

(32) Warning number [E1] : Warning overload

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 overload 1.

(33) Warning number [E4] : Warning parameter error

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.

(34) Warning number [E5] : Warning absolute detect

There is an error in the internal data for absolute position detection.
The servo OFF status does not result.

	Cause	Check method	Remedy
1	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 add-on card for absolute value detection.
2	Incorrect absolute value compensation data		Replace detector and add-on card.

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

(35) Warning number [E6] : Warning over travel

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	Check method	Remedy
1	Overtravel	During overtravel?	Normal operation

(36) Warning number [E7] : NC emergency

The NC system is set to emergency stop.

	Cause	Check 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	Check 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  .	1. Replace EPROM. 2. Replace main 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.

	Check and remedy method
1	Try adjusting the servo parameters.

	Servo parameters
①	5. VG1 Try reducing this in units of 50 (lower limit: 50).
②	11. IQG Reduce this in units of 50 (lower limit: 128).
③	12. IDG Reduce this in units of 50 (lower limit: 256).
④	17. STY Try raising FBC (bit 11).
⑤	17. STY Try raising FBF (bit 10).
⑥	17. STY 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.

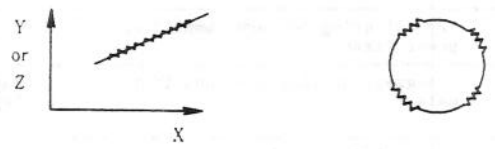
(2) Vibration or noise during rapid traverse

	Check and remedy method
1	Try adjusting the servo parameters.

	Servo parameters
①	Proceed in the same way as for (1).
②	Enter the value equivalent to cutting feed speed + 100 rpm into SP2 and enter the same value as VG1 into VG2. Repeat rapid traverse and keep reducing VG2 in units of 10. (Limit: 0)

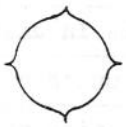
4.2.4 POOR CUTTING SURFACE ACCURACY; POOR CIRCULARITY

	Check and remedy method
1	When surface accuracy in 45 direction of taper, arc is poor.

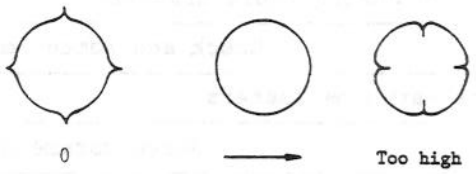


	Servo parameters
①	5. VG1 Try in creasing this in units of 50. (Limit is reached if vibration or noise is generated during stop or rapid traverse)
②	8. VIA Try increasing this in units of 200 (upper limit: 2000).
③	31. SP4 Set 10 in this.

2	Noticeable projections appear at point where arc quadrant cutting changes (joins are noticeable).



	Servo parameters
①	5. VG1 Try increasing this in units of 50.
②	8. VIA Try increasing this in units of 200 (upper limit: 2000).
③	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

	Check and remedy method
1	With semi-closed loop system

	Servo parameters
①	5. VG1 Try increasing this in units of 50. (Limit is reached if vibration or noise is generated during stop or rapid traverse)
②	8. VIA Try increasing this in units of 200 (upper limit: 2000)

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 the axis specifications.
If there is no overshooting, overshooting occurs not with the motor itself but with the machine system. → Check out the machine system.

2 With closed loop system

	Servo parameters
①	5. VG1 Try increasing this in units of 50. (Limit is reached if vibration or noise is generated during stop or rapid traverse)
②	8. VIA Try increasing this in units of 200 (upper limit: 2000).
③	3. PGN Try reducing this in units of 5. (Min. 20) The simultaneous interpolation axis must be set to the same value.
④	27.SSF Try raising PID (bit 0) 7. VIL and reducing this in units of 5 from 10000. (Lower limit: 9800)
⑤	27.SSF Raise PID (bit 0), IDC (bit 1) and IDF (bit 2), and reduce VIL is units of 20 from 10000. (Lower limit: 9500) Note) Overshooting and limit cycle are eliminated by (4) but try (5) if the response is poor.
⑥	When variations of less than 1 or 0.1 micron are generated during stop when a 1 or 0.1 micron scale is used, raise SSF CNG (bit 11).

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.

4.2.6 SURGE FEED WITH 1 PULSE FEED

	Check and remedy method
1	When there is no movement even when several pulses are supplied, check the servo monitor screened roop and check whether about the same amount of droop has occurred. (1) When droop has occurred

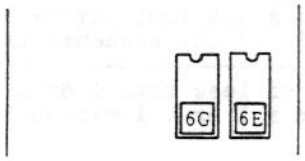
	Servo parameters
①	5. VG1 Try increasing this in units of 50.
②	8. VIA Try increasing this in units of 200. (Limit applies if vibration or noise arises during stop or rapid traverse)

Note: when closed loop 27. SSF PID (bit 0) is raised:

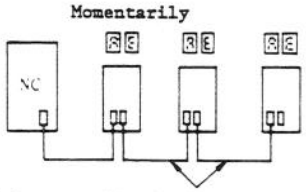
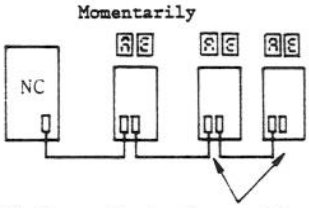
	Servo parameters
①	Proceed with ⑤ in Section 4.2.5.

(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	Check method	Remedy
1	Control power supply on RF202 card is shorted by detector cable.	Try disconnecting detector cable from RF202 card. (Do this in emergency stop status.)	Replace detector or detector cable.
2	Control power supply on RF202 card is shorted by add-on card (RF312/332).	Try disconnecting add-on card (RF312/332). (Do this in emergency stop status.)	Replace add-on card.
3	EPROM on RF202 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.

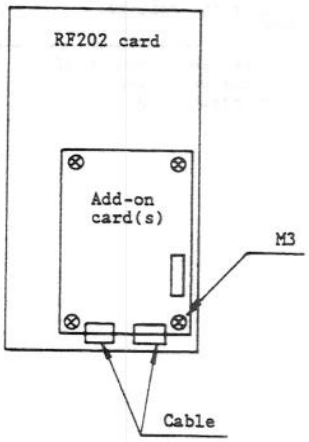
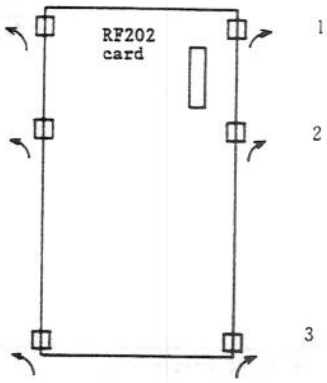
4.2.8 NO CHANGE IN SEGMENT DISPLAY FROM Ab , AA , EVEN WHEN NC POWER IS SWITCHED ON; ALTERNATIVELY, AC , Ad , AE APPEARS FOR AN INSTANT AND THEN DISPLAY RETURNS TO Ab , AA .

	Cause	Check method	Remedy
1	Disconnected cable between NC system and amplifier or between amplifiers	Visual check • RF202 card CN1A, CN1B • NC side.	Connect properly.
2	Incorrect setting of RF202 card axis No. selector switch.	Check whether axis number is duplicated.	Set properly.
3	Defective cable between NC system and amplifier or between amplifiers	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.  Defect may lie in these cables.	Replace cable.
4	Defective RF202 card	If AE appears momentarily up to a particular axis in the sequence of the cable connections from the NC system, the subsequence cards are suspect. Try replacing the RF202 card.  Defect may lie in these cables.	Replace RF202 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

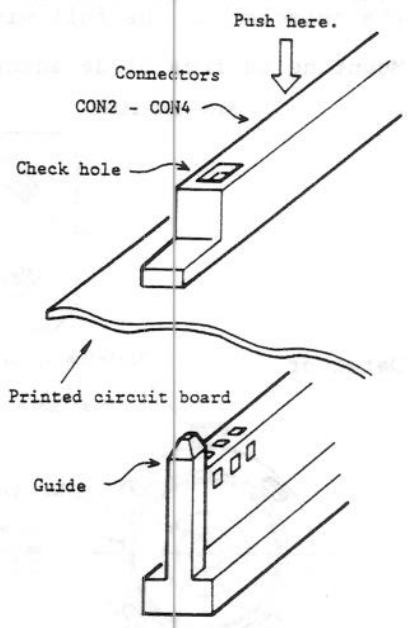
5.1 CONTROL PRINTED CIRCUIT BOARD INSTALLATION/REMOVAL

5.1.1 CONTROL PRINTED CIRCUIT BOARD REMOVAL

1	Removing the add-on printed circuit boards
	1) Switch off the power and disconnect the accessory connectors. Note: When the absolute value detection card is in position, do not disconnect the connectors. Dog-type zero point return must be performed when the connectors have been disconnected. 2) Remove the 4 screws which attach the printed circuit boards. 3) Disconnect the connectors for each of the PCBs. 
2	Removing the main card (RF202)
	1) Switch off the power and disconnect the accessory connectors. 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. 
3	How to remove the base amplifier card (RF22)
	1) When the RF202 main card is removed, the RF22 card is visible underneath. 2) This card can also be removed by following the same procedure as for stage 2. Note: If stage 3 is conducted without conducting stage 2, the RF202/22 cards can be removed together.

5.1.2 CONTROL PRINTED CIRCUIT BOARD MOUNTING

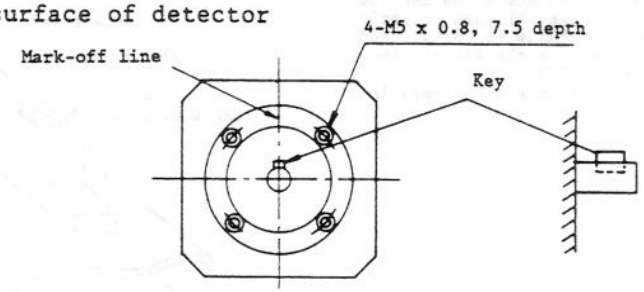
1	Mounting the base amplifier card (RF22)
	1) Insert connectors CON2 through CON4 on the PCB along the connector guide at the main circuit side. 2) After having inserted the connectors, look through the check hole to check whether the connectors below have been aligned properly. Note: If the connector below is not aligned, press down firmly on the top of the connector on the PCB. 3) Check whether the 6 supports are firmly in place.
2	How to mount the main card (RF202)
	1) Install the card so that CON1 (reverse side of card) interlocks on the RF22 card. 2) After having installed the card, check that CON1 is securely in place. 3) Check that the 6 supports are firmly in place. 4) Attach the accessory connectors. 5) Check the settings when the card is replaced.
3	Mounting the add-on card (RF312/332)
	1) Align the connectors of the add-on card with the connectors (J1) on the RF202 card and mount. 2) Tighten up the 4 mounting screws. 3) Mount the accessory connectors.



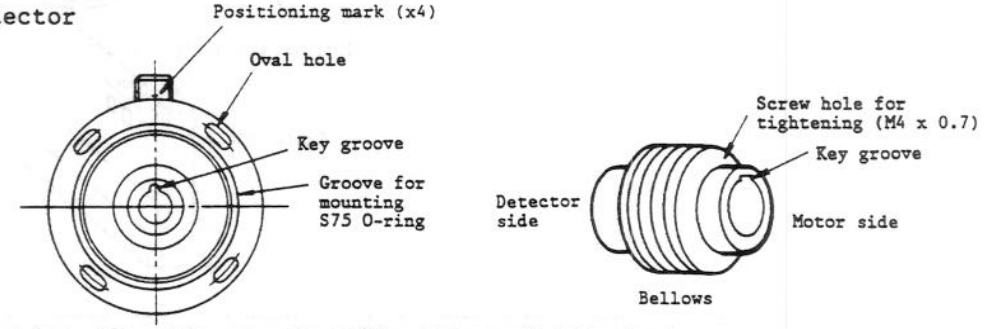
5.2 DETECTOR MOUNTING METHOD

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 mount the detector in the following sequence.

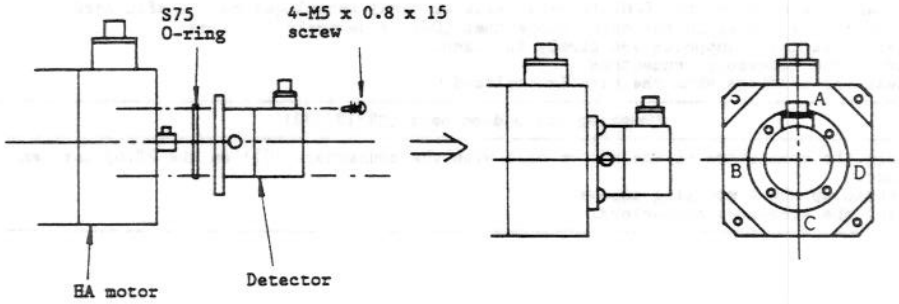
(1) Mounting surface of detector



(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.

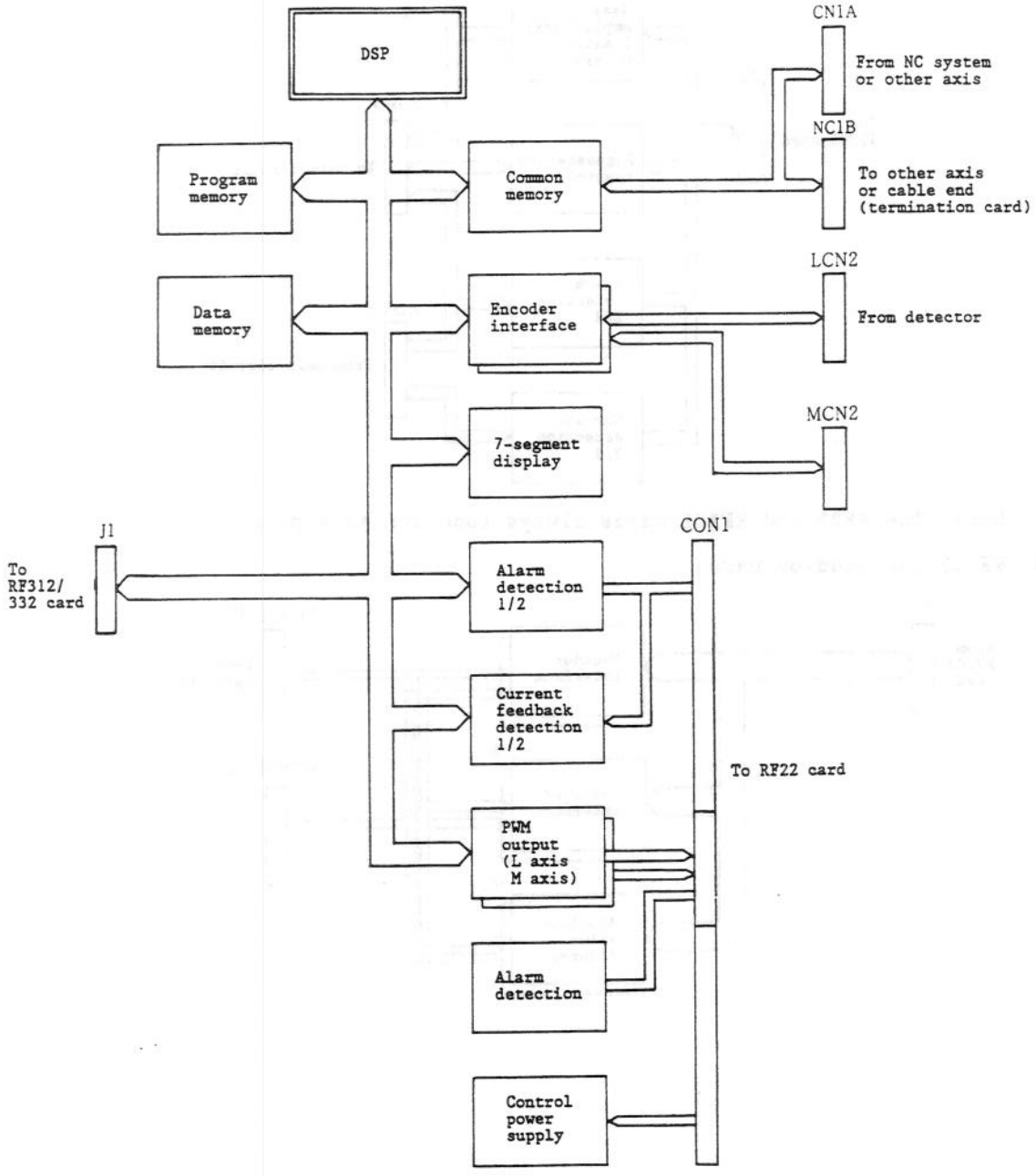
(4) Mounting procedure
1) Mount the O-ring (S75) onto the detector flange.
2) Mount the M4 hexagon socket head screws onto the coupling.
3) Align the motor shaft key with the key groove on the detector bellows and fit together.
4) Align the positioning marks on the detector with the mark-off line on 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.

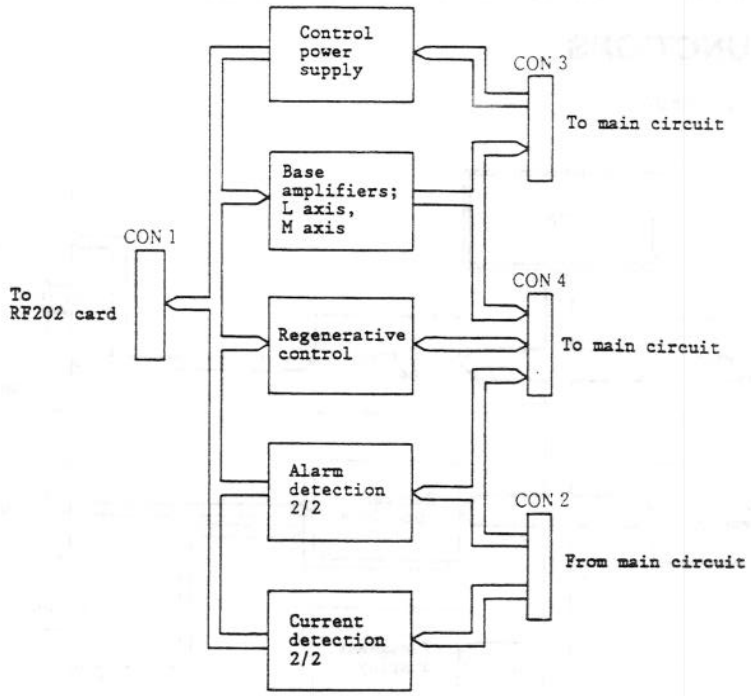
6. HARDWARE CHECK METHODS

6.1 CARD FUNCTIONS

(1) RF202 (main card)

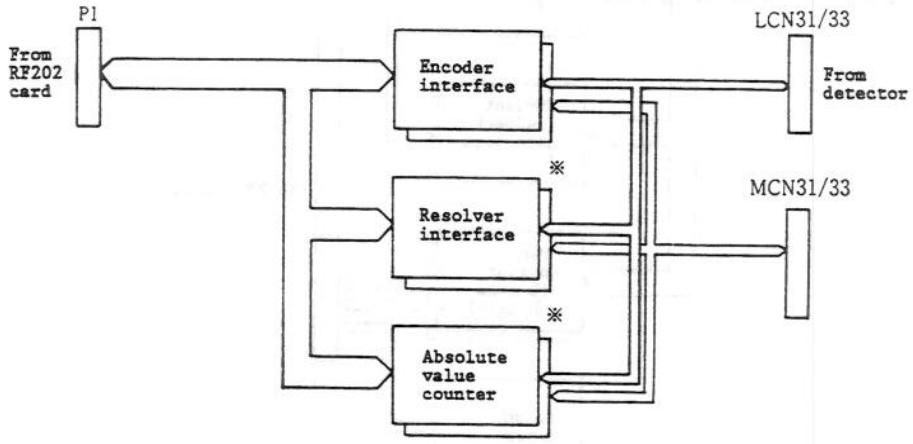


(2) RF22 (base amplifier card)



Note) The RF22 and RF202 cards always function as a pair.

(3) RF312/332 (add-on card)

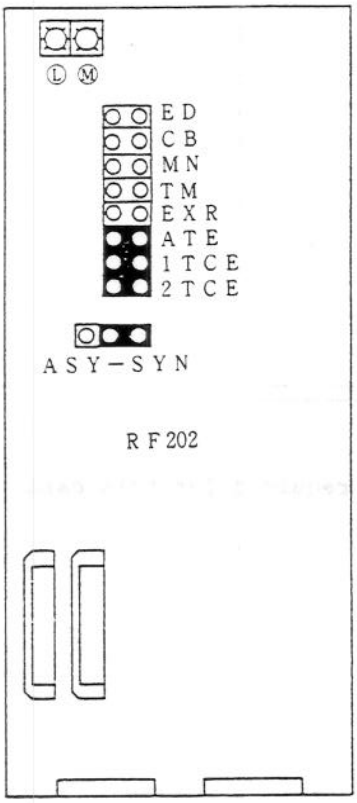


* Not provided on RF312 card

6.2 HARDWARE SETTINGS AND CHECK PINS

6.2.1 HARDWARE SETTINGS

RF202 setting outline



: ON setting

: OFF setting

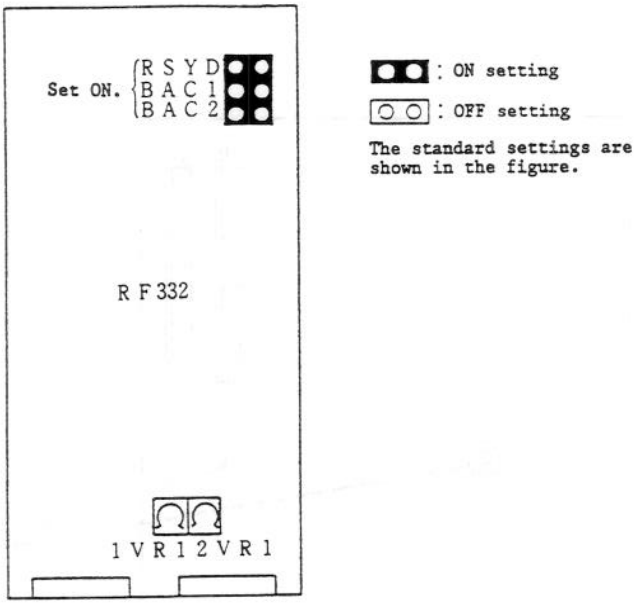
The standard settings are shown in the figure.

Name	Function	Setting		Standard	Stand alone
		ON	OFF		
ED	Emergency stop	Valid	Invalid	OFF	ON
CB	Contactor block	Valid	Invalid	OFF	OFF
MN	Monitor mode	Valid	Invalid	OFF	OFF
TM	Operation mode	Test mode	Normal mode	OFF	ON
EXR	IT sync selection	Not synchronized with MCP	Synchronized with MCP	OFF	ON
ATE				ON	ON
1TCE	Td compensation L axis	Valid	Invalid	ON	ON
2TCE	Td compensation L axis	Valid	Invalid	ON	ON
ASY-SYN	IT clock selection	SYN: MCP clock	ASY: Internal clock	SYN	ASY
L	Axis number selection for L axis	0-5: Axis selection number in normal mode F : When corresponding axis is not being used 6-E: Axis selection error		0-5, F	Setting by motor capacity
M	Axis number selection for M axis			0-5, F	

RF312 setting outline

No settings at all are required for this card.

RF322 setting outline



Name	Function	Setting		Standard	Remarks
		ON	OFF		
RSYD	Absolute value counter reset	Invalid	Valid	ON	Must be ON during use. (See Notes).
BAC1	Battery connection	Connected	Not connected	OFF	
BAC2	Battery connection	Connected	Not connected	OFF	
1VR1	Resolver phase adjustment for L axis				Do not touch the controls which were adjusted before the card was shipped from manufacturing plant.
2VR2	Resolver phase adjustment for M axis				

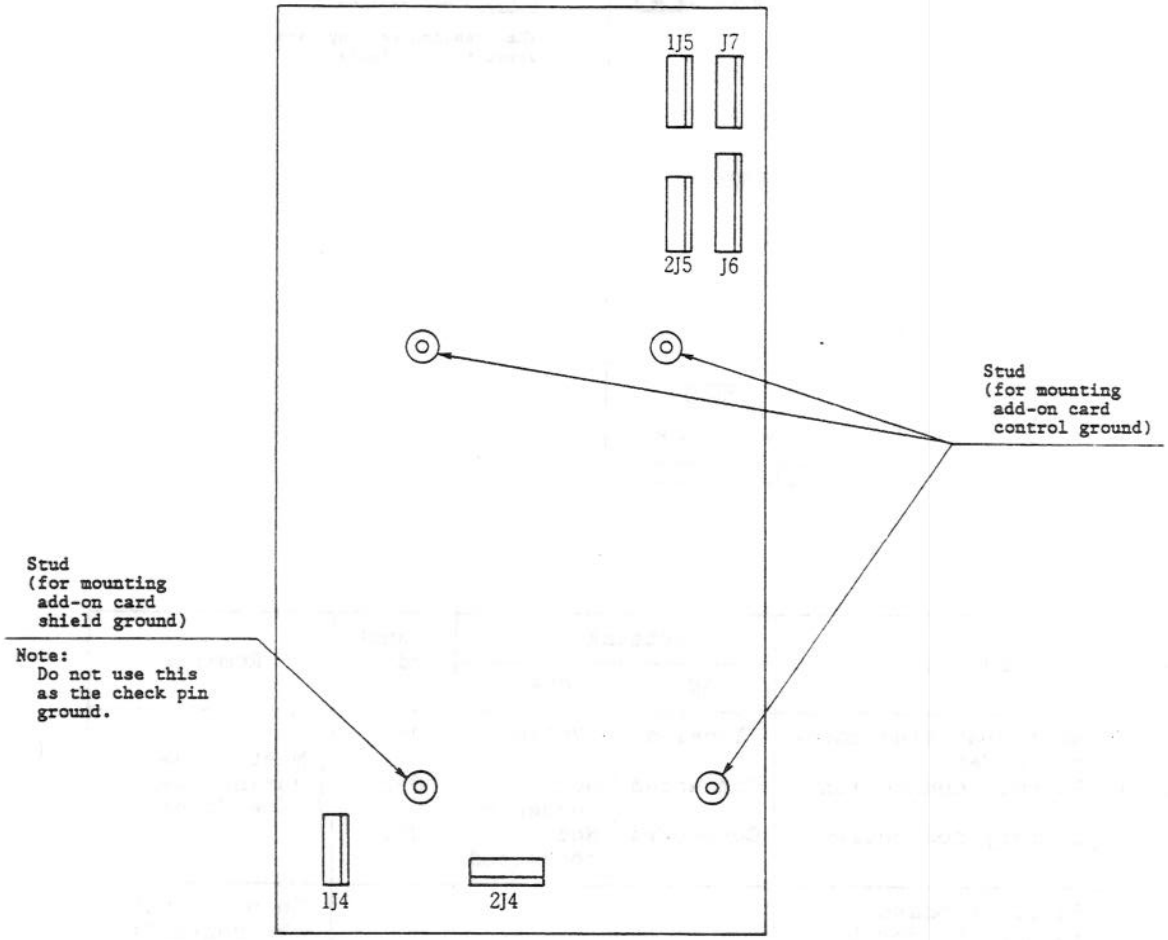
Observe the settings in the table even when the card is not being used.

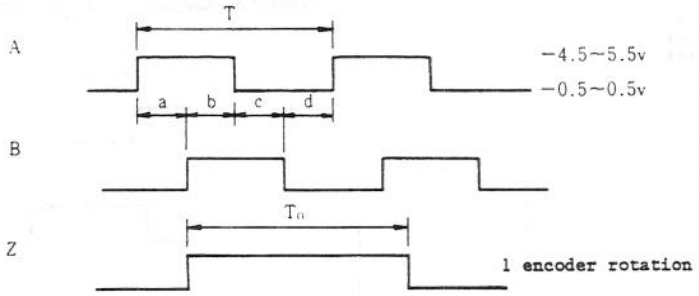
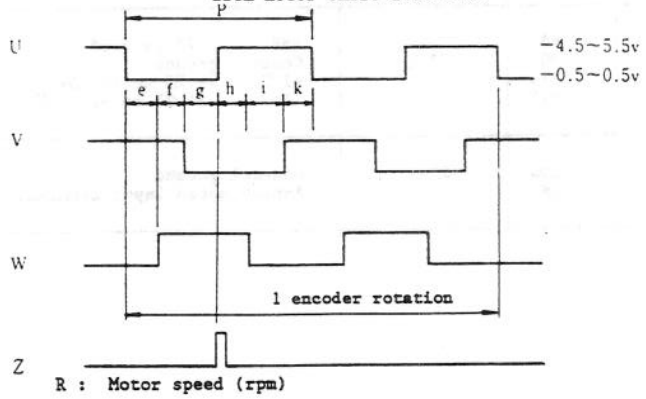
Note: When the card is shipped, BAC1 and BAC2 are OFF.
Set them ON before switching on the power.
It should be borne in mind that if these ON settings are not made, the absolute values will not be backed up by the batteries.

6.2.2 CHECK PINS AND WAVEFORMS

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

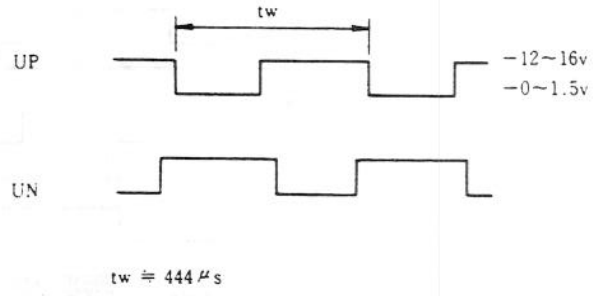
(1) RF202



Terminal name	Signal name	Ground terminal	Signal and waveform
nJ4-1 nJ4-2 nJ4-3 n=1,2 1=L axis 2=M axis	A B Z	Bottom right stud	Encoder phase A n = 1 (L axis encoder feedback signal) Encoder phase B n = 2 (M axis encoder feedback signal) Encoder phase Z Waveform examples: During counterclockwise rotation as seen from motor shaft load side  R : Motor speed (rpm) Encoder : OSE5K-6-8-108 (5000 p/r) $T = \frac{60}{R \times 5000}$ [sec] $a, b, c, d = \frac{1}{4}T \pm \frac{1}{12}T$ To = T to 3T
nJ4-4 nJ4-5 nJ4-6 n=1,2 1=L axis 2=M axis	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) $P = \frac{60}{R \times 2}$ $e \cdot f \cdot g \cdot h \cdot j \cdot k = \frac{1}{6}P \pm \frac{1}{900}P$

<table>
<tr><th>Terminal name</th><th>Signal name</th><th>Ground terminal</th><th>Signal and waveform</th></tr>
<tr><td>nJ5-1
nJ5-2
nJ5-3
nJ5-4
nJ5-5
nJ5-6

n=1,2
1=L axis
2=M axis</td><td>UP
UN
VP
VN
WP
WN</td><td>Bottom right stud</td><td>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

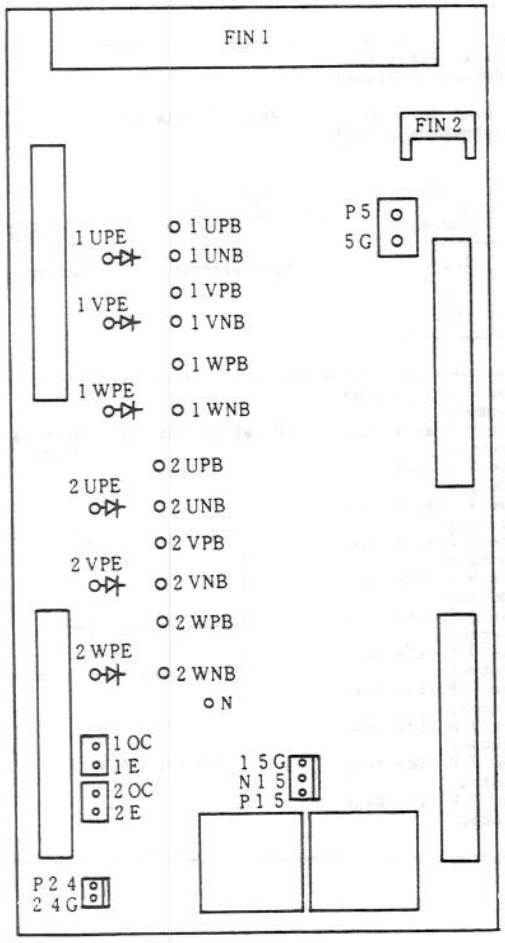
Waveform example: During servo ON stop
 

tw ≒ 444 μs</td></tr>
<tr><td>J6-1
J6-2
J6-3
J6-4
J6-5
J6-6
J6-7
J6-8</td><td>1U
1V
2U
2V
3U
3V
EXT
AG</td><td>J6-8</td><td>L axis motor phase U current
L axis motor phase V current
M axis motor phase U current
M axis motor phase V current
S axis motor phase U current
S axis motor phase V current
External analog input
Analog ground
 
Acceleration Deceleration

<table><tr><th>Motor</th><th>Current</th></tr><tr><td>HA23, 33</td><td>6.1 A/V</td></tr><tr><td>HA40, 43</td><td>12.7 A/V</td></tr><tr><td>HA80, 83</td><td>21.2 A/V</td></tr><tr><td>HA100</td><td>31.8 A/V</td></tr></table>
Waveforms differ according to load.
(Current values are given as the respective peaks.)</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 to 5.25 V
Control ground
+15V 14.25 to 15.75V
-15V -14.25 to -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>
</table>

Check pins and waveforms
Make sure that the emergency stop status is established when the synchroscope probe touches the check pins.

(2) RF22

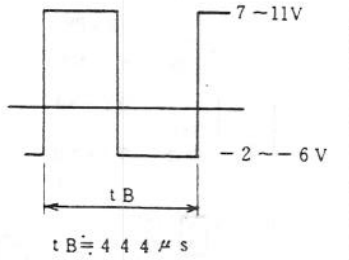


* FIN1 and FIN2 are connected to the control ground.

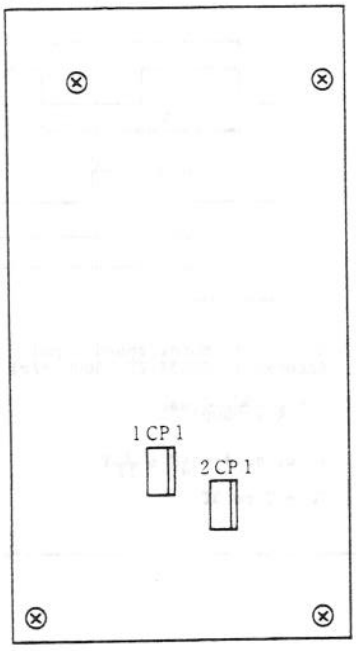
Terminal name	Signal name	Ground terminal	Signal and waveform
P5 5G	P5 5G	5G	+5V 4.75 to 5.25V Control ground
15G N15 P15	15G N15 P15	15G 15G	Control ground -15V -14.25 to -15.75V +15V 14.25 to 15.75V
P24 24G	P24 24G	24G	+24V 20 to 28V
1OC 1E	1OC 1E	1E	L axis OC level detection L axis OC detection ground
2OC 2E	2OC 2E	2E	M axis OC level detection M axis OC detection ground Waveform example: Acceleration Deceleration
1UPB	1UPB	1UPE	L axis phase U P side base amplifier output
1UNB	1UNB	N	L axis phase U M side base amplifier output
1VPB	1VPB	1VPE	L axis phase V P side base amplifier output
1VNB	1VNB	N	L axis phase V N side base amplifier output
1WPB	1WPB	1WPE	L axis phase W P side base amplifier output
1WNB	1WNB	N	L axis phase W N side base amplifier output
2UPB	2UPB	2UPE	M axis phase U P side base amplifier output
2UNB	2UNB	N	M axis phase U N side base amplifier output
2VPB	2VPB	2VPE	M axis phase V P side base amplifier output
2UNB	2VNB	N	M axis phase V N side base amplifier output
2WPB	2WPB	2WPE	M axis phase W P side base amplifier output
2WNB	2WNB	N	M axis phase W N side base amplifier output

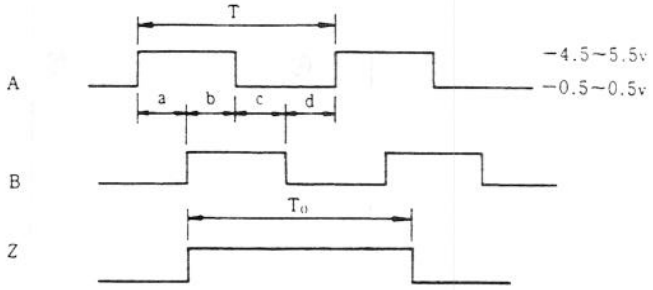
Motor	Bus current
HA23, 33	2.2 A/V
HA40, 43	4
HA80, 83	7.2
HA100	11.4

Waveform example: With servo ON stop

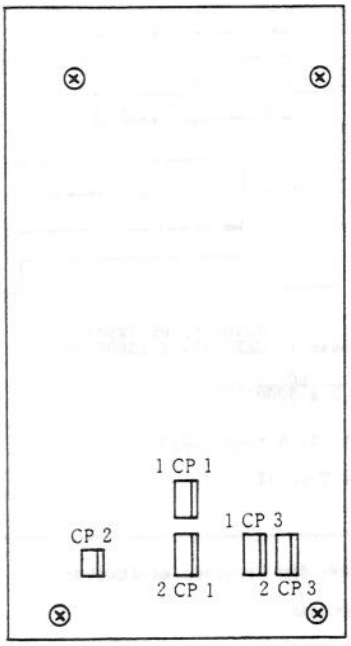


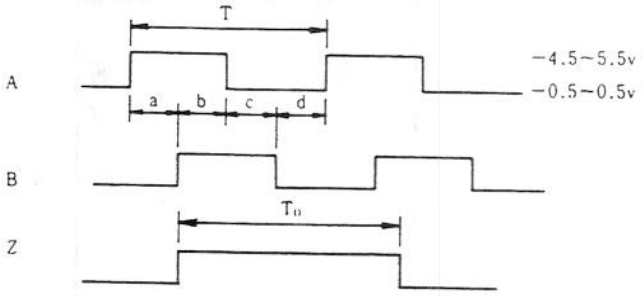
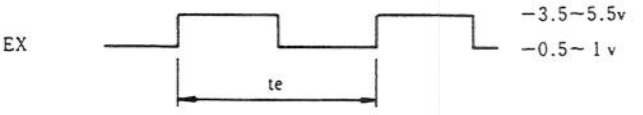
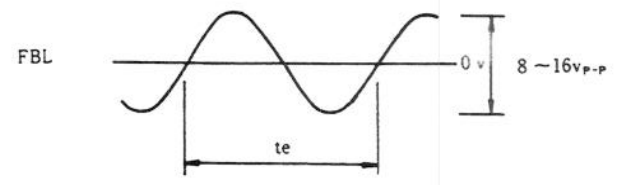
(3) RF312



Terminal name	Signal name	Ground terminal	Signal and waveform
nCP-1 nCP-2 nCP-3 n-1,2 1=L axis 2=M axis	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 : OSE5K-ET (5000 p/r) $T = \frac{60}{R \times 5000}$ [sec] a, b, c, d = $\frac{1}{4}T \pm \frac{1}{12}T$ To = T to 3T

(4) RF332



Terminal name	Signal name	Ground terminal	Signal and waveform
nCP1-1 nCP1-2 nCP1-3 n=1,2 1=L axis 2=M axis	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 (5000 p/r) $T = \frac{60}{R \times 5000}$[sec] a, b, c, d = $\frac{1}{4}T \pm \frac{1}{12}T$ To = T to 3T
CP2-1 CP2-2 n=1,2 1=L axis 2=M axis	EX 15G	CP2-2	Square wave for resolver excitation Control ground Waveform example: 
nCP3-1 n=1,2 1=L axis 2=M axis	FBL	CP3-3	Resolver FB level Waveform example:  te ≒ 222 μs
nCP3-2 nCP3-3 nCP3-4	P15 15G N15	CP3-3	+15V control power 14.25 to 15.75V Control ground -15V control power -14.25 to -15.75V

7. DETAILS OF SERVO PARAMETER

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.
The parameter contents are shown on the following pages.

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 to 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 to 30 (Note 1)
3	PGN		This sets the position loop gain in gradations of 0.25. Normally, setting is made to 33.00.	1 to 100 (rad/sec)
4	LGN		This is usually set to 0.	Hexadecimal setting
5	VG1		Sets the velocity loop gain. The standard setting is 150. When set higher (approx. 200 to 300), the response is enhanced but this is accompanied by increased vibration and noise. (Equivalent to VR9 in conventional amplifiers.)	1 to 500
6	VG2		This is set when using the VG1 variable function. Set the gain of the speed loop with a speed which is 1.2 times the rated motor speed. Normally, it is set to 0.	-32768 to 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 9990. (Equivalent to IND 1 or 2 in conventional amplifiers.)	9000 to 10000
8	VIA		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.)	163 to 16384 (0.085 rad/sec)

<table>
<tr><th></th><th colspan="2">Item</th><th>Description</th><th>Setting range (unit)</th></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 to 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 to 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 to 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 to 2560</td></tr>
<tr><td>13</td><td>ILP</td><td></td><td rowspan="2">This sets the current limit value. This is set by multiplying the value of α in the table below by the peak current (A) which is to be limited.
It cannot be set to a value higher than the maximum current value.
Current limit when ILP, ILN = ±1364
(in the same sequence as the signals)
<table><tr><th>Motor model</th><th>Max. current</th><th>α</th></tr><tr><td>HA23, 33</td><td>12A</td><td>166</td></tr><tr><td>40, 43</td><td>24</td><td>79</td></tr><tr><td>80, 83</td><td>40</td><td>47</td></tr><tr><td>100</td><td>60</td><td>32</td></tr></table></td><td>1 to 1364</td></tr>
<tr><td>14</td><td>ILN</td><td></td><td>-1 to -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 to 100 (%)</td></tr>
</table>

	Item		Description	Setting range (unit)
17	STY		This setting relates to the servo loop.	Hexadecimal setting

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
VDR	SMC			FBC	FBF			ABS	PDC		FCL	PD2	PD1	VD2	VD1

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 90° 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

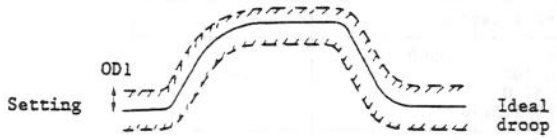
Connection destination card	PD2/VD2	PD1/VD1
Main card	0	0
Add-on card	0	1

Example) This sets one of the values in the table below according to the servo amplifier.

Servo amplifier	PD2	PD1	VD2	VD1	
E01	0	0	0	0	0
E31	0	1	0	0	4
Z33	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 to 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>OSE5K-6-8-108 5000 p/r
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>OAER25K-1X-3-8-108 25000 p/r</td><td>100</td></tr><tr><td>Linear scale
Inductosyn</td><td>$\frac{\text{PIT} \times 1\mu}{\text{Scale resolution}(\mu)}$</td></tr></table></td><td>1 to 4000</td></tr>
<tr><td>20</td><td>ORT</td><td></td><td>This sets the thermal time constant of the regenerative 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>The same value must be input for the axis parameters in the same amplifier.</td><td>51 to 18000 (100 ms)</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 to 18000 (100 ms)</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 to 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 to 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 0.5μ
In the above case, OD1 is set using the formula below.

$$\frac{15 \times 10^6}{60 \times 33 \times 0.5} \times 0.2 = 3030 \fallingdotseq 3100$$

Position loop gain 33
Interpolation unit 0.5μ
The OD1 settings for the above case based on the rapid traverse rate are shown in the table below.

Rapid traverse	Setting
1 m/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

<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 judgement value.
The servo parameter is not changed except during in-position.
Units of 100 are the normal guideline for setting.</td><td>0 to 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.
C 8 4 0
PEN | ENT | MTT
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>5000 p/r encoder
OSE5K-6-8-108,
OSE5K-ET-3-9.52-0</td><td>1</td></tr><tr><td>5000 p/r encoder + resolver 1X
OAER5K-1X-3-8-108,
OAER5K-1X-ET-3-9.52</td><td>9</td></tr><tr><td>Linear scale (inductosyn + A/D converter, optical scale magnescale)</td><td>4</td></tr><tr><td>When HA053/HA13 is used</td><td>6</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>HA053</td><td>8C</td></tr><tr><td>HA13</td><td>8D</td></tr><tr><td>HA23</td><td>8E</td></tr><tr><td>HA33</td><td>8F</td></tr><tr><td>40</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></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 OD1.
If 0 is set, excessive errors will not be detected.</td><td>0 to 32767
(interpolation unit)</td></tr>
</table>

	Item		Description	Setting range (unit)
27	SSF		This selects the special servo function.	Hexadecimal setting

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
VBS	ODU	ODI		CNG	PGR	DIR	IND		DPC				IDF	IDC	PID

PID : Velocity loop delay compensation (Normally set to 0)
- 0: No operation
- 1: Operation

IDC, IDF : Setting is made to the response improvement when the above PID setting is conducted for a closed loop.

	IDF	IDC	PID
Semi-closed standard	0	0	0
Closed loop standard	0	0	1
Closed loop response improvement	1	1	1

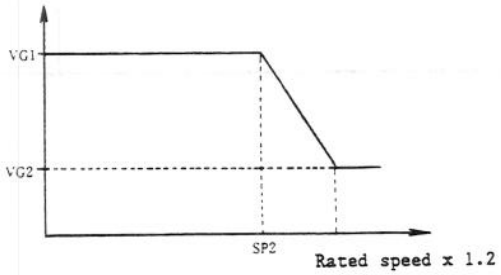
IND, DIR : Setting is made when the inductosyn and A/D converter are used.

	DIR	IND
Zero point return + direction when inductosyn + A/D converter are used	0	1
Zero point return - direction when inductosyn + A/D converter are used	1	1

PGR PC1, PC2 setting range expansion function (Available starting with B1 version)
- 0: Invalid
- 1: Valid (With position loop gain PGN as an integer, the values of PC1 and PC2 on page 12 can be set up to 4-fold. In this case, PGN can be changed only after the NC power has been switched on.) (Note 1)

CNG Compensation with closed loop stop (Available starting with B1 version)
- 0: Invalid
- 1: Valid (This compensates for microscopic jitter within 1 or 0.1 micron in the stop status when a 1 or 0.1 micron scale is used.)

ODI OD1, OD2 parameter regular change (Available starting with B1 version)
- 0: Invalid
- 1: Valid (This is used for special NC applications such as stopping the machine by holding it. When valid, OD1 and OD2 parameters can be changed even if the NC power is not set OFF.)

	Item		Description	Setting range (unit)
			ODU OD1, OD2 parameter x10 function (Available starting with B1 version) 0: Invalid 1: Valid (This is used when the value of OD1 and OD2 exceeds 32700. When valid, the value produced by multiplying the OD1 and OD2 setting by 10 falls under the actual excessive error range.) VBS Software blind zone compensation (Available starting with B1 version) 0: Invalid 1: Valid (The compensation amount is based on SP3. Normally, the RF202/203 card setting (□ TCE) is removed for use. When valid, bear in mind that PID, IDC and IDF cannot be used.	
29	SP2		This is set when the VG1 variable function is used. When it is not used, be sure to set it to 0. When it is used, the speed of the motor which starts to select the speed loop gain is set in 0.1 rpm units. (Available starting with B1 version)  	-32768 to 32767
30	SP3		This sets the amount of software blind zone compensation. It is valid when VBS (bit 15) of SSF has been set, and it is normally set as 30 when valid. Set it to 0 when it is not used. (Available starting with B1 version)	

	Item		Description	Setting range (unit)
31	SP4		Not used	0
32	SP5		Unbalanced torque compensation This is used when SMC (bit 14) of STY or PID (bit 0) of SSF has been set. Proceed to check the maximum setting if the current load is positive and the minimum value if it is negative after feeding in the + and - directions using manual pulses with about a dozen pulses at a time, while observing the current load (%) of the servo monitor on the I/F diagnosis screen. Set the average of the + and - direction values into SP5. Set a negative value by first setting it to an absolute value and then subtracting it from 65537. (Available starting with B0 version) Example: When the current load applying with feed is 50% in the + direction and -10% in the - direction 50-10/2 = 20 Therefore, 20 is set into SP5. When the current load applying with feed is -30% in the + direction and -10% in the - direction -30-10/2 = -20 This is a negative value. Therefore, 65537 - |-20| = 65517, and 65517 is set into SP5.	

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, which is obtained by reducing PIT and RNG, is substituted in the above formula.
   The value entered for RNG is the value applying before the reduction.
   Example: In a fully closed system with PIT = 10, RNG = 20, U = 0.5 and PGN = 33, the value of PIT' obtained by reducing PIT is equal to 1.
   (1) PC1 ≤ 2370/1 (1 x 20) ≒ 273
   (2) PC2 ≤ 32767/ (20 x 0.5) ≒ 3276
   (3) PC2 ≤ 8190/33 ≒ 248
   Therefore, PC1 < 273, PC2 < 248

3. The restrictions change when SSF bit A PGR is made valid.

   1) With a semi-closed system:
      (1) PC1 ≤ 10920/ (PIT x PNG)
      (2) PC2 ≤ 32767/ (RNG x U)

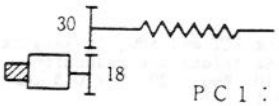
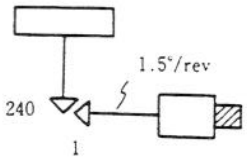
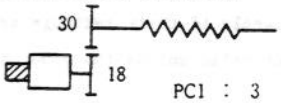
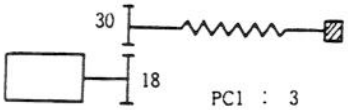
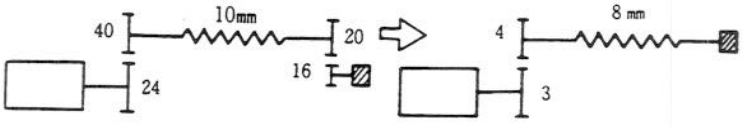
   2) With a closed system:
      (1) PC1 ≤ 10920/ (PIT x PNG)
      (2) PC2 ≤ 32760/PGN

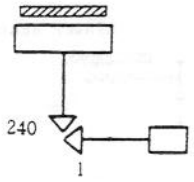
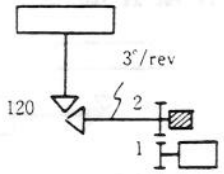
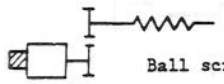
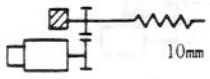
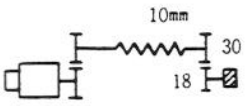
Note 2. Interpolation unit (U)
This is the NC internal unit. It is one of the values below, depending on the command unit (input unit).

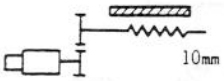
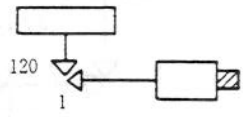
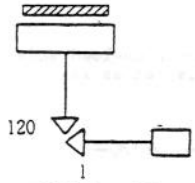
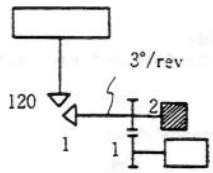
Command (input) unit	Interpolation unit(V)
10 μ/5 μ	5
1 μ/0.5 μ	0.5
0.1 μ/0.05 μ	0.05

Note 3. Parameters 3 through 16 are valid immediately if their settings are changed; the settings should be changed during emergency stop.
Parameters 1, 2 and 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 2	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 360°.  PC1 : 1 PC2 : 240 (PIT : 360) (2) When detector is on machine side (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.  PC1 : 3 PC2 : 5 Exception: With a special gear configuration  $\frac{24}{20}\times\frac{20}{16}=\frac{3}{4}$ PC1 : 3 PC2 : 4 PIT : 8

	Item	Description
	PC1, PC2 cont.	• With rotary 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. Example:  P I T : 10 Exception: With a special gear configuration  $10 \times \frac{18}{30} = 6$ 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					Z-33		
Velocity detector		OSE5K	OSE5K					OAER5K-1X	OSE5K	
Position detector			OSE5K-ET (ball screw end)	Linear scale (1μ)	Inductosyn A/C converter 1/2000	Rotary inductosyn 360P A/D converter 1/2000	Linear scale (0.1μ)		OAER5K-1X-ET	
Servo parameter	17. STY	xx00	xx14 xx54	xx14 xx54	xx14 xx54	xx14 xx54	xx14 xx54	xx85	xx94 xxD4	
	19. RNG	20	20	PIT	PIT	360	PIT x 10	20	20	
	25. MTY	11xx	11xx	41xx	41xx	41xx	41xx	99xx	91xx	
	27. SSF	0000	0000	0000	0100(+) 0300(-)	0100(+) 0300(-)	0000	0000	0000	
	Others					PIT = 360 Example with 1/90 gear ratio PC1 = 1 PC2 = 90	OD1 OD2 x 10 ZR2			
Zero point return parameter	4. graspc	20, 10, 5, 4, 2, 1	20, 10, 5, 4, 2, 1	Note)	2, 1	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.

Standard parameter setting list by MR-S2 motor

Motor / Parameter		HA053	HA13	HA23	HA32	HA40	HA43	HA80	HA83	HA100	Remarks
1	PC1										
2	PC2										
3	PGN	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	
4	LGN	0	0	0	0	0	0	0	0	0	
5	VG1	70	70	100	100	150	150	150	150	150	
6	VG2	0	0	0	0	0	0	0	0	0	
7	VIL	10000	10000	10000	10000	10000	10000	10000	10000	10000	
8	VIA	682	682	682	682	682	682	682	682	682	
9	IQA	1024	1024	2048	2048	2048	1024	2048	1024	1024	
10	IDA	1024	1024	2048	2048	2048	2048	2048	2048	2048	
11	IQG	256	256	224	224	512	256	512	256	256	
12	IDG	256	256	224	224	512	512	512	512	512	
13	ILP	1230	1230	1230	1230	1230	1230	1230	1230	1230	
14	ILN	-1230	-1230	-1230	-1230	-1230	-1230	-1230	-1230	-1230	
15	FFC	0	0	0	0	0	0	0	0	0	
16	TGN	0	0	0	0	0	0	0	0	0	
17	STY										
18	PIT										
19	RNG										
20	ORT	4680	4680	4680	4680	4680	4680	4680	4680	4680	Set 3010 when the optional regenerative resistance is used.
21	OLT	600	600	600	600	600	600	600	600	600	
22	OLL	150	150	150	150	150	150	150	150	150	
23	OD1										
24	ZRZ	100	100	100	100	100	100	100	100	100	
25	MTY	XX8C	XX8D	XX8E	XX8F	XX00	XX80	XX01	XX81	XX02	
26	OD2										
27	SSF	0	0	0	0	0	0	0	0	0	
28	SP1	0	0	0	0	0	0	0	0	0	
29	SP2	0	0	0	0	0	0	0	0	0	
30	SP3	0	0	0	0	0	0	0	0	0	
31	SP4	0	0	0	0	0	0	0	0	0	
32	SP5	0	0	0	0	0	0	0	0	0	

* The machine specifications should be referred to for the settings in the blank columns.
(Indicated by "$" in the remarks column.)
It should be borne in mind that mistakes can easily be made for the settings in the "XX" areas.

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	abson	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		133D

ii) Ball screw end detection

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

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

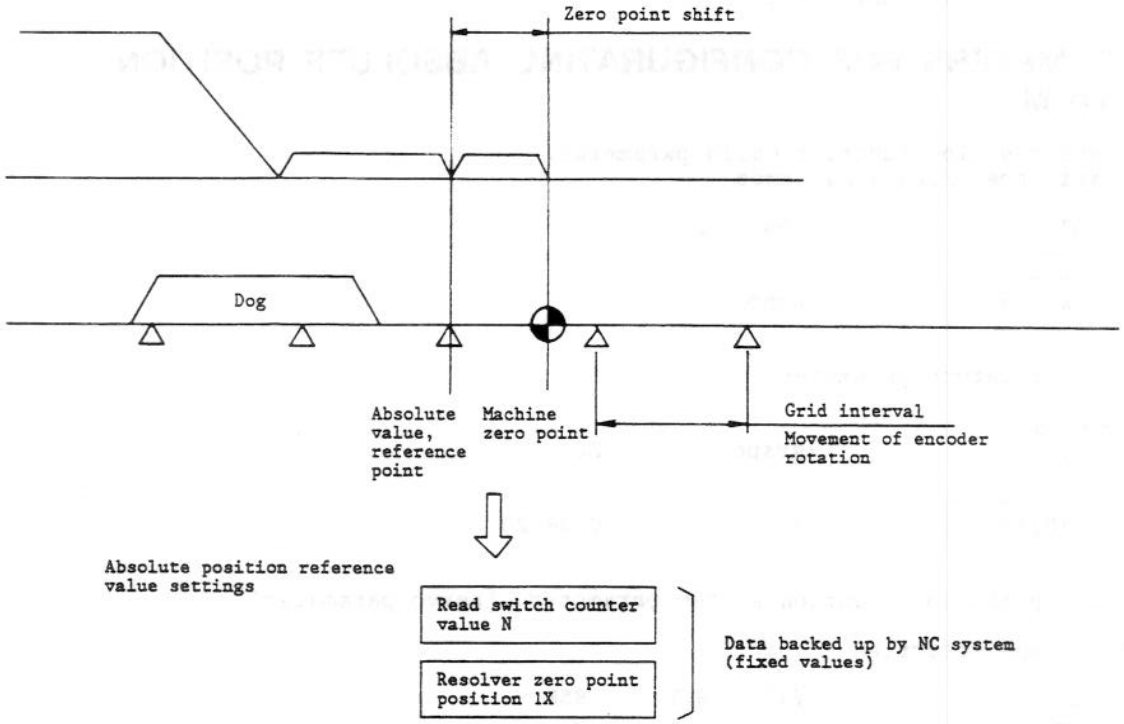
i) Motor end detection

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

ii) Ball screw end detection

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

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
i) Addressing The address are set on the I/F diagnosis screen.

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

ii) Data The absolute value data below appears on the I/F diagnosis screen.

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 L/M/S axis	Address L L/M/S axis	Data H/L
Present reed switch value ni	8E/8F/8F	CB/4B/CB	Data 3,4
Present resolver value 1Xi	8E/8F/8F	95/15/95	Data 3,4
Cyclic counter value	8E/8F/8F	C0/40/C0	Data 3,4

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 The absolute value data below appears on the diagnosis screen
181F00 (address L)
F01 (address H)
2nd axis
181F10 (address L)
F11 (address H)
2) Data

1st axis

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

2nd axis

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

(3) Servo window addresses

	Address H L/M/S axis	Address L L/M/S axis	Data L/H
Present reed switch value ni	8E/8F/8F	CB/4B/CB	Data 1,2
Present resolver value 1 Xi	8E/8F/8F	95/15/95	Data 1,2
Cyclic counter value	8E/8F/8F	C0/40/C0	Data 1,2

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
9

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

2nd axis 9988
9

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

(3) Servo window addresses

	Address H L/M/S axis	Address L L/M/S axis	Data L/H
Present reed switch value ni	8E/8F/8F	CB/4B/CB	Data 1,2
Present resolver value 1Xi	8E/8F/8F	95/15/95	Data 1,2
Cyclic counter value	8E/8F/8F	C0/40/C0	Data 1,2

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

(1) The amplifier addresses are set in the window address (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	980C	9E0C
	Window address	9688	9988	9C88	9F88
Address for monitoring 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 RF332/RF333 card. Replace or recharge battery. Absolute position data may be lost.
E5	WAB	Absolute position detection error warning	Incorrect encoder/resolver error of reference 1 x value backed up by NC system. 20° < 1 x < 340° or 365° < x 1 or |ERE|> 50. Absolute position data may be lost.

II. MAINTENANCE MANUAL FOR MELDAS MR-S3 SERIES OF AC SERVO AMPLIFIERS

(3-axis integrated AC servo amplifiers)

1. OUTLINE OF S3 SERIES AC SERVO SYSTEM

1.1 FEATURES OF THE S3 SERIES SERVO SYSTEM

(1) The MELDAS MR-S3 series is a line-up of 3-axis integrated AC servo amplifiers.
It includes a total of 4 models which enable combinations of motors with varying capacities (1.0 kW to 2.0 kW) and which make it possible to configure systems with compact dimensions.

(2) This system can be connected to the NC of the MELDAS M300 series.

(3) 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.

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

(5) 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.

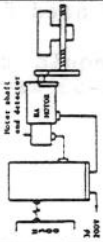
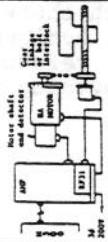
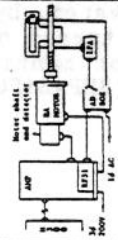
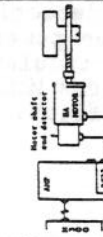
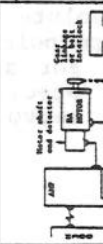
(6) Compact converter and reduction of number of cables.
Compactness has been achieved by placing the converter (rectifier unit and condenser unit), used in the AC input circuit, in the amplifier container, while reducing the number of cables required.

(7) 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.

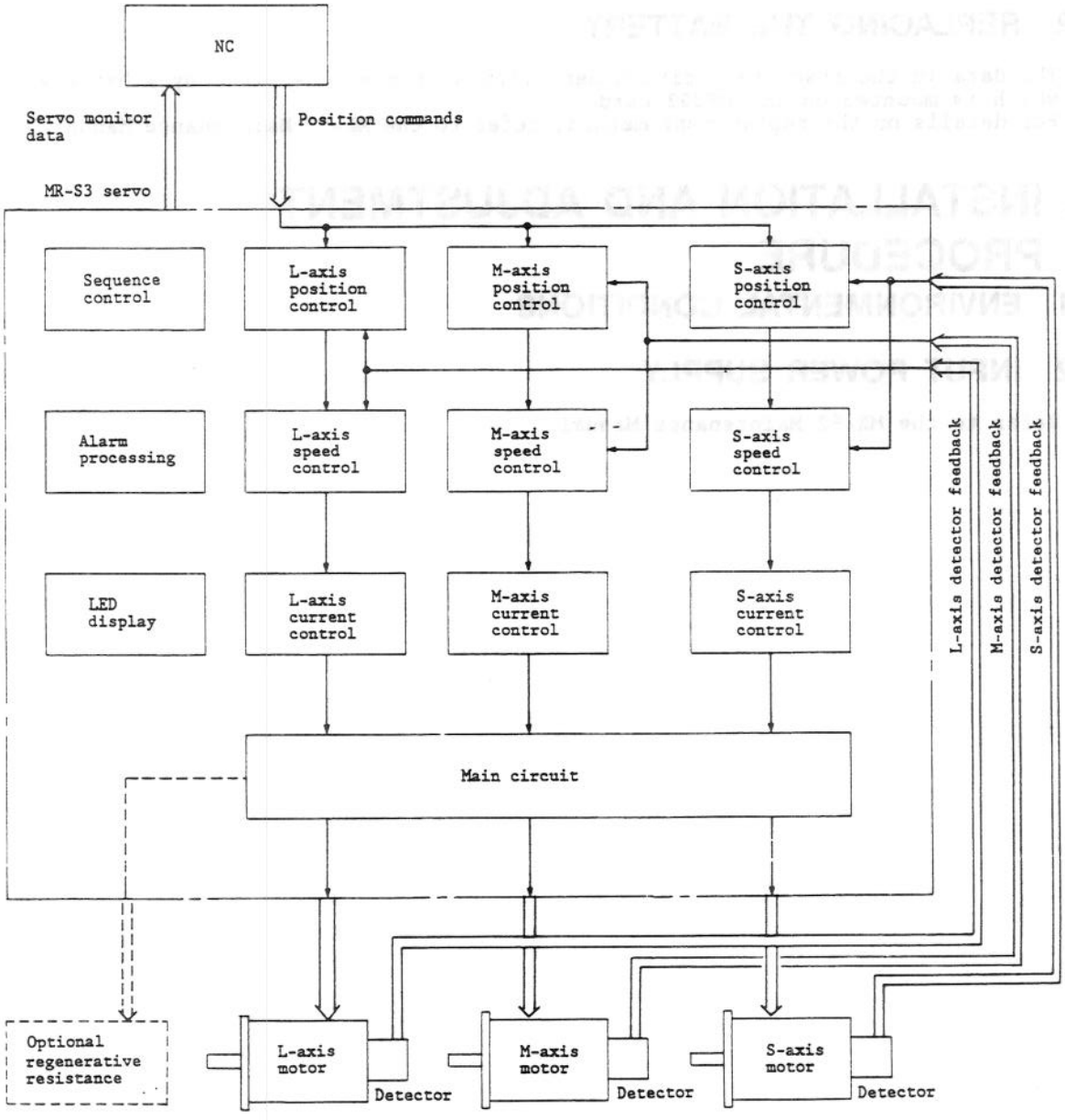
(8) System's intelligence has been enhanced.
The servo side and the host (NC) is linked by a data path, thus, the reception of control parameters and transfer of self-diagnostics are possible.
The system is designed to be amenable to auto-tuning in the future; it will be able to adapt to control requirements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

(9) 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.
Note: For any particulars not mentioned, reference should be to the Specifications Manual (BNP-B3501) covering the MR-S3 series of AC servo amplifiers.

1.2 LIST OF S3 SERIES SERVO SYSTEMS

System		Command	System structural drawing	System performance	Unit format: Servo amplifier model	Unit format: Option card	Unit model: Motor shaft end detector	Unit model: Machine end /ball screw end detector	Cable name: Amplifier-motor shaft end detector cable	Cable name: Amplifier - ball screw end detector - machine end detector cable	Remarks
Incremental detection	Semi-closed loop	1 micron		Standard type • Maximum follow-up performance: 1 Mpps • Minimum resolution : 0.018 o/p (Motor shaft end) • Maximum speed : 3000 rpms The maximum speed depends on the motor being used.	MR-S3-□-E01	-	OSE5K-6-12-108 (OSE5K)	-	CN2KO ↑ Axis number L < 7.5m- N541C583 L > 7.5m- N541C582	-	
Closed loop	Ball screw end detection	1 micron		Special specification • Maximum follow-up performance: 1 Mpps (Ball screw end) • Minimum resolution : 0.018 o/p (Ball screw end) • Maximum speed : 3000 rpm (Ball screw end) The maximum speed depends on the motor being used.	MR-S3-□-E31	RF-313	OSE5K-6-12-108 (OSE5K)	OSE5KN-ET□-3-9.52-0 ↑ Connector direction	CN2KO	CN31NRO	
	Scale F/B	1 micron		Special specification • Maximum follow-up performance: 1 Mpps • Minimum resolution : 1μm or 0.5μm • Maximum speed : 3000 rpm System performance depends on the motor and scale being used.	MR-S3-□-E31	RF-313	OSE5K-6-12-108 (OSE5K)	Various scales of pulse F/B outputs of 1 μ and 0.5 μ specification can be connected.	CN2KO	CN31MO	
Absolute position detection	Semi-closed loop	1 micron		Optional specification • Maximum follow-up performance: 1 Mpps • Minimum resolution : 0.018 o/p (Motor shaft end) • Maximum speed : 3000 rpm The maximum speed depends on the motor being used.	MR-S3-□-Z33	RF-333	OAER5K-1X-3-8-108 (OAER5K-1X)	-	CN33KO	-	
Closed loop	Ball screw end detection	1 micron		Optional specification • Maximum follow-up performance: 1 Mpps (Ball screw end) • Minimum resolution : 0.018 o/p (Ball screw end) • Maximum speed : 3000 rpm (Ball screw end) The maximum speed depends on the motor being used.	MR-S3-□-Z33	RF-333	OSE5K-6-12-108 (OSE5K)	OAER5K-1X-ET□-3-9.52-0 ↑ Connector direction	CN2KO	CN33RO	

1.3 BLOCK DIAGRAM OF MR-S3 SERVO SYSTEM FUNCTIONS



2. REGULAR MAINTENANCE

2.1 INSTRUMENTS AND TOOLS USED FOR MAINTENANCE

Refer to the MR-S2 Maintenance Manual.

2.2 REPLACING THE BATTERY

The data in the absolute position detection system are retained by a battery which is mounted on the RF333 card.
For details on the replacement method, refer to the MR-S2 Maintenance Manual.

3. INSTALLATION AND ADJUSTMENT PROCEDURE

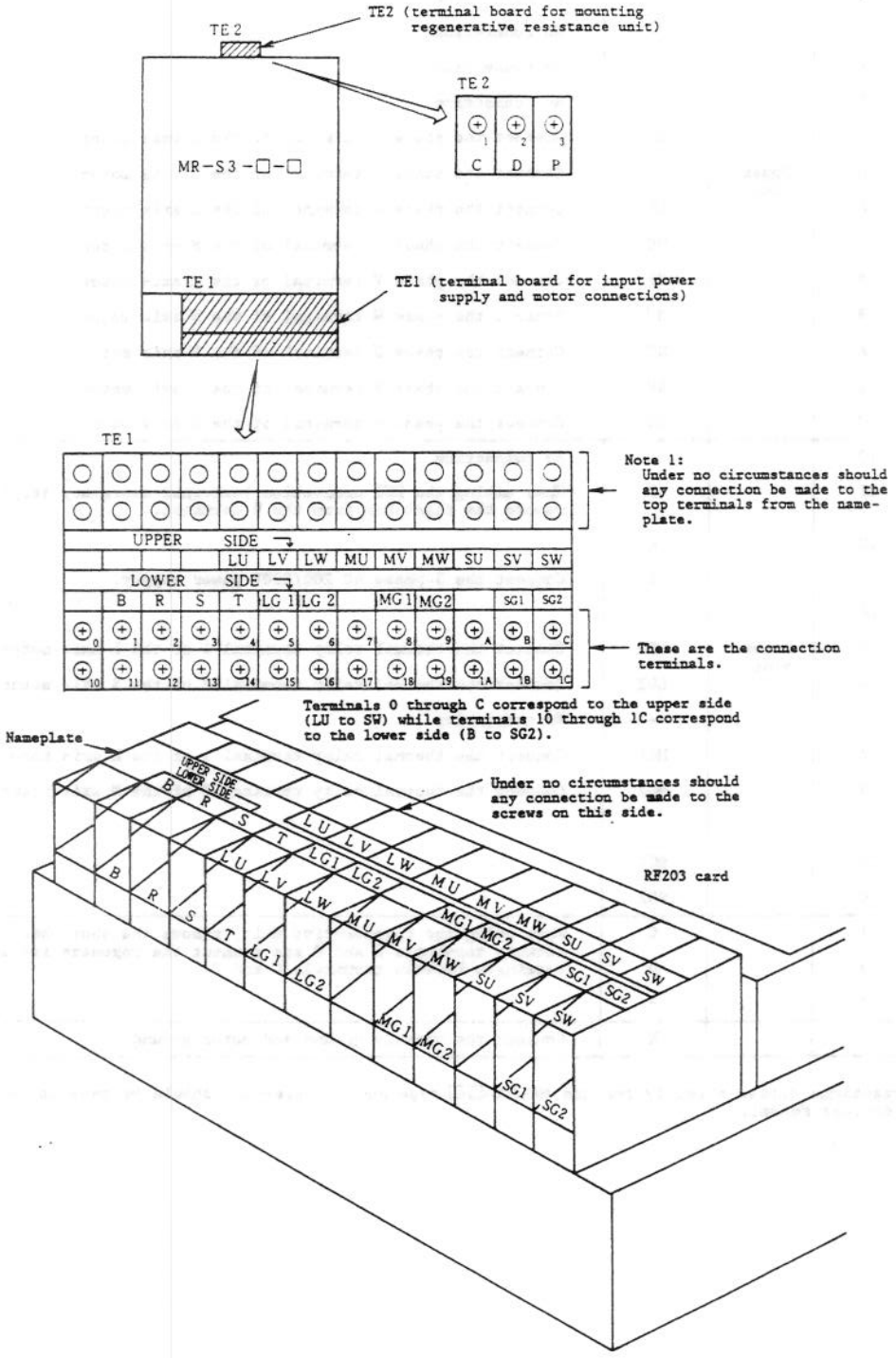
3.1 ENVIRONMENTAL CONDITIONS

3.2 INPUT POWER SUPPLY

Refer to the MR-S2 Maintenance Manual.

3.3 MAIN CIRCUIT WIRING

3.3.1 EXTERNALLY CONNECTED TERMINALS (MR-S2- □ - □ TYPE)

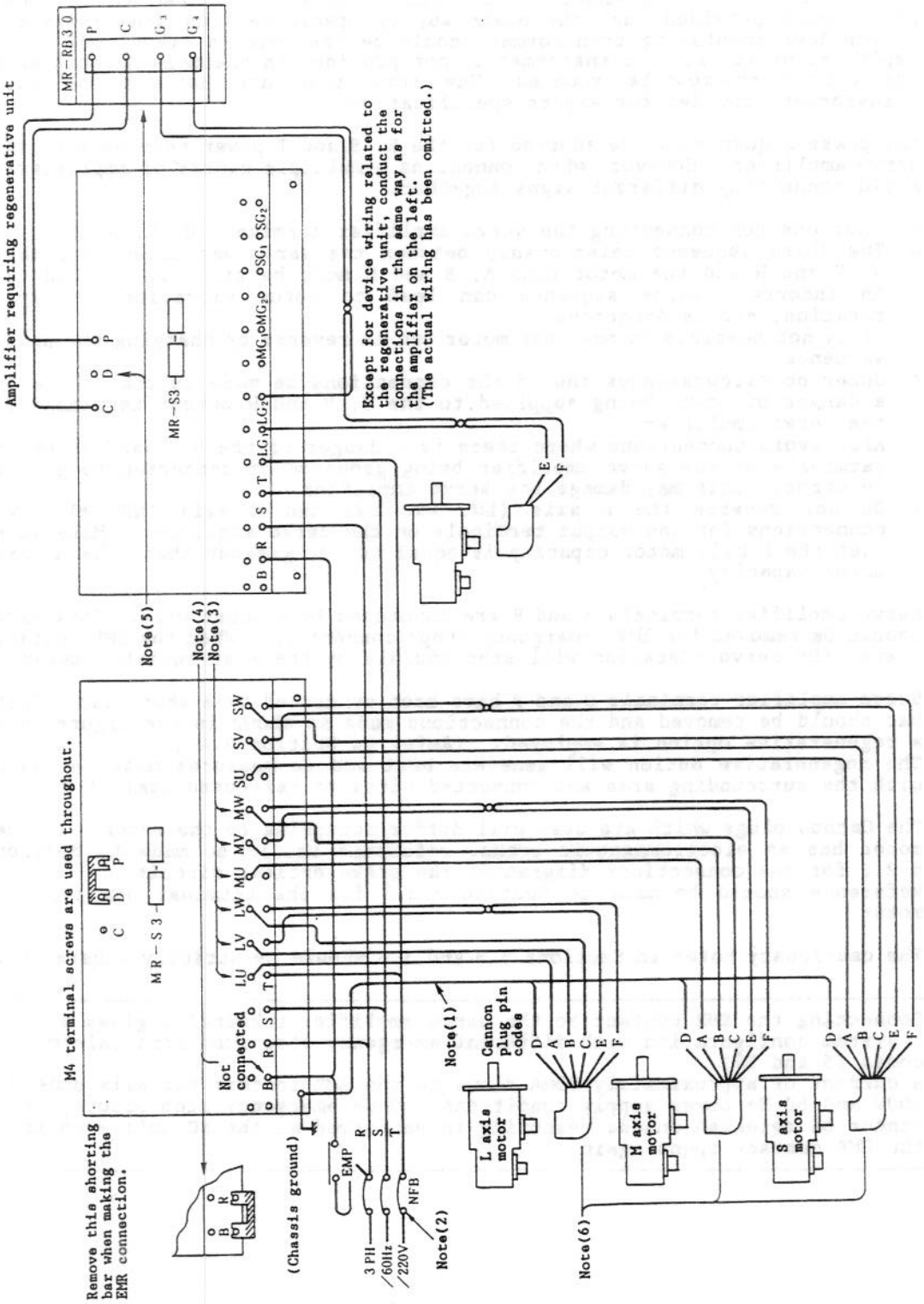


3.3.2 TERMINAL BOARD CONNECTIONS

Terminal board	Terminal board No.	Terminal position	Terminal name	Details of connection
TE1	0	Upper side	-	No connection
	1		-	No connection
	2		-	No connection
	3		-	No connection
	4		LU	Connect the phase U terminal of the L axis motor.
	5		LV	Connect the phase V terminal of the L axis motor.
	6		LW	Connect the phase W terminal of the L axis motor.
	7		MU	Connect the phase U terminal of the M axis motor.
	8		MV	Connect the phase V terminal of the M axis motor.
	9		MW	Connect the phase W terminal of the M axis motor.
	A		SU	Connect the phase U terminal of the S axis motor.
	B		SV	Connect the phase V terminal of the S axis motor.
	C		SW	Connect the phase W terminal of the S axis motor.
	10	Lower side	-	No connection
	11		B	When making the EMR connection (external emergency stop), remove the short bar from the R terminal.
	12		R	
	13		S	Connect the 3-phase AC 200/220V power supply.
	14		T	
	15		LG1	Connect the thermal relay terminal 1 of the L axis motor.
	16		LG2	Connect the thermal relay terminal 2 of the S axis motor.
	17		-	No connection
	18		MG1	Connect the thermal relay terminal 1 of the M axis motor.
	19		MG2	Connect the thermal relay terminal 2 of the M axis motor.
	1A		-	
	1B		SG1	
	1C		SG2	
TE2	1		C	When using the regenerative unit, remove the short bar between terminals D and P and connect the regenerative unit terminals between terminals C and P.
	2		D	
	3		P	
			E	Connect the chassis ground and motor ground.

Note: The connections differ slightly for the MR-S2S-□-□ type and so reference should be made to the MR-S2 Specifications Manual.

3.3.3 CONNECTION 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) Any phase sequence may be adopted for the R, S and T power terminals on the servo amplifier. However, when connecting a multiple number of amplifiers, avoid connecting different signs together.

(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.
   c. Do not reverse the L axis (LU, LV, LW) and M axis (MU, MV, MW) connections for the output terminals on the servo amplifier. Make sure that the L axis motor capacity is equal to, or greater than, the M axis motor capacity.

(4) Servo amplifier terminals B and R are connected by a short 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 P have been connected by a short bar. This bar should be removed and the connections made as shown in the figure when a regenerative option is employed. (Refer to Section 3.4.)
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 3.3.7 for the terminal box type of motor.

(7) The cautionary notes in Sections 3.5 and 3.6 should be strictly adhered to.

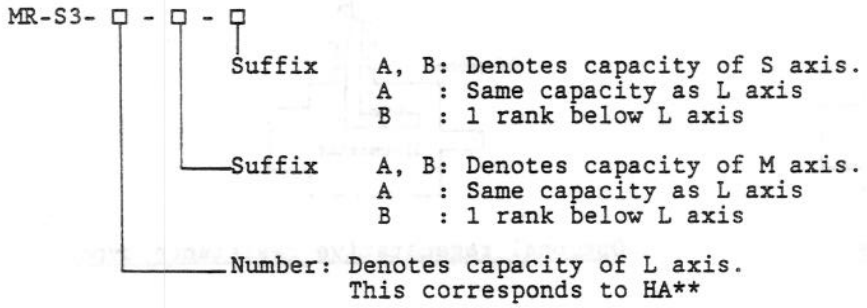
Connecting the EMR contact to the servo amplifier terminal B gives a 2-system configuration with different emergency stop functions (alarm codes 55 and E7).
A current of approximately 30mA flows to the EMR contact per axis under 200V and 60 Hz power supply conditions. Once emergency stop occurs, it cannot be released unless resetting is performed at the NC unit even if the EMR contact opens again.

3.3.4 CONNECTED MOTORS

The MR-S3 series breaks down by capacity into 4 types, and it should be borne in mind that there are restrictions on each L axis and M axis governing on the motors which can be used.

Amplifier model name	L axis drive motor	M axis drive motor	S axis drive motor
MR-S3-33AA- □	HA33/23	HA33/23	HA33/23
MR-S3-40AA- □	HA40/43	HA40/43	HA40/43
MR-S2-80AA- □	HA80/83	HA80/83	HA80/83
MR-S2-100BB- □	HA100	HA80/83	HA80/83
MR-S2-100AB- □	HA100	HA100	HA80/83
MR-S2-100AA- □	HA100	HA100	HA100

(1) The L axis motor must not have a smaller capacity than the M axis motor. Also, the M axis motor must not have a smaller capacity than the S axis motor.
For instance, the MR-S3-100AB- □ is an amplifier which corresponds to the HA100 motor for the L axis and since its suffix letter is "A", it means that it corresponds to HA100 as for the L axis. The next suffix letter is "B" and so it corresponds to the HA80 which is one rank below from the L axis.



(2) If the HA80 motor is mistakenly connected to the L axis and the HA100 motor is connected to the S axis when using the MR-S3-100AB- □, there is a danger that the HA80 mounted on the L axis will demagnetize when the motors are driven. A thorough check should be undertaken to prevent this from happening.

(3) LCN2 (semi-closed) is the feedback connector on the L axis motor, for the M axis motor, it is MCN2 (semi-closed); and for the S axis motor it is SCN2.

3.3.5 CANNON PLUGS USED

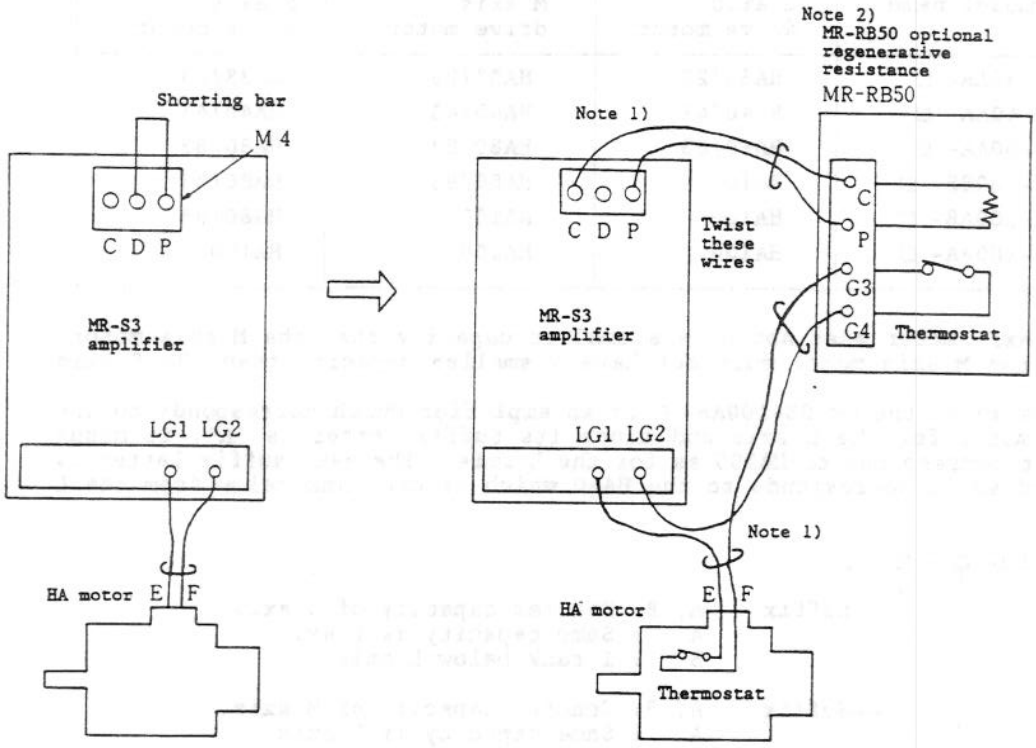
3.3.6 CABLES USED

3.3.7 TERMINAL BOX MOTORS

For details, refer to the MR-S2 Maintenance Manual.

3.4 OPTIONAL REGENERATIVE RESISTANCE CONNECTIONS

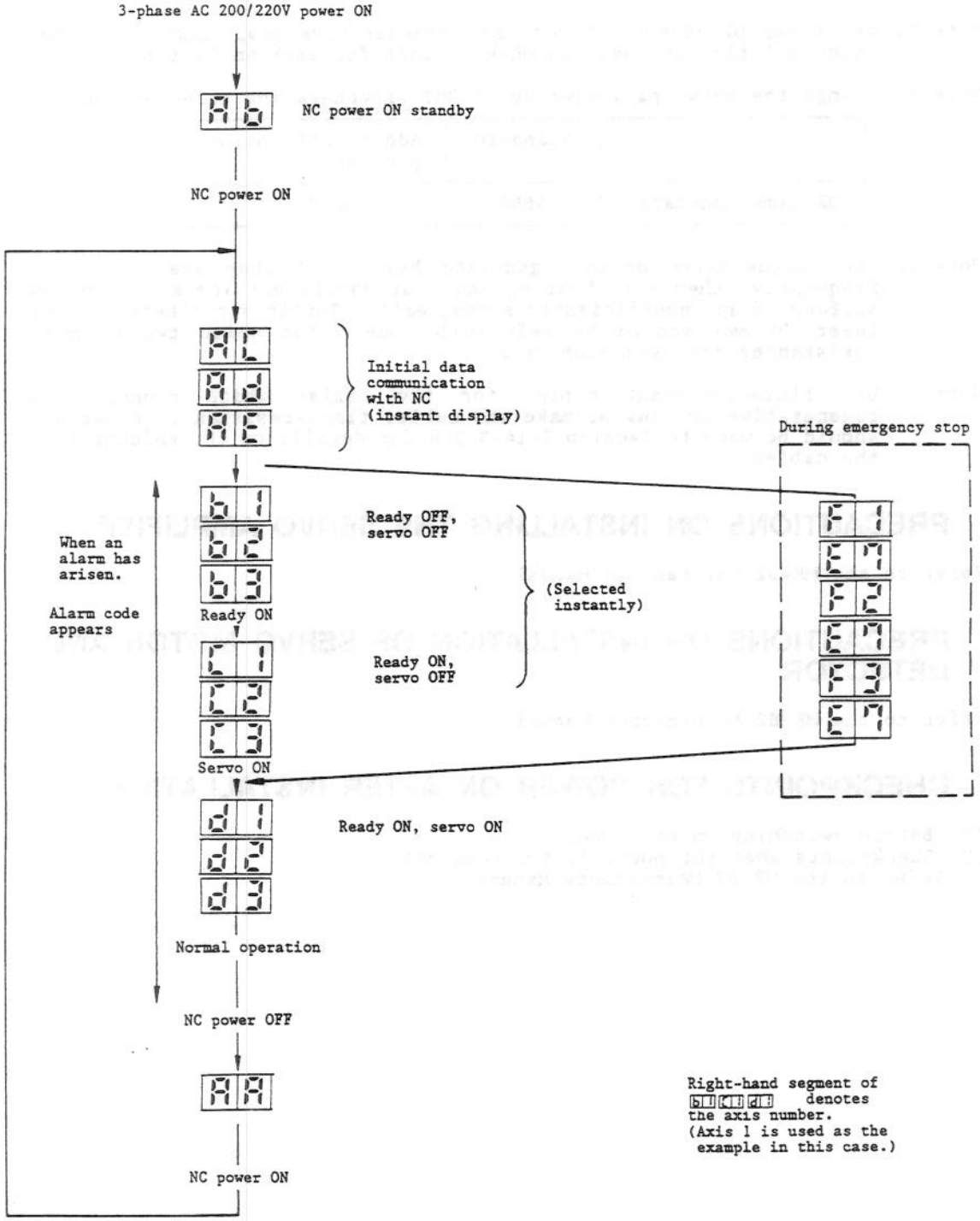
(1) When using the MR-RB50 optional regenerative resistance.



Standard type

Optional regenerative resistance type

(2) Checkpoints after switching on the power
The normal 7-segment display appears after the power has been switched on. (This is located on the RF203 card.)



Note 1. With the standard type of amplifier, remove the short bar connected to the D and P terminals, and connect the optional regenerative resistance to the C and P terminals. When the MR-RB30 is used, connect the motor and the thermostat of the regenerative unit in series.

Note 2. Use three GZG200W390HMK optional regenerative resistance units for each amplifier and use one MR-RB30 unit for each amplifier.

Note 3. Change the servo parameter No.20 ORT (regenerative time constant).

	Standard	Additional option present
OR time constant	4680	3010

Note 4. The regenerative options generate heat. If they are used very frequently, they will heat up and thus should not installed on the surface of an insufficiently strong wall. Sufficient clearances (at least 70 mm) should be left with models for which two or more resistances are used side by side.

Note 5. Use flame-resistant cables for the cables which connect the regenerative options or make the cables flame-resistant. Reference should be made to Section I-14-3-3-6 for details on the thickness of the cables.

3.5 PRECAUTIONS ON INSTALLING THE SERVO AMPLIFIER

Refer to the MR-S2 Maintenance Manual.

3.6 PRECAUTIONS ON INSTALLATION OF SERVO MOTOR AND DETECTOR

Refer to the MR-S2 Maintenance Manual.

3.7 CHECKPOINTS FOR POWER ON AFTER INSTALLATION

(1) Before switching on the power
(2) Checkpoints when the power is switched off
Refer to the MR-S2 Maintenance Manual.

4. TROUBLESHOOTING

4.1 7-SEGMENT DISPLAY

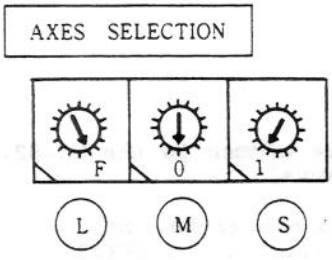
The status of the amplifier is indicated on the 7-segment display in the center of the amplifier.
The alarm code appears when an alarm has arisen.

MR-S amplifier status displays

Display	Status	Description
AA	INITIALIZE	NC power ON standby (when NC power is turned from ON to OFF)
Ab	INITIALIZE	NC power ON standby (when NC power is turned from OFF to ON and when NC power is OFF)
AC	INITIALIZE	Requesting to send parameters
Ad	INITIALIZE	Requesting to convert parameters
AE	INITIALIZE	Standing by for main servo IT start
b#	READY OFF	Ready off
C#	SERVO OFF	Servo off
d#	SERVO ON	Servo on
F# → E*	WARNING	Warning now generated
F# → **	ALARM	Alarm now generated
..	WATCH DOG ALM	Watchdog alarm
FA	NO CONTROL L	L axis not being controlled (Note 1)
Fb	NO CONTROL M	L axis not being controlled (Note 2)
FC	NO CONTROL S	S axis not being controlled (Note 1)

Note: When the AXES SELECTION switch at the top left of the RF203 card is set to "F" while the amplifier power is off and then the servo amplifier's power is switched on, total control will not be exercised over that axis.
(There will be no communication between the NC system in the initialized status and no alarm will be generated.)
In the case of the figure below, the L axis is the axis which is not controlled.

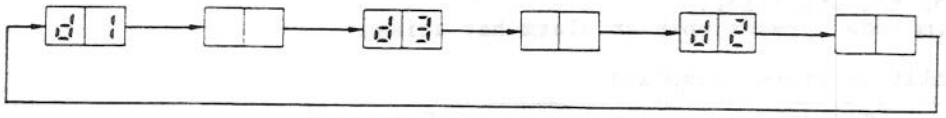
(Example)



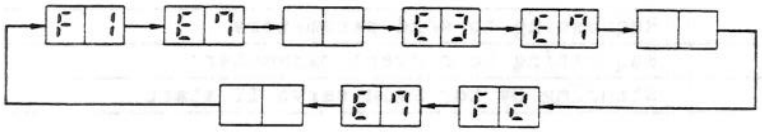
\# : Axis number
* : Warning number
** : Alarm number (Refer to the section on servo alarms and warnings) (in the MR-S2 Maintenance Manual.)

The display of the statuses starting with INITIALIZE is indicated in sequence for each axis by the segments which repeatedly light up and go out. Examples are given below.

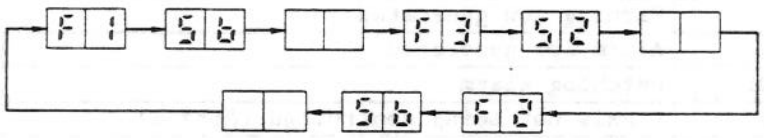
(Example 1) Display which appears when the L axis is the 1st axis (X axis), the M axis is the 3rd axis (Z axis), and the S axis functions as the 2nd axis, and the servo ON status applies to all axes.



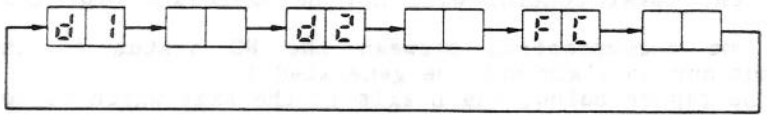
(Example 2) Display which appears while the emergency stop signal is being input from the NC system with the above axis numbers.



(Example 3) Display which appears when the excessive error alarm (No.52) occurs in the M(Z) axis with the above axis numbers.
(The other axis malfunction alarm applies to the L(X) and S(Y) axes.)



(Example 4) Display which appears when the AXES SELECTION switch Ⓢ is set to "F" because the S axis is not used, when the L axis is made the first (X) axis and the M·axis is made the second (Y) axis, when the power is switched on and when the servo ON status is established.



Note: Refer to the MR-S3 Maintenance Manual for the alarm codes.

4.2 TROUBLESHOOTING

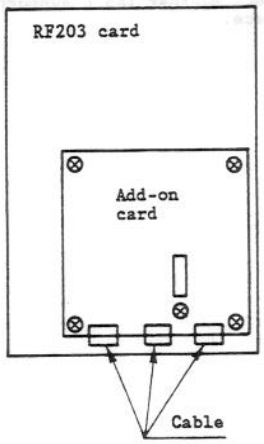
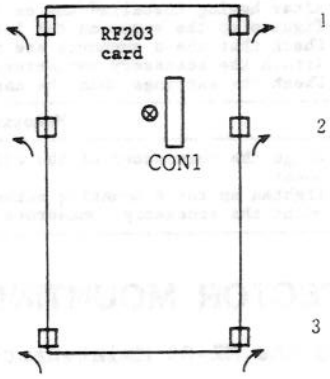
The troubleshooting procedures are common to the MR-S2.
Refer to the MR-S2 Maintenance Manual.

Note: The card names for the MR-S3 are as follows:
Main card RF203
Base amplifier card RF23
Add-on cards
For closed loop RF313
For absolute value detection RF333

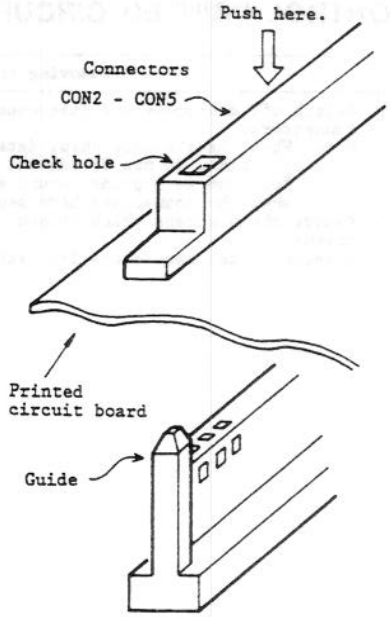
5. UNIT REPLACEMENT METHODS

5.1 CONTROL PRINTED CIRCUIT BOARD INSTALLATION/REMOVAL

5.1.1 CONTROL PRINTED CIRCUIT BOARD REMOVAL

1	Removing the add-on printed circuit boards
	1) Switch off the power and disconnect the accessory connectors. Note: When the absolute value detection card is in position, do not disconnect the connectors. Dog-type zero point return must be performed when the connectors have been disconnected. 2) Remove the 5 screws which attach the printed circuit boards. 3) Disconnect the connectors for each of the PCBs. 
2	Removing the main card (RF203)
	1) Switch off the power and disconnect the accessory connectors. 2) Remove the screw on the left of CON1. 3) Remove the supports used to secure the card and draw the card forward. 4) Remove the supports in the order of 1, 2 and 3. 
3	How to remove the base amplifier card (RF23)
	1) When the RF203 main card is removed, the RF23 card is visible underneath. 2) This card can also be removed by following the same procedure as for stage 2. Note: If stage 3 is conducted without conducting stage 2, the RF203/23 cards can be removed together.

5.1.2 CONTROL PRINTED CIRCUIT BOARD MOUNTING

1	Mounting the base amplifier card (RF23)
	1) Insert connectors CON2 through CON5 on the PCB 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 PCB. 3) Check whether the 6 supports are firmly in place. 
2	How to mount the main card (RF203)
	1) Install the card so that CON1 (reverse side of card) interlocks on the RF2 card. 2) After having installed the card, check that CON1 is securely in place. 3) Tighten up the screw on the left of CON1. 4) Check that the 6 supports are firmly in place. 5) Attach the accessory connectors. 6) Check the settings when the card is replaced.
3	Mounting the add-on card (RF313/333)
	1) Align the connectors of the add-on card with the connectors (JI) on the RF202 card and mount. 2) Tighten up the 4 mounting screws. 3) Mount the accessory connectors.

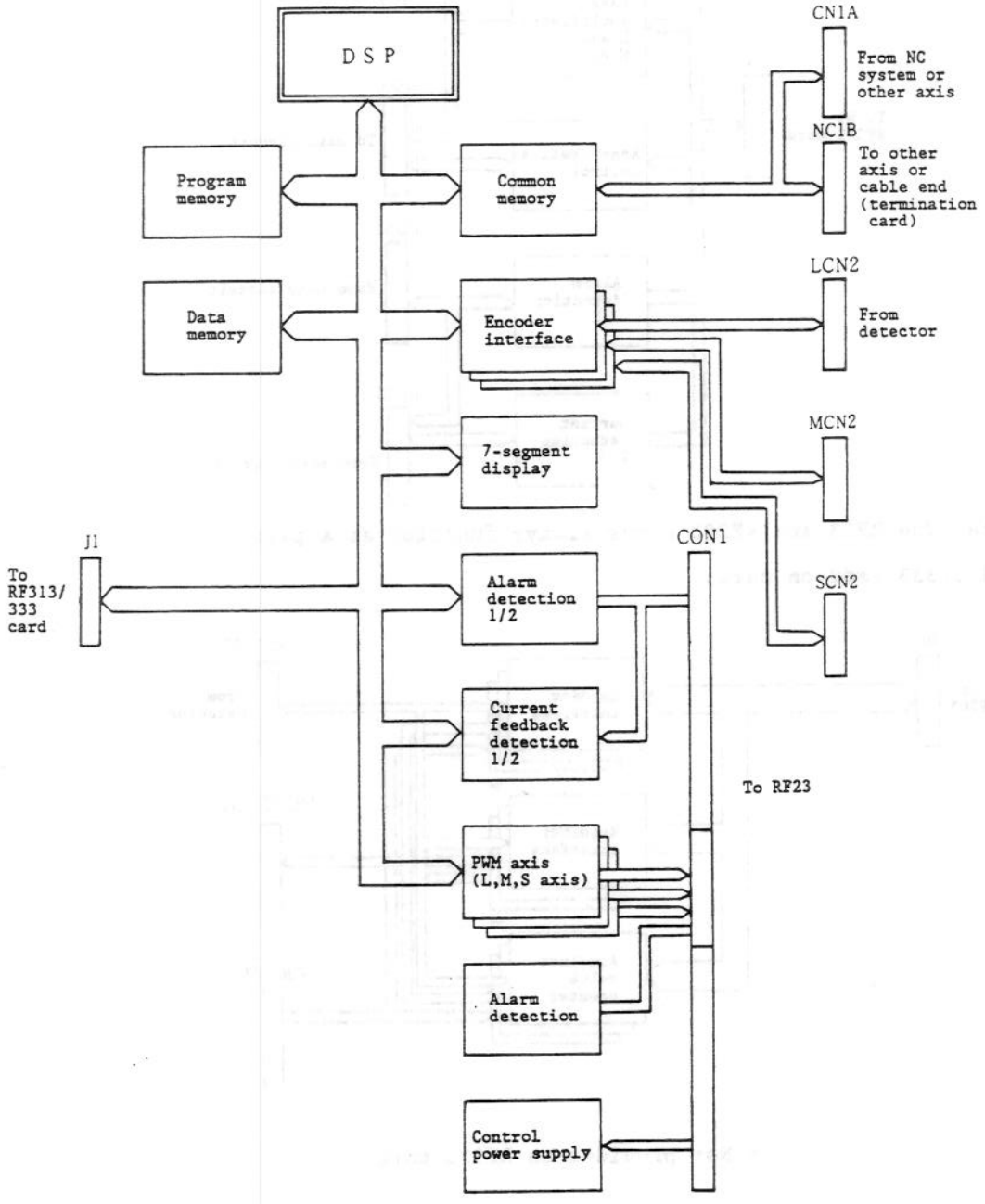
5.2 DETECTOR MOUNTING METHOD

Refer to the MR-S2 Maintenance Manual.

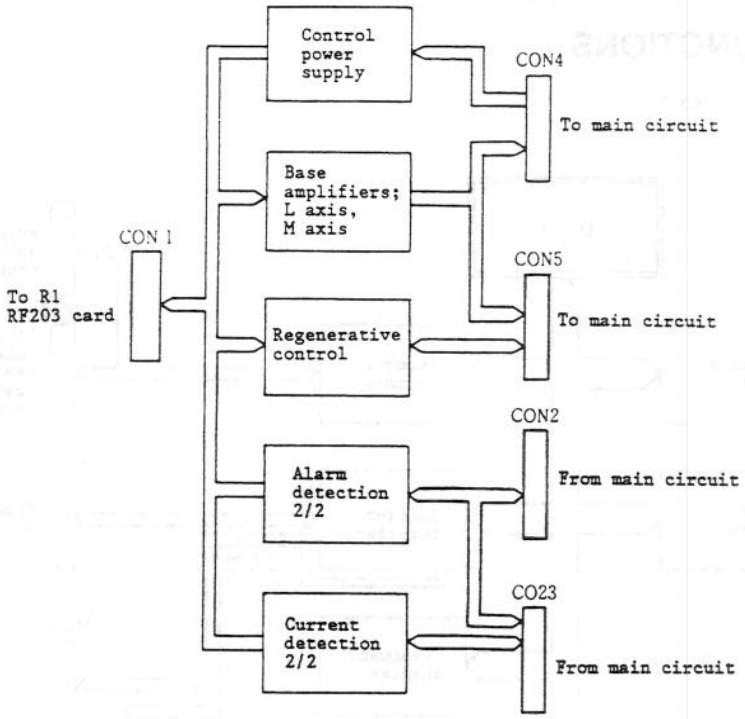
6. HARDWARE CHECK METHODS

6.1 CARD FUNCTIONS

(1) RF203 (main card)

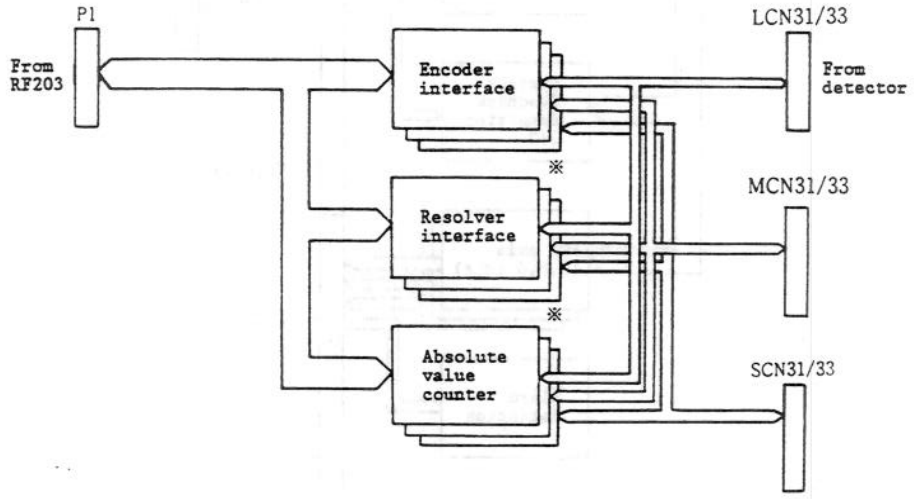


(2) RF23 (base amplifier card)



Note) The RF23 and RF203 cards always function as a pair.

(3) RF313/333 (add-on card)

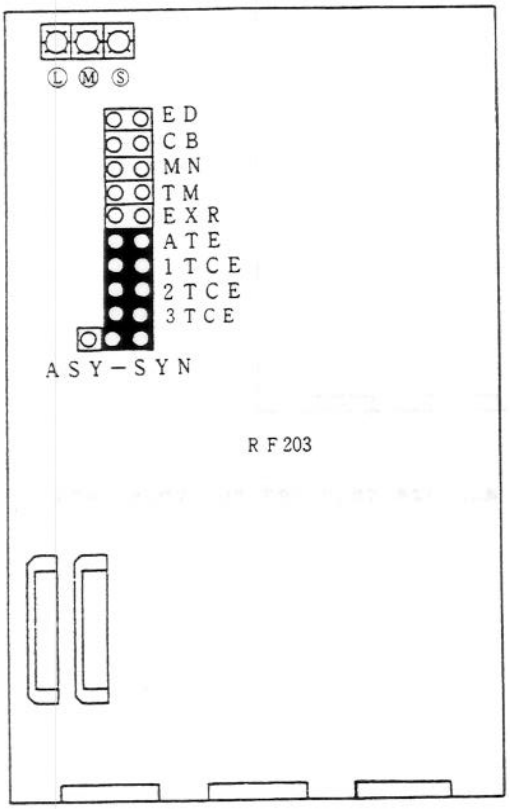


* Not provided on RF313 card

6.2 HARDWARE SETTINGS AND CHECK PINS

6.2.1 HARDWARE SETTINGS

RF203 setting outline



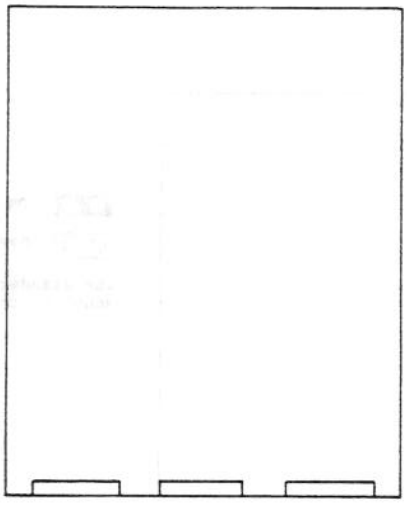
: ON setting

: OFF setting

The standard settings are shown in the figure.

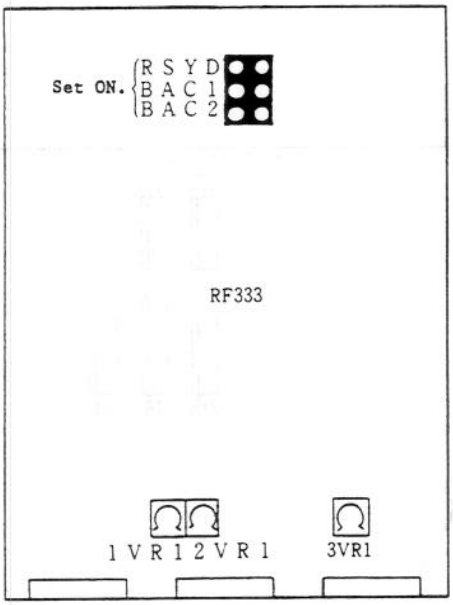
Name	Function	Setting		Standard	Stand-alone
		ON	OFF		
ED	Emergency stop	Valid	Invalid	OFF	ON
CB	Contactor block	Valid	Invalid	OFF	OFF
MN	Monitor mode	Valid	Invalid	OFF	OFF
TM	Operation mode	Test mode	Normal mode	OFF	ON
EXR	IT sync selection	Not synchronized with MCP	Synchronized with MCP	OFF	ON
ATE				ON	ON
1TCE	Td compensation L axis	Valid	Invalid	ON	ON
2TCE	Td compensation L axis	Valid	Invalid	ON	ON
3TCE	Td compensation S axis	Valid	Invalid	ON	ON
ASY-SYN	IT clock selection	SYN: MCP clock	ASY: Internal clock	SYN	ASY
L	Axis number selection for L axis	0-5: Axis selection number in normal mode F : When corresponding axis is not being used 6-E: Axis selection error		0-5, F	Setting by motor capacity
M	Axis number selection for M axis			0-5, F	
S	Axis number selection for S axis			0-5, F	

RF313 setting outline



No settings at all are required for this card.

RF333 setting outline



: ON setting

: OFF setting

The standard settings are shown in the figure.

Name	Function	Setting		Standard	Remarks
		ON	OFF		
RSYD	Absolute value counter reset	Invalid	Valid	ON	Must be ON during use. (See Notes).
BAC1	Battery connection	Connected	Not connected	OFF	
BAC2	Battery connection	Connected	Not connected	OFF	
1VR1	Resolver phase adjustment for L axis				Do not touch the controls which were adjusted before the card was shipped from the manufacturing plant.
2VR1	Resolver phase adjustment for M axis				
3VR1	Resolver phase adjustment for S axis				

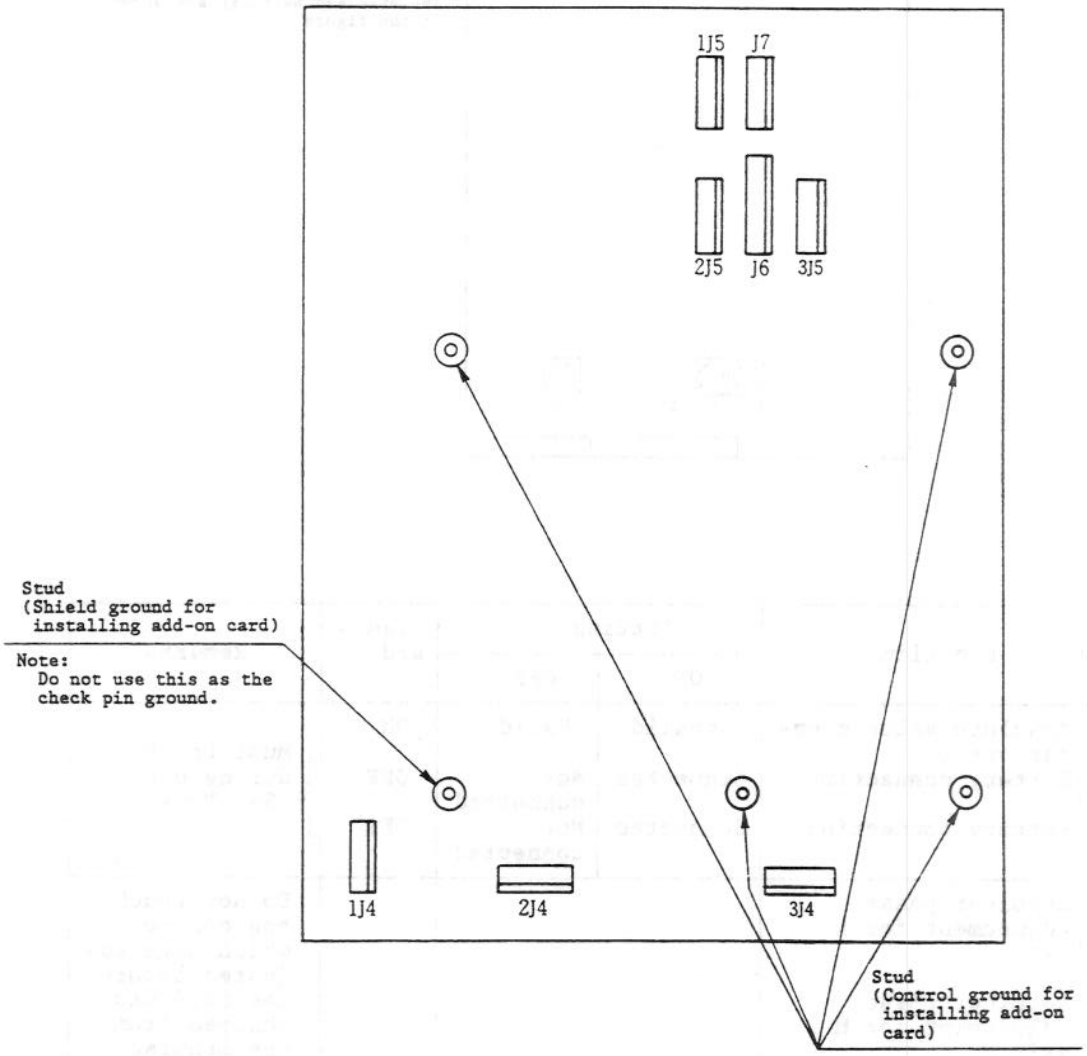
Observe the settings in the table even when the card is not being used.

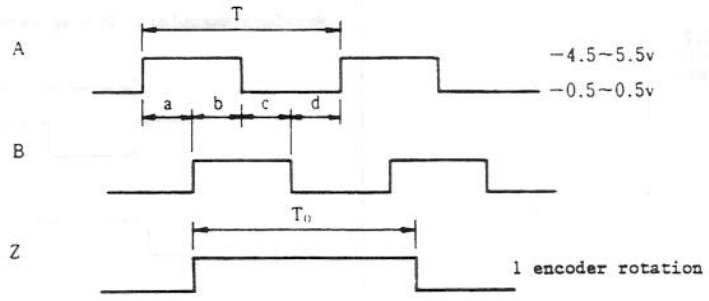
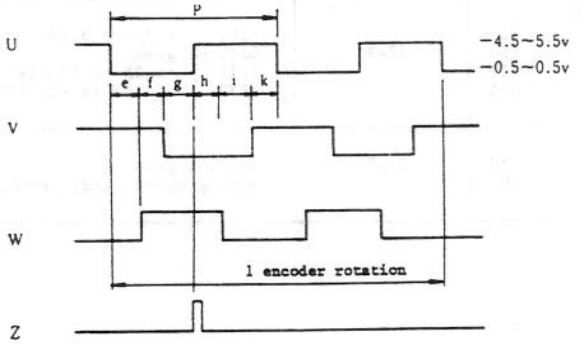
Note: When the card is shipped, BAC1 and BAC2 are OFF.
Set them ON before switching on the power.
It should be borne in mind that if these ON settings are not made, the absolute values will not be backed up by the batteries.

6.2.2 CHECK PINS AND WAVEFORMS

Make sure that the emergency stop status is established when the synchroscope probe touches the check pins.

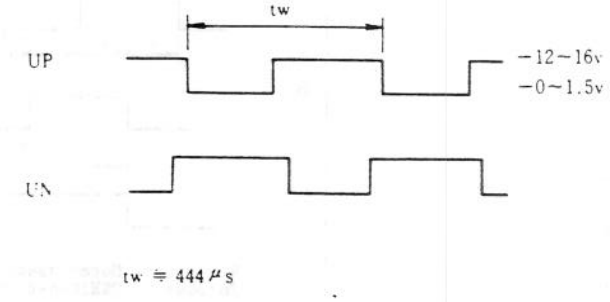
(1) RF203



Terminal name	Signal name	Ground terminal	Signal and waveform
nJ4-1 nJ4-2 nJ4-3 n=1,2 1=L axis 2=M axis 3=S axis	A B Z	Bottom right stud	Encoder phase A n = 1 (L axis encoder feedback signal) Encoder phase B n = 2 (M axis encoder feedback signal) Encoder phase Z Waveform examples: During counterclockwise rotation as seen from motor shaft load side  R : Motor speed (rpm) Encoder : OSE5K-6-8-108 (5000 p/r) $T = \frac{60}{R \times 5000}$ [sec] $a, b, c, d = \frac{1}{4}T \pm \frac{1}{12}T$ To = T to 3T
nJ4-4 nJ4-5 nJ4-6 n=1,2 1=L axis 2=M axis 3=S axis	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) $P = \frac{60}{R \times 2}$ $e \cdot f \cdot g \cdot h \cdot j \cdot k = \frac{1}{6}p \pm \frac{1}{900}p$

<table>
<tr><th>Terminal name</th><th>Signal name</th><th>Ground terminal</th><th>Signal and waveform</th></tr>
<tr><td>nJ5-1
nJ5-2
nJ5-3
nJ5-4
nJ5-5
nJ5-6

n=1,2
1=L axis
2=M axis</td><td>UP
UN
VP
VN
WP
WN</td><td>Bottom right stud</td><td>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
 

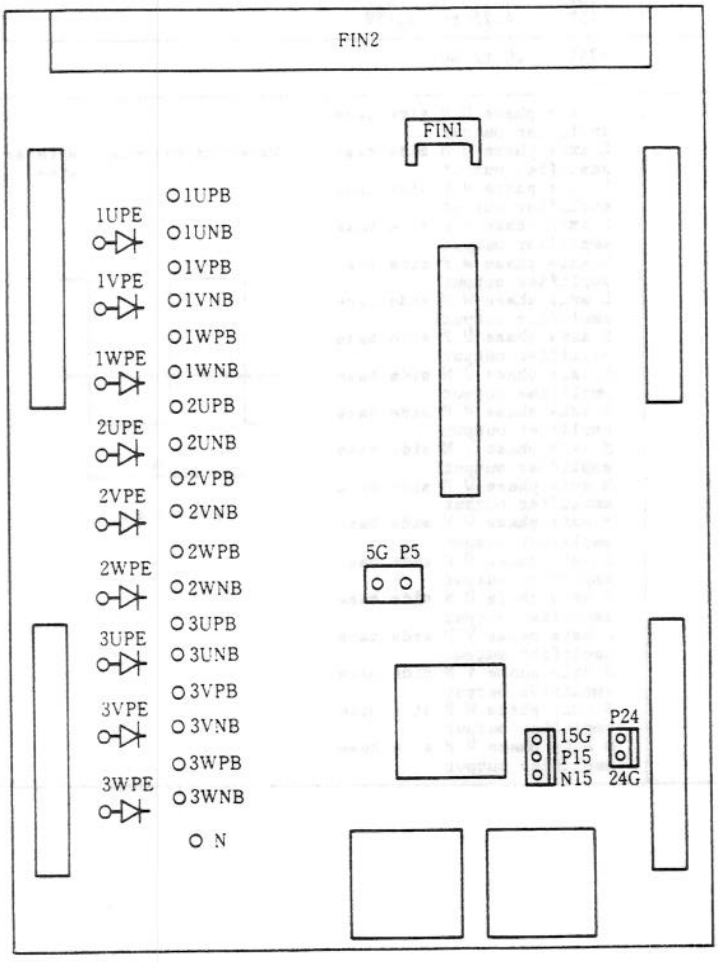
tw ≒ 444 μs</td></tr>
<tr><td>J6-1
J6-2
J6-3
J6-4
J6-5
J6-6
J6-7
J6-8</td><td>1U
1V
2U
2V
3U
3V
EXT
AG</td><td>J6-8</td><td>L axis motor phase U current
L axis motor phase V current
M axis motor phase U current
M axis motor phase V current
S axis motor phase U current
S axis motor phase V current
External analog input
Analog ground

<table><tr><th>Motor</th><th>Current</th></tr><tr><td>HA23, 33</td><td>6.1 A/V</td></tr><tr><td>HA40, 43</td><td>12.7 A/V</td></tr><tr><td>HA80, 83</td><td>21.2 A/V</td></tr><tr><td>HA100</td><td>31.8 A/V</td></tr></table>
 
Acceleration Deceleration

Waveforms differ according to load.
(Current values are given as the respective peaks.)</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 to 5.25 V
Control ground
+15V 14.25 to 15.75V
-15V -14.25 to -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>
</table>

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

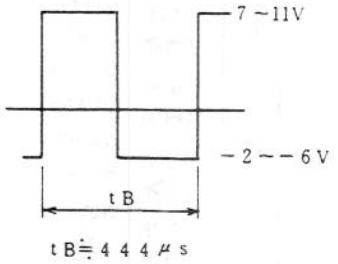
(2) RF23



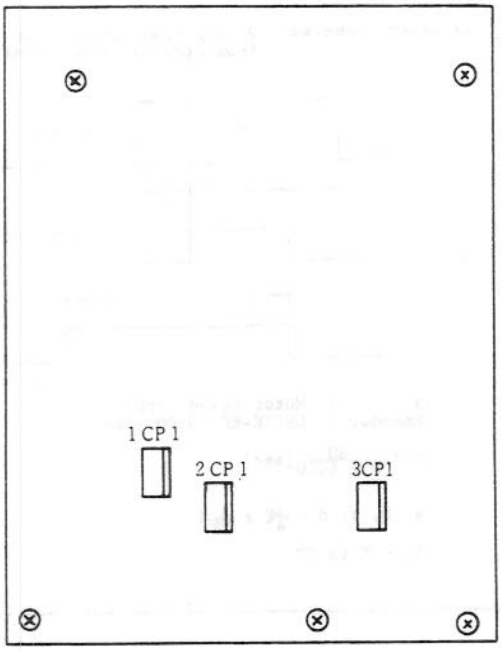
* FIN2 is connected to the control ground (5G).

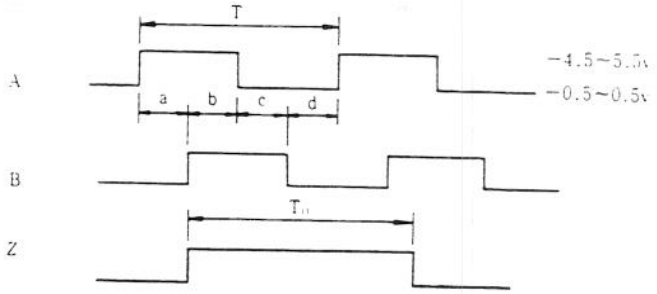
Terminal name	Signal name	Ground terminal	Signal and waveform
P5 5G	P5 5G	5G	+5V 4.75 to 5.25V Control ground
15G N15 P15	15G N15 P15	 15G 15G	Control ground -15V -14.25 to -15.75V +15V 14.25 to 15.75V
P24 24G	P24 24G	24G	+24V 20 to 28V
1UPB	1UPB	1UPE	L axis phase U P side base amplifier output
1UNB	1UNB	N	L axis phase U M side base amplifier output
1VPB	1VPB	1VPE	L axis phase V P side base amplifier output
1VNB	1VNB	N	L axis phase V N side base amplifier output
1WPB	1WPB	1WPE	L axis phase W P side base amplifier output
1WNB	1WNB	N	L axis phase W N side base amplifier output
2UPB	2UPB	2UPE	M axis phase U P side base amplifier output
2UNB	2UNB	N	M axis phase U N side base amplifier output
2VPB	2VPB	2VPE	M axis phase V P side base amplifier output
2UNB	2VNB	N	M axis phase V N side base amplifier output
2WPB	2WPB	2WPE	M axis phase W P side base amplifier output
2WNB	2WNB	N	M axis phase W N side base amplifier output
3UPB	3UPB	3UPB	S axis phase U P side base amplifier output
3UNB	3UNB	N	S axis phase U N side base amplifier output
3VPB	3VPB	3VPB	S axis phase V P side base amplifier output
3VNB	3VNB	N	S axis phase V N side base amplifier output
3WPB	3WPB	3WPB	S axis phase W P side base amplifier output
3WNB	3WNB	N	S axis phase W N side base amplifier output

Waveform example: With servo ON stop

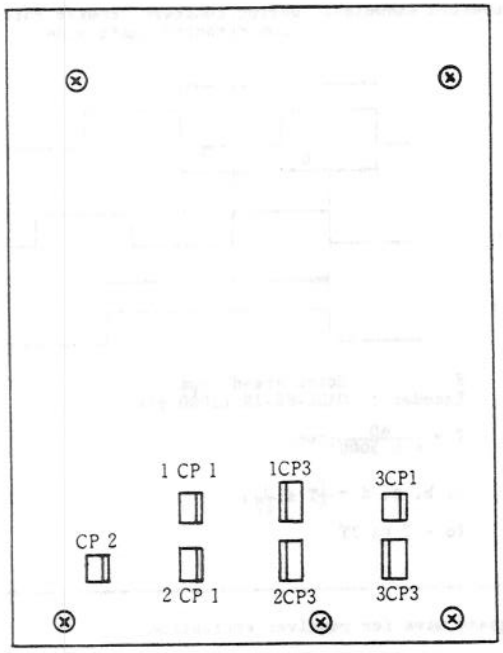


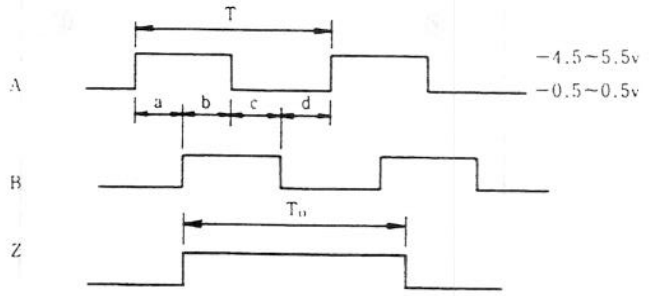
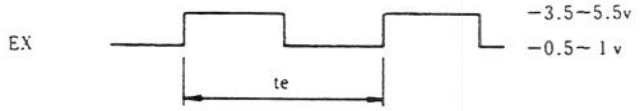
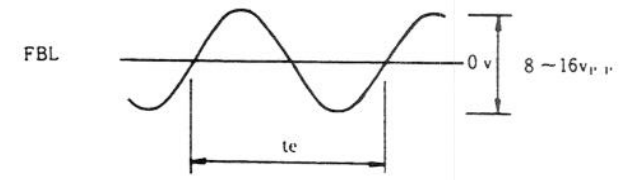
(3) RF313



Terminal name	Signal name	Ground terminal	Signal and waveform
nCP-1 nCP-2 nCP-3 n=1,2 1=L axis 2=M axis	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 : OSE5K-EK (5000 p/r) $T = \frac{60}{R \times 5000}$ [sec] $a, b, c, d = \frac{1}{4}T \pm \frac{1}{12}T$ To = T to 3T

(4) RF333



Terminal name	Signal name	Ground terminal	Signal and waveform
nCP1-1 nCP1-2 nCP1-3 n=1,2 1=L axis 2=M axis	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 (5000 p/r) $T = \frac{60}{R \times 5000}$ [sec] $a, b, c, d = \frac{1}{4}T \pm \frac{1}{12}T$ To = T to 3T
CP2-1 CP2-2 n=1,2 1=L axis 2=M axis	EX 15G	CP2-2	Square wave for resolver excitation Control ground Waveform example: 
nCP3-1 n=1,2 1=L axis 2=M axis	FBL	CP3-3	Resolver FB level Waveform example:  te ≒ 222 μs
nCP3-2 nCP3-3 nCP3-4	P15 15G N15	CP3-3	+15V control power 14.25 to 15.75V Control ground -15V control power -14.25 to -15.75V

7. DETAILS OF SERVO PARAMETER

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.
For details on the parameters, refer to the MR-S2 Maintenance Manual.

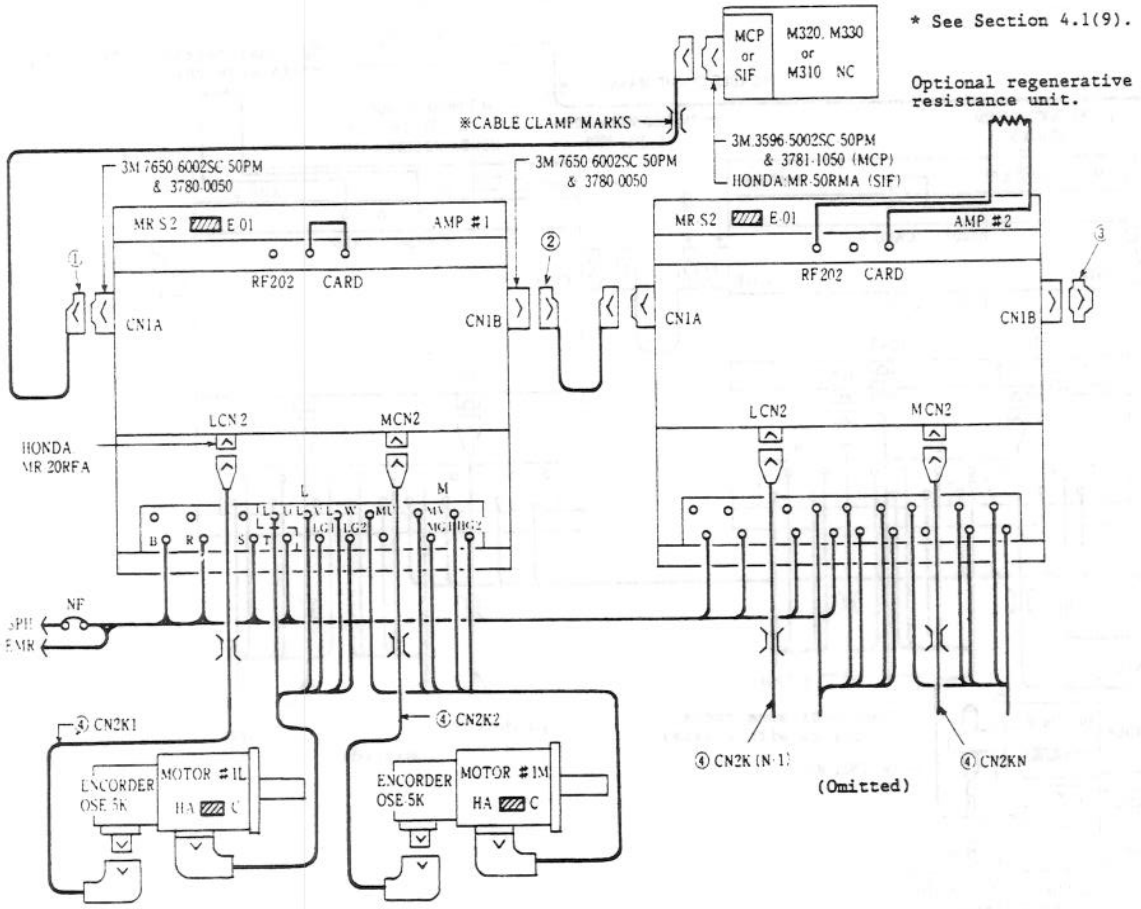
8. ABSOLUTE POSITION SYSTEM

For details on the absolute position system, refer to the MR-S2 Maintenance Manual.

APPENDIX

APPENDIX 1. CABLE DIAGRAMS

APPENDIX 1.1 MR-S2-□□-E01 CABLE DIAGRAM



Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	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	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2KN

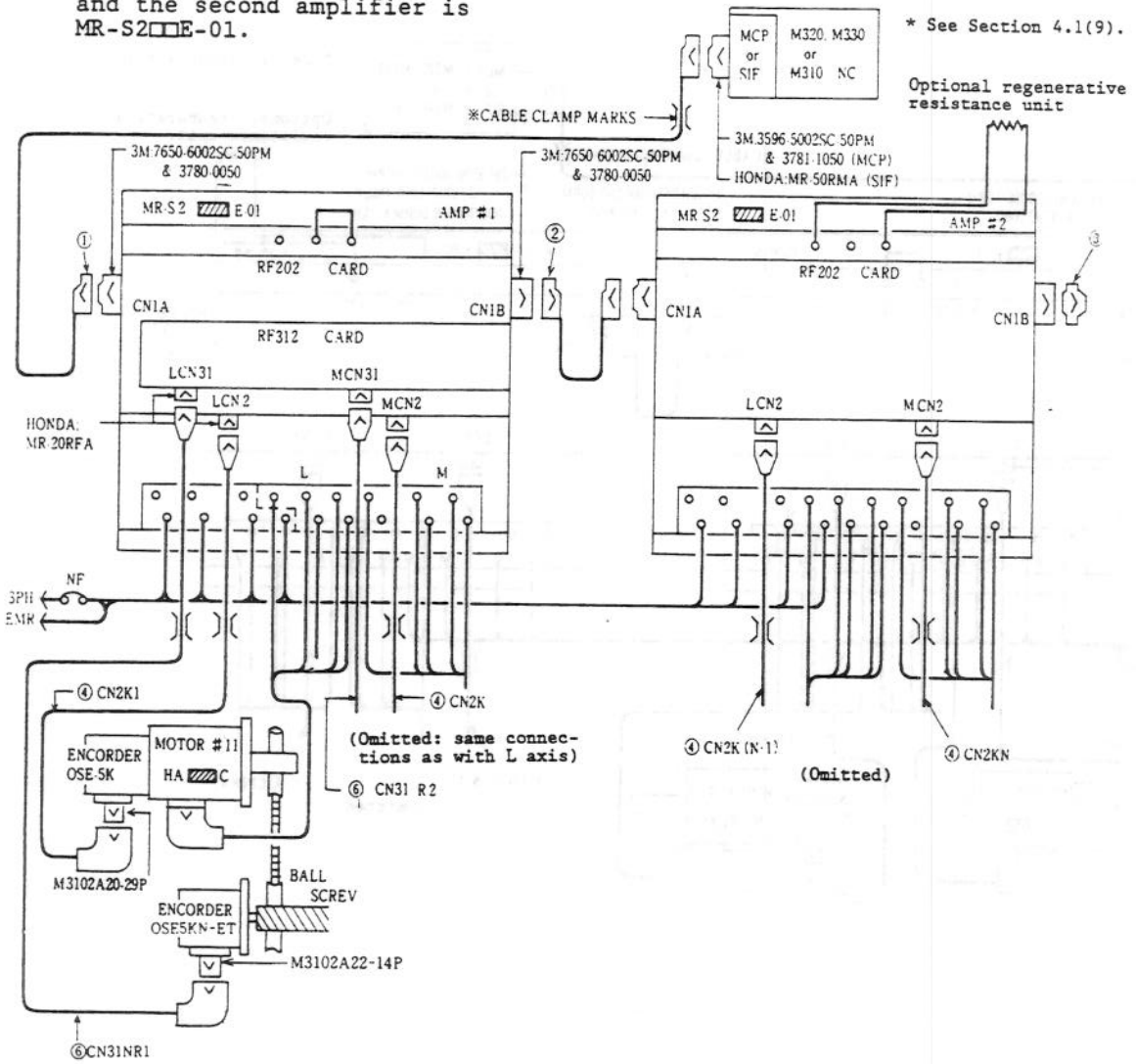
Note (1) N: total number of axes; but N < 6 (N < 4 with M310 NC system)
K: Number of amplifiers

Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor.

APPENDIX 1.2 MR-S2-□□-E31 CABLE DIAGRAM (Ball screw detection end)

The diagram indicates a case where the first amplifier is MR-S2-□□E-31 and the second amplifier is MR-S2□□E-01.



Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	Max. length 30 m	Item 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5 m			
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 5.4.1	CN31NR1-CN31NRN

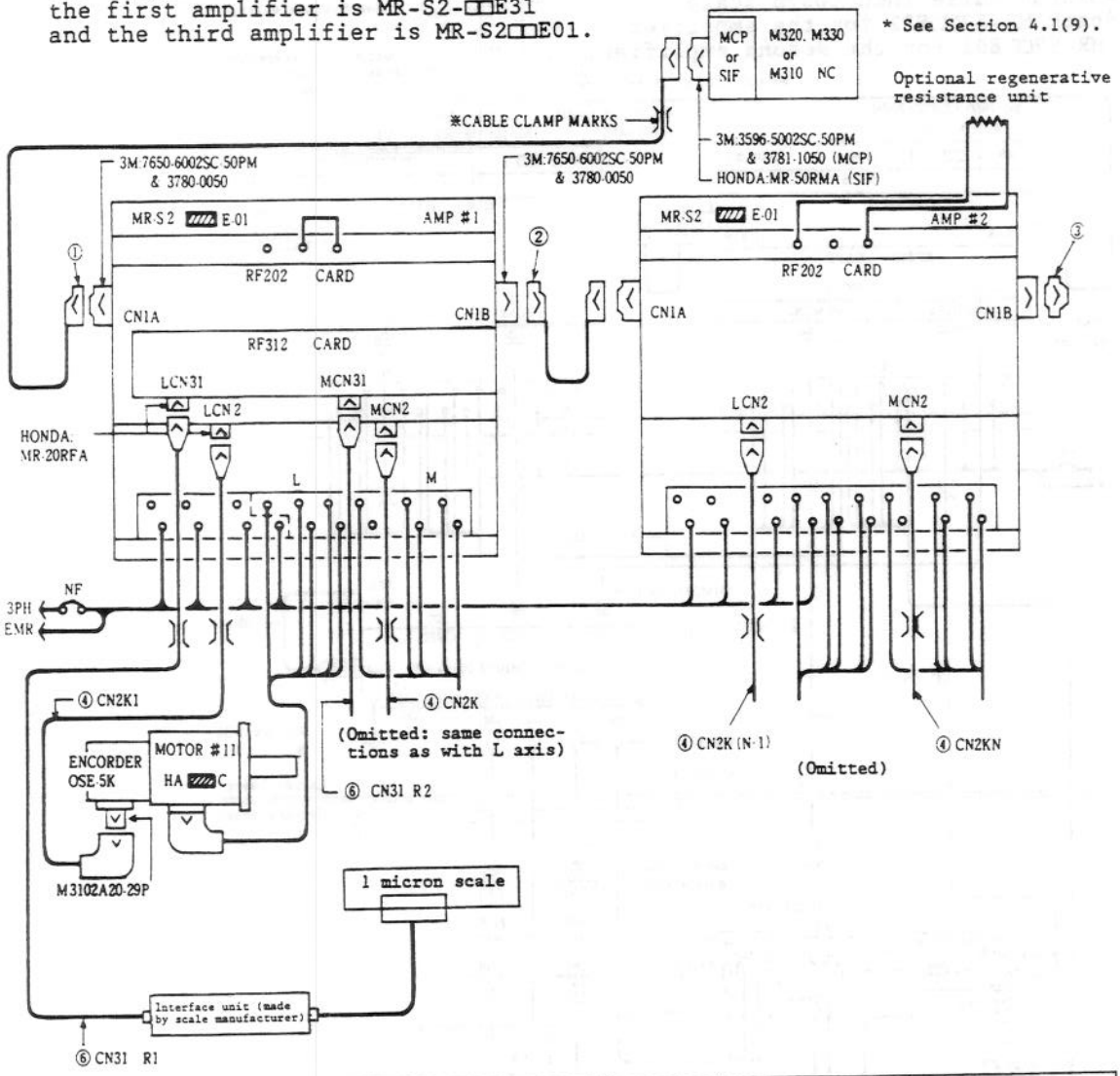
Note (1) N: total number of axes; n: number of MR-S2-□□E31 axes, but N < 6, N < n (n = 2 in this figure) K: Number of amplifiers

Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor.

APPENDIX 1.3 MR-S2-□□-E31 CABLE DIAGRAM (Scale feedback, 1 micron)

The diagram indicates a case where the first amplifier is MR-S2-□□E31 and the third amplifier is MR-S2□□E01.



Part No.	Part name	Q'ty	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 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2KN
7	AMP CABLE	n	5 m	50 m	Details available separately	CN311-CN312

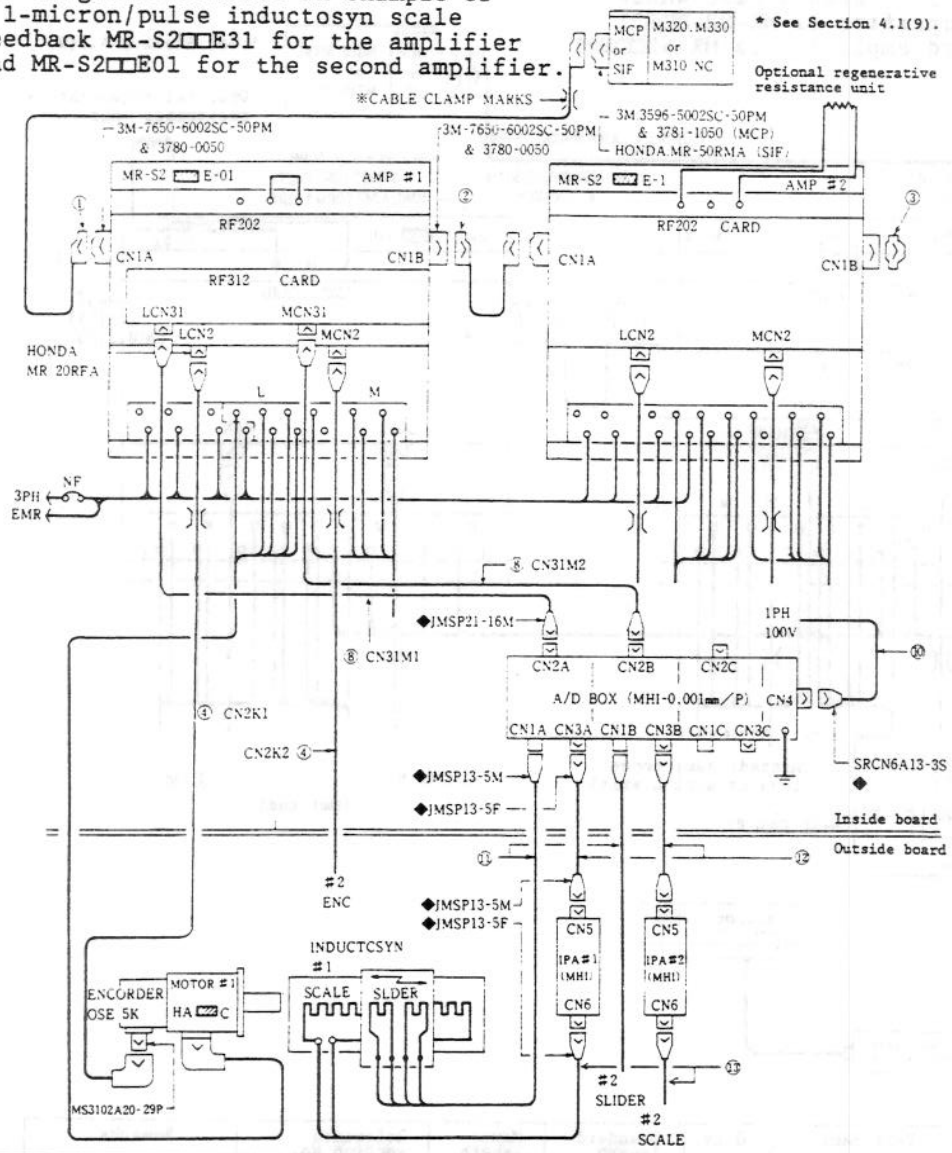
Note (1) N: total number of axes; n: number of MR-S2-□□E31 axes, but N < 6, N > n (n = 1 in this figure) K: Number of amplifiers

Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the L axis motor is greater than the capacity of the M axis motor.

APPENDIX 1.4 MR-S2-□□-E31 CABLE DIAGRAM (Scale feedback, 1 micron)

The diagram indicates an example of a 1-micron/pulse inductosyn scale feedback MR-S2□□E31 for the amplifier and MR-S2□□E01 for the second amplifier.



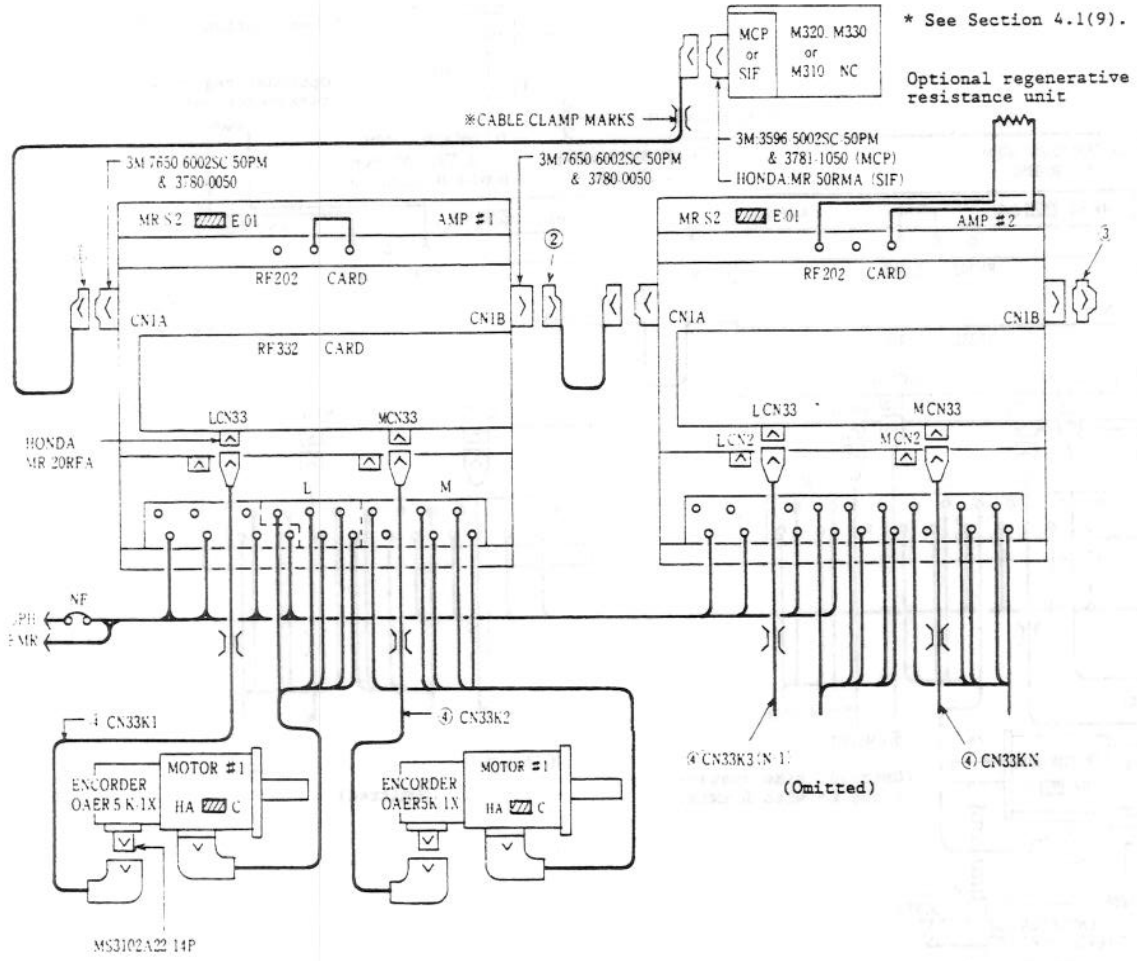
Part No.	Part name	Q'ty	Standard length	Max length	Reference section No.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2K3
8	AMP-A/D CABLE	N	5 m	15 m	Section 5.4.5	CN31M1-CN31M3

Part No.	Part name	Q'ty	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 LPA CABLE	N	20 m		
13	IPA-SCALE CABLE	N	0.5 m		

Note (1) N: Total number of axes; but N < 6 (N < 4 with M310 NC system)
K: Number of amplifiers
(2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.
(3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor.
(4) The plugs with a ◆ mark are accessories of the inductosyn system.

APPENDIX 1.5 MR-S2-□□-Z33 CABLE DIAGRAM (Absolute value, semi-closed)

The diagram indicates a case where MR-S2-□□Z33 applies to all axes.

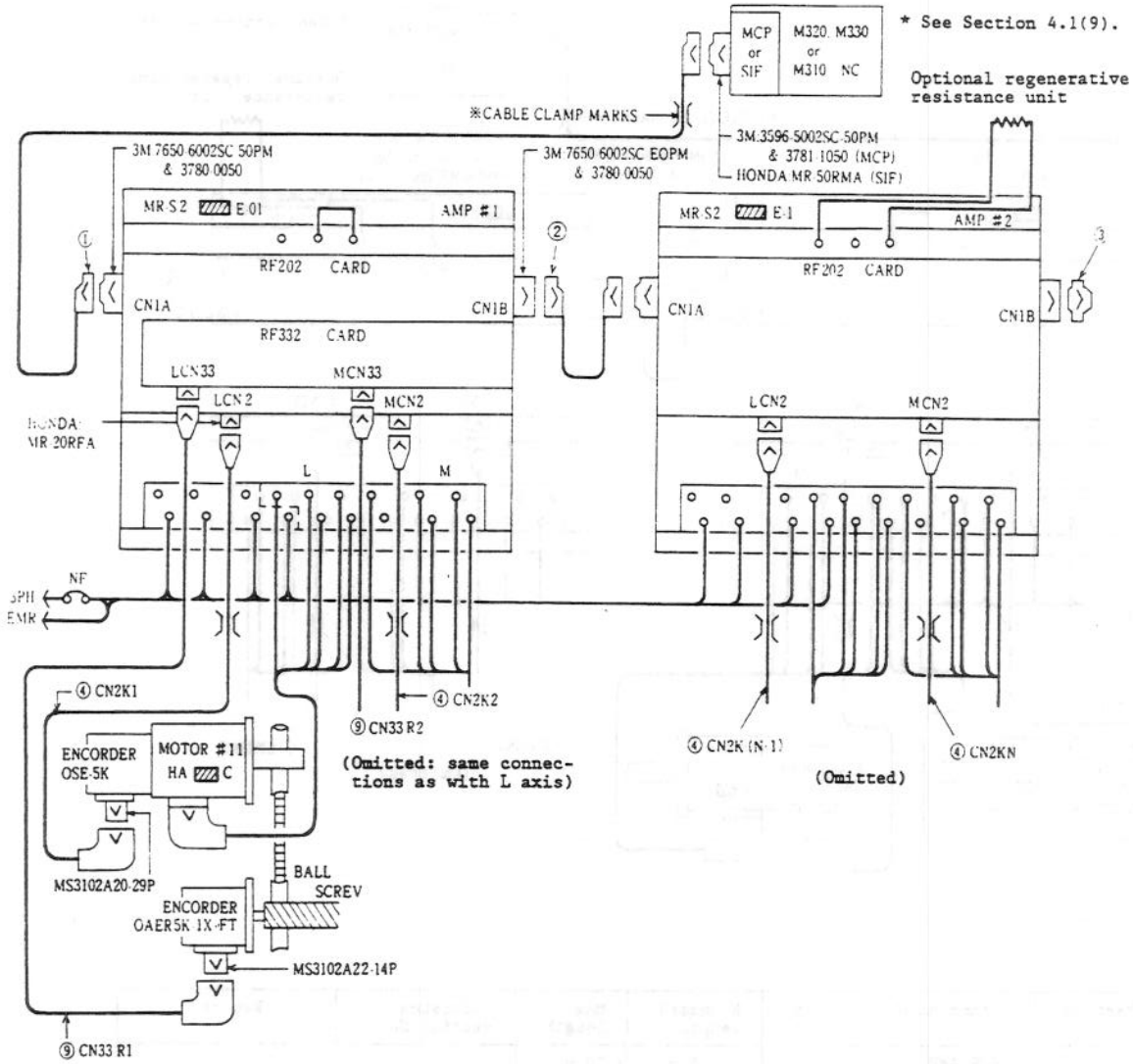


Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
5	AMP-ENC CABLE	N	5 m	20 m	Section 5.4.3	CN33K1-CN33KN

Note (1) N: total number of axes; but N < 6 (N < 4 with M310 NC system), K: Number of amplifiers
Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.
Note (3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor.

APPENDIX 1.6 MR-S2-□□-Z33 CABLE DIAGRAM (Absolute value, ball screw end)

The diagram indicates a case where the first amplifier is MR-S2-□□Z33 and the second amplifier is MR-S2-□□E01.



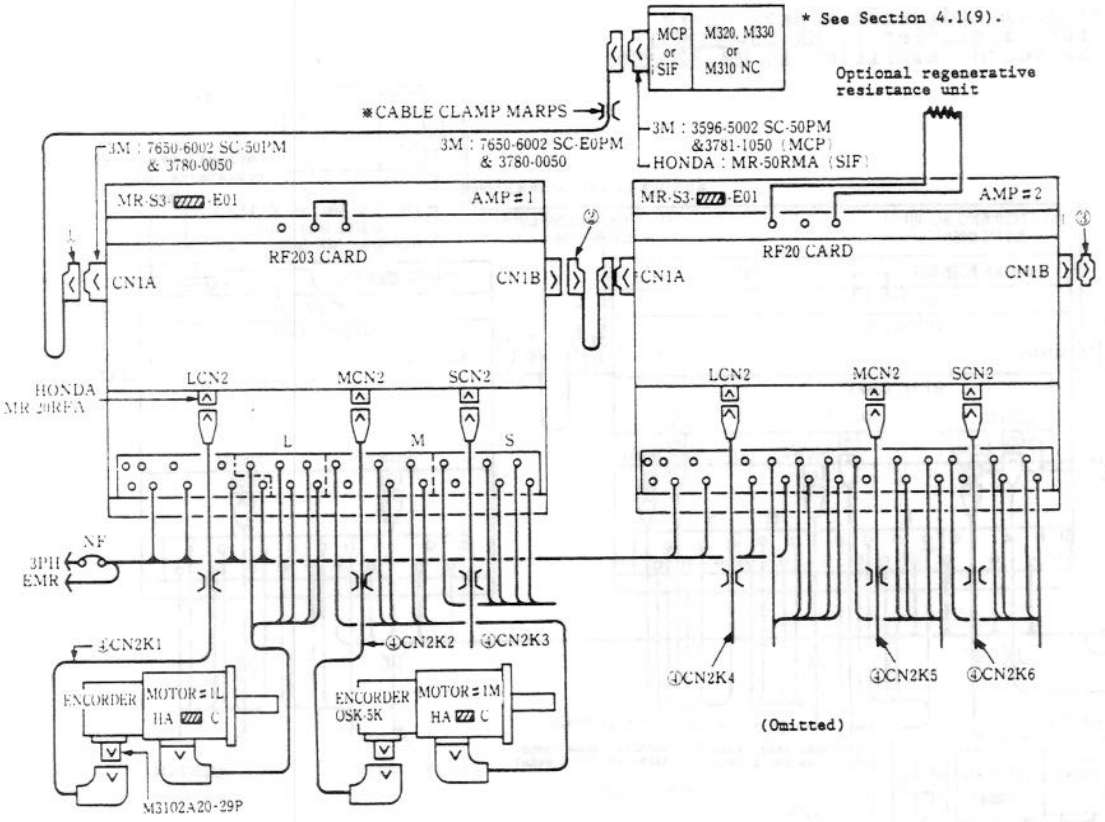
Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m		Section 5.4.3	CN33K1-CN33K3
9	AMP-ENC CABLE	n	5 m		Section 5.4.2	CN33R1-CN33R2

Note (1) N: total number of axes; n: number of MR-S2-□□Z33 axes; but N < 6, N < n (n = 1 in this figure) K: Number of amplifiers

Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the M axis motor is greater than the capacity of the L axis motor.

APPENDIX 1.7 MR-S3-□□-E01 CABLE DIAGRAM

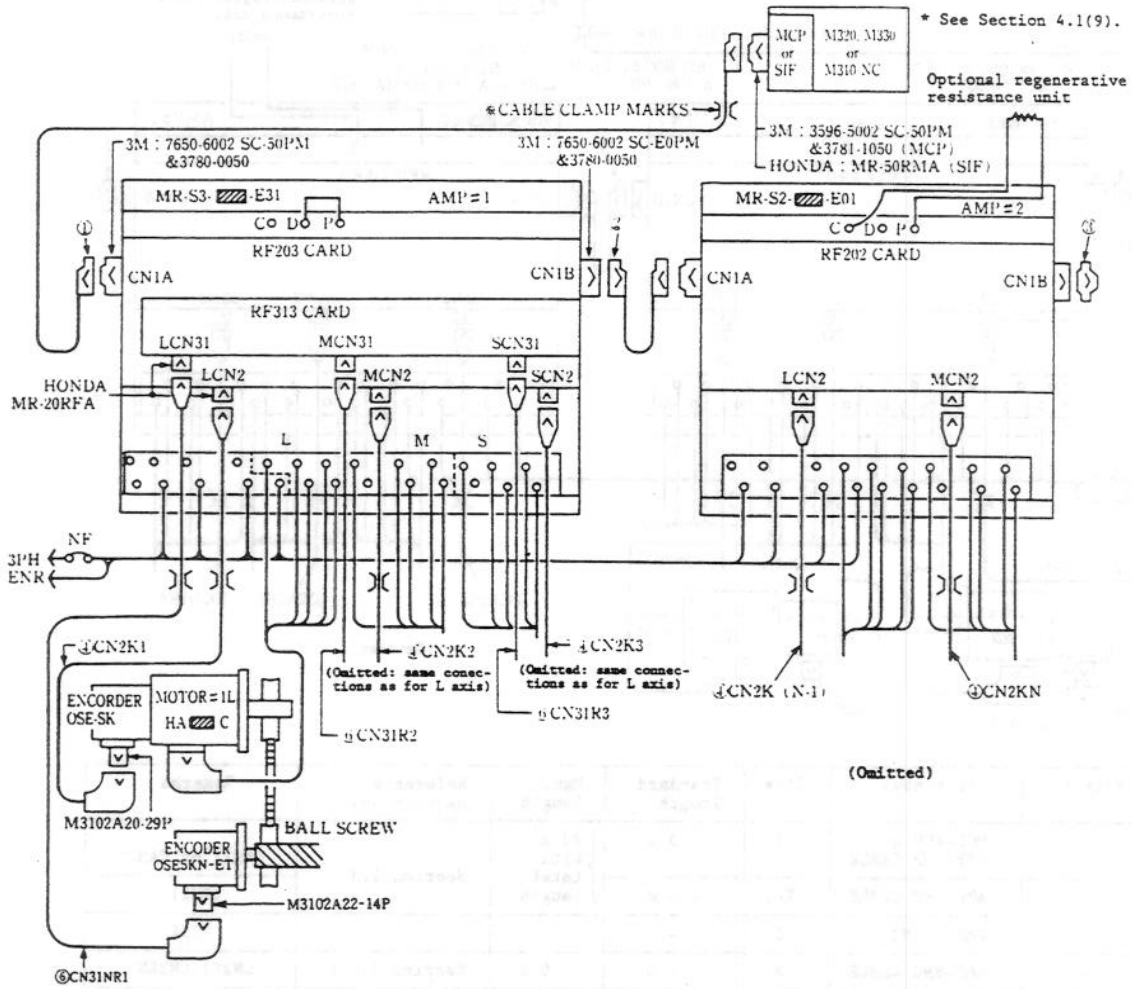


Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11 or CAM21
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2KN

Note (1) N: total number of axes; but N < 6 (N < 4 with M310 NC system), K: Number of amplifiers
Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 2 amplifiers is 1 x 5 + (1 x 0.5) = 5.5 m.
Note (3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor.

APPENDIX 1.8 MR-S3-□□□-E31 CABLE SYSTEM DIAGRAM (Ball screw detection end)

The diagram indicates a case where the first amplifier is MR-S3-□□□E31 and the second amplifier is MR-S2□□E01.



Part No.	Part name	Q'ty	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
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2KN
5	AMP-ENC-CABLE	n	5 m	50 m	Section 5.4.1	CN31R1-CN31R

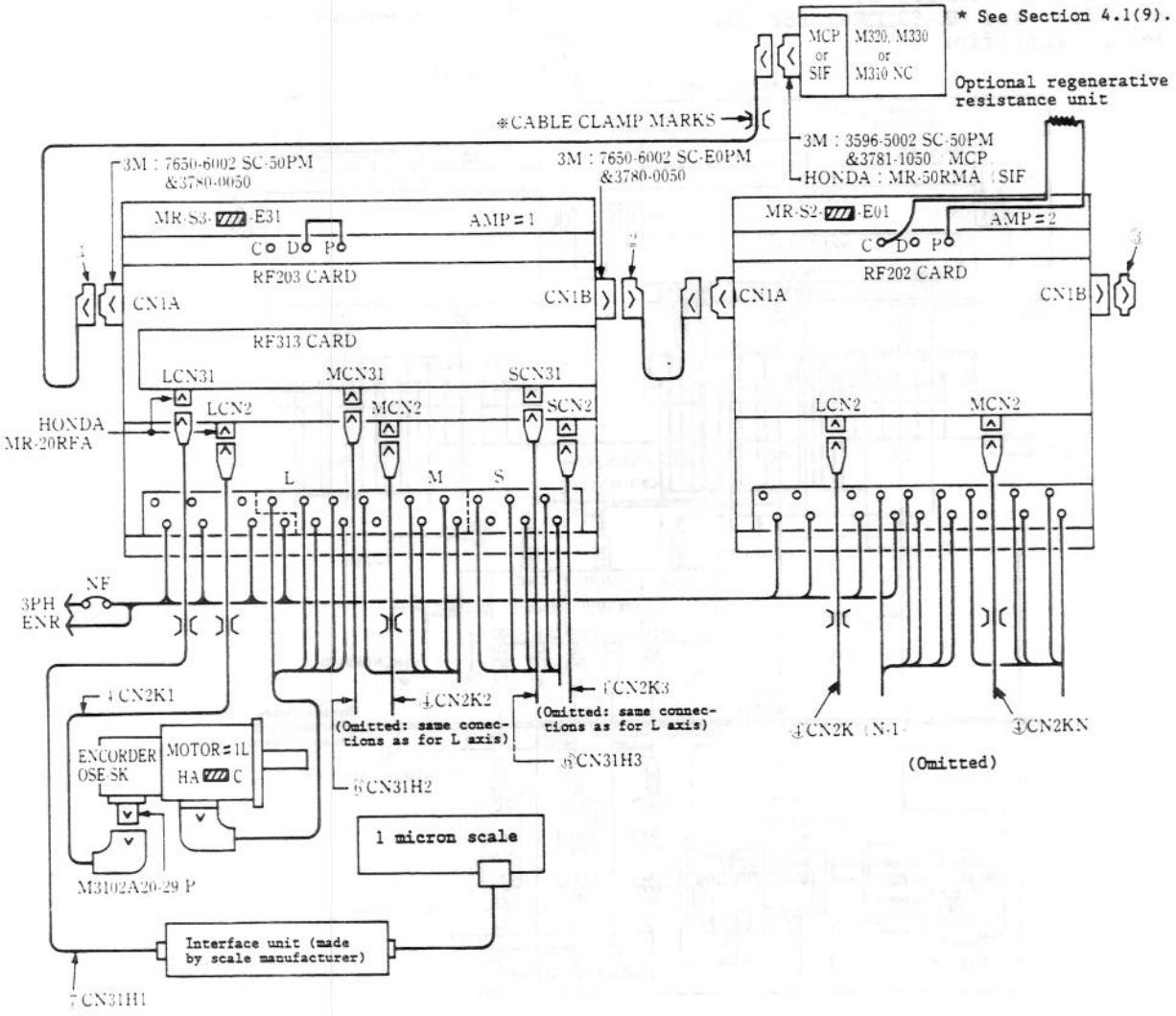
Note (1) N: total number of axes; n: Number of MR-S3-□□E31 axes. N < 6, N < n (n = 1 in this figure), K: Number of amplifiers

Note (2) Example of total length for cables with Part No. (1) and (2): Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor which in turn must be equal to, or greater than, the capacity of the S axis motor.

APPENDIX 1.9 MR-S3-□□□-E31 CABLE DIAGRAM (Scale feedback, 1 micron scale)

The diagram indicates a case where the first amplifier is MR-S2-□□Z33 and the second amplifier is MR-S2□□E01.



Part No.	Part name	Q'ty	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
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m		Section 5.4.3	CN33K1-CN33K3
7	AMP-ENC-CABLE	n	5 m		Section 5.4.2	CN33R1-CN33R2

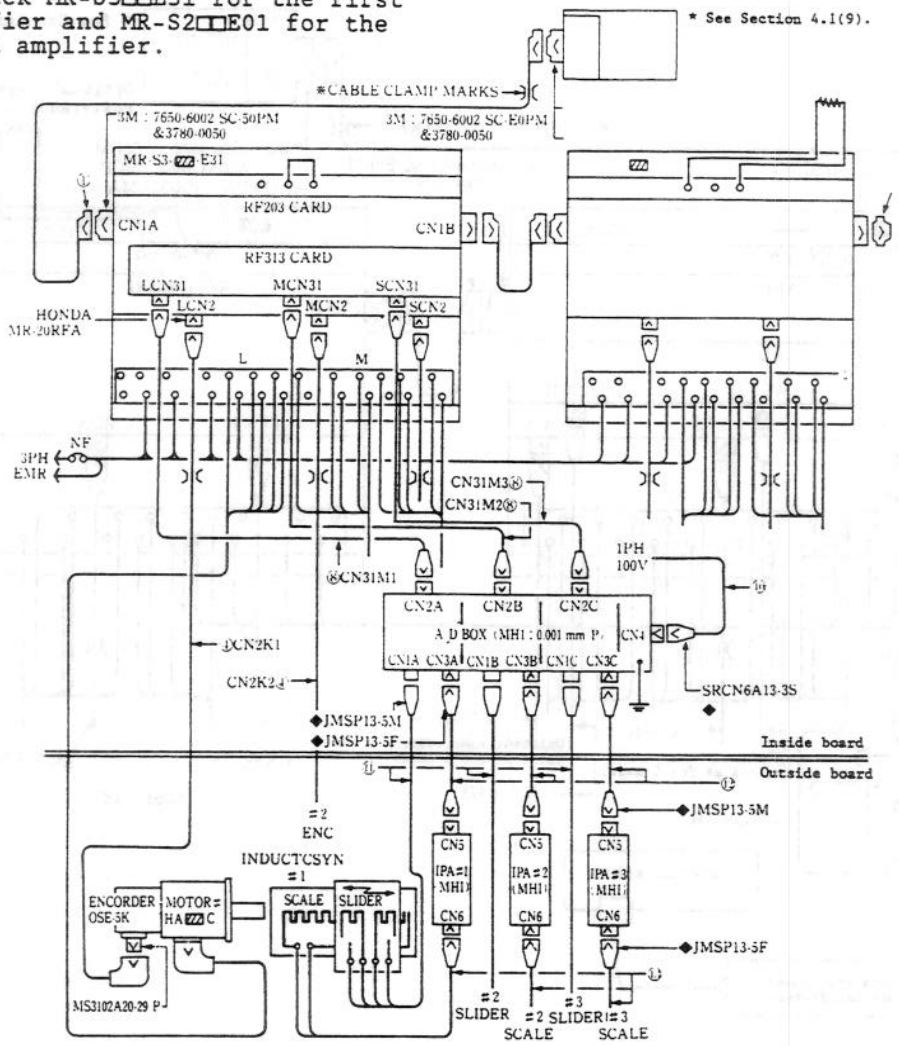
Note (1) N: total number of axes; n: Number of MR-S3-□□F*31 axes. N < 6, N > n (n = 1 in this figure), K: Number of amplifiers

Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the L axis motor is greater than, the capacity of the M axis motor which in the turn must be greater than the capacity of the S axis motor.

APPENDIX 1.10 MR-S3-□□-E31 CABLE DIAGRAM (Inductosyn feedback, 1-micron)

The diagram indicates an example of a 1-micron/pulse inductosyn scale feedback MR-S3□□E31 for the first amplifier and MR-S2□□E01 for the second amplifier.



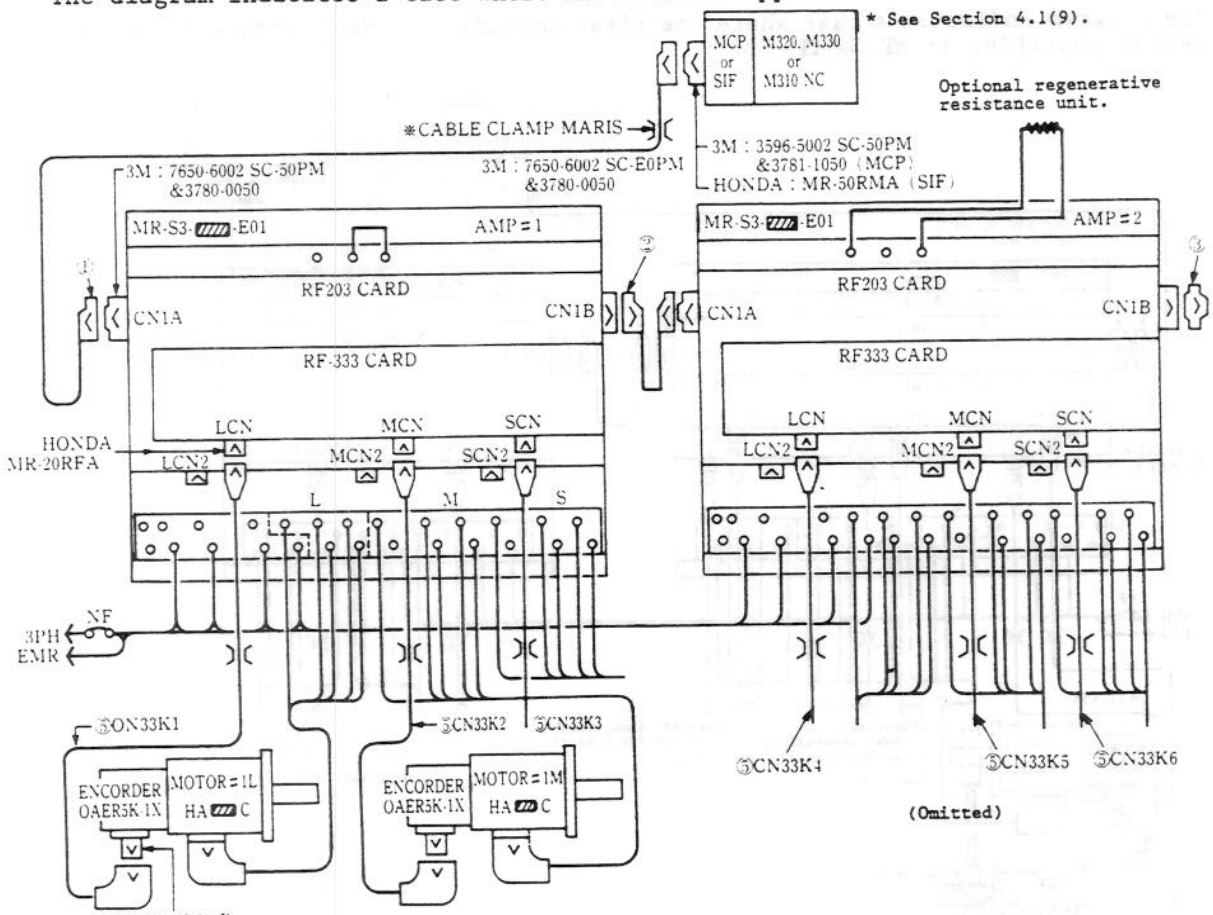
Part No.	Part name	Q'ty	Standard length	Max length	Reference section No.	Remarks
1	MCP-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2K3
8	AMP-A/D CABLE	N	5 m	15 m	Section 5.4.5	CN31M1-CN31M3

Part No.	Part name	Q'ty	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 LPA CABLE	N	20 m		
13	IPA-SCALE CABLE	N	0.5 m		

Note (1) N: Total number of axes; n: number of MR-S3 E-31 axes; but N < 6, N > n (n = 2 in this figure), K: Number of amplifiers
(2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.
(3) The plugs with a ◆ mark are accessories of the inductosyn system.

APPENDIX 1.11 MR-S3-□□-Z33 CABLE DIAGRAM

The diagram indicates a case where MR-S2-□□Z33 applies to all axes.

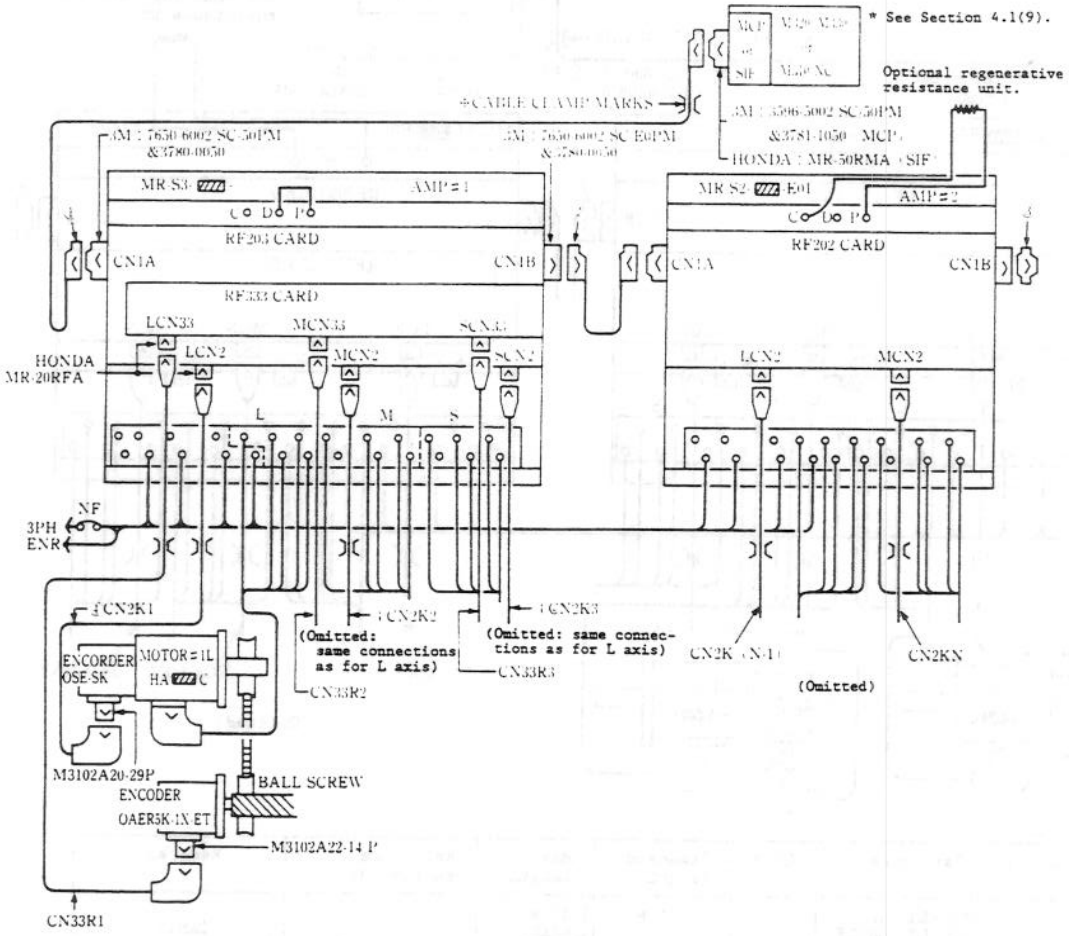


Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
5	AMP-ENC CABLE	N	5 m	20 m	Section 5.4.3	CN33K1-CN33KN

Note (1) N: total number of axes; but N < 6 (N < 4 with M310 NC system), K: Number of amplifiers.
Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (1 x 0.5) = 5.5 m.
Note (3) Make sure that the capacity of the L axis motor is equal to, or greater than, the capacity of the M axis motor.

APPENDIX 1.12 MR-S3-□□-Z33 CABLE DIAGRAM (Absolute value, ball screw end)

The diagram indicates a case where the first amplifier is MR-S3-□□□-Z33 and the second amplifier is MR-S2-□□-E01.



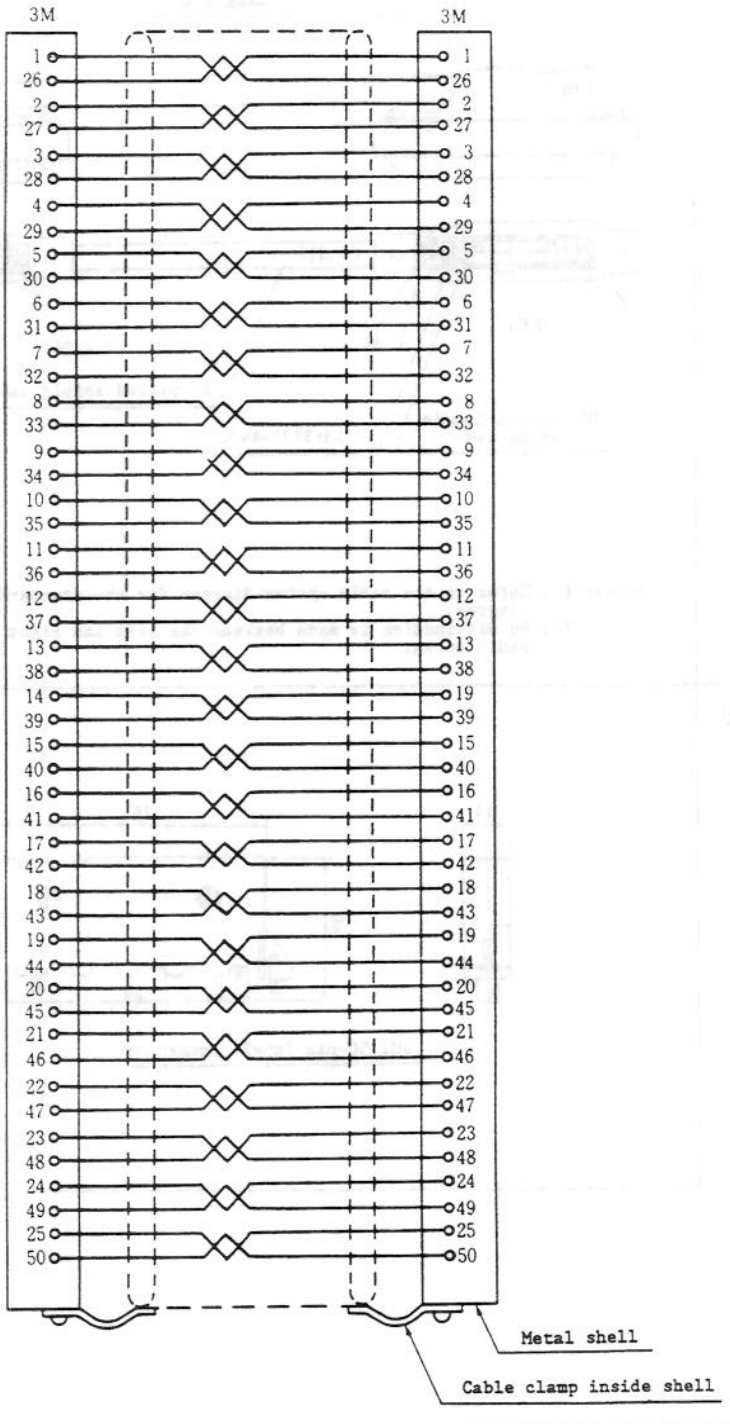
Part No.	Part name	Q'ty	Standard length	Max. length	Reference section No.	Remarks
1	MCP-AMP or SIF-AMP CABLE	1	5 m	30 m with total length	Section 5.3	CAM11 or CAM21
2	AMP-AMP CABLE	K-1	0.5 m			CAM11
3	CABLE END	1	-	-		RF54
4	AMP-ENC CABLE	N	5 m	50 m	Section 5.4.1	CN2K1-CN2KN
6	AMP-ENC CABLE	n	5 m	50 m	Section 5.4.2	CN33R1-CN33R2

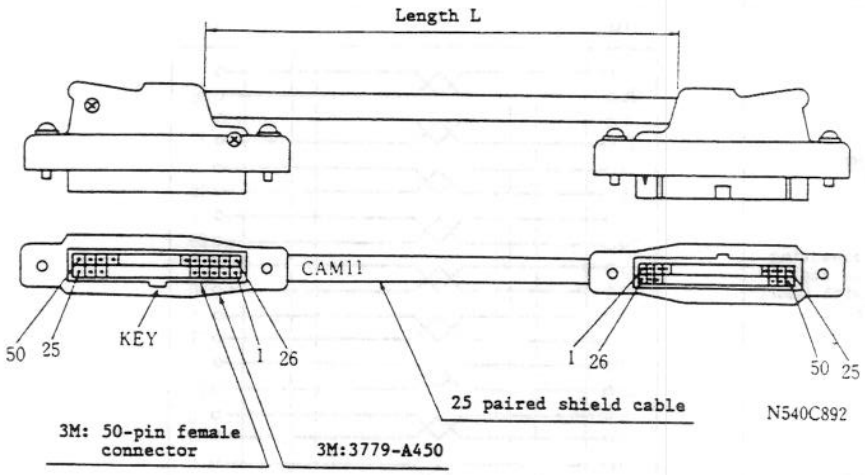
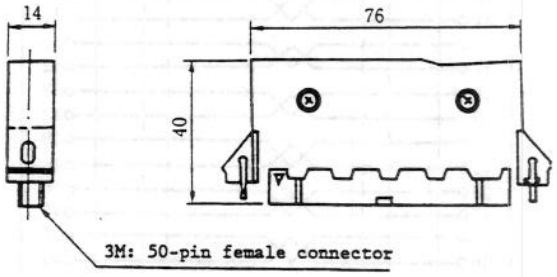
Note (1) N: total number of axes; n: Number of MR-S3-□□E31 axes; but N ≤ 6, N ≥ n (n = 1 in this figure), K: Number of amplifiers.

Note (2) Example of total length for cables with Part No. ① and ②: Standard length with 3 amplifiers is 1 x 5 + (2 x 0.5) = 6.0 m.

Note (3) Make sure that the capacity of the L axis motor is greater than the capacity of the M axis motor which in turn must be greater than the capacity of the S axis motor.

APPENDIX 2. CABLE SPECIFICATIONS

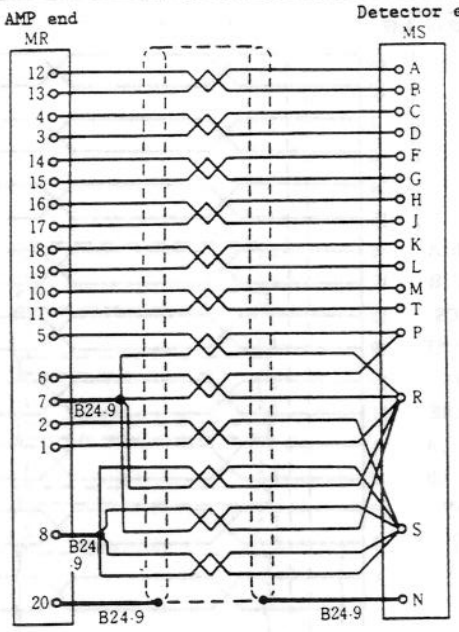
Cable	Specifications
CAN11 MCP-AMP CABLE || For connecting CN1A on amplifier with CAM11 on MCP AMP-AMP CABLE || For connecting CA1A on next amplifier with CN1B on amplifier	

Cable	Specifications
(CAN11 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	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

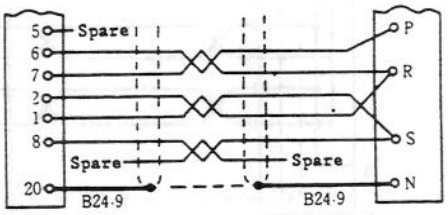
  Connector
  MS3108B20-29S

- Cable type

  F-DPEVSB 12P x 0.2SQ

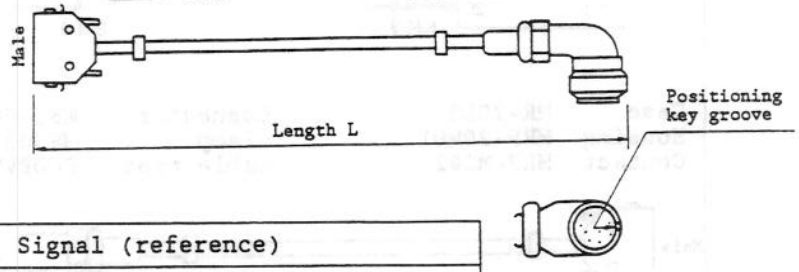
Maximum length = 50 m

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



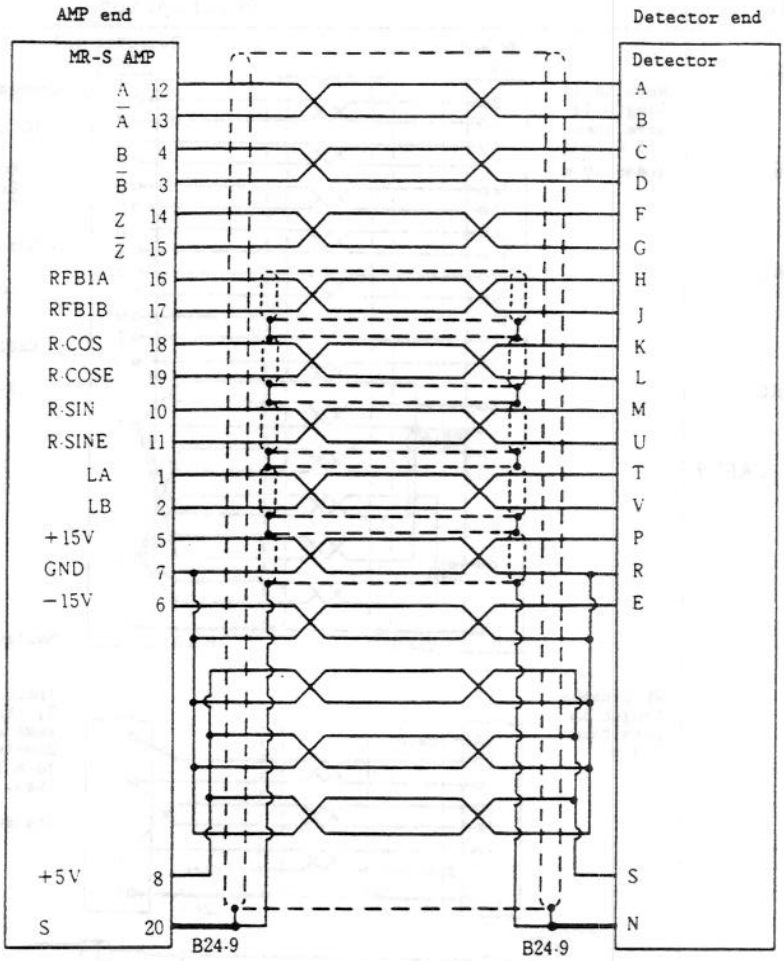
Signal (reference)

RF202 card nCN2 → OSE-5K

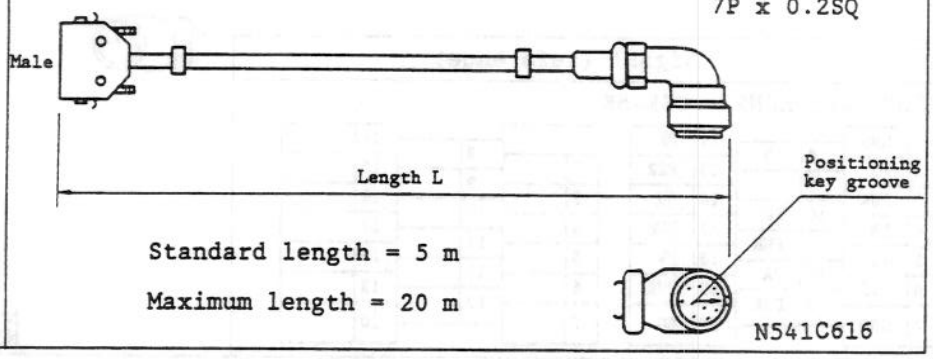
1	GND	8	+5	14	PZ	1		8		14	
2	+5	9		15	PZR	2		9		15	
3	PBR	10	PW	16	PU	3		10		16	
4	PB	11	PWR	17	PUR	4		11		17	
5	+15	12	PA	18	PV	5		12		18	
6	+15	13	PAR	19	PVR	6		13		19	
7	GND			20	SG	7				20	

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 x 0.2SQ



Standard length = 5 m

Maximum length = 20 m

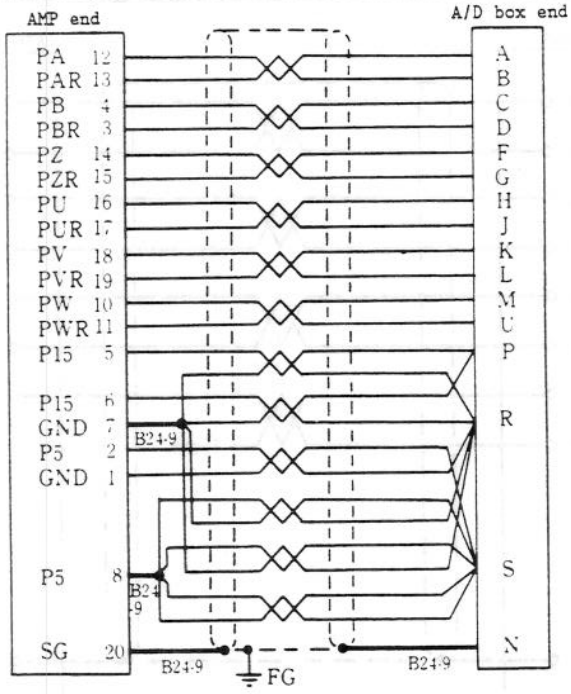
AMP-ENC CABLE (OSE5KN/OSE5KN-ET□ ONLY)

Cable	Description

CN2NK1
〜
CN2NK6

CN31NR1
〜
CN31NR6

AMR-ENC CABLE



Connector type

- MR connector

  Case MR-20L5
  Housing MRP-20M01
  Contact MRP-M102

- Cannon connector

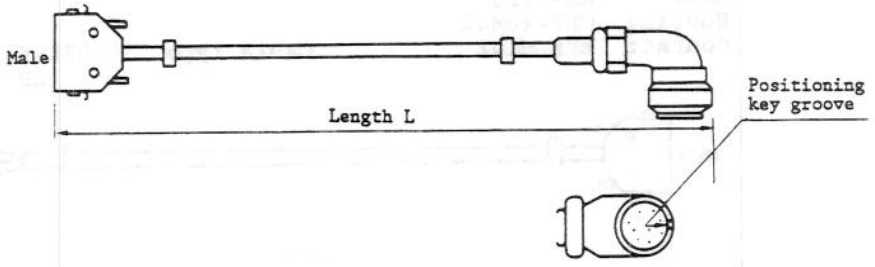
  Connector MS3108B22-14S
  Clamp MS3057-12A

- Cable type

  F-DPEVSB 12P x 0.2SQ

Maximum length = 50 m

Note) This cable is used for the 19-pin connector type standard encoder OSE5KN-6-12-108 and the 19-pin connector type ball screw mounting encoder OSE5KN-ET1-3-9.52-0 rather than the 17-pin connector type encoders OSE5K-6-12-108 and OSE5K-ET1-3-9.52-0 and the absolute value encoders OAER5K and OAER25K.



Signal (reference)

RF01 card CN2 → OSE 5KN

1	GND	8	P5	14	PZ
2	P5	9		15	PZR
3	PBR	10	PW	16	PU
4	PB	11	PWR	17	PUR
5	P15	12	PA	18	PV
6	P15	13	PAR	19	PVR
7	GND			20	SG

1	8	14	
2	9	15	
3	10	16	
4	11	17	
5	12	18	
6	13	19	
7		20	

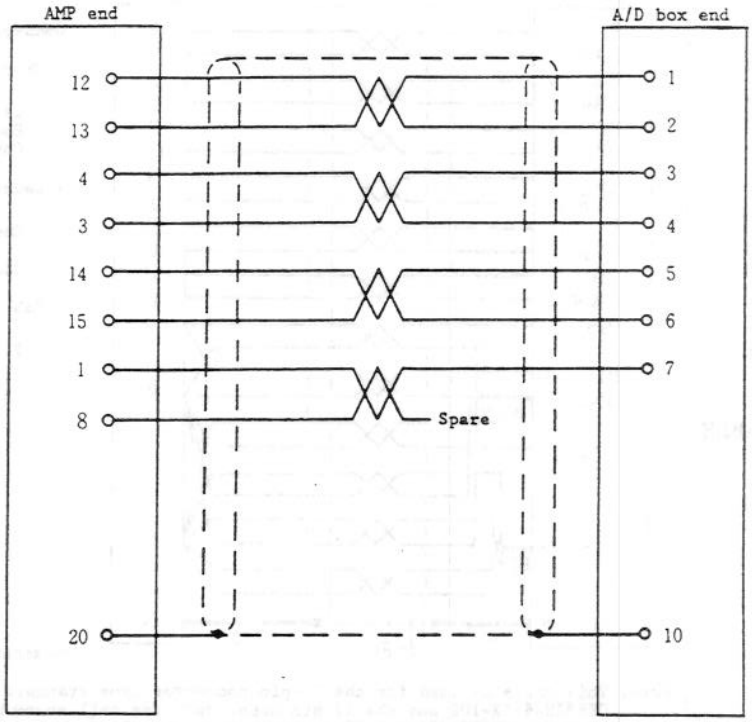
N541C671

AMP-A/D CABLE

Cable	Description

CN31M1
〜
CN31M6

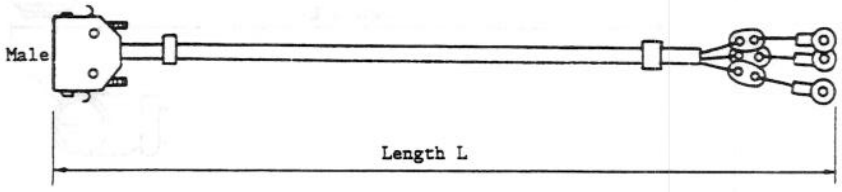
AMP-A/D CABLE



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 x 0.2SQ



Signal (reference)

RF312 card nCN31

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/C CN2

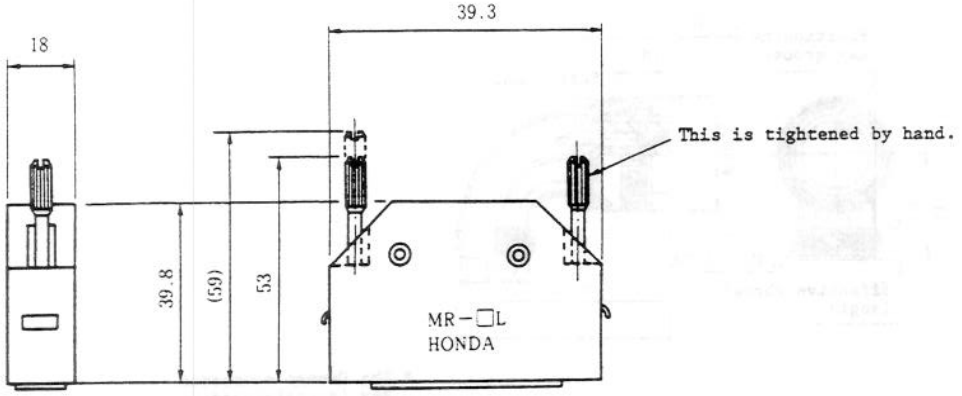
(1)	PA	(2)	PA
(3)	PB	(4)	PB
(5)	PZ	(6)	PZ
(7)	GP	(10)	SE
(12)	TSA	(13)	TSB
(15)	OH1	(16)	OH2

Since the plug JMSP21-16M at the other end is an accessory of the inductosyn system, no plug is supplied.

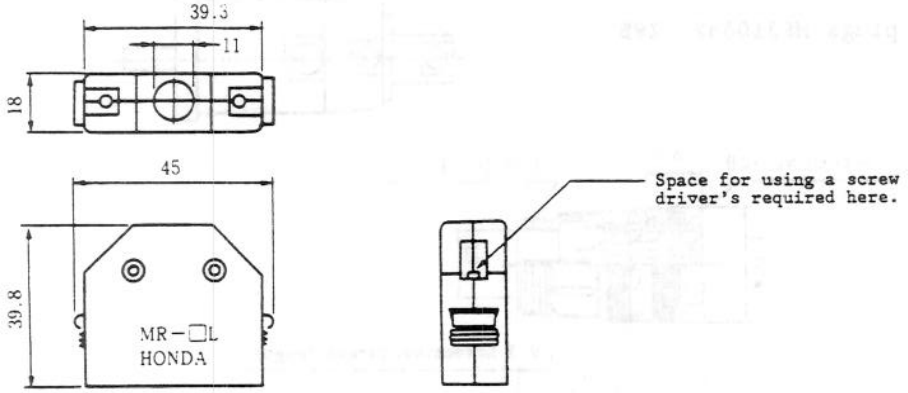
Standard length L = 50 m
Maximum length = 20 m

20-pin Square Connector (Honda)

(1) Connector case MR20L5



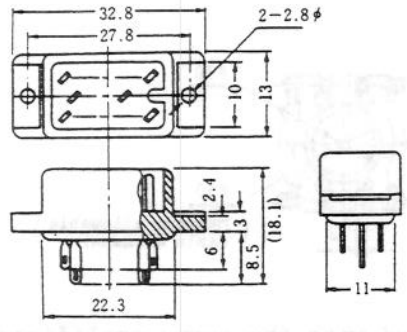
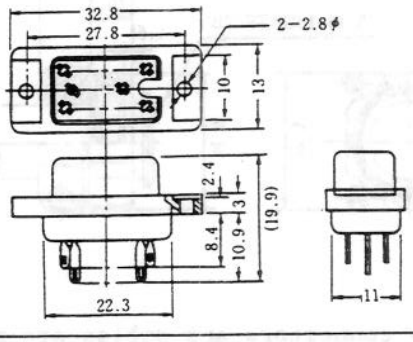
(2) Connector case MR-20L



(3) Soldering type of connectors

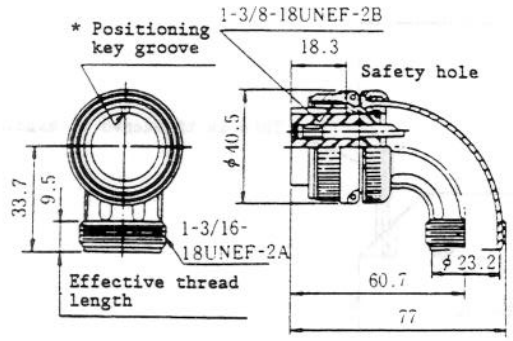
MR-20M

MR-20F

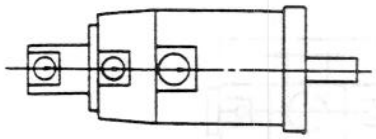
Soldering type/male connector	Soldering type/female connector
	

Cannon Plugs for Detectors (Japan Aviation Electronics)

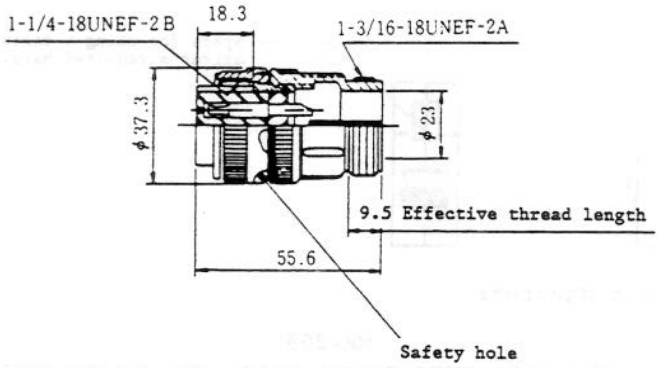
(1) Angular plugs MS3108B20-29S

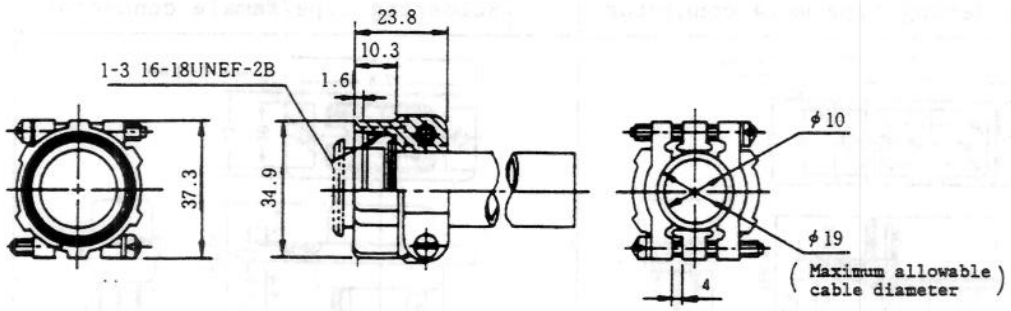


* The Cannon connector key is positioned in the motor flange direction.



(2) Straight plugs MS3106B20-29S

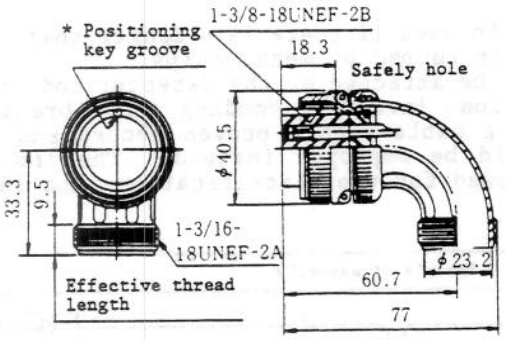




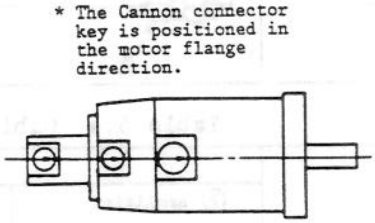
The connectors and cables are not provided with the servo amplifiers and motors.

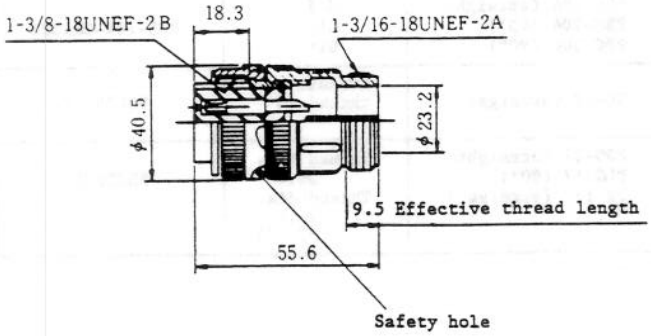
Cannon Plugs for Detectors (Japan Aviation Electronics)

(3) Angular plugs MS3108B22-14S



(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.

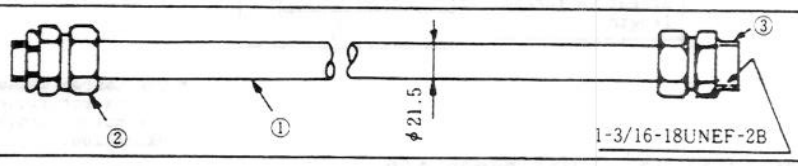
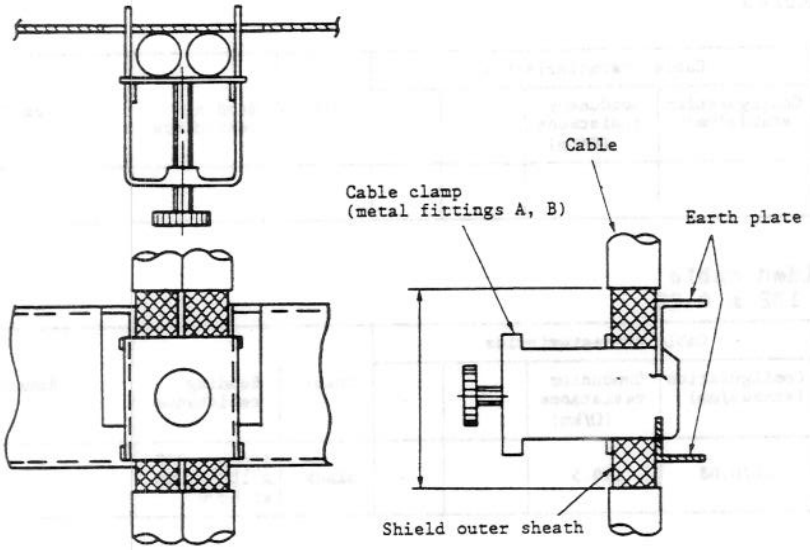
Application	Example of assembly
For motor detector	

Table 5.4 Cable selection examples

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

Cable Clamps

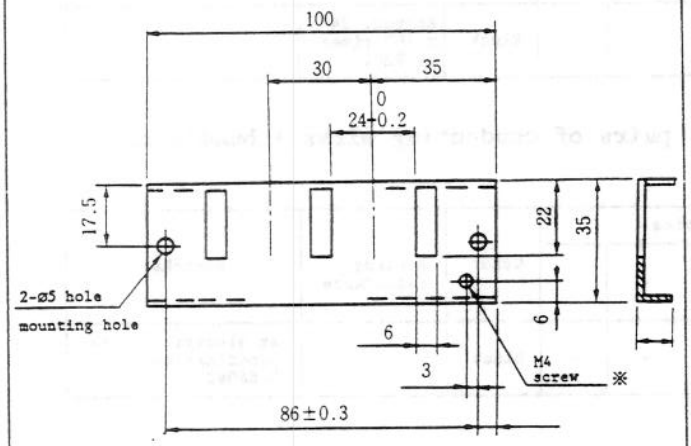
A earth plate for the detector cable should be installed near the servo amplifier and, as shown in the figure, part of the cable covering should be stripped away to leave the outer sheath exposed and this part should be pressed against the earth plate using the cable clamp. If the cables are thin, several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



Detail of clamping area

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

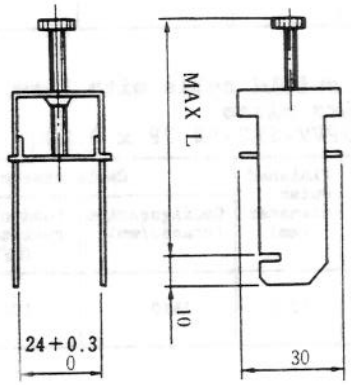
Outline drawing of earth plate (D)



- The grounding wire must be connected from the earth plate to the earth plate on the cabinet.
- Two metal fittings A can be used.

* Screw hole for connecting grounding wire to earth 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 to bending.
The tables below show the typical types of cables as manufactured by MITSUBISHI.

Shield cables
Name:

No. size (mm²)	Finished outer diameter (mm)	Cable characteristics				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	-	-			

12-paired shielded cable
Name: F-DPEVSB 12P x 0.2Q

No. size (mm²)	Finished outer diameter (mm)	Cable characteristics				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	-	-			
12 x 0.2	11.0	40/0.08	100.5	-	-	Black	Approx. 220 x 10^4 times at R200	

Paired shield cable with 7 twisted pairs of conducting wires
Name: F-DPVVSBS 7P x 0.2SQ

No. size (mm²)	Finished outer diameter (mm)	Cable characteristics				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	-	-			
7 x 0.2	12.3	26/0.1	107	-	-	Black	Approx. 24 x 10^4 times at R200	

Paired shield cable with 7 twisted pairs of conducting wires + bundle of non-pairs wires
Name: JPVV-SBS-SB 7P x 0.2SQ

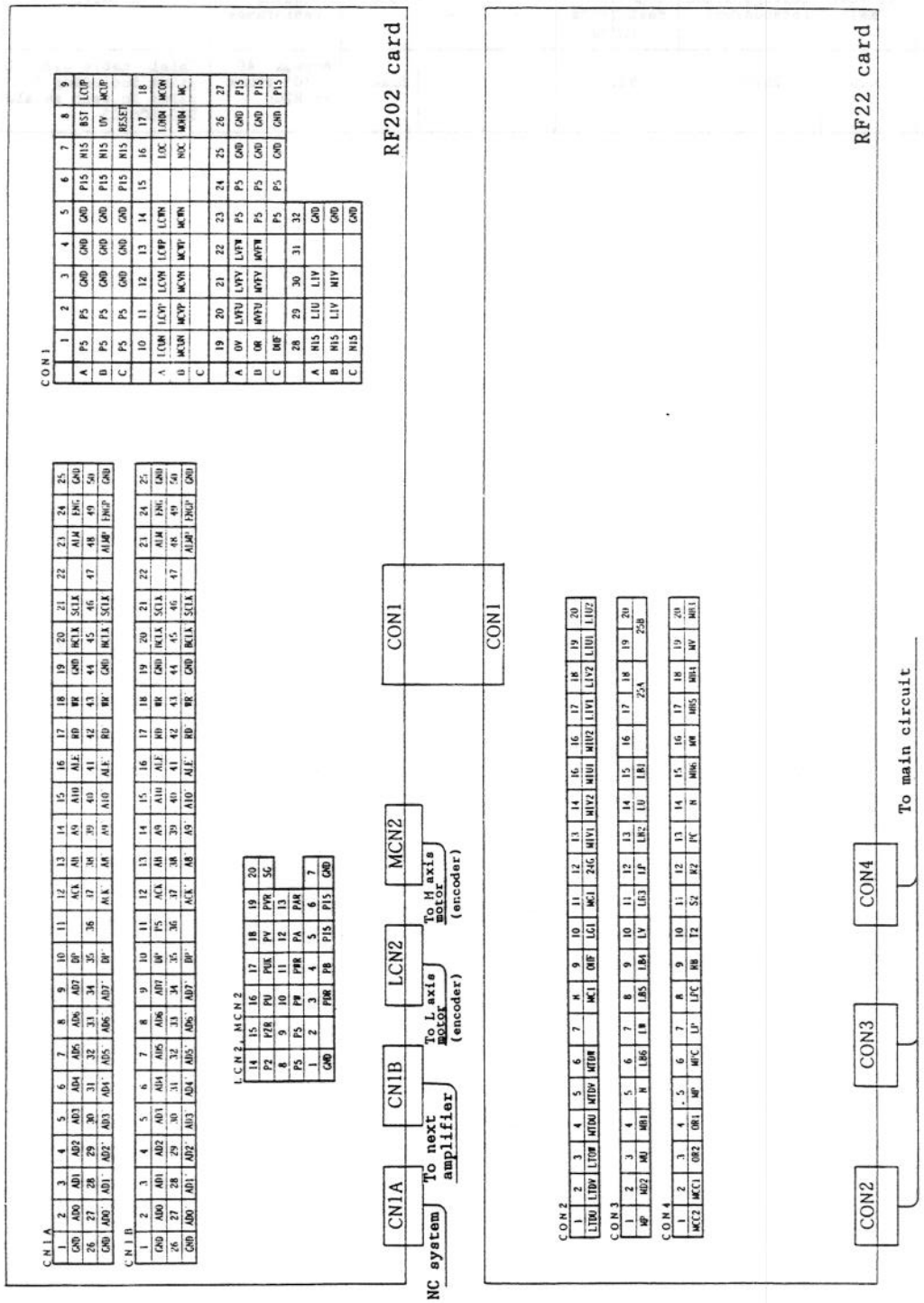
No. size (mm²)	Finished outer diameter (mm)	Cable characteristics				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	-	-			
7 x 0.2	13.0	26/0.1	107	-	-	Black		1st electrical work specifications TS-86062

Special shield cable
Name: F-DPVVSBS5P7P x 0.2SQ

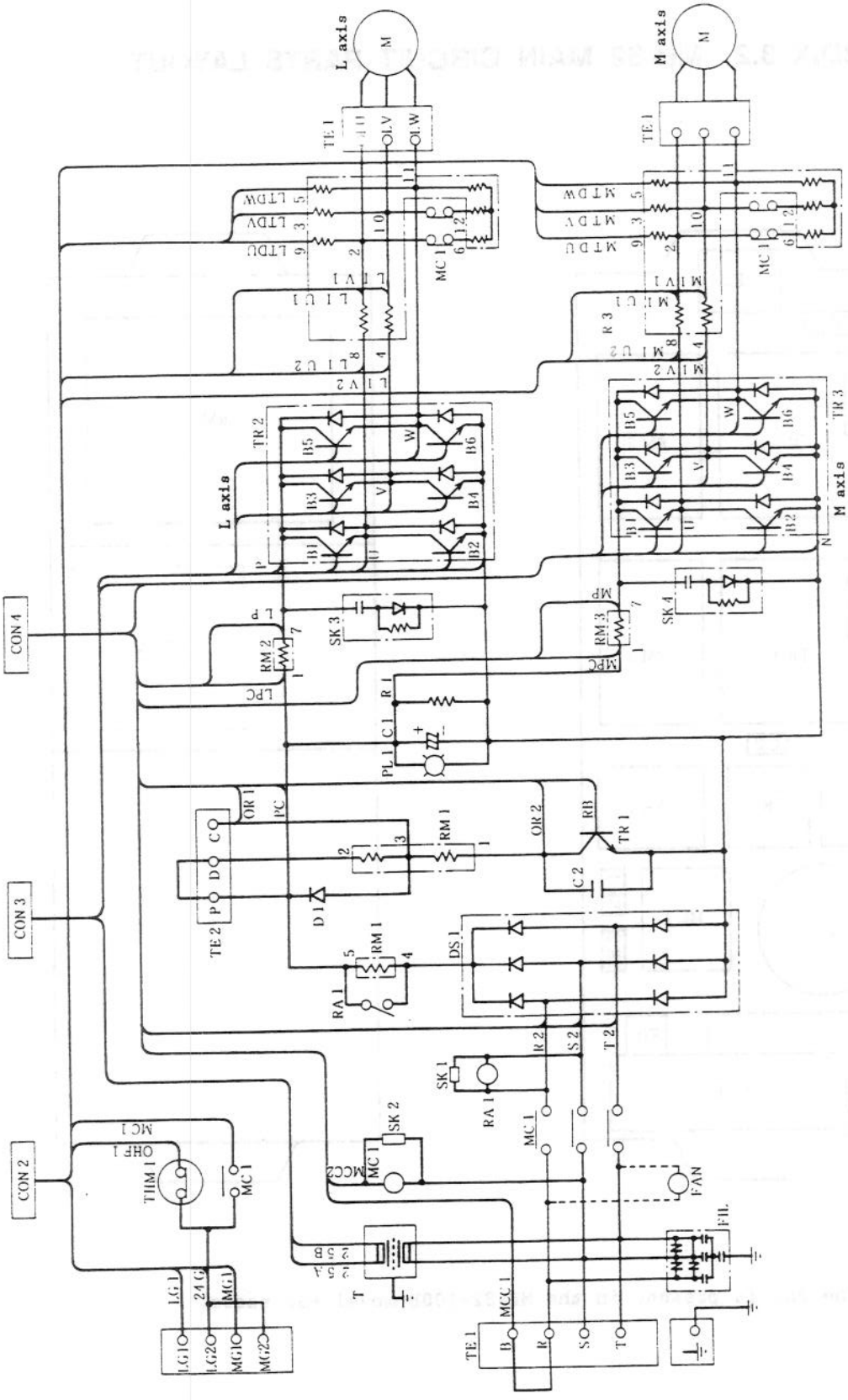
No. size (mm^2)	Finished outer diameter (mm)	Cable characteristics				Color	Bending resistance	Remarks
		Configuration (stands/mm)	Conductor resistance (Ω/km)	-	-			
5 x 0.2 7 x 0.2	14.0	26/0.1	93.9	-	-	Black	Approx. 40 x 10^4 times at R200	Shield cable with 12 pairs including 5 pairs in each shield BKO-NC6265

APPENDIX 3. MAIN CIRCUIT CONFIGURATION

APPENDIX 3.1 MAIN CIRCUIT CONFIGURATION OF MR-S2

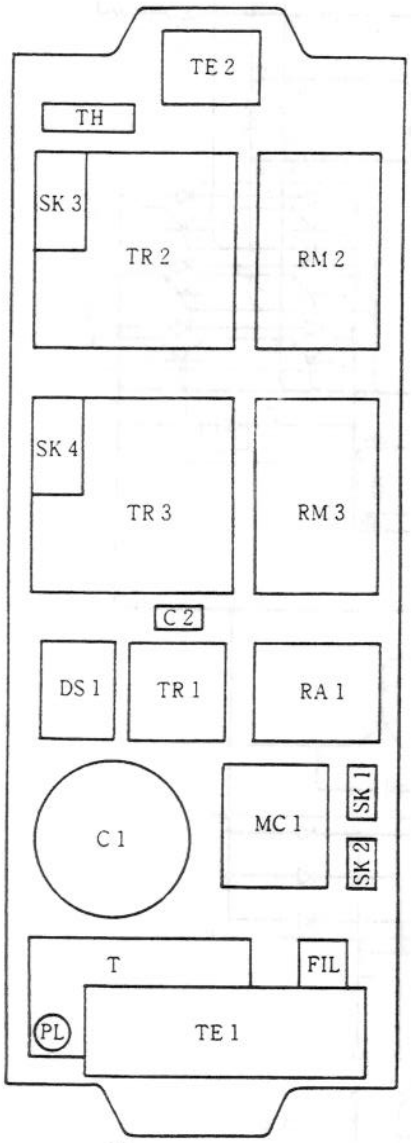


APPENDIX 3
MAIN CIRCUIT CONFIGURATION
APPENDIX 3.1 MAIN CIRCUIT
CONFIGURATION OF MR-S2

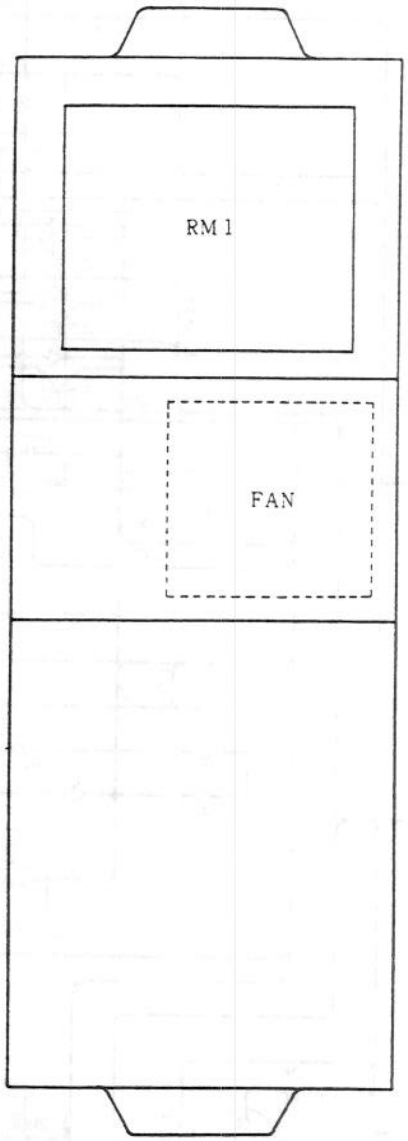


APPENDIX 3.2 MR-S2 MAIN CIRCUIT PARTS LAYOUT

TOP VIEW

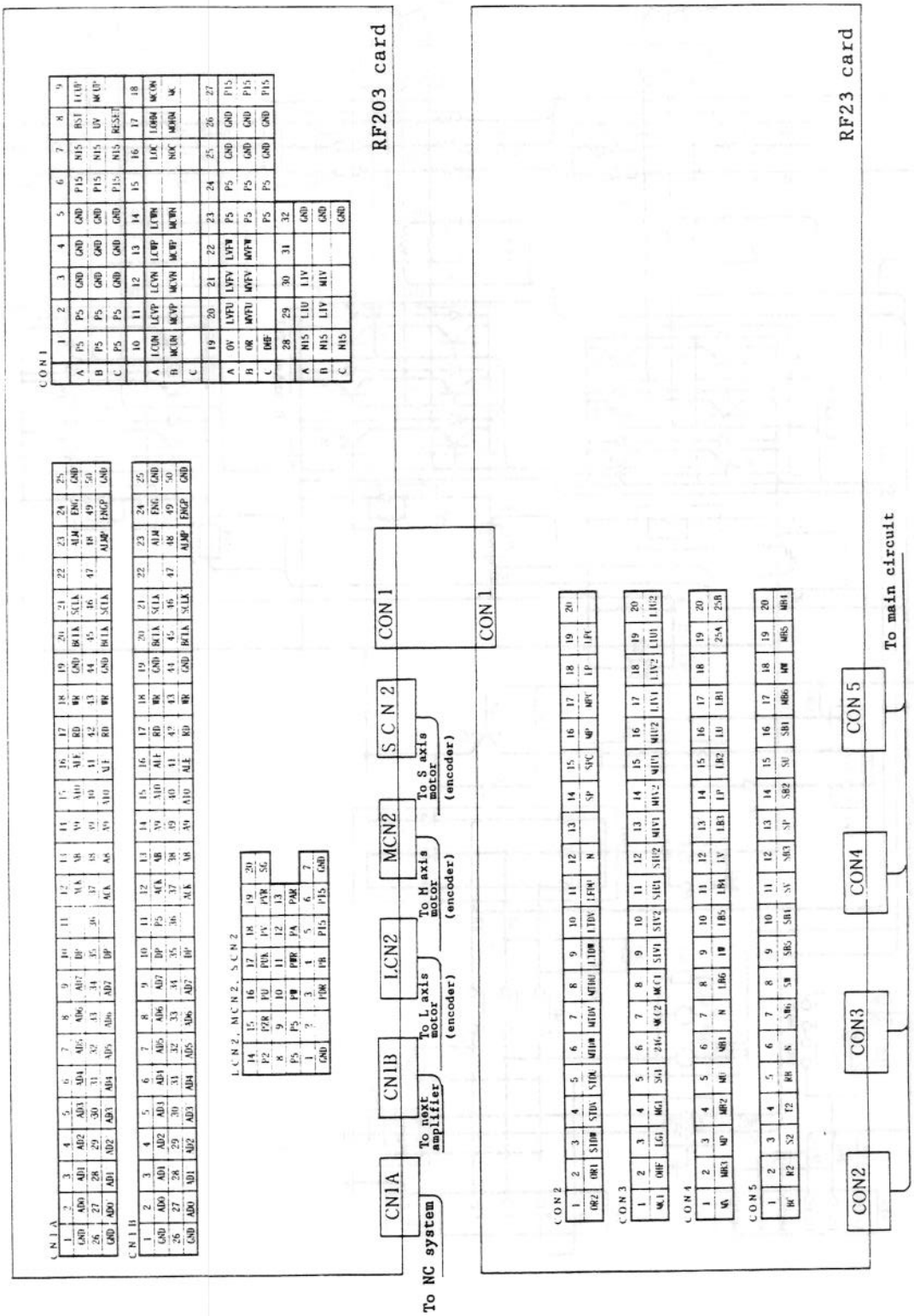


BOTTOM VIEW

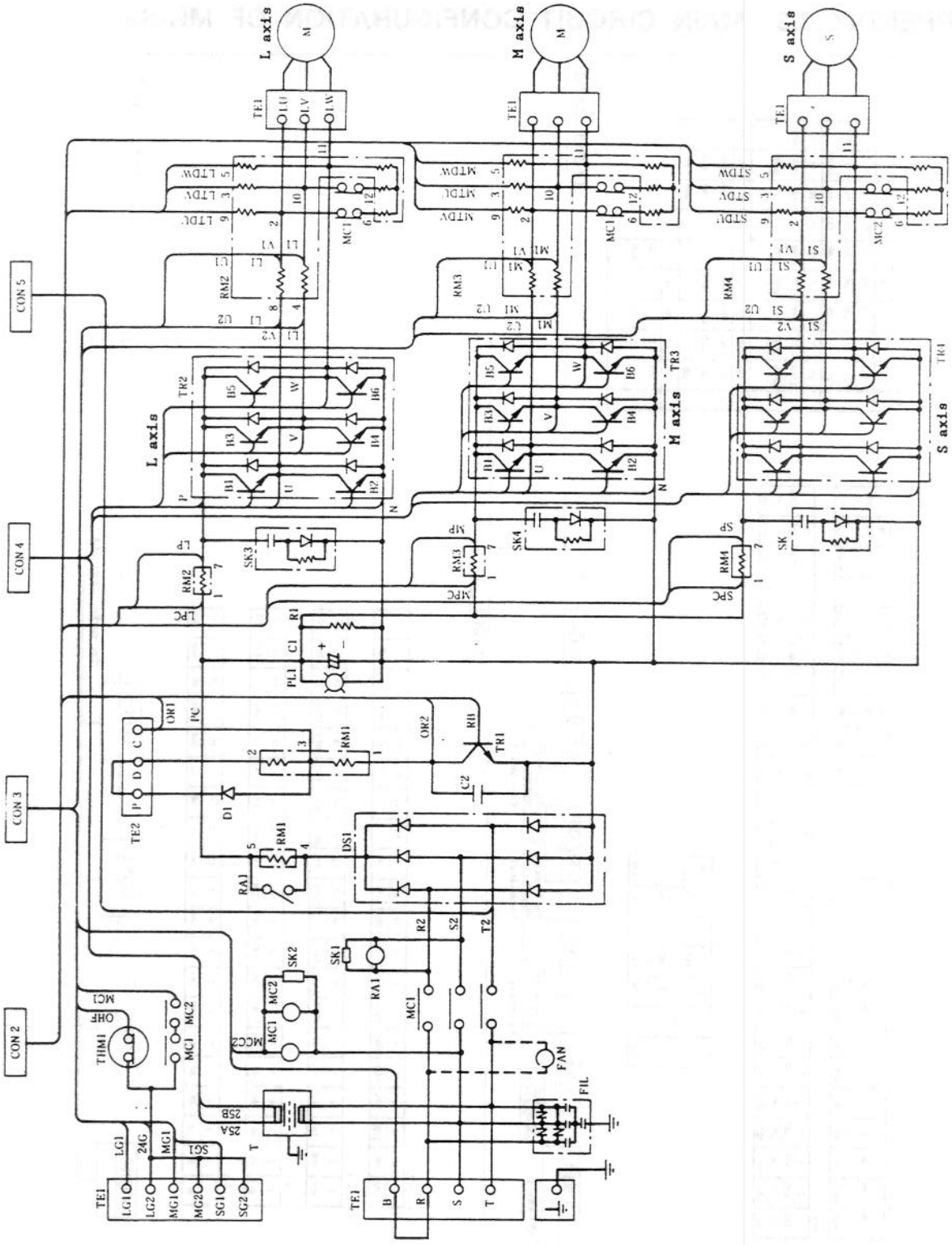


Note: The fan is present in the MR-S2-100B model and above.

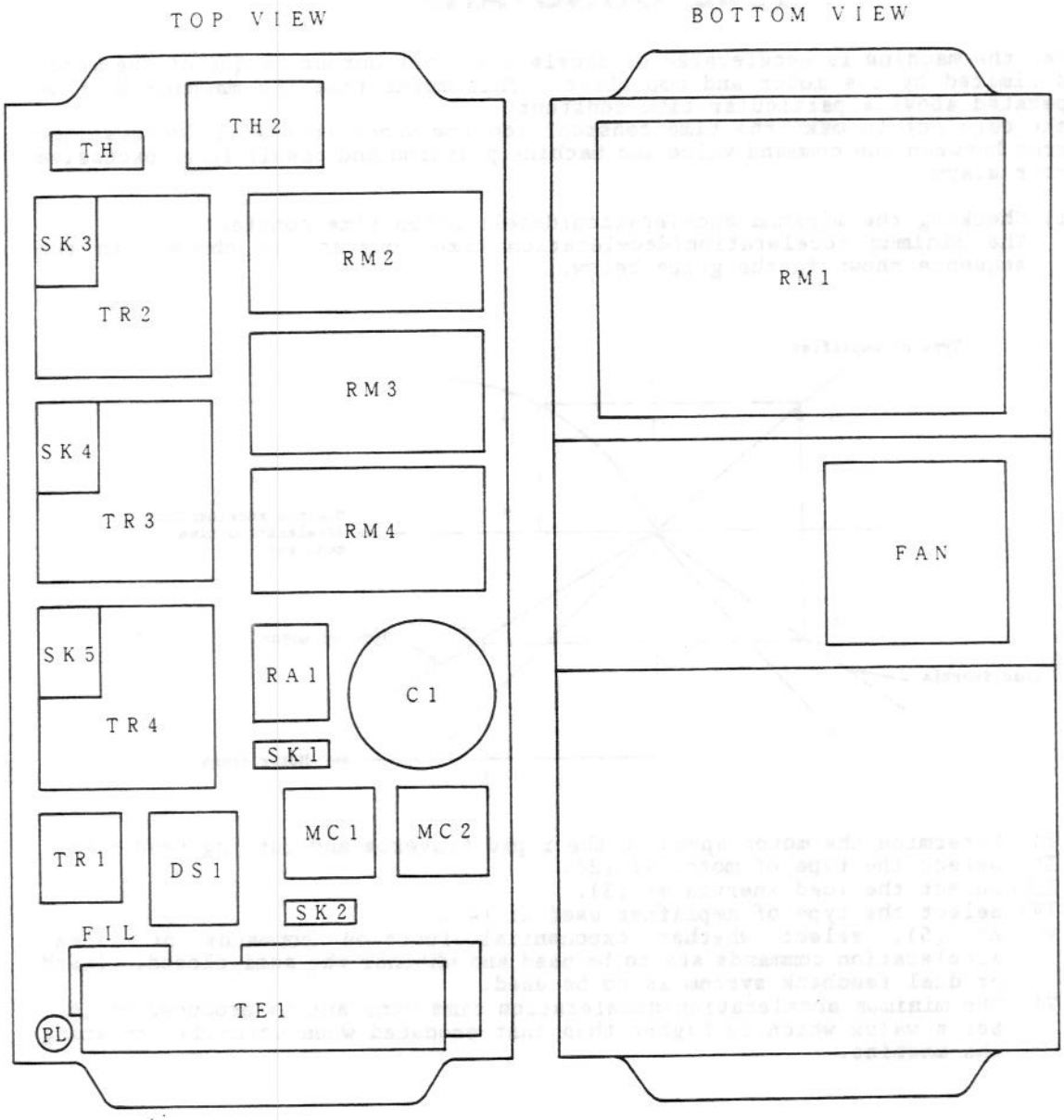
APPENDIX 3.3 MAIN CIRCUIT CONFIGURATION OF MR-S3



APPENDIX 3
MAIN CIRCUIT CONFIGURATION
APPENDIX 3.3 MAIN CIRCUIT CONFIGURATION OF MR-S3



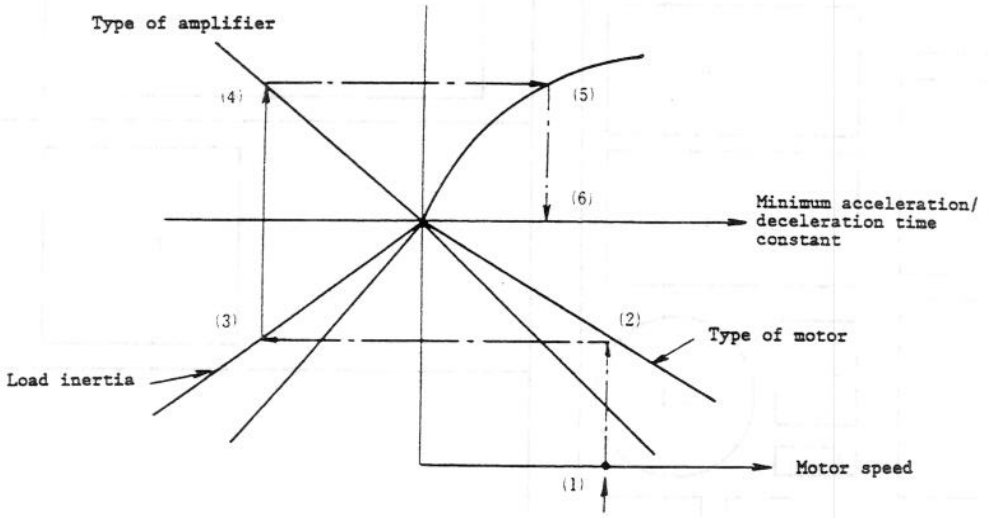
APPENDIX 3.4 MR-S3 MAIN CIRCUIT PARTS LAYOUT



APPENDIX 4 CHECKING THE MINIMUM ACCELERATION/DECELERATION TIME CONSTANT

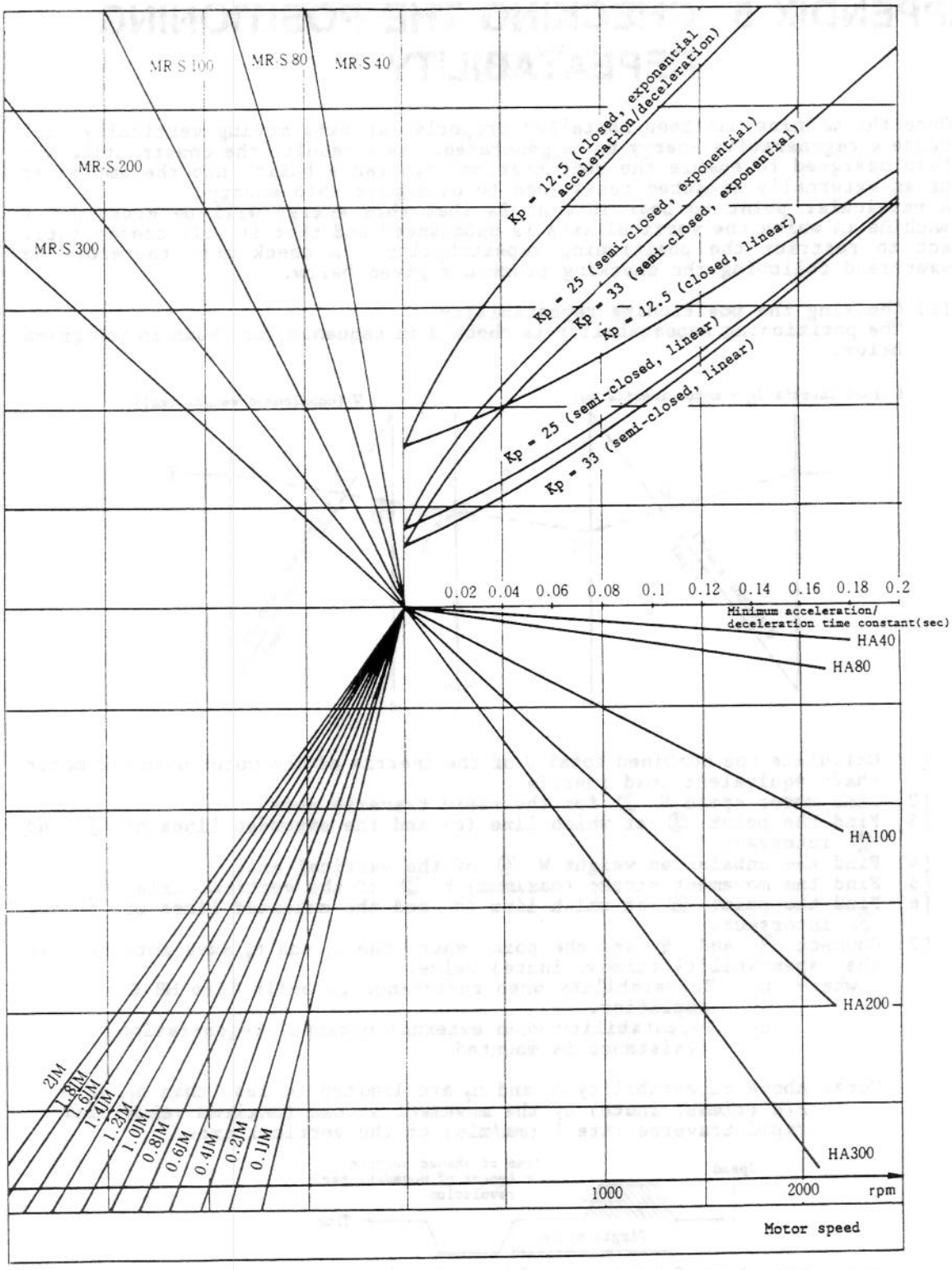
When the machine is accelerated or decelerated, the output torque of the motor is limited by the motor and amplifier. This means that the machine must be operated above a particular time constant.
Take care not to make the time constant too low since this will increase the error between the command value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

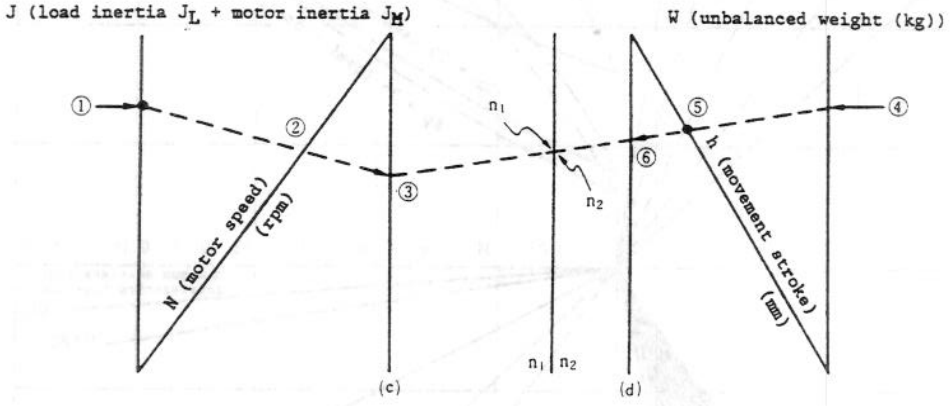
APPENDIX 4
CHECKING THE MINIMUM ACCELERATION/DECELERATION TIME CONSTANT



APPENDIX 5 CHECKING THE POSITIONING REPEATABILITY

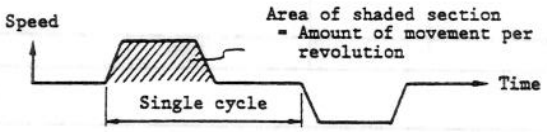
Once the machine has been installed properly, an axis moving vertically will cause a regenerative energy to be generated. As a result, the construction has been designed to enable the regeneration resistance built into the amplifier or an externally attached resistance to dissipate this energy.
A particular 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 positioning repeatability. A check must therefore be exercised following the checking procedure given below.

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



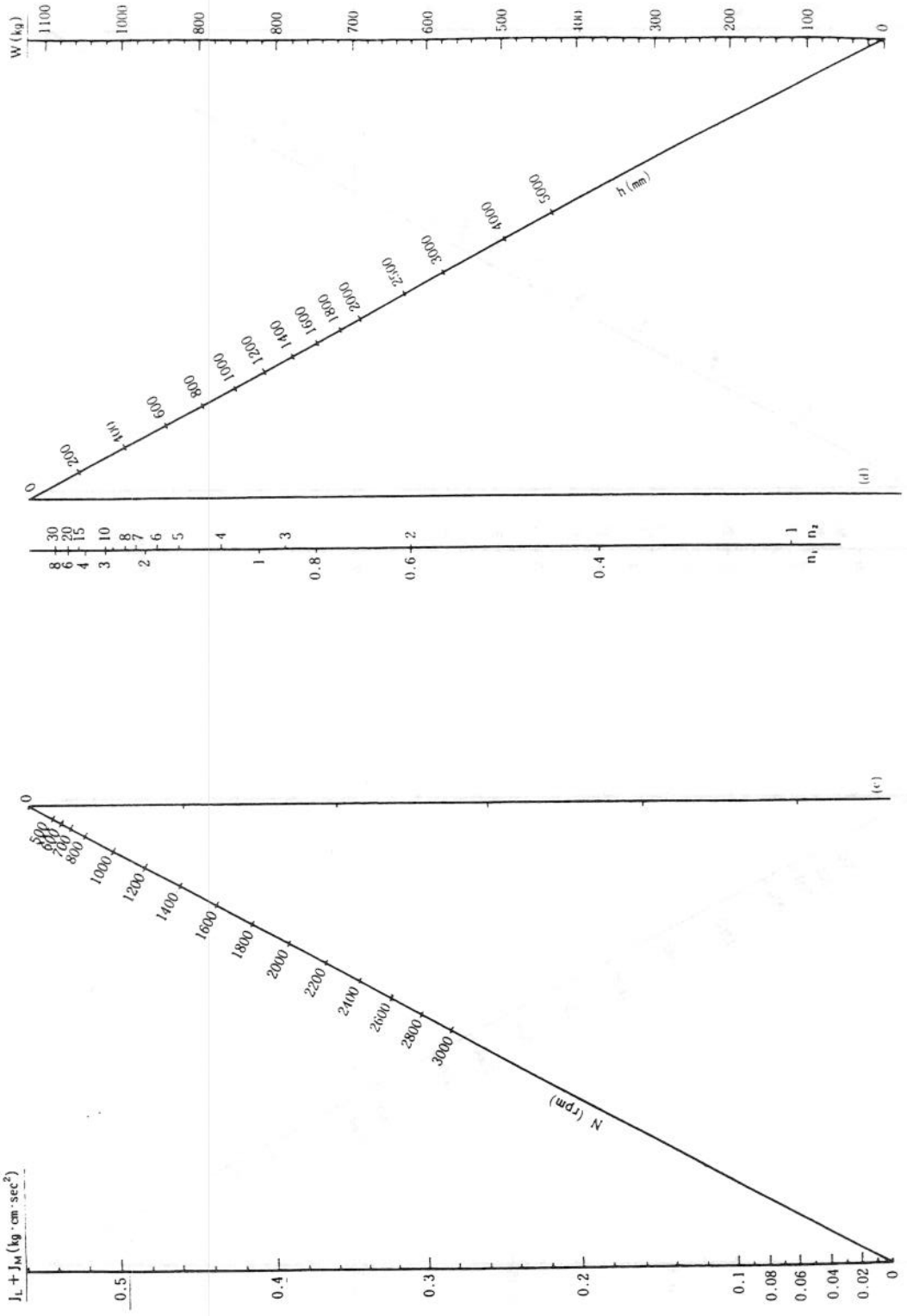
[1] Calculate the combined total J of the inertia of the motor used and motor shaft equivalent load inertia.
[2] Find motor speed N ② for the rapid traverse rate.
[3] Find the point ③ at which line (c) and the extended lines of ① and ② intersect.
[4] Find the unbalanced weight W ④ of the vertical axis.
[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 n_1 and n_2 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.

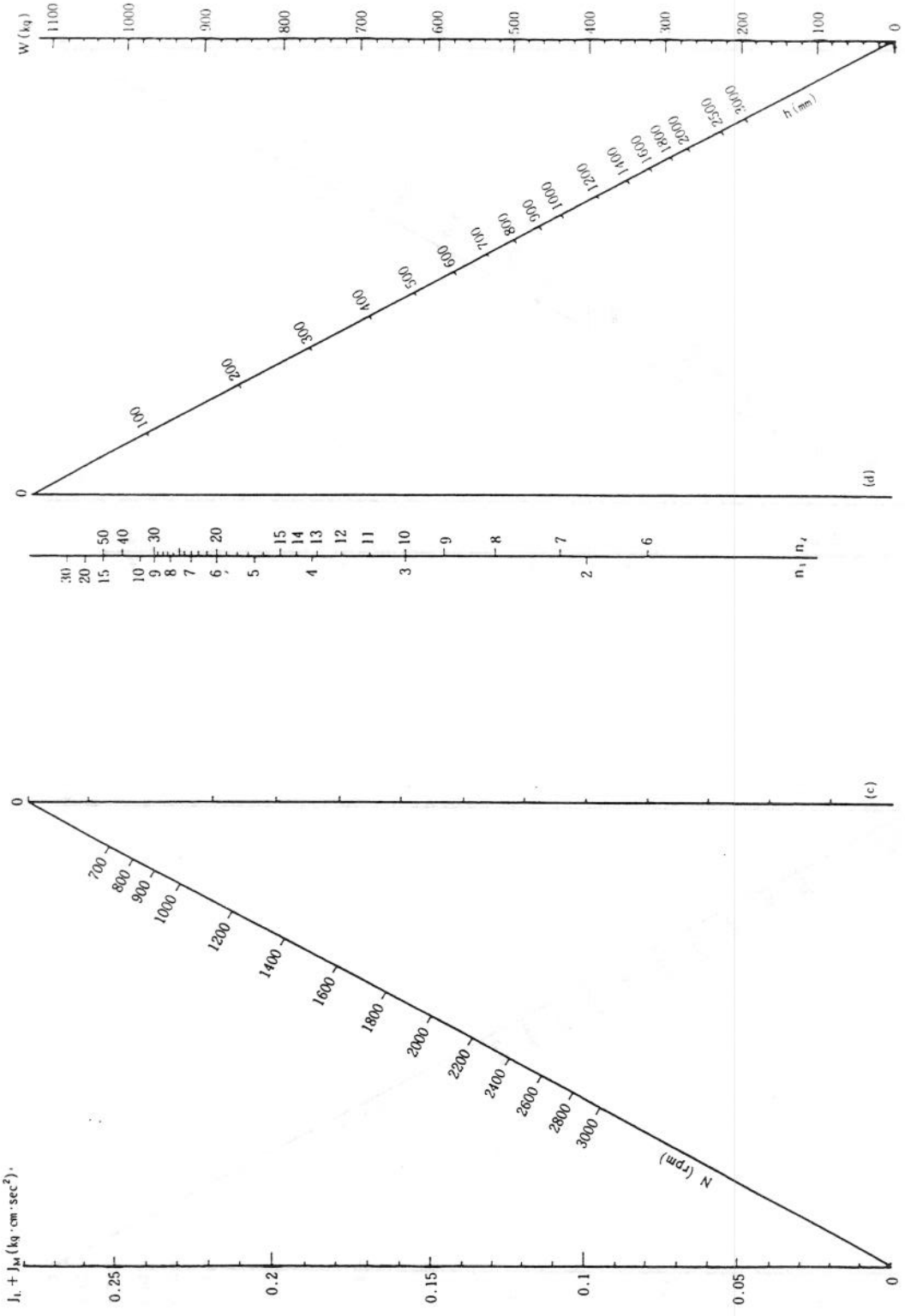


Note: The above frequency applies only when the motor of one axis has been moved.

(2) Computation graphs (J = 0 to 0.56 kg·cm·sec²)



(3) Computation graphs (J = 0 to 0.28 kg•cm•sec²)



(4) Check method using calculation formula
Use the following formula when employing a formula to check the positioning repeatability.

$$n = \sum_{i=Ⓛ,Ⓜ} \left\{ \frac{120W_R}{\frac{Ji}{100} \cdot \left(\frac{2\pi Ni}{60}\right)^2 \cdot g + Wi \cdot g \cdot \frac{hi}{100} \cdot 0.8} \right\}$$

where
n : Position repeatability (times/min)
J : Motor shaft equivalent inertia (kg·cm·sec²)
(J Ⓛ ; L axis, J Ⓜ : M axis, J: S axis)
$J = J_L + J_M$
J_L = Motor shaft equivalent load inertia (kg·cm·sec²)
J_M = Rotor inertia of motor used (kg·cm·sec²)
N : Rapid traverse motor speed (rpm)
(N Ⓛ : L axis, N Ⓜ : M axis, N Ⓢ : S axis)
g : 9.8 m/sec²
W : Unbalanced weight (kg)
(W Ⓛ : L axis, W Ⓜ : M axis, W Ⓢ : S axis)
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)
(h Ⓛ : L axis, h Ⓜ : M axis, h Ⓢ : S axis)
W_R : Allowable heat generation of regeneration resistance (W)

Standard specifications

2 axis type	MR-S2 80A and below		: 100W
	MR-S2 100B and above		: 140W
3 axis type	All series		: 200W

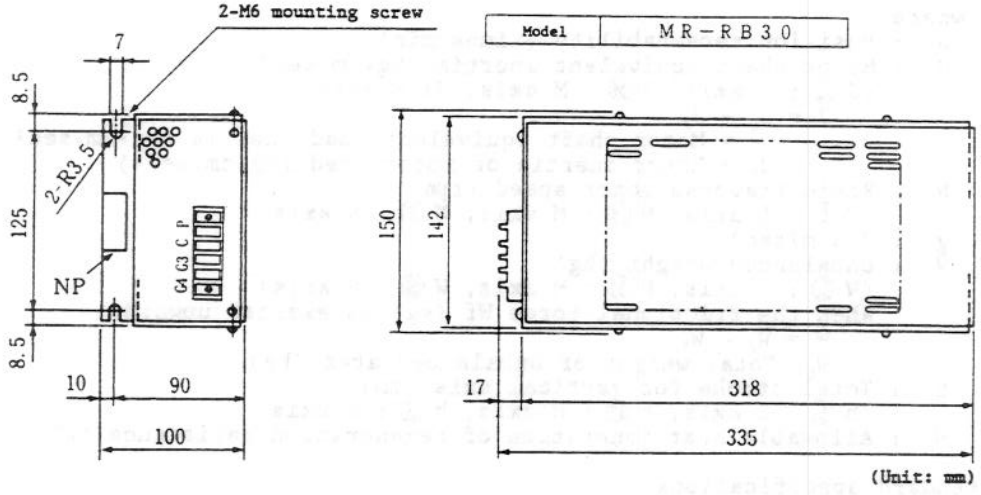
When optional regenerative resistance has been attached

2-axis type	Separate specifications	G8G200W39OHM x 3	: 250W
	Sheet-metal specifications	MR-RB30	
3-axis type	Sheet-metal specifications	MR-RB50	: 500W

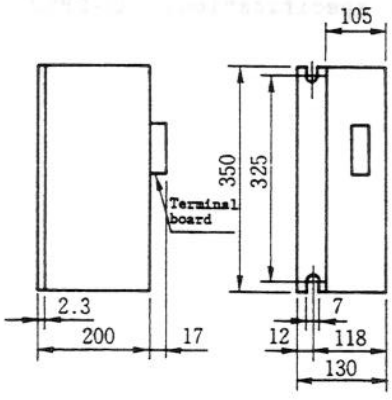
(5) Outline drawing of regeneration resistance

Note: The MR-RB30 and GZG200W390HMK are used for the MR-S2 series; the MR-RB50 is used for the MR-S3 series.

Model	Rated power	Resistance	Remarks
MR-RB30	250 W	13 ohms	Built-in thermostat



Model	Rated power	Resistance	Remarks
MR-RB50	450 W	13 ohms	Built-in thermostat



Note: Use the cooling fan (3.5 m/s or more, □92) for forced cooling.

APPENDIX 5
CHECKING THE POSITIONING REPEATABILITY

Mounting direction

Mount the unit in direction A or B as shown in the figure below.

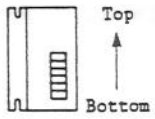


Fig. A

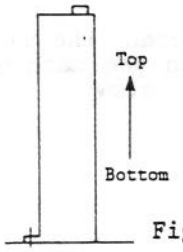
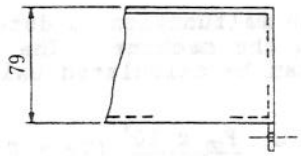
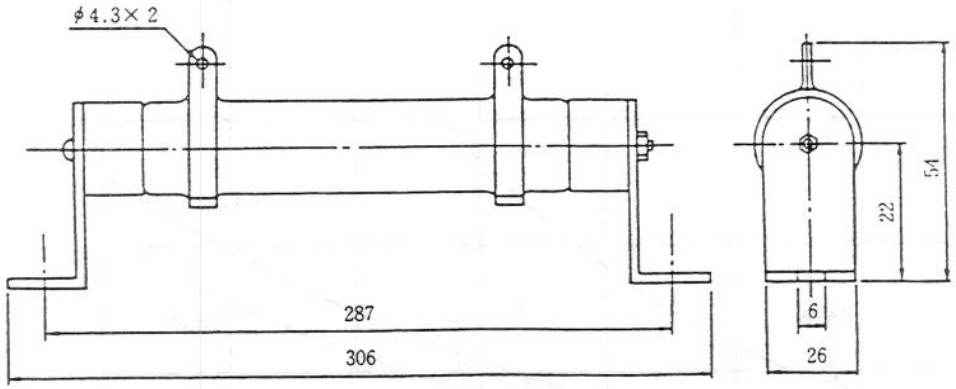


Fig. B



Model	Rated power	Resistance	Remarks
GZG200W390HMK	200 W	39 ohms	3 units connected in parallel for use



Three GZG200W390HMK units are required for one amplifier.
(Unit: mm)

APPENDIX 6 DETERMINING THE COASTING WITH EMERGENCY STOP

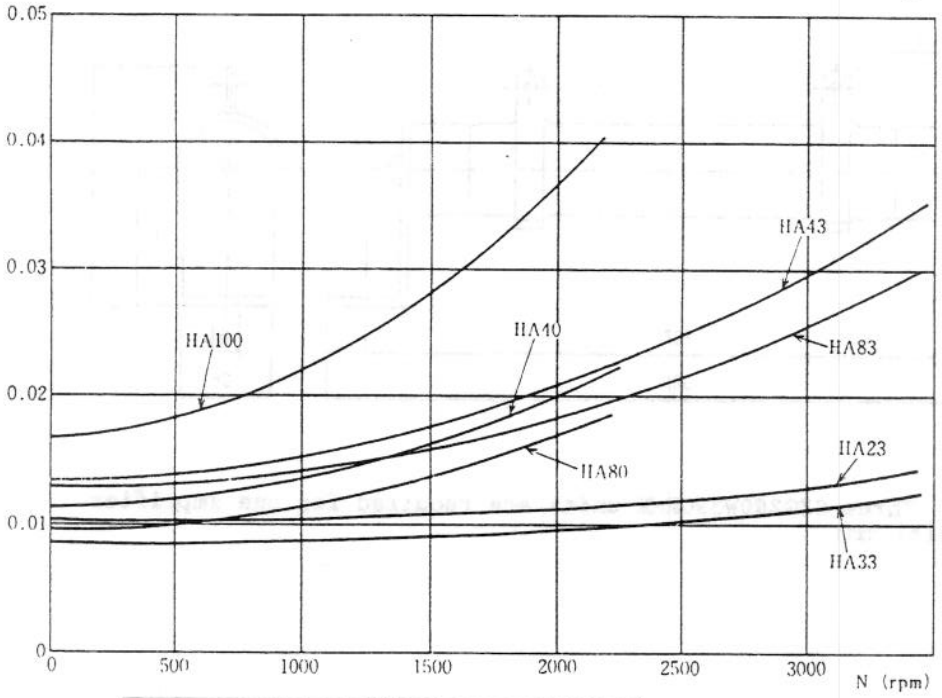
When the malfunction is detected by the system, the motor uses a dynamic brake to stop the machine. The amount by which the machine coasts at times like these can be calculated using the formula below.

$$L_{max} = \frac{F_{GO} \times 10^3}{60} (Te + 0.03) \text{ mm}$$

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

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
HA40/43	0.01
HA80/83	0.02
HA100	0.07

APPENDIX 7 SERVO MOTOR SPECIFICATIONS

Model name	Shaft end without oil seal Shaft end with oil seal	HA053 C-S	HA13 C-S	HA23 C-S	HA33 C-S	HA40 C-S	HA43 C-S	HA80 C-S	HA83 C-S	HA100C HA100 C-S	HA23 CB-S	HA33 CB-S	HA40 CB-S	HA80 CB-S	HA100 CB HA100 CB-S
Classification (1)(2)		○	○	○	○	○	*	○	*	○/*	*	*	*	*	*/*
Rated output (kW)	At 3000 rpm At 2000 rpm At 1000 rpm	0.05 - -	0.1 - -	0.18 - -	0.3 - -	- 0.5 0.28	0.5 0.43 0.26	- 1.0 0.56	1.0 0.86 0.52	- 2.0 1.22	0.18 - -	0.3 - -	- 0.5 0.28	- 1.0 0.56	- 2.0 1.22
Rated torque (kg-cm)	At 3000 rpm At 2000 rpm At 1000 rpm When stalled	1.63 - - 2.5	3.25 - - 5.0	5.8 - - 7	9.7 - - 12	- 24.4 27.2 30	16.3 20.9 25.4 30	- 48.7 54.4 60	32.5 41.7 50.8 60	- 97.4 118.7 140	5.8 - - 7	9.7 - - 12	- 24.4 27.2 30	- 48.7 54.4 60	- 97.4 118.7 140
Maximum speed (rpm)		3000	3000	3000	3000	2000	3000	2000	3000	2000	3000	3000	2000	2000	2000
Rotor inertia	J kg·cm·S²	1.88 x 10⁻⁴	3.65 x 10⁻⁴	0.001	0.002		0.010	0.020	0.020	0.070			0.011	0.021	0.074
	GD kg·cm²	0.74	1.43	3.92	7.84	39.2	39.2	78.4	78.4	274			41.9	81.1	291
Weight (incl. detector) kg		1.1	1.5	3.5	4.5	8	8	12	12	21	4.5	5.5	10	14	27
Ambient temperature (°C)		0 - 40					0 - 40				0 - 40				
Equipment	Thermal protector	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided	Provided
	Shaft end oil seal	Provided	Provided	Provided	Provided	Provided	Provided	Optional	Optional	Optional	Optional	Optional	Provided	Provided	Optional
	Motor end detector	OHE 2500-6-8		(3) User must designate brand of detector separately; (4) Standard direction A applies for Cannon connector of detector							Same as left				
	Electromagnetic brake (6)	None	None	None	None	None	None	None	None	None	DC24V7.4W 9 kg·cm		DC24V15W 60 kg·cm		DC24V 25W 300 kg·cm

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 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 and 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
	HA053 HA13 encoder	OHE 2500-6-8	3000	DC5V +0.25V -0.5V	A phase, B phase, 2500 P/R	Detecting machine's position (After gradual increase to 4-fold, 10000 P/R)
					Z phase, 1 P/R	Zero-point indexing
					U phase, V phase, W phase, 2 P/R	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, 20000 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, 20000 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, 20000 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)			30 m/min	Signal phase 100/110V	A phase, B phase, 0.004 mm/P	Detecting machine's position (After gradual increase to 4-fold, 0.001 mm P/R)
					Z phase, 2 mm/P	Zero-point indexing (grid width = 2 mm)

Note: 1. Regarding the servo system'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.)

HISTORY OF PAST REVISIONS/AMENDMENTS

Suffix	Month/Year	Revision or amendment
*	Nov.1987	Issue of maintenance manual
A	Feb.1988	A section on the GZG200W390HMK was added to the methods of connecting the optional regenerative resistance units in Section 3.4. Outline drawings of the GZG200W390HMK optional regenerative resistance unit were added in Appendix 5.
B	Sept.1988	Addition of MR-S3 Maintenance Manual; addition of MR-S2-13A.
C	1989	Change of model name according to the detector version up. OSE5K-6-8-108 → OSE5K-6-12-108
D	Feb.1990	Addition of MR-S3-40AA/33A Specification.

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