Mazak

Maintenance Manual
for
MDS-A, MDS-B & MDS-C1
AC Servo Amplifier & Spindle Controller
(Mitsubishi BNP-B2046C)
Publication # CMDSMA1100E

3/2001

CAUTION

This Manual is published to assist experienced personnel on the operation, maintenance and/or programming of Mazak machine tools.

All Mazak machine tools are engineered with a number of safety devices to protect personnel and equipment from injury or damage. Operators should not, however, rely solely upon these safety devices, but should operate the machine only after fully understanding what special precautions to take by reading the following documentation thoroughly.

Do not attempt to operate or perform maintenance / repair on the machine without a thorough understanding of the actions about to be taken. If any question exists, contact the nearest Mazak service center for assistance.

Certain covers, doors or safety guards may be open or removed to more clearly show machine components. These items must be in place before operating the machine. Failure to comply with this instruction may result in serious personal injury or damage to the machine tool.

This manual was considered complete and accurate at the time of publication, however, due to our desire to constantly improve the quality and specification of all Mazak products, it is subject to change or modification.

Notes:

SAFETY PRECAUTIONS

The machine is provided with a number of safety devices to protect personnel and equipment from injury and damage. Operators should not, however, rely solely upon these safety devices, but should operate the machine only after fully understanding what special precautions to take by reading the following documentation thoroughly.

• BASIC OPERATING PRACTICES

DANGER:

1) Some control panels, transformers, motors, junction boxes and other parts have high voltage terminals. These should not be touched or a severe electric shock may be sustained.
2) Do not touch any switches with wet hands. This too, can produce an electric shock.

WARNING:

1) The emergency stop pushbutton switch location should be well known, so that it can be operated at any time without having to look for it.
2) Before replacing a fuse, turn off the main incoming power switch to the machine.
3) Provide sufficient working space to avoid hazardous falls.
4) Water or oil can make floors slippery and hazardous. All floors should be clean and dry to prevent accidents
5) Do not operated any switch without a thorough understanding of the actions about to be taken.
6) Avoid accidental operation of switches.
7) Work benches near the machine must be strong enough to hold materials placed on them to prevent accidents. Articles should be prevented from slipping off the bench surface.
8) If a job is to be done by two or more persons, coordinating signals should be given at each step of the operation. The next step should not be taken unless a signal is given and acknowledged.

CAUTION:

1) In the event of power failure, turn off the main circuit breaker immediately.
2) Use the recommended hydraulic oils, lubricants and grease or acceptable equivalents.
3) Replacement fuses should have the proper current ratings.
4) Protect the NC unit, operating panel, electric control panel, etc. from shocks, since this could cause a failure or malfunction.
5) Do not change parameters or electrical settings. If changes are unavoidable, record the values prior to the change so that they can be returned to their original settings, if necessary.
6) Do not deface, scratch or remove any caution plate. Should it become illegible or missing, order another caution plate from the supplier, specifying the part number shown at the lower right corner of the plate.

• BEFORE POWERING UP

DANGER:

Cables, cords or electric wires whose insulation is damaged can produce current leaks and electric shocks. Before using, check their condition.

WARNING:

1) Be sure the instruction manual and the programming manual are fully understood before operating the machine. Every function and operating procedure should be completely clear.
2) Use approved oil resistant safety shoes, safety goggles with side covers, safe clothes, and other safety protection required.
3) Close all NC unit, operating panel, electric control panel doors and covers.

CAUTION:

1) The power cable from the factory feeder switch to the machine main circuit breaker should have a sufficient sectional area to handle the electric power used.
2) Cables which must be laid on the floor must be protected from hot chips, by using rigid or other approved conduit, so that short-circuits will not occur.
3) Before first time operation of the machine after unpacking it or from being idle for a long period of time (several days or more), each sliding part must be sufficiently lubricated. To do so, push and release the pump button several times until the oil seeps out on the sliding parts. The pump button has a return spring, so do not force it to return.
4) Oil reservoirs should be filled to indicated levels. Check and add oil, if needed.
5) For lubrication points, oil specification and appropriate levels, see the various instruction plates.
6) Switches and levers should operate smoothly. Check that they do.
7) When powering the machine on, turn on the switches in the following order: first the factory feeder switch, then the machine main circuit breaker, and then the control power on switch located on the operating panel.
8) Check the coolant level, and add coolant, if needed.

• **AFTER CONTROL POWER IS TURNED ON**

CAUTION:

When the control power “ON” switch on the operating panel is on, the "READY" lamp on the operating panel should also be on (check to see that it is).

• **ROUTINE INSPECTIONS**

WARNING:

When checking belt tensions, do not get your fingers caught between the belt and pulley.

CAUTION:

1) Check pressure gages for proper readings.
2) Check motors, gear boxes and other parts for abnormal noises.
3) Check the motor lubrication, and sliding parts for evidence of proper lubrication.
4) Check safety covers and safety devices for proper operation.
5) Check belt tensions. Replace any set of belts that have become stretched with a fresh matching set.

• **WARM UP**

CAUTION:

1) Warm up the machine, especially the spindle and feed shaft, by running the machine for 10 to 20 minutes at about one-half or one-third the maximum speed in the automatic operation mode.
2) The automatic operation program should cause each machine component to operate. At the same time, check their operations.
3) Be particularly careful to warm up the spindle which can turn above 4000 rpm.

   If the machine is used for actual machining immediately after being started up following a long idle period, the sliding parts may be worn due to the lack of oil. Also, thermal expansion of the machine components can jeopardize machining accuracy. To prevent this condition, always make sure that the machine is warmed up.

• **PREPARATIONS**

WARNING:

1) Tooling should conform to the machine specifications, dimensions and types.
2) Replace all seriously worn tools with new ones to prevent injuries.
3) The work area should be adequately lighted to facilitate safety checks.
4) Tools and other items around the machine or equipment should be stored to ensure good footing and clear aisles.
5) Do not place tools or any other items on the headstock, turret, covers and similar places (For T/M).

CAUTION:

1) Tool lengths should be within specified tolerances to prevent interference.
2) After installing a tool, make a trial run.

• **OPERATION**

WARNING:

1) Do not work with long hair that can be caught by the machine. Tie it back, out of the way.
2) Do not operate switches with gloves on. This could cause mis-operation.
3) Whenever a heavy workpiece must be moved, if there is any risk involved, two or more people should work together.
4) Only trained, qualified workers should operate forklift trucks, cranes or similar equipment and apply slings.
5) Whenever operating a forklift truck, crane or similar equipment, special care should be taken to prevent collisions and damage to the surroundings.
6) Wire ropes or slings should be strong enough to handle the loads to be lifted and should conform to the mandatory provisions.
7) Grip workpieces securely.
8) Stop the machine before adjusting the coolant nozzle at the tip.
9) Never touch a turning workpiece in the spindle with bare hands, or in any other way.
10) To remove a workpiece from the machine other than by a pallet changer, stop the tool and provide plenty of distance between the workpiece and the tool (for M/C).
11) While a workpiece or tool is turning, do not wipe it off or remove chips with a cloth or by hand. Always stop the machine first and then use a brush and a sweeper.
12) Do not operate the machine with the chuck and front safety covers removed (For T/M).
13) Use a brush to remove chips from the tool tip, do not use bare hands .
14) Stop the machine whenever installing or removing a tool.
15) Whenever machining magnesium alloy parts, wear a protective mask.

CAUTION:

1) During automatic operation, never open the machine door. Machines equipped with the door interlock will set the program to single step.
2) When performing heavy-duty machining, carefully prevent chips from being accumulated since hot chips from certain materials can cause a fire.

• TO INTERRUPT MACHINING

WARNING:

When leaving the machine temporarily after completing a job, turn off the power switch on the operation panel, and also the main circuit breaker.

• COMPLETING A JOB

CAUTION:

1) Always clean the machine or equipment. Remove and dispose of chips and clean cover windows, etc.
2) Make sure the machine has stopped running, before cleaning.
3) Return each machine component to its initial condition.
4) Check the wipers for breakage. Replace broken wipers.
5) Check the coolant, hydraulic oils and lubricants for contamination. Change them if they are seriously contaminated.
6) Check the coolant, hydraulic oil and lubricant levels. Add if necessary.
7) Clean the oil pan filter.
8) Before leaving the machine at the end of the shift, turn off the power switch on the operating panel, machine main circuit breaker and factory feeder switch in that order.

• SAFETY DEVICES

1) Front cover, rear cover and coolant cover.
2) Chuck barrier, tail barrier and tool barrier (NC software).
3) Stored stroke limit (NC software).
4) Emergency stop pushbutton switch.

• MAINTENANCE OPERATION PREPARATIONS

1) Do not proceed to do any maintenance operation unless instructed to do so by the foreman.
2) Replacement parts, consumables (packing, oil seals, O rings, bearing, oil and grease, etc.) Should be arranged in advance.
3) Prepare preventive maintenance and record maintenance programs.

CAUTION:

1) Thoroughly read and understand the safety precautions in the instruction manual.
2) Thoroughly read the whole maintenance manual and fully understand the principles, construction and precautions involved.

• MAINTENANCE OPERATION

DANGER:

1) Those not engaged in the maintenance work should not operate the main circuit breaker or the control power "ON" switch on the operating panel. For this purpose, "Do not Touch the Switch, Maintenance Operation in Progress!" or similar warning should be indicated on such switches and at any other appropriate locations. Such indication should be secured by a semi-permanent means in the reading direction.
2) With the machine turned on, any maintenance operation can be dangerous. In principle, the main circuit breaker should be turned off throughout the maintenance operation.

WARNING:

1) The electrical maintenance should be done by a qualified person or by others competent to do the job. Keep close contact with the responsible person. Do not proceed alone.
2) Overtravel limit and proximity switches and interlock mechanisms including functional parts should not be removed or modified.
3) When working at a height, use steps or ladders which are maintained and controlled daily for safety.
4) Fuses, cables, etc. made by qualified manufacturers should be employed.

• BEFORE OPERATION & MAINTENANCE BEGINS

WARNING:

1) Arrange things in order around the section to receive the maintenance, including working environments. Wipe water and oil off parts and provide safe working environments.
2) All parts and waste oils should be removed by the operator and placed far enough away from the machine to be safe.

CAUTION:

1) The maintenance person should check that the machine operates safely.
2) Maintenance and inspection data should be recorded and kept for reference.

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WARNING

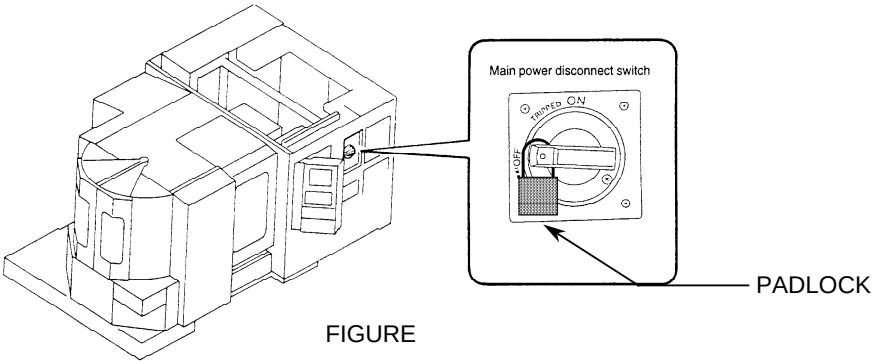
ALWAYS TURN THE MAIN CIRCUIT BREAKER TO THE "OFF" POSITION & USE AN APPROVED LOCKOUT DEVICE WHEN COMPLETING MAINTENANCE OR REPAIRS.

THE LOCKOUT PROCEDURE THAT FOLLOWS IS INTENDED TO SAFEGUARD PERSONNEL & EQUIPMENT DURING MAINTENANCE OPERATIONS, AND, REPRESENTS THE MINIMUM REQUIREMENTS. ANY ACTION SHOULD BE PRECEDED BY A "HAZARD ANALYSIS" TO DETERMINE ANY ADDITIONAL SAFETY PRECAUTIONS THAT MAY BE NECESSARY TO ENSURE THE SAFETY OF PERSONNEL AND EQUIPMENT.

***NOTE*: USE OF THE FOLLOWING LOCKOUT PROCEDURE IS MANDATORY WHEN COMPLETING MAINTENANCE OR REPAIRS.**

LOCKOUT PROCEDURE

1) THE LOCKOUT PROCESS MUST BE PERFORMED BY AUTHORIZED PERSONNEL ONLY.
2) INFORM ALL EFFECTED PERSONNEL OF YOUR INTENT TO LOCKOUT AND SERVICE THE SPECIFIED MACHINE.
3) SHUT OFF MACHINE POWER USING NORMAL SHUT DOWN PROCEDURES.
4) TURN OFF THE MACHINE AND INDIVIDUAL BUILDING CIRCUIT BREAKERS. MAKE SURE ALL STORED ELECTRICAL ENERGY IS RELIEVED. (EG: SPINDLE & AXIS SERVO CONTROLLERS)
5) CONNECT THE LOCKOUT DEVICE AS SHOWN IN FIGURE 1, AND ATTACH THE APPROPRIATE TAG AT THE MACHINE CIRCUIT BREAKER. THE TAG MUST IDENTIFY THE PERSON RESPONSIBLE FOR THE LOCKOUT. THIS WILL ENSURE THAT POWER CANNOT BE RESTORED BY ANYONE ELSE.
6) TEST THE MACHINE TO VERIFY THAT MACHINE SYSTEMS DO NOT OPERATE IN ANY WAY. ONCE TESTING IS COMPLETE, MAKE SURE ALL SWITCHES ARE IN THE "OFF" POSITION. CONFIRM THAT THE LOCKOUT DEVICES REMAIN PROPERLY INSTALLED.
7) COMPLETE THE REQUIRED MAINTENANCE OPERATIONS.
8) MAKE SURE ALL PERSONNEL ARE CLEAR OF THE MACHINE.
9) REMOVE THE LOCKOUT DEVICE. MAKE SURE ALL PERSONNEL ARE AT A SAFE LOCATION BEFORE RESTORING MACHINE POWER.



FIGURE

INSTALLATION PRECAUTIONS

The following subjects outline the items that directly affect the machine installation and start-up. To ensure an efficient and timely installation, please follow these recommendations before calling to schedule a service engineer.

• ENVIRONMENTAL REQUIREMENTS

Avoid the following places for installing the machine:

1) Avoid exposure to direct sunlight and/or near a heat source, etc. Ambient temperature during operation: 0° thru 45°C (32°F to 113°F).
2) Avoid areas where the humidity fluctuates greatly and/or if high humidity is present; normally 75% and below in relative humidity. A higher humidity deteriorates insulation and might accelerate the deterioration of parts.
3) Avoid areas that are especially dusty and/or where acid fumes, corrosive gases and salt are present.
4) Avoid areas of high vibration.
5) Avoid soft or weak ground **(minimum load bearing capacity of 1025 lbs./ft^2)**

• FOUNDATION REQUIREMENTS

For high machining accuracy, the foundation must be firm and rigid. This is typically accomplished by securely fastening the machine to the foundation with anchor bolts. In addition, the depth of concrete should be as deep as possible (minimum 6 - 8 inches). Note the following:

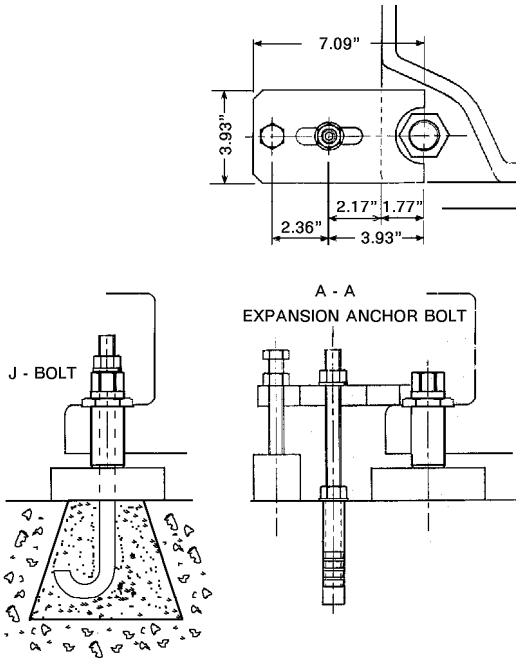
1) There can be no cracks in the foundation concrete or surrounding area.
2) Vibration proofing material (such as asphalt) should be put all around the concrete pad.
3) Form a “cone” in the foundation for J-bolt anchors, or use expansion anchors.
4) With the foundation anchor bolt holes open pour the primary **concrete at a minimum thickness of 6 - 8 inches.** Typically, the concrete must have a **minimum compression rating of 2500 lbs. @ 250 lbs. compression** and strengthened with reinforcing rods. When the concrete has cured, rough level the machine, and install the J-bolts, leveling blocks, etc., and pour grout into foundation bolt holes.
5) Mix an anti-shrinkage agent such as Denka CSA with concrete, or use Embeco grout to fill the foundation bolt holes.
6) In pouring grout, fasten the leveling block base plates with the collar retaining screws to prevent the base plates from dropping. When the grout has completely hardened, level the machine properly, and tighten M24 nuts to secure the machine to the foundation.

Note:

The machine must be anchored to the foundation with J-bolts, expansion bolts or other suitable method.

The machine accuracy and alignment specifications quoted by Mazak can usually be obtained when the minimum foundation requirements are met. However, production of close tolerance parts requires the use of an appropriate certified foundation. Foundations that do not meet certified specifications may require more frequent machine re-leveling and re-alignment, which can not be provided under terms of warranty.

If any of these conditions cannot be met, contact the nearest Mazak service office immediately.



TYPICAL MACHINE HOLD DOWN OPTIONS

• WIRING

1) Use only electrical conductors with performance ratings equivalent or superior.
2) Do not connect any power cables for devices which can cause line noise to the power distribution panel, such as arc welders and high frequency machinery.
3) Arrange for a qualified electrician to connect the power lines.
4) Incoming supply voltage should not deviate more than ±10% of specified supply voltage.
5) Source frequency should be±2 Hz of nominal frequency.

[CAUTION]

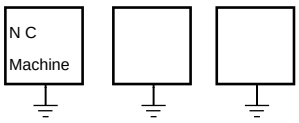
VERIFY THE ACTUAL MACHINE ELECTRICAL POWER REQUIREMENT AND THE MAIN TRANSFORMER RATING (IF APPLICABLE), AS WELL AS THE LOCAL ELECTRICAL CODE BEFORE SIZING AND INSTALLING THE INCOMING POWER WIRING.

PLEASE SEE THE ADDITIONAL CAUTIONS ON THE FOLLOWING PAGE.

• GROUNDING

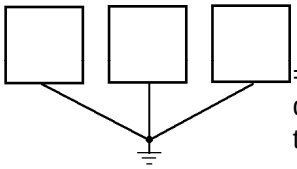
1) An isolated earth ground with a resistance to ground of less than 100 ohms is required. Typically, a 5/8" copper rod, 8 feet long, and no more than 5 feet from the machine, is sufficient. Building grounds or multiple machines grounded to the same ground rod, are not acceptable.
2) The wire size should be greater than AWG (American Wire Gauge) No. 5 and SWG (British Legal Standard Wire Gauge) No. 6.

Desirable Independent Grounding:



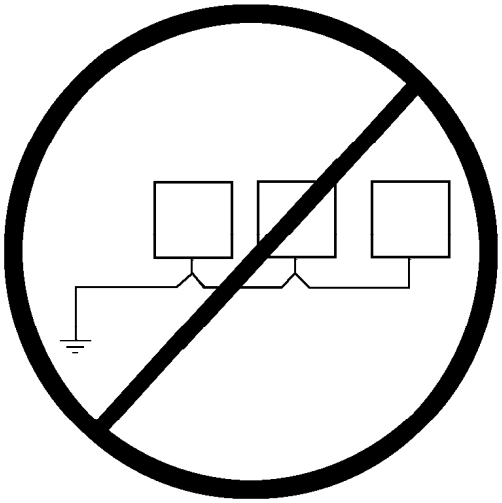
Earth resistance:
Less than 100 ohms

Common Grounds:



Resistance to ground = 100 ÷ the number of devices connected to the grounding (ohms)

Note: Never ground equipment as shown below:



CAUTION

A step-down transformer is *optional* on some machine models. Be certain to verify the transformer Kva rating (where applicable), as well as local electrical code requirements *before* sizing and installing the incoming power wiring.

Machines not equipped with a main transformer are wired for 230 VAC, 3 phase. The end user must supply a step-down transformer where factory electrical power varies more than ± 10% of the 230 VAC rating.

NOTE:

Step-down or voltage regulating transformers are external (peripheral) to the machine tool and are considered the primary input line (source) for the machine. Local electrical code or practice may require a circuit breaker or other switching device for the isolation of electrical power when this type of transformer is used. In such cases, the machine tool end user is required to supply the necessary circuit breaker or switching device.

FAILURE TO COMPLY CAN RESULT IN PERSONAL INJURY AND DAMAGE TO THE MACHINE. IF ANY QUESTION EXISTS, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

WARNING

MAZATROL CNC CONTROLLERS PROVIDE PARAMETER SETTINGS TO LIMIT SPINDLE RPM. THESE SETTINGS ARE BASED ON THE MAXIMUM SPEED SPECIFIED BY THE CHUCK/ACTUATOR MANUFACTURER.

MAKE SURE TO SET THESE PARAMETERS ACCORDING TO CHUCK SPECIFICATION WHEN INSTALLING A CHUCKING PACKAGE. ALSO, STAMP THE MAXIMUM SPINDLE RPM ON THE CHUCK IDENTIFICATION PLATE LOCATED ON THE MACHINE TOOL COVERS.

REFERENCE THE CNC PARAMETER MANUAL SUPPLIED WITH THE SPECIFIC MACHINE TOOL TO IDENTIFY THE REQUIRED PARAMETERS TO CHANGE.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

WARNING

MAZAK MACHINES ARE ENGINEERED WITH A NUMBER OF SAFETY DEVICES TO PROTECT PERSONNEL AND EQUIPMENT FROM INJURY AND DAMAGE.

DO NOT REMOVE, DISCONNECT, BYPASS OR MODIFY ANY LIMIT SWITCH, INTERLOCK, COVER, OR OTHER SAFETY FEATURE IN ANY WAY, EITHER MECHANICALLY OR ELECTRICALLY.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

WARNING

MAZAK MACHINES ARE ENGINEERED WITH A NUMBER OF SAFETY DEVICES TO PROTECT PERSONNEL AND EQUIPMENT FROM INJURY AND DAMAGE.

MACHINE OPERATOR DOORS AND COVERS ARE DESIGNED TO WITHSTAND ACCIDENTAL IMPACT OF A BROKEN INSERT WHERE A MAXIMUM WEIGHT INSERT AT MAXIMUM TOOL DIAMETER IS RUNNING AT MAXIMUM SPINDLE RPM

NEVER USE A CUTTING TOOL OR TOOL INSERT THAT EXCEEDS MACHINE SPECIFICATIONS OR THAT OF A SPECIFIC TOOL HOLDER ITSELF, WHICHEVER IS LESS. THIS RESTRICTION APPLIES TO DIAMETER, WEIGHT, MAXIMUM SPINDLE RPM, MAXIMUM CUTTING TOOL ROTATION SPEED, ETC.

FOR COMPLETE SPECIFICATIONS, MAKE SURE TO REFERENCE OPERATION, MAINTENANCE AND DETAIL SPECIFICATION DOCUMENTATION SUPPLIED WITH THE MACHINE AND BY THE TOOLING MANUFACTURER.

NOTE: THE MAXIMUM INSERT WEIGHT FOR MAZAK MACHINES IS 20 gf. (0.04 lbs.).

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

WARNING

BEFORE STARTING OPERATION, CHECK THAT THE WORKPIECE IS SECURELY MOUNTED IN A VISE OR A SUITABLE FIXTURE. BE CERTAIN THAT THE MOUNTING IS SUFFICIENT TO WITHSTAND CUTTING FORCES DURING WORKPIECE MACHINING.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

WARNING

CONFIRM PROPER WORKPIECE FIXTURING/CLAMPING, TOOL SETUP AND THAT THE MACHINE DOOR IS SECURELY CLOSED BEFORE THE START OF MACHINING.

VERIFY ALL SAFETY PRECAUTIONS OUTLINED IN THIS MANUAL BEFORE USING THE FOLLOWING CUTTING CONDITIONS:

- CUTTING CONDITIONS THAT ARE THE RESULT OF THE MAZATROL FUSION 640 AUTOMATIC CUTTING DETERMINATION FUNCTION
- CUTTING CONDITIONS SUGGESTED BY THE MACHINING NAVAGATION FUNCTION
- CUTTING CONDITIONS FOR TOOLS THAT ARE SUGGESTED TO BE USED BY THE MACHINING NAVAGATION FUNCTION

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

DOOR INTERLOCK SAFTY SPEC.

Determined by YMW Eng. H.Q. '99/9/1
Revised by YMC Prod. Eng. '99.10.28

MACHINING CENTER

DOOR	MODE	SET UP SWITCH	
		O (OFF)	**I** (ON)
OPEN	MANUAL	Prohibit to move axis. Prohibit to start spindle running. Prohibit to operate manual ATC. Prohibit to operate manual Pallet Changer. Prohibit to run chip spiral conveyor.	Limit the rapid override. Max is 12%. Prohibit to run chip spiral conveyor. Can run spindle JOG. Can run spindle Orient. Can operate manual ATC.
	AUTO	Prohibit cycle start. Prohibit to run chip spiral conveyor.	Prohibit cycle start. Prohibit to run chip spiral conveyor.
CLOSE I V OPEN	MANUAL	Door is always locked. Door lock can be released by pushing "DOOR UNLOCK SW" on operator panel. But, it can not release in operating ATC/Pallet changer/Axis/Spindle.	
		Prohibit to move axis. Prohibit to start spindle running. Prohibit to operate manual ATC. Prohibit to operate manual Pallet Changer. Prohibit to run chip spiral conveyor.	Limit the rapid override. Max is 12%. Chip spiral conveyor would stop. Can run spindle JOG. Can run spindle Orient. Can operate manual ATC.
	AUTO	Door is always locked. Door lock can be released by pushing "DOOR UNLOCK SW" on operator panel. But, it can not release in auto operation running except single block stop or feed hold stop or M00 program stop or M01 optional stop and spindle stop. If not, Alarm displayed "Door open invalid".	
		If release the lock by note(*1), Alarm will occur then stop the all motion. Chip spiral conveyor would stop.	Prohibit cycle start. Chip spiral conveyor would stop.
CLOSE	MANUAL	No Limitation.	No Limitation.
	AUTO	No Limitation.	Can not run auto operation.

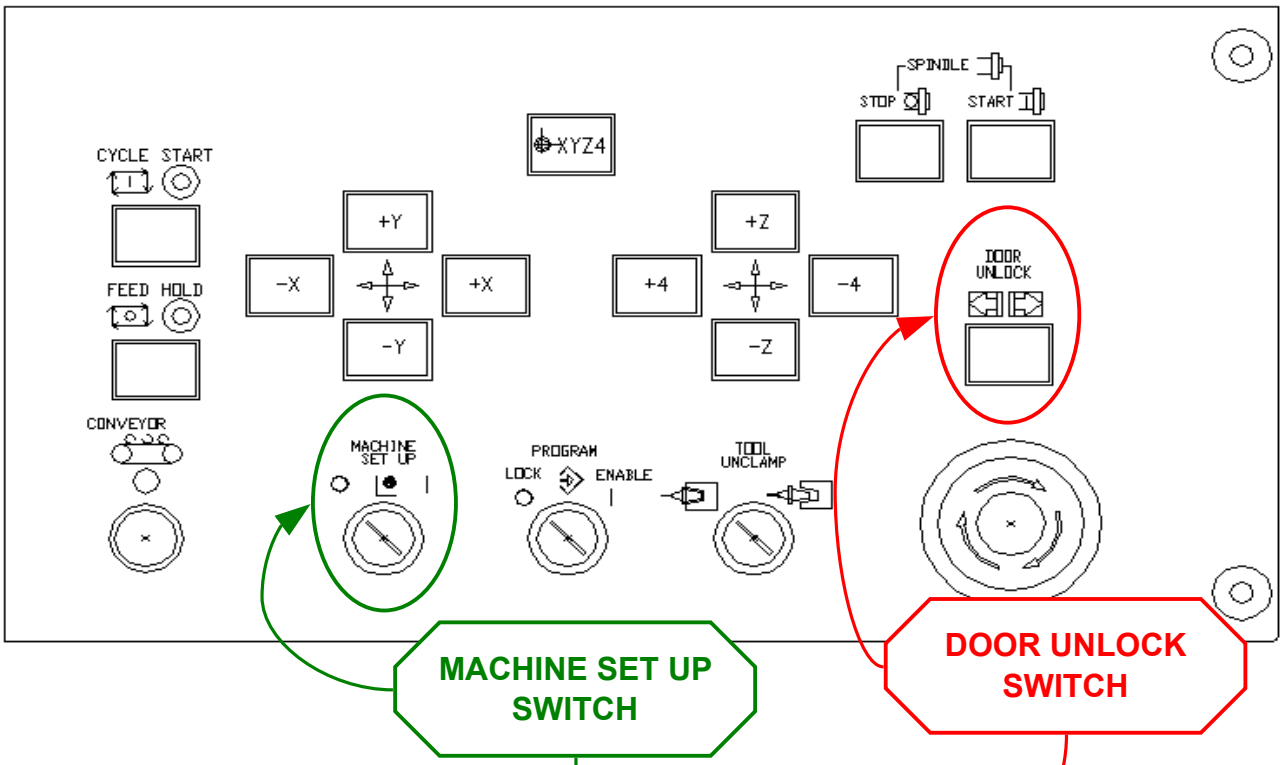
TURNING CENTER

DOOR	MODE	SET UP SWITCH	
		O (OFF)	**I** (ON)
OPEN	MANUAL	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can NOT operate Spindle, Axis, Turret, Coolant, ToolEye, Partscatcher, Chip Conveyor.	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can not operate Spindle running, but Can operate Spindle JOG and Spindle Orient. Limitation of speed for axis movement . (Override is 10% max.) 1 step index only for turret.
	AUTO	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can not run Auto-operation.	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can not run Auto-operation.
CLOSE -> OPEN	MANUAL & AUTO	Can not open the front door in Spindle running, Axis moving, Auto-running(Cycle start, Feed hold) due to Mechanical locking system. (Except Single Block Stop or M00 program stop or M01 optional stop) But, if release the lock by note(*1), Alarm will occur then stop the all motion.	
CLOSE	MANUAL	No Limitation.	No Limitation.
	AUTO	No Limitation.	Can not run Auto-operation.

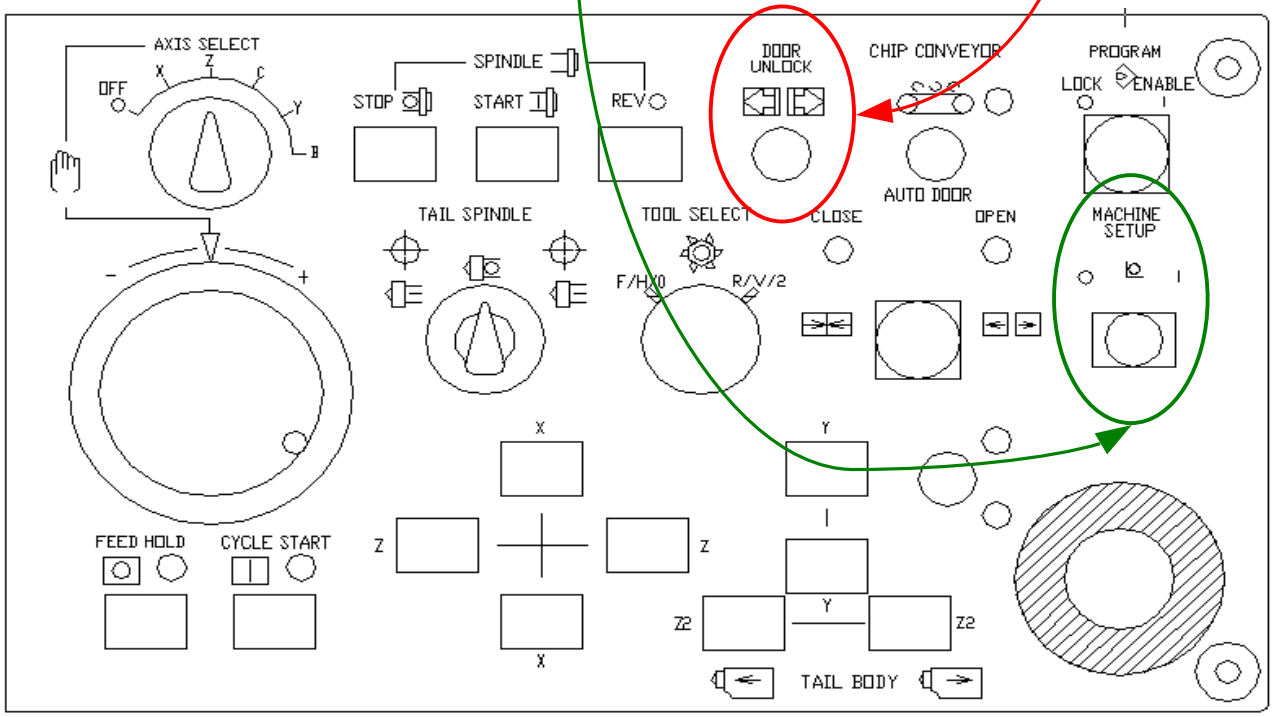
*1 : Door lock mechanism can not be released in machine stop by NC power OFF.
If it is necessary to release the lock such as emergencies, the lock can be released by operating the supplementary lock release mechanism of the main body of the safety door lock switch.
*2 : Override Limitation of Rapid speed of AXIS
Machining Center : 12%. Turning Center : 10%.
*3 : Chip Conveyor and Coolant should stop in the door open.

APPENDIX

SWITCH PANEL for M640M (Machining Center)



SWITCH PANEL for M640MT/T (Turning Center)



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MACHINE DOCUMENTATION CUSTOMER EVALUATION

Mazak

The Other Thoroughbred From Kentucky

Your opinion is important to enable us to issue documentation that will fit your needs.
Thank you for taking the time to supply this information.

Date: _____ _____

Machine Type: _____ Machine Serial#: _____ NC Type: _____

Customer: _____ Reported By: _____

Address: _____ Position: _____

_____ Telephone#: _____

Manual Publication #: _____

	Excellent	Good	Adequate	Fair	Poor
How well is the documentation suited to your needs?	☐	☐	☐	☐	☐
Were you able to find the necessary information easily?	☐	☐	☐	☐	☐
How well are the manuals organized?	☐	☐	☐	☐	☐
How easy are the manuals to understand?	☐	☐	☐	☐	☐
Are the illustrations helpful?	☐	☐	☐	☐	☐
Overall, how do you rate the documentation?	☐	☐	☐	☐	☐

What did you like about the documentation? How can it be improved?

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Florence, Kentucky 41042

SF-202Xa

Notes:

Introduction

Thank you for purchasing the Mitsubishi numeric control unit.
This manual describes the handling and caution points for using this AC servo.
Incorrect handling may lead to unforeseen accidents, so always read this instruction manual thoroughly to ensure correct usage.
Make sure that this instruction manual is delivered to the end user. Keep this manual in a safe place for future reference.

Precautions for safety

Please read this manual and auxiliary documents before starting installation, operation, maintenance or inspection to ensure correct usage. Thoroughly understand the device, safety information and precautions before starting operation.

The safety precautions in this instruction manual are ranked as "WARNING" and "CAUTION".

⚠ WARNING When a dangerous situation may occur if handling is mistaken leading to fatal or major injuries.

⚠ CAUTION When a dangerous situation may occur if handling is mistaken leading to medium or minor injuries, or physical damage.

Note that some items described as **⚠ CAUTION** may lead to major results depending on the situation. In any case, important information that must be observed is described.

The numeric control unit is configured of the control unit, operation board, servo amplifier, spindle amplifier, power supply + servo drive or spindle drive, servomotor, and spindle motor, etc.

In this manual, the following items are generically called the "servomotor".
- Servomotor
- Spindle motor

In this manual, the following items are generically called the "servo amplifier".
- Servo amplifier
- Spindle amplifier
- Power supply + servo drive or spindle drive

Changes in terminal names

The terminal names have been changed in two stages as shown below.

	Prior to March 95	April 95 to March 96	Following April 96 (MDS-B Series)
Terminal name	R	R / L1	L1
	S	S / L2	L2
	T	T / L3	L3
	P	L+ / P	L+
	N	L– / N	L–
	Ro	L11 / Ro	L11
	So	L21 / So	L21
	G	G / ⏚	

For Safe Use

1. Electric shock prevention

⚠ WARNING

- Do not open the front cover whole the power is ON or during operation. Failure to observe this could lead to electric shocks.
- Do not operate the unit with the front cover removed. The high voltage terminals and charged sections will be exposed, and can cause electric shocks.
- Do not remove the front cover even when the power is OFF unless carrying out wiring work or periodic inspections. The inside of the servo amplifier is charged, and can cause electric shocks.
- Wait at least 10 minutes after turning the power OFF before starting wiring or inspections. Failure to observe this could lead to electric shocks.
- Ground the servo amplifier and servomotor with Class 3 grounding or higher.
- Wiring and inspection work must be done by a qualified technician.
- Wire the servo amplifier and servomotor after installation. Failure to observe this could lead to electric shocks.
- Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks.
- Do not damage, apply forcible stress, place heavy items or engage the cable. Failure to observe this could lead to electric shocks.

2. Fire prevention

⚠ CAUTION

- Install the servo amplifier, servomotor and regenerative resistor on noncombustible material. Direct installation on combustible material or near combustible materials could lead to fires.
- Shut off the power on the servo amplifier side if a fault occurs in the servo amplifier. Fires could be caused if a large current continues to flow.
- Shut off the power with an error signal when using the regenerative resistor. The regenerative resistor could abnormally overheat and cause a fire due to a fault in the regenerative transistor, etc.

Contents

IV. MDS-A-SP MDS-B-SP Spindle System Section

3. Injury prevention

⚠ CAUTION	
	Do not apply a voltage other than that specified in Instruction Manual on each terminal. Failure to observe this item could lead to ruptures or damage, etc.
	Do not mistake the terminal connections. Failure to observe this item could lead to ruptures or damage, etc.
	Do not mistake the polarity (⊕, ⊖). Failure to observe this item could lead to ruptures or damage, etc.
	Do not touch the servo amplifier fins, regenerative resistor or servomotor, etc., while the power is turned ON or immediately after turning the power OFF. Some parts are heated to high temperatures, and touching these could lead to burns.

4. Various precautions

Observe the following precautions. Incorrect handling of the unit could lead to faults, injuries and electric shocks, etc.

(1) Transportation and installation

⚠ CAUTION	
	Correctly transport the product according to its weight.
	Use the servomotor's suspension bolts only when transporting the servomotor. Do not transport the servomotor when it is installed on the machine.
	Do not stack the products above the tolerable number.
	Do not hold the cables, axis or detector when transporting the servomotor.
	Do not hold the connected power supply or cables when transporting the servomotor.
	Do not hold the front cover when transporting the servo amplifier. The unit could drop.
	Follow this Instruction Manual and install the unit in a place where the weight can be borne.
	Do not get on top of or place heavy objects on the unit.
	Always observe the installation directions.
	Secure the specified distance between the servo amplifier and control panel, or between the servo amplifier and other devices.
	Do not install or run a servo amplifier or servomotor that is damaged or missing parts.
	Do not block the intake or exhaust ports of the servomotor provided with a cooling fan.
	Do not let conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter the servo amplifier or servomotor.
	The servo amplifier and servomotor are precision devices, so do not drop them or apply strong impacts to them.

⚠ CAUTION

⚠ Store and use the units under the following environment conditions.

Environment	Conditions	
	Servo amplifier	**Servomotor**
Ambient temperature	0°C to +55°C (with no freezing)	0°C to +40°C (with no freezing)
Ambient humidity	To follow separate specifications	80%RH or less (with no dew condensation)
Storage temperature	To follow separate specifications	–15°C to +70°C
Storage humidity	To follow separate specifications	90% RH or less (with no dew condensation)
Atmosphere	Indoors (Where unit is not subject to direct sunlight) With no corrosive gas, combustible gas, oil mist or dust	
Altitude	1000m or less above sea level	
Vibration	To follow separate specifications	

⚠ Securely fix the servomotor to the machine. Insufficient fixing could lead to the servomotor slipping off during operation.

⚠ Always install the servomotor with reduction gears in the designated direction. Failure to do so could lead to oil leaks.

⚠ Never touch the rotary sections of the servomotor during operations. Install a cover, etc., on the shaft.

⚠ When coupling to a servomotor shaft end, do not apply an impact by hammering, etc. The detector could be damaged.

⚠ Do not apply a load exceeding the tolerable load onto the servomotor shaft. The shaft could break.

❗ When storing for a long time, please contact the Service Center or Service Station.

(2) Wiring

⚠ CAUTION

⚠ Correctly and securely perform the wiring. Failure to do so could lead to runaway of the servomotor.

⚠ Do not install a condensing capacitor, surge absorber or radio noise filter on the output side of the servo amplifier.

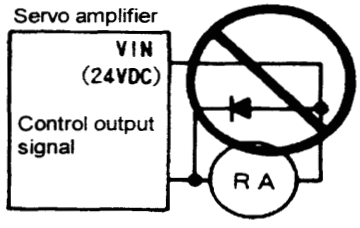
⚠ Correctly connect the output side (terminals U, V, W). Failure to do so could lead to abnormal operation of the servomotor.

⚠ Do not directly connect a commercial power supply to the servomotor. Doing so could lead to faults.

⚠ When using an inductive load such as a relay, always connect a diode as a noise measure parallel to that load.

⚠ When using a capacitance load such as a lamp, always connect a protective resistor as a noise measure serial to that load.

⚠ When connecting a DC relay for the control output signals such as the brake signal or contactor, do not mistake the polarity of the diode. Failure to observe this could cause the signals not to be output due to a fault or the protective circuit to fail.



⚠ Do not connect/disconnect the cables connected between the units while the power is ON.

⚠ Securely tighten the cable connector fixing screw or fixing mechanism. An insecure fixing could cause the cable to fall off while the power is ON.

⚠ When use of a shielded cable is instructed in the connection diagrams, always ground the cable with a cable clamp, etc.

⚠ Always separate the signals wires from the drive wire and power line.

⚠ Use wires and cables that have a wire diameter, heat resistance and flexibility that conforms to the system.

⚠ Check the cables sufficiently before wiring so that the battery unit is not mistakenly wired. The battery in the battery unit could short circuit and be charged due to incorrect wiring, and could lead to battery ignition, heating, rupture or generation of toxic gas.

(3) Trial operation and adjustment

⚠ CAUTION

⚠ Check and adjust each program and parameter before starting operation. Failure to do so could lead to unforeseen operation of the machine.

⚠ Do not make remarkable adjustments and changes as the operation could become unstable.

(4) Usage methods

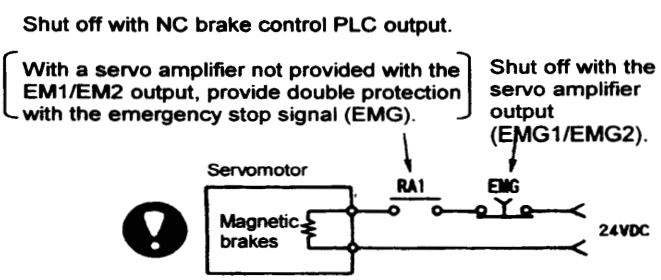
⚠ CAUTION

- Install an external emergency stop circuit so that the operation can be stopped and power shut off immediately.
- Turn the power OFF immediately if smoke, abnormal noise or odors are generated from the spindle motor or spindle amplifier.
- Unqualified persons must not disassemble or repair the unit.
- Never make modifications.
- Reduce magnetic damage by installing a noise filter. The electronic devices used near the servo amplifier could be affected by magnetic noise.
- Use the spindle motor, spindle amplifier and regenerative resistor with the designated combination. Failure to do so could lead to fires or trouble.
- The brakes (magnetic brakes) assembled into the servomotor are for holding, and must not be used for normal braking.
- There may be cases when holding is not possible due to the magnetic brake's life or the machine construction (when ball screw and servomotor are coupled via a timing belt, etc.). Install a stop device to ensure safety on the machine side.
- After changing the parameters or after maintenance and inspection, always test the operation before starting actual operation.
- Do not enter the movable range of the machine during automatic operation. Never place body parts near or touch the spindle during rotation.
- Follow the power supply specification conditions given in the separate specifications manual for the power (input voltage, input frequency, tolerable power failure time, etc.).

(5) Troubleshooting

⚠ CAUTION

- If a hazardous situation is predicted during power failure or product trouble, use a servomotor with magnetic brakes or install an external brake mechanism.
- Use a double circuit configuration that allows the operation circuit for the magnetic brakes to be operated even by the external emergency stop signal.



- Always turn the input power OFF when an alarm occurs.
- Never go near the machine after restoring the power after a failure, as the machine could start suddenly. (Design the machine so that personal safety can be ensured even if the machine starts suddenly.)

(6) Maintenance, inspection and part replacement

⚠ CAUTION

⚠ Always backup the servo amplifier programs and parameters before starting maintenance or inspections.

⚠ The capacity of the electrolytic capacitor will drop due to deterioration. To prevent secondary damage due to failures, replacing this part every five years when used under a normal environment is recommended. Contact the Service Center or Service Station for replacemet.

⚠ Do not perform a megger test (insulation resistance measurement) during inspections.

❗ If the battery low warning is issued, save the machining programs, tool data and parameters with an input/output unit, and then replace the battery.

⚠ Do not short circuit or charge the battery unit connector terminals. Do not deform, heat or incinerator the battery unit or disassemble the internal battery.
Failure to observe this could lead to fires, heating, rupture or generation of toxic gases.

⚠ When storing the battery unit, avoid places subject to direct sunlight, high temperatures or high humidities. Failure to observe this could lead to leaking or rupture of the internal battery.

(7) Disposal

⚠ CAUTION

⚠ Treat this unit as general industrial waste.
If the heat radiating fins are protruding from the rear of the MDS Series, substitute Freon is used. Do not dispose of this type of unit as general industrial waste. Always contact the Service Station or Service Center for disposal.

⚠ Do not disassemble the spindle motor or spindle amplifier.

⚠ Plug the gaps on the battery unit with non-conductive material such as cellophane tape before disposing.
Disposal in the original state allow other metal chips entering the internal battery, and lead to ruptures or fires.

⚠ Dispose of the battery according to local laws.

(8) General precautions

The drawings given in this Specifications and Maintenance Instruction Manual show the covers and safety partitions, etc., removed to provide a clearer explanation. Always return the covers or partitions to their respective places before starting operation, and always follow the instructions given in this manual.

I. MDS-A Series
MDS-B Series
Servo/Spindle System Configuration Section

1. Outline

The MDS-A Series is a drive system that corresponds to the MELDAS M500 Series NC that has been developed to totally connected the servo drive and spindle drive sections. The MDS-B Series is the successor to the MDS-A Series, and has been developed to satisfy European Safety Standards. This Series has the following features.
The MDS-C1 Series is a drive system compatible with the NC system. This high-performance, compact series is compatible with the MDS-B Series (some changes have been made).

1.1 Features

(1) Compact and lightweight

The converters that were conventionally built in each servo and spindle drive have been integrated into one unit. The drive system volume, installation area and weight have been drastically reduced with the incorporation of high density mounted electronic parts IGBT-IPM (Intelligent Power Module) and the high performance heat radiating fin.

(2) Standardization of dimensions

The outline has been standardized to the book end type, and by unifying the height and depth dimensions, installation in cabinets has been made easy. Furthermore, by matching the shape with the NC unit, an integrated appearance with the NC has been realized.

(3) Low heat generation

By incorporating the IPM and using power supply regeneration in the servo drive, the amount of heat generated has been greatly reduced.

(4) High speed and precision processing

A high speed CPU has been mounted on the control PCB, and a 100,000 pulse/rotation sub micron detector has been incorporated as a standard to allow faster and more precise interpolation.
By incorporating the stable position loop control (SHG control) method, having an outstanding response, the positioning time and tracking have been improved and the machine vibration during acceleration/deceleration has been reduced.
The cutting performance and cutting precision during position control have been improved by using the high speed CPU also for the spindle drive.

(5) High speed spindle orientation

Smooth operations and minimum orientation times have been realized by using the high speed orientation method while allows direct orientation from the high speed during the spindle drive.

(6) Features of the MDS-B Series

(a) European Safety Standards compliant
Approval from a third party approval agency (TUV) has been acquired in respect to the European Safety Standards (LVD Directives).
(Note that the B Series target models are limited to the CV (power regenerative power supply), SP (spindle drive) and V1/V2 (1/2-axis servo drive.)

(7) Addition of power supply emergency stop input line

With the B Series, the external contactor can be directly shut off from the power supply even when the emergency stop hot line from the NC does not function for any reason.
(This function is validated with the rotary switch and connected drive parameter settings. Thus, the functions doe not change from the conventional functions when used in the same manner as the A Series.)

(8) Features of the MDS-C1 Series

1) High performance

High-performance servo control, equivalent to the high gain amplifier (B-V14/V24) is mounted.

2) Compact

The fin outline has been downsized by incorporating high-efficiency fins and a low loss compact IPM, and a thin type drive unit is realized.

3) Reliability

Heat generation has been reduced by incorporating a low loss IPM, and the strength of the inner support structure has been increased by integrating the terminal block with the wiring conductors. This has improved the reliability compared to the conventional B Series.

4) Compatibility

This series can be used without problem together with the B Series in the same machine. The installation dimensions, and servo/spindle parameters are compatible with the B Series.

- Outline dimensions, installation dimensions, terminal connections
  Compatible with the current B Series.
  * Some changes have been made to the PE terminal position and control terminal position (in some capacities).
- Control function (servo)
  The system automatically judges whether the standard amplifier (B-V1/V2) or high gain amplifier (B-V14/V24) is mounted. The parameters are compatible. Refer to the following pages for details.
  * Note that there are some restrictions to the motor end encoder. Refer to the following pages for details.
  * The system is shipped from the factory with the high-gain specifications. Refer to the following pages for details.
- Control function (spindle)
  The control functions and parameters are both compatible.
  * This series can be used without problem together with the B Series in the same machine.

1.2 System configuration

⚠ WARNING
Always ground the spindle driver and spindle motor with Class 3 or higher grounding.

⚠ CAUTION
1. Correctly connect the power phases (U, V, W) of the spindle amplifier and spindle motor. Failure to do so could cause the spindle motor to malfunction. 2. Do not apply a voltage other than that specified to each terminal. Failure to observe this could lead to ruptures or trouble.

The system is composed of the following units:

(1) Power supply unit ··· This unit converts the 3-phase AC power supply into a DC power supply for inverter drive, and regenerates the energy into power or resistance when decelerating the motor.
(2) Spindle drive unit···· This is the inverter unit for spindle motor drive.
(3) Servo drive unit ····· This is the inverter unit for servomotor drive.
(4) Battery unit ····· This unit is used to save the data in the absolute position detection system.

Drive section wiring system drawing

⚠ CAUTION
1. Shut off the power on the spindle amplifier side if a fault occurs in the spindle amplifier. Fires could be caused if a large current continues to flow. 2. Shut off the power with a fault signal. The regenerative resistor could abnormally overheat and cause a fire due to a fault in the regenerative transistor, etc. 3. Configure the magnetic brake operation circuit as a double circuit so that tit will function with the emergency stop switch even when the power supply is OFF, and alarm has occurred or when the servo ON signal is OFF.

Wire the power and main circuit as shown on the next page. Always use a no-fuse breaker (NF) for the power input wire.

Observe the following points for the MDS-C1-V1/V2 servo drive unit.

⚠ CAUTION

<Control mode changeover>

(1) The 2-system compatible software is compatible from Version A1 (BND-582W000-A1). Version A0 is not compatible with the standard amplifier mode. It is compatible only with the high-gain amplifier mode.

(2) Whether to start the servo amplifier in the standard amplifier compatible mode or the high-gain amplifier compatible mode is judged by the servo parameters SV009 to SV012 and SV033 setting values set in the machine.

(3) When the control mode has been changed to the high-gain amplifier (MDS-B-V14/V24) mode after remounting from the standard amplifier (MDS-B-V1/V2), the parameters must be changed for the high-gain amplifier and the servo parameters must be adjusted.

Refer to the section "III. Servo System, section 1.1.2 2-system compliance" for details.

⚠ CAUTION

<Servo alarm "7F">

(1) The actual mode is changed between the standard amplifier mode and high-gain amplifier mode when the 200V power is turned ON. Thus, if the above servo parameters are changed, the alarm "7F" will occur, and the restarting of the power will be requested.
Alarm "7F" is a status flag that occurs when the amplifier mode state changes. It does not indicate an amplifier fault like the other alarms. (Alarm "7F" is not counted as a fault.)

(2) The system is shipped from the factory with the high-gain amplifier mode. Thus, the amplifier state after the machine is installed will be as follows.

Standard amplifier parameters → First time 200V power is turned ON.
Alarm "7F"
→ Second and subsequent time 200V power is turned ON.
Normal connection

High-gain amplifier parameters → First and subsequent time 200V power is turned ON.
Normal connection

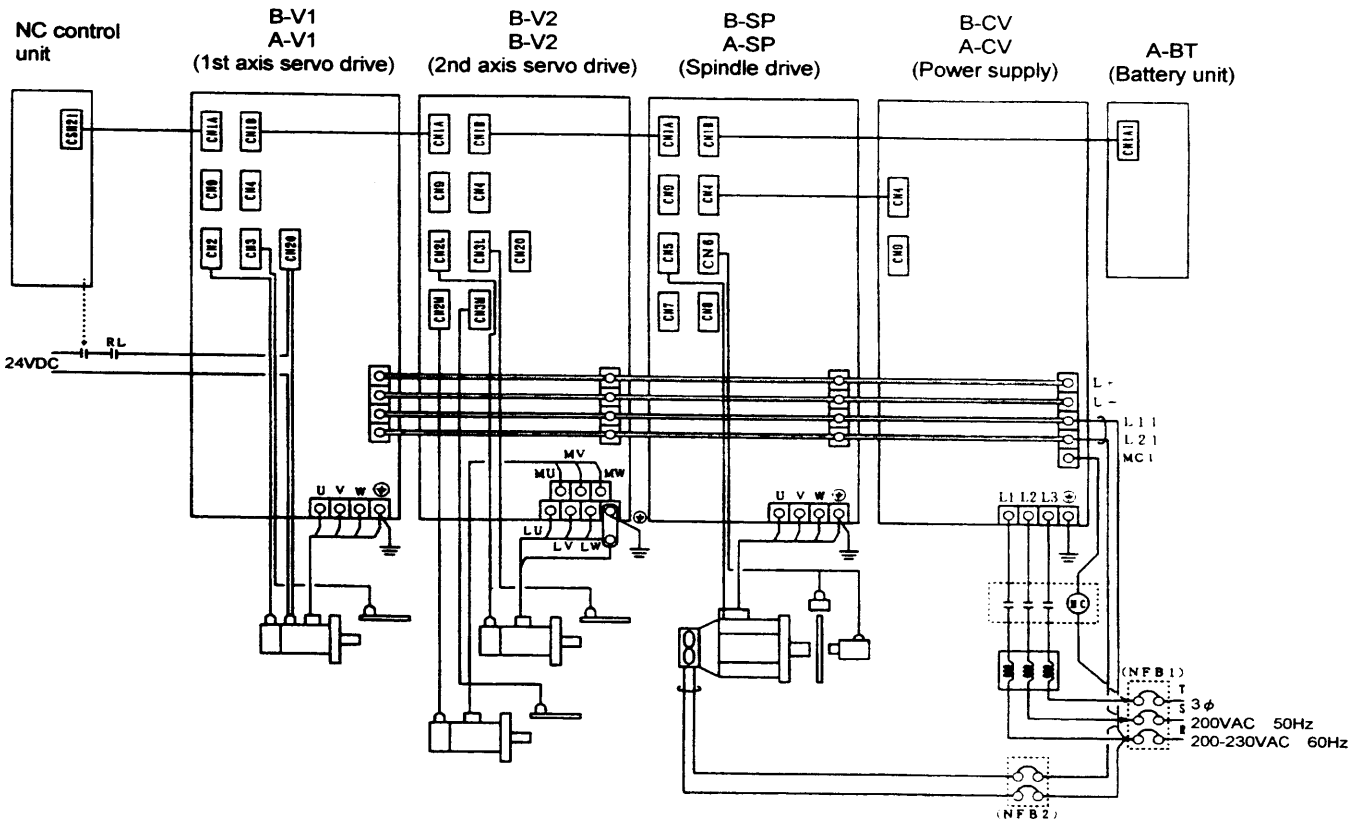
When using the standard amplifier mode (using the standard amplifier parameters), the 200V power must be turned ON again after the machine is installed. "7F" will appear in the alarm history, but as "7F" does not indicate an amplifier fault, clear the alarm history and erase the "7F" record.

(3) If alarm "7F" is detected even after the 200V power is turned ON again, an error will be detected in the internal memory circuit (EEPROM). The amplifier must be replaced in this case.

Refer to the section "III. Servo System, section 1.1.2 2-system compliance" for details.

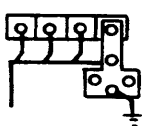
<MDS-A/B series>

Standard connection

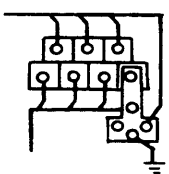


* Please read the "MDS-A Series Specifications BNP-B3759" together with this manual when servicing the MDS system.

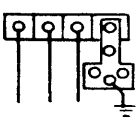
For V1 and SP



For V2



For CV



Note 1. Starting from production in April 1995, a grounding bar is enclosed with each unit when shipped. Connect the grounding wire as shown above, and make sure that the grounding wires are not tightened together.

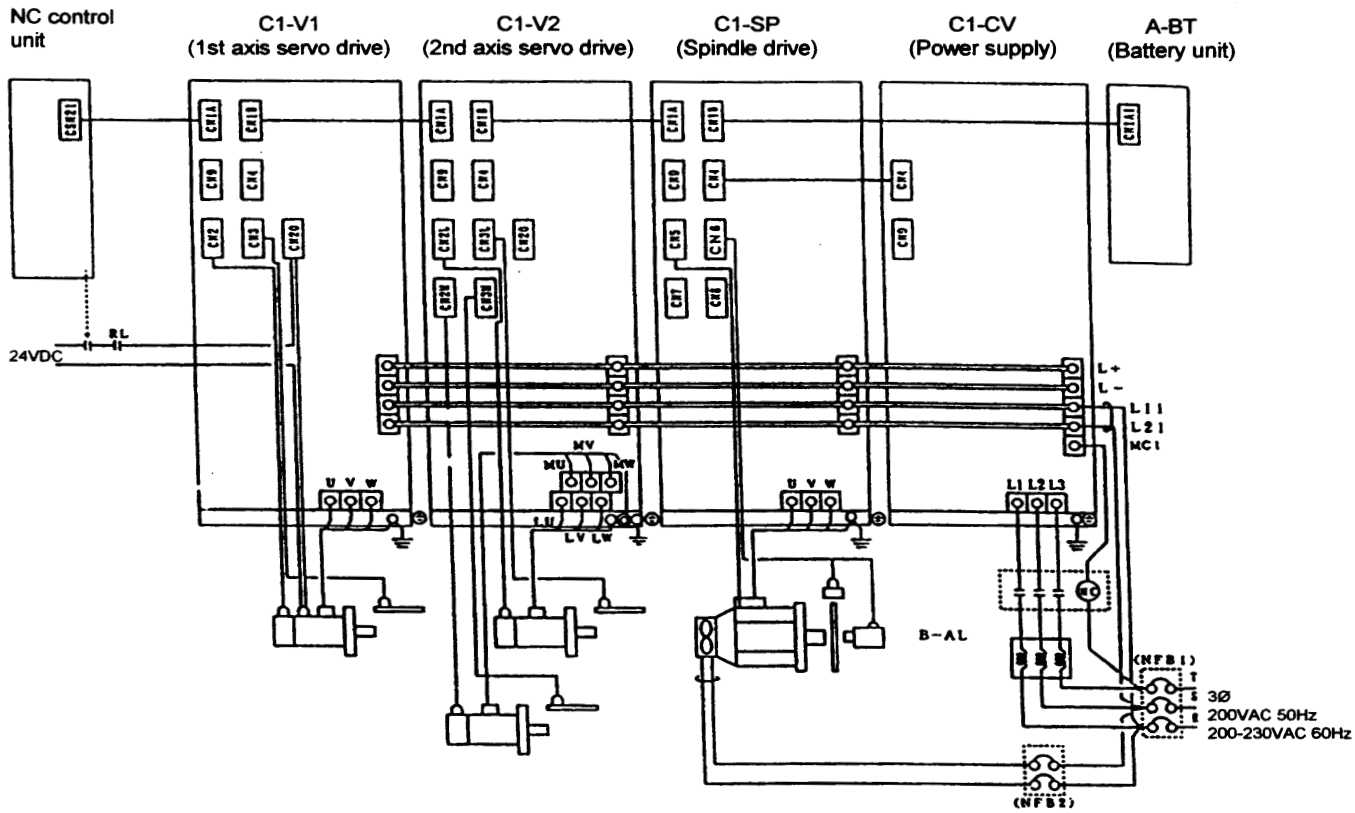
Note 2. Always install a surge killer on both ends of the contactor coils.

Note 3. The terminal block names have been changed in two stages as shown in the table.

	Prior to March 95	April 95 to March 96	Following April 96 (MDS-B Series)
Terminal name	R	L1 / R	L1
	S	L2 / S	L2
	T	L3 / T	L3
	P	L+ / P	L+
	N	L– / N	L–
	Ro	L11 / Ro	L11
	So	L21 / So	L21
	G	G / ⏚	⏚

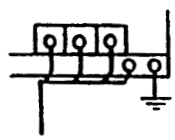
<MDS-C1 series>

Standard connection

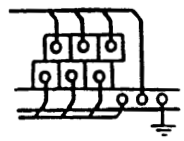


*•Please read the "MDS Series Specifications BNP-C3000" together with this manual when servicing the MDS system.

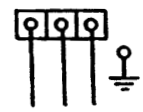
For V1 and SP



For V2



For CV



Note 1. Starting from production in April 1995, a grounding cover is enclosed with each unit when shipped. Connect the grounding wire as shown above, and make sure that the grounding wires are not tightened together.

Note 2. Always install a surge killer on both ends of the contactor coils.

Note 3. The terminal block names have been changed in two stages as shown in the table.

	Prior to March 95	April 95 to March 96	Following April 96 (MDS-B Series)
Terminal name	R	L1 / R	L1
	S	L2 / S	L2
	T	L3 / T	L3
	P	L+ / P	L+
	N	L– / N	L–
	Ro	L11 / Ro	L11
	So	L21 / So	L21
	G	G / ⏚	⏚

2. System Start Up

⚠ WARNING
1. Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks. 2. Do not operate the unit with the front cover removed. The high voltage terminals and charged sections will be exposed, and can cause electric shocks. 3. Do not open the front cover whole the power is ON or during operation. Failure to observe this could lead to electric shocks.

⚠ CAUTION
1. Always check the parameters before starting. Depending on the machine, unforeseen operation could take place. 2. Do not touch the servo amplifier fins, regenerative resistor or servomotor, etc., while the power is turned ON or immediately after turning the power OFF. Some parts are heated to high temperatures, and touching these could lead to burns.

The procedure for starting up the entire system is explained in this chapter.
Refer to the section for each unit for the individual adjustment procedures.

(1) Connect the units according to the connection drawing. (Refer to 1.2 System configuration wiring system drawing. Refer to the specifications for details.) Observe the cautions in the specifications when installing each unit, motor and detector.
(2) Set the rotary switches on each unit. (Refer to the settings below. Refer to the specifications for details.)
(3) Confirm the wiring and input voltage, etc., and turn ON the power while the NC emergency stop is applied. Confirm that the LED displays on each unit are normal. (Refer to following page.)
(4) Confirm that the servo and spindle parameters are set as specified on the NC screen. (Refer to the specifications for the parameter definitions and setting methods.)
(5) Release the NC emergency stop and confirm that the movement is normal.
(6) Make adjustments according to each unit section.

* If any instability such as runaway of the servo axis is sensed with the first machine, lower the parameter SV013 ILMT1 value. The limiter will be applied on the torque and the damage to the machine can be reduced.

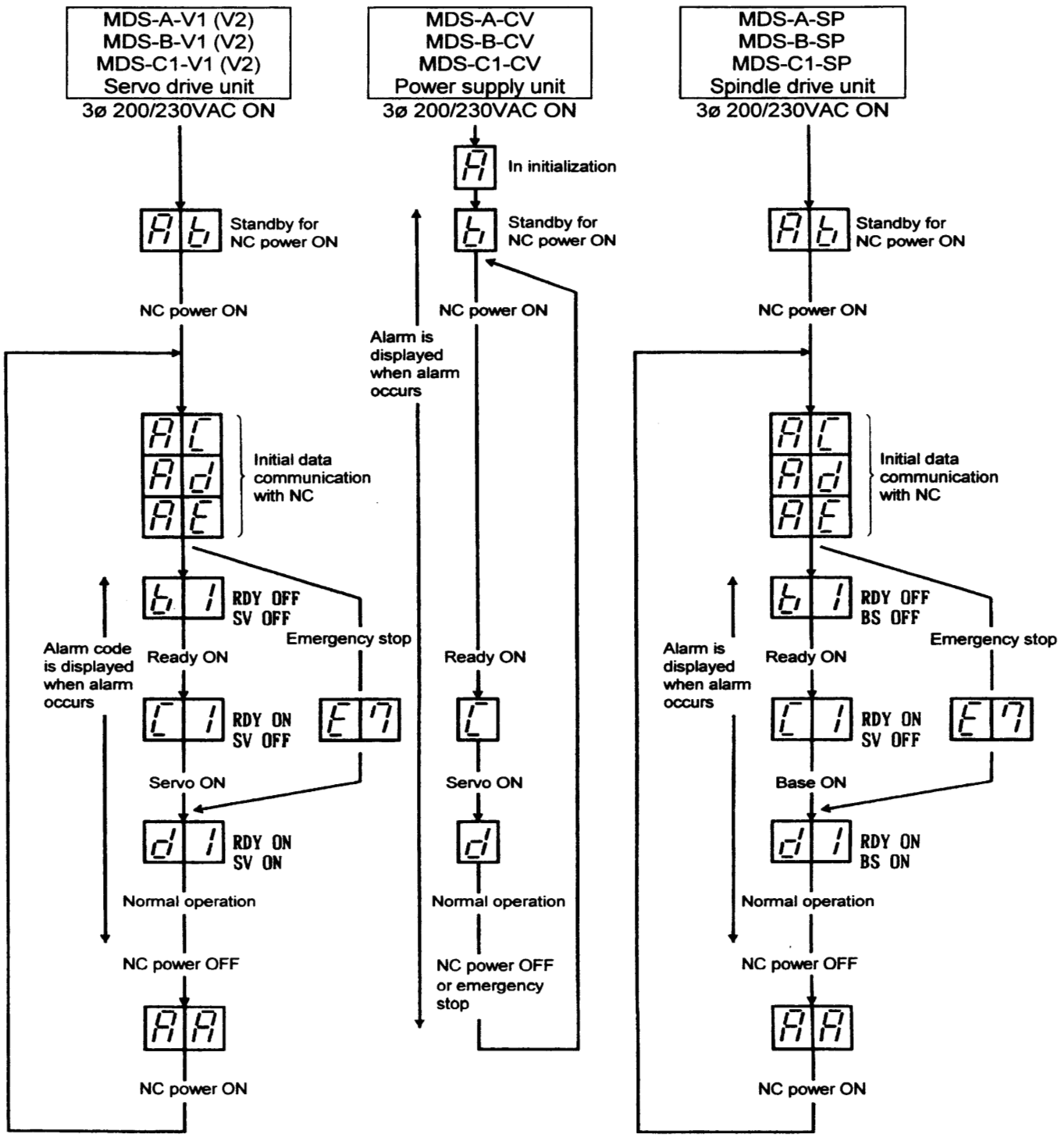
* Rotary switch settings

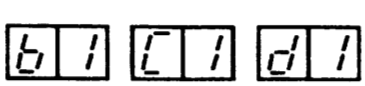
1) Power regenerative type power supply unit — Setting: 0 : Contactor used; 1 : Contactor not used

2) Resistance regenerative type power supply unit — Setting: 0

3) Servo/spindle unit — Setting: 0 : 1st axis; 1 : 2nd axis; ~; 6 : No. 7 axis

Status display





The right segment indicates the axis No.
(The No. 1 axis is indicated in this example.)

3. Addition and Replacement Methods of Units and Parts

⚠ CAUTION

1. Correctly transport the product according to its weight. Doing so could lead to injuries.
2. Do not stack the products above the tolerable number.
3. Install the unit on non-combustible materials. Installation directly on combustible matters or near combustible objects could lead to fires.
4. Follow this Instruction Manual and install the unit in a place where the weight can be borne.
5. Do not get on top of or place heavy objects on the unit. Doing so could lead to injuries.
6. Use within the designated environmental condition range.
7. Do not let conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter the servo amplifier or servomotor.
8. Do not block the intake or exhaust ports of the servomotor provided with a cooling fan. Doing so could lead to trouble.
9. The servo amplifier and servomotor are precision devices, so do not drop them or apply strong impacts to them.
10. Do not install or run a servo amplifier or servomotor that is damaged or missing parts.
11. When storing for a long time, please contact the Service Center or Service Station.

Before adding or replacing units or parts, always turn OFF the main power and confirm that the CHARGE lamp on the power supply unit is not lit.

3.1 Unit replacement

⚠ CAUTION

1. Do not hold the front cover when transporting the servo amplifier. The unit could drop.
2. Always observe the installation directions. Failure to do so could lead to faults.
3. Secure the specified distance between the spindle amplifier and inner side of the control panel and the other devices. Failure to do so could lead to faults.

Use the following procedure when replacing the units.

(1) Power supply unit replacement

1) Disconnect the connectors connected to CN4 and 9.
2) Disconnect the wires connected to L1, L2, L3, ⏚, L+, L–, L11, L21 and MC1 on the terminal block.
3) Remove the two (four) screws fixing the unit to the control panel, and remove the unit from the control panel.
4) Install the new unit following the removal procedure in reverse.

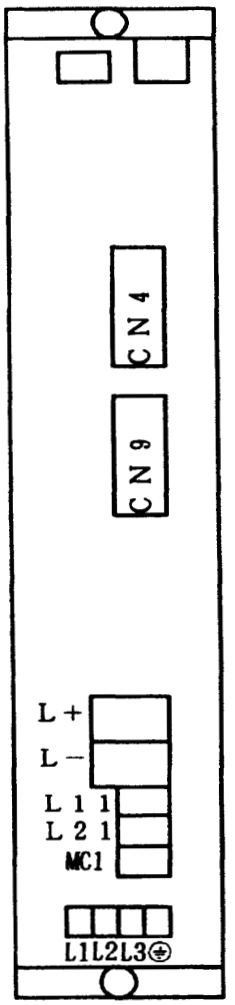
(2) Drive unit replacement (Ex. spindle drive)

1) Disconnect the connectors connected to CN1A, 1B, 4, 5, 6, 7, 8 and 9.
2) Disconnect the wires connected to U, V, W, ⏚, L+, L–, L11, L21 on the terminal block.
3) Remove the two (four) screws fixing the unit to the control panel, and remove the unit from the control panel.
4) Install the new unit following the removal procedure in reverse.

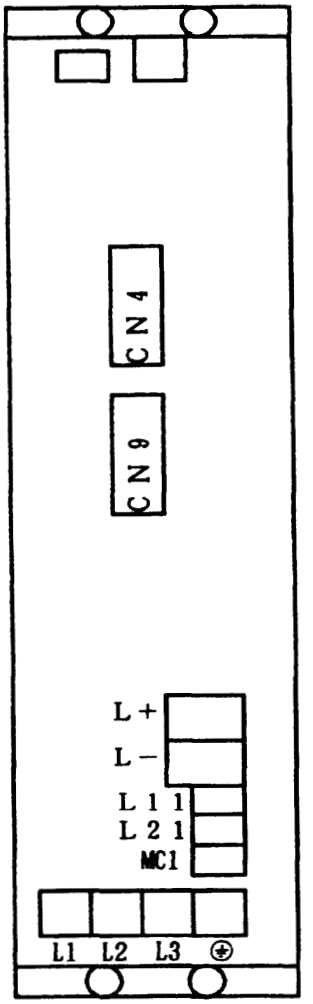
[Outline drawing for MDS-A/B series]

(1) Power supply unit

A-CV-37 to 185
B-CV-37 to 185

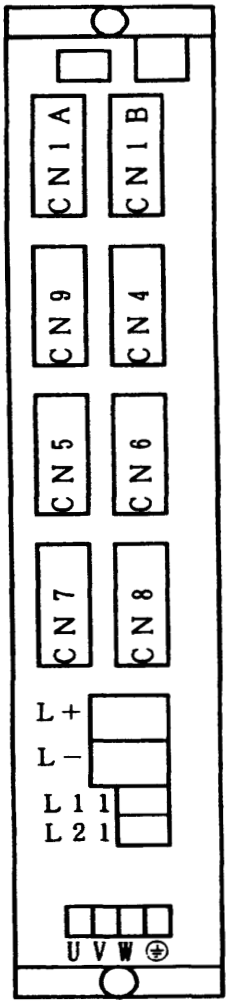


A-CV-220 to 300
B-CV-220 to 370

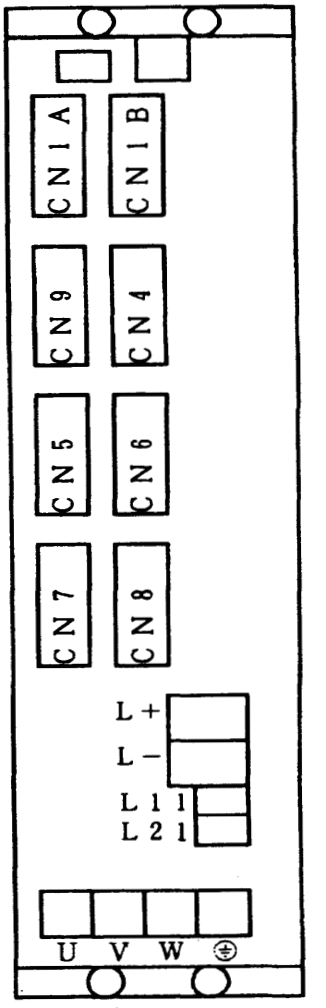


(2) Drive unit (for spindle drive)

A-SP-04 to 185
B-SP-04 to 185



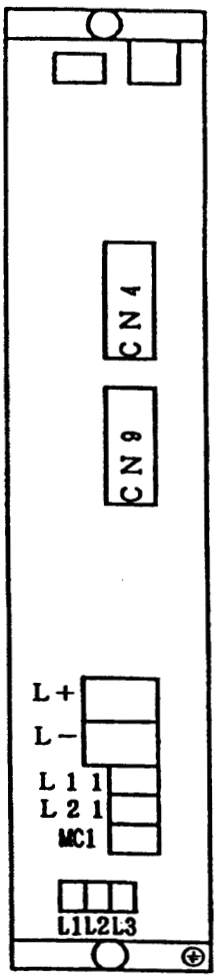
A-SP-220 to 300
B-SP-220 to 300



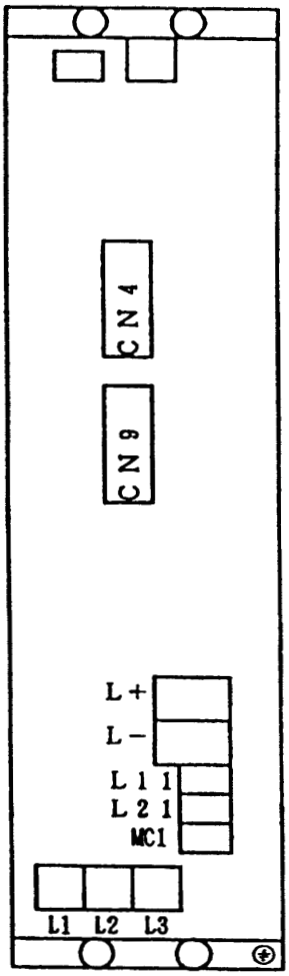
[Outline drawing for MDS-C1 series]

(1) Power supply unit

C1-CV-37 to 185

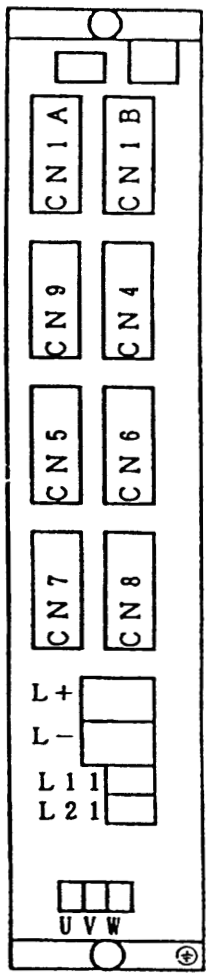


C1-CV-220 to 300

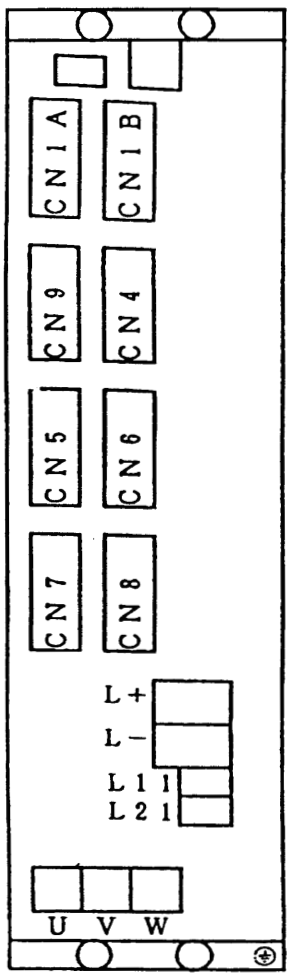


(2) Drive unit (for spindle drive)

C1-SP-04 to 185



C1-SP-220 to 300



3.2 Servomotor encoder

⚠ CAUTION
The MDS-C1 Series is not compatible with the OHE/OHA encoder (motor end).

(Only MDS-A/B Series)

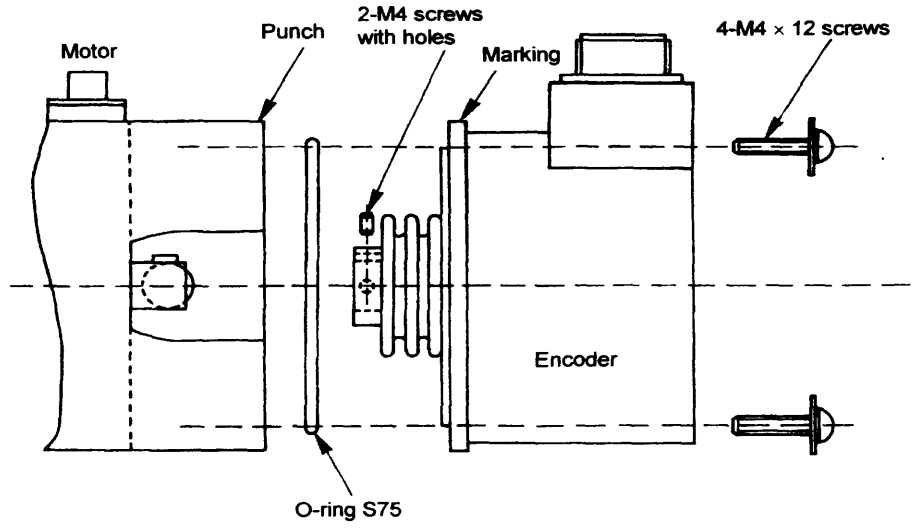
3.2.1 OHE/OHA type encoder

(1) OHE25K-85, OHA25K-85 (for HA23/33 motor)

Installation method

1) Install the M4 screw on the coupling. Make sure that the screw does not protrude on the inside.
2) Remove one or two rubber bushings for the motor.
3) Install the O-ring on the encoder spigot section.
4) Install the motor detector and insert the key in the shaft. Make sure that there is no dirt or burrs in the key hole at this time, and push the key in completely.
5) Install the encoder on the motor. Match the coupling keyway and shaft key position at this time before inserting. The encoder connector position must be fixed to the motor connector position or the designated position.
6) Fix the encoder with four M4 P screws. Align the encoder flange markings and the motor flange punch position.
7) Install the rubber bushing.
   Note) Prevent the coupling screw from loosening.
   * The current position will be lost after replacement in the OHA25K-85 type, and initializing will be required.

Installation procedure drawing



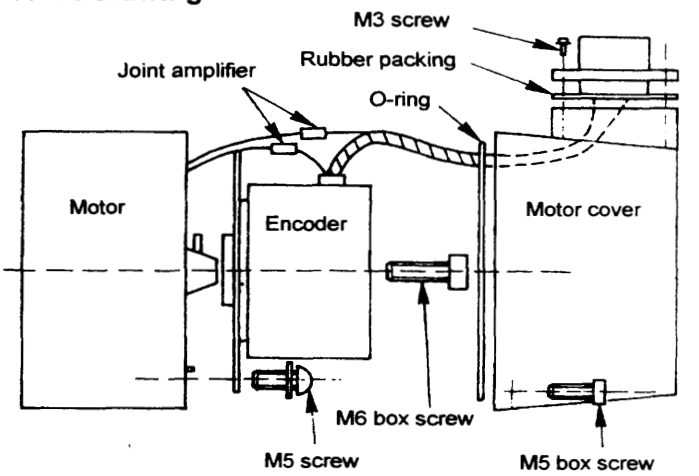
(2) OHE25K-6, OHA25K-4

Installation method

1) Remove the cover screws with a M5 hexagonal wrench and remove the cover.
2) Install the encoder on the motor. Align the motor shaft pin and encoder shaft groove, and the encoder flat spring's slotted hole and motor flange pin.
3) Fix the flat spring to the motor with the M5 screws. (Three positions)

4) Insert the M6 box screw through the hole on the encoder cover, and fix with six wrenches. Fix the motor shaft at this time, and tighten the screws so that the screws will not loosen.
5) Place the seal enclosed with the encoder onto the hole on the encoder cover.
6) Cut the two wires from the encoder and the wires form the motor to a length that is suitable, and connect each with joint amplifiers.
7) Remove the cannon connector housing with a special tool, pass through the motor cover hole, and assemble the housing (including the rubber packing). Fix to the motor cover with four M3 screws.
8) Install the motor cover to the motor.

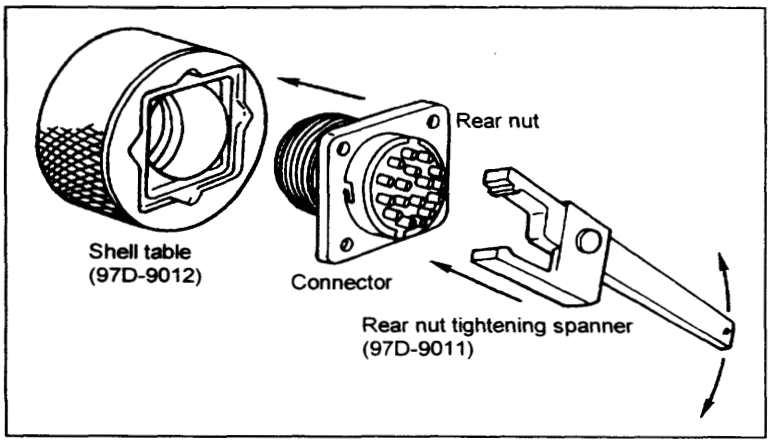
Installation procedure drawing



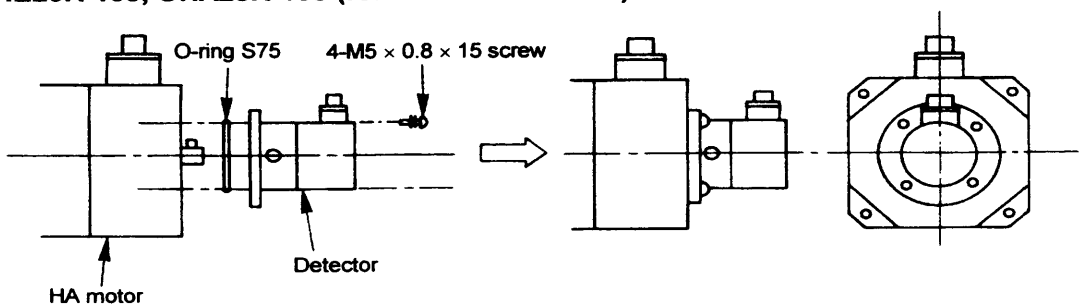
* The current position will be lost after replacement in the OHA25K-4 type, and initializing will be required.
A 0.5mm^2 joint amplifier and a cannon connector housing removal tool will be required at this time.

Name of removal tool	Shell table 97D-9012 Rear nut tightening spanner 97D-9011
Manufacturer	DDK Chicago Office 245 West Roosevelt Road, Bldg. 15 Unit 3, West Chicago, IL60185, U.S.A. Phone: 708-293-7335 Fax: 708-293-7337

Mounting/dismounting of insert



(3) OHE25K-108, OHA25K-108 (for low inertia motor)



(Note) If the detector installation direction is B, C, D, the detector connector must come to the B, C, D position shown above.

Mounting method

1) Install the O-ring (S75) on the detector flange.
2) Install a M4 hexagonal socket screw on the coupling.
3) Align and insert the motor shaft key in the detector bellow keyway.
4) Align the position mark on the detector and the motor markings.
5) Install the detector on the motor. (Use M5 × 0.8 screws.)
6) Tighten the screw on the keyway to fix the key.
7) Tighten the detector's rubber plug.

(Note) The detector and bellow position is determined so do not remove the bellow from the detector.

3.2.2 OSE/OSA type encoder

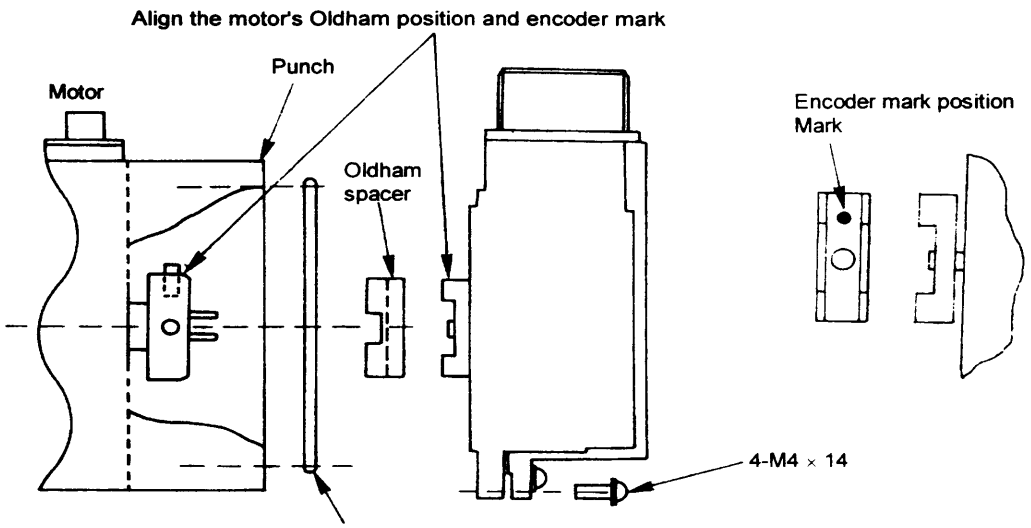
Note 1. The pole position must be adjusted for the low-inertia motor, so do not replace the encoder.
Note 2. The IP67 compliant motor is submerge-proof, so do not replace the motor.
Note 3. For the IP65 compliant motor, replace the packing with new packing when replacing the motor.

(1) OSE104S/105S, OSA104S/105S (for HA23/33 motor)

Installation method

1) Install the O-ring on the encoder spigot section.
2) Install the encoder on the motor. At this time, align the motor's Oldham position (Oldham installation screw hole position) and encoder's Oldham mark position. Install the Oldham spacer between this. Fix the encoder's connector position to the motor connector position or designated position.
3) Fix the encoder with four M4 P screws. Align the encoder flange markings and the motor flange punch position.
   * The current position will be lost after replacement in the OSA104S/105S type, and initializing will be required.

Installation procedure drawing

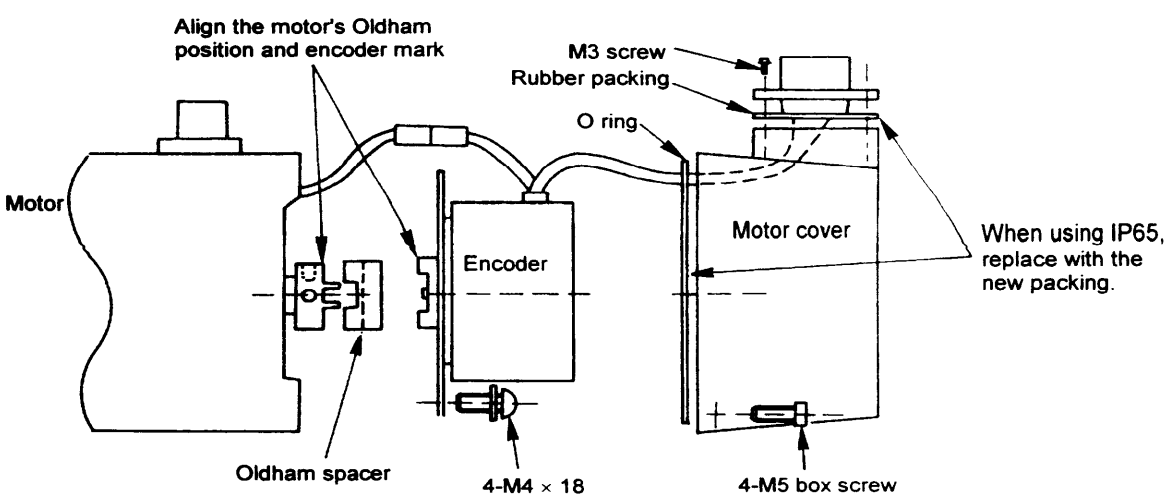


(2) OSE104/105, OSA104/105

Installation method

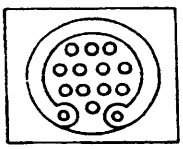
1) Remove the cover screws with a M5 hexagonal wrench and remove the cover.
2) Install the encoder on the motor. At this time, align the motor shaft pin (Oldham installation screw hole position) and the encoder's Oldham mark position. Install the Oldham spacer between this.
3) Fix the motor with four M4 screws.
4) Connect the two connectors from the encoder with the two connectors from the motor.
5) Remove the cannon connector housing with a special tool, pass through the motor cover hole, and assemble the housing (including the rubber packing). Fix to the motor cover with four M3 screws.
6) Install the motor cover to the motor.

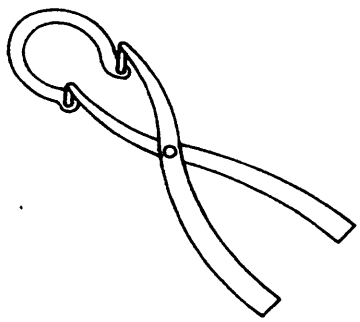
Installation procedure drawing



* The current position will be lost after replacement in the OHA25K-4 type, and initializing will be required.
A 0.5mm^2 joint amplifier and a cannon connector housing removal tool will be required at this time.

Mounting/dismounting of insert



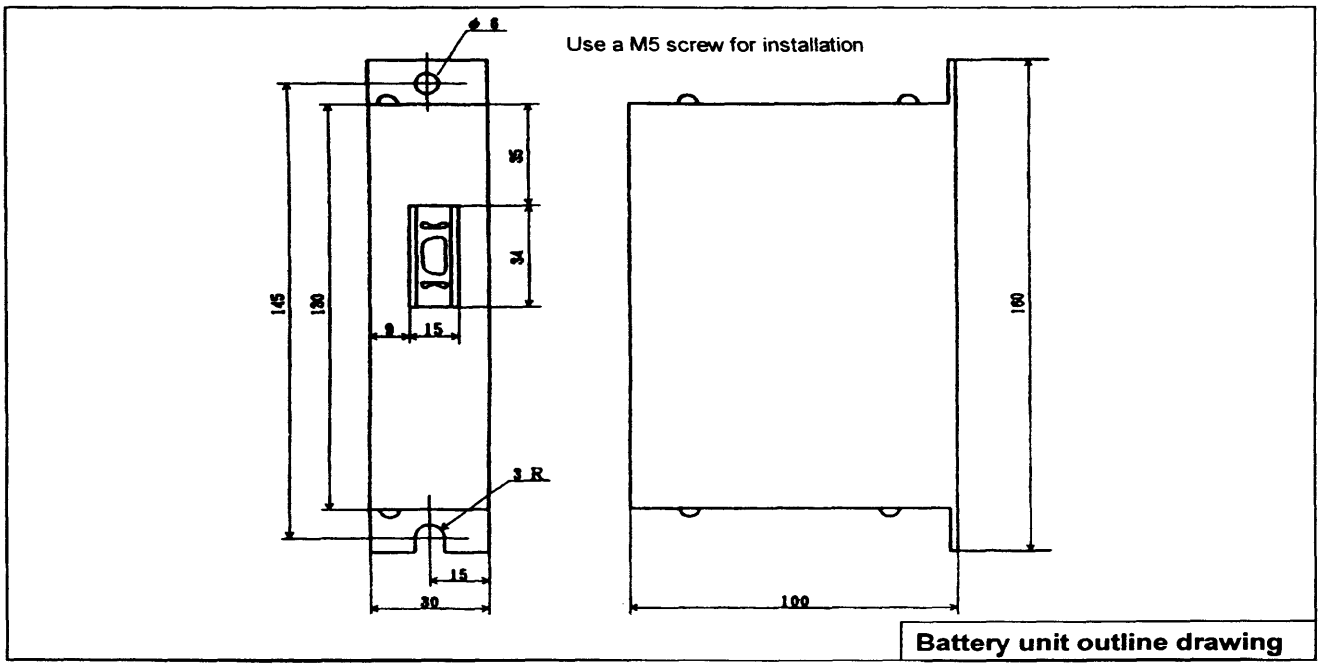


3.3 Battery unit

The battery built in the battery unit MDS-A-BT is used to save data in the absolute position detection system.

- o Applicable battery : Li battery
- o Battery back up time : 7 years (at 265 workdays, 100 holidays)
  - * The back up time will be reduced if there are more holidays or if the ambient temperature is high.

The battery is brazed onto the PCB in the battery unit, so the battery cannot be replaced by itself. Instead, the entire unit must be replaced.



Battery unit outline drawing

[Replacement procedure]

1. Turn OFF the NF for the input power supply 200/230VAC, pull out the cable, and remove the battery unit.
2. Replace the battery unit, and connect the cable.
3. Turn ON the power and confirm the operation.

Note) The backup time of the built-in backup capacitor in the absolute value detector OHA25K-4, -85 and -ET is 20 hours when delivered, and will decrease by half to ten hours after five years of use. Complete the operation within that time.

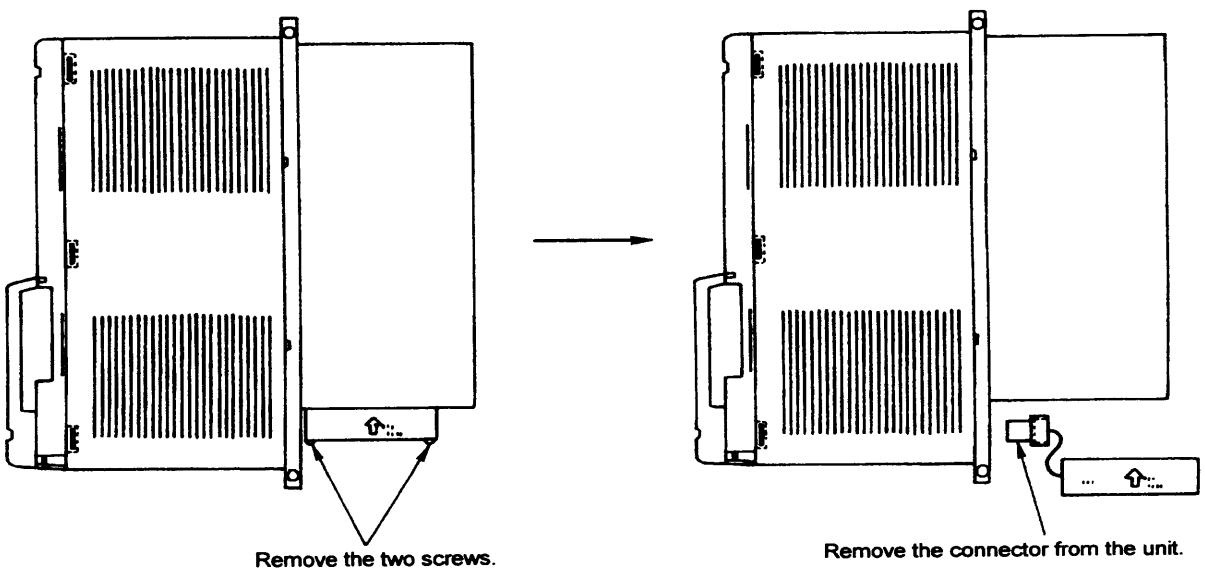
3.4 Unit fan

The life of the fan is approximately 5 years during normal use (the life will differ according to the usage state and environment). Follow the procedure below to replace the fan.

(1) MDS-A/B series

[Replacement procedure]

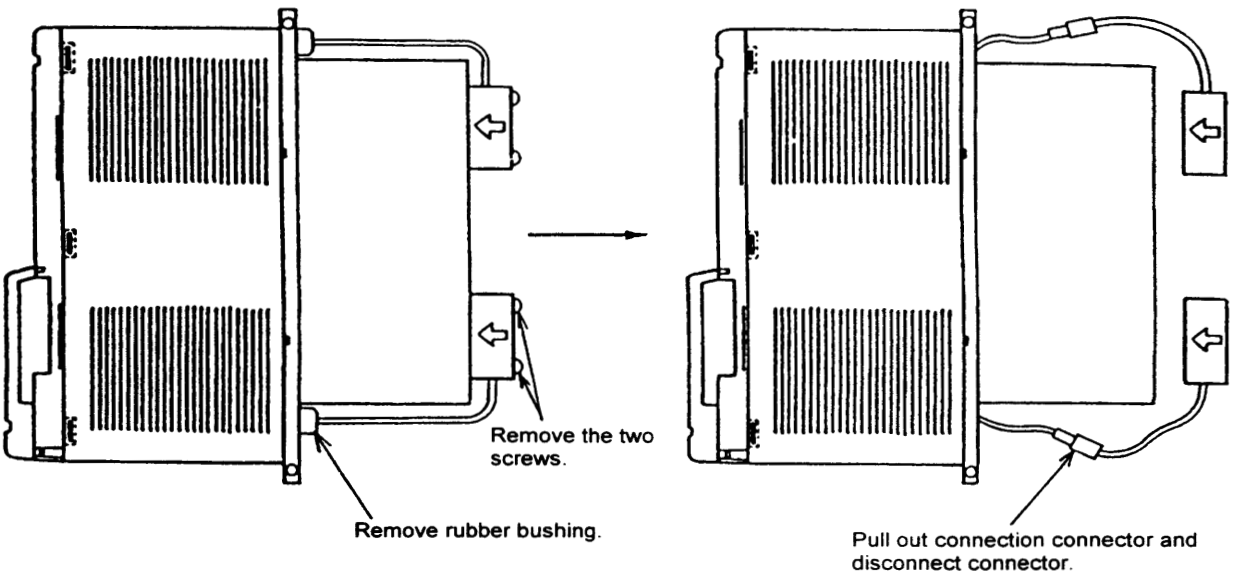
1. Turn OFF the NF for the input power supply 200/230VAC, wait for the CHARGE lamp on the power supply unit to go out, and then remove the unit.
2. Remove the two fan installation screws on the bottom of the cooling fin.
3. Remove the connector from the rear of the unit, and replace the fan.



(2) MDS-C1 series

[Replacement procedure]

1. Turn OFF the NF for the input power supply 200/230VAC, wait for the CHARGE lamp on the power supply unit to go out, and then remove the unit.
2. Remove the fan guard from the end of the unit, and remove the two screws installing the fan.
3. Remove the rubber bushing for the fan power cable, and pull out the connection connector.
4. Disconnect the connection connector, and replace the fan.



4. Daily Maintenance

⚠ WARNING
1. Always wait at least ten minutes after turning the power supply OFF before starting maintenance and inspection. Failure to do so could lead to electric shocks. 2. Maintenance and inspection must be done by a qualified technician. Failure to observe this could lead to electric shocks. Contact your nearest Service Center or Service Station for repairs and part replacement.

4.1 Tools for maintenance

NOTICE
Never perform a megger test (insulation resistance measurement) on the spindle amplifier control circuit.

(1) Measurement instruments

The following measurement instruments are required to confirm that the correct power is being supplied to the servo amplifier and that the servo amplifier wiring is correct.

Equipment	Conditions	Application
Tester		Confirm that the wiring to the servo amplifier is correct before turning ON the power.
Oscilloscope		For general measurement and troubleshooting.
AC voltmeter	Measure the AC power voltage. The tolerable difference is ±2% or less.	Measure the AC power voltage being supplied to the servo amplifier.
DC voltmeter	Maximum reading 10V, 30V. The tolerable difference is ±2% or less.	Measure the DC power voltage.
AC ammeter		Measure the alternate current being supplied to the motor.

(2) Tools

Screwdrivers (Large and medium Phillips type, small flat head)

4.2 Periodic inspection

A still type drive unit is being used, but the fan built in the unit and the additional cooling fans must be inspected periodically.
The servomotor is brush-less and basically does not require maintenance, but must be inspected periodically for abnormal noise and vibration.

Recommended periodic inspection items

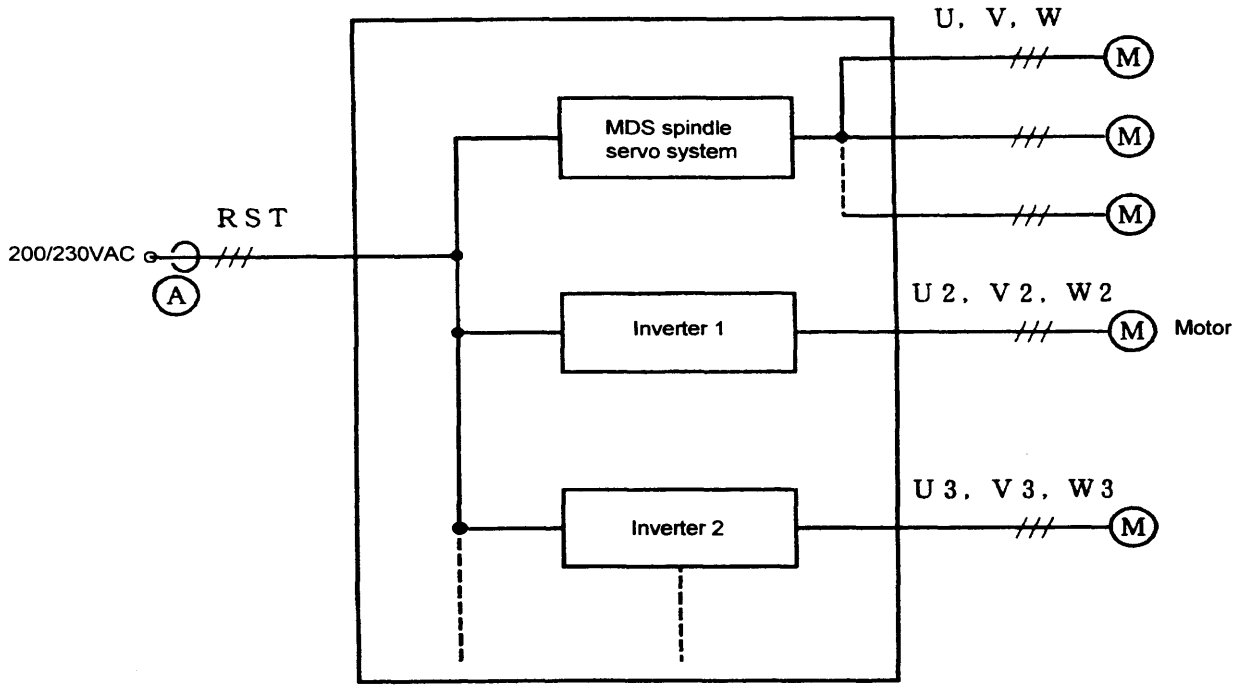
Item		Inspection frequency	Inspection details	Remedies
Cooling fan (fan built-in unit) and additional cooling fan (outside unit)		Monthly	1. Can the fan be rotated easily by hand? 2. Does the fan rotate properly when the power is ON? 3. Is the fan dirty with oil or dirt? 4. Do the bearings make abnormal sounds?	Clean or replace the fan
Terminal block screws		As necessary	1. Are the screws loose? 2. Are the screws dirty with oil or dirt?	Tighten and clean the screws
Cables and connectors		As necessary	1. Is there any damage or scratches, etc.? 2. Are the connectors loose?	Replace the cable Tighten the connectors
Battery unit		Every 7 years	1. The battery life is 7 years under normal use. This will differ according to the usage environment (temperature, usage frequency, etc.).	Replace the unit
Motor	Sound, vibration	Monthly	Is there any abnormal sound or vibration?	
	Tempera-ture	Monthly	Are the motor bearings or frame hot when touched by hand?	
	Insulation	Twice/year	Is the resistance 1MΩ or higher when insulated with a 500V megger tester between the motor frame and motor terminals (U, V, W). (Remove the motor's cannon plug before measuring).	

5. Maintenance Parts

No.	Part	Type	Applicable unit	Maker	Q'ty	Replacement time	Remarks
1	Fan (built-in unit)	VFA-4018-BH20 BKO-NC6855H01	A/B-CV- 37 55 75	Style Electro-nics	1	5 years	The fan life will differ according to the usage conditions. * The additional cooling fans must be prepared by the machine maker. (Refer to the specifications)
			A/B-V1- 35				
			A/B-V2- 2010 2020				
			A/B-SP- 22 37				
		VFA-8018-BH20 BKO-NC6855H02	B-V1-45				
			A/B-V2- 3510 3520 3535				
			B-V2- 4520 4535				
			A/B-SP- 55 75 110				
		US80D22-T BKO-NC6855H21	A/B-CV- 110				
			A-V1-45				
			A-SP-110 (old type)				
		S92B22-T BKO-NC6855H22	A/B-CV- 150 185				
			A/B-V1- 70 90				
			A/B-SP- 150 185				
		US12D22-T BKO-NC6855H23	A/B-CV- 220 260 300				
			B-CV-370				
			B-V1- 110 150				
			A/B-SP- 220 260 300				
		MMF-09C24TS-RN4 BKO-NC5332H14	C1-CV- 150 185	MELCO TECHNO-REX	1		
			C1-CV- 220 260 300 370		2		
			C1-SP/H- 150 185 220 260S 300S		2		
			C1-V1- 70 90 110 150		2		
			C1-V2-7035 7045 7070		2		

No.	Part	Type	Applicable unit	Maker	Q'ty	Replacement time	Remarks
1	Fan (built-in unit)	MMF-06F24ES-RN5 BKO-NC5332H12	C1-CV-110	MELCO TECHNO-REX	1	5 years	The fan life will differ according to the usage conditions. * The additional cooling fans must be prepared by the machine maker. (Refer to the specifications)
			C1-SP/H-55 75 110 150S		2		
			C1-SP/H-260 300		4		
			C1-V1-45		2		
			C1-V2-3535 4520 4535 7070S 4545		2		
		MMF-04C24DS-ROE BKO-NC5332H11	C1-SP/H-22 37		2		
			C1-V1-20		1		
			C1-V1-35 45S 70S		2		
			C1-V2-2010 2020 3510S 3520S		2		
2	Battery unit	MDS-A-BT-2 4 6 8	———	Mitsubishi Electric	1 (only absolute position detection system)	7 years	The life will differ according to the usage conditions.
3	AC reactor	B-AL-7.5K -11K -18.5K -30K -37K	———	Mitsubishi Electric	According to the system configuration	When broken	
4	Contactor	According to power supply unit capacity	———	Mitsubishi Electric	According to the system configuration	When broken	
5	NFB	According to power supply unit capacity	———	Mitsubishi Electric	According to the system configuration	When broken	

As a high frequency chopper current that is PWM controlled flows to the AC servo/spindle, the leakage current will be larger than a motor run with a commercial power supply. Select the leakage breaker according to the following explanation and securely ground both the amplifier and motor.



Machine power distribution box

The commercial frequency composition of the leakage current for the MELDAS MDS-A Series spindle and servo system is approximately 6mA for one spindle axis and 1mA for one servo axis. However, when selecting the leakage breaker, differences in the motor power line length, distance with the grounding and motor size, etc., must be considered, and should be calculated as a max. of 15mA per spindle axis and 2mA per servo axis.
Furthermore, if other inverter equipment is connected to the same power line, the leakage current for that equipment must also be considered, and so select and install the leakage breaker in the position marked Ⓐ above.
Select a leakage breaker (for inverters) that removes the high frequency elements with a filter, and that detects only the leakage current within the commercial frequency range (approx. 50 to 60Hz).
If a leakage breaker that is too sensitive towards the high frequency elements is used, the breaker may malfunction.

Note) There is one spindle axis and three servo axes in the MDS Series, and if the total of the leakage current from the equipment on the same power line is 7mA, select a leakage breaker so that the following calculated value is within the rated non-operative sensitivity current.

15mA + 2mA × 3 + 7mA = 28mA

When using a leakage tester to investigate the cause of leakage breaker malfunction, etc., select one that is not affected easily by the high frequency and which has a measurement range of 50 to 60Hz.

Example) LC-30F manufactured by Soko Denki

Note) Always ground the machine with class 3 grounding for safety purposes.

6. Noise Filter

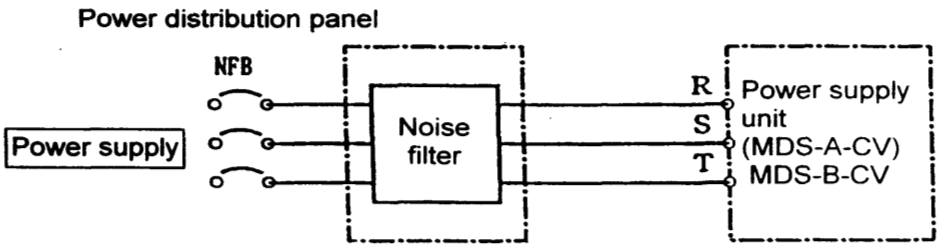
(1) Selection

If radio noise needs to be reduced, select one of the following noise filters according to the type of power supply unit being used.

MDS-A-CV- MDS-B-CV-	Noise filter type (Tohoku Kinzoku)
37	LF-330
55	LF-340
77	LF-350
110	LF-360
150, 185	LF-380K
220, 260, 300	Two LF-380K filters in parallel
MDS-B-CV-370	Two LF-380K filters in parallel

(2) Noise filter installation position

Insert the noise filter at the unit's input.



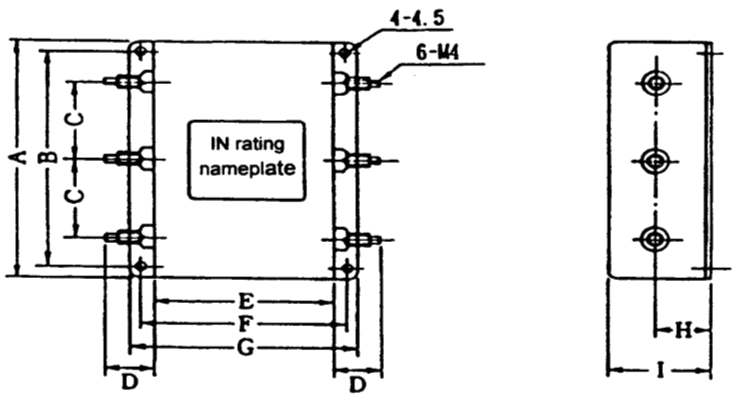
* Connect to the transformer input for the power units used by the transformer.

(3) Specifications

Part name	Rated voltage AC DC (V)	Rated current AC DC (A)	Test voltage AC (V) between case terminals for one minute	Insulation resistance (MW) 500VDC	Leakage current (mA) 250V 60Hz	Working temperature range (°C)
330	200V	30A	1500	> 300	< 1	-20 to +55
340	200V	40A	1500	> 300	< 1	-20 to +45
350	200V	50A	1500	> 300	< 1	-20 to +45
360	200V	60A	1500	> 300	< 1	-20 to +45
380K	200V	80A	2000	> 300	< 5	-25 to +55

(4) Shape and dimensions

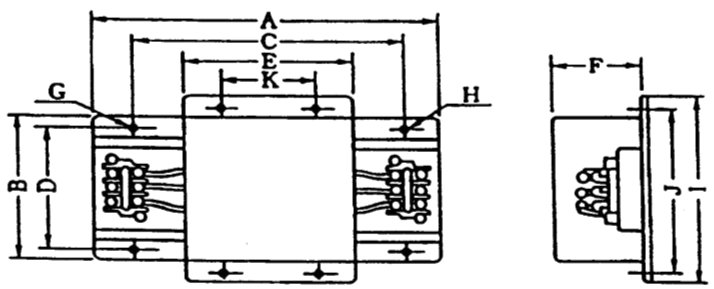
LF-300 Series



Part name	A	B	C	D	E	F	G	H	I
LF-330	180	170	60	29	120	135	150	35	65
LF-340	180	160	50	30	200	220	240	40	80
LF-350	180	160	50	30	200	220	240	40	80
LF-360	200	160	60	30	300	320	340	50	100

(mm)

LF-K Series



Name	Terminal plate	A	B	C	D	E	F	G	H
LF-380K	TE-K22 M6	670	400	560	380	500	170	9X6.5ø	6.5ø

II. MDS-A-CV
MDS-B-CV
MDS-A-CR
Power Supply Section

1. Troubleshooting

1.1 Status display

⚠ WARNING
1. Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks. 2. Do not operate the unit with the front cover removed. The high voltage terminals and charged sections will be exposed, and can cause electric shocks. 3. Do not open the front cover whole the power is ON or during operation. Failure to observe this could lead to electric shocks.

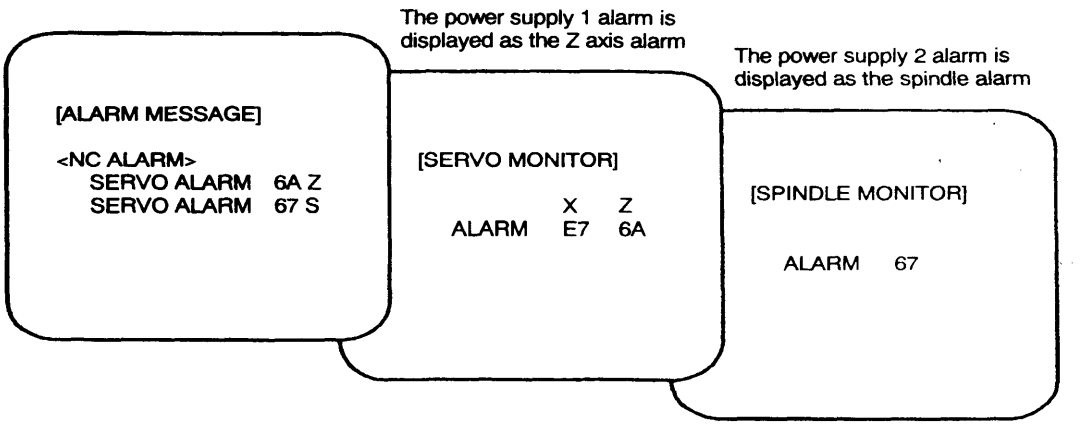
⚠ CAUTION
1. Always check the parameters before starting. Depending on the machine, unforeseen operation could take place. 2. Do not touch the servo amplifier fins, regenerative resistor or servomotor, etc., while the power is turned ON or immediately after turning the power OFF. Some parts are heated to high temperatures, and touching these could lead to burns.

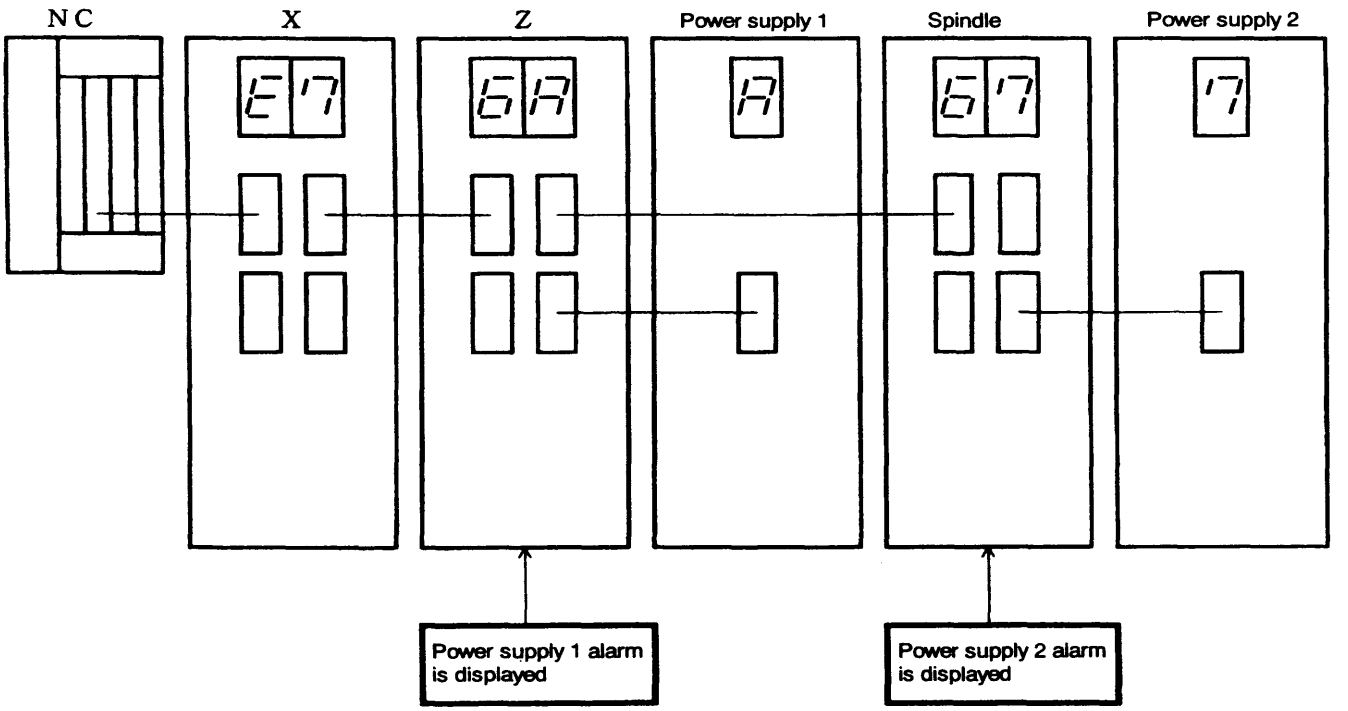
The power supply state is displayed on the 7-segment LED on the top of the power supply. When an alarm occurs, the alarm No. will display on 7-segment LED on the servo/spindle drive connected with the communication cable (CN4) and on the NC diagnosis screen.

(1) Alarm display on NC diagnosis screen

Alarm display with 7-segment LED on drive unit

If the servo/spindle alarms #60 to #7F display on the diagnosis screen, a power supply alarm has occurred. The power supply alarm will display as the alarm for the axis connected to the power supply communication cable (CN4). At the same time, the same alarm No. will display on the spindle/servo drive unit's 7-segment LED. An example is shown below.





(2) 7-segment display

The power supply state will be indicated by the 7-segment LED on the power supply. When an alarm or warning occurs, the alarm code will flicker and display. If the code does not flicker, the display is not an alarm display.

Display	Details	
b	Ready OFF	From 200VAC (24VDC) ON to release of emergency stop.
c	Servo OFF	Displayed for approx. 1 sec. after emergency stop is released and then changes to d display.
d	Servo ON	Indicates that emergency stop is released and operation is possible.
: Flicker	Alarm or warning has occurred	

: Alarm display code (This display code differs from the alarm No.)

Power supply alarm and warning list

Alarm No.	LED display	Alarm display model				Meaning	Detection timing	Alarm release
		A-CV	B-CV	C1-CV	A-CR			
60	0				O	Instantaneous stop (24VDC)	Constantly after power is turned ON	PR
61	1	O	O	O		Power module overcurrent	Constantly after power is turned ON	PR
62	2			O		Frequency error	Constantly after power is turned ON	PR
63	3	O	O		O	Auxiliary regeneration error	Constantly after power is turned ON	PR
64	4					Not used		
65	5	O	O		O	Rush relay error	When ready OFF → ready ON	PR
66	6					Not used		
67	7	O	O	O		Open phase	When ready OFF → ready ON	PR
68	8	O	O	O	O	Watch dog	Constantly after power is turned ON	AR
69	9	O	O	O	O	Ground fault	When ready OFF → ready ON	PR
6A	A	O	O	O		Contactor melt	During ready OFF	PR
6B	b	O	O		O	Rush relay melt	During ready OFF	PR
6C	c	O	O	O	O	Main circuit error	When ready OFF → ready ON	PR
6D	d				O	Parameter error	When NC power is turned ON	PR
6E	E	O	O	O	O	Memory error	Immediately after power is turned ON	AR
6F	F	O	O	O		A/D converter error/power supply error	Immediately after power is turned ON/constantly	AR
70	G							
71	H	O	O	O		Instantaneous stop/external emergency stop	During ready ON	NR
72	i							
73	J		O	O	O	Over-regeneration	Constantly after power is turned ON	PR
74	K				O	Regenerative resistor overheat	Constantly after power is turned ON	PR
75	L	O	O	O	O	Overvoltage	Constantly after power is turned ON	NR
76	M		O	O		External emergency stop setting error	When NC power is turned ON	AR
77	n	O	O	O	O	CV : Power module overheat, CR : PCB overheat	Constantly after power is turned ON	PR
E8	o	O	O		O	Auxiliary regeneration frequency over	Constantly after power is turned ON	–
E9	p	O	O	O		Instantaneous stop warning	During ready ON	–
EA	q		O	O		External emergency stop input	When NC power is turned ON	–
EB	r		O	O		Over-regeneration warning	During ready ON	–

[Alarm No.] Alarm No. displayed on the drive unit connected to the power supply unit
[LED display] LED displayed on power supply unit
[Release] AR : Released when power supply unit power is turned ON again.
PR : Released when NC power is turned ON again.
NR : Released with NC reset key.

1.2 Troubleshooting per power supply alarm

⚠ CAUTION
When an alarm occurs, remove the cause of the alarm, confirm that an operation signal is not being input, and secure the safety. Then reset the alarm to resume operation.

When an alarm occurs in the spindle amplifier, the base will be shut off and the motor will coast to a stop. Turn the power OFF with an external sequence.

(1) Alarm No. 60 Instantaneous stop

[Meaning] The 24VDC voltage connected to the CN22 connector has dropped.

[Detection] Constantly after power is turned ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
			○

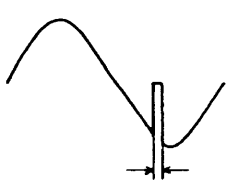
	Investigation item	Investigation results	Remedy
1	Is 24CDC applied on the CN22 connector? Is the voltage low? Does the voltage drop periodically?	The voltage is not applied.	Perform investigation item 3.
		The voltage is 20.4VDC or less.	Increase the power voltage.
		The voltage drops to DC20.4VDC periodically.	Perform investigation item 4.
		The voltage is applied normally.	Perform investigation item 2.
2	Is the CR unit LED lit?	Not lit.	Replace the unit.
		Lit.	• Check the problems in the grounding wiring and noise, etc. • Perform investigation item 4.
3	Investigate the wiring and power voltage.	The power is faulty.	Replace the power supply
		There is a fault in the wiring or connector.	Replace the wiring.
4	• Wiring contact defect • Voltage drop caused by other drive	• Wiring contact is defective.	Replace the wiring.
		Voltage drops due to other drive.	Increase the power supply capacity.

(2) Alarm No. 61 Power module overcurrent

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

[Meaning] This is a overcurrent in the power module in the power supply.

[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	Confirm the operation state at occurrence and repeatability	Occurs each time servo turns ON after turning 200VAC ON.	Replace the unit.
		Occurs often during servo ON	Perform investigation item 3.
		Occurs when motor decelerates	
		Occurs when continuous operation for long time is performed. Unit is hot.	Perform investigation item 2.
2	Investigate the load state, start/stop frequency of each motor.	The total of all motors' loads exceeds power supply rated capacity.	Lower motor load and operation frequency.
		Not exceeded.	Perform investigation item 3.
3	Investigate whether the power supply is normal.		
	1) Is rated power supply capacity secured?	Power capacity is insufficient.	Increase the power supply capacity.
	2) Confirm that the power is 170V or more even during motor acceleration/ deceleration.	Power is less than 170V.	Increase the power supply capacity.
		Power is higher than 170V.	Perform item 3).
	3) Observe the power voltage with a synchroscope. (Also during acceleration/ deceleration)	1. Distortion in voltage waveform.  2. When there is a partial drop.  3. Other waveform or frequency error.	Eliminate the waveform distortion. 1. Increase the power capacity or power cable size. 2. Improve the other semiconductor units where waveform distortion is occurring. (Add an AC reactor.)
	Measure the voltage between R-S, S-T, T-R with a tester.	The voltage difference between each wire is 10V or more.	Improve the power phase balance.
		None of the above apply.	Perform investigation item 4.
4	Investigate the installation environment. Is the grounding correct? Is there any noise generating equipment in the surrounding area?	Grounding is incomplete. Alarm occurs easily when a certain device operates.	Correctly ground. Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.

(3) Alarm No. 62 Frequency error

Operation unit			
A-CV	B-CV	C1-CV	A-CR
		○	

[Meaning] The power frequency is not within the specifications range.

[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	Confirm the operation state at occurrence and repeatability	Occurs each time power is turned ON.	Perform investigation item 2.
		Occurs periodically regardless of operation state.	
		Occurs only when motor accelerates/decelerates.	Perform investigation item 3.
2	Measure power voltage when operation is normal	The frequency is deviated from 50Hz±3% or 60Hz±3%. The frequency may deviate from 50Hz±3% or 60Hz±3% due to fluctuation in the frequency.	Review the power facilities.
		There is a partial drop in the voltage waveform.	Take measures for the power unit or device causing the problem. (Add an AC reactor, etc.)
		The frequency is 50Hz±3% or 60Hz±3%.	Replace the unit.
		No problem found.	Perform investigation item 4.
3	Measure the power voltage while the motor is accelerating/decelerating.	The frequency fluctuation during acceleration/deceleration is great.	Review the power facilities.
		There is a partial drop in the voltage waveform during deceleration.	Take measures for the power unit or device causing the problem. (Add an AC reactor, etc.)
		No problem found.	Perform investigation item 4.
4	Investigate the installation environment.	The grounding is incomplete.	Correctly ground.
		Alarm occurs easily when a certain device operates.	Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.

(4) Alarm No. 63 Auxiliary regeneration error

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○		○

[Meaning] The auxiliary regeneration transistor in the power supply is continuously ON.
[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	Dirt on the regenerative resistance unit on the unit rear.	Cutting oil or oil mist is adhered on the regenerative resistance unit.	Take measures so that cutting oil or dust does not get on the fins on the unit rear, and perform investigation item 2.
		Not dirty.	Replace the unit.
2	Confirm the conductivity of the terminal block (P, N, R, S, T) and the resistor surface with a tester.	There is a conductivity.	Replace the unit.
		Resistance value infinite.	Clean the resistor or fin and take measures so that oil and dust do not get on them. If the alarm occurs again, replace the unit.

(5) Alarm No. 65 Rush relay error

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○		○

[Meaning] The rush resistance short circuit relay in the power supply does not turn ON.
[Detection] When ready OFF → ready ON

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability	Occurs every ready ON	Replace the unit.
		Occurs periodically	Perform investigation item 2.
2	Investigate the installation environment. Is the grounding correct? Is there any noise generating equipment in the surrounding area?	Grounding is incomplete. Alarm occurs easily when a certain device operates.	Correctly ground. Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.

(6) Alarm No. 67 Open phase

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

[Meaning] One phase of input 3øAC200V is not connected.
[Detection] When ready OFF → ready ON

	Investigation item	Investigation results	Remedy
1	Investigate each input phase voltage with a tester.	There is a phase with no voltage.	Supply the correct power.
		All phases are normal.	Perform investigation items 3 and 4 for alarm 71 Instantaneous stop.

(7) Alarm No. 68 Watch dog

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	○

[Meaning] The power supply software process did not end within the designated time.
[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability	Occurs every ready ON	Replace the unit.
		Occurs periodically	Perform investigation item 2.
2	Investigate the installation environment. Is the grounding correct? Is there any noise generating equipment in the surrounding area?	Grounding is incomplete. Alarm occurs easily when a certain device operates.	Correctly ground. Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.

(8) Alarm No. 69 Ground fault

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	○

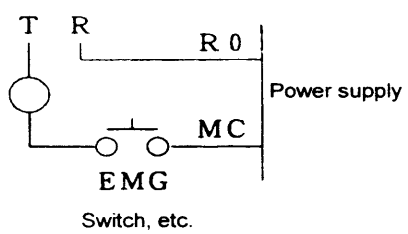
[Meaning] Motor ground fault
[Detection] When ready OFF → ready ON

	Investigation item	Investigation results	Remedy
1	Measure the insulation between the UVW terminals of all motors and the grounding with a megger tester.	100kΩ or less	Motor defect or cable ground fault. Replace motor and cable.
		100kΩ or more	Perform investigation item 2.
2	Is motor or cable covered with oil?	Oil is found.	Take measures so that oil does not come in contact. Clean the motor's cannon connector and inside the terminal box. If the error occurs again, perform investigation item 3.
		Oil is not found.	Perform investigation item 3.
3	Perform the insulation measurement again.	1MΩ or less	Replace motor or cable.
		1MΩ or more	Replace the unit.

(9) Alarm No. 6A Contactor melt

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

[Meaning] The externally connected contactor is on even during ready OFF.
[Detection] During ready OFF

	Investigation item	Investigation results	Remedy
1	Is the contactor externally installed?	Contactor is not externally installed.	Set the power supply rotary switch (SW1) to 1.
		Connector is externally installted.	Perform investigation item 2.
2	Has the contactor melted? Disconnect the contactor exciting wire and start up.	Alarm 6A occurs.	Perform investigation item 3.
		Alarm 6A does not occur.	Perform investigation item 4.
3	Has an error occurred on the driver side (power module error, etc.) before alarm 6A occurred?	Error has occurred.	Remove driver side error cause and then replace contactor.
		Error has not occurred.	Replace contactor.
4	Is the contactor exciting wiring correctly passed though the MC1-R0 terminal?	Wiring is not correct.	Wire as shown below. 
		Wiring is correct.	Replace the unit.

(10) Alarm No. 6B Rush relay melt

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○		○

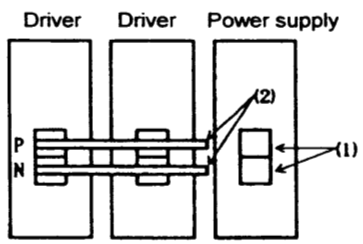
[Meaning] The rush resistance short circuit relay in the power supply is ON.
[Detection] During ready OFF

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs each time power is turned ON.	Perform investigation item 3.
		Occurs periodically.	Perform investigation item 2.
2	Investigate the installation environment. Is the grounding correct? Is there any noise generating equipment in the surrounding area?	Grounding is incomplete. Alarm occurs easily when a certain device operates.	Correctly ground. Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.
3	Has an error occurred on the driver side (power module error, etc.) before alarm 6B occurred?	Error has occurred.	Remove driver side error cause and then replace power supply unit.
		Error has not occurred.	Replace the unit.

(11) Alarm No. 6C Main circuit error

[Meaning] Charging to the main circuit is not normal.
[Detection] When ready OFF → ready ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	○

	Investigation item	Investigation results	Remedy
1	Observe the CHARGE lamp lighting when the alarm occurs.	The CHARGE lamp remains lit for a short time.	Replace the unit.
		The CHARGE lamp lights momentarily but soon the alarm occurs, and when the contactor turns OFF, it goes out immediately.	Perform investigation item 2.
		The CHARGE lamp does not light.	Perform investigation item 2, and then replace the unit.
2	Disconnect the PN terminal block wiring and confirm the following resistance values with a tester.	(1) Error on the power supply side.	Replace the unit.
		(2) Error on the driver side	Review the PN wiring and investigate the drive unit.
	 Disconnect only the PN wiring on the power supply. Measure the positions (1) and (2) with a tester.	Both (1) and (2) are normal.	Replace the unit.

Tester measurement point	+	–	Normal resistance value	Defect
Power supply side	P	N	Several 100Ω	Short circuit or infinite
	N	P	Infinite	Short circuit or several 100Ω
Drive unit	P	N	Several 100Ω	Short circuit or infinite
	N	P	Infinite	Short circuit or several 100Ω

(12) Alarm No. 6D Parameter error

Operation unit			
A-CV	B-CV	C1-CV	A-CR
			○

[Meaning] The power supply unit (CR) capacity and the regenerative resistance type (rtyp) set in the parameter PRYP are not set to an adequate combination.

[Detection] When NC power is turned ON

	Investigation item	Investigation results	Remedy
1	Confirm the parameters of the drive unit connected to the power supply unit. Spindle : SP041 (PTYP) Servo : SV036 (PTYP)		Change the setting to the following combinations.

Servo/spindle parameter :

SV036 SP041 PTYP

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
								rtyp				ptyp			

rtyp External regenerative resistance type

(Set type from following table)

External regenerative resistance type	Resistance value (Ω)	Wattage (W)	rtyp
Power supply not connected	–	–	0
CZ200W260HMJ	26	80	1
CZG300W130HMJ × 2	26	150	2
MR-RB30	13	300	3
MR-RB50	13	500	4
CZG200W200HMJ × 3	6.7	350	5
CZG300W200HMJ × 3	6.7	500	6
R-UNIT-1	30	700	7
R-UNIT-2	15	700	8
R-UNIT-3	15	2.1K	9
FCUA-RB37	25	185	A
FCUA-RB75/2 × 2	15	680	B

ptyp Power supply type

(Set type from following table)

Power supply type	ptyp
CR-10	81
CR-15	82
CR-22	83
CR-37	84
CR-55	86
CR-75	88
CR-90	89

External regenerative resistance and power supply (A-CR) compatibility table

External regenerative resistance type	CR-10	CR-15	CR-22	CR-37	CR-55	CR-75	CR-90
Power supply not connected	×	×	×	×	×	×	×
CZ200W260HMJ	○	○	○	○	○	○	○
CZG300W130HMJ × 2	○	○	○	○	○	○	○
MR-RB30	×	×	×	○	○	○	○
MR-RB50	×	×	×	○	○	○	○
CZG200W200HMJ × 3	×	×	×	×	×	○	○
CZG300W200HMJ × 3	×	×	×	×	×	○	○
R-UNIT-1	○	○	○	○	○	○	○
R-UNIT-2	×	×	×	○	○	○	○
R-UNIT-3	×	×	×	○	○	○	○
FCUA-RB37	○	○	○	○	○	○	○
FCUA-RB75/2 × 2	×	×	×	○	○	○	○

(13) Alarm No. 6E Memory error

[Meaning] Error in the memory circuit in the power supply
[Detection] Immediately after power is turned ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	○

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs each time power is turned ON.	Replace the unit.
		Occurs periodically.	Perform investigation item 2.
2	Investigate the installation environment. Is the grounding correct? Is there any noise generating equipment in the surrounding area?	Grounding is incomplete. Alarm occurs easily when a certain device operates.	Correctly ground. Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.

(14) Alarm No. 6F A/D converter error/power supply error

[Meaning] Error in the A/D converter in the power supply, or the driver detected an error in the power supply
[Detection] Immediately after power is turned ON (A/D converter error)/constantly (power supply error)

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

	Investigation item	Investigation results	Remedy
1	Check the power supply 7-segment LED display.	F is flickering.	A/D converter error. Perform same remedies as for alarm 6E memory error.
		Other alarm code is flickering.	Refer to each alarm section.
		0 is displayed.	Perform investigation item 2.
		F is displayed.	Perform investigation item 2.
		8 is displayed.	Refer to alarm 68 watch dog alarm.
		b, c, d are displayed.	Perform investigation item 3.
		Other display	Refer to alarm 68 watch dog alarm.
2	Investigate the rotary switch setting.	Setting is 0 or 1.	Replace the unit.
		Setting is not 0 or 1.	Correctly set the rotary switch.
3	Check the driver communication cable wiring.	The wiring is mistaken. There is no shield.	Replace the cable.
		The wiring is OK.	Perform investigation item 4.
4	Try replacing the driver communication cable.	OK after replacement.	Cable defect.
		NG even after replacement.	Replace the unit.

(15) Alarm No. 71 Instantaneous stop/external emergency stop

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

[Meaning] The externally installed contactor is OFF.
An instantaneous stop exceeding 25ms occurred.
[Detection] During ready ON

	Investigation item	Investigation results	Remedy
1	Is the externally installed contactor OFF due to emergency stop, etc.? Check the sequence.	Contactor is OFF.	The power supply operates normally. Check the machine sequence. When directly turning OFF the contactor with the emergency stop button, etc., and the NC emergency stop is applied simultaneously with the contactor OFF, emergency stop will occur instead of alarm.
		Contactor is not OFF.	Perform investigation item 2.
2	Occurrence state.	Occurs constantly during ready ON.	Perform investigation item 3.
		Occurs with certain operation.	Perform investigation item 1 again. If there is no error, perform investigation item 3.
		Occurs sometimes during operation (not-regulated).	Perform investigation item 4.
3	Is the RST wiring correct? Is the contactor wiring sequence correct?	The wiring or sequence is incorrect.	Repair the items noted on the left.
		No error.	Perform investigation item 4.
4	Observe the power waveform with a synchroscope.	Instantaneous power failure or voltage drop occur often.	Review the power facilities.
		No error.	Replace the unit.

(16) Alarm No. 73 Over-regeneration

Operation unit			
A-CV	B-CV	C1-CV	A-CR
	○	○	○

[Meaning] The regenerative resistor's load exceeded the tolerable value.
[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	What is the alarm occurrence state and the regenerative load displayed on the monitor screen? Confirm by changing the operation mode.	The regeneration load display increases when the power is turned ON and the motor is rotated.	Check for the effect of power fluctuation, grounding connection and noise. If there is no abnormality, replace the unit.
		The regeneration load display increases each time the motor decelerates, and an alarm occurs.	A-CR : Perform investigation item 2. B-CV : Perform investigation item 3.
		The regeneration load display increases each time the motor decelerates, but an alarm does not occur when the operation mode is eased.	If there is no problem after performing investigation item 2, ease the operation mode.

	Investigation item	Investigation results	Remedy
2. Only CR	Confirm that the external regenerative resistance type set in the parameter (PTYP) of the drive unit connected to the power supply unit is correct. Confirm that the rotary switch is set to "0". * This may be set to "2" for special specifications.	The setting is incorrect. (Refer to the parameter settings for alarm "6D".	Set to the correct setting, and confirm again.
		The setting is correct.	Perform investigation item 3.
3	Confirm whether the operation is correct after performing investigation item 3 for alarm "75", and that the regenerative resistance value, etc., is correct.		

(17) Alarm No. 74 Regenerative resistance overheat

Operation unit			
A-CV	B-CV	C1-CV	A-CR
			○

[Meaning] The external regenerative resistance thermal relay has functioned.

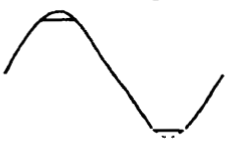
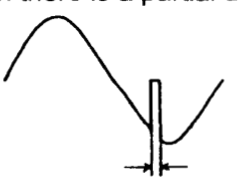
[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	Confirm whether the resistor has overheated. **Note)** Do not touch the resistor or case directly. It is hot and can cause burns.	The unit is hot.	Perform investigation item 2.
		The unit is not hot.	Perform investigation item 3.
2	Confirm the alarm history. The over-regeneration warning or over-regeneration alarm has occurred. Is the resistor installation correct?	The alarm has occurred.	Check the items for alarm "73". If there is no abnormality, ease the operation mode.
		The alarm has not occurred.	Perform heat measures for the regenerative resistor. • Install in a well-ventilated place. • Cool with a fan, etc.
3	Confirm the CN22 (B) connector pins 1 and 2. • Confirm whether there is a short circuit caused by the resistor's terminal or wire.	The wire is cut.	Replace with correct wiring.
		There is no conductivity in the resistor's terminal relay.	Replace the resistor.
		The wire is correct.	Replace the unit.

(18) Alarm No. 75 Overvoltage

[Meaning] The voltage between PN exceeded 410V.
[Detection] Constantly after power is turned ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	○

	Investigation item	Investigation results	Remedy
1	What state did the alarm occur in?	Occurs each time the motor decelerates.	Perform investigation item 4.
		Occurs always during a certain deceleration mode.	Perform investigation item 3.
		Occurs periodically.	Perform investigation item 2.
2	Look at the alarm history on the power supply diagnosis screen.	E0 is output right before the overvoltage. (Over-regeneration warning)	Perform investigation item 3.
		Others	Perform investigation item 3.
3	Observe the regeneration load of the axis where the alarm occurred on the servo/spindle monitor screen.	Regeneration load increases when several axes decelerate simultaneously.	Decrease the simultaneous deceleration frequency.
		Other than the above.	Perform investigation item 4.
4	Investigate whether the power supply is normal.		
	1) Is rated power supply capacity secured?	Power capacity is insufficient.	Increase the power supply capacity.
	2) Confirm that the power is 170V or more even during motor acceleration/ deceleration.	Power is less than 170V.	Increase the power supply capacity.
		Power is higher than 170V.	Perform item 3).
	3) Observe the power voltage with a synchroscope. (Also during acceleration/ deceleration)	1. Distortion in voltage waveform.  2. When there is a partial drop.  3. Other waveform or frequency error.	Eliminate the waveform distortion. 1. Increase the power capacity or power cable size. 2. Improve the other semiconductor units where waveform distortion is occurring. (Add an AC reactor.)
	Measure the voltage between R-S, S-T, T-R with a tester.	The voltage difference between each wire is 10V or more.	Improve the power phase balance.
		None of the above apply.	Perform investigation item 5.
5	Observe the power waveform with a synchroscope.	Instantaneous power failure or voltage drops occur often.	Review the power facilities.
		No error.	Perform investigation item 6.
6	Investigate the installation environment. Is the grounding correct? Is there any noise generating equipment in the surrounding area?	Grounding is incomplete. Alarm occurs easily when a certain device operates.	Correctly ground. Perform the noise measures for the device on the left.
		No problem found.	Replace the unit.

(19) Alarm No. 76 External emergency stop setting error

Operation unit			
A-CV	B-CV	C1-CV	A-CR
	○	○	

[Meaning] The rotary switch setting and parameter (PTYP) setting do not match.
[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy
1	Confirm the rotary switch setting and the parameter (PTYP) of the drive unit connected to the power supply unit.	When not using external emergency stop 1. The rotary switch is set to 4 or 5. 2. The parameter (PTYP) is set to **40 to **79.	1. Set the rotary switch to 0 or 1. 2. Set the parameter (PTYP) to **00 to **39.
		When using external emergency stop 1. The rotary switch is set to 0 or 1. 2. The parameter (PTYP) is set to **00 to **39.	1. Set the rotary switch to 4 or 5. 2. Set the parameter (PTYP) to **40 to **79.
		The combination is correct.	Replace the unit.

(20) Alarm No. 77 Power module overheat

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

[Meaning] Overheating of the power module (IPM) in the power supply was detected.
[Detection] Constantly after power is turned ON

	Investigation item	Investigation results	Remedy	
1	Investigate the heat radiating environment			
	1) Rotation of fan on rear of unit	The fan is not rotating correctly.	Replace the fan	Take measures to prevent cutting oil or dust from contacting the fins.
	2) Contamination of radiating fins on rear of unit	Remarkable amounts of cutting oil or dust are adhered on the radiating fins.	Clean the fins	
	3) Measurement of unit ambient temperature	55°C is exceeded.	Consider ventilating or cooling measures for the panel.	
		None of the above apply.	Perform investigation item 2.	
2	Investigate the installation environment. Is the grounding correct? Are there any noise generating devices in the periphery?	The grounding is incomplete. Alarms occur easily when a certain device operates.	Correctly ground. Take noise measures for the device on the left.	
		No particular problem.	Replace the unit.	

1.3 Power supply warnings

The power supply warnings are not displayed on the servo/spindle monitor screen. The warning will be displayed on the power supply's 7-segment LED and in the alarm history on the power supply diagnosis screen.
Operation can be continued after the warning, but it does indicate that there is a factor for an alarm.

(1) Alarm history display [E0] Auxiliary regeneration frequency over LED display [□]

[Meaning] This indicates that the instantaneous regeneration energy is large, and regeneration was not possible only with the power supply regeneration. Due to this, regeneration at the auxiliary regeneration's performance limit occurred. When this warning occurs, the auxiliary regeneration will not function, so this could lead to an overvoltage alarm.

[Detection] During ready ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○		○

	Investigation item	Investigation results	Remedy
1	Perform inspection items 3 and following in alarm 75 overvoltage.		

(2) Alarm history display [E9] Instantaneous stop warning LED display [P]

[Meaning] An abnormal instantaneous stop occurred for 25ms or more. An alarm did not occur because the main circuit voltage did not drop. This may cause an instantaneous stop alarm, overvoltage alarm or power module error.

[Detection] During ready ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
○	○	○	

	Investigation item	Investigation results	Remedy
1	Perform inspection items 3 and following in alarm 71 instantaneous stop.		

(3) Alarm history display [EA] External emergency stop input LED display [9]

[Meaning] The external emergency stop signal was input.
24V is not applied on the CN23 connector.
[Detection] Constantly after power is turned ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
	○	○	

	Investigation item	Investigation results	Remedy
1	When not using external emergency stop Investigate the rotary switch and parameter (PTYP).	The external emergency stop is set to valid.	Set to invalid. Refer to investigation item 1 of alarm 76.
2	When using external emergency stop • Investigate the CN23 connector voltage.	24V is applied on the CN23 connector.	Replace the unit.
		24V is not applied on the CN23 connector.	Perform investigation item 3.
3	① Investigate whether the CN23 connector or cable is broken.	The wire is broken or breaks sometimes.	Correctly wire.
	② Investigate the external emergency stop switch contact.	The contact is defective or is periodically defective.	Replace the switch.

(4) Alarm history display [EB] Over-regeneration LED display [r-]

[Meaning] 80% of the over-regeneration alarm level was reached.
[Detection] During ready ON

Operation unit			
A-CV	B-CV	C1-CV	A-CR
	○	○	

	Investigation item	Investigation results	Remedy
	Perform the investigation items for alarm 73 over-regeneration.		

III. MDS-A-Vx
MDS-B-Vx
Servo System Section

1. MDS-C1-V1/V2 Servo Drive Unit

1.1 Points changed from B Series

1.1.1 Compatible detectors and compatible motors

(1) Compatible detectors

Note that some detectors are not compatible with the C1 Series.

○: Connectable, ×: Not connectable

Detector type		Detector model	MDS-B-V1/V2 Series	MDS-B-V14/V24 Series	MDS-C1-V1/V2 Series
Motor end detector	ABZ (+ low-speed serial)	OHE25K-6, OHE25K-85, OHA25K-6, OHA25K-85	○	×	×
	High-speed serial	OSE104, OSE104S, OSE104S1, OSE104S2 OSE105, OSE105S, OSE105S1, OSA105S2 OBA13, OSA14, OBA17	○	○	○
	Motor built-in encoder (For HA053C/13C)	OHE2500	○	×	×
Ball screw end detector	ABZ (+ low-speed serial)	OHE-25K-ET, OHA-25K-ET	○	○	○
	High-speed serial	OSE104-ET, OSA104-ET OSA105-ET, OSE105-ET	○	○	○
Linear scale	ABZ	Optical scale, magnetic scale, MP scale	○	○	○
	Low-speed serial	AT41 (Mitsutoyo) FME type, FLE type (Futaba Denshi)	○	○	○
	High-speed serial	AT342 (Mitsutotyo) Resolution 0.5μm	○	○	○
		LC191M (Heidenhain) Resolution 0.1μm	×	○	○
		AT343 (Mitsutoyo) Resolution 0.05μm	×	×	○
		Heidenhain analog output scale (LF Series, LS Series) + MDS-B-HR (Scale interface unit)	×	×	○

(2) Compatible motors

1) HC motor : (INC specification) HC***-E42/E51,
(ABS specification) HC***-A42/A51
2) HC R motor : (INC specification) HC***R-E42/E51,
(ABS specification) HC***R-A42/A51
3) HA N motor : (INC specification) HA***N/INC high-speed serial encoder,
(ABS specification) HA***N/ABS high-speed serial encoder
4) HA L motor : (INC specification) HA***L/INC high-speed serial encoder,
(ABS specification) HA***L/ABS high-speed serial encoder
5) HA-LH S1 motor : (INC specification) HA-LH**S1/INC high-speed serial encoder,
(ABS specification) HA-LH**S1/ABS high-speed serial encoder
6) HA-FF motor : (ABS specification) HA-FF***
7) HC-MF motor : (ABS specification) HC-MF***
8) HA compact motor : (INC specification) HA053NC, 13NC/INC high-speed serial encoder,
HA-FE**
(ABS specification) HA053NC, 13NC/ABS high-speed serial encoder,
HA-FH**

INC high-speed serial encoder = OSE104/S/S1, OSE105/S/S1
ABS high-speed serial encoder = OSA104/S/S1, OSA105/S/S1

1.1.2 2-system compliance (standard amplifier (MDS-B-V1/V2) mode and high-gain amplifier (MDS-B-V14/V24) mode)

(1) Outline

- With the C1 Series, control can be carried out in the standard amplifier (MDS-B-V1/V2) mode and high-gain amplifier (MDS-B-V14/V24) mode. This allows the amplifier to be changed from the standard amplifier (MDS-B-V1/V2) or from the high-gain amplifier (MDS-B-V14/V24) with the same parameters.
- When the standard amplifier is replaced with the high-gain amplifier, the amplifier is recognized automatically by the status of the servo parameters set with the machine.

⚠ CAUTION

When the control mode has been changed to the high-gain amplifier (MDS-B-V14/V24) mode after remounting from the standard amplifier (MDS-B-V1/V2), the parameters must be changed for the high-gain amplifier and the servo parameters must be adjusted.

(2) Compatible software version

The 2-system compatible software is compatible from Version A1 (BND-582W000-A1).

* Version A0 is not compatible with the standard amplifier mode. It is compatible only with the high-gain amplifier mode.

(3) Judging changeover of control mode

Whether to start the servo amplifier in the standard amplifier compatible mode or the high-gain amplifier compatible mode is judged by the servo parameters SV009 to SV012 and SV033 setting values set in the machine.

Servo parameters	SV009 to SV012	SV009 = 4096 or more, SV010 = 4096 or more, SV011 = 768 or more, and SV012 = 768 or more.	Setting in which not even one of the following conditions is satisfied. SV009 = 4096 or more, SV010 = 4096 or more, SV011 = 768 or more, and SV012 = 768 or more	SV009=* SV010=* SV011=* SV012=*	SV009=* SV010=* SV011=* SV012=*	SV009=* SV010=* SV011=* SV012=*
	sv033 (SSF2)/bit8	0	0	1	0	1
	sv033 (SSF2)/bit9	0	0	0	1	1
Control mode		High-gain mode	Standard mode	Standard mode	High-gain mode	High-gain mode

⚠ CAUTION

The actual mode is changed between the standard amplifier mode and high-gain amplifier mode when the 200V power is turned ON. Thus, if the above servo parameters are changed, the alarm "7F" will occur, and the resetting of the power will be requested. Alarm "7F" may also occur when the power is turned ON for the first time after the machine is installed. If alarm "7F" occurs, turn the power ON again. The alarm "7F" will not occur after the second and subsequent power ON unless the above servo parameters are set.

(4) Display of servo monitor type for high-gain mode and standard amplifier mode (Servo Monitor screen)

Whether the system is running in the high-gain mode or standard amplifier mode can be confirmed with the type displayed on the Servo Monitor screen.

Unit type	For standard amplifier mode	For high gain mode
MDS-C1-V1-□□□	C1V1s□□□	C1V1-□□□
MDS-C1-V2-□□○○	C1V2s□□○○	C1V2-□□○○
MDS-C1-V1-45S	C1Vs14S	C1V1-4S
MDS-C1-V2-7070S	C1V2s7S7S	C1V2-7S7S
MDS-C1-V2-3510S	C1V2s3510	C1V2-3510
MDS-C1-V2-3520S	C1V2s3520	C1V2-3520

2. Adjustment Procedure

2.1 Initial adjustment

⚠ CAUTION
Do not make remarkable adjustments and changes of the parameters as the operation could become unstable.

2.1.1 Confirmation of parameters

Confirm the servo parameters once again after installing the machine and checking the wiring, etc.

(1) Confirm that the servo specification parameter data (machine specifications, servo system specifications) are correct.
Refer to the SERVO MONITOR screen (3/3) [SERVO DIAGNOSIS] for the servo system, and confirm that the amplifier type (UNIT TYP), control method (CONTROL), motor end detector (MOT DT), machine end detector (MAC DT) and motor (MOTOR) are correct.

SERVO MONITOR (SERVO DIAGNOSIS) Screen

```
[SERVO DIAGNOSIS]                    3/3
                      <X>   <Y>   <Z>

UNIT TYP
UNIT NO
S/W VER
CONTROL
MOT DT
MAC DT
MOTOR
WORK TIME
ALM HIST

MNT
 /SYS
```

(2) Confirm that the standard parameters for the specifications motor are set.
Refer to the specifications for the standard parameters for each motor type.

2.1.2 Adjustment of optimum acceleration/deceleration time constant

The rapid traverse acceleration/deceleration time constants are adjusted according to the following settings as they differ according to the load inertia, friction and motor capacity.

(1) Set the acceleration/deceleration time constant initial value. The basic setting equation is shown below.

$$Ts = 1000\ (2\pi N/60) \cdot (J_m + J_L) / (0.8 \cdot T_{max} - T_F)\quad (ms)$$

Ts	:	Acceleration/deceleration time constant (ms)
N	:	Motor speed during rapid traverse (rpm)
J_m	:	Motor inertia ($kg \cdot cm \cdot s^2$)
J_L	:	Load inertia ($kg \cdot cm \cdot s^2$)
T_{max}	:	Maximum output torque for amplifier (during motor combination) (kg•cm)
T_F	:	Motor shaft conversion load torque during rapid traverse (kg•cm)

(2) The rapid traverse acceleration/deceleration mode is selected and the time constants set in the NC device parameter axis specifications screen.

(3) After reciprocating with rapid traverse for about five times, adjust the acceleration/deceleration time constant so that the MAX current 1 value on the servo monitor screen (1/3) is within the optimum maximum current value range given in Table 3.1.

Note) If the maximum current value exceeds the optimum maximum current value given in Table 3.1, the acceleration/deceleration constant must be increased.
The max. current 1 indicates the maximum value (stall current conversion % (absolute value)) from when the NC power is turned ON, so the NC power must be turned OFF when repeating rapid traverse operation to confirm the current.
The max. current 2 indicates the absolute value of the max. current in 2 sec. intervals, so the power does not need to be turned OFF when adjusting while looking at this value.

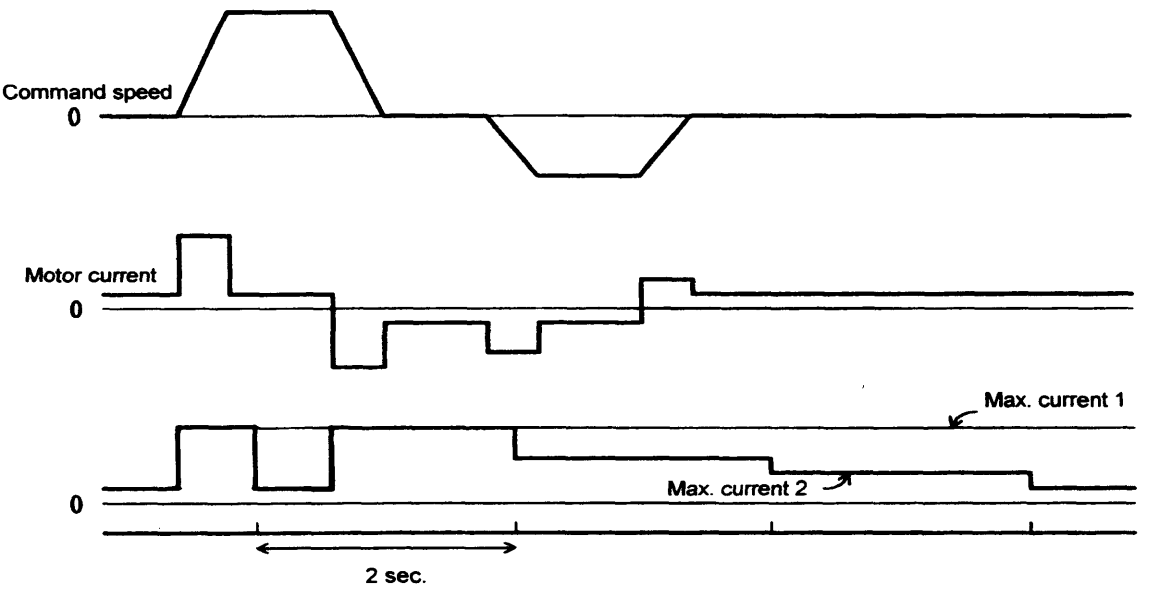


Table 3.1 Max. output torque per motor and optimum max. current

Standard 2000rpm motor			Standard 3000rpm motor		
Motor	**Tmax**	**Optimum max. current**	**Motor**	**Tmax**	**Optimum max. current**
HA40N	14.2	355 to 400	HA053N	0.7	210 to 240
HA80N	25.5	325 to 365	HA13N	1.4	210 to 240
HA100N	42.0	230 to 260	HA23N	2.8	205 to 230
HA200N	60.0	200 to 225	HA33N	5.6	205 to 230
HA300N	87.0	180 to 200	HA43N	10.2	260 to 295
HA700N	120.0	185 to 205	HA83N	19.2	245 to 275
HA900N	153.0	195 to 220	HA103N	40.0	220 to 245
			HA203N	56.0	185 to 210
			HA303N	80.0	160 to 180
			HA703N	105.0	160 to 180
HC52	11.8	323 to 366	HC52	8.8	219 to 249
HC102	21.6	283 to 321	HC103	16.7	214 to 243
HC152	35.3	317 to 359	HC153	28.4	222 to 251
HC202	41.7	228 to 259	HC203	40.2	214 to 243
HC352	59.8	209 to 237	HC353	55.9	191 to 216
HC452	87.5	157 to 178	HC453	79.8	147 to 167
HC702	120.0	183 to 208	HC703	105.0	157 to 178
HC902	153.0	189 to 214			
Low inertia 2000rpm motor			**Low inertia 3000rpm motor**		
Motor	**Tmax**	**Optimum max. current**	**Motor**	**Tmax**	**Optimum max. current**
HA50NL	13.0	320 to 365	HA53NL	14.1	360 to 410
HA100NL	20.9	265 to 300	HA103NL	22.5	285 to 320
HA150NL	31.0	275 to 315	HA153NL	22.8	195 to 220
HA200NL	32.0	175 to 195	HA203NL	37.0	200 to 230
HA300NL	52.0	175 to 195	HA303NL	60.0	195 to 225
HA500NL	72.0	145 to 165	HA503NL	78.0	155 to 175
HA-LH11K2	158.0	180 to 205			
HA-LH11K5	215.0	195 to 220			

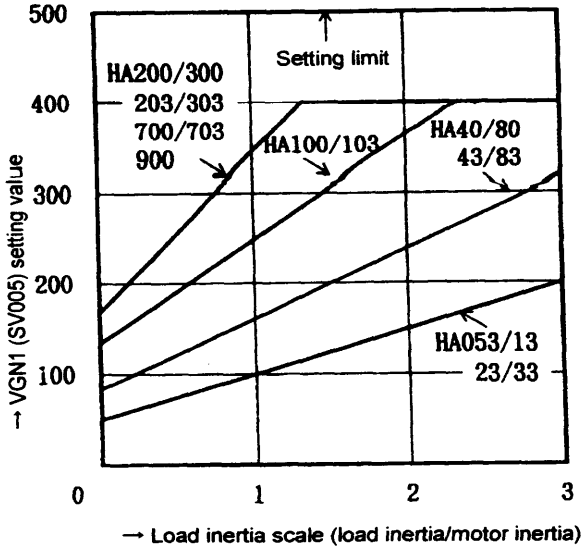
2.1.3 Adjustment of speed gain

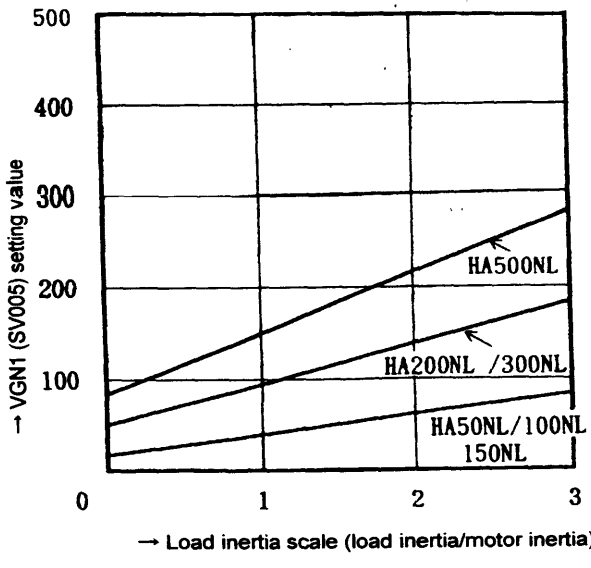
(1) The speed related gain is adjusted on the servo adjustment parameter screen. The corresponding items are 2. VGN1 (SV005), 3. VIA (SV008) and 4. VIL (SV007).
- VIL (SV007) is used only for the closed loop, so the adjustment procedure will be explained later.
- The standard value for the VIA (SV008) speed integrated gain is 1364, and is set to 1900 when using the feed forward control or SHG control in the high precision control mode.
(If the machine system resonance frequency is low and the speed loop gain VGN1 (SV005) does not increase, the VIA (SV008) may need to be lowered, but in this case, the other values above will be the standard values and do not need to be adjusted.)

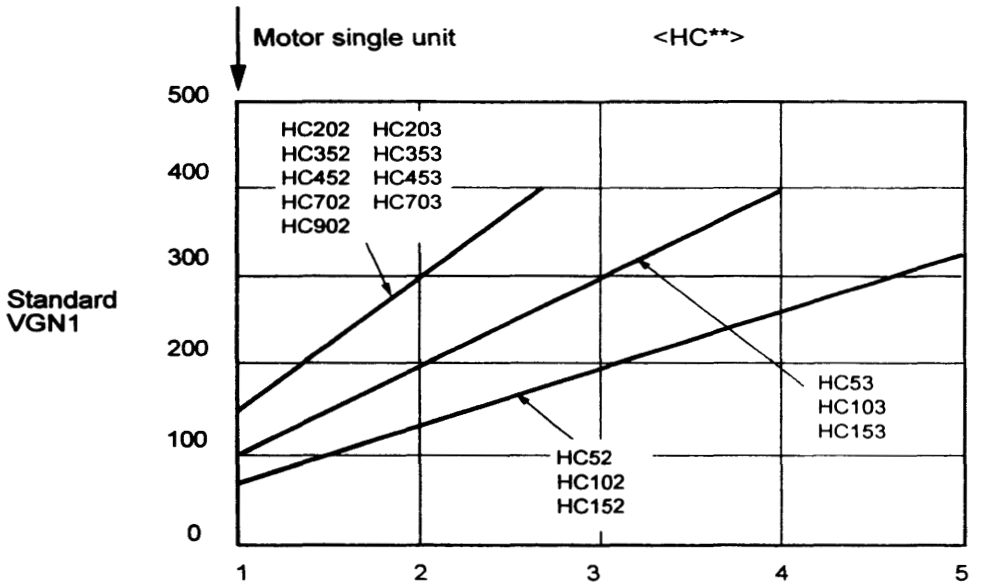
Servo adjustment parameter screen

```
[SERVO PARAM]                                    2/6
                    <X>    <Y>    <Z>    <C>
 1 PGN2(1/SEC)
 2 VGN
 3 VIA
 4 VIL
 5 FFC
 6 JL
 7 FHz(Hz)
 8 TOF(%)
 9 LMC1(%)
10 LMC2(%)
11 OVS1(%)
12 OVS2(%)
```

The VGN1 (SV005) optimum value and maximum value will change according to the load inertia so refer to the following diagram and set the initial VGN1 (SV005) value. The following diagram shows the values when the motor and load are linked, so the motor may vibrate even with a lower setting when gears are used, or due to the coupling method and ball screw twisting even if linking is used. In that case, lower the value to that which is 50 lower than the value where vibration occurs, and reset.



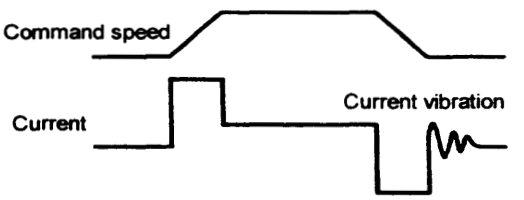




Load inertia scale (all load inertia/motor inertia)

(2) Perform rapid traverse acceleration/deceleration and confirm the following.
- Has the load current on the servo monitor screen fluctuated after stopping? (Changed by ±10 or more)
- Is vibration still felt in the table and cover? (Vibration may also occur due to the hydraulic pump, etc.)

If the above vibration or abnormal sound occurs, lower VGN1 (SV005) by 50 at a time. Set the value as 0.7 times the gain when the abnormality stopped.
The VGN1 (SV005) is finely adjusted with the servo amplifier's DA output function. Check the current stability after outputting the current command and performing rapid traverse acceleration/deceleration. Set the VGN1 (SV005) value as 0.7 times the VGN1 (SV005) value when current vibration such as shown below stopped.



The vibration may occur due to the machine resonance, and if the frequency is known may be eliminated by setting the frequency in the machine resonance suppression frequency FHz (SV038) without lowering VGN1 (SV005). If the vibration is eliminated with this setting, raise VGN1 (SV005) again, and confirm the limit.
If the optional adaptive filter is mounted, turn ON servo parameter "27. SSF1 bit F" and the machine resonance will be eliminated automatically.

2.1.4 Zero point return

(1) Parameter settings

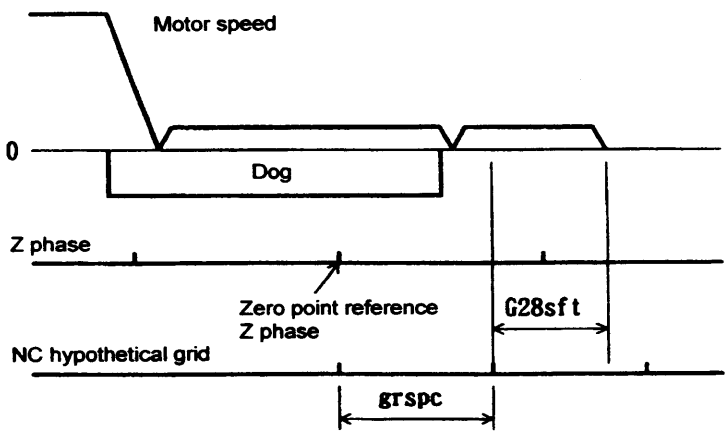
1) Servo parameters
The MDS-A/B Series servo does not require special parameter settings even when the 1 shot type scale is used in the closed loop.

2) NC parameters (zero point return parameters)
Basically, the settings are the same as the M300 Series. However, in the M500 Series, the 4. grspc (grid space) setting unit is mm, and there is no limit to the setting amount. (In the M300, the zero point position may deviate if the servo parameter RNG (equivalent to RNG1 in the MDS-A/B Series) if it is not a divisor.)

(2) Theory of zero point

The basic configuration of zero point return is shown below.

1) The reference for the zero point position is the last Z phase passed before reaching the dog OFF stop, and the NC creates the hypothetical grid for each grspc from the Z phase.
2) The position stopped at after the distance (L) from the dog OFF position to the next grid + the grid shift amount (G28sft) is moved is the zero point.



(3) Confirmation of zero point return position

Confirm that the zero point position is correct with the cycle counter (P) on the servo monitor screen. Repeat zero point return about five times, and confirm that the cycle counter value is the same after reaching the zero point.

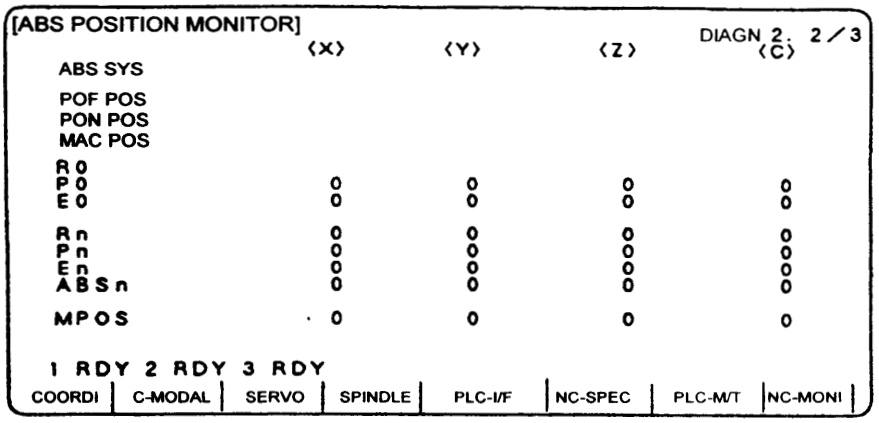
(Note) After zero point return, the high speed zero point return mode (not using Z phase) will be applied from the second return, so turn OFF the power before starting each zero point return. (Dog-type zero point return can be performed without turning the power OFF each time by turning ON the automatic dog method or manual dog method in the NC user parameter's axis parameter.)

2.1.5 Adjustment of absolute position detection

To confirm the absolute position detection with absolute position deviation, etc., investigation, confirm the data on the servo monitor's ABSOLUTE POSITION MONITOR screen.

(1) Confirmation of ABSOLUTE POSITION MONITOR screen data

ABSOLUTE POSITION MONITOR Screen

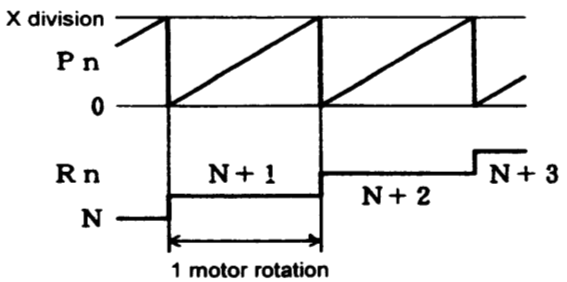


No.	Display item	Description
1	ABS SYS	The servo side absolute position detection system is displayed. ES : Semi-closed EC : Ball screw end detection LS : Absolute position linear scale
2	POF POS (command unit)	The absolute position before the power was turned OFF last is displayed.
3	PON POS (command unit)	The absolute position when the power was turned ON this time is displayed. (Absolute position detected when power is turned ON.)
4	MAC POS (Command unit)	The coordinate value in the NC basic machine coordinate system is displayed.
5	R0	The detector's multi-rotation counter value (motor cumulated speed) registered when the reference point was set is displayed.
6	P0	The position in one detector rotation registered when the reference point was set is displayed.
7	E0	The absolute position error registered when the reference point was set is displayed.
8	Rn	The current motor accumulated speed is displayed.
9	Pn	The current position in one motor rotation is displayed. (x division)
10	En	The absolute position error when the NC power is turned OFF is displayed.
11	ABSn (NC interpolation unit)	The current absolute position displayed.
12	MPOS	The MP scale offset amount when the power is turned ON is displayed. Other displays may be used for special specifications.

(2) Confirmation of absolute position detection

1) Current monitor
Turn the NC power and MDS Series input power OFF and ON several times in the emergency stop state and confirm the following:

- Check that the relation of the power OFF position and power ON position is not greatly deviated. (However, there may be a difference due to sequential axes or unbalanced axes.)
- Confirm that ABSn, Rn and Pn do not move greatly. (However, Pn will change as shown below, so 4094, 4095 → 0, 1 movement can be considered.)



Encoder type	X division
OHA25K	4096
OSA104	131072
OSA105	1048576

- Write down the ABSn, Rn and Pn values displayed when the zero point position is set. The absolute position detection can be confirmed with the following equation when absolute position deviation occurs.
(Substitute the noted ABSn, Rn and Pn values as ABS0, R0 and P0.)
The above values will be displayed on the monitor screen, so confirm that the left side equals the right side with the following equation.

  ABSn = {Rn – R0 + (Pn – P0)/x} *PIT*PC1/PC2/interpolation unit

  Machine position = ABSn × Interpolation unit

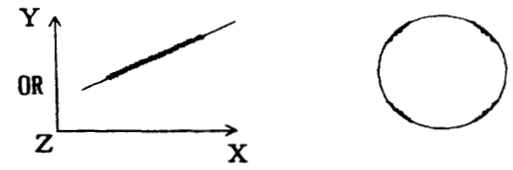
2.2 Adjustment details

2.2.1 Vibration or vibration sounds occur

<table>
<tr><td colspan="2">(1) A fine vibration is felt when the machine is touched, or the machine makes a groaning sound.</td></tr>
<tr><td>1)</td><td>Lower 5. VGN1 by 50 at a time. (Lower limit 50)</td></tr>
<tr><td>2)</td><td>Lower 11. IQG by 50 at a time. (Lower limit 128)</td></tr>
<tr><td>3)</td><td>Lower 12. IDG by 50 at a time. (Lower limit 256)</td></tr>
<tr><td>3)</td><td>Set 27. SSF1 vfct1 (bit 4), vfct2 (bit5) in the following order.
<table>
<tr><th></th><th>vfct1 (bit4)</th><th>vfct2 (bit5)</th></tr>
<tr><td>1)</td><td>1</td><td>0</td></tr>
<tr><td>2)</td><td>0</td><td>1</td></tr>
<tr><td>3)</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>5)</td><td>Set 27. SSF1 af1t (bitF).</td></tr>
<tr><td>6)</td><td>Use both 4) and 5) above.</td></tr>
</table>

<table>
<tr><td colspan="2">(2) Vibration and sounds occur during rapid traverse.</td></tr>
<tr><td>1)</td><td>Lower 5. VGN1 by 50 at a time. (Lower limit 50)</td></tr>
<tr><td>2)</td><td>Lower 11. IQG by 50 at a time. (Lower limit 128)</td></tr>
<tr><td>3)</td><td>Lower 12. IDG by 50 at a time. (Lower limit 256)</td></tr>
<tr><td>4)</td><td>Set 27. SSF1 vfct1 (bit 4), vfct2 (bit5) in the following order.
<table>
<tr><th></th><th>vfct1 (bit4)</th><th>vfct2 (bit5)</th></tr>
<tr><td>1)</td><td>1</td><td>0</td></tr>
<tr><td>2)</td><td>0</td><td>1</td></tr>
<tr><td>3)</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>5)</td><td>Set 27. SSF1 af1t (bitF).</td></tr>
<tr><td>6)</td><td>Use both 4) and 5) above.</td></tr>
<tr><td>7)</td><td>Set a value that is the cutting feed speed + 100rpm in 29. VCS and set the same value as 5. VGN1 in 6. VGN2.
Repeat rapid traverse, and lower 6. VGN2 by 10 at a time. (Lower limit 0)</td></tr>
</table>

2.2.2 The cutting surface precision is poor. The roundness is poor.

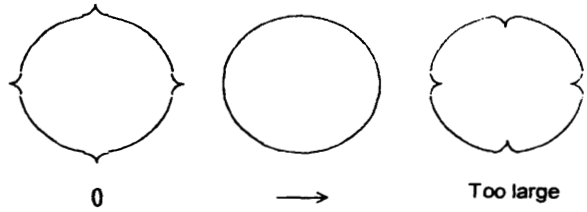
(1) The taper and arc 45° direction surface precision is poor.	
1)	Raise 5. VGN1 by 20 at a time. (The limit is when vibration or sounds occur when stopping or during rapid traverse.)
2)	Raise 8. VIA by 200 at a time. (Upper limit 2000)
	

(2) Protrusion that occur when the arc quadrant changing points are annoying. (The lines are annoying)	
1)	Raise 5. VGN1 by 20 at a time. (The limit is when vibration or sounds occur when stopping or during rapid traverse.)
2)	Raise 8. VIA by 200 at a time. (Upper limit 2000)
3)	When the axis load is unbalanced, perform unbalance torque compensation (32, TOF), and remove the electrical unbalance element. Look at the power load [%] on the I/F diagnosis screen servo monitor, and feed the axis with manual pulse by 10 to 20 pulses in the + and – directions. If the current load is positive, check the maximum value, and if negative check the minimum value. Set the average value of the + and – directions value in TOF. **<Example>** When + direction +50%, – direction –10% {(+50)+(–10)}/2 = +20 ∴ 20 → TOF When + direction –30%, – direction –10% {(–30)+(–10)}/2 = –20 ∴ –20 → TOF
4)	Select the lost motion compensation type. (Set the 27. SSF1 bit 8 or bit 9 to validate lost motion compensation.) In the MDS Series, the lost motion compensation type 2 is the standard, and is suitable for the following cases. • High speed machining • Closed loop

Lost motion compensation type 1	Lost motion compensation type 2
Set 27. SSF1 lmct1 (bit 8). Gradually increase 16. LMC1 from 0 by 20. If this is set too high, the axis will eat into the workpiece.	Set 27. SSF1 lmct2 (bit 9). Look at the current load [%] on the I/F diagnosis screen servo monitor, and feed with manual feed etc. (the feed rate is approx. 500 to 1000mm/m). Check the current load value. Double the checked value and set it in 16. LMC1.

The 16. LMC1 optimum value is the maximum value where overshoot does not occur when one pulse is fed and the direction is reversed.

If differing compensation amounts are required in the – → + direction and + → – direction, set the compensation gain for – → + direction in 16. LMC1, and the + → – direction compensation gain in 41. LMC2.



(3) The load fluctuation is large during cutting and vibration or surface precision defects occur. (Especially during heavy cutting)	
1)	Raise 5. VGN1 by 20 at a time. (The limit is when vibration or sounds occur when stopping or during rapid traverse.)
2)	Raise 8. VIA by 200 at a time. (Upper limit 2000)

2.2.3 Overshooting occurs during positioning. A limit cycle occurs.

(1) For semi-closed loop	
1)	Raise 5. VGN1 by 50 at a time. (The limit is when vibration or sounds occur when stopping or during rapid traverse.)
2)	Raise 8. VIA by 200 at a time. (Upper limit 2000)
Note 1. If the overshoot amount is large (5μ or more), confirm the droop on the servo monitor screen, and if the same amount of overshooting occurs, take the above measures. If no improvements are seen after the above measures are taken, set 3.PGN1 to approx. 20, or increase the axis specifications acceleration/deceleration time constant. If the droop does not overshoot, the motor itself is not overshooting and only the machine system is overshooting. → Adjust the machine system.	

(2) For full closed loop	
1)	Raise 5. VGN1 by 50 at a time. (The limit is when vibration or sounds occur when stopping or during rapid traverse.)
2)	Raise 8. VIA by 200 at a time. (Upper limit 2000)
3)	Lower 3. PGN1 by 5 at a time. (Lower limit 20.) However, set the interpolation between axes to the same value.
4)	Set 27. SSF1 ovst1 (bit A), and increase 31. OVS1 by 2% at a time from 2. (Upper limit 10) After setting OVS1, turn the NC power OFF and ON once.
5)	Set 27. SSF1 vcnt1 (bit 0), and increase 7. VIL by 15 at a time from 0. (Upper limit 656)
6)	Return 27. SSF1 vcnt1 (bit 0) to 0, set vcnt2 (bit1), and raise 7. VIL by 65 at a time from 0. (Upper limit 1640)
7)	Try combining 4) and 5), or 4) and 6).
Note 1. If the overshooting or limit cycle is improved with 5) but the response is poor, perform the same measure as 6). **Note 2.** In case of full-closed loop as with Note 1 for the semi-closed loop, if the droop on the servo monitor screen is not overshooting, the overshooting is not occurring near the scale, and only the machine system is overshooting. → Adjust the machine system.	

2.2.4 Accumulated feed occurs with pulse feed

<table>
<tr><td>(1)</td><td colspan="3">Command several pulses, and confirm that the droop corresponding to the command pulse is occurring by checking the droop on the servo monitor screen.</td></tr>
<tr><td></td><td colspan="2">Droop is occurring</td><td>Droop is not occurring</td></tr>
<tr><td></td><td>1)</td><td>Raise 5. VGN1 by 50 at a time.
(The limit is when vibration or sounds occur when stopping or during rapid traverse.)</td><td rowspan="3">1)</td><td rowspan="3">Movement has been made to near the position detector (scale, ball screw end detector) in the motor or full closed loop. The following machine system is accumulated feed.
→ Adjust the machine system.</td></tr>
<tr><td></td><td>2)</td><td>Raise 8. VIA by 200 at a time.
(Upper limit 2000)</td></tr>
<tr><td></td><td></td><td>Perform the same measures as 1.2.3 (2) 5).</td></tr>
</table>

2.3 Adjustment of special functions

2.3.1 High precision control mode

When performing high precision control, the various parameters for performing acceleration/ deceleration before interpolation, feed forward control and SHG control, etc. must be set.

(1) Outline

The delay caused by the NC side command time constants is removed with acceleration/ deceleration before interpolation. The delay caused by the position loop on the servo side is corrected only with feed forward control in the M300 Series, but the correction has been stabilized in the M500 Series by combining SHG control and feed forward control.

(2) Basic parameters for high precision control

Servo parameter setting procedure to use SHG control

No.	Parameter No.	Parameter name	Details
1	SV003	PGN1	When using SHG control in the position loop gain, set these three parameters with the following combination.
2	SV004	PGN2	
3	SV057	SHGC	
4	SV008	VIA	When performing SHG control with the speed integral gain, set 1900.
5	SV015	FFC	When performing SHG control with the acceleration feed forward gain, set 100.

Class	Parameter name	Combination of parameters during SHG control			Remarks
		No.1	No.2	No.3	
Position control parameters	PGN1	33	38	47	
	PGN2	86	102	125	
	SHGC	187	225	281	
Speed control parameters	VIA	1900	1900	1900	
	FFC	100	100	100	Set 50 when using the low inertia motor.

- Always observe the above relation for the three parameters related to position control.
- Setting the same value as PGN1 and setting SHG control will double the conventional control's position loop gain and be effective.
  As the response during acceleration/deceleration in SHG control is smoother than the conventional position control, if PGN1 = 33 (1/S) in the conventional position control, further gain up may be possible with SHG control.

SHG control effect

The SHG control is capable of compensating the position tracking error that occurs with the servo position loop time constant as with the conventional feed forward control. The equivalent feed forward gains for the above No. 1 to 3 are shown below.

No.	PGN1	PGN2	SHGC	Equivalent feed forward (%)
1	33	86	187	87
2	38	102	225	90
3	47	125	281	94

The equivalent feed forward comparison are all based on the PGN1 = 33 conventional control.

Combination with feed forward control

If a compensation close to 100% is required, combine the use with feed forward control.
In this case, the setting limit of the feed forward gain (fwd_g) is 40%. (Theoretically, 50% is equivalent to 100%, but excessive overshooting will occur. If under 40%, the overshooting may occur due to the machine, so determine the value by adjusting.)

Setting limits

All axes must be matched for the SHG control parameters (PGN1, PGN2, SHGC) and feed forward gain (fwd_g). (For interpolation axis)

1) Calculation of equivalent feed forward % during SHG control.
(The equivalent feed forward gain is compared to when PGN1=33.)

$$\text{Equivalent FF (\%)} = 100 \wedge \sqrt{1 - \left(\frac{33}{2 \cdot \text{PGN1}}\right)^2}$$

2) Calculation of equivalent feed forward % during SHG control + feed forward control

$$\text{Equivalent FF (\%)} = 100 \wedge \sqrt{1 - \left\{1 - \left(\frac{\text{fwd\_g}}{50}\right)^2\right\} \times \left(\frac{33}{2 \cdot \text{PGN1}}\right)^2}$$

Setting of feed forward gain

No.	SHG control	fwd_g	Equivalent feed forward gain (%)
1	No.1	40	95
2	No.2	40	97
3	No.3	40	98

Equivalent FFG is the comparison of when PGN1=33 SHG control is not being used.

3. Troubleshooting (MDS-A/B Series)

3.1 Status display

⚠ WARNING

1. Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks.
2. Do not operate the unit with the front cover removed. The high voltage terminals and charged sections will be exposed, and can cause electric shocks.
3. Do not open the front cover whole the power is ON or during operation. Failure to observe this could lead to electric shocks.

⚠ CAUTION

1. Always check the parameters before starting. Depending on the machine, unforeseen operation could take place.
2. Do not touch the servo amplifier fins, regenerative resistor or servomotor, etc., while the power is turned ON or immediately after turning the power OFF. Some parts are heated to high temperatures, and touching these could lead to burns.

The state of the drive unit is displayed on the 7-segment display on the drive unit and the NC servo monitor screen.
Confirm one of these displays before troubleshooting.

Caution: The machine's power distribution box door must be opened to confirm the drive unit's 7-segment display. Take special care not to touch the conductive parts at this time.

(1) 7-segment display

The drive unit state is indicted with the 7-segment display on the drive unit.
When an alarm occurs, the alarm No. will be displayed. If several alarms occur simultaneously for one axis, the latest alarm No. will be displayed.

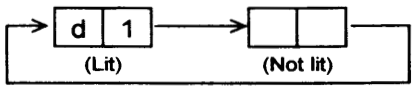
Servo Drive Unit Status Display

Amplifier display	NC display	Details
AA	(No display)	Initializing. Standby for NC power start up (When NC power ON → OFF)
Ab		Initializing. Standby for NC power start up (When NC power has not been turned ON yet)
AC	(No display)	Initializing. Requesting parameter transmission
Ad		Initializing. Requesting parameter conversion
AE		Initializing. Standby for main servo IT start
b#		Ready OFF
C#		Servo OFF
d#		Servo ON
F# → 9*	9*	Warning (* is 0 to F. Note "E6", "E7" and "EA" are status displays).
F# → E*	E*	
F# → **	**	Alarm occurring

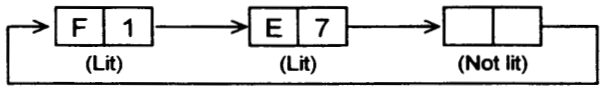
\# : Axis No.
* : Warning No.
** : Alarm No. (Refer to <Servo alarm> <Warning> Tables on following pages.)

The status display after initializing will repeat lighting and going out per axis and show the axes in order. An example is shown below.

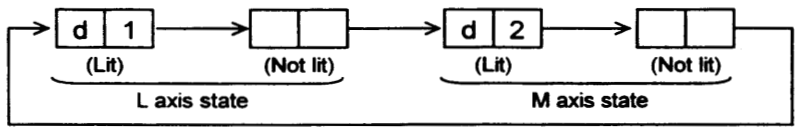
(Example 1) 1st axis in a single-axis drive unit. Display of servo ON state.



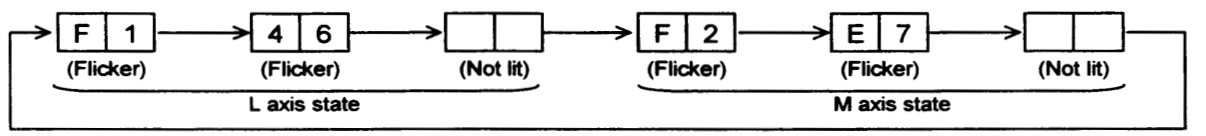
(Example 2) With the above axis. Display of emergency stop signal input from NC.



(Example 3) L axis is 1st axis, M axis is 2nd axis in 2-axes integrated drive unit. Display of servo ON state.



(Example 4) With the above axes. Display of motor overheat alarm (No. 46) in L axis. (Emergency stop is applied on M axis)



(2) Servo monitor screen display (NC screen)

The NC will display the servo alarm No. in the servo alarm column in the servo monitor screen when an alarm occurs in the drive unit. The Nos. are the same as the drive unit's 7-segment display but, may differ depending on the alarm details. (Ex. When there is an obstacle in the communication with the drive unit.)
Nothing will display when operations are normal.

The servo monitor screen is displayed by pressing the NC function selection key [DIAGN] (diagnosis), and then pressing menu key [SERVO MONITOR] .
The servo alarm Nos. may display on other screens depending on the NC type. Refer to the NC instruction manual for details on this.

<Servo alarms>

Dis-play	Abbr.	Name	Mearning	Release	Class	Alarm/warning check period			
						f1	f2	f3	f4
11	ASE	Axis selection error	The axis setting rotary switch was set illegal in the 2-axes integrated drive unit.	AR	C	O	—	—	—
12	ME	Memory error	The memory IC (SRAM or FLROM) check sum was illegal.	AR	C	O	—	—	—
13	SWE	Software processing error	The software data processing was not completed within the normal time. Includes peripheral G/A errors.	PR	C	—	O	O	O
16	RD1	Pole position detection error	The differential input of the U, V, or W phase of the pole position detection signal of the OHE type detector were both "H" or "L".	PR	A	—	O	O	—
17	ADE	AD converter error	The AD converter for current detection did not function correctly during initialization.	PR	A	—	O	—	—
18	WAT	Initial communication error	The absolute position or pole position data from the OHA type detector or serial pulse encoder was not correctly sent.	PR	A	—	O	-	—
1A	STE1	Serial detector communication error (SUB)	The initial communication with the serial encoder installed on the ball screw end was not possible.	PR	A	—	O		
1B	Scpu	CPU error (SUB)	An error was detected in the data stored in the EEROM of the serial pulse encoder installed on the ball screw end. (Alarm output by the detector.)	PR	A	—	O	O	O
1C	Sled	LED error (SUB)	Deterioration of the LEDs in the serial pulse encoder installed on the ball screw end was detected. (Alarm output by the detector.)	PR	A	—	O	O	O
1D	Sdat	Data error (SUB)	An error was detected in the per rotation position data of the serial pulse encoder installed on the ball screw end. (Alarm output by the detector.)	PR	A	—	O	O	O
1E	SOHE	Serial detector thermal error (SUB)	The thermal protector built in the detector operated in the serial pulse encoder installed on the ball screw end. (Alarm output by the detector.)	PR	A	—	O	O	O
1F	Stre	Communication error (SUB)	Communication with the detector in the serial pulse encoder installed on the ball screw end was cut off.	PR	A	—	O	O	—
20	NS1	No signal detected 1	The differential input of the A, B or Z phase signal from the motor end installation detector were both "H" or "L". (Software detection in B Series.)	PR	A	—	O	O	—
21	NS2	No signal detected 2	The differential input of the A, B or Z phase signal from the machine end installation detector were both "H" or "L". (Software detection in B Series.)	PR	A	—	O	O	—
25	ABSE	Absolute position lost	The absolute position data in the absolute position detector was lost.	AR	A	—	O	—	—
26	NAE	Not used axis error	A power module error occurred in the axis that is not being controlled set as "F" by the axis setting rotary switch in the 2-axes integrated drive unit.	PR	C	—	O	O	O
27	SCCPU	Absolute position detection scale CPU error	An error was detected in the CPU of the absolute position linear scale. (Alarm output by the detector.)	PR	A	—	O	O	O
28	SOSP	Absolute position overspeed	The scale moved at more than 45mm/sec during initialization with the absolute position linear scale. (Alarm output from the linear scale.)	PR	A	—	O	—	—
29	SABS	Absolute position detection circuit error	A hardware error was detected in the absolute position detection circuit of the absolute position linear scale. (Alarm output by the linear scale.)	PR	A	—	O	O	O
2A	SINC	Relative position detection circuit error	A hardware error was detected in the relative position detection circuit of the absolute position linear scale. (Alarm output by the linear scale.)	PR	A	—	O	O	O
2B	SCPU	Scale CPU error	A CPU error was detected in the serial pulse encoder installed on the motor end. (Alarm output by the detector.)	PR	A	—	O	O	O

Dis-play	Abbr.	Name	Mearning	Release	Class	Alarm/warning check period			
						f1	f2	f3	f4
2C	SLED	Scale LED error	Deterioration of the LEDs in the serial pulse encoder installed on the motor end was detected. (Alarm output by the detector.)	PR	A	—	O	O	O
2D	SDAT	Scale data error	An error was detected in the per rotation position data of the serial pulse encoder installed on the motor end. (Alarm output by the detector.)	PR	A	—	O	O	O
2F	STRE	Scale communication error	Communication with the OHA type detector or serial pulse encoder installed on the motor end and the detector was cut off.	PR	A	—	O	O	O
31	OS	Overspeed	The motor speed reached 1.2 times the rated speed.	PR	A	—	O	O	—
32	PMOC	Power module overcurrent	An overcurrent was detected in the IPM used in the servo drive's main circuit.	PR	A	—	O	O	O
34	DP	CRC error	A CRC error occurred in the communication data from the NC.	PR	C	—	O	O	O
35	DE	Data error	The movement command data from the NC is abnormally large.	PR	A	—	O	O	—
36	TE	Transmission error	The cyclic data transmission from the NC was terminated.	PR	C	—	O	O	—
37	PE	Parameter error	There is error in the servo parameters transmitted from the NC during servo drive initialization.	PR	A	—	O	—	O
38	TP1	Protocol error 1	There was an error in the communication protocol with the NC. (Frame error)	PR	C	—	O	O	O
39	TP2	Protocol error 2	There was an error in the communication protocol with the NC. (Information error)	PR	A	—	O	O	O
3A	OC	Overcurrent	An excessive current flowed to the motor.	PR	A	—	O	O	O
3B	PMOH	Power module overheat	Overheating of the IPM used in the servo driver's main circuit was detected.	PR	A	—	O	O	O
42	FE1	Feedback error 1	(1) A skip of the detector feedback signal pulse occurred in the OHE type or OHA type detector used in the semi-closed loop system and ball screw end closed loop system. (2) A skip of the detector feedback signal pulse in the low-speed serial type absolute position linear scale.	PR	A	—	O	O	—
43	FE2	Feedback error 2	A deviation occurred in the feedback amount from the motor end detector and machine end detector in the closed loop system.	PR	A	—	O	O	—
46	OHM	Motor overheat	The motor or detector thermal protector operated.	NR	A	—	O	O	—
50	OL1	Overload 1	The motor current operated in the range set with the overload detection level (parameter OLL) and overload time constant (parameter OLT).	NR	A	—	O	O	O
51	OL2	Overload 2	A current command with a maximum output current exceeding 95% continued for 1 second or more.	NR	A	—	—	O	—
52	OD1	Excessive error 1	The actual position to the command exceeded the excessive error width 1 (parameter OD1) when the servo was turned ON.	NR	A	—	—	O	—
53	OD2	Excessive error 2	The actual position to the command exceeded the excessive error width 2 (parameter OD2) when the servo was turned OFF.	NR	A	—	O	—	—
54	OD3	Excessive error 3	The motor current did not flow when the excessive error 1 alarm was detected. (Added with the B Series.)	NR	A	—	—	O	—
58	CLE0	Collision detection 0	A collision detection type 1 error was detected during the G0 modal (rapid traverse).	NR	A	—	—	O	—
59	CLE1	Collision detection 1	A collision detection type 1 error was detected during the G1 modal (cutting feed).	NR	A	—	—	O	—

Dis-play	Abbr.	Name	Mearning	Release	Class	Alarm/warning check period			
						f1	f2	f3	f4
5A	CLT2	Collision detection 2	A collision detection type 2 error was detected.	NR	A	—	—	O	—
60 ~7F			An error occurred in the power supply unit. (Refer to the power supply section for details.)						
82	NSP	Power supply no signal	A breakage in the cable connected with the power supply or incorrect connection was detected. (Only A Series)	PR	C	—	O	O	O
88	WD	Watch dog	The servo amplifier software process was not executed within the designated time.	AR	C	O	O	O	O

<Servo warnings>

Dis-play	Abbr.	Name	Mearning	Release	Class	Alarm/warning check period			
						f1	f2	f3	f4
90	WST	Low-speed serial initial communication error	Initial communication with the low-speed serial type absolute position linear scale was not possible.	PR	A	—	O	—	—
91	WAS	Detector communication error	The absolute position serial data was not properly sent from the OHA type detector and low-speed serial type absolute position linear scale.	—	A	—	O	O	—
92	WAF	Detector serial format error	The format of the serial data from the OHA type detector was incorrect.	—	A	—	O	O	—
93	WAM	Absolute position fluctuation	The absolute position counter cannot be set as the absolute position data fluctuated when the NC power was turned ON.	PR	A	—	O Note	O	—
96	MPE	MP scale feedback error	In the MP scale absolute detection system, an excessive deviation in the motor end installation detector and MP scale feedback amount was detected.	—	A	—	O	O	O
97	MPO	MP scale offset error	In the MP scale absolute position detection system, an error was detected in the offset data read when the NC power was turned ON.	PR	A	—	O	—	—
9E	WAN	High-speed serial multi-rotation counter error	An error was detected in the multi-rotation counter in the serial pulse encoder installed on the motor end or ball screw end.	—	A	—	O	O	O
9F	WAB	Battery voltage drop	The voltage of the battery supplied to the absolute position detector dropped.	—	A	—	O	O	O
E1	WOL	Overload warning	An 80% level of the overload 1 alarm was detected. (If operation is continued, the overload 1 alarm may occur.)	—	C	—	O	O	O
E3	WAC	Absolute position counter warning	The absolute position counter value is illegal. The absolute position must be initialized.	—	A	—	O	O	—
E4	WPE	Parameter error warning	A parameter exceeding the setting range was set. The illegal parameter will be ignored and the previously set value will be held.	—	A	—	O	O	—

<Status displays other than alarms and warnings>

Dis-play	Abbr.	Name	Mearning	Release	Class	Alarm/warning check period			
						f1	f2	f3	f4
E6	AXE	Removing control axis	The axis removal command is input from the NC.	—	A	—	O	O	O
E7	NCE	NC emergency stop	The emergency stop command is input from the NC.	—	C	—	O	O	O
E8~ EB			A warning was generated with the power supply unit. (Refer to the power supply unit item for details.)						

[Release]

AR : The alarm is released by turning the servo drive unit power OFF and ON.
PR : The alarm is released by turning the NC power OFF and ON.
NR : The alarm is released by NC reset.
(However, overload alarm "50" cannot be released until the load is lowered passed the reset level (50% of the current value on the monitor screen.))
— : Automatically restored when the warning state is eliminated.

[Class]

C : Detects both axes even during the 2-axes integrated drive unit.
A : Detects each axis independently.

[Alarm/warning check period]

f1 : When servo drive unit power is turned ON.
f2 : When NC power is turned ON (emergency stop ON)
f3 : During normal operation (servo ON)
f4 : During axis removal (ready ON, servo OFF)

(**Note** : Warning "93" may occur after axis removal while installing the axis again.)

3.2 Troubleshooting per servo alarm

> **⚠ CAUTION**
>
> When an alarm occurs, remove the cause of the alarm, confirm that an operation signal is not being input, and secure the safety. Then reset the alarm to resume operation.

When an alarm occurs in the spindle drive, the servo will turn OFF and the motor will coast to a stop. Turn the power OFF with an external sequence.
To release the alarm, remove the cause and then turn the power ON.

(1) Alarm No. 11 Axis selection error (only MDS-A/B-V2)

[Meaning] Illegal setting of the axis setting rotary switch in the drive unit.

Alarm check period

f1	f2	f3	f4
○	–	–	–

	Investigation item	Investigation results	Remedy
1	Confirm the rotary switch setting.	One setting is 7 ~ E.	Correctly set. (Set a No. that is the axis No. minus 1.)
		The L axis and M axis are set to the same No.	Same as above.
		None of the above.	Replace the drive unit.

(2) Alarm No. 12 Memory error 1

[Meaning] Error in the drive unit memory IC (SRAM or FLROM) and peripheral G/A

Alarm check period

f1	f2	f3	f4
○	–	–	–

	Investigation item	Investigation results	Remedy
1	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

(3) Alarm No. 13 Software processing error

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] The drive unit software data processing was not completed within the normal time or an illegal IT process was input.

	Investigation item	Investigation results	Remedy
1	Check whether the servo software version was changed recently.	Changed	Try replacing with the drive unit with the original software version.
		Not changed.	Perform investigation item 2.
2	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 3.
3	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

(4) Alarm No. 16 Pole position detection error 1

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] Error in the output of the OHE type detector (motor end installation) U, V, W phases
1) When the "H" differential inputs from the U, V or W phases are both "L".
2) When the states of the U, V and W phases are all "H" or "L".

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (SV25) setting value.	"0" or "3" is set in the parameter detector setting position even though the OHE type detector is not connected.	Correctly set.
		The setting is correct.	Perform investigation item 2.
2	Tug the connector by hand to check whether the detector connector (unit side and detector side) is not loose.	Disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 3.
3	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 4.
4	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Replace the detector (motor).

(5) Alarm No. 17 AD converter error

[Meaning] AD converter IC error in the drive unit

Alarm check period

f1	f2	f3	f4
–	○	–	–

	Investigation item	Investigation results	Remedy
1	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan. Grounding not enforced ..... add grounding measures.

(6) Alarm No. 18 Initial communication error

[Meaning] Initial communication with the detector was not possible in a system using the OHA type detector (motor end or ball screw end installation) or serial pulse encoder.

Alarm check period

f1	f2	f3	f4
–	○	–	–

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (SV25) setting value.	"1", "5" or "9" is set in the parameter detector setting position even though the OHA type detector is not connected.	Set correctly.
		The setting is correct.	Perform investigation item 2.
2	Tug the connector by hand to check whether the detector connector (unit side and detector side) is not loose.	Disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 3.
3	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 4.
4	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Replace the motor (detector).

(7) Alarm No. 1A Serial pulse encoder communication error (SUB)

[Meaning] The initial communication with the serial encoder installed on the ball screw end was not possible.

	Investigation item	Investigation results	Remedy
1	Perform the items 2 and following for alarm No. "18".		

(8) Alarm No. 1B Serial pulse encoder CPU error (SUB)

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] An error was detected in the data stored in the EEROM of the serial pulse encoder installed on the ball screw end. (Alarm output by the detector.)

	Investigation item	Investigation results	Remedy
1	Perform the items 2 and following for alarm No. "18".		

(9) Alarm No. 1C Serial pulse encoder LED error (SUB)

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] Deterioration of the LEDs in the serial pulse encoder installed on the ball screw end was detected. (Alarm output by the detector.)

	Investigation item	Investigation results	Remedy
1	Perform the items 2 and following for alarm No. "18".		

(10) Alarm No. 1D Serial pulse encoder data error (SUB)

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] An error was detected in the per rotation position data of the serial pulse encoder installed on the ball screw end. (Alarm output by the detector.)

	Investigation item	Investigation results	Remedy
1	Perform the items 2 and following for alarm No. "18".		

(11) Alarm No. 1E Serial pulse encoder thermal error

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] The thermal protector built in the detector operated in the serial pulse encoder installed on the ball screw end. (Alarm output by the detector.)

	Investigation item	Investigation results	Remedy
1	Perform the items 2 and following for alarm No. "18".		

(12) Alarm No. 1F Serial pulse encoder communication error (SUB)

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] Communication with the detector in the serial pulse encoder installed on the ball screw end was cut off.

	Investigation item	Investigation results	Remedy
1	Perform the items 2 and following for alarm No. "18".		

(13) Alarm No. 20 No signal detected 1

[Meaning] Error in the OHE, OHA type detector (motor end installation) A, B or Z phase

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (SV25) setting value.	"0" or "3" is set in the parameter detector setting position even though the OHE or OHA type detector is not installed.	Correctly set.
		The setting is correct.	Perform investigation item 2.
2	Tug the connector by hand to check whether the detector connector (unit side and detector side) is not loose.	Disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 3.
3	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 4.
4	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 5.
5	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan. Grounding not enforced ..... add grounding measures.

(14) Alarm No. 21 No signal detected 2

[Meaning] Error in the OHE-ET, OHA-ET type detector or each sale (machine end installation) A, B or Z phase.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (SV25) setting.	"4", "5", "8" or "9" is set in the parameter detector setting position even though the OHE-ET or OHA-ET type detector or each scale is not connected.	Correctly set.
		The value is correct.	Perform investigation item 2.
2	Perform the items for alarm "20".		

(15) Alarm No. 25 Absolute position lost

Alarm check period

f1	f2	f3	f4
–	○	–	–

[Meaning] When absolute position data is lost.
- This occurs when the power in the absolute position detector is lost, and will return to normal when the unit's 200VAC is reset and zero point return is performed again.

	Investigation item	Investigation results	Remedy
1	Check whether the absolute position detector cable (including battery connection cable) was left disconnected for a while.	Was disconnected. Guideline: At delivery: 20 hours or more After 5 years: 10 hours or more	Reset the amplifier's 200VAC power and perform zero point return again.
		Was not disconnected.	Perform investigation item 2.
2	Check whether a battery error alarm occurred recently.	Alarm occurred.	Check the battery voltage.
		Did not occur.	Perform investigation item 3.
3	Tug the detector connector (unit and detector side) to see if it has disconnected. Also check the cable between the battery unit and drive unit.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 5.
5	Check the repeatability. Perform zero point return again.	Does not recur.	Perform investigation item 7, and if there is no error, continue to use.
		Always recurs. Returns to normal once, but recurs periodically.	Perform investigation item 6.
6	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 7.
7	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(16) Alarm No. 26 Not used axis error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] A IPM alarm is occurring in an axis that is set as "F" in the unit axis setting rotary switch and which is not being controlled. (Alarm only for 2-axes integrated drive unit)

	Investigation item	Investigation results	Remedy
1	Check whether a wire is connected to the motor output terminal block (UVW) for the axis set as "F".	Connected.	Perform the items for alarm No. "32".
		Not connected.	Perform investigation item 2.
2	Check the repeatability.	Always recurs or returns to normal but recurs periodically.	Perform investigation item 3.
		Does not recur.	Perform investigation item 3, and if there is no error, continue to use.
3	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(17) Alarm No. 27 Absolute position detection scale CPU error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] The CPU in the absolute position linear scale did not operate correctly. (Alarm output by the linear scale.)

	Investigation item	Investigation results	Remedy
1	Tug the detector cable connector (unit side and NC side) to see if it is disconnected.	Is disconnected (or loose).	Correctly connected.
		Not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the detector cable connection with a tester.	Connection is faulty.	Replace the detector cable.
		Connection is connect.	Perform investigation item 3.
3	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 4.
4	Check for abnormalities in the unit's peripheral environment. (Ex. ambient temperature, noise, grounding.)	No special abnormalities were found.	Replace the detector (linear scale.)
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(18) Alarm No. 28 Absolute position overspeed

Alarm check period

f1	f2	f3	f4
–	O	–	–

[Meaning] The scale moved at more than 45mm/sec during initialization when NC power is turned ON with the absolute value linear scale. (Alarm output from the linear scale.)

	Investigation item	Investigation results	Remedy
1	Check the absolute value linear scale specifications.	The specifications are not for the absolute value linear scale.	Set the SV025: MTYP parameter correctly.
		The specifications are for the absolute value linear scale.	Perform investigation item 2.
2	Is the machine moving during the alarm?	Is moving.	Check the motor mechanical brakes and machine system.
		Is not moving.	Perform investigation item 3.
3	Tug the detector connector (unit and detector side) to see if it has disconnected.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 5.
5	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 6.
6	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the detector (linear scale).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(19) Alarm No. 29 Absolute position detection circuit error

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] An error occurred in the absolute position detection side circuit of the absolute position linear scale. (Output from the linear scale)

	Investigation item	Investigation results	Remedy
1	Perform the items for alarm No. "28".		

(20) Alarm No. 2A Relative position detection circuit error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] An error was detected in the linear scale side absolute position detection circuit. (Output from the linear scale)

	Investigation item	Investigation results	Remedy
1	Is the machine moving during the alarm?	Is not moving	Perform investigation item 3.
		Is moving	Perform investigation item 2.
2	Check whether movement is normal at low speeds.	Is moving	Perform investigation item 3.
		Is not moving	Check the cautionary items before turning the power ON. • Check the wiring • Check the parameters
3	Tug the detector cable (unit and detector side) to see if it has disconnected.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 5.
5	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 6.
6	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(21) Alarm No. 2B Serial pulse encoder CPU error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] An error was detected in the data stored in the EEROM of the serial pulse encoder connected to the motor end. (Alarm output from the detector or the linear scale.)

	Investigation item	Investigation results	Remedy
1	Perform item 3 and following of alarm No. "2A".		

(22) Alarm No. 2C Serial pulse encoder LED error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] Deterioration of the LEDs in the serial pulse encoder connected to the motor end was detected. (Alarm output from the detector or the linear scale.)

	Investigation item	Investigation results	Remedy
1	Perform item 3 and following of alarm No. "2A".		

(23) Alarm No. 2D Serial pulse encoder data error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] An error was detected in the per rotation position data of the serial pulse encoder connected to the motor end. (Alarm output from the detector)

	Investigation item	Investigation results	Remedy
1	Perform item 3 and following of alarm No. "2A".		

(24) Alarm No. 2F Detector communication error

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] Communication with the OHA type detector or serial pulse encoder connected to the motor end and the detector was cut off.

	Investigation item	Investigation results	Remedy
1	Perform item 3 and following of alarm No. "2A".		

(25) Alarm No. 31 Overspeed

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] The motor speed is exceeding the tolerable speed.

	Investigation item	Investigation results	Remedy
1	Is the machine moving during the alarm?	Is not moving	Perform investigation item 5.
		Is moving	Perform investigation item 2.
2	Check whether movement is normal at low speeds.	Is moving	Perform investigation item 3.
		Is not moving	Check the cautionary items before turning the power ON. • Check the wiring • Check the parameters
3	Check the servo parameter (MTYP) setting value.	The motor has 3000rpm specifications, but is set for 2000rpm.	Correctly set.
		The setting is correct.	Perform investigation item 4.
4	Is the rapid traverse rate too high? Motor speed = $\frac{\text{Rapid traverse rate(mm/min)}}{\text{Ball screw lead (mm)}} \times \frac{PC2}{PC1}$	Is too high.	Correct to below the rated speed.
		Is set to below the rated speed.	Perform investigation item 5.
5	Check whether the time constant is too low. • Check the current value displayed on the servo monitor screen.	80% or more of the maximum value is displayed.	Lower the rapid traverse time constant so that the current value during rapid traverse acceleration/deceleration is less than 80% of the maximum value.
		The setting is less than 80% of the maximum value.	Perform investigation item 6.
6	Perform items 2 and following in alarm No. "28".		

(26) Alarm No. 32 Power module overcurrent

[Meaning] An overcurrent was detected in the IPM used by the servo drive.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Are the UVW phases on the unit output short circuited. • Disconnect the UVW wires from the terminal block and the motor cannon plug and check between UVW with a tester.	There is a short circuit or conductivity.	Replace the UVW wires.
		No conductivity.	Perform investigation item 2.
2	Check the UVW wires for a ground fault. • Check between the UVW wires and grounding with a tester in the item 1 state.	There is a short circuit or conductivity.	Replace the UVW wires.
		No conductivity.	Perform investigation item 3.
3	Check for a motor ground fault. • Check between the UVW wires and grounding with a megger tester in the item 1 state.	There is a short circuit or conductivity.	Replace the motor.
		No conductivity. (Same level as other axes)	Perform investigation item 4.
4	Check the servo parameter setting values. • Refer to the adjustment procedures.	The settings are incorrect.	Correctly set.
		The settings are correct.	Perform investigation item 5.
5	Tug the detector connector (unit and detector side) to see if it has disconnected.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 6.
6	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 7.
7	Check the repeatability.	Does not recur.	Perform investigation item 9.
		Recurs periodically.	Perform investigation item 9.
		Always recurs.	Perform investigation item 8.
8	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Replace the motor (detector).
9	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Wait.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(27) Alarm No. 34 CRC error

[Meaning] A CRC error occurred in the communication data from the NC.

Alarm check period

f1	f2	f3	f4
–	O	O	O

	Investigation item	Investigation results	Remedy
1	Tug the connection connectors between the NC and drive unit, battery unit and drive unit, and between drive units to see if they are loose. Check that an excessive force is not being applied on the connector section.	The connectors are disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the connection of the communication cable in item 1 with a tester. Try replacing with a normal cable.	A connection defect was found.	Replace the communication cable.
		Connection is normal.	Perform investigation item 3.
3	Check whether the NC and drive unit software version was recently changed.	Was changed.	Try returning to the original software version. ↓ If the problem is not solved, perform investigation item 4.
		Not changed.	Perform investigation item 4.
4	Replace with another normal unit, and check whether the error is on the NC side or unit side.	The alarm is on the unit side.	Replace the drive unit.
		The amplifier is not the cause.	Perform investigation item 5.
5	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the MCP card on the NC side.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(28) Alarm No. 35 Data error

[Meaning] The movement command data from the NC is abnormally large.

Alarm check period

f1	f2	f3	f4
–	O	O	–

	Investigation item	Investigation results	Remedy
1	Perform the items for alarm No. "34".		

(29) Alarm No. 36 Transmission error

[Meaning] The cyclic data transmission from the NC was terminated.

Alarm check period

f1	f2	f3	f4
–	O	O	–

	Investigation item	Investigation results	Remedy
1	Perform the items for alarm No. "34".		

(30) Alarm No. 37 Parameter error

[Meaning] There is error in the servo parameters transmitted from the NC during initialization.

Alarm check period

f1	f2	f3	f4
–	○	–	○

	Investigation item	Investigation results	Remedy
1	The illegal parameter No. is displayed on the NC diagnosis screen, so adjust the servo parameter with the parameter adjustment procedures.	The setting is incorrect.	Set the correct parameter.
		The setting is correct.	Perform investigation item 3.
		The parameter No. is other than 1 to 64.	Perform investigation item 2 when parameter No. is 101.
2	The servo parameter (PIT) (RNG) (PC1) (PC2) combination is illegal or the setting range is exceeded.	Illegal or setting range is exceeded.	Refer to the parameter settings and supplementary explanations in the specifications, and reset to the correct value.
		The setting is correct.	Perform investigation item 3.
3	Perform the items for alarm No. "34".		

* Note that if an alarm 37 occurs in a system using the MDS-AVx Series servo software version B and above and provided with an OHE 25 encoder, there may be no signal (V, W phase).

(31) Alarm No. 38 Protocol error 1

[Meaning] There was a protocol error in the communication with the NC. (Frame error)

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Perform the items for alarm No. "34".		

(32) Alarm No. 39 Protocol error 2

[Meaning] There was a protocol error in the communication with the NC. (Information error)

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Perform the items for alarm No. "34".		

(33) Alarm No. 3A Overcurrent

[Meaning] The motor drive current is excessive.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Perform the items for alarm No. "32".		

(34) Alarm No. 3B Power module overheat

[Meaning] Overheating of the IPM used in the servo drive was detected.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy	
1	Investigate the heat radiating environment			
	1) Rotation of fan on rear of unit	The fan is not rotating correctly.	Replace the fan	Take measures to prevent cutting oil or dust from contacting the fins.
	2) Contamination of radiating fins on rear of unit	Remarkable amounts of cutting oil or dust are adhered on the radiating fins.	Clean the fins	
	3) Measurement of unit ambient temperature	55°C is exceeded.	Consider ventilating or cooling measures for the panel.	
		None of the above apply.	Perform investigation item 2.	
2	Investigate the installation environment. Is the grounding correct?	The grounding is incomplete. Alarms occur easily when a certain device operates.	Correctly ground. Take noise measures for the device on the left.	
	Are there any noise generating devices in the periphery?	No particular problem.	Replace the unit.	

(35) Alarm No. 42 Feedback error 1

[Meaning]
1) A skip of the detector feedback signal pulse occurred in the OHE type or OHA type detector used in the semi-closed loop system and ball screw end closed loop system.
2) A skip of the detector feedback signal pulse in the low-speed serial type absolute position linear scale.

Alarm check period

f1	f2	f3	f4
–	○	○	–

	Investigation item	Investigation results	Remedy
1	Perform the item 3 and following for alarm No. "20".		

(36) Alarm No. 43 Feedback error 2

[Meaning]
1) A deviation occurred in the feedback amount from the motor end detector and machine end detector in the closed loop
2) The serial pulse encoder is detected in the semi-closed loop.

Alarm check period

f1	f2	f3	f4
–	○	○	–

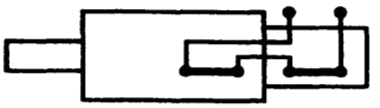
	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "2A".		

(37) Alarm No. 46 Motor overheat

Alarm check period

f1	f2	f3	f4
–	○	○	–

[Meaning] The thermal protector built in the motor (detector) operated.
* In the MDS-B Series, this is connected by the serial communication with the detector.

	Investigation item	Investigation results	Remedy
1	Check the repeatability.	Recurs within one minute of start up.	Perform investigation item 3.
		Recurs periodically after operating for some time.	Perform investigation item 2.
2	Check the motor temperature when the alarm occurs.	The motor is hot.	Lessen the operation pattern. ↓ If the problem is not solved, perform investigation item 3.
		The motor is not hot.	Perform investigation item 3.
3	Tug the detector cable connectors (unit side and motor side cannons) to see if they are loose.	The connectors are disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection is normal.	Perform investigation item 5.
5	Check the thermal relay terminal conductivity in the detector's cannon connector with a tester. (Excluding MDS-B Series) • Between pin Nos. "T" and "V"	No conductivity or resistance is high.	Perform investigation item 6.
		Normal (short circuit)	Perform investigation item 7.
6	If the thermal connection is as shown below for OHE25K-6, OHA25K-4, OSE104/105 and OSA104/105, so cut the wire between the motor and detector with a joint amplifier, and check the thermal conductivity for each.  For OHE25K-85, OHA25K-85, OHE25K-108 and OHA25K-108, the thermal is only on the detector side, so the detector is defective if there is no conductivity.	No conductivity or large resistance in the motor and detector thermal.	Replace the motor or detector.
		Normal	Perform investigation item 7.
7	Replace with another normal axis unit, and check if the defect is on the unit.	The alarm is on the unit side.	Replace the unit.
		Occurs even if unit is replaced.	Perform investigation item 7.
8	Check for abnormalities in the unit's peripheral environment. (**Ex.** Ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(38) Alarm No. 50 Overload 1

Alarm check period

f1	f2	f3	f4
–	O	O	O

[Meaning] The time that the motor drive current exceeded the overload detection level (parameter OLL) converted with stall conversion exceeded the overload time constant (parameter OLT).

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (OLL) (OLT) setting values. Standard setting values OLL: 60 (unit: sec.) OLT: 150	The setting is not the standard setting value.	Correct to the standard setting value if special specifications are not being used.
		The value is the standard setting value.	Perform investigation item 2.
2	Check the motor temperature when the alarm occurs.	The motor is hot.	Ease the operation pattern. ↓ If the problem is not solved, perform investigation item 3.
		The motor is not hot.	Perform investigation item 3.
3	Check whether the motor is hunting.	Hunting is occurring.	Refer to the adjustment procedures and readjust. • Check the cable wiring and connector connections. • Check for mistaken parameter settings. • Adjust the gain. ↓ If the problem is not solved, perform investigation item 4.
		Hunting is not occurring.	Perform investigation item 4.
4	Replace with another normal axis unit and check whether the defect is on the unit. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the unit.
		Problem still occurs even after unit is replaced.	Perform investigation item 5.
5	Check if the current value on the NC servo monitor screen is abnormally high when stopped and operating.	The value is abnormal.	Check the machine system.
		The value is correct.	Perform investigation item 6.
6	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Supplementary explanation

1) MDS-B Series

The unit was run in the region of the thermal characteristics shown with slanted lines below.

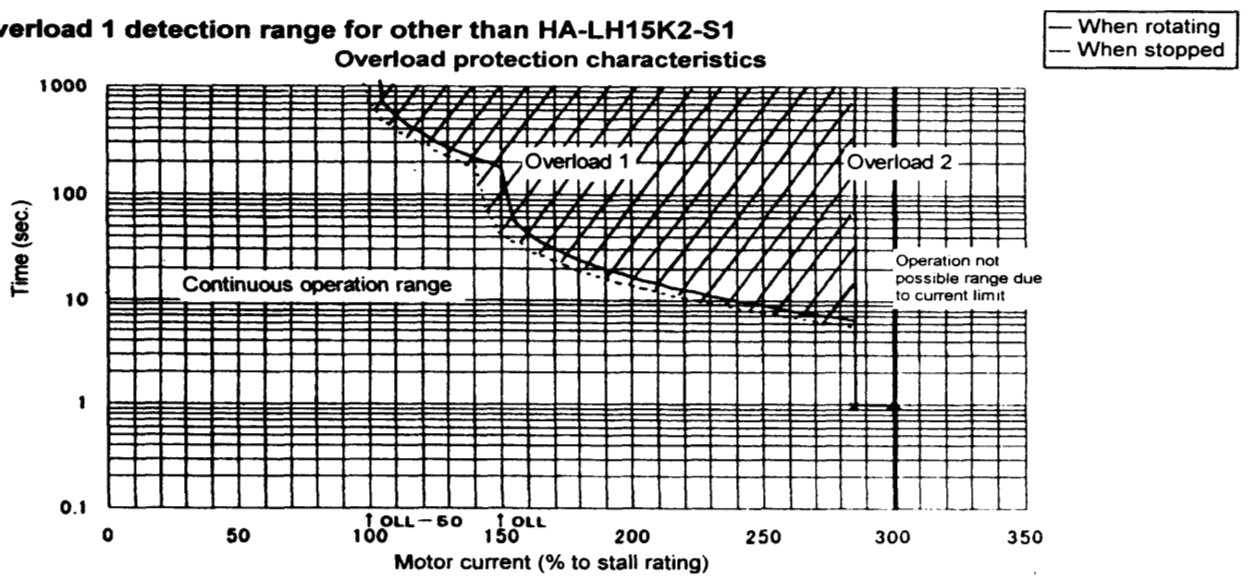
With the MDS-B Series, continuous protection characteristics were realized by changing the overload alarm detection process.

Note 1) The overload 1 detection region can be changed with the parameters (SV021:)LT, SV022: OLL) in the same manner as MDS-A. However, as long as there is no particular reason, use the standard parameters.

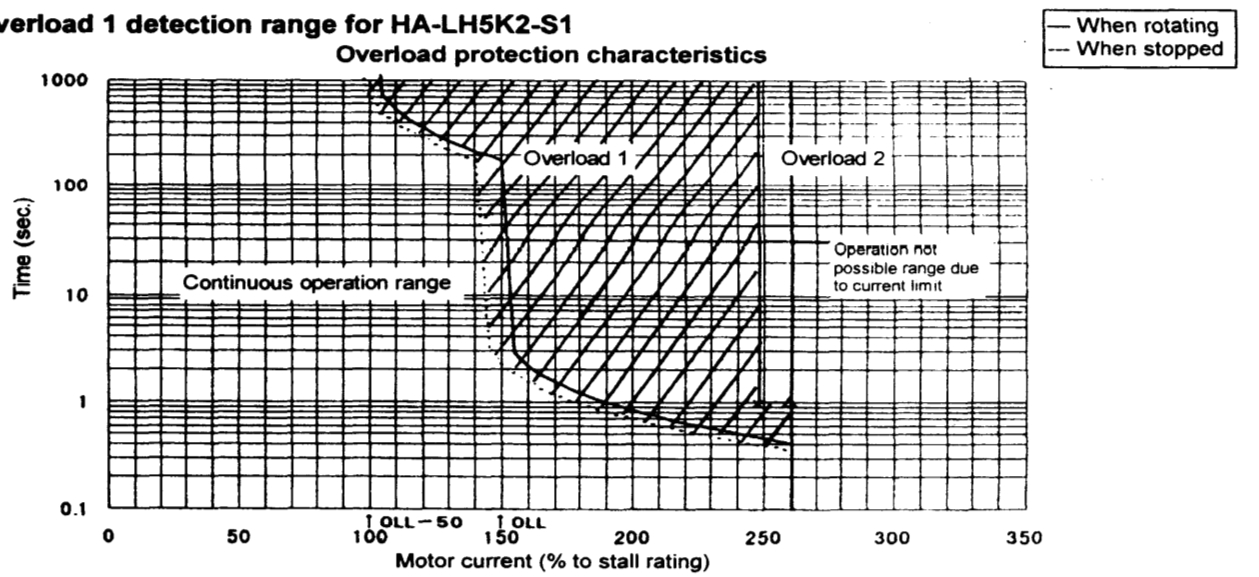
Note 2) With this alarm, as the overload detection method has been changed, the alarm occurrence time and the value displayed at "Overload (%)" on the servo monitor screen may differ from the MDS-A Series even when using the same operation pattern.

Note 3) To prevent operation from being resumed immediately from the overload state, this alarm cannot be reset until the control power (L11, L12) continuity state is not continued for several minutes after the alarm occurs.
The condition for resetting the alarm is that the "Overload (%)" display value must drop to 50% or less. The time to wait for this alarm to reset will differ according to the servo parameters (OLT and OLL), but is approximately five minutes with the standard parameters.
If the control power is turned ON again immediately after the alarm has occurred, the alarm will not be reset due to the above operation. Wait at least 5 minutes in the continuity state, and then carry out NC reset or turn the power ON again.

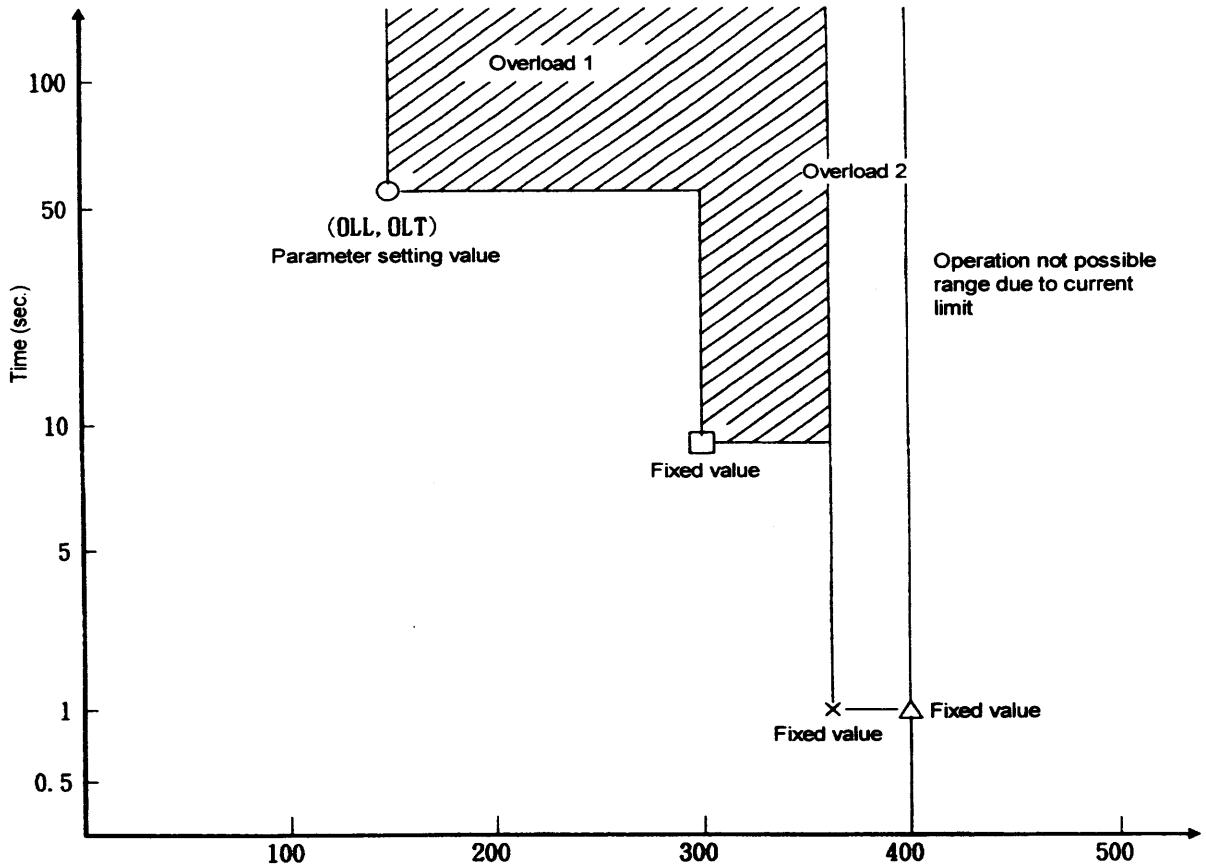
① Overload 1 detection range for other than HA-LH15K2-S1



② Overload 1 detection range for HA-LH5K2-S1



2) MDS-A series



Note 1) Parameter standard setting value OLL = 150%
OLT = 60 sec.

Note 2) The △ level is for parameter SVO13: ILMT1 = 500.
The △ level will change proportionally when the parameter is changed.

Note 3) The motor's rated current ratio and time shown with ○, □, × and △ symbols in the diagram will differ according to the motor.

(39) Alarm No. 51 Overload 2

Alarm check period

f1	f2	f3	f4
–	–	○	–

[Meaning] A current command that is 95% or more of the amplifier's maximum output current value continued for 1 second or more.

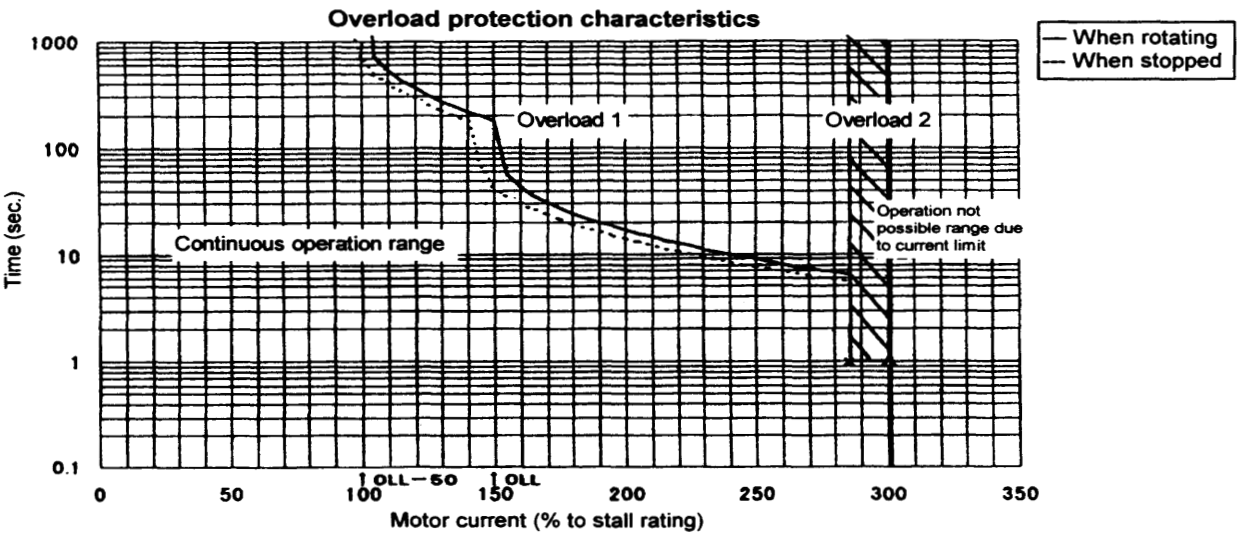
	Investigation item	Investigation results	Remedy
1	Check if the PN voltage is being supplied to the amplifier. • Check the axis where the alarm occurred, and the axis farthest from the power supply.	The voltage is supplied.	Perform investigation item 3.
		The voltage is not supplied.	Perform investigation item 2.
2	Confirm that the power supply unit CHARGE lamp is lit and check the PN terminal voltage.	There is no voltage at the PN terminal. (The lamp is not lit.)	Check the power supply unit.
		There is a voltage at the PN terminal.	Check the PN wiring between the units.
3	Is an abnormally large current value displayed on the NC servo monitor screen during acceleration/deceleration?	The maximum value exceeds the level indicated with an x in the table on the previous page.	Lengthen the acceleration/deceleration time constant, and lower to 80% of the limit value.
		A correct value is displayed.	Perform investigation item 4.
4	Perform the items 3 and following for alarm No. "50".		

Supplementary explanation

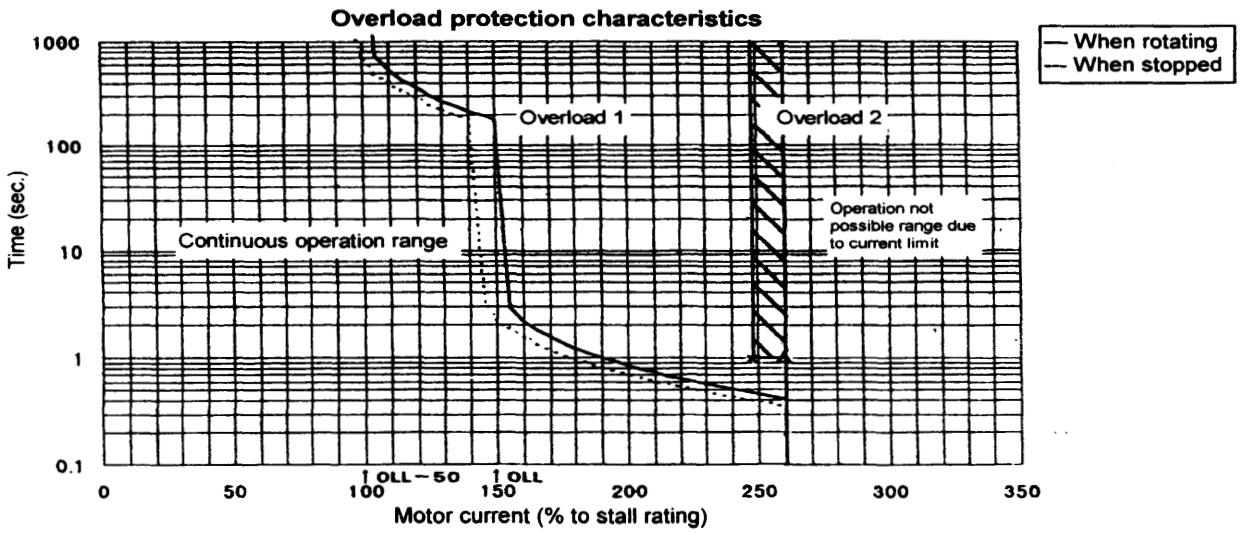
1) MDS-B Series

The unit was run in the region of the thermal characteristics shown with slanted lines below.

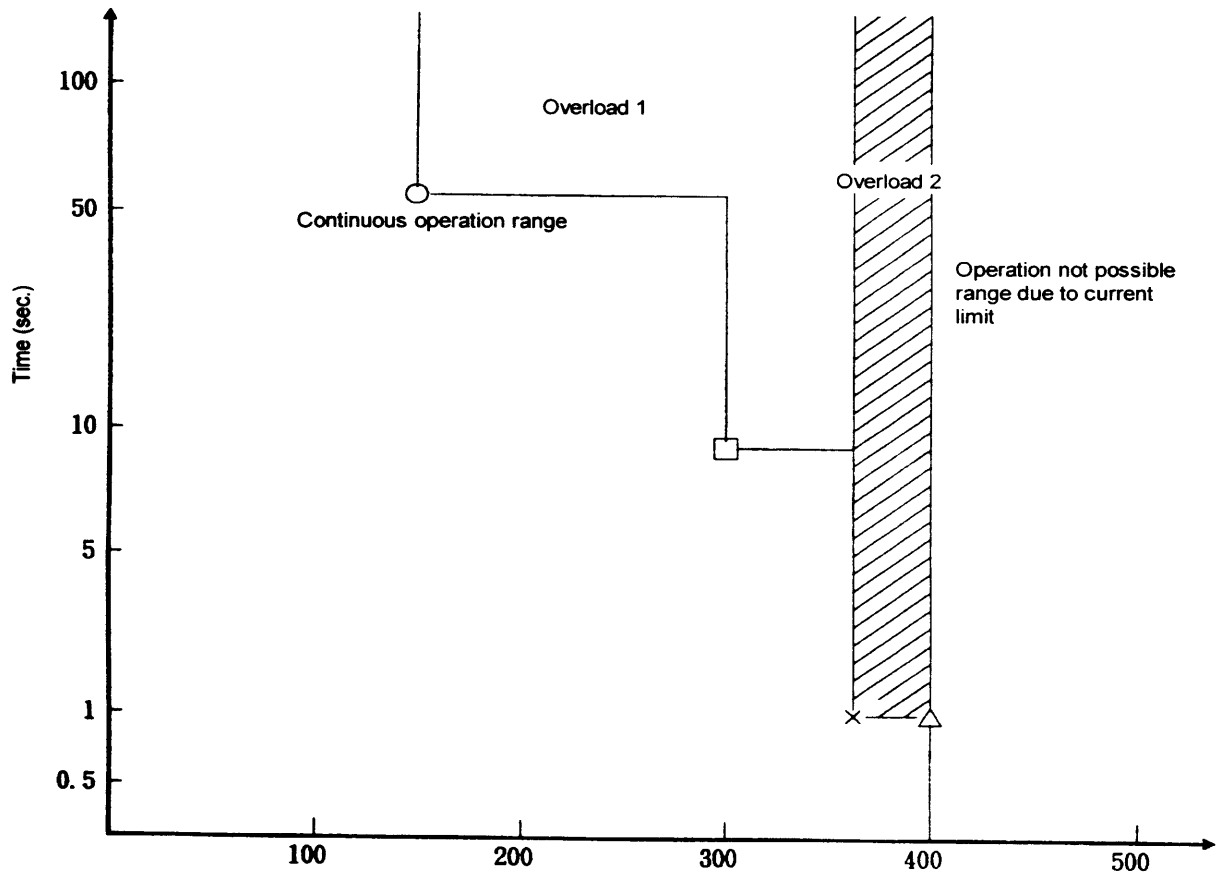
① Overload 2 detection range for other than HA-LH15K2-S1



② Overload 2 detection range for HA-LH5K2-S1



2) MDS-A series



Note 1) Parameter standard setting value OLL = 150%
OLT = 60 sec.

Note 2) The △ level is for parameter SVO13: ILMT1 = 500.
The △ level will change proportionally when the parameter is changed.

Note 3) The motor's rated current ratio and time shown with ○, □, × and △ symbols in the diagram will differ according to the motor.

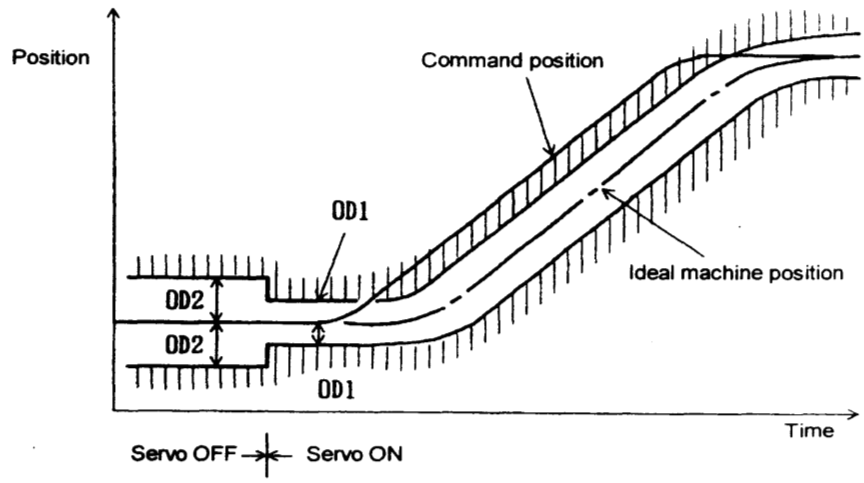
Motor	○		□		×		△
	Level	Time	Level	Time	Level	Time	Level
HA 40N	OLL	OLT	250	10	450%	1 sec.	472%
80N	OLL	OLT	250	10	400	1	424
100N	OLL	OLT	250	10	285	1	300
200N	OLL	OLT	200	5	250	1	260
300N	OLL	OLT	180	5	220	1	230
700N	OLL	OLT	180	5	220	1	231
900N	OLL	OLT	180	5	240	1	252
053	OLL	OLT	250	10	265	1	279
13	OLL	OLT	250	10	265	1	279
23N	OLL	OLT	250	10	255	1	270
33N	OLL	OLT	250	10	255	1	270
43N	OLL	OLT	250	10	320	1	340
83N	OLL	OLT	250	10	300	1	318
103N	OLL	OLT	220	5	275	1	291
203N	OLL	OLT	190	5	235	1	246
303N	OLL	OLT	180	5	195	1	205
703N	OLL	OLT	180	5	195	1	207
50NL	OLL	OLT	250	10	400	1	425
100NL	OLL	OLT	250	10	330	1	350
150NL	OLL	OLT	250	10	345	1	365
200NL	OLL	OLT	200	10	220	1	231
300NL	OLL	OLT	200	5	215	1	228
500NL	OLL	OLT	180	5	180	1	193
LH11K2-S1	—	—	—	—	193	1	204
LH15K2-S1	—	—	—	—	247	1	260

(40) Alarm No. 52 Excessive error 1

Alarm check period			
f1	f2	f3	f4
–	–	○	–

[Meaning] The actual position to the command exceeded the value set in parameter setting value OD1 (excessive error width during servo ON) when the servo was turned ON.

The actual machine position deviated an amount exceeding the value set in OD1 from the ideal machine position for the command position.
This will occur if the actual machine position enters the shaded area shown below.



	Investigation item	Investigation results	Remedy
1	Check if the PN voltage is being supplied to the amplifier. • Check the axis where the alarm occurred, and the axis farthest from the power supply.	The voltage is supplied.	Perform investigation item 3.
		The voltage is not supplied.	Perform investigation item 2.
2	Confirm that the power supply unit CHARGE lamp is lit and check the PN terminal voltage.	There is no voltage at the PN terminal. (The lamp is not lit.)	Check the power supply unit.
		There is a voltage at the PN terminal.	Check the PN wiring between the units.
3	Check the servo parameter (OD1) setting value. • OD1 = OD2 = $\frac{\text{Rapid traverse rate (mm/min.)}}{60 \times \text{PGN1}} \times 0.5$ (mm)	The setting is not the standard setting value.	Correct to the standard setting value if special specifications are not being used.
		The setting is the standard setting value.	Perform investigation item 4.
4	Perform the items 3 and following for alarm No. "50".		

(41) Alarm No. 53 Excessive error 2

Alarm check period

f1	f2	f3	f4
–	○	–	–

[Meaning] The actual position to the command exceeded the value set in parameter setting value OD2 (excessive error width during servo OFF) during servo OFF.

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (OD2) setting value. • OD1 = OD2 = $\frac{\text{Rapid traverse rate (mm/min.)}}{60 \times \text{PGN1}} \times 0.5$ (mm)	The setting is not the standard setting value.	Correct to the standard setting value if special specifications are not being used.
		The setting is the standard setting value.	Perform investigation item 2.
2	Check if the machine is moving during servo OFF.	Is moving.	Check the machine and mechanical brakes.
		Is not moving.	Perform investigation item 3.
3	Tug the communication cable connector from the NC to the terminator (unit side and NC side) to see if it is disconnected.	Is disconnected (loose).	Correctly connect.
		Normal.	Perform investigation item 4.
4	Turn the power OFF, and check the communication cable connection with a tester. Try changing with a normal cable.	A connection defect was found.	Replace the communication cable.
		Normal.	Perform investigation item 5.
5	Replace with another normal axis unit and check whether the defect is on the unit. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the unit.
		Problem still occurs even after unit is replaced.	Replace the NC side MCP card. ↓ If the problem is not solved, perform investigation item 6.
6	Tug the detector cable connector (unit side and motor side cannon) to check if it is disconnected.	Is disconnected (loose).	Correctly connect.
		Normal.	Perform investigation item 7.
7	Turn the power OFF, and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Normal.	Perform investigation item 8.
8	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(42) Alarm No. 54 Excessive error 3

Alarm check period

f1	f2	f3	f4
–	○	○	–

[Meaning] The motor current did not flow when the excessive error 1 alarm was detected.

	Investigation item	Investigation results	Remedy
1	Check if the PN voltage is being supplied to the drive unit.	The voltage is supplied.	Perform investigation item 3.
		The voltage is not supplied.	Perform investigation item 2.
2	Confirm that the power supply unit CHARGE lamp is lit and check the PN terminal voltage.	There is no voltage at the PN terminal. (The lamp is not lit.)	Check the power supply unit.
		There is a voltage at the PN terminal.	Check the PN wiring between the units.
3	Check whether the motor power wire is connected to the motor. • Disconnect the power wire from the terminal block, and check between the UVW wires with a tester.	The power wire is not connected or the power wire is broken.	Correctly connect the power wire.
		The power wire is correctly connected.	Perform investigation item 4.
4	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side. (Refer to the cautions in section 2.3.)	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the motor.	Replace the motor.

(43) Alarm No. 58 Collision detection 0 (CLE0)

Alarm check period

f1	f2	f3	f4
–	–	○	–

[Meaning] A collision detection type 1 error was detected during the G0 modal (rapid traverse).
A disturbance torque that exceeds the external disturbance torque was detected.

[Detecting] During servo ON

	Investigation item	Investigation results	Remedy
1	Is the collision detection function being used? Check whether the machine has collided.	The collision detection function is not used.	Perform investigation item 2.
		The machine has collided.	Modify so that the machine does not collide.
		The collision detection function is used, but the machine has not collided.	Perform investigation item 3.
2	Check the parameters. Is sv060 (TLMT) set to "0"?	The setting is incorrect.	Change sv060 (TLMT) to "0".
3	Check whether the current has reached the current limit value or 90% of the limit value during normal rapid traverse acceleration/deceleration.	The current is 90% or more of the current limit value.	Increase the time constant, and perform investigation item 4.
		The current is less than 90% of the current limit value.	Perform investigation item 4.
4	Adjust the collision detection function again, and try operation. (Refer to the separate collision detection function specifications.)	The alarm does not occur.	——
		The alarm occurs.	Perform investigation item 5.
5	Does the machine or current vibrate?	Is vibrating.	Eliminate the vibration by adjusting the gain, etc., and then perform investigation item 4.
		Is not vibrating.	Perform investigation item 6.
6	Try increasing the detection level.	The alarm does not occur.	If the problem is not solved by replacing the unit, try increasing the level.
		The alarm occurs.	Replace the unit.

(44) Alarm No. 59 Collision detection 1 (CLE1)

Alarm check period

f1	f2	f3	f4
–	–	○	–

[Meaning] A collision detection type 1 error was detected during the G1 modal (cutting feed).
A disturbance torque that exceeds the external disturbance torque was detected.

[Detecting] During servo ON

	Investigation item	Investigation results	Remedy
1	Is the collision detection function being used? Check whether the machine has collided.	The collision detection function is not used.	Perform investigation item 2.
		The machine has collided.	Modify so that the machine does not collide.
		The collision detection function is used, but the machine has not collided.	Perform investigation item 3.
2	Check the parameters. Is sv060 (TLMT) set to "0"?	The setting is incorrect.	Change sv060 (TLMT) to "0".
3	Check whether the current has reached the current limit value or 90% of the limit value during normal cutting feed acceleration/deceleration.	The current is 90% or more of the current limit value.	Increase the time constant, and perform investigation item 4.
		The current is less than 90% of the current limit value.	Perform investigation item 4.
4	Adjust the collision detection function again, and try operation. (Refer to the separate collision detection function specifications.)	The alarm does not occur.	——
		The alarm occurs.	Perform investigation item 5.
5	Does the machine or current vibrate?	Is vibrating.	Eliminate the vibration by adjusting the gain, etc., and then perform investigation item 4.
		Is not vibrating.	Perform investigation item 6.
6	Try increasing the detection level.	The alarm does not occur.	If the problem is not solved by replacing the unit, try increasing the level.
		The alarm occurs.	Replace the unit.

(45) Alarm No. 5A Collision detection 2

Alarm check period

f1	f2	f3	f4
–	–	○	–

[Meaning] A collision detection type 2 error was detected.
A current command at the maximum performance of the drive unit was detected.

[Detecting] During servo ON

	Investigation item	Investigation results	Remedy
1	Perform the investigation items for alarm 58.		

(46) Alarm No. 60 to 7F

Alarm check period

f1	f2	f3	f4
–	○	○	○

[Meaning] An error occurred in the power supply unit.

	Investigation item	Investigation results	Remedy
1	Refer to II. MDS-A/B-CV power supply section.		

(47) Alarm No. 82 Power supply no signal

[Meaning] The cable connected to the power supply is broken or the connection is mistaken.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Check if the connector for the communication cable with the power supply is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the cable connection with a tester. Try changing the cable with a normal cable.	A broken wire or incorrect connection was found.	Replace the communication cable.
		The connection is normal.	Perform investigation item 3.
3	Connect with another normal axis unit, and check if the defect is on the drive unit side or power supply side.	The alarm is on the drive unit side.	Replace the drive unit.
		The alarm is on the power supply side.	Replace the power supply unit.

(48) Alarm No. 88 Watch dog

[Meaning] The servo drive software process was not executed within the designated time.

Alarm check period

f1	f2	f3	f4
○	○	○	○

	Investigation item	Investigation results	Remedy
1	Check whether the servo software version was changed recently.	It was changed.	Try returning to the original software version.
		Not changed.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

(49) Alarm No. 90 Low speed serial initial communication error

[Meaning] The initial communication with the low speed serial type absolute position linear scale was not possible.

Alarm check period

f1	f2	f3	f4
–	–	○	–

	Investigation item	Investigation results	Remedy
1	Perform investigation items of alarm No.58.		

(50) Warning No. 91 Communication error

[Meaning] The absolute position serial data was not properly sent during normal operation.

Alarm check period

f1	f2	f3	f4
–	○	○	–

	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "25"		

(51) Warning No. 92 Serial format error

[Meaning] The format of the serial data from the absolute position detector was incorrect.

Alarm check period

f1	f2	f3	f4
–	○	○	–

	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "25"		

(52) Warning No. 93 Absolute position fluctuation

[Meaning] The absolute position counter cannot be set as the absolute position data fluctuated when the NC power was turned ON.

Alarm check period

f1	f2	f3	f4
–	○	–	–

	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "25"		

(53) Alarm No. 96 MP scale feedback error

[Meaning] In the MP scale absolute detection system, an excessive deviation in the motor end installation detector and MP scale feedback amount was detected.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "25"		

(54) Alarm No. 97 MP scale offset error

[Meaning] In the MP scale absolute position detection system, an error was detected in the offset data read when the NC power was turned ON.

Alarm check period

f1	f2	f3	f4
–	○	–	–

	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "25"		

(55) Alarm No. 9E High-speed serial multi-rotation counter error

[Meaning] An error was detected in the multi-rotation counter in the serial pulse encoder connected to the motor end or ball screw end.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Perform the items 3 and following for alarm No. "25"		

(56) Warning No. 9F Battery voltage drop

[Meaning] The voltage of the battery supplied to the absolute position detector dropped.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Check the battery unit voltage.	The battery voltage has dropped.	Replace the battery.
		There is no error in the battery voltage.	Perform investigation item 2.
2	Perform the items 3 and following for alarm No. "25"		

(57) Warning No. E1 Overload warning

[Meaning] An 80% level of the overload 1 alarm was detected. As this is not an alarm, continued use is possible, but the overload 1 alarm may occur.

Alarm check period

f1	f2	f3	f4
–	○	○	○

	Investigation item	Investigation results	Remedy
1	Check whether the motor is hot.	The motor is not hot.	Perform the items for alarm No. "50".
		The motor is hot.	Perform investigation item 2.
2	Check if there is an error when acceleration/ deceleration is performed.	Operation is possible without error.	1. If the operation pattern can be eased, ease it. 2. If operation is possible without an alarm occurring, continue use.
		Operation is abnormal.	Perform the items 3 and following for alarm No. "50".

(58) Warning No. E3 Absolute position counter warning

[Meaning] The absolute position counter value is illegal.
- If the power is being turned ON for the first time, perform zero point return, turn the power OFF and ON once to restore the value.

Alarm check period

f1	f2	f3	f4
–	○	○	–

	Investigation item	Investigation results	Remedy
1	Investigate the state where the warning occurred.	Occurs when NC power is turned ON.	Check the battery voltage, perform zero point return, and then turn power OFF and ON.
		Occurs during operation.	Perform the items for alarm "25".
2	Check whether a battery error alarm occurred recently.	An alarm occurred.	Check the battery voltage.
		Did not occur.	Check the detector and cable.

(59) Warning No. E4 Parameter error warning

[Meaning] A parameter exceeding the setting range was set.
The illegal parameter will be ignored and the previously set value will be held.

Alarm check period

f1	f2	f3	f4
–	O	O	–

	Investigation item	Investigation results	Remedy
1	Set the correct value according to the parameter adjustment procedure.		

(60) Warning No. E7 NC emergency stop

[Meaning] An emergency stop signal is being sent from the NC or an alarm occurred in another axis.

Alarm check period

f1	f2	f3	f4
–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check if the NC side emergency stop switch is activated.	Emergency stop is activated.	Perform investigation item 2.
		Emergency stop is released.	Perform investigation item 3.
2	Release the emergency stop.	The machine starts up normally.	Normal
		"E7" is still displayed.	Perform investigation item 3.
3	Check if a terminator or battery unit is connected or if disconnected.	Abnormal place found	Correct the abnormality.
		Normal	Perform the items for alarm "34".

3.3 Precautions

(1) When changing the motor and amplifier combination due to troubleshooting, avoid running the motor with an amplifier that has a capacity larger than the designated amplifier. The motor may be demagnetized.
However, checking in the emergency stop state is no problem.
Running the motor with an amplifier having a capacity smaller than that designated is no problem.

4. Troubleshooting (MDS-C1 Series)

4.1 Servo warnings and servo alarms

(1) Precautions and matters to confirm

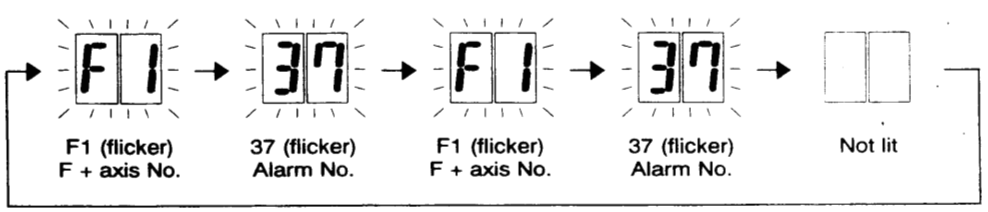
If an error occurs in the servo system, a servo warning or servo alarm will occur. If a servo warning or servo alarm occurs, pay attention to the following points and check the state of the system. Then, carry out the inspections and repairs described in this section.

⚠ CAUTION

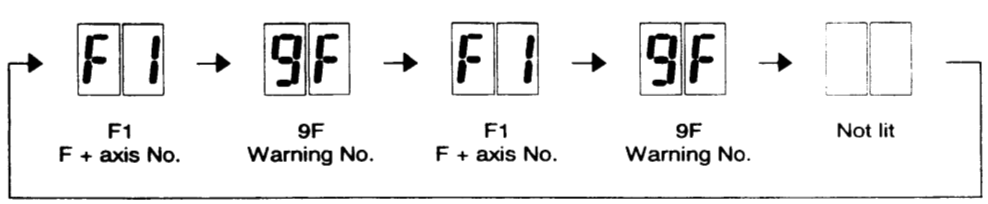
1. This servo system uses a large capacity electrolytic capacitor. When the CHARGE lamp on the front of the power supply unit (MDS-C1-CV) in the system is lit, there is still a voltage in the unit. Take care to prevent electric shocks and short circuits. (The voltage will remain for several minutes after the power is turned OFF.)
2. The continuity inside the driver cannot be checked due to the structure.
3. Do not carry out a megger test as the driver could be damaged.

<Matters to confirm>

1. What alarm No. is displayed?
2. Can the error or fault be repeated? (Investigate alarm history)
3. Is the motor and servo driver temperature and ambient temperature correct?
4. Are the servo driver, control unit and motor grounded?
5. Did the problem occur during acceleration, deceleration or constant speed operation? What was the speed?
6. Is there any difference in the state during forward run and reverse run operation?
7. Was there a instantaneous power failure?
8. Did the problem occur when a certain operation or command was carried out?
9. How often does the problem occur?
10. Does the problem occur when the load is applied or removed?
11. Has the driver unit been replaced, any part been replaced, or any remedial measure been taken?
12. How many years have passed since operation was started?
13. Is the power voltage normal? Is there any great fluctuation according to the time zone?



LED display during servo alarm



LED display during servo warning

(2) Troubleshooting at start up

If the NC system does not start up correctly and a system error occurs when the NC power is turned ON, the servo driver may not have been started up correctly.
Confirm the LED display on the driver, and take measures according to this section.

LED display	Symptom	Cause of occurrence	Investigation method	Remedy
AA	Initial communication with the NC was not completed correctly.	The driver axis No. setting is incorrect.	Is there any other driver set to the same axis No.?	Set correctly.
		The NC setting is incorrect.	Is the number of NC controlled axes correct?	Set correctly.
		Communication with NC is incorrect.	Is the connector (CN1A, CN1B) disconnected?	Connect correctly.
			Is the cable disconnected? Check the continuity with a tester.	Replace the cable.
Ab	Initial communication with the NC was not carried out.	The axis is not used, or is set to disabled.	Is the axis setting rotary switch set between 7 and F?	Set correctly.
		Communication with NC is incorrect.	Is the connector (CN1A, CN1B) disconnected?	Connect correctly.
			Is the cable disconnected? Check the continuity with a tester.	Replace the cable.

(3) List of servo alarms and warnings

No.	Abbr.	Name	RS	A/C	No.	Abbr.	Name	RS	A/C
10					40	KE1	A-TK unit changeover error	PR	SP
11	ASE	Axis selection error	AR	C	41	KE2	A-TK unit communication error	PR	SP
12	ME	Memory error	AR	C	42	FE1	Feedback error 1	PR	A
13	SWE	Software processing error	PR	C	43	FE2	Feedback error 2	PR	A
14	SWE2	Software processing error 2	PR	C	44	CAXC	C axis changeover alarm	NR	SP
15					45				
16	RD1	Pole position detection error 1	PR	BV	46	OHM	Motor overheat	NR	A
17	ADE	AD converter error	PR	A	47				
18	WAT	Initial communication error	PR	A	48	SCGPU	Scale CPU error	PR	VL
19					49	SOSP	Scale overspeed	PR	VL
1A	Stei	Serial detector initial communication error (SUB)	PR	A	4A	SABS	Absolute position detection circuit error	PR	VL
1B	Scpu	CPU error (SUB)	PR	A	4B	SINC	Relative position detection circuit error	PR	VL
1C	Sled	EEPROM/LED error (SUB)	PR	A	4C				
1D	Sdat	Data error (SUB)	PR	A	4D				
1E	Sohe	ROM-RAM/thermal error (SUB)	PR	A	4E				
1F	Stre	Serial detector communication error (SUB)	PR	A	4F				
20	NS1	No signal 1	PR	BV	50	OL1	Overload detection 1	NR	A
21	NS2	No signal 2	PR	A	51	OL2	Overload detection 2	NR	A
22					52	OD1	Excessive error 1 (at servo ON)	NR	A
23	OSE	Speed deflection excessive	PR	SP	53	OD2	Excessive error 2 (at servo OFF)	NR	A
24					54	OD3	Excessive error 3 (no power)	NR	A
25	ABSE	Absolute position lost	AR	A	55				
26	NAE	Not used axis error	PR	C	56				
27	SCcpu	Scale CPU error (SUB)	PR	A	57				
28	Sosp	Scale overspeed (SUB)	PR	A	58	CLG0	Collision detection method 1·G0	NR	A
29	Sabs	Absolute position detection circuit error (SUB)	PR	A	59	GLG1	Collision detection method 1·G1	NR	A
2A	Sinc	Relative position detection circuit error (SUB)	PR	A	5A	CLT2	Collision detection method 2	NR	A
2B	SCPU	Scale CPU error	PR	A	5B				
2C	SLED	EEPROM/LED error	PR	A	5C	ORFE	Orientation/feedback error	NR	SP
2D	SDAT	Scale data error	PR	A	5D				
2E	SRRE	ROM-RAM error	PR	A	5E				
2F	STRE	Serial detector communication error	PR	A	5F				
30	OR	Over-regeneration	PR	SVJ	60	0	Instantaneous power failure	PR	R
31	OS	Overspeed	PR	A	61	1	Power module overcurrent	PR	V
32	PMOC	Overcurrent (IPM error)	PR	A	62	2			
33	OV	Overvoltage	PR	SVJ	63	3	Auxiliary regeneration error	PR	V
34	DP	NC communication CRC error	PR	C	64	4			
35	DE	NC communication Data error	PR	A	65	5	Rush relay error	PR	V/R
36	TE	NC communication Communication error	PR	C	66	6			
37	PE	Initial parameter error	PR	A	67	7	Open phase	PR	V
38	TP1	NC communication Protocol error 1	PR	C	68	8	Watch dog	AR	V/R
39	TP2	NC communication Protocol error 2	PR	A	69	9	Gourd fault	PR	V
3A	OC	Overcurrent	PR	A	6A	A	Contactor melting	PR	V
3B	PMOH	Overheat (IPM error)	PR	A	6B	B	Rush relay melting	PR	V/R
3C					6C	C	Main circuit error	PR	V/R
3D					6D	D			
3E					6E	E	Memory error	AR	V/R
3F					6F	F	AD error (PS error)	AR	V/R

Note 1) For RS, PR: Reset by turning NC power OFF, AR: Reset by turning servo driver power OFF.
*: This is a warning display, and the servo will not turn OFF.

Note 2) For A/C, A: Alarm occurring for each axis, C: Common alarm in driver, SP: Spindle alarm, SVJ: MDS-A-SVJ alarm, AV: MDS-A-Vx alarm, BV: MDS-B-Vx alarm, VL: MDS-B-Vx4L alarm, V: Power regeneration power supply alarm, R: Resistor regeneration power supply alarm

No.	Abbr.	Name	RS	A/C	No.	Abbr.	Name	RS	A/C
70	G				A0				
71	H	Instantaneous power failure/external emergency stop	NR	V	A1				
72	I				A2				
73	J	Over-regeneration	PR	R	A3				
74	K	Regenerative resistor overheat	PR	R	A4				
75	L	Overvoltage	NR	V/R	A5				
76	M	External emergency stop setting error	AR	V	A6				
77	N	Power module (V)/fin (R) overheat	PR	V/R	A7				
78					A8	WTW	Turret indexing command error warning	*	SP
79					A9				
7A					AA		NC initial communication 1st phase standby		
7B					AB		NC initial communication 1st phase standby		
7C					AC		NC initial communication 2nd phase standby		
7D					AD		NC initial communication 3rd phase standby		
7E					AE		NC initial communication 4th phase standby		
7F	AMP	Amplifier power reset request	AR	C	AF		Reserved		
80	HCN	HR unit connection error	PR	VL	E0	WOR	Over-regeneration warning	*	SVJ
81	HHS	HR unit HSS communication error	PR	VL	E1	WOL	Overload warning	*	A
82	NSP	Power supply no signal	PR	AV	E2				
83	HSC	HR unit scale judgment error	PR	VL	E3	WAC	Absolute position counter warning	*	A
84	HCPU	HR unit CPU error	AR	VL	E4	WPE	Parameter error warning	*	A
85	HDAT	HR unit data error	PR	VL	E5				
86	HMAG	HR unit polarity error	PR	VL	E6	AXE	Control axis removal warning	*	A
87					E7	NCE	NC emergency stop	*	C
88	WD	Watch dog	AR	C	E8	O	Over-regeneration warning	*	V/R
89	Hcn	HR unit connection error (SUB)	PR	A	E9	P	Instantaneous power failure warning	*	V
8A	Hhs	HR unit HSS communication error (SUB)	PR	A	EA	Q	External emergency stop input	*	V
8B					EB	R			
8C	Hsc	HR unit scale judgment error (SUB)	PR	A	EC	S			
8D	Hcpu	HR unit CPU error (SUB)	AR	A	ED	T			
8E	Hdat	HR unit data error (SUB)	PR	A	EE	U			
8F	Hmag	HR unit polarity error (SUB)	PR	VL	EF	V			
90	WST	Low-speed serial initial communication error	PR	A	00				
91	WAS	Low-speed serial communication error	*	A	01	When writing software	FLASH programming error	.	
92	WAF	Low-speed serial protocol error	*	A	02		FLASH erase error		
93	WAM	Absolute position fluctuation	PR	A	03		Vpp error		
94					04		Check sum error		
95					05		Compare error		
96	MPE	MP scale feedback error	*	A	06				
97	MPO	MP scale offset error	PR	A	07				
98					08		Bank designation error		
99					09		Initial address error		
9A					0A		Bank changeover error		
9B	WMS	HR unit polarity shift warning	*	VL	0B		Address error		
9C	WMG	HR unit polarity warning	*	VL	0C		Reception timeout		
9D	Wmg	HR unit polarity warning (SUB)	*	VL	0D				
9E	Wan	High-speed serial multi-rotation counter error	*	A	0E				
9F	WAB	Battery voltage drop	*	A	0F		Command sequence error		

Bn		In READY OFF (n is control axis No.)	Dn		In servo ON (n is control axis No.)
Cn		In SERVO OFF (n is control axis No.)	Fn		Control axis No. display (n is control axis No.)

Note 1) For RS, PR: Reset by turning NC power OFF, AR: Reset by turning servo driver power OFF.
*: This is a warning display, and the servo will not turn OFF.

Note 2) For A/C, A: Alarm occurring for each axis, C: Common alarm in driver, SP: Spindle alarm, SVJ: MDS-A-SVJ alarm, AV: MDS-A-Vx alarm, BV: MDS-B-Vx alarm, VL: MDS-B-Vx4L alarm, V: Power regeneration power supply alarm, R: Resistor regeneration power supply alarm

(4) Alarm details

Servo alarms

No.	Abbr.	Name	Details	RS	A/C
12	ME	Memory error	During the self-check when the driver power was turned ON, an error was detected in the memory IC/FB IC. (Refer to the section (5) LED display No. at memory error.)	AR	C
13	SWE	Software processing error	The software data process did not end within the specified time.	PR	C
14	SWE2	Software processing error 2	The current processing processor is not operating correctly.	PR	C
17	ADE	AD converter error	During the self-check when the driver power was turned ON, an error was detected in the A/D converter for current detection.	PR	A
18	WAT	Initial communication error	Initial communication with the high-speed serial detector connected to the motor end was not possible.	PR	A
1A	Stei	Serial detector initial communication error (SUB)	In the system using the OHA25K-ET or high-speed serial detector as the machine end detector, initial communication with the detector was not possible.	PR	A
1B	Scpu	CPU error (SUB)	An error was detected in the data stored in the EEPROM of the high-speed serial detector connected to the machine end.	PR	A
1C	Sled	EEPROM/LED error (SUB)	The linear scale connected to the machine end detected an EEPROM error. Or, deterioration of the LEDs was detected in the high-speed serial detector connected to the machine end.	PR	A
1D	Sdat	Data error (SUB)	An error was detected at a position within one rotation of the high-speed serial detector connected to the machine end.	PR	A
1E	Sohe	ROM-RAM/thermal error (SUB)	The linear scale connected to the machine end detected an error in the ROM/RAM. Or, the thermal protector built in the high-speed serial detector connected to the machine end activated.	PR	A
1F	Stre	Serial detector communication error (SUB)	Communication with the high-speed serial detector connected to the machine end was disconnected.	PR	A
21	NS2	No signal 2	An A, B or Z phase error was detected in the closed loop system.	PR	A
25	ABSE	Absolute position lost	The backup voltage in the absolute position detector dropped. The absolute position cannot be guaranteed.	AR	A
26	NAE	Not used axis error	A power module error occurred in the axis for which the axis selection rotary switch is set to [F].	PR	C
27	SCcpu	Absolute position detection scale CPU error (SUB)	The CPU in the absolute position linear scale connected to the machine end is not operating correctly.	PR	A
28	Sosp	Absolute position overspeed (SUB)	The absolute position linear scale connected to the machine end detected a speed of 45m/sec. or more when the NC power was turned ON.	PR	A
29	Sabs	Absolute position detection circuit error (SUB)	The absolute position linear scale connected to the machine end detected an error in the scale or scale circuit.	PR	A
2A	Sinc	Relative position detection circuit error (SUB)	The absolute position linear scale connected to the machine end detected a speed exceeding the scale's maximum movement speed.	PR	A
2B	SCPU	Scale CPU error	An error was detected in the data stored in the EEPROM of the high-speed serial detector connected to the motor end.	PR	A
2C	SLED	EEPROM/LED error	Deterioration of the LEDs in the high-speed serial detector connected to the motor end was detected.	PR	A
2D	SDAT	Scale data error	An error was detected at a position within one rotation of the high-speed serial detector connected to the motor end.	PR	A
2F	STRE	Serial detector communication error	Communication with the high-speed serial detector connected to the motor end was disconnected.	PR	A
31	OS	Overspeed	A speed exceeding the motor's tolerable speed was detected. (Maximum motor speed × 1.2)	PR	A
32	PMOC	Power module error (overcurrent)	The IPM used by the inverter detected an overcurrent.	PR	A
34	DP	NC communication CRC error	An error was detected in the data sent from the NC to the driver.	PR	C
35	DE	NC communication Data error	An error was detected in the movement command data from the NC.	PR	A
36	TE	NC communication Communication error	Communication from the NC was disconnected.	PR	C
37	PE	Initial parameter error	An illegal parameter was detected in the parameters sent when the NC power was turned ON. (Refer to section (6) Error parameter No. at initial parameter error)	PR	A
38	TP1	NC communication Protocol error 1	An error was detected in the communication frame sent from the NC.	PR	C
39	TP2	NC communication Protocol error 2	An error was detected in the axis information data sent from the NC.	PR	A
3A	OC	Overcurrent	An excessive current was detected in the motor drive current.	PR	A
3B	PMOH	Power module error (overheat)	The IPM used by the inverter detected overheating.	PR	A
42	FE1	Feedback error 1	The feedback pulse was skipped or a Z phase error was detected in the position detector.	PR	A
43	FE2	Feedback error 2	Excessive deviation was detected in the feedback amount of the motor end detector and machine end detector within the closed loop. An FB IC error was detected in the semi-closed loop.	PR	A

No.	Abbr.	Name	Details	RS	A/C
46	OHM	Motor overheat	An error was detected in the temperature of the motor being driven. Or, the thermal protector built in the high-speed serial detector connected to the motor end activated.	NR	A
50	OL1	Overload 1	The servomotor or servo driver load level obtained from the motor current reached the overload level set with the overload detection level (sv022: OLL).	NR	A
51	OL2	Overload 2	A current command 95% or more of the driver's maximum performance continued for 1 sec. or more.	NR	A
52	OD1	Excessive error 1	The difference of the ideal position and actual position exceeded parameter SV023: OD1 (or SV053: OD3) when the servo was turned ON.	NR	A
53	OD2	Excessive error 2	The difference of the ideal position and actual position exceeded parameter SV026: OD2 when the servo was turned OFF.	NR	A
54	OD3	Excessive error 3	The motor current was not flowing when the excessive error alarm 1 was detected. This occurs when the power line connection is incorrect or disconnected, or when there is no bus voltage.	NR	A
58	CLE0	Collision detection 0	A collision detection type 1 error was detected during the G0 modal (rapid traverse).	NR	A
59	CLE1	Collision detection 1	A collision detection type 1 error was detected during the G1 modal (cutting feed).	NR	A
5A	CLE2	Collision detection 2	A collision detection type 2 error was detected.	NR	A
6F	PSE	Power supply alarm	The power supply is not connected. Or, an error was detected in the power supply's AD converter section.	AR	C
7F	AMP	Amplifier power reset request	An error was detected when the control mode (high gain mode, standard mode) was selected. Turn the amplifier power ON again. If this alarm is detected after detecting alarm 7F and turning the amplifier power ON again, an error has been detected in the EEPROM.	AR	C
88	WD	Watch dog	The servo system is not operating correctly.	AR	C
89	Hcn	HR unit connection error (SUB)	Incorrect connection or disconnection of the MDS-B-HR connected the machine end was detected.	PR	A
8A	Hhs	HR unit HSS communication error (SUB)	The MDS-B-HR connected to the machine end detected a communication error with the absolute position linear scale.	PR	A
8C	Hsc	HR unit scale judgment error (SUB)	The MDS-B-HR connected to the machine end could not judge the connected linear scale's analog wave cycle.	PR	A
8D	Hcpu	HR unit CPU error (SUB)	The CPU for the MDS-B-HR connected to the machine end is not operating correctly.	AR	A
8E	Hdat	HR unit data error (SUB)	An error was detected in the analog interpolation data for the MDS-B-HR connected to the machine end.	PR	A

Servo warnings

No.	Abbr.	Name	Details	RS	A/C
90	WST	Low-speed serial initial communication error	Initial communication with the absolute position linear scale was not possible.	PR	A
91	WAS	Low-speed serial communication error	An error was detected in the communication with the detector in the absolute position detection system using the OHA25K-ET/absolute position linear scale.	*	A
92	WAF	Low-speed serial protocol error	An error was detected in the data from the detector in the absolute position detection system using the OHA25K-ET/absolute position linear scale.	*	A
93	WAM	Absolute position fluctuation	Fluctuation exceeding the tolerable value was detected in the absolute position detected when the NC power was turned ON.	PR	A
96	MPE	MP scale feedback error	Excessive deviation was detected in the feedback amount of the motor end detector and MP scale in the MP scale absolute position detection system.	*	A
97	MPO	MP scale offset error	An error was detected in the offset data read in when the NC power was turned ON within the MP scale absolute position detection system.	PR	A
9E	Wan	High-speed serial multi-rotation counter error	An error was detected in the multi-rotation counter of OSE104/OSA104/OSE105/OSA105/OSE104-ET/OSA104-ET/OSE105-ET/OSA105-ET. The absolute position cannot be guaranteed.	*	A
9F	WAB	Battery voltage drop	The voltage of the battery supplying to the absolute position detector has dropped.	*	A
E1	WOL	Overload warning	A level 80% of the overload alarm 1 was detected.	*	A
E3	WAC	Absolute position counter warning	Deviation of the absolute position and relative position was detected.	*	A
E4	WPE	Parameter error warning	A parameter exceeding the setting range was set.	*	A
E6	AXE	Control axis removal warning	The control axis is removed.	*	A
E7	NCE	NC emergency stop	The NC is in the emergency stop state.	*	C

(5) LED display No. at memory error

When a memory error (alarm 12) occurs, in most cases, a connection is not established with the NC. If the connection is not established even when normally connected with the NC, check the servo driver's LED display to see whether a memory error (alarm 12) has occurred.

The faulty section can be pinpointed according to the No. displayed on the LED at this time. (Refer to the following table.)

No.	Details	Time of occurrence	Alarm display
–	Power PCB ID error	At NC power ON	Same display as other alarms
01	LSI internal RAM error 1	At servo driver power ON	Only 12 and No. flicker on the LED (Not connected with LED)
02	LSI internal RAM error 2		
03	LSI transmission buffer error		
04	LSI reception buffer error		
05	External SRAM error		
11	LSI timing status error		
21	LSI encoder I/F counter error L axis MAIN		
22	LSI encoder I/F counter error L axis SUB		
23	LSI encoder I/F counter error L axis MAIN		
24	LSI encoder I/F counter error L axis SUB		
31	External FLASH boot code error 1		
32	External FLASH check sum error 1		
33	External FLASH boot code error 2		
34	External FLASH check sum error 2		
41	CPU internal RAM error 1	At NC power ON	
42	CPU internal RAM error 2		
51	Driver model error		
61	External FLASH boot code error 3		
62	External FLASH check sum error 3		
63	External FLASH check sum error 4		

(6) Error parameter No. at initial parameter error

When an initial parameter error (alarm 37) occurs, the erroneous parameter is displayed on the NC Diagnosis screen.
The display method differs according to each NC, so refer to the respective NC Instruction Manual.

Normally the parameter No. (SV00xx) is displayed at this time.
There is also a special 3-digit No. (Refer to the following table.)
In this case, an error is occurring for several parameters, so correctly set the related parameters.

No.	Details	Related parameter
69	The maximum rapid traverse rate value set with the NC is incorrect. This normally does not occur, but could be caused by the NC system software.	NC axis parameter rapid
71	The maximum cutting feedrate value set by the NC is incorrect. This normally does not occur, but could be caused by the NC system software.	NC axis parameter clamp
101	The constants used by the following functions are overflowing. Electronic gears Position loop gain Speed feedback conversion Confirm that each related parameter is correctly set.	SV001:PC1, SV002:PC2 SV003:PGN1, SV018:PIT SV019:RNG1, SV020:RNG2 SV049:PGN1sp
102	Turn the absolute position detection parameter OFF. The connected detector is an incremental specification detector, so to carry out absolute position detection, exchange the detector with an absolute position specification detector.	SV017:SPEC, SV025:MTYP
103	The servo option is not provided. The option is required for closed loop (including ball screw end detection) or dual feedback control function.	SV025:MTYP/pen SV017:SPEC/dfbx
104	The servo option is not provided. The SHG control function is an option.	SV057:SHGC SV058:SHGCsp
105	The servo option is not provided. The adaptive filter function is an option.	SV027:SSF1/aflt
106	The servo option is not provided. The MP scale absolute position detection function is an option.	SV017:SPEC/mp, mpt3

(7) Troubleshooting according to each servo alarm

[Alarm/warning check period]

f1: At servo driver power ON
f2: At NC power ON there after (emergency stop ON)
f3: During normal operation (servo ON)
f4: During axis removal (READY ON, servo OFF)

(Note) Warning "93" could occur when installing the axis again after removing it once.

Alarm No.	Memory error:	Alarm check period			
12	Error in the drive unit memory IC (SRAM or FLROM)	f1	f2	f3	f4
		O	O	–	–

	Investigation item	Investigation results	Remedy
1	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

Alarm No.	Software processing error:	Alarm check period			
13	The drive unit software data processing was not completed within the normal time or an illegal IT process was input.	f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check whether the servo software version was changed recently.	Changed	Try replacing with the drive unit with the original software version.
		Not changed.	Perform investigation item 2.
2	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 3.
3	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

Alarm No.	Software processing error 2:	Alarm check period			
14	Of the driver software processing times, the current loop process was not completed within the set time.	f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check whether the servo software version was changed recently.	Changed	Try replacing with the drive unit with the original software version.
		Not changed.	Perform investigation item 2.
2	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 3.
3	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

Alarm No.	A/D converter error:	Alarm check period			
17	An error occurred in the drive unit's A/D converter.	f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

Alarm No. 18	Initial communication error: Initial communication with the detector was not possible in a system using a high-speed serial detector at the motor end.	Alarm check period f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (SV025) setting value.	The value is not correct.	Correctly set SV025.
		The setting is correct.	Perform investigation item 2.
2	Tug the connector to check if the detector connector (driver side and detector side) is disconnected.	Disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 3.
3	Turn the power OFF and check the detector cable connection with a tester.	Connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 4.
4	Interchange with another normal axis drive, and check whether the fault is located in the driver side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 5.
5	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the detector.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan. Grounding not enforced ..... add grounding measures.

Alarm No. 1A	Serial detector initial communication error (SUB): Initial communication with the detector was not possible in the system using OHA25K-ET or a high-speed serial detector at the machine end.	Alarm check period f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "18".		

Alarm No. 1B	CPU error (SUB): An error was detected in the data stored in the EEPROM of the high-speed serial detector connected to the motor end.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Tug the connector to check if the absolute position linear scale connector (driver side and scale side) is disconnected.	Disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the detector cable connection with a tester.	Connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 3.
3	Interchange with another normal axis drive, and check whether the fault is located in the driver side or scale side.	The alarm is on the unit.	Replace the drive unit.
		The alarm occurs with the absolute position linear scale.	Perform investigation item 4.
4	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the absolute position linear scale.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan. Grounding not enforced ..... add grounding measures.

Alarm No. 1C	EEPROM/LED error (SUB): The linear scale connected to the machine end detected an EEPROM error. Or, deterioration of the LEDs was detected in the high-speed serial detector connected to the machine end.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "1B".		

Alarm No. 1D	Data error (SUB): An error was detected at a position within one rotation of the high-speed serial detector connected to the machine end.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "1B".		

Alarm No. 1E	ROM-RAM/ thermal error (SUB): The linear scale connected to the machine end detected an error in the ROM/RAM. Or, the thermal protector built in the high-speed serial detector connected to the machine end activated.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "1B".		

Alarm No. 1F	Serial detector communication error (SUB): Communication with the high-speed serial detector connected to the machine end was disconnected.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 2 and following for the alarm No. "18".		

Alarm No. 21	No signal 2: An A, B or Z phase error was detected in the closed loop system.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (SV025) setting value.	"4", "5", "8" or "9" is set for the parameter detector setting even though the OHE-ET, OHA-ET detector or various scale is not connected.	Correctly set.
		The setting is correct.	Perform investigation item 2.
2	Tug the connector by hand to check whether the detector connector (unit side and detector side) is not loose.	Disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 3.
3	Turn the power OFF and check the detector cable connection with a tester.	Connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 4.
4	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 5.
5	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

Alarm No. 25	Absolute position lost: This occurs when the power in the absolute position detector is lost, and will return to normal when the unit's 200VAC is reset and zero point return is performed again.	Alarm check period			
		f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Check whether the absolute position detector cable (including battery connection cable) was left disconnected for a while.	Was disconnected. Guideline: At delivery: 20 hours or more After 5 years: 10 hours or more	Reset the drive unit's 200VAC power and perform zero point return again.
		Was not disconnected.	Perform investigation item 2.
2	Check whether a battery error alarm occurred recently.	Alarm occurred.	Check the battery voltage.
		Did not occur.	Perform investigation item 3.
3	Tug the detector connector (unit and detector side) to see if it has disconnected. Also check the cable between the battery unit and drive unit.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 5.
5	Check the repeatability. Perform zero point return again.	Does not recur.	Perform investigation item 7, and if there is no error, continue to use.
		Always recurs. Returns to normal once, but recurs periodically.	Perform investigation item 6.
6	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Perform investigation item 7.
7	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 27	Scale CPU error: The CPU in the absolute position linear scale connected to the machine end is not operating correctly.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Tug the connector to check if the absolute position linear scale connector (unit side and scale side) is disconnected.	Is disconnected (or loose).	Correctly connected.
		Not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the detector cable connection with a tester.	Connection is faulty.	Replace the detector cable.
		Connection is connect.	Perform investigation item 3.
3	Try connecting with another normal axis unit and check whether the defect is on the unit side or scale side.	The alarm is on the unit.	Replace the drive unit.
		The alarm occurs with the absolute position linear scale.	Perform investigation item 4.
4	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding.)	No special abnormalities were found.	Replace the absolute position linear scale.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 28	Scale overspeed (SUB): The absolute position linear scale detected a speed of 45m/sec. or more when the NC power was turned ON.	Alarm check period			
		f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Check the absolute value linear scale specifications.	The specifications are not for the absolute value linear scale.	Set the SV025: MTYP parameter correctly.
		The specifications are for the absolute value linear scale.	Perform investigation item 2.
2	Check whether the machine was operating when the alarm occurred.	Is moving.	Check the motor mechanical brakes and machine system.
		Is not moving.	Perform investigation item 3.
3	Tug the connector to check if the absolute position linear scale connector (unit side and scale side) is disconnected.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 5.
5	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm occurs with the absolute position linear scale.	Perform investigation item 6.
6	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the absolute position linear scale.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 29	Absolute position detection circuit error (SUB): The absolute position linear scale connected to the machine end detected an error in the scale or scale circuit.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "28".		

Alarm No. 2A	Relative position detection circuit error (SUB): The absolute position linear scale connected to the machine end detected a speed exceeding the absolute position linear scale's maximum movement speed.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check whether the machine was operating when the alarm occurred.	The machine was operating.	Perform investigation item 3.
		The machine was not operating.	Perform investigation item 2.
2	Check whether movement is normal at low speeds.	Is moving	Perform investigation item 3.
		Is not moving	Check the cautionary items before turning the power ON. • Check the wiring • Check the parameters
3	Tug the connector to check if the absolute position linear scale connector (unit side and scale side) is disconnected.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 5.
5	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm occurs with the absolute position linear scale.	Perform investigation item 6.
6	Check for abnormalities in the unit's peripheral environment. (Ex. ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (absolute position linear scale).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. Ex. High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 2B	CPU error: An error was detected in the data stored in the EEPROM of the high-speed serial detector connected to the motor end.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for the alarm No. "2A".		

Alarm No. 2C	EEPROM/LED error: An error was detected in the EEPROM of the high-speed serial detector connected to the motor end.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for the alarm No. "2A".		

Alarm No. 2D	Data error: An error was detected at a position within one rotation of the high-speed serial detector connected to the motor end.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for the alarm No. "2A".		

Alarm No. 2F	Serial detector communication error: Communication with the high-speed serial detector connected to the motor end was disconnected.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 2 and following for the alarm No. "18".		

Alarm No. 31	Overspeed: A speed exceeding the motor's tolerable speed was detected. (Maximum motor speed × 1.2)	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Is the machine moving during the alarm?	Is not moving	Perform investigation item 4.
		Is moving	Perform investigation item 2.
2	Check whether movement is normal at low speeds.	Is moving	Perform investigation item 3.
		Is not moving	Check the cautionary items before turning the power ON. • Check the wiring • Check the parameters
3	Check whether the rapid traverse rate is too fast.	Is too high.	Correct to below the rated speed.
		Is set to below the rated speed.	Perform investigation item 4.
4	Check whether the time constant is too low. • Check the current value displayed on the servo monitor screen.	80% or more of the maximum value is displayed.	Lower the rapid traverse time constant so that the current value during rapid traverse acceleration/deceleration is less than 80% of the maximum value.
		The setting is less than 80% of the maximum value.	Perform investigation item 5.
5	Investigate the items 2 and following for the alarm No. "18".		

Alarm No. 32	Power module error (overcurrent): The IPM used by the inverter detected an overcurrent.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Are the U, V, W phases on the unit output short circuited. • Disconnect the U, V, W wires from the terminal block and the motor cannon plug and check between U, V, W with a tester.	Short-circuited, or not energized.	Replace the U, V, W wires.
		Normal.	Perform investigation item 2.
2	Check the U, V, W wires for a ground fault. • Check between the U, V, W wires and grounding with a tester in the item 1 state.	Short-circuited, or not energized.	Replace the U, V, W wires.
		Normal.	Perform investigation item 3.
3	Check for a motor ground fault. • Check between the U, V, W wires and grounding with a megger tester in the item 1 state.	Short-circuited, or not energized.	Replace the motor.
		Normal. (Same level as other axes)	Perform investigation item 4.
4	Check the servo parameter setting values. • Refer to the adjustment procedures.	The settings are incorrect.	Correctly set.
		The settings are correct.	Perform investigation item 5.
5	Tug the detector connector (unit and detector side) to see if it has disconnected.	Was disconnected (loose).	Correctly connect.
		Was not disconnected.	Perform investigation item 6.
6	Turn the power OFF and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Connection was normal.	Perform investigation item 7.
7	Check the repeatability.	Does not recur.	Perform investigation item 9.
		Recurs periodically.	Perform investigation item 9.
		Always recurs.	Perform investigation item 8.
8	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the detector.	Replace the motor (detector).
9	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Wait.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 34	NC communication CRC error: An error was detected in the data sent from the NC to the driver.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Tug the connection connectors between the NC and drive unit, battery unit and drive unit, and between drive units to see if they are loose. Check that an excessive force is not being applied on the connector section.	The connectors are disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the connection of the communication cable in item 1 with a tester. Try replacing with a normal cable.	A connection defect was found.	Replace the communication cable.
		Connection is normal.	Perform investigation item 3.
3	Check whether the NC and drive unit software version was recently changed.	Was changed.	Try returning to the original software version.
		Not changed.	Perform investigation item 4.
4	Replace with another normal unit, and check whether the error is on the NC side or unit side.	The alarm is on the unit side.	Replace the drive unit.
		The driver is not the cause.	Perform investigation item 5.
5	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the MCP card on the NC side.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 35	NC communication Data error: An error was detected in the movement command data from the NC.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "34".		

Alarm No. 36	NC communication Communication error: Communication from the NC was disconnected.	Alarm check period			
		f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "34".		

Alarm No. 37	Initial parameter error: An illegal parameter was detected in the parameters sent when the NC power was turned ON.	Alarm check period f1	f2	f3	f4
		–	O	–	O

	Investigation item	Investigation results	Remedy
1	The illegal parameter No. is displayed on the NC diagnosis screen, so adjust the servo parameter with the parameter adjustment procedures.	The setting is incorrect.	Set the correct parameter.
		The setting is correct.	Perform investigation item 3.
		The parameter No. is other than 1 to 64.	Perform investigation item 2 when parameter No. is 101.
2	Check whether the servo parameter (PIT) (RNG1) (RNG2) (PC1) (PC2) combination is illegal, or whether the setting range has been exceeded.	Illegal or setting range is exceeded.	Refer to the parameter settings and supplementary explanations in the specifications, and reset to the correct value.
		The setting is correct.	Perform investigation item 3.
3	Check the items for alarm No. "34".		

Alarm No. 38	NC communication protocol error 1: An error was detected in the communication frame sent from the NC.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "34".		

Alarm No. 39	NC communication protocol error 2: An error was detected in the axis information data sent from the NC.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "34".		

Alarm No. 3A	Overcurrent: An excessive current was detected in the motor drive current.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "32".		

Alarm No. 3B	Power module error (overheat): The IPM used by the inverter detected overheating.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy	
1	Investigate the heat radiating environment			
	1) Rotation of fan on rear of unit	The fan is not rotating correctly.	Replace the fan	Take measures to prevent cutting oil or dust from contacting the fins.
	2) Contamination of radiating fins on rear of unit	Remarkable amounts of cutting oil or dust are adhered on the radiating fins.	Clean the fins	
	3) Measurement of unit ambient temperature	55°C is exceeded.	Consider ventilating or cooling measures for the panel.	
		None of the above apply.	Perform investigation item 2.	
2	Check for abnormalities in the unit's peripheral environment. (Ex. ambient temperature, noise, grounding)	The grounding is incomplete. Alarms occur easily when a certain device operates.	Correctly ground. Take noise measures for the device on the left.	
		No particular problem.	Replace the drive unit.	

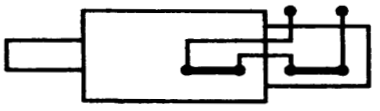
Alarm No. 42	Feedback error 1: The feedback pulse was skipped or a Z phase error was detected in the position detector.	Alarm check period f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Investigate items 3 and following for alarm No. "21".		

Alarm No. 43	Feedback error 2: Excessive deviation was detected in the feedback amount of the motor end detector and machine end detector within the closed loop. An FB IC error was detected in the semi-closed loop.	Alarm check period f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Investigate items 3 and following for alarm No. "2A".		

Alarm No. 46	Motor overheat: An error was detected in the temperature of the motor being driven. Or, the thermal protector built in the high-speed serial detector connected to the motor end activated.	Alarm check period f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Check the repeatability.	Recurs within one minute of start up.	Perform investigation item 3.
		Recurs periodically after operating for some time.	Perform investigation item 2.
2	Check the motor temperature when the alarm occurs.	The motor is hot.	Lessen the operation pattern. ↓ If the problem is not solved, perform investigation item 3.
		The motor is not hot.	Perform investigation item 3.
3	Tug the detector cable connectors (unit side and motor side cannons) to see if they are loose.	The connectors are disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 4.
4	Turn the power OFF and check the detector cable connection with a tester.	Connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 5.
5	If the thermal connection is as shown below for OSE104/105 and OSA104/105, so cut the wire between the motor and detector with a joint amplifier, and check the thermal conductivity for each. 	No conductivity or large resistance in the motor and detector thermal.	Replace the motor or detector.
		Normal	Perform investigation item 7.
6	Replace with another normal axis unit, and check if the defect is on the unit.	The alarm is on the unit side.	Replace the unit.
		Occurs even if unit is replaced.	Perform investigation item 7.
7	Check for abnormalities in the unit's peripheral environment. (**Ex.** Ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 50	Overload 1: The servomotor or servo driver load level obtained from the motor current reached the overload level set with the overload detection level (SV022: OLL).	Alarm check period			
		f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (OLL) (OLT) setting values. Standard setting values OLL: 150	The setting is not the standard setting value.	Correct to the standard setting value if special specifications are not being used.
		The value is the standard setting value.	Perform investigation item 2.
2	Check the motor temperature when the alarm occurs.	The motor is hot.	Ease the operation pattern. ↓ If the problem is not solved, perform investigation item 3.
		The motor is not hot.	Perform investigation item 3.
3	Check whether the motor is hunting.	Hunting is occurring.	Refer to the adjustment procedures and readjust. • Check the cable wiring and connector connections. • Check for mistaken parameter settings. • Adjust the gain. ↓ If the problem is not solved, perform investigation item 4.
		Hunting is not occurring.	Perform investigation item 4.
4	Replace with another normal axis unit and check whether the defect is on the unit.	The alarm is on the unit.	Replace the drive unit.
		Problem still occurs even after unit is replaced.	Perform investigation item 5.
5	Check whether the current value displayed on the NC Servo Monitor screen is abnormally large when stopped or during operation.	The value is abnormal.	Check the machine system.
		The value is correct.	Perform investigation item 6.
6	Check for abnormalities in the unit's peripheral environment. (Ex. ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor (detector).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. Ex. High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 51	Overload 2: A current command 95% or more of the driver's maximum performance continued for 1 sec. or more.	Alarm check period			
		f1	f2	f3	f4
		–	–	O	–

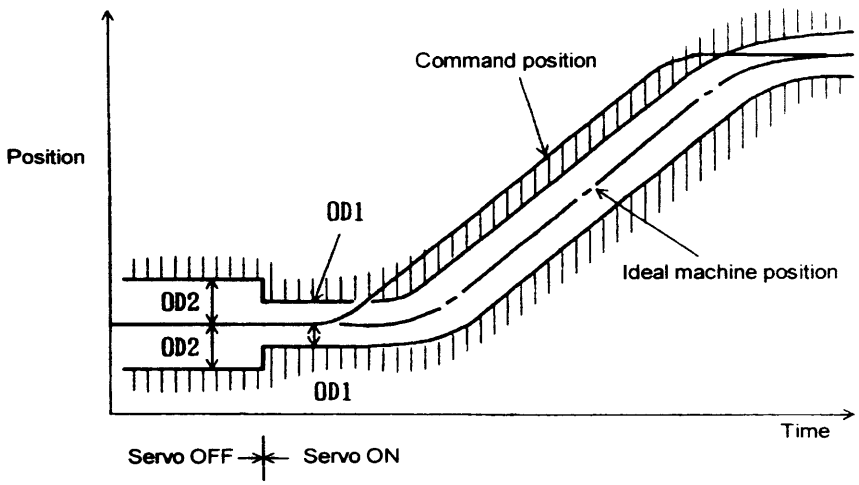
	Investigation item	Investigation results	Remedy
1	Check whether the PN power is being supplied to the driver. • Check the axis for which the alarm is occurring and the axis farthest from the power supply.	The voltage is supplied.	Perform investigation item 3.
		The voltage is not supplied.	Perform investigation item 2.
2	Confirm that the power supply unit CHARGE lamp is lit and check the PN terminal voltage.	There is no voltage at the PN terminal. (The lamp is not lit.)	Check the power supply unit.
		There is a voltage at the PN terminal.	Check the PN wiring between the units.
3	Check whether the current value displayed on the NC Servo Monitor screen is abnormally large during acceleration/ deceleration.	The maximum value exceeds the level indicated with an x in the table on the previous page.	Lengthen the acceleration/ deceleration time constant, and lower to 80% of the limit value.
		A correct value is displayed.	Perform investigation item 4.
4	Perform the items 3 and following for alarm No. "50".		

Alarm No. 52	Excessive error 1: The difference of the ideal position and actual position exceeded parameter SV023: OD1 (or SV053: OD3) when the servo was turned ON.	Alarm check period			
		f1	f2	f3	f4
		–	–	O	–

	Investigation item	Investigation results	Remedy
1	Check whether the PN power is being supplied to the driver. • Check the axis for which the alarm is occurring and the axis farthest from the power supply.	The voltage is supplied.	Perform investigation item 3.
		The voltage is not supplied.	Perform investigation item 2.
2	Confirm that the power supply unit CHARGE lamp is lit and check the PN terminal voltage.	There is no voltage at the PN terminal. (The lamp is not lit.)	Check the power supply unit.
		There is a voltage at the PN terminal.	Check the PN wiring between the units.
3	Check the servo parameter (OD1) setting value.	The setting is not the standard setting value.	Correct to the standard specification value if special specifications are not being used.
		The setting is the standard setting value.	Perform investigation item 4.
4	Perform the items 3 and following for alarm No. "50".		

Supplementary explanation

The actual machine position deviated an amount exceeding the value set in OD1 from the ideal machine position for the command position.
This will occur if the actual machine position enters the shaded area shown below.



Alarm No. 53	Excessive error 2: The difference of the ideal position and actual position exceeded parameter SV026: OD2 when the servo was turned OFF.	Alarm check period			
		f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Check the servo parameter (OD2) setting value.	The setting is not the standard setting value.	Correct to the standard setting value if special specifications are not being used.
		The setting is the standard setting value.	Perform investigation item 2.
2	Check if the machine is moving during servo OFF.	Is moving.	Check the machine and mechanical brakes.
		Is not moving.	Perform investigation item 3.
3	Tug the communication cable connector from the NC to the terminator (unit side and NC side) to see if it is disconnected.	Is disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 4.
4	Turn the power OFF, and check the communication cable connection with a tester. Try changing with a normal cable.	A connection defect was found.	Replace the communication cable.
		Connection is normal.	Perform investigation item 5.
5	Replace with another normal axis unit and check whether the defect is on the unit.	The alarm is on the unit.	Replace the drive unit.
		Problem still occurs even after unit is replaced.	Replace the NC side MCP card. ↓ If the problem is not solved, perform investigation item 6.
6	Tug the detector cable connector (unit side and motor side cannon) to check if it is disconnected.	Is disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 7.
7	Turn the power OFF, and check the detector cable connection with a tester.	A connection defect was found.	Replace the detector cable.
		Not disconnected.	Perform investigation item 8.
8	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 54	Excessive error 3: The motor current was not flowing when the excessive error alarm 1 was detected.	Alarm check period f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Check whether the PN power is being supplied to the driver. • Check the axis for which the alarm is occurring and the axis farthest from the power supply.	The voltage is supplied.	Perform investigation item 3.
		The voltage is not supplied.	Perform investigation item 2.
2	Confirm that the power supply unit CHARGE lamp is lit and check the PN terminal voltage.	There is no voltage at the PN terminal. (The lamp is not lit.)	Check the power supply unit.
		There is a voltage at the PN terminal.	Check the PN wiring between the units.
3	Check whether the motor power wire is connected to the motor. • Disconnect the power wire from the terminal block, and check between the UVW wires with a tester.	The power wire is not connected or the power wire is broken.	Increase the acceleration/ deceleration time constant, and lower to approx. 80% of the limit value.
		The power wire is correctly connected.	Perform investigation item 4.
4	Try connecting with another normal axis unit and check whether the defect is on the unit side or detector side.	The alarm is on the unit.	Replace the drive unit.
		The alarm is on the motor.	Replace the motor.

Alarm No. 58	Collision detection 0: A collision detection type 1 error was detected during the G0 modal (rapid traverse). (A disturbance torque that exceeds the external disturbance torque was detected.)	Alarm check period f1	f2	f3	f4
		–	–	O	–

	Investigation item	Investigation results	Remedy
1	Is the collision detection function being used? Check whether the machine has collided.	The collision detection function is not used.	Perform investigation item 2.
		The machine has collided.	Modify so that the machine does not collide.
		The collision detection function is used, but the machine has not collided.	Perform investigation item 3.
2	Check the parameters. Is SV060 (TLMT) set to "0"?	The setting is incorrect.	Change SV060 (TLMT) to "0".
3	Check whether the current has reached the current limit value or 90% of the limit value during normal rapid traverse acceleration/deceleration.	The current is 90% or more of the current limit value.	Increase the time constant, and perform investigation item 4.
		The current is less than 90% of the current limit value.	Perform investigation item 4.
4	Adjust the collision detection function again, and try operation. (Refer to the separate collision detection function specifications.)	The alarm does not occur.	——
		The alarm occurs.	Perform investigation item 5.
5	Does the machine or current vibrate?	Is vibrating.	Eliminate the vibration by adjusting the gain, etc., and then perform investigation item 4.
		Is not vibrating.	Perform investigation item 6.
6	Try increasing the detection level.	The alarm does not occur.	If the problem is not solved by replacing the unit, try increasing the level.
		The alarm occurs.	Replace the drive unit.

Alarm No.	Collision detection 1:	Alarm check period			
59	A collision detection type 1 error was detected during the G1 modal (cutting feed). (A disturbance torque that exceeds the external disturbance torque was detected.)	f1	f2	f3	f4
		–	–	O	–

	Investigation item	Investigation results	Remedy
1	Is the collision detection function being used? Check whether the machine has collided.	The collision detection function is not used.	Perform investigation item 2.
		The machine has collided.	Modify so that the machine does not collide.
		The collision detection function is used, but the machine has not collided.	Perform investigation item 3.
2	Check the parameters. Is SV060 (TLMT) set to "0"?	The setting is incorrect.	Change SV060 (TLMT) to "0".
3	Check whether the current has reached the current limit value or 90% of the limit value during normal cutting feed acceleration/deceleration.	The current is 90% or more of the current limit value.	Increase the time constant, and perform investigation item 4.
		The current is less than 90% of the current limit value.	Perform investigation item 4.
4	Adjust the collision detection function again, and try operation. (Refer to the separate collision detection function specifications.)	The alarm does not occur.	——
		The alarm occurs.	Perform investigation item 5.
5	Does the machine or current vibrate?	Is vibrating.	Eliminate the vibration by adjusting the gain, etc., and then perform investigation item 4.
		Is not vibrating.	Perform investigation item 6.
6	Try increasing the detection level.	The alarm does not occur.	If the problem is not solved by replacing the unit, try increasing the level.
		The alarm occurs.	Replace the drive unit.

Alarm No.	Collision detection 2:	Alarm check period			
5A	A collision detection type 2 error was detected.	f1	f2	f3	f4
		–	–	O	–

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "58".		

Alarm No.	Power supply alarm:	Alarm check period			
60 to 7E	An alarm is occurring in the power supply unit.	f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	MDS-C1-CV Refer to the power supply specifications.		

Alarm No. 7F	Amplifier power reset request: An error was detected when the control mode (high gain mode, standard mode) was selected. Or, an error was detected in the EEPROM if this error is detected again after the power is reset.	Alarm check period			
		f1	f2	f3	f4
		○	○	○	–

	Investigation item	Investigation results	Remedy
1	Confirm the repeatability.	Always occurs.	Replace the drive unit.
		Returns to normal once, but recurs periodically.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (Ex. ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. Ex. High temperature ..... confirm cooling fan Grounding not enforced ..... add grounding measures.

Alarm No. 88	Watch dog: The servo drive software process was not executed within the designated time.	Alarm check period			
		f1	f2	f3	f4
		○	○	○	○

	Investigation item	Investigation results	Remedy
1	Check whether the servo software version was changed recently.	It was changed.	Try returning to the original software version.
		Not changed.	Perform investigation item 2.
2	Check for abnormalities in the unit's peripheral environment. (Ex. ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the drive unit.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. Ex. High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No.	HR unit connection error:	Alarm check period			
89	Incorrect connection or disconnection of the MDS-B-HR connected the machine end was detected.	f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Tug the connector to check if the MDS-B-HR connector (unit side, HR side and linear scale side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the connection of the detector cable (between driver and I/F unit, and between I/F unit and scale) with a tester.	The connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 3.
3	Interchange with another correct axis unit (or MDS-B-HR), and check whether the faulty section is in the unit or MDS-B-HR (linear scale).	Alarm occurs in unit.	Replace the drive unit.
		Alarm occurs in MDS-B-HR (linear scale).	Perform investigation item 4.
4	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace MDS-B-HR (linear scale).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No.	HR unit HSS communication error:	Alarm check period			
8A	The MDS-B-HR connected to the machine end detected an error in the communication with the absolute position linear scale.	f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "89".		

Alarm No.	HR unit scale judgment error:	Alarm check period			
8C	The MDS-B-HR connected to the machine end could not judge the connected scale's analog wave cycle.	f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Tug the connector to check if the MDS-B-HR connector (unit side, HR side and linear scale side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the connection of the detector cable (between driver and I/F unit, and between I/F unit and scale) with a tester.	The connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 3.
3	Interchange with another correct axis unit (or MDS-B-HR), and check whether the faulty section is in the unit or MDS-B-HR (linear scale).	Alarm occurs in unit.	Replace the drive unit.
		Alarm occurs in MDS-B-HR (linear scale).	Perform investigation item 4.
4	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace MDS-B-HR (linear scale).
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 8D	HR unit CPU error: The CPU for the MDS-B-HR connected to the machine end is not operating correctly.	Alarm check period f1	f2	f3	f4
		○	–	–	–

	Investigation item	Investigation results	Remedy
1	Tug the connector to check if the MDS-B-HR connector (unit side and HR side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the connection of the detector cable (between driver and I/F unit) with a tester.	The connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 3.
3	Interchange with another correct axis unit, and check whether the faulty section is in the unit or MDS-B-HR.	Alarm occurs in unit.	Replace the drive unit.
		Alarm occurs in MDS-B-HR.	Perform investigation item 4.
4	Check for abnormalities in the unit's peripheral environment. (**Ex.** ambient temperature, noise, grounding)	No special abnormalities were found.	Replace MDS-B-HR.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan. Grounding not enforced..... add grounding measures.

Alarm No. 8E	HR unit data error: An error was detected in the analog interpolation data for the MDS-B-HR connected to the main side.	Alarm check period f1	f2	f3	f4
		–	○	○	○

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "89".		

Alarm No. 90	Low-speed serial initial communication error: Initial communication with the absolute position linear scale was not possible.	Alarm check period f1	f2	f3	f4
		–	○	○	○

	Investigation item	Investigation results	Remedy
1	Investigate the items for alarm No. "58".		

Alarm No. 91	Low-speed serial communication error: An error was detected in the data from the detector in the absolute position detection system using the OHA25K-ET/ absolute position linear scale.	Alarm check period f1	f2	f3	f4
		–	○	○	○

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for alarm No. "25"		

Alarm No. 92	Low-speed serial protocol error: An error was detected in the data from the detector in the absolute position detection system using the OHA25K-ET/ absolute position linear scale.	Alarm check period f1	f2	f3	f4
		–	○	○	○

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for alarm No. "25"		

Alarm No. 93	Absolute position fluctuation: Fluctuation exceeding the tolerable value was detected in the absolute position detected when the NC power was turned ON.	Alarm check period f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Tug the connector to check if the detector connector (unit side and detector side) is disconnected. Check the cable between the battery unit and drive unit at the same time.	The connectors are disconnected (loose).	Correctly connect.
		Not disconnected.	Perform investigation item 2.
2	Turn the power OFF and check the detector cable connection with a tester.	Connection is defective.	Replace the detector cable.
		Connection is normal.	Perform investigation item 3.
3	Check the repeatability. Carry out zero point return again.	The error is not repeatable.	Perform investigation item 5, and connect and use if there is no abnormality.
		The error is always repeated, or the state is recovered once, but the error is repeated.	Perform investigation item 4.
4	Replace with another normal axis unit, and check if the defect is on the unit.	The alarm is on the unit side.	Replace the unit.
		Occurs even if unit is replaced.	Perform investigation item 5.
5	Check for abnormalities in the unit's peripheral environment. (**Ex.** Ambient temperature, noise, grounding)	No special abnormalities were found.	Replace the motor.
		An abnormality was found in the ambient peripheral environment.	Take measures according to the cause. **Ex.** High temperature ..... confirm cooling fan Grounding not enforced..... add grounding measures.

Alarm No. 96	MP scale feedback error: Excessive deviation was detected in the feedback amount of the motor end detector and MP scale in the MP scale absolute position detection system.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for alarm No. "25"		

Alarm No. 97	MP scale offset error: Excessive deviation was detected in the feedback amount of the motor end detector and MP scale in the MP scale absolute position detection system.	Alarm check period f1	f2	f3	f4
		–	O	–	–

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for alarm No. "25"		

Alarm No. 9E	High-speed serial multi-rotation counter error: An error was detected in the multi-rotation counter with the high-speed serial detector connected to the motor end and ball screw end.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Investigate the items 3 and following for alarm No. "25"		

Alarm No. 9F	Battery voltage drop: The voltage of the battery supplied to the absolute position detector dropped.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check the battery unit voltage.	The battery voltage has dropped.	Replace the battery.
		There is no error in the battery voltage.	Perform investigation item 2.
2	Investigate the items 3 and following for alarm No. "25"		

Alarm No. E1	Overload warning: An 80% level of the overload 1 alarm was detected.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check whether the motor is hot.	The motor is not hot.	Perform the items for alarm No. "50".
		The motor is hot.	Perform investigation item 2.
2	Check if there is an error when acceleration/ deceleration is performed.	Operation is possible without error.	1. If the operation pattern can be eased, ease it. 2. If operation is possible without an alarm occurring, continue use.
		Operation is abnormal.	Perform the items 3 and following for alarm No. "50".

Alarm No. E3	Absolute position counter warning: Deviation of the absolute position and relative position was detected.	Alarm check period f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Investigate the state where the warning occurred.	Occurs when NC power is turned ON.	Check the battery voltage, perform zero point return, and then turn power OFF and ON.
		Occurs during operation.	Perform the items for alarm "25".
2	Check whether a battery error alarm occurred recently.	An alarm occurred.	Check the battery voltage.
		Did not occur.	Check the detector and cable.

Alarm No. E4	Parameter error warning: A parameter exceeding the setting range was set.	Alarm check period f1	f2	f3	f4
		–	O	O	–

	Investigation item	Investigation results	Remedy
1	Set the correct value according to the parameter adjustment procedure.		

Alarm No. E7	NC emergency stop: An emergency stop signal is being sent from the NC or an alarm occurred in another axis.	Alarm check period f1	f2	f3	f4
		–	O	O	O

	Investigation item	Investigation results	Remedy
1	Check if the NC side emergency stop switch is activated.	Emergency stop is activated.	Perform investigation item 2.
		Emergency stop is released.	Perform investigation item 3.
2	Release the emergency stop.	The machine starts up normally.	Normal
		"E7" is still displayed.	Perform investigation item 3.
3	Check if a terminator or battery unit is connected or if disconnected.	Abnormal place found	Correct the abnormality.
		Normal	Perform the items for alarm "34".

5. Appendix

5.1 Changing from closed loop to semi-closed loop

To move the axis with the semi-closed loop for troubleshooting due to a defect in the closed loop or for temporary operation, changeover with the following procedure.

1. Leave the parameter SV017 SPEC bit 5 setting as it is, and change the other bits to 0.

2. Set parameter SV019 RNG1 according to the motor shaft end detector type.

   - For HA053/13 10
   - For other motors 100 (Motor end detector : OHA25K, OHE25K, OSA104, OSE104)
     1000 (Motor end detector : OSA105, OSE105)

3. Set parameter SV020 RNG2 to the same value as SV019 RNG1.

4. Leave the lower 8-bit of parameter SV025 MTYP as is, and change the upper 8-bit as shown below.

   - For HA053/13 33xx (xx is the same setting as the lower 8-bit)
   - For other motors 00xx (xx is the same setting as the lower 8-bit)
     ~ Motor end detector : OHE, OSE type
     11xx (xx is the same setting as the lower 8-bit)
     ~ Motor end detector : OHA, OSA type

5. Turn the NC power OFF and ON and confirm the axis movement.

6. Confirm the backlash amount, 1 pulse response, and overshooting during acceleration/deceleration, and change the compensation amounts if necessary.

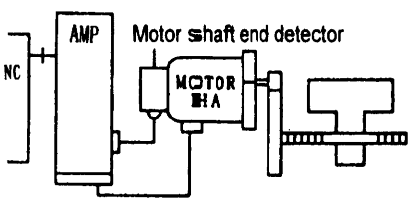
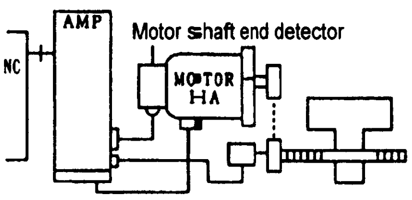
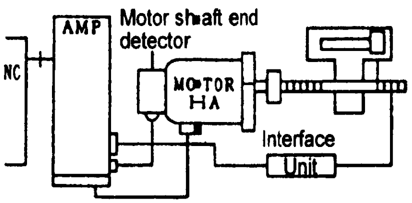
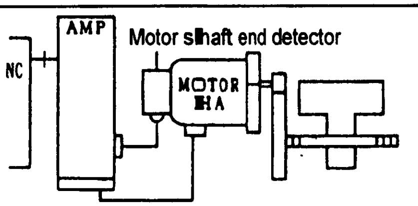
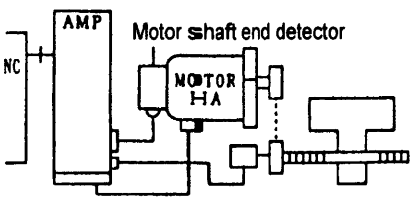
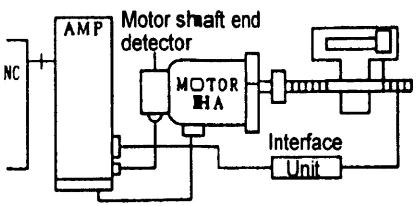
   Note 1) Write down the parameter data before changing so it can be applied when returning to closed loop.
   Note 2) Always perform set the reference point again when returning to the closed loop in the absolute position detection system.

Parameters per servo system

Parameter	Relative position detection			Absolute position detection		
	Semi-closed loop	Closed loop		Semi-closed loop	Closed loop	
		Ball screw end detection	Scale detection		Ball screw end detection	Scale detection
sv017 SPEC (HEX)	• bit5-HA23/33N Detector connector position	• bit1 (DUAL FB) • bit 4 (Polarity) • bit5-HA23/33N Detector connector position	• bit1 (DUAL FB) • bit 4 (Polarity) • bit5-HA23/33N Detector connector position • bit8-Z-phase type	• bit7=1	• bit1 (DUAL FB) • bit 4 (Polarity) • bit5-HA23/33N Detector connector position • bit7=1	• bit1 (DUAL FB) • bit 4 (Polarity) • bit5-HA23/33N • bit7=1 • bit8=Z-phase type • bit9-Detector type
sv019 RNG1	10 (HA053/13)	100 (OHE25K/OSE104)	Ball screw pitch	100 (OHA25K/OSA104)	100 (OHA25K) (OSA104) OR 1000 (OSA105)	Ball screw pitch
	100 (OHE25K/OSE104)					
	1000 (OSE105)	1000 (OSE105)	Scale resolution	1000 (0SA105)		Scale resolution
sv020 RNG2	Same setting as sv019	10 (HA053/13)	10 (HA053/13)	Same setting as sv019	10 (HA053/13)	10 (HA053/13)
		100 (OHE25K/OSE104)	100 (OHE25K/OSE104)		100 (OHE25K/OSE104)	100 (OHE25K/OSE104)
		1000 (0SE105□)	1000 (OSE105□)		1000 (OSE105)	1000 (OSE105)
sv025 MTYP	33XX (HA053/13)	43XX/63XX 43XX (HA053/13)	83XX (HE053/13)	11XX (OHA25K/OSA104)	53XX/63XX (HA053/13)	93XX/A3XX (HA053/13)
	00XX (OHE25K/OSE104)	40XX/60XX (OSE25K/OSE104)	80XX (OHE25K/OSE104)		50XX/60XX (OHE25K/OSE104)	90XX/A0XX (OHE25K/OSE104)
	22XX (OSE105)	43XX/62XX (OSE105)	82XX (OSE105)	22XX (OSA105)	52XX/62XX (OSE105)	92XX/A2XX (OSE105)

* The 1μm, 0.1μm changeover is performed with the NC parameters. (When using HA053/13, 0.1μm cannot be used.)

5.2 Servo system configuration table

System			Configuration	Capacity	Amplifier: No. of axis	Amplifier: Servo amplifier	Detector: Motor end detector: Type	Detector: Motor end detector: Motor	Detector: Machine end detector	F/B cable: Motor end	F/B cable: Machine end
Relative position detection	Semi-closed loop			Max. tracking capacity : 5MPPS Min. resolution : 0.0036° Max. speed : 3000rpm	1	MDS-A/B-V1-□	OHE25K-6 OSE104/OSE105	HA40N or more	—	CN2	—
							OHE25K-85 OSE104S/OSE105S	HA23N HA33N			
					2	MDS-A/B-V2-□	OHE25K-108 OSE104S/OSE105S	Low inertia motor			
							Built-in encoder	HA053 HA13			
	Closed loop	Ball screw end		Max. tracking capacity : 5MPPS Min. resolution : 0.0036° Max. speed : 3000rpm	1	MDS-A/B-V1-□	OHE25K-6 OSE104/OSE105	HA40N or more	OHE25K-ET OSE104ET OSA104ET	CN2	CN3
							OHE25K-85 OSE104S/OSE105S	HA23N HA33N			
					2	MDS-A/B-V2-□	OHE25K-108 OSE104S/OSE105S	Low inertia motor			
							Built-in encoder	HA053 HA13			
		Scale		Max. tracking capacity (according to maker) Min. resolution (according to maker)	1	MDS-A/B-V1-□	OHE25K-6 OSE104/OSE105	HA40N or more	Connection of various scales with a 1μ specification, 0.5μ specification pulse F/B possible. (Ex. MP scale (Mitsubishi Heavy Industries))	CN2	CN3
							OHE25K-85 OSE104S/OSE105S	HA23N HA33N			
					2	MDS-A/B-V2-□	OHE25K-108 OSE104S/OSE105S	Low inertia motor			
							Built-in encoder	HA053 HA13			
Absolute position detection	Semi-closed loop			Max. tracking capacity : 5MPPS Min. resolution : 0.0036° Max. speed : 3000rpm	1	MDS-A/B-V1-□	OHA25K-4 OSA104/OSA105	HA40N or more	——	CN2	—
							OHA25K-85 OSA104S/OSA105S	HA23N HA33N			
					2	MDS-A/B-V2-□	OHA25K-108 OSA104S/OSA105S	Low inertia motor			
	Closed loop	Ball screw end		Max. tracking capacity : 5MPPS Min. resolution : 0.0036° Max. speed : 3000rpm	1	MDS-A/B-V1-□	OHE25K-6 OSE104/OSE105	HA40N or more	OHA25K-ET OSA104ET OSA105ET	CN2	CN3
							OHE25K-85 OSE104S/OSE105S	HA23N HA33N			
					2	MDS-A/B-V2-□	OHE25K-108 OSE104S/OSE105S	Low inertia motor			
							Built-in encoder	HA053 HA13			
		Scale		Max. tracking capacity : 0.83MPPS Min. resolution : 1μ Max. speed : 50m/min.	1	MDS-A/B-V1-□	OHE25K-6 OSE104/OSE105	HA40N or more	Absolute value linear scale AT-41/AT342 (Mitsutoyo)	CN2	CN3
							OHE25K-85 OSE104S/OSE105S	HA23N HA33N			
					2	MDS-A/B-V2-□	OHE25K-108 OSE104S/OSE105S	Low inertia motor			
							Built-in encoder	HA053 HA13			

IV. MDS-A-SP
MDS-B-SP
Spindle System Section

1. Adjustment Procedure

1.1 Trial operation

⚠ CAUTION
Do not make remarkable adjustments and changes of the parameters as the operation could become unstable.

Link the motor and machine, and check the control status while breaking in the machine.

(1) Do the command speed and actual speed match.
When they do not match, confirm the following ;

1) Are the spindle parameters (SP000 to SP384) correctly set?
Especially check that the following parameters are correctly set :

1) SP017 (TSP)
2) SP034 (SFNC2)
3) SP040 (MTYP)
4) SP257 to SP384

2) Confirm that the following spindle NC parameters are correctly set :

1) Slimit1 to 4
2) Smax1 to 4
3) Smini

(2) Is the rotation smooth?

(3) Are there any abnormal noises?

(4) Are there any unusual odors?

(5) Is the bearing temperature abnormal?

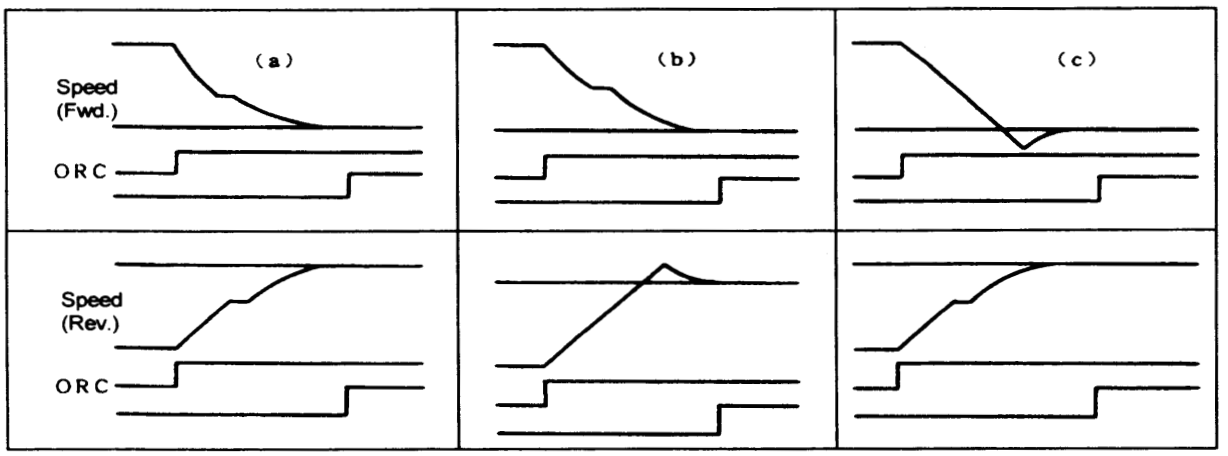
Next, run the motor with an actual load, and confirm that there are no errors.

1.2 Adjustment of orientation

1.2.1 Operation

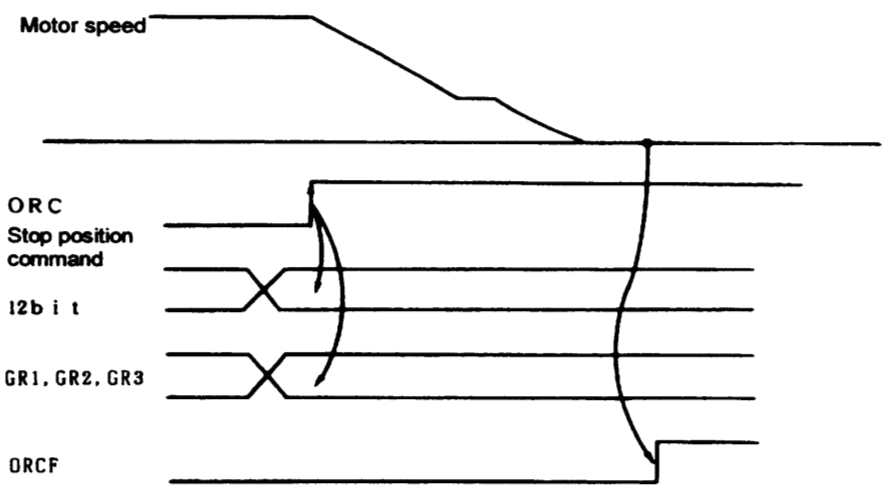
There are three types of orientation stop that can be selected by setting parameter SPECO .

1. PRE ..... (a) Spindle approaches the stop position in the rotation direction which is same as that of on-going rotation.
2. Forward run ..... (b) Spindle always approaches the stop position in the forward run direction.
3. Reverse run ..... (c) Spindle always approaches the stop position in the reverse run direction.



1.2.2 Operation sequence

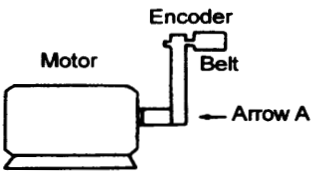
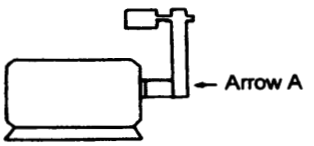
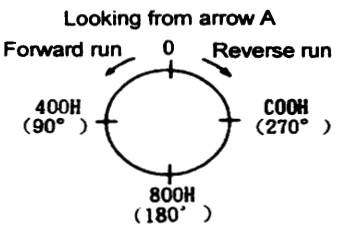
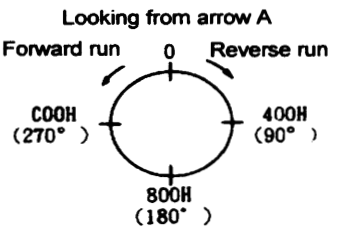
(1) When orient command signal ORC turns ON, motor speed changes from steady run speed to position loop changeover speed and at the same time "stop position command" (multipoint orientation) is read.
(2) When motor speed reaches the position loop changeover speed, control mode changes from "speed control" mode to "position control" mode (position loop gain parameter (Note 1)).
(Position loop changeover speed is automatically set in accordance with position loop gain setting.)
(3) When control mode changes to position control mode, the distance to the stop position is calculated and spindle speed is decelerated in accordance with the deceleration pattern set by parameter [CSP] to stop.
(4) When the spindle enters the "in-position" range set by parameter [OINP] , oriented complete signal ORCF turns ON.
(5) The zero point can be shifted by setting parameter [OPST] .
(6) When orient command signal (ORC) is turned OFF, motor speed returns to the previously set reference speed.



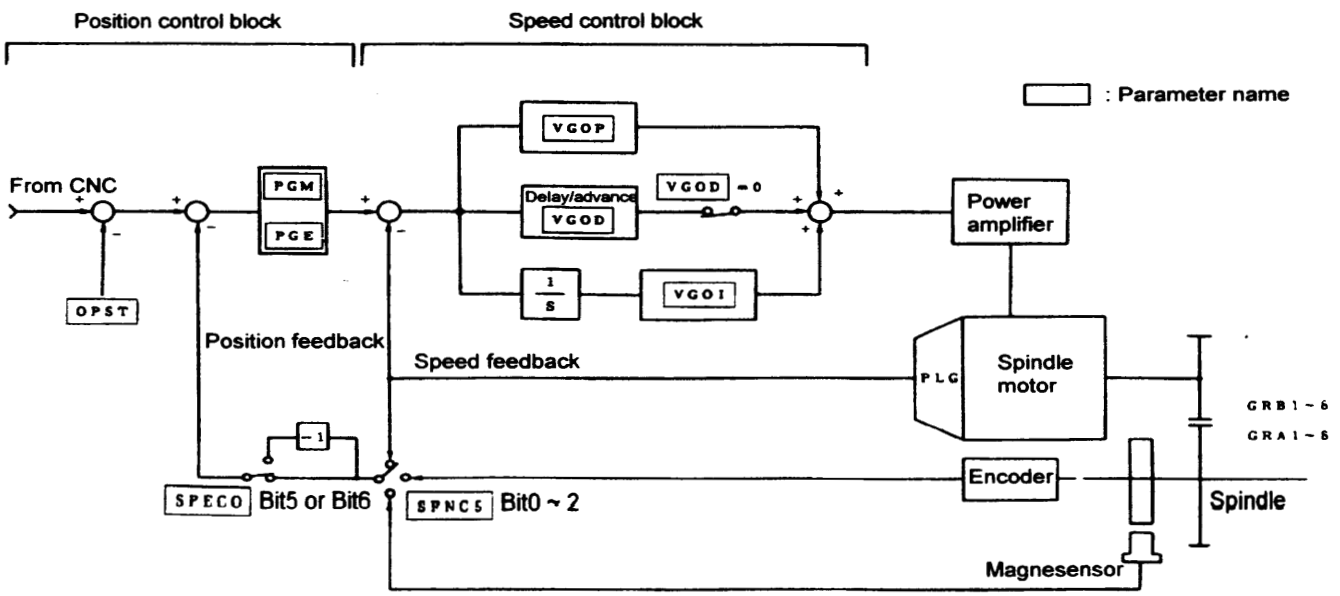
Note) [PGM] is used for magnesensor/motor built-in encoder type orientation, and [PGE] for encoder type orientation.

1.2.3 Encoder orientation stop positions

The stop positions will be as shown below depending on the direction that the encoder is installed.

	Case 1	Case 2
Installation direction		
Normal orientation		

1.2.4 Parameter block diagram for orientation



1.2.5 Preparation for adjustment of motor built-in encoder orientation

[Related Parameters]

Parameter No.	Abbrev.	Name	Default value
SP001	PGM	Position loop gain for magnesensor or motor built-in encoder orientation	100
SP004	OINP	Orientation in-position width	16
SP005	OSP	Orientation changeover speed limit value	0
SP006	CSP	Deceleration rate during orientation	20
SP007	OPST	Orientation position shift amount	0
SP025	GRA1	No. of gear teeth on spindle side 1	1
SP026	GRA2	No. of gear teeth on spindle side 2	1
SP027	GRA3	No. of gear teeth on spindle side 3	1
SP028	GRA4	No. of gear teeth on spindle side 4	1
SP029	GRB1	No. of gear teeth on motor side 1	1
SP030	GRB2	No. of gear teeth on motor side 2	1
SP031	GRB3	No. of gear teeth on motor side 3	1
SP032	GRB4	No. of gear teeth on motor side 4	1
SP097	SPECO	Orientation specifications	0000
SP098	VGOP	Speed loop gain proportional item during orientation	63
SP099	VGOI	Speed loop gain integral item during orientation	60
SP100	VGOD	Speed loop gain delay/advance item during orientation	15
SP105	IQGO	Current loop gain magnification during orientation 1	100
SP106	IDGO	Current loop gain magnification during orientation 2	100
SP107	CSP2	Orientation deceleration rate 2	0
SP108	CSP3	Orientation deceleration rate 3	0
SP109	CSP4	Orientation deceleration rate 4	0
SP119	MPGH	Orientation position loop gain H coil compensation magnification	0
SP120	MPGL	Orientation position loop gain L coil compensation magnification	0
SP121	MPCSH	Deceleration rate H coil magnification during orientation	0
SP122	MPCSL	Deceleration rate L coil magnification during orientation	0

[Preparation]

1) Confirm that the parameters are set to the values given above.

1.2.6 Preparation for adjustment of encoder orientation

[Related Parameters]

Parameter No.	Abbrev.	Name	Default value
SP002	PGE	Position loop gain during encoder orientation	100
SP004	OINP	Orientation in-position width	16
SP005	OSP	Orientation changeover speed limit value	0
SP006	CSP	Deceleration rate during orientation	20
SP007	OPST	Orientation position shift amount	0
SP025	GRA1	No. of gear teeth on spindle side 1	1 to 32767
SP026	GRA2	No. of gear teeth on spindle side 2	1 to 32767
SP027	GRA3	No. of gear teeth on spindle side 3	1 to 32767
SP028	GRA4	No. of gear teeth on spindle side 4	1 to 32767
SP029	GRB1	No. of gear teeth on motor side 1	1 to 32767
SP030	GRB2	No. of gear teeth on motor side 2	1 to 32767
SP031	GRB3	No. of gear teeth on motor side 3	1 to 32767
SP032	GRB4	No. of gear teeth on motor side 4	1 to 32767
SP096	EGRA	Encoder gear ratio	0
SP097	SPECO	Orientation specifications	0000
SP098	VGOP	Speed loop gain proportional item during orientation	63
SP099	VGOI	Speed loop gain integral item during orientation	60
SP100	VGOD	Speed loop gain delay/advance item during orientation	15
SP105	IQGO	Current loop gain magnification during orientation 1	100
SP106	IDGO	Current loop gain magnification during orientation 2	100
SP107	CSP2	Orientation deceleration rate 2	0
SP108	CSP3	Orientation deceleration rate 3	0
SP109	CSP4	Orientation deceleration rate 4	0
SP119	MPGH	Orientation position loop gain H coil compensation magnification	0
SP120	MPGL	Orientation position loop gain L coil compensation magnification	0
SP121	MPCSH	Deceleration rate H coil magnification during orientation	0
SP122	MPCSL	Deceleration rate L coil magnification during orientation	0

[Preparation]

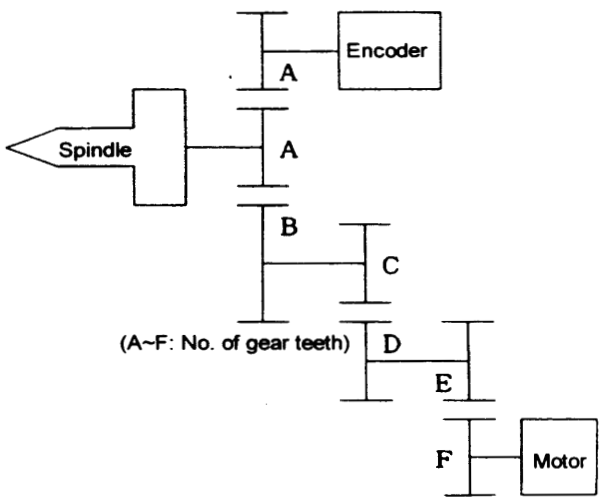
1) The accurate gear ratio (or pulley ratio) from the motor shaft to the encoder rotation axis is required. Confirm that the correct No. of gear teeth is set in SP025 (GRA1) to SP032 (GRB1).

SP025 (GRA1) to SP028 (GRA4) = A × C × E

SP029 (GRB1) to SP032 (GRB4) = B × D × F

Note) SP025 (GRA1) to SP032 (GRB4) may be set by the user, so make sure that these are set accurately to correspond to the machine.

2) Confirm that the parameters are set to the values given above.



1.2.7 Preparation for adjustment of magnesensor orientation

[Related Parameters]

Parameter No.	Abbrev.	Name	Default value
SP001	PGM	Position loop gain for magnesensor or motor built-in encoder orientation	100
SP004	OINP	Orientation in-position width	16
SP005	OSP	Orientation changeover speed limit value	0
SP006	CSP	Deceleration rate during orientation	20
SP007	OPST	Orientation position shift amount	0
SP025	GRA1	No. of gear teeth on spindle side 1	1 to 32767
SP026	GRA2	No. of gear teeth on spindle side 2	1 to 32767
SP027	GRA3	No. of gear teeth on spindle side 3	1 to 32767
SP028	GRA4	No. of gear teeth on spindle side 4	1 to 32767
SP029	GRB1	No. of gear teeth on motor side 1	1 to 32767
SP030	GRB2	No. of gear teeth on motor side 2	1 to 32767
SP031	GRB3	No. of gear teeth on motor side 3	1 to 32767
SP032	GRB4	No. of gear teeth on motor side 4	1 to 32767
SP097	SPECO	Orientation specifications	0000
SP098	VGOP	Speed loop gain proportional item during orientation	63
SP099	VGOI	Speed loop gain integral item during orientation	60
SP100	VGOD	Speed loop gain delay/advance item during orientation	15
SP105	IQGO	Current loop gain magnification during orientation 1	100
SP106	IDGO	Current loop gain magnification during orientation 2	100
SP107	CSP2	Orientation deceleration rate 2	0
SP108	CSP3	Orientation deceleration rate 3	0
SP109	CSP4	Orientation deceleration rate 4	0
SP119	MPGH	Orientation position loop gain H coil compensation magnification	0
SP120	MPGL	Orientation position loop gain L coil compensation magnification	0
SP121	MPCSH	Deceleration rate H coil magnification during orientation	0
SP122	MPCSL	Deceleration rate L coil magnification during orientation	0
SP123	MGD0	Magnesensor output peak value	Standard magnet = 542 Compact magnet = 500
SP124	MGD1	Magnesensor linear zone width	Standard magnet = 768 Compact magnet = 440
SP125	MGD2	Magnesensor changeover point	Standard magnet = 384 Compact magnet = 220

[Preparation]

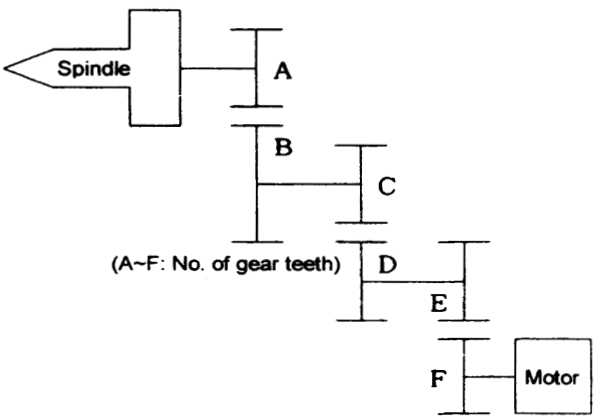
1) The accurate gear ratio (or pulley ratio) from the motor shaft to the magnesensor rotation axis is required. Confirm that the correct No. of gear teeth is set in [SP025 (GRA1)] to [SP032 (GRB1)].

[SP025 (GRA1)] to [SP028 (GRA4)] = A × C × E

[SP029 (GRB1)] to [SP032 (GRB4)] = B × D × F

Note) [SP025 (GRA1)] to [SP032 (GRB4)] may be set by the user, so make sure that these are set accurately to correspond to the machine.

2) Confirm that the parameters are set to the values given above.



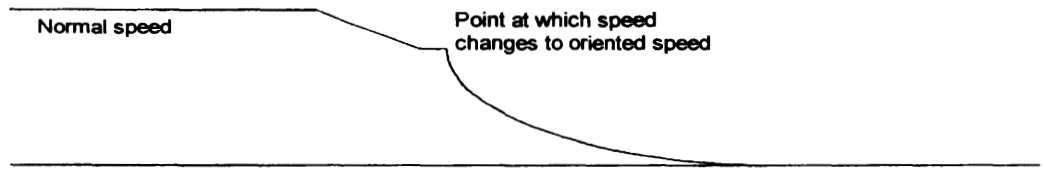
1.2.8 Adjustment of orientation

<Adjustment> ({ } for encoder orientation)

(1) Orient position shift adjustment

There is no volume or rotary switch for the position shift.
Set the position shift with parameter SP007 (OSPT) .
After setting SP007 (OSPT) , perform orientation, and adjust so that the target stop point is achieved.

(2) Orientation



Refer to the following table and set the corresponding orientation set.

Phenomena	Adjustment	
	SP001 (PGM) { SP002 (PGE) }	SP006 (CSP)
Overrun at stop	→	→
Long orientation time	↗	↗
Hunting at stop	↘	→
Excessive error alarm	↘	↘

Note 1) ↗ : Increase setting value.
→ : Do not change setting value.
↘ : Decrease setting value.

Note 2) The excessive error alarm will also occur when the detector direction SP097 (SPEC0) is incorrectly set.

Adjust SP001 (PGM) { SP002 (PGE) } first and then adjust SP006 (CSP) .
To execute the shortest orientation time per gear setting, adjust SP107 (CSP2) , SP108 (CSP3) and SP109 (CSP4) in the same manner.
To set the shortest orientation time per coil when using the coil changeover motor, adjust SP119 (MPGH), SP120 (MPGL), SP121 (MPSCH) and SP122 (MPCSL) in the same manner.
If the gear ratio is large (ex. 1:10), an excessive error alarm occurs and cannot be remedied with the above adjustments, adjust SP005 (OSP) .
If the spindle rotates slowly in the forward/reverse run direction and does not stop during magnesensor orientation, change the SP097 (SPEC0) detector installation direction bit.

1.2.9 Adjustment of servo rigidity

Carry out adjustments with the following procedures to raise the servo rigidity.

1) Raise the position loop gain to the extent that overrun does not occur during orientation.
For motor built-in encoder orientation and magnesensor orientation :
Raise the [SP001 (PGM)] value.
For encoder orientation : Raise the [SP002 (PGE)] value.

2) Raise the [SP098 (VGOP)] and [SP099 (VGOI)] values with the same proportion to the degree that vibration does not occur during orientation stop.
For example, if [SP098 (VGOP)] is set to 80, set [SP099 (VGOI)] to 80.

3) The value of [SP100 (VGOD)] can be increased to raise the impact response during stopping. However, if this value is too large, the torque for the position deflection will drop. Thus, the movement could be adversely affected such as the orientation stop position being inconsistent, etc. PI control will be applied if this value is set to 0.

1.2.10 "Delay/advance control" and "PI control" application

Normally, "delay/advance control" is selected. ([SP100 (VGOD)] $\neq$ 0)

In the case described below, select the "PI control" function. ([SP100 (VGOD)] $\neq$ 0)

Frictional torque of spindle is large and particularly accurate stop is required.
When "PI control" is used, servo rigidity will be somewhat inferior than that in "delay/advance" control.

1.2.11 Troubleshooting during orient error

(1) Does not orient (Keeps rotating)

Cause	Check Items	Remedy	Remarks
The parameter setting value is inappropriate.	The parameters with the orient detector do not match. [SP037 (SFNC5)] Motor built-in encoder orient ..... 4 Encoder orient ..... 1 Magnesensor orient 2	Set [SP037 (SFNC5)] correctly.	
Specifications are not correct.	Motor built-in encoder orientation is being carried out with a standard motor not provided with the Z phase.	Change to the motor with the motor built-in encoder with Z-phase.	For motor built-in encoder orientation.
Wiring error	The connector pin No. is incorrect, or the connector No. where the wire is connected is incorrect. The wire is broken.	Change the wiring. Change the wire.	

(2) Stops after exceeding stopping point.

Cause	Check Items	Remedy	Remarks
The parameter setting value is inappropriate.	Gear ratio parameters [SP025 (GRA1)] to [SP032 (GRB4)] are incorrect.	Set [SP025 (GRA1)] to [SP032 (GRB4)] correctly.	
	Improves when the orientation deceleration ratio parameter [SP006 (CSP)] is halved.	Readjust [SP006 (CSP)].	The same applies to the following : [SP107 (CSP2)] [SP108 (CSP3)] [SP109 (CSP4)] [SP121 (MPCSH)] [SP122 (MPCSL)]
	Improves when the position loop gain parameters [SP001 (PGM)] and [SP002 (PGE)] are halved.	Readjust [SP001 (PGM)] and [SP002 (PGE)].	The same applies to the following : [SP119 (MPGH)] [SP122 (MPGL)]
	The orient stop direction is in one direction (CCW or CW).	Set [SP097(SPEC0)] bit 0 and 1 to 0 (pre).	

(3) The stop position is OFF.

Cause	Check items	Remedy	Remarks
Machine factor	The stop position is not OFF on the encoder axis.	There is backlash or slippage between the spindle and encoder. The gear ratio between the spindle and encoder is not 1:1 or 1:2.	For encoder orientation
		There is backlash or slippage between the spindle and motor. The gear ratio between the spindle and motor is not 1:1.	For motor built-in encoder orientation.
Noise	The position detection cable is junctioned with a terminal block (connector), etc.	Do not junction the cable.	
	The position detector cable shield treatment is not correct.	Correctly treat the shield.	
	The signal wire is peeled too much at the position detector cable connector section. (The section not having a shield is long).	Keep the peeled section to 3cm or less when possible. Keep the peeled section as far away from the drive line as possible.	

(4) The stop position does not change even when the position shift parameter is changed.

Cause	Check items	Remedy	Remarks
The parameter setting value is inappropriate	The gear ratio between the spindle and encoder is 1:2 (encoder rotates once per two spindle rotations), and the position shift was changed to 2048.	If the gear ratio on the left is used between the spindle and encoder, the position shift amount per spindle rotation is 2048 and not 4096.	

(5) Vibrates when stopping.

Cause	Check Items	Remedy	Remarks
The parameter setting value is inappropriate	Gear ratio parameters SP025 (GRA1) to SP032 (GRB4) are incorrect.	Set SP025 (GRA1) to SP032 (GRB4) correctly.	
	The vibration frequency is several Hz.	Decrease the position loop gain parameters SP001 (PGM) and SP002 (PGE). Increase the current loop gain parameters for orientation SP105 (IQGO) and SP106(IDGO).	
	The vibration frequency is 10Hz or higher.	Decrease the speed loop gain parameter for orientation SP098 (VGOP) and SP099 (VGOI). Decrease the current loop gain parameters for orientation SP105 (IQGO) and SP106(IDGO).	

(6) The oriented complete signal is not output.

Cause	Check Items	Remedy	Remarks
Refer to (1) Does not orient.			
The machine load is heavy.	The in-position is too small (parameter SP004 (OINP).)	Review the in-position range. Increase SP004 (OINP).	
	Change the orientation stop control from delay/advance to PI control.	Review the values set in the speed loop gain parameters for orientation SP098 (VCGOP), SP099 (VGO1) and SP100 (VGOD).	

1.3 Synchronous tap adjustment

1.3.1 Synchronous tap operation adjustment

<Preparation>

Before adjusting the synchronous tap, carry out operation with the speed command or orient adjustment, and then follow the steps below.

<Parameter>

(1) Setting the spindle controller

<table>
<tr><th>#</th><th colspan="2">Parameter</th><th>Description</th></tr>
<tr><td>SP037</td><td>SFNC5</td><td>Spindle function 5</td><td>Possibilities of orient type and synchronous tap type combinations and setting values.
<table>
<tr><th colspan="2" rowspan="2">Synchronous tap type / Orient type</th><th colspan="2">Closed type</th><th colspan="2">Semi-closed type</th><th rowspan="2">Setting value</th></tr>
<tr><th></th><th></th><th></th><th></th></tr>
<tr><td colspan="2">No orient</td><td>×</td><td>×</td><td>×</td><td>○</td><td>○</td></tr>
<tr><td rowspan="3">Orient type</td><td>Motor built-in encoder</td><td>×</td><td>×</td><td>○</td><td>○</td><td>4</td></tr>
<tr><td>Encoder orient</td><td>○</td><td>○</td><td>×</td><td>×</td><td>1</td></tr>
<tr><td>Magnesensor orient</td><td>×</td><td>×</td><td>○</td><td>○</td><td>2</td></tr>
</table>
○ ..... Possible, × ..... Not possible</td></tr>
</table>

(2) NC screen settings

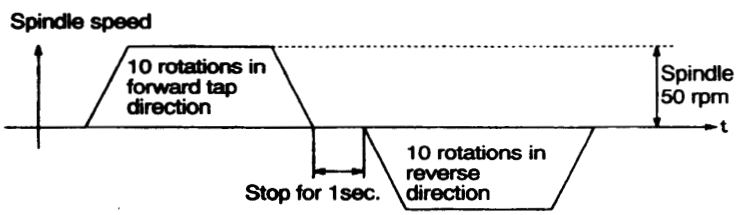
Selection screen	Parameter	Description	Setting value
<User parameter>			
Control parameter	Synchronous tap	Synchronous tap is validated. When not valid, the conventional tap cycle will run.	Valid
<Machine parameter>			
Basic specifications parameters	bit3 of mparl	Set whether the synchronous tap uses the time constant set method or slope set method.	0:Time constant set 1:Slope set
	tap-t1	Sets the position command time constant for the time constant set synchronous tap. If the start up time or fall time to rotate to the considerable max. tap speed with the S command is t, set the following: { When tap precision is priority : tap-t1 ≒ t × 2 (ms) { When tap cycle time is priority: tap-t1 ≒ t × 1.2 (ms)	1 to 1500 (msec) Standard: 1000
Servo parameter (Z axis)	PGN1SP (SV049)	Sets the position loop gain during synchronous tap. Always set the same value as for the spindle parameter PGT.	1 to 200 Standard: 10
Spindle NC parameters	sgear	Sets the gear ratio between the spindle and spindle encoder. Always set to 0 (1:1) when not using the spindle encoder (semi-closed type).	0 Standard: 0
	stap 1 stap 2 stap 3 stap 4	Sets the max. spindle speed during the slope set tap cycle at gears 00, 01, 10, 11.	0 to 99999 (rpm)
	stap 1 stap 2 stap 3 stap 4	Sets the time constant to the max. tap speed during the slope set tap cycle at gears 00, 01, 10, 11. The setting method is the same as tap-t1 above.	0 to 5000 (msec)
Spindle parameters	PGT	Sets the position loop gain during synchronous tap. Always set the same value for (Z axis) parameter PGN1SP.	1 to 100 Standard: 10
	SPECT	bit 5..... Sets the detector (spindle encoder) rotation direction during synchronous tap. Set 0 for semi-closed. bit 3..... Set to 1 for a strong excitation during synchronous tap. The response to impact loads will increase. Normally 0. bit 0..... 0: Closed (when there is an encoder on the spindle) 1: Semi-closed (when there is no encoder on the spindle) bit 4..... Decides the motor command direction (spindle rotation direction at G84) during synchronous tap. bitE=0 .... Performs zero point return at the beginning of the synchronous tap mode. bitE=1 .... Enters the position loop immediately after deceleration and stopping without performing zero point return.	—
	GRA1~ GRA4, GRB1~ GRB4	The gear ratio of each gear step must be set correctly with the no. of teeth. $\text{Motor speed} \times \frac{\text{Motor shaft side No. of teeth (GRB1~GRB4)}}{\text{Spindle side No. of teeth (GRA1~GRA4)}} = \text{Spindle speed}$	—
	EGEAR	Sets the gear ratio between the spindle and spindle encoder. Always set 0 (1:1) when not using the spindle encoder (semi-closed type).	0 Standard: 0

<Points of caution>

1) When the spindle is driven with the belt or the timing belt in the semi-closed method (with no spindle encoder) the belt may slip or stretch and make precise synchronized tapping difficult.
   When driving with the belt, use the spindle encoder, and carry out synchronized tapping in the closed method. In this case, use the encoder type orient for orientation.
2) When the spindle and encoder are connected with a speed ratio of 2:1 in the closed method (with the spindle encoder), set the spindle parameter [EGAR] to 1.

   Set the spindle NC parameter [sgear] to 1.

<Confirmation and adjustment of the operation>

	Normal operation	Items to check during abnormal operation
1	With the work not in place: G84 Z-10, F1.0, P1000, S50  	Reverse [SPECT] bit 4 when the rotation direction goes in the reverse tap direction. When the rotation numbers differ, recheck whether the parameter and machine specifications match. Others: Refer to troubleshooting for synchronous tap error.
2	Carry out the cutting test with the floating tap chuck installed. 1) Is there any stretching or shrinking of the tapper? 2) Is precise tap machining carried out?	Refer to troubleshooting for synchronous tap error.
3	Carry out the cutting test without the floating tap chuck installed. 1) Is precise tap machining carried out?	Refer to troubleshooting for synchronous tap error.

1.3.2 Troubleshooting for synchronous tap error

No.	Phenomena	Cause / remedy
1	Excessive difference alarm (alarm 52) occurs.	1) The spindle parameter [SPECT] bit 5 synchronous tap detector direction is set in reverse. 2) The spindle motor cannot follow the command as the tap time constant is too short. Multiply the longer of the S command's rising time or falling time by 1.2 or more, and set.
2	An overcurrent (alarm 32) occurs.	1) The spindle motor cannot follow the command as the tap time constant is too short. Multiply the longer of the S command's rising time or falling time by 1.2 or more, and set.
3	The spindle rotation movement amount does not match the command value.	1) The spindle parameter [SPECT] bit 0 close/semi-close setting is wrong. 2) The spindle parameter gear ratio [GRA1] to [GRA4], [GRB1] to [GRB4] settings do not match the machine gear ratio.
4	1) The tap breaks. 2) The tap precision is poor.	1) The (Z axis) parameter [PGNISP] and spindle parameter [PGM] values are not the same. 2) The tap time constant is too short. 3) The program screw pitch F and the actual tap pitch are different. 4) The tap slips at the chuck. Change to a larger chuck with a looser tightening torque. 5) The prepared hole is shallow and the cut powder is not removed well. 6) A tap with poor removal of the chip is used. (A spiral tap is desirous.) 7) The tap depth is too deep for the tap diameter. (Normally 2 to 3 times.) 8) A large noise interrupts the position feedback signal, and the synchronized precision is poor. In the closed method, check the spindle encoder cable and in the semi-closed method check the shield treatment of the speed feedback cable from the motor. → Check whether a normal shield wire is used or if it is disconnected. 9) Replace with a new tap.
5	1) The spindle stops or the precision is poor during tapping as the load is too heavy.	1) Set the spindle parameter [SPECT] bit 3 to 1, and select the strong excitation. 2) Increase speed loop gain during tapping. 3) Use tapping paste.
6	At low-speed rotations (under 1000 rpm) there are no problems, and at high speeds: 1) The tap breaks. 2) The tap precision is poor.	1) The position loop gain is slightly OFF. **(Example)** At close, the pulley ratio when V belt connection is carried out between the motor and spindle does not match the theoretical gear ratio (a).

2. Troubleshooting

⚠ WARNING

1. Always wait at least ten minutes after turning the power supply OFF before starting maintenance and inspection.
   Failure to do so could lead to electric shocks.
2. Maintenance and inspection must be done by a qualified technician. Failure to observe this could lead to electric shocks. Contact your nearest Service Center or Service Station for repairs and part replacement.

2.1 Introduction

If any trouble occurs with the control unit, perform the preliminary checks described below and then proceed to the troubleshooting described later.
The following preliminary checks are very important when you consult with service engineer.

Preliminary check

NOTICE

Never perform a megger test (insulation resistance measurement) on the spindle amplifier control circuit.

1. Which alarm is displayed on the unit alarm display? Confirm the past alarms on the unit's 7-segment display or on the NC diagnosis screen. (Refer to the alarm and warning list in 2.4.)
2. Is the trouble or failure repeatable?
3. Are ambient and inner-panel temperatures normal?
4. When did the trouble occur (during acceleration, or deceleration, or steady-speed operation)? What was the speed?
5. Is rotation direction correct?
6. Did instantaneous power failure occur?
7. Does the same trouble occur in a specific operation, or when a specific command is given?
8. How frequently does the trouble occur?
9. Does the trouble occur when load is applied, or when load is removed?
10. Were emergency procedures performed?
11. How many years has the control system been used?
12. Is supply voltage normal?
    Does it change from time to time?

2.2 First step of troubleshooting

Perform the following check:

(1) Power supply voltage: 200V (+10%–15%) 50Hz, 200 ~ 230V (+10%–15%) 60Hz
In any case, it should not drop below –15% of 200V.
(Ex.) • Check if the supply voltage drops at a specific time everyday.
• Check if the supply voltage drops at start of a specific machine.

(2) Is the peripheral control unit or functions in good condition?
(Ex.) • Are the NC, sequence circuit, etc., proper?
• Visually check the condition of cables and other components.

(3) Is temperature inside and outside the control unit below 55°C?

(4) Visually check the control unit appearance.
(Ex.) Looseness in the connector, damage or entering of foreign matter, etc.

If the above status confirmation is carried out sufficiently, the faulty section should be apparent.
The most likely troubles or failures of MDS-A-CV, SP can be largely divided into the following two groups:

- Trouble A
  - Control unit does not work satisfactorily when it is turned on for the first time (I).
  - Control unit comes into a standstill abruptly (II).
  - Control unit fails from time to time, or error occurs in orientation stop position, or "alarm" lamp lights (III).
- Trouble B
  - Unit trouble
    - Trouble in power supply unit
    - Trouble in spindle drive unit
  - Trouble with detector
    - Failure in speed detect encoder
    - Trouble in 1024P/rev encoder
    - Trouble in 90000P/rev encoder
    - Trouble in magnesensor
  - Trouble in parameter, transfer data from NC
  - Trouble with power supply
  - Trouble with motor
  - Other troubles (mismatching input signal conditions, cable disconnection, etc.)

2.3 Second step of troubleshooting

Trouble I	Check items	Remedy
Unit does not work satisfactorily when it is turned ON for the first time	As long as the control unit is handled carefully, this type of trouble is quite unlikely to occur. The most possible cause is,	
	(1) Mechanical shock or impact was given to the unit during shipment, installation or handling.	(1) Visually check if any part of the equipment is damaged.
	(2) External wiring or sequence is incorrect, or disconnected. Check grounding wire. (It is not required to consider power phase sequence.)	(2) Confirm that the 7-segment LED in the unit is lit. Check the external wiring and sequence. **(Note 1)** The input/output signals to the unit can be checked on the NC spindle monitor screen.
	(3) Check for mistakes in the parameter settings.	(3) Check the spindle parameters.
	(4) Motor speed cannot be increased.	(4) Check that the motor wires are correctly connected to UVW. When using the built-in motor, make sure that the waveform output from the speed detector is correct.
	(5) No-load operation is in good condition.	(5) Check the load condition.
	(6) Only orientation stop function is not in good condition (overrun, etc.)	(6) Adjust the orientation.
	(7) The C axis, synchronous tap, and spindle synchronous are not operating normally.	(7) Adjust and check the waveform from each detector.
	(8) An alarm is displayed on the unit's 7-segment display.	(8) Refer to 2.5.

Note 1) "Start signal CW, CCW" should be turned ON after "ready" signal and speed command have been input.

Trouble II	Check items	Remedy
Control unit comes into a standstill abruptly	(1) Check the input power voltage. AC200V +10% –15% 50Hz AC200 to 230V +10% –15% 60Hz	(1) Restore to normal if abnormal. Secure a power capacity that can maintain the voltages on the left during operations (during acceleration/deceleration, cutting).
	(2) An alarm is displayed on the unit's 7-segment.	(2) Refer to 2.5.
	(3) Is the signal input from NC correct?	(3) Check on the NC spindle monitor screen.
	(4) Is the waveform output from each detector normal? • Built-in speed detector • 1024P/rev encoder • 90000P/rev encoder • Magnesensor	(4) Check the waveform with a synchroscope, and readjust or replace.

Trouble III	Check items	Remedy
Operation is not correct sometimes. The orientation stop position deviates. An alarm displays, but after turning the power OFF and ON or resetting, the operation is restored.	In this case, the comprehensive analysis must be accomplished to determine the cause (load condition, operation mode, etc.). Refer to the causes below.	
	(1) The input power stopped instantaneously or dropped, and the instantaneous stop alarm displayed.	(1) Perform a detailed investigation of the input power fluctuation, etc.
	(2) Check if malfunction occurred in control circuit, due to large noise. The unit is capable of withstanding noise (in power supply) of 1600V/1μs.	(2) Find the noise source, and install a surge killer, etc. Review the unit's grounding, detector shields and grounding, etc.
	(3) The orientation is incorrect. The orientation stop position is deviated. The orientation time is long.	(3) Readjust the parameters for orientation. (Change the SP001, 002, and 006 setting values.) When using the 1024P/rev encoder, inspect the backlash between the spindle and encoder.

2.4 Alarm and warning table

Alarm No.	Abbr.	Name	Details	Operation (Note)
12	ME1	Memory error 1	A check sum or RAM check error occurred in the spindle drive control card ROM.	PR
13	SWE	Software process error	The software data process did not end within the set time.	PR
17	ADE	AD error	The current detection AD converter did not function correctly during initialization.	PR
21	NS2	No signal (spindle encoder)	The signal was not input from the spindle encoder (for orientation, C axis), or was not at the normal level.	PR
23	OSE	Excessive speed deflection	The speed command and motor speed deflection exceeded the specified value and the state continued for a specified time.	PR
31	OS	Overspeed	The motor speed exceeded 115% of the set max. speed.	PR
32	PMOC	Power module overcurrent	A current exceeding the set value flowed into the IPM used by the spindle drive's main circuit.	PR
34	DP	CRC error	A CRC error occurred in the communication data from the NC.	PR
35	DE	Data error	The movement command from the NC was excessively large during position control.	PR
36	TE	Transmission error	The periodic data transmission from the NC was terminated.	PR
37	PE	Parameter error	A parameter value exceeding the tolerable value was set.	PR
38	TP1	Protocol error 1	There was a protocol error in the communication with the NC. (Frame error)	PR
39	TP2	Protocol error 2	There was a protocol error in the communication with the NC. (Information error)	PR
3B	PMOH	Power module overheat	Overheating of the IPM used by the spindle drive's main circuit was detected.	PR
40	KE1	TK unit change error	The changeover signal procedure was mistaken when using the TK unit.	PR
41	KE2	TK unit communication error	The communication with the TK unit was not correct when using the TK unit.	PR
44	CAXE	C axis changeover alarm	When using the coil changeover motor, C axis control was carried out with the H coil.	NR
46	OHM	Motor overheat	Overload, or the motor cooling blower stop and the motor overheated causing the built-in thermal protector to function.	NR
50	OL	Overload	The motor current flowed for a time exceeding the overload time constant of the overload detection level.	NR
52	OD	Excessive error	The position tracking error was over the specified value in the position loop operation.	NR
5C	ORFE	Orientation feedback error	The pulse miss value was higher than the parameter set value (SP114: OPER) when orientation positioning was completed.	NR
6F	PALM	Power supply alarm	An alarm occurred in the power supply.	PR
82	NSP	Power supply no signal	A breakage or incorrect connection of the cable connected to the power supply was detected.	PR
E1	WOL	Overload warning	The motor current flowed at 80% or more of the detection time constant for a time exceeding the overload detection level.	AR
E7	NCE	NC emergency stop	The emergency stop command is input from the CNC.	PR

Note) If the above protective functions activate, the alarm No. will be displayed on the 7-segment LED built into the spindle drive, and the following will occur.

- Operation PR : The base current of the spindle drive will be shut off, the external contactor will turn OFF, and the spindle motor will coast to a stop.
- Operation NR : The spindle motor will decelerate and stop with the regenerative motor, and then the base current will be shut off.
- Operation AR : Only a warning will display, and operation can be continued.

2.5 Approach per phenomenon

2.5.1 When alarm or warning is displayed on the 7-segment display

(1) Alarm No. 12 : Memory error 1

[Meaning] A check sum or RAM check error occurred in the spindle drive control unit ROM.

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs each time the power is turned ON.	Replace the spindle drive unit.
		Occurs periodically.	Perform investigation item 2, and remedy.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground.
	2) Is there any equipment generating noise near the unit?	2) The alarm occurs easily when certain equipment operates.	Take noise prevention measures for the left equipment.
		No special problem.	Replace the spindle drive unit.

(2) Alarm No. 13 : Software process error

[Meaning] The spindle drive unit data process did not end within the set time.

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs each time the power is turned ON.	Replace the spindle drive unit.
		Occurs periodically.	Perform investigation item 2, and remedy.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground.
	2) Is there any equipment generating noise near the unit?	2) The alarm occurs easily when certain equipment operates.	Take noise prevention measures for the left equipment.
		No special problem.	Replace the spindle drive unit.

(3) Alarm No. 17 : AD converter error

[Meaning] The current detection AD converter circuit did not function correctly during initialization.

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs each time the power is turned ON.	Replace the spindle drive unit.
		Occurs periodically.	Perform investigation item 2, and remedy.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground.
	2) Is there any equipment generating noise near the unit?	2) The alarm occurs easily when certain equipment operates.	Take noise prevention measures for the left equipment.
		No special problem.	Replace the spindle drive unit.

(4) Alarm No. 21 : No signal detected

[Meaning] Error in the 1024P/rev encoder for orientation or 90,000 pulse encoder for C axis A, B, Z phase signals.

	Investigation item	Investigation results	Remedy
1	Check the spindle parameter (SP037: SFNC5) setting value.	"1" is set to Bit 0 even though encoder orientation is not used.	Correctly set.
		No special problem.	Perform investigation item 2, and remedy.
2	Tug the connector to check if the detector connector (spindle drive unit side and detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 3, and remedy.
3	Turn the power OFF and check the detector cable connection with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	When using MBE-90K for the C axis detector, perform investigation item 4, and remedy. In other cases, replace the spindle drive unit or detector.
4	When using the C axis built-in detector MBE-90K, check the output waveform.	The waveform is not correct.	Readjust. Replace the detector.
		The waveform is correct.	Replace the spindle drive unit.

(5) Alarm No. 23 : Excessive speed deflection

[Meaning] The speed command and current motor speed difference exceeded 50rpm or more for 12 seconds.

	Investigation item	Investigation results	Remedy
1	Check the UVW wiring between the spindle drive unit and motor.	The wiring is not correct.	Correctly wire.
		The wiring is correct.	Perform investigation item 2, and remedy.
2	Check the spindle parameters (SP034, SP040, SP055, SP257 and following) setting values.	The values are not correct.	Correctly set.
		The correct values are set.	Perform investigation item 3, and remedy.
3	Measure the acceleration/ deceleration time to the max. spindle speed. If the alarm occurs when changing from forward run (reverse run) to reverse run (forward run), measure the time from the forward run (reverse run) max. speed to the reverse run (forward run) max. speed.	Takes 12 sec. or more.	Increase the spindle parameter (SP055) setting value.
		Takes 12 sec. or less.	Perform investigation item 4, and remedy.
4	If the alarm occurs during cutting, check the load amount.	The load amount is 120% or higher.	Decrease the load.
		The load amount is 119% or lower.	Perform investigation item 5, and remedy.
5	Tug the connector to check if the speed detector connector (spindle drive unit side and speed detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 6, and remedy.
6	Turn the power OFF and check the speed detector cable connection with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 7, and remedy.
7	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. Replace the detector.
		The waveform is correct.	Replace the spindle drive unit.

(6) Alarm No. 31 : Overspeed

[Meaning] The motor speed exceeded 115% of the value set in spindle parameter (SP017:TSP).

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability	Occurs only during speed loop operation.	Perform investigation item 2, and remedy.
		Occurs only during position loop.	Perform investigation item 3, and remedy.
		Occurs constantly.	Perform investigation item 4, and remedy.
2	Check the spindle parameter (SP017: TSP) setting value.	The setting value is 2000' or less.	Increase the setting value.
		The setting value is 2001' or more.	Perform investigation item 4, and remedy.
3	1) If the alarm occurs during synchronous tap, check the spindle parameter (SP193:SPECT) setting value and the tap time constant.	1) The SP193 bit 5 (position detector polarity) setting is incorrect or the tap time constant setting is too low.	Correctly set.
	2) If the alarm occurs during spindle synchronization, check the spindle parameter (SP177: SPECS) setting value and the spindle synchronization time constant.	2) The SP177 bit 5 (position detector polarity) setting is incorrect or the spindle synchronization time constant setting is too low.	Correctly set.
	3) If the alarm occurs during the C axis, check the spindle parameter (SP129: SPECC) setting value, and C axis rapid traverse and cutting feed time constants.	3) The SP129 bit 5 (position detector polarity) setting is incorrect or each feed time constant setting during C axis is too low.	Correctly set.
		The set values are correct.	Perform investigation item 4, and remedy.
4	Investigate the wiring and installation environment. 1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground.
	2) Is there any equipment generating noise near the unit?	2) The alarm occurs easily when certain equipment operates.	Take noise prevention measures for the left equipment.
	3) Are the speed and position detector cables correctly shielded?	3) The shields are not correct.	Correctly shield the cables.
		No special problem.	Perform investigation item 5, and remedy.
5	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. Replace the detector.
		The waveform is correct.	Replace the spindle drive unit.

(7) Alarm No. 32 : Power module overcurrent

[Meaning] A current exceeding the specified value flowed into the IPM used by the spindle drive unit.

	Investigation item	Investigation results	Remedy
1	Check when the phenomenon occurred.	Occurs before ready ON.	Replace the spindle drive unit.
		Occurs after servo ON.	Perform investigation item 2, and remedy.
2	Check the spindle parameters (SP034, SP040, SP055, SP257 and following) setting values.	The values are not correct.	Correctly set.
		The correct values are set.	Perform investigation item 3, and remedy.
3	If the alarm occurs during cutting, check the load amount.	The load amount is 120% or higher.	Decrease the load.
		The load amount is 119% or lower.	Perform investigation item 4, and remedy.
4	Check the UVW wiring between the spindle drive unit and motor.		
	1) Are the terminal screws loose?	1) The screws are loose.	Correctly tighten.
	2) Do the wires short-circuit between phases?	2) There is a short-circuit.	Replace the cable.
	3) Is there a ground fault in one of the phases?	3) There is a ground fault.	Replace the cable.
	Open both ends of the cable when checking 2) and 3).	There is no special problem.	Perform investigation item 5, and remedy.
5	Check the motor insulation. Check between each motor wire and ground with a megger tester.	The resistance value is 1MΩ or less.	Replace the motor.
		The resistance value is 1MΩ or more.	Perform investigation item 6, and remedy.
6	Check the power voltage.	The power voltage drops below 170V during acceleration/ deceleration and cutting.	Review the power capacity.
		The power voltage is constantly 171V or more.	Perform investigation item 7, and remedy.
7	Investigate the wiring and installation environment.		
	1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground.
	2) Is there any equipment generating noise near the unit?	2) The alarm occurs easily when certain equipment operates.	Take noise prevention measures for the left equipment.
		No special problem.	Replace the spindle drive unit.

(8) Alarm No. 34 : CRC error

[Meaning] A CRC error occurred in the communication data from the NC.

	Investigation item	Investigation results	Remedy
1	Tug the connection connectors or terminating connectors between the NC and spindle drive units, battery unit and spindle drive unit, and spindle drive unit and servo drive unit to check if they are disconnected. Also check if an excessive force is being applied on the connectors.	Is disconnected (loose). Force was applied.	Correctly connect.
		No special problem.	Perform investigation item 2, and remedy.
2	Disconnect each cable in item 1, and check the connection with a tester.	A connection defect was found.	Replace the cable.
		No connection defect was found.	Perform investigation item 3, and remedy.
3	Investigate the wiring and installation environment.		
	1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground.
	2) Is there any equipment generating noise near the unit?	2) The alarm occurs easily when certain equipment operates.	Take noise prevention measures for the left equipment.
		No special problem.	Replace the spindle drive unit or the MCP card on the NC side.

(9) Alarm No. 35 : Data error

[Meaning] The movement command data from the NC was excessively large during position control.

	Investigation item	Investigation results	Remedy
1	Perform the same investigations items and remedies as for alarm No. 34 .		

(10) Alarm No. 36 : Transmission error

[Meaning] The periodic data transmission from the NC was terminated.

	Investigation item	Investigation results	Remedy
1	Perform the same investigations items and remedies as for alarm No. 34 .		

(11) Alarm No. 37 : Parameter error

[Meaning] The spindle parameter sent from the NC during initialization was illegal.

	Investigation item	Investigation results	Remedy
1	Check the spindle parameter setting values. The No. of the parameter with an abnormal setting will display on the NC spindle diagnosis screen.	The setting is incorrect.	Correctly set.
		No special problem.	Perform investigation item 2, and remedy.
2	Perform the same investigations items and remedies as for alarm No. 34 .		

(12) Alarm No. 38 : Protocol error 1

[Meaning]There was a protocol error in the communication with the NC. (Frame error)

	Investigation item	Investigation results	Remedy
1	Perform the same investigations items and remedies as for alarm No. 34 .		

(13)Alarm No. 39 : Protocol error 2

[Meaning] There was a protocol error in the communication with the NC. (Information error)

	Investigation item	Investigation results	Remedy
1	Perform the same investigations items and remedies as for alarm No. 34 .		

(14) Alarm No. 3B : Power module overheat

[Meaning] Overheating of the IPM used in the main circuit of the spindle drive was detected.

	Investigation item	Investigation results	Remedy	
1	Investigate the heat radiating environment			
	1) Rotation of fan on rear of unit	The fan is not rotating correctly.	Replace the fan	Take measures to prevent cutting oil or dust from contacting the fins.
	2) Contamination of radiating fins on rear of unit	Remarkable amounts of cutting oil or dust are adhered on the radiating fins.	Clean the fins	
	3) Measurement of unit ambient temperature	55°C is exceeded.	Consider ventilating or cooling measures for the panel.	
		None of the above apply.	Perform investigation item 2.	
2	Investigate the installation environment. Is the grounding correct? Are there any noise generating devices in the periphery?	The grounding is incomplete. Alarms occur easily when a certain device operates.	Correctly ground. Take noise measures for the device on the left.	
		No particular problem.	Replace the unit.	

(15) Alarm No. 40 : TK unit change error

[Meaning] The changeover signal procedure was mistaken when using the TK unit.

	Investigation item	Investigation results	Remedy
1	Refer to the separate 1 amplifier 2 motor specifications (BNP-A-2993-22).		

(16) Alarm No. 41 : TK unit communication error

[Meaning] The communication between the TK unit and spindle drive unit was not correct when using the TK unit.

	Investigation item	Investigation results	Remedy
1	Refer to the separate 1 amplifier 2 motor specifications (BNP-A-2993-22).		

(17) Alarm No. 44 : C axis changeover alarm

[Meaning] When using the coil changeover motor, C axis control was carried out with the H coil.

	Investigation item	Investigation results	Remedy
1	Check the sequence for C axis changeover. Check the 3H bit D display for the control input on the NC spindle monitor.	0 is displayed.	Issue the correct command. (Check the sequence.)
		1 is displayed.	Perform investigation item 2, and remedy.
2	Check the 3H bit D display for control output when the C axis servo is ON.	0 is displayed.	Replace the amplifier.
3	Check the parameters. Is the coil changeover valid for special motor specifications?	Valid. (The SP034 [mkch] bit is set to 1.)	Invalidate. (Set the SP034 [mkch] bit to 0.)

(18) Alarm No. 46 : Motor overheat

[Meaning] The motor overheated and the thermal protector built-in the motor activated.

When this alarm occurs, it cannot be released until the motor has stopped and the motor cooling fan has run for 10 or more minutes.

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs immediately after turning power ON. Occurs several minutes after operation starts.	Perform investigation item 2, and remedy.
		Occurs after operating for a while.	Perform investigation item 5, and remedy.
2	Tug the speed detector cable connector on the spindle drive unit to see if it is disconnected.	Is disconnected (loose).	Correctly connect.
		No special problem.	Perform investigation item 3, and remedy.
3	Check the speed detector cable connection.	A connection defect is found.	Correctly connect.
		Connection is normal.	Perform investigation item 4, and remedy.
4	Check between OHS1 and OHS2 on the motor thermal protector with tester.	The resistance value is several 100Ω or higher.	Replace the motor.
		The resistance value is several 10Ω or lower.	Replace the spindle drive unit.
5	Check the spindle load amount.	The unit is started and stopped frequently, or the cutting load is large.	Decrease the starting/ stopping frequency or lower the load.
		No special problem.	Perform investigation item 6, and remedy.
6	Check the motor cooling fan wiring and rotation.	The motor cooling fan wiring is incorrect.	Correctly wire.
		The wiring is correct but the fan does not rotate.	Replace the motor.
		No special problem.	Perform investigation item 7, and remedy.
7	Check the finger guard on the motor cooling fan section.	The guard is clogged.	Clean.
		No special problem.	Replace the spindle drive unit.

(19) Alarm No. 50 : Overload

[Meaning] The current flowed to the spindle motor exceeded the overload detection level (spindle parameter SP064: OLL) and continued longer than the overload detection time (spindle parameter SP063: OLT).

	Investigation item	Investigation results	Remedy
1	Check the spindle parameters (SP034, SP040, SP055, SP257 and following) setting values.	The values are not correct.	Correctly set.
		The correct values are set.	Perform investigation item 2, and remedy.
2	Check the spindle parameters (SP063, SP064) setting values.	The standard value is not set.	Set the standard value.
		The standard value is set.	Perform investigation item 3, and remedy.
3	Check the UVW wiring between the spindle drive unit and motor. 1) Are the terminal screws loose?	1) The screws are loose.	Correctly tighten.
	2) Do the wires short-circuit between phases?	2) There is a short circuit.	Replace the cable.
	3) Is there a ground fault in one of the phases?	3) There is a ground fault.	Replace the cable.
	Open both ends of the cable when checking 2) and 3).	There is no special problem.	Perform investigation item 4, and remedy.
4	Tug the connector to check if the speed detector connector (spindle drive unit side and speed detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 5, and remedy.
5	Turn the power OFF and check the speed detector cable connection with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 6, and remedy.
6	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. (Refer to Page IV-38) Replace the detector.
		The waveform is correct.	Perform investigation item 7, and remedy.
7	Check the motor load amount.	The load amount exceeds the motor rating.	Decrease the load to within the motor rating.
		No special problem.	Perform investigation item 8, and remedy.
8	Check the motor rotation.	The motor is locked.	Review the machine side.
		No special problem.	Replace the spindle drive unit.

(20) Alarm No. 52 : Excessive error

[Meaning] The position tracking error was over the specified value (excessive error width setting value) in the orientation or position loop operation.

- Excessive error width setting value

During orientation (SP102:OODR)	: Standard value 32767 (32767 pulses)
During C axis (SP154:CODRL, SP155:CODRH)	: Standard value SP154:D4C0, SP155: 1 (120000 pulses)
During spindle synchronization (SP186:SODR)	: Standard value 32767 (32767 pulses)
During synchronous tap (SP218:TODR)	: Standard value 32767 (32767 pulses)

	Investigation item	Investigation results	Remedy
1	Investigate the repeatability.	Occurs during orientation.	Perform investigation item 2, and remedy.
		Occurs during C axis.	Perform investigation item 7, and remedy.
		Occurs during spindle synchronization.	Perform investigation item 12, and remedy.
		Occurs during synchronous tap.	Perform investigation item 16, and remedy.
2	If the alarm occurs during encoder orientation, check the spindle parameter (SP097: SPEC0) bit 5 setting value.	OK if the bit 5 setting value is changed.	Change the bit 5 setting value.
		NG even if the bit 5 setting value is changed.	Return the bit 5 setting value to the original value, perform investigation item 3, and remedy.
3	Check the spindle parameter (SP001:PGM, SP002:PGE, P006: CSP) setting values.	OK if PGM and PGE are doubled or if CSP is decreased to half. NG even with the above settings.	Change the setting values. Perform investigation item 4, and remedy.
4	Tug the connector to check if the detector connector (spindle drive unit side and position/speed detector sides) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 5, and remedy.
5	Turn the power OFF and check the position/speed detector cable connections with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 6, and remedy.
6	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. (Refer to Page IV-35) Replace the detector.
		The waveform is correct.	Replace the spindle drive unit or position detector.

	Investigation item	Investigation results	Remedy
7	Check the spindle parameter (SP129: SPECC) bit 5 setting.	OK if the bit 5 setting value is changed.	Change the bit 5 setting value.
		NG even if the bit 5 setting value is changed.	Return the bit 5 setting value to the original value, perform investigation item 8, and remedy.
8	Check the axis specifications parameter rapid traverse and cutting feed rate setting values.	OK if setting value is lowered.	Change the setting value.
		NG even if the setting value is lowered.	Return the setting value to the original value, perform investigation item 9, and remedy.
9	Check the axis specifications parameter time constant setting value.	OK if the setting value is increased.	Change the setting value.
		NG even if the setting value is increased.	Return the setting value to the original value, perform investigation item 10, and remedy.
10	Check the spindle parameter (SP003:PGC0, SP130 ~ SP133: PGC1 ~ PGC4, SP165: PG2C, SP166:PG3C) setting values.	OK if the setting value is increased.	Change the setting value.
		NG even if the setting value is increased.	Return the setting value to the original value, perform investigation item 11, and remedy.
11	Check the other spindle parameters (SP129 ~ SP166, SP257 and following)	The correct value is not set.	Correctly set.
		No special problem.	Replace the spindle drive unit or readjust or replace the position detector.
12	Check the spindle parameter (SP177: SPECS) bit 5 setting.	OK if the bit 5 setting value is changed.	Change the bit 5 setting value.
		NG even if the bit 5 setting value is changed.	Return the bit 5 setting value to the original value, perform investigation item 13, and remedy.
13	Check the spindle parameter's spindle synchronous time constant.	OK if the setting value is increased.	Change the setting value.
		NG even if the setting value is increased.	Return the setting value to the original value, perform investigation item 14, and remedy.
14	Check the spindle parameter (SP010: PGS, SP189: PG2S, SP190: PG3S) setting values.	OK if the setting value is increased.	Change the setting value.
		NG even if the setting value is increased.	Return the setting value to the original value, perform investigation item 15, and remedy.

	Investigation item	Investigation results	Remedy
15	Check the other spindle parameter (SP177 to SP190, SP257 and following) setting values.	The correct value is not set.	Correctly set.
		No special problem.	Replace the spindle drive unit or readjust or replace the position detector.
16	Check the spindle parameter (SP193: SPECT) bit 5 setting.	OK if the bit 5 setting value is changed.	Change the bit 5 setting value.
		NG even if the bit 5 setting value is changed.	Return the bit 5 setting value to the original value, perform investigation item 17, and remedy.
17	Check the spindle parameter's spindle synchronous time constant.	OK if the setting value is increased.	Change the setting value.
		NG even if the setting value is increased.	Return the setting value to the original value, perform investigation item 18, and remedy.
18	Check the spindle parameter (SP009: PGT, SP221: PG2T, SP222: PG3T) setting values.	OK if the setting value is increased.	Change the setting value.
		NG even if the setting value is increased.	Return the setting value to the original value, perform investigation item 19, and remedy.
19	Check the other spindle parameter (SP193 to SP222, SP257 and following) setting values.	The correct value is not set.	Correctly set.
		No special problem.	Replace the spindle drive unit or readjust or replace the position detector.

The tracking error amount (droop amount) can be calculated with the following equation.
If this value exceeds each excessive error width setting, this alarm will occur.

$$\text{Droop amount (No. of pulses)} = \frac{\{\text{Spindle speed (rpm)} / 60\} \times \text{No. of pulses per rotation (*1)}}{\text{Position loop gain (sec}^{-1}\text{)}}$$

(*1) The No. of pulses per rotation is as follows:
During C axis : 360000
Other than the above : 4096

(*2) The spindle speed during C axis is calculated with the following equation.

$$\text{Spindle speed (rpm)} = \frac{\text{C axis feed rate (°/min)}}{360°}$$

(21) Alarm No. 5C

[Meaning] The pulse miss value was higher than the parameter set value (SP114: OPER) when orientation positioning was completed.

	Investigation item	Investigation results	Remedy
1	Is the speed detector cable shield correctly treated?	The shield is correct.	Correctly treat the shield.
		The shield is correct.	Perform investigation item 2, and remedy.
2	Is the encoder cable junctioned?	It is junctioned.	Use one encoder cable.
		It is not junctioned.	Perform investigation item 3, and remedy.
3	Stretch and contract the encoder or speed detector cable, and use a tester to check for wire breakage.	The wire broken.	Replace the cable.
		The wire is not broken.	Perform investigation item 4, and remedy.
4	Are the A, B and Z phase waveforms of the speed detector correctly adjusted?	The waveform is deviated.	Correctly adjust. Refer to the adjustment procedures (BNF-14052-01).
		The waveform is correct.	Perform investigation item 4, and remedy.

(22) Alarm No. 60 to 7F : Power supply error

[Meaning] An error occurred in the power supply.

	Investigation item	Investigation results	Remedy
1	Refer to the power supply troubleshooting section.		

(23) Warning No. E1 : Overload warning

[Meaning] The current flowed to the spindle motor exceeded the overload detection level (spindle parameter SP064: OLL) and the time exceeded 80% of the overload detection time (spindle parameter SP063: OLT).

	Investigation item	Investigation results	Remedy
1	Perform the same investigation and remedies as for alarm No. 50 .		

(24) Warning No. E7 : NC emergency stop

[Meaning] The emergency stop command was input from the NC or an alarm occurred in another servo axis or in the spindle.

	Investigation item	Investigation results	Remedy
1	Check whether the emergency stop switch is ON.	Switch is ON.	Turn OFF the emergency stop switch.
		Switch is OFF.	Perform investigation item 2, and remedy.
2	Perform the same investigation and remedies as for alarm No. 34 .		

2.5.2 When alarm or warning is not displayed on 7-segment unit

(1) Motor does not rotate even when an alarm is not displayed.

	Investigation item	Investigation results	Remedy
1	Check the wiring around the power supply unit and spindle drive unit. Also check for looseness in the terminal screws and for broken wires, etc.	The wiring is incorrect. Loose screws or broken wires are found.	Correctly wire. Tighten the screws. Replace the wires.
		No special problem.	Perform investigation item 2, and remedy.
2	Check the input voltage.	The voltage exceeds the specified value.	Restore the power to the specified value.
		The voltage is within the specified value.	Perform investigation item 3, and remedy.
3	Confirm all spindle parameters.	The correct value is not set.	Correctly set.
		The correct value is set.	Perform investigation item 4, and remedy.
4	Confirm the input signals. (Confirm on the spindle diagnosis screen.) Are the ready, forward run, reverse run signals input? The forward and reverse run signals must be input at least one second after ready ON. The forward run and reverse run signals may be turned ON simultaneously.	The signal is not input or the sequence is incorrect. The orientation command is input.	Correct the input signals.
		No special problem.	Perform investigation item 5, and remedy.
5	Confirm the speed command. (Confirm on the spindle diagnosis screen.)	The speed command is not correctly input.	Correctly input the speed command.
		The speed command is correctly input.	Replace the spindle drive unit.

(2) An alarm is not displayed but the motor only rotates slowly. The sound from the motor is loud.

	Investigation item	Investigation results	Remedy
1	Check the UVW wiring between the spindle drive unit and motor.	The wiring is not correct.	Correctly wire.
		The wiring is correct.	Perform investigation item 2, and remedy.
2	Confirm the input voltage.	One of the three phases is not the specified value.	Restore the power to the specified value.
		No special problem.	Perform investigation item 3, and remedy.
3	Confirm the speed command. (Confirm on the spindle diagnosis screen.)	The speed command is not correctly input.	Correctly input the speed command.
		The speed command is correctly input.	Perform investigation item 4, and remedy.

	Investigation item	Investigation results	Remedy
4	Tug the connector to check if the speed detector connector (spindle drive unit side and speed detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 5, and remedy.
5	Turn the power OFF and check the speed detector cable connection with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 6, and remedy.
6	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. (Refer to Page IV-38) Replace the detector.
		The waveform is correct.	Replace the spindle drive unit.

(3) The commanded speed and actual speed do not match.

	Investigation item	Investigation results	Remedy
1	Confirm the speed command. (Confirm on the spindle diagnosis screen.)	The speed command is not correctly input.	Correctly input the speed command.
		The speed command is correctly input.	Perform investigation item 2, and remedy.
2	Check for slips between the motor and spindle. (If the belt or clutch are connected.)	Slipping is found.	Repair the machine side.
		No special problem.	Perform investigation item 3, and remedy.
3	Check the spindle parameters (SP034, SP040, SP017, SP257 and following).	The correct value is not set.	Correctly set.
		The correct value is set.	Replace the spindle drive unit.

(4) The start up time is long or has become longer.

	Investigation item	Investigation results	Remedy
1	Check if the friction torque has increased.	The torque has increased.	Repair the machine side.
		No special problem.	Perform investigation item 2, and remedy.
2	Rotate the motor bearings by hand to see that they are normal.	The bearings do not rotate smoothly.	Replace the spindle motor.
		The bearings rotate smoothly.	Perform investigation item 3, and remedy.
3	Check if the torque limit signal is being input. (Check on the spindle diagnosis screen.)	The signal is input.	Do not input the signal.
		The signal is not input.	Replace the spindle drive unit.

(5) The motor stops during cutting.

	Investigation item	Investigation results	Remedy
1	Check the load amount during cutting.	The load meter indicates a value higher than 120% during cutting.	Decrease the load.
		No special problem.	Perform investigation item 2, and remedy.
2	Perform the same investigation and remedies as for item (4).		

(6) The vibration and noise (gear noise) is large.

	Investigation item	Investigation results	Remedy
1	Check the machines movement balance. (Free run from the max. speed.)	The same sound is heard during free run.	Repair the machine side.
		No special problem.	Perform investigation item 2, and remedy.
2	Check for a resonance point on the machine. (Free run from the max. speed.)	The vibration and sound increases at a certain speed during free run.	Repair the machine side.
		No special problem.	Perform investigation item 3, and remedy.
3	Check the machine backlash.	Backlash is large.	Repair the machine side.
		No special problem.	Perform investigation item 4, and remedy.
4	Confirm the spindle parameter (SP022: VGNP1, SP023: VGNI1, SP056: PYVR) settings.	The phenomenon decreases when the setting value is lowered to half.	Change the setting. Note that the impact response will decrease.
		No change even with the above settings.	Return the setting value to the original value, perform investigation item 5, and remedy.
5	Tug the connector to check if the speed detector connector (spindle drive unit side and speed detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 6, and remedy.
6	Turn the power OFF and check the speed detector cable connection with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 7, and remedy.
7	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. (Refer to Page IV-38) Replace the detector.
		The waveform is correct.	Replace the spindle drive unit.

(7) The spindle coasts during deceleration.

	Investigation item	Investigation results	Remedy
1	Check for slips between the motor and spindle. (If the belt or clutch are connected.)	Slipping is found.	Repair the machine side.
		No special problem.	Replace the spindle drive unit.

(8) The rotation is not stable.

	Investigation item	Investigation results	Remedy
1	Confirm the spindle parameter (SP022: VGNP1, SP023: VGNI1) settings.	The stabilizes when the setting values are doubled.	Change the setting. Note that the gear noise may increase.
		No change even with the above settings.	Return the setting value to the original value, perform investigation item 2, and remedy.
2	Tug the connector to check if the speed detector connector (spindle drive unit side and speed detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 3, and remedy.
3	Turn the power OFF and check the speed detector cable connection with a tester.	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 4, and remedy.
4	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. (Refer to Page IV-38) Replace the detector.
		The waveform is correct.	Perform investigation item 5, and remedy.
5	Investigate the wiring and installation environment. Is grounding properly performed?	Grounding is incomplete.	Correctly ground.
		No special problem.	Replace the spindle drive unit.

(9) The motor speed does not rise above a certain speed.

	Investigation item	Investigation results	Remedy
1	Check the speed command. (Confirm on the spindle diagnosis screen.) Confirm whether the override input on the machine operation panel is being input.	The speed command is not correctly input.	Correctly input the speed command.
		The speed command is correctly input.	Perform investigation item 2, and remedy.
2	Check whether the load has increased suddenly.	The load has increased.	Repair the machine side.
		No special problem.	Perform investigation item 3, and remedy.
3	Check that the motor bearings can be rotated normally by hand.	The bearings do not rotate smoothly.	Replace the spindle motor.
		The bearings rotate smoothly.	Perform investigation item 4, and remedy.
4	Tug the connector to check if the speed detector connector (spindle drive unit side and speed detector side) is disconnected.	Is disconnected (loose).	Correctly connect.
		Is not disconnected (loose).	Perform investigation item 5, and remedy.
5	Turn the power OFF and check the speed detector cable connection with a tester. (Especially check the shield wiring.)	A connection defect or broken wire is found.	Replace the detector cable. Correctly connect.
		Connection is normal.	Perform investigation item 6, and remedy.
6	Check the speed detector waveform.	The waveform is not correct.	Adjust so that it is correct. (Refer to Page IV-35) Replace the detector.
		The waveform is correct.	Replace the spindle drive unit.

2.6 Periodic Inspection

⚠ WARNING

1. Always wait at least ten minutes after turning the power supply OFF before starting maintenance and inspection.
   Failure to do so could lead to electric shocks.
2. Maintenance and inspection must be done by a qualified technician. Failure to observe this could lead to electric shocks. Contact your nearest Service Center or Service Station for repairs and part replacement.

The periodic inspection is particularly important to ensure high-performance operation of equipment, and trouble-free long use of equipment.

Caution

To prevent major accidents, make sure the power is interrupted completely before starting the inspection. Make sure that the CHARGE lamp on the power supply unit is OFF.

2.6.1 Inspection of control unit

NOTICE

Never perform a megger test (insulation resistance measurement) on the spindle amplifier control circuit.

Check item	Frequency	Check	Remedy
1. Cooling fan	Monthly	(1) Rotate the fan shaft manually to check. (2) Turn ON the fan to check that the fan runs powerfully. (3) Check if abnormal sound occurs in bearing.	Replace the fan.
2. Dirt and terminal screw looseness	Appropriate interval	Periodically clean the areas around the amplifier, especially the cooling fan, and tighten the input/output terminals and connections.	
3. Wiring	Appropriate interval	Check that the wires are not contacting the conductive parts and that they are not caught.	

2.6.2 Inspection of motor

Check Item	Frequency	Check	Remedy
1. Noise and vibration	Monthly	◎ Check if abnormal sound or intense vibration occurs. If abnormal sound or intense vibration occurs, perform the following check: (1) Check foundation and installation. (2) Check shaft alignment. (3) Check if vibration is transmitted through shaft coupling. (4) Check if bearing is damaged or abnormal noise occurs. (5) Check if noise or vibration is caused by reduction gear or belt. (6) Check control unit for condition. (7) Check cooling fan for condition. (8) Check belt tension.	Clean
2. Temperature rise	Monthly	◎ Check bearing temperature. (Normal amb. temp. + 10 to 40°C) ◎ Check motor frame temperature. If temperature is high excessively, perform the following check: (1) Check cooling fan operation. (2) Check cooling air passage (between frame and cover). (3) Check load condition.	
		(4) Check control unit.	Refer to 2.5.
3. Insulation resistance	Every 6 months	◎ Check if insulation resistance is excessively low. Disconnect the wiring with the spindle drive unit, and measure the resistance between the entire circuit and ground. (There is no problem if the value is 1MΩ or more with a 500V megger tester.) If the insulation resistance is less than 1MΩ, clean the inside of the motor and dry it out. To dry, disassemble the motor and heat it in a dryer at a temperature less than 90°C.	
4. Cooling fan	Weekly, monthly	◎ Check cooling fan for operation, abnormal noise and vibration.	

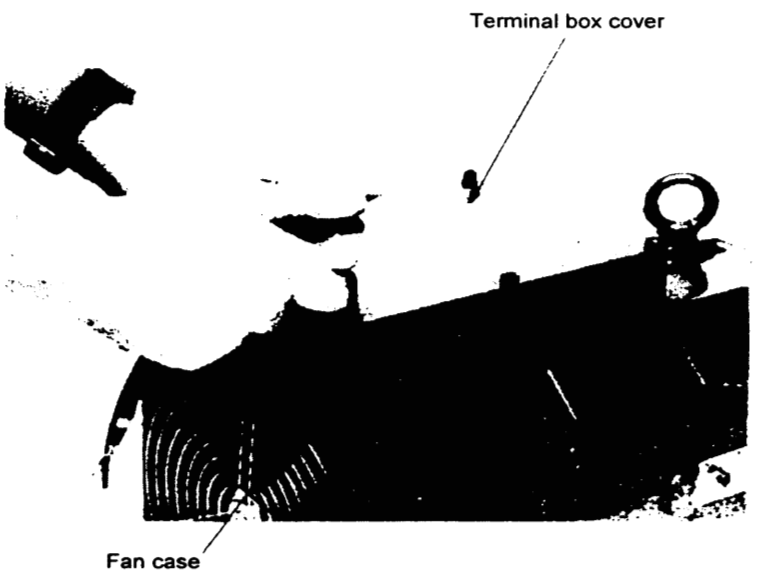
3. Disassembly and Assembly of Motor

3.1 Disassembly and assembly of SJ type AC spindle motor

1 Cables and PCB

(1) Remove the cover of terminal box on the fan case.

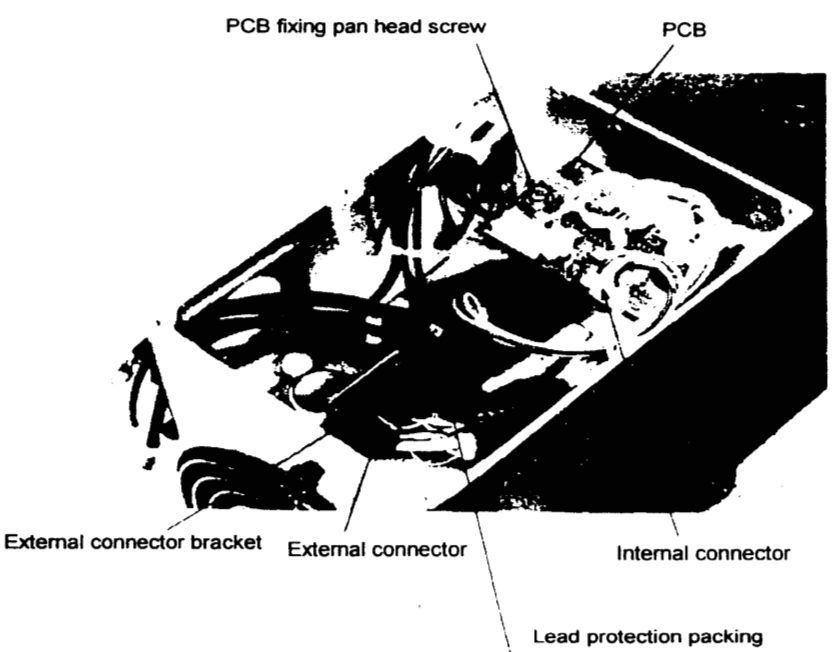
(2) Disconnect the cables coming from the power panel.
   a) 3 motor main leads (U, V and W).
   b) 2 cooling fan leads (BU and BV).
   c) 2 thermal protector leads (OHS1 and OHS2).
   d) Mate plug of PCB 's external connector.



(3) Remove the external connector from the connector bracket.
Disengage the internal connector.

(4) Remove the PCB fixing pan head screws to remove the PCB.

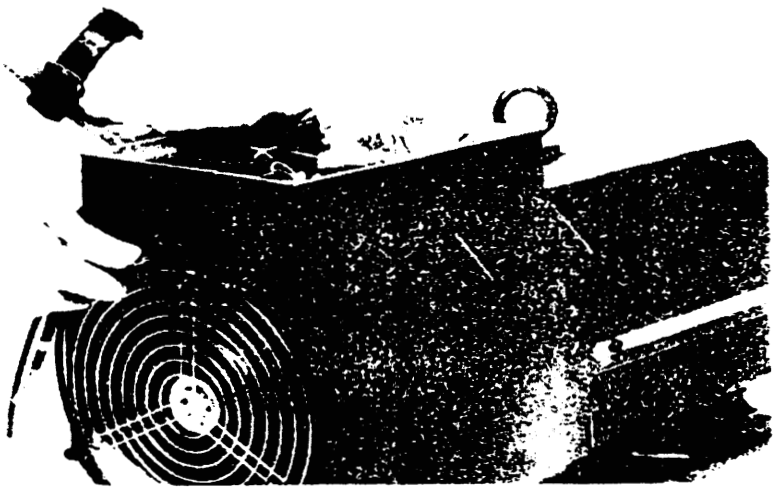
(5) To assemble, perform the steps in reverse [(4) to (1)].



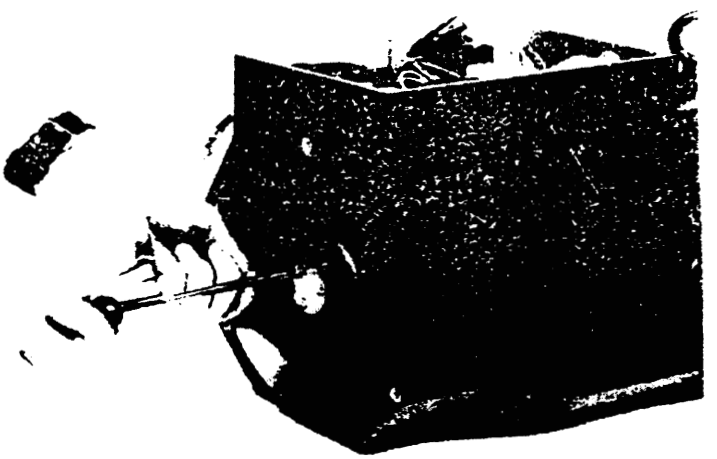
[2] Cooling fan

For types smaller than frame No.132

(1) Remove the hexagon socket head bolts fixing the finger guard.



(2) Remove the pan-head screws at the center of the cooling fan to remove the fan.

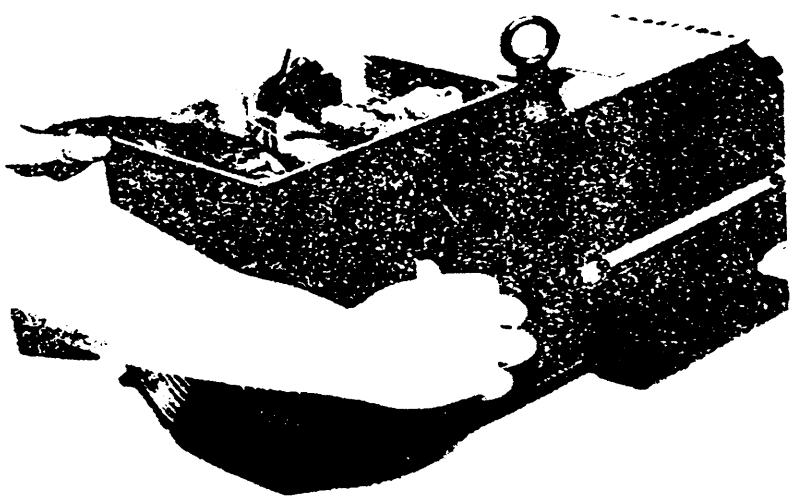


(3) Cut the four fan leads. Remove the pan-head screws and draw out the fan motor from the fan case.

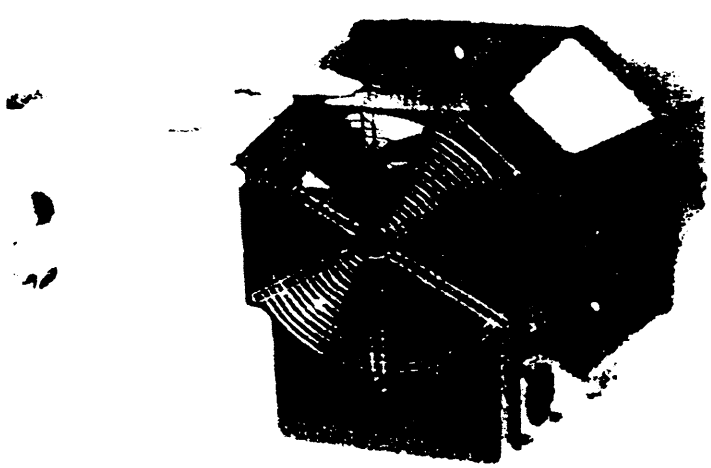
(4) To assemble, perform the steps in reverse [(3) to (1)].

For types larger than frame No. 160

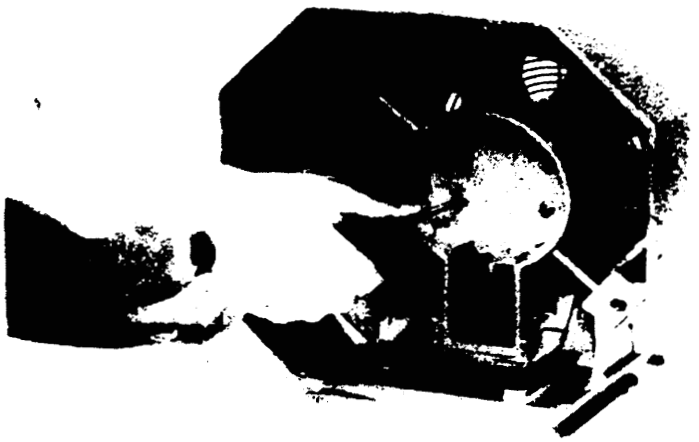
(1) Remove 3 fan case mounting hexagon socket head bolts. Pull back the fan case to remove the fan case together with fan.



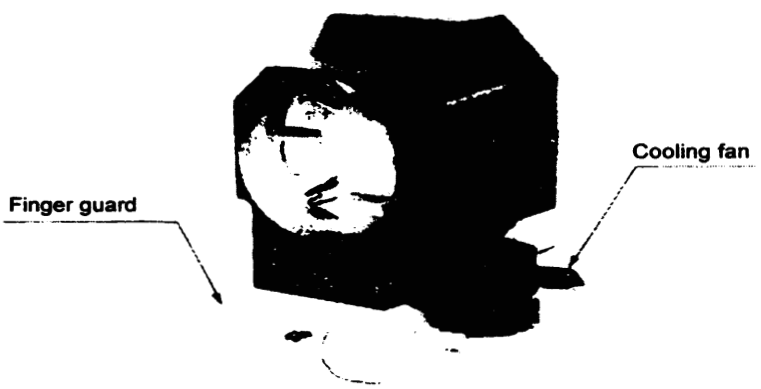
(2) Remove the hexagon socket head bolts fixing the finger guard.



(3) Cut the three cooling fan leads. Remove the pan-head screws fixing the cooling fan and draw out the fan from the fan case.



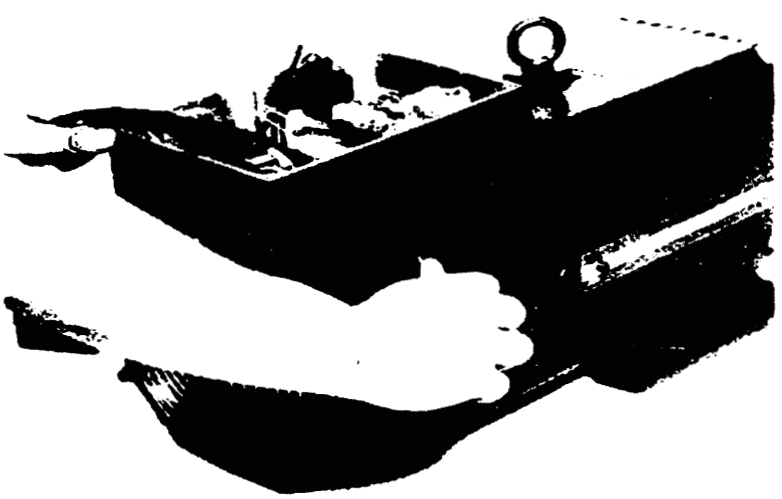
(4) To assemble again, perform the steps in reverse [(3) to (1)].



3 Sensor and sensor gear

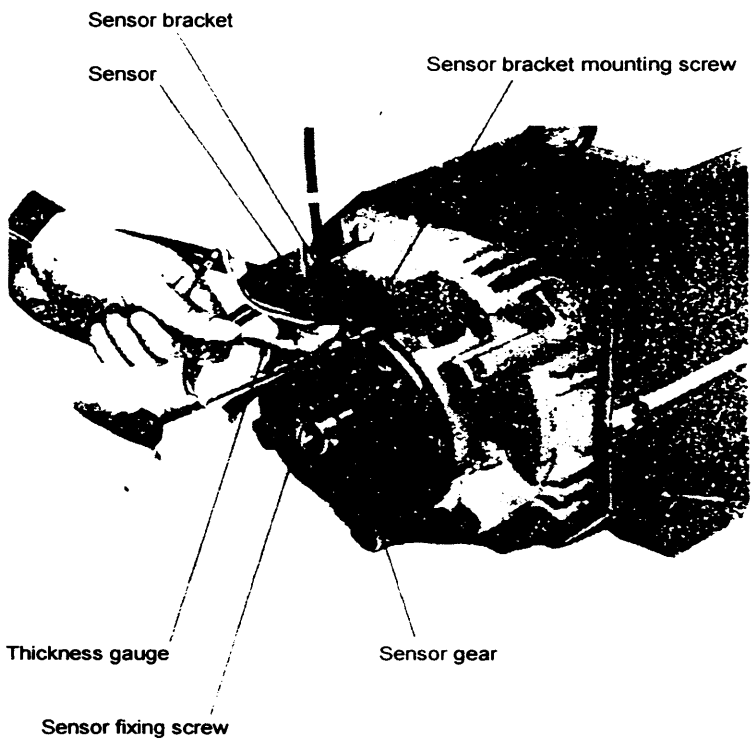
(1) Disengage the sensor connector (internal) from the PCB in the terminal box.

(2) Remove the three fan mounting hexagon socket head bolts. Pull back the fan case to remove the fan case together with fan.



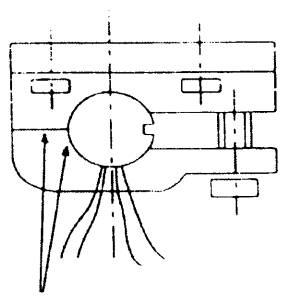
(3) Remove the two pan-head screws fixing the sensor bracket to remove the sensor bracket together with sensor. (Take care to prevent hitting the sensor against the sensor gear.)

(4) To adjust sensor position, loosen the sensor fixing screw with the sensor bracket held in position and insert a thickness gauge into the gap between the sensor and the sensor gear. Adjust the gap to 0.15±0.01. After making sure that the sensor marking lines are aligned with each other, tighten the sensor fixing screw to secure the sensor in position. (Refer to the figure on the right.)



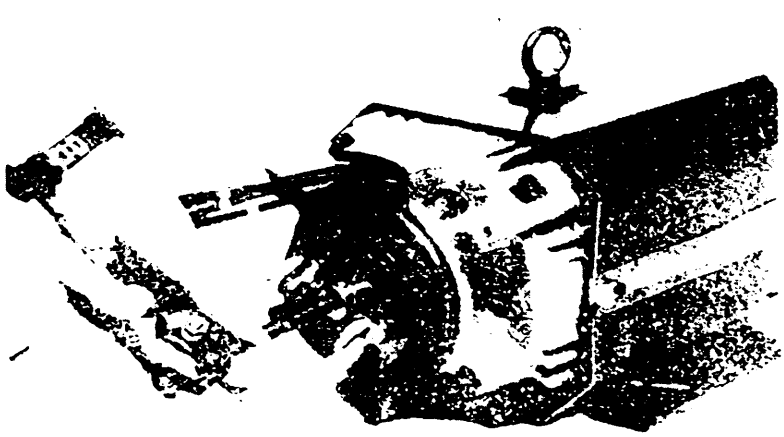
(5) Apply lock paint to the sensor fixing screw and the sensor bracket mounting screws.

(6) When the sensor is put into the fan case, arrange the sensor leads properly to prevent sensor lead from being wedged.



(7) To remove the sensor gear, screw eye bolts (M8) into the screw holes and using a screw removing tool, rotate the bolt with a wrench, etc. Then, remove.

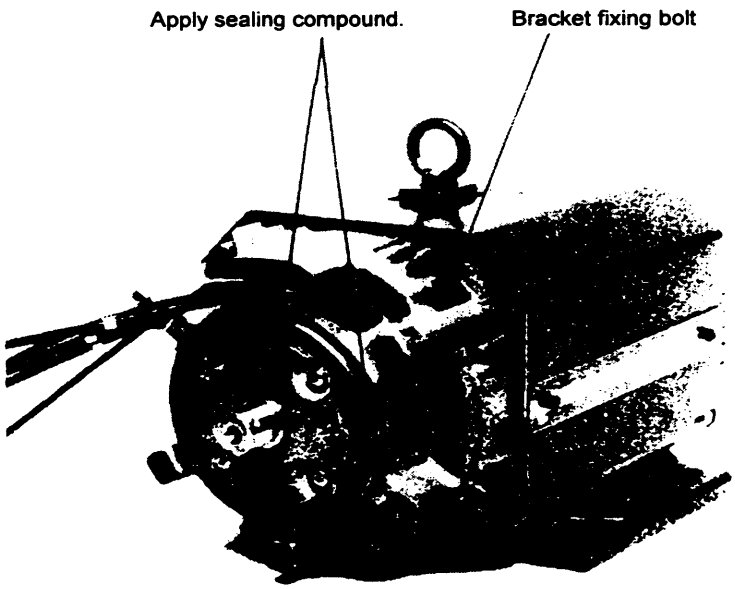
(8) To install the sensor gear again, it must be shrinkage-fit at a temperature within 100°C to 150°C.
Note that an excessively high temperature may cause distortion to the gear.



4 Bearings

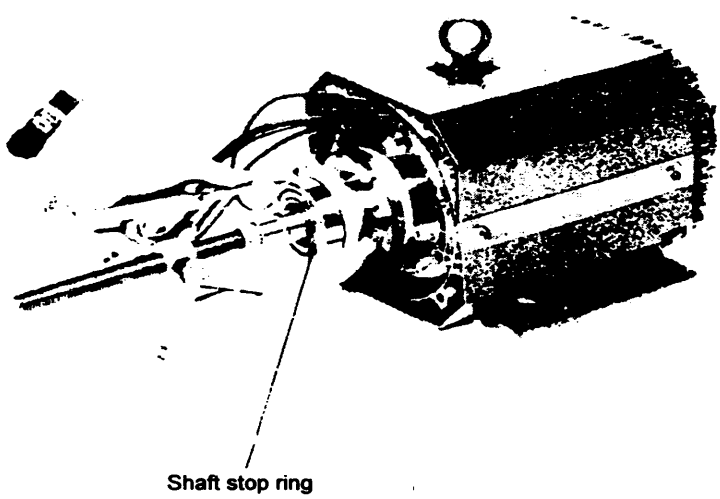
(1) Remove the bearing case cover fixing screws and the bracket fixing hexagon socket head bolts and remove the bracket on the opposite drive side.

(2) When the bracket on the opposite drive side is installed again, apply sealing compound to the fitting surface.



Bearing case cover fixing screw

(3) To remove the bearing on the opposite drive side, remove the shaft stop ring and apply a bearing remover.
The bearing can be removed together with the shaft case cover.

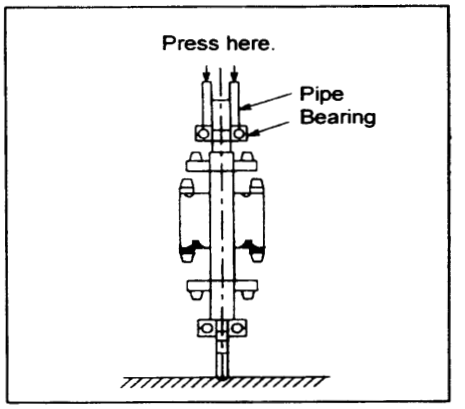


Shaft stop ring

(4) To remove the bearing on the drive side, apply a bearing remover to the inner ring of bearing and turn the handle of bearing remover.

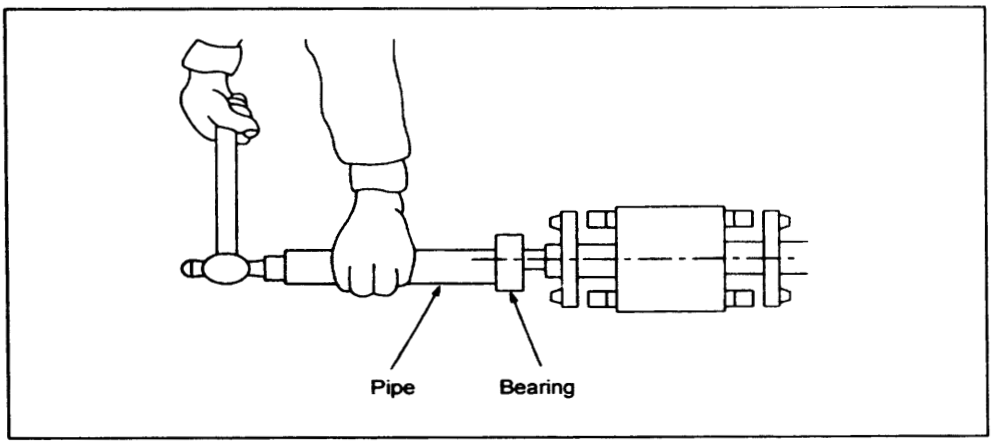
(5) To install bearing onto shaft, all fitting surfaces should be thoroughly cleaned and smoothed.

(6) Apply grease to bearing bore surface and shaft. Put a pipe on the bearing inner ring and carefully depress the bearing with a press machine.



Installation with press machine

(7) If press machine is not available, lightly hammer the pipe to drive. Use care not to hammer the outer ring of bearing.



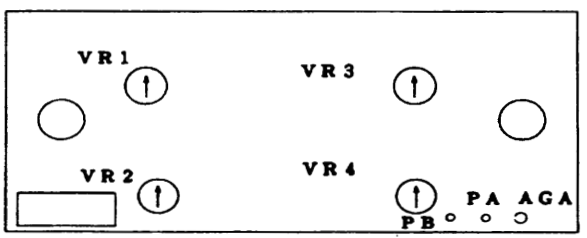
Installation with hammer

<Confirmation of motor built-in encoder (speed detector) waveform>

> The waveform must be confirmed and adjusted before running the motor after disassembly and reassembly.

The explanation here is for the motor without the Z phase. Refer to the separate ADJUSTMENT PROCEDURES (BFN-14052-01) when using the Z phase.

1. PCB volume layout drawing

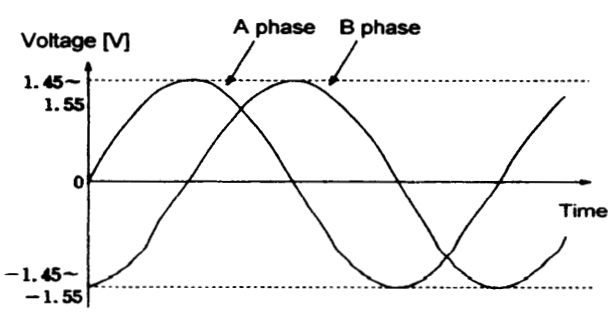


Check terminals
PA : A phase signal
PB : B phase signal
AGA : Ground

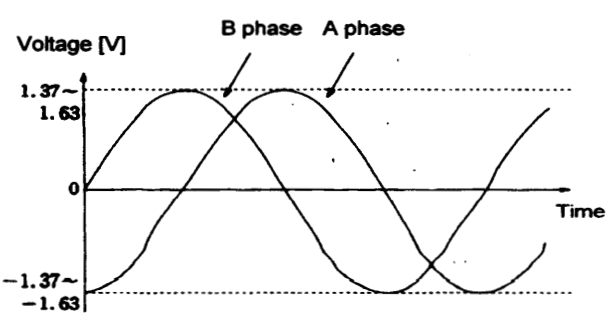
Volume
VR1 : A phase 0 position adjustment
VR2 : A phase gain adjustment
VR3 : B phase 0 position adjustment
VR4 : B phase gain adjustment

2. Confirmation method

(1) Set the spindle parameter SP038 (SFNC6) bit F to "1" and turn the NC power OFF and ON. (Enter the open loop.)
(2) Input the forward run command, and gradually raise the motor speed to 1800rpm.
(3) Measure the A and B phase waveforms with a synchroscope.
(4) Confirm that the waveform is as shown below. If not as shown below, adjust with VR1 to VR4.
(5) If the waveform cannot be adjusted with VR1 to 4, readjust the gap between the sensor and gear teeth.
  1) If voltage level does not decrease below ±1.6V: Increase the gap
  2) If voltage level does not increase above ±1.4V: Decrease the gap
(6) Next, reverse run the motor and measure the waveform at 1800rpm.
(7) Set the SP038 (SFNC6) bit F to "0" after completing the confirmation and adjustments, and turn the NC power OFF and ON.



A phase/B phase output signal waveform during forward run

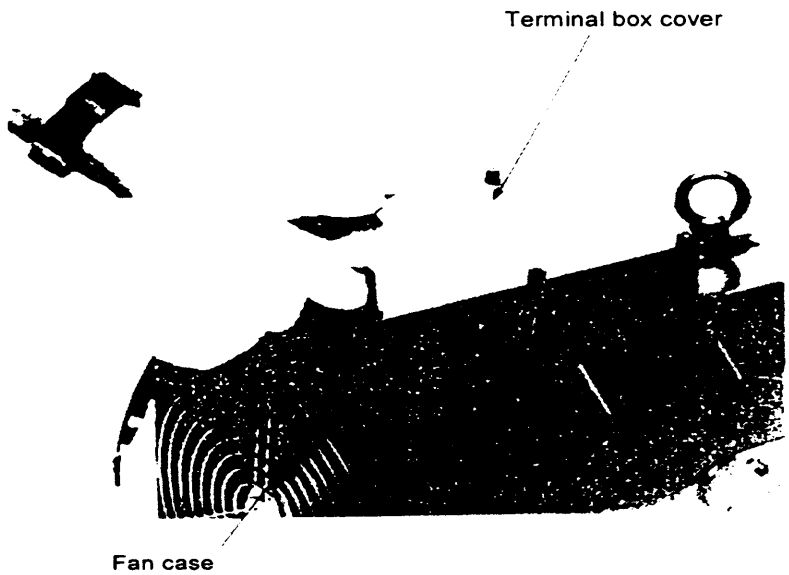


A phase/B phase output signal waveform during reverse run

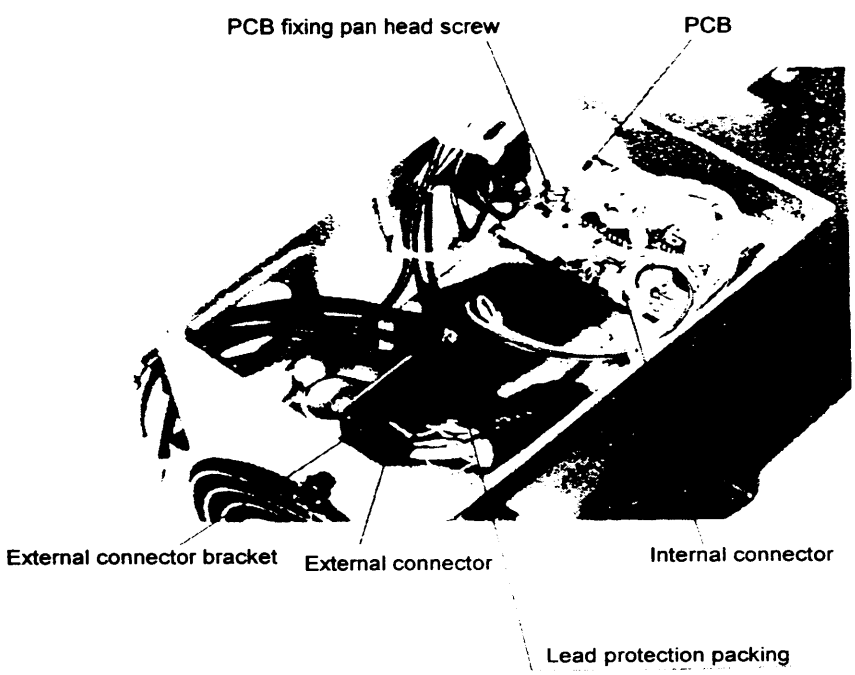
3.2 Disassembly and assembly of SJ-N type AC spindle motor

[1] Cables and PCB

(1) Remove the terminal box cover on the top of the fan case.
(2) Disconnect the cables and leads coming from the power control box.
   a) 3 motor main leads (U, V and W).
   b) 2 cooling fan leads (BU and BV).
   c) 2 thermal protector leads (OHS1 and OHS2).
   d) Mating plug to external connector of PCB.

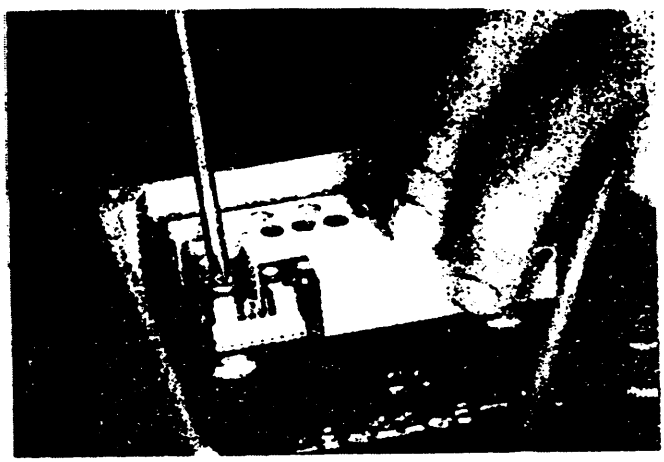


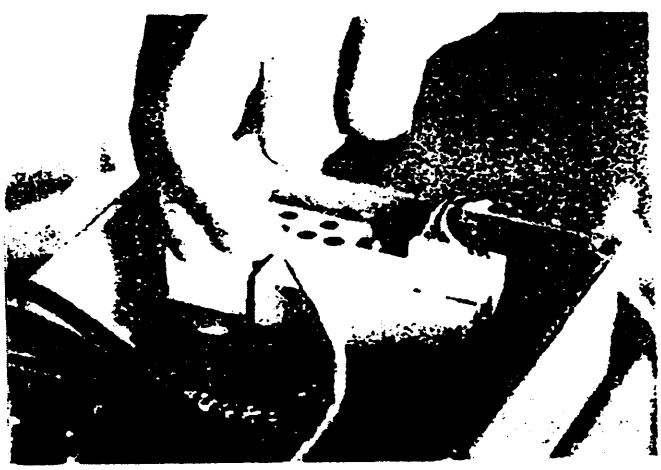
(3) Remove the external connector from the connector bracket. Disengage the internal connector from the socket.
(4) Remove the PCB mounting pan- head screws to remove the PCB.
(5) To assemble, perform the steps in reverse [(1) to (4)]. For details, see (6).

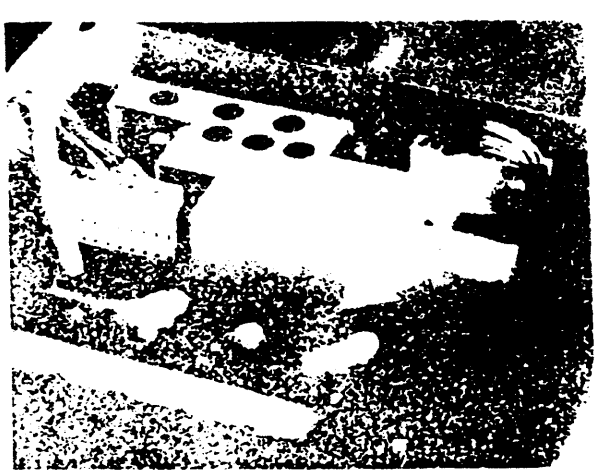


(6) Mounting of the PCB

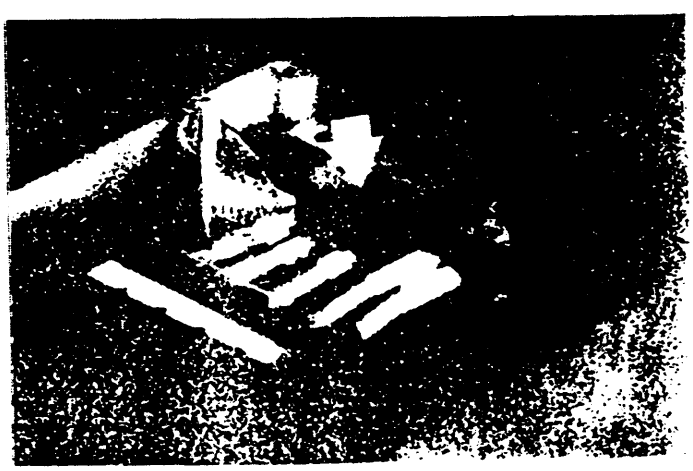
Method:	Fix with two bolts together with the case. Connect the sensor connector.
Caution:	Connect the output cable to the amplifier. Do not allow the motor power cable to contact the bottom of the amplifier.







The motor cable is under the amplifier.



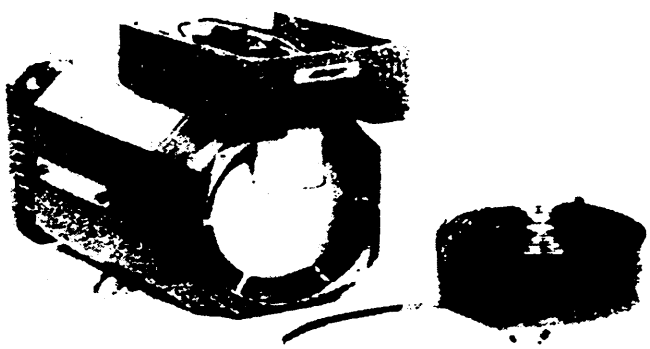
The motor cable protrudes from the amplifier.

2 Cooling fan

For frame No. 90

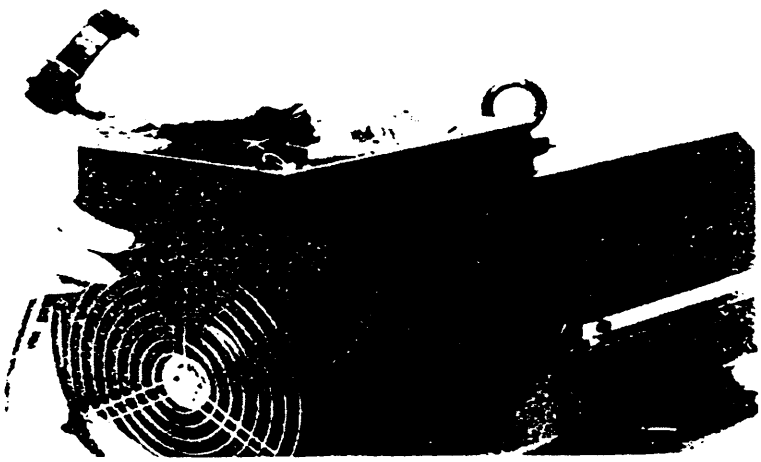
(1) Remove two hexagon socket head bolts used to secure the cooling fan.
The cooling fan can be removed from the fan case assembled with finger guard.

(2) To reassemble, perform step (1) in the reverse order.

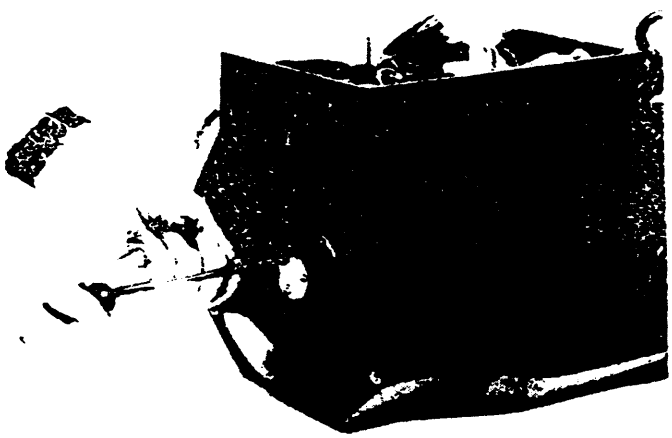


For frame No.112

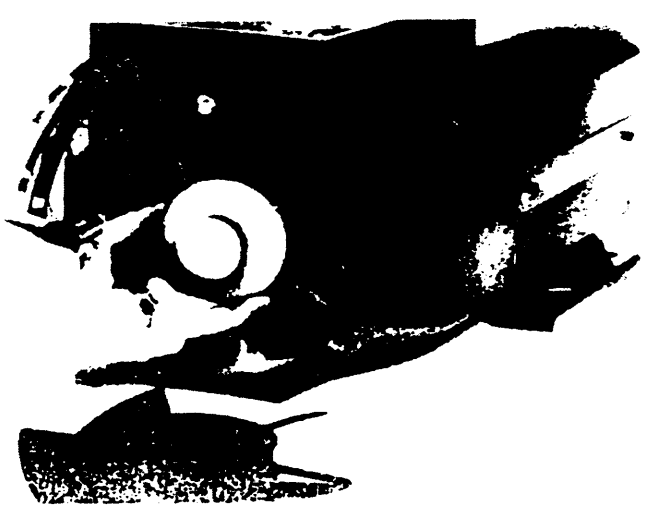
(1) Remove the hexagon socket head bolts used to secure the finger guard.



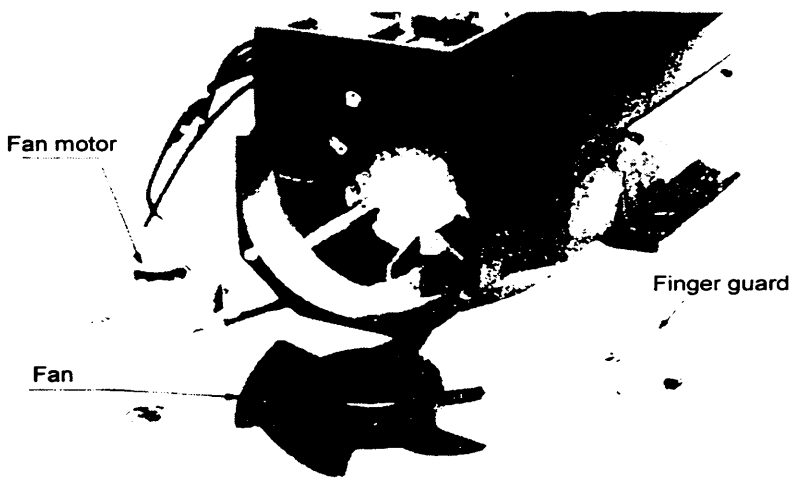
(2) Remove the pan-head screws at the center of the cooling fan to remove the fan.



(3) Cut the four fan leads of the cooling fan which are connected inside the terminal box.
Remove the pan-head screws used to mount the fan motor assembly and draw out the fan motor from the fan case.



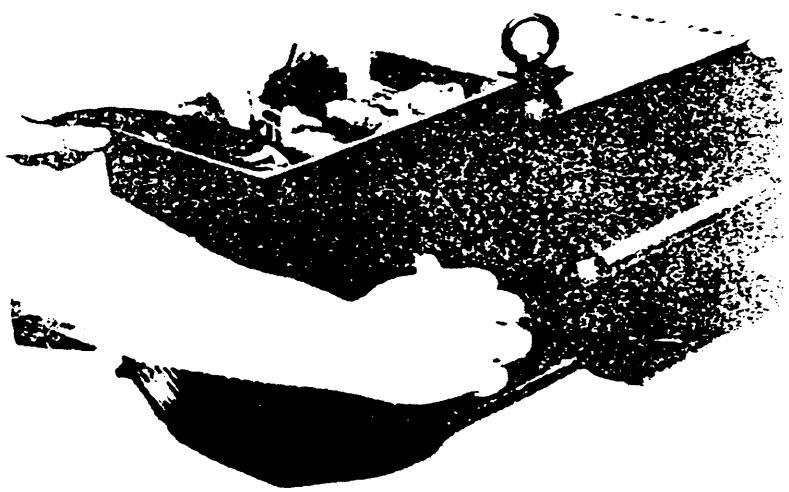
(4) To reassemble, perform steps (1) to (3) in the reverse order.



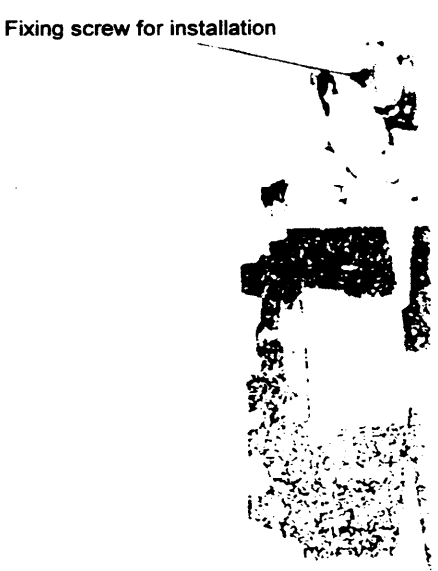
3 Sensor and detection drum

(1) Disengage the sensor connector (internal) from the PCB in the terminal box.

(2) Remove the three fan case fixing hexagon socket head screws.
Pull back the fan case to remove the fan case together with the cooling fan.



(3) Remove two pan-head screws used to fix the sensor bracket and the sensor bracket can be removed together with sensor. (Take care to prevent hitting the sensor against the detection drum).



(4) Mounting the sensor

Conditions:
Position with the sensor V-type base side and the motor base positioning ring protrusion.

Preparation:
Clean (air blow) the sensor block mounting face (motor base) and the sensor V-type base side.

Method:
Lightly fix the sensor block with bolts (so that the block can be moved.) Tighten the bolt so that the sensor block is pressed against the mounting face and so that the V-type base side contacts the motor base positioning ring as shown in the figure.

Caution:
Take care so that the sensor base does not slip from the tightening of the bolts.
Do not apply strength to the flexible plate.

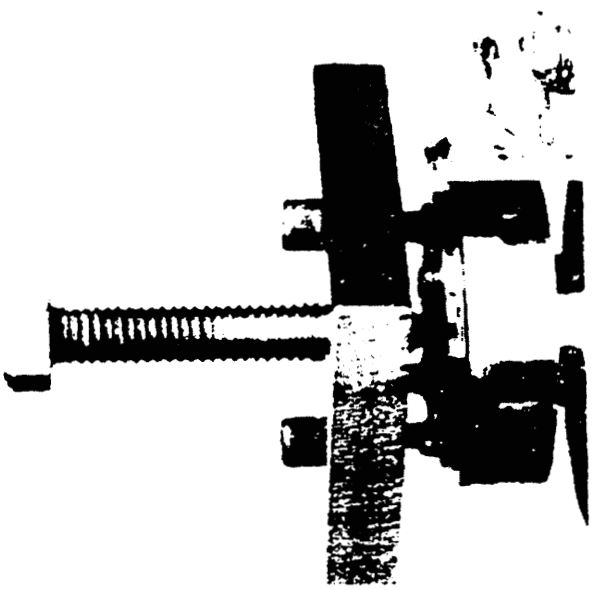
(5) Apply lock paint to the sensor fixing screw and the sensor bracket fixing screws.

(6) When the sensor is put into the fan case, arrange the sensor leads properly inside the terminal box to prevent sensor lead from being wedged.

(7) Removal of the drum

Method:	Forcibly pull out with the removal jig.
Caution:	The removed drum cannot be reused.

To remove the detection drum, an eye bolt is screwed into the screw hole (M8 screw), and the removing bolt is removed using a remover while turning with a spanner, etc.



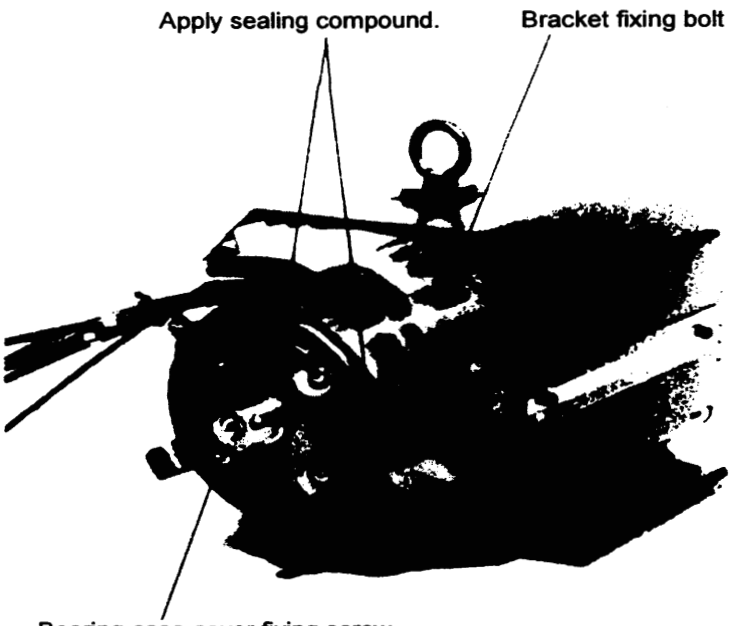
(8) Installation of the drum

Condition:	Heat fitting (heated temperature: below 150°C)
Method:	Confirm that the drum is at the specified temperature. Hold the drum with leather gloved hands and quickly insert it.
Caution:	There must not be a magnetic field of over 50G inside the heating device. Cotton gloves will slip.
Confirmation:	Is the drum completely inserted?

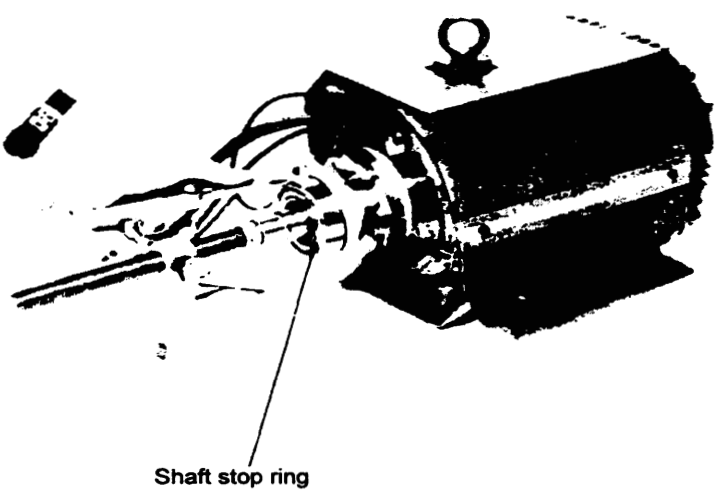
4 Bearings

(1) Remove the bearing case cover fixing screws and the bracket fixing hexagon socket head bolts and remove the bracket on the opposite drive side.

(2) When the bracket on the opposite drive side is installed again, apply a sealing compound to the fitting surfaces.



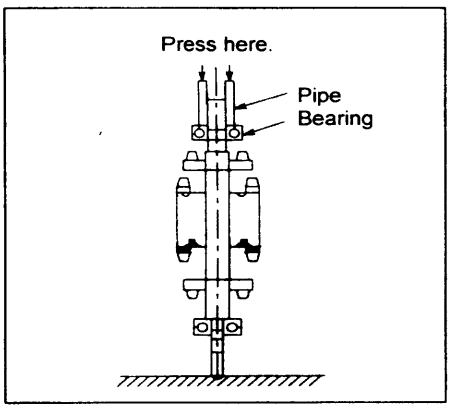
(3) To remove the bearing on the opposite drive side, remove the C type shaft stop ring and apply a bearing remover.
Turn the removing bolt with spanner and the bearing can be removed together with the shaft case cover.



(4) To remove the bearing on the drive side, apply a bearing remover to the inner ring of bearing and turn the handle of bearing remover.

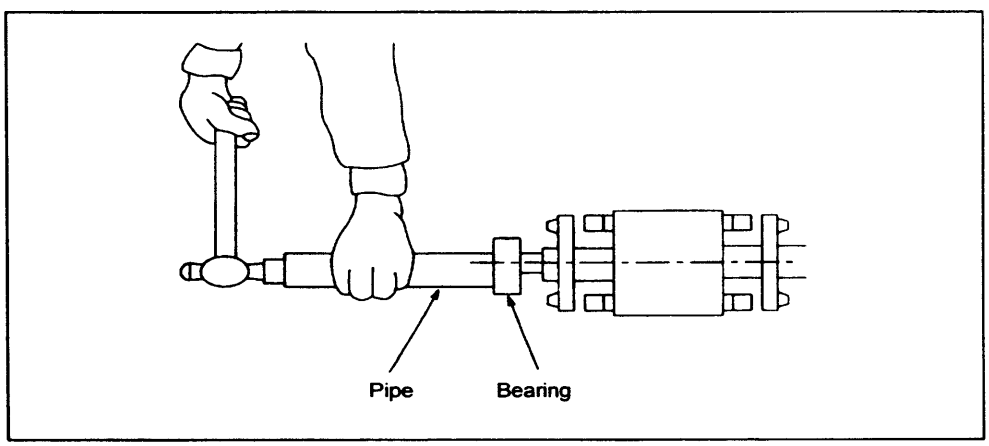
(5) To install the bearing onto the shaft, all fitting surfaces should be thoroughly cleaned and smoothed.

(6) Apply grease to bearing bore surface and shaft. Put a pipe on the bearing inner ring and carefully depress the bearing with a press machine.



Installation with press machine

(7) If press machine is not available, lightly hammer the pipe to drive the bearing in. Use care not to hammer the outer ring of the bearing.



Installation with hammer

4. Installation of Orientation Position Detector

4.1 Magnesensor 1-point orientation

4.1.1 Magnet and sensor

The sensor generates two types of voltage signals as shown in Fig. 6.1.

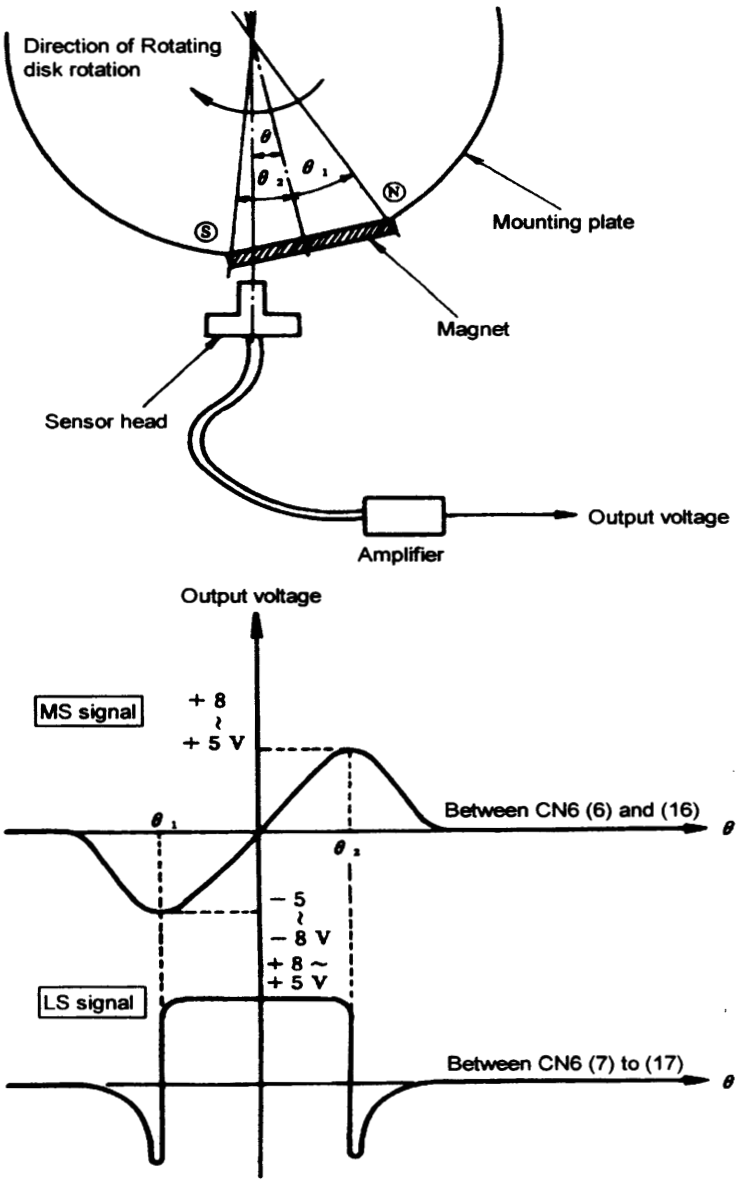


Fig. 6.1 Sensor Output Voltage

MS signal : Signal voltage output is 0V when the center of magnet comes to the sensor head, and maximum at both ends of the magnet.
Spindle is stopped with this signal at 0V.
(Note that the target voltage will fluctuate a max. of ± 2.5V depending on the position shift setting.)

LS signal : Signal voltage is constant within the magnet zone (width).
This signal is used to verify that spindle remains stopped within the magnet zone.

4.1.2 Orientation of magnet and sensor head

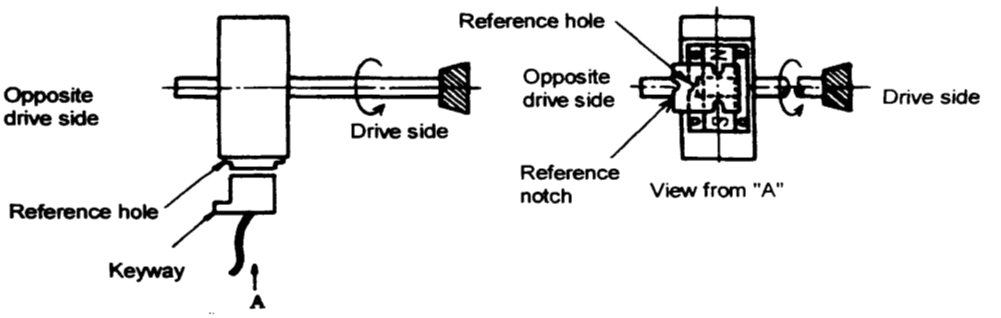
The magnet and sensor head should be installed in the specified orientation.

Standard type
High speed standard type
..... The center reference hole of magnet and the reference notch of sensor head should come to the same side.
Refer to [CASE 1], [CASE 2], [CASE 3] and [UNACCEPTABLE EXAMPLE 1].

High speed miniature type
..... The reference notch of sensor head should be positioned in reference with polarity (N, S) of magnet.
Refer to [CASE 4], [CASE 5] and [UNACCEPTABLE EXAMPLE 2].

High speed ring type
..... The reference notch of sensor head should be positioned in reference with polarity (N, S) of magnet.
Refer to [CASE 6], [CASE 7] and [UNACCEPTABLE EXAMPLE 3].

[CASE 1] Magnet is installed on the circumferential surface of rotating disk.
(Circumferential mounting)
The center reference hole of magnet and the reference notch of sensor head should come to the opposite drive side of the spindle, as shown below.

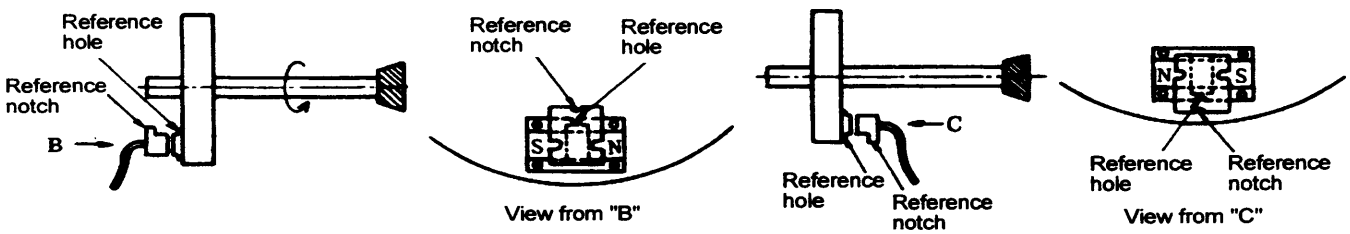


Magnet is installed on circumferential surface of rotating disk.

CASE 2 Magnet is installed on the front or back flat surface of rotating disk.
(Flat mounting)

(1) When the magnet is installed on the opposite drive side of spindle, the reference hole of magnet and reference notch of sensor head should face inward, as shown below.

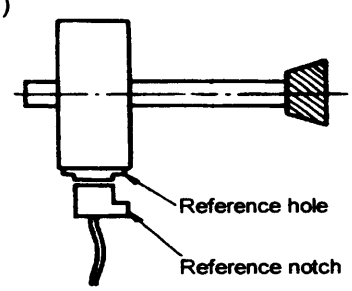
(2) When the magnet is installed on the drive side of spindle, the reference hole of magnet and reference notch of sensor head should face outward, as shown below.



Magnet is installed on the opposite drive side.

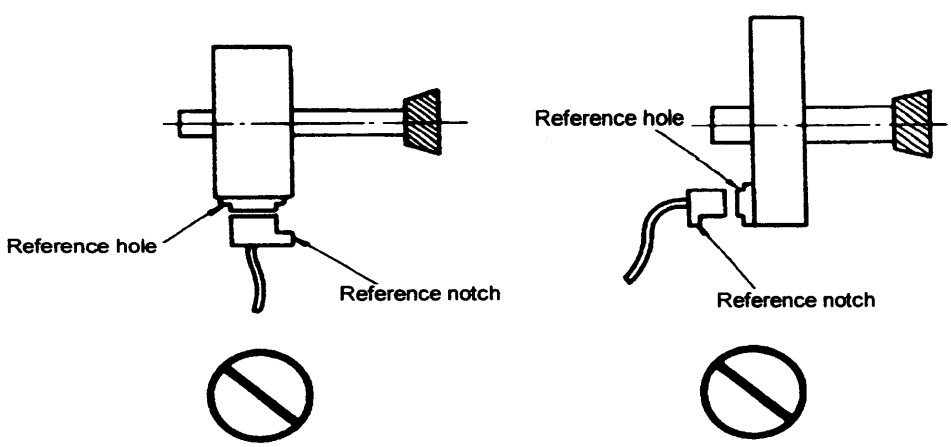
Magnet is installed on the drive side.

CASE 3 In regard to CASE 1 , the magnet and sensor head can be changed to the following position as long as the reference hole and reference notch are aligned. With this, normal orientation can be carried out.
(However, the parameter SP097 SPEC0 magnesensor detection polarity bit must be changed in this case.)



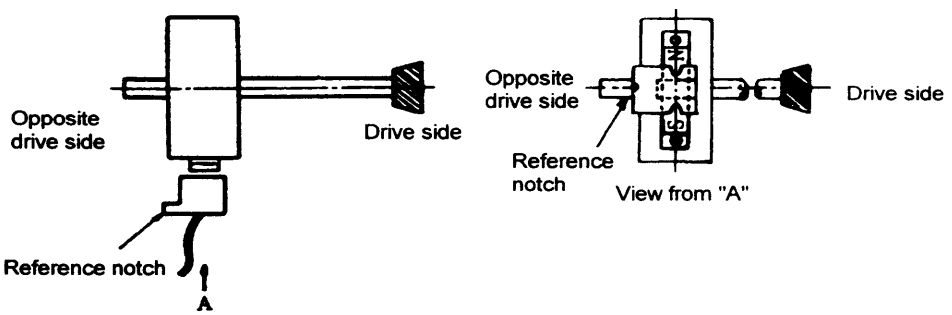
UNACCEPTABLE EXAMPLE 1

If the magnet reference hole and sensor head reference notch are not aligned, intense vibration will occur when the sensor head is at end of magnet (orientation is impossible.)



CASE 4 Magnet is installed on the circumferential surface of rotating disk.

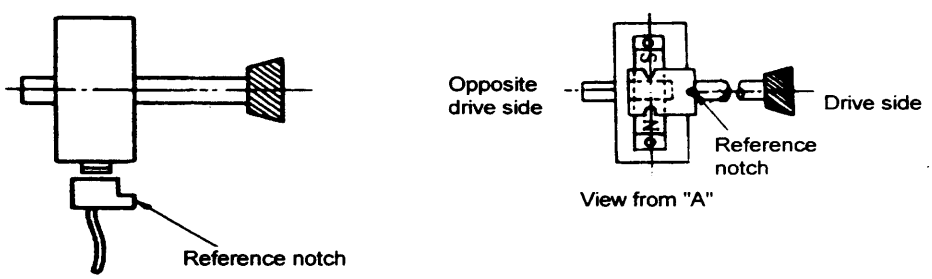
(Circumferential mounting)
The sensor head reference notch should be on the opposite drive side and the magnet should be installed in the polarity shown below.



Magnet is installed on the circumferential surface of rotating disk.

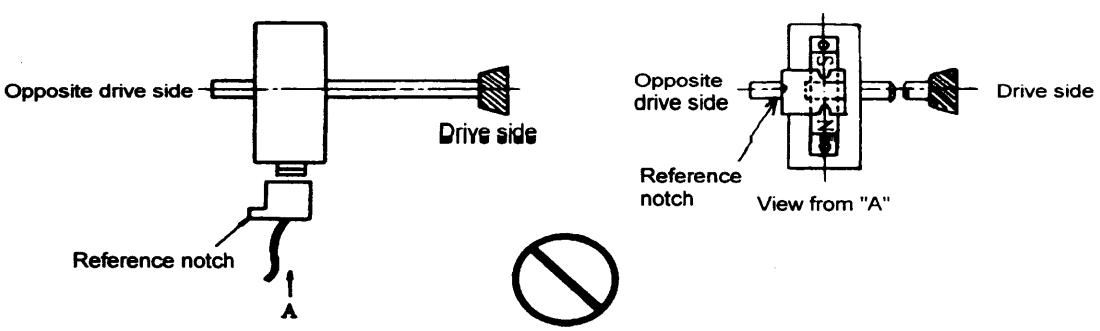
CASE 5 As long as the relation between location of the sensor head reference notch and the polarity of the magnet are aligned, the sensor head and the magnet can be installed as shown below in CASE 4 , and normal orientation can be carried out.

(However, the parameter SP097 SPEC0 magnesensor detection polarity bit must be changed in this case.)



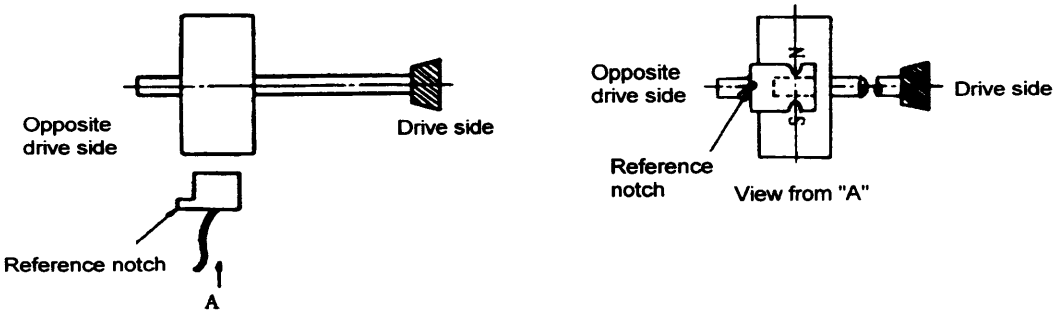
UNACCEPTABLE EXAMPLE 2

If the sensor head reference notch is not aligned properly in reference to polarity of the magnet, intense vibration occurs when the sensor head is at the end of the magnet, and orientation is impossible.

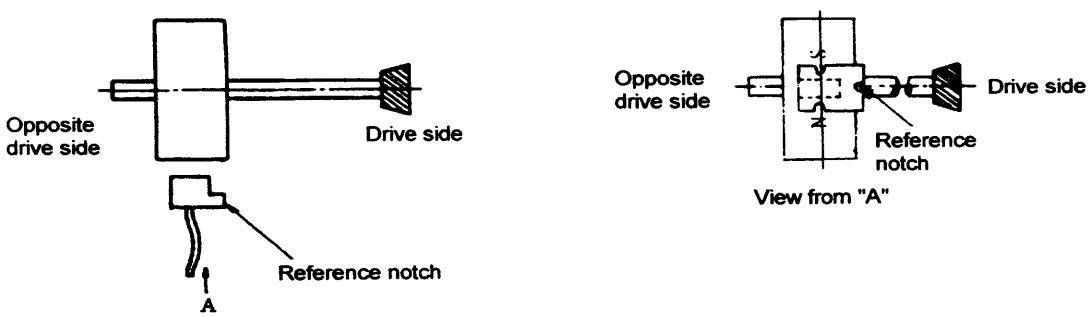


In this example, polarity (N, S) of magnet is inverse to that in CASE 4 .

CASE 6 The sensor head reference notch is on the opposite drive side of spindle and the polarity of the magnet is as shown below.

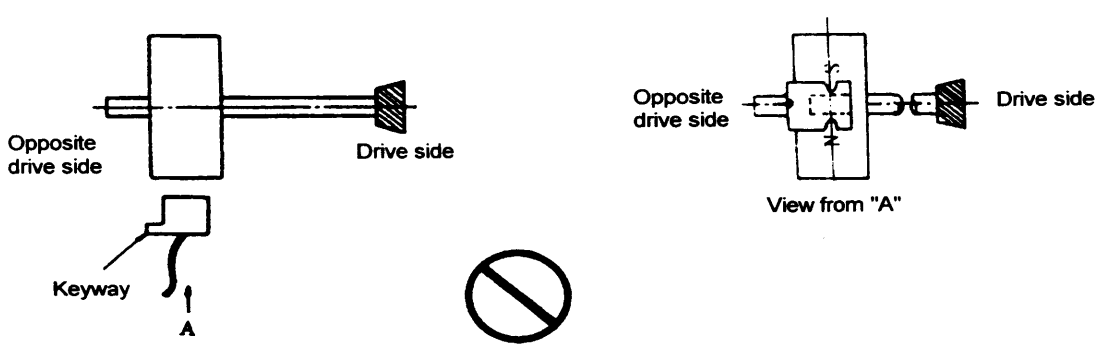


CASE 7 As long as the relation between location of sensor head reference notch and the polarity of the magnet are aligned, the sensor head and the magnet can be installed as shown below in CASE 4, and normal orientation can be carried out.
(However, the parameter SP097 SPEC0 magnesensor detection polarity bit must be changed in this case.)



UNACCEPTABLE EXAMPLE 3

If the sensor head reference notch is not aligned properly in reference to polarity of the magnet, intense vibration occurs when the sensor head is at the end of the magnet, and orientation is impossible.



In this example, polarity (N, S) of magnet is inverse to that in CASE 4 .

4.1.3 Caution on installation of magnet

When the magnet is installed to the spindle, pay attention to the following:

(1) Do not place a strong magnetic source near the magnet.
(2) Carefully handle the magnet, avoiding mechanical shock to the magnet.
(3) Secure the magnet to the spindle with appropriate screws.
For appropriate screws, refer to the drawing showing the outside view of magnet in the Page IV-69.
(4) After the magnet is installed, balance the entire spindle.
(5) Align the center of the magnet (between N and S) with the center line of the rotating disk and make sure the orientation of the magnet and sensor head is as indicated in 4.1.2 [CASE 1] to [CASE 7] (Page IV-60 to IV-63).
(6) Keep the magnet clean and keep the peripherals free of iron particles and cut chips (iron particles may cause malfunction).
(7) Apply lock paint etc. to prevent mounting screw from becoming loose.
(8) If the magnet is installed on a ground rotation disk, demagnetize the disk.
(9) Diameter of rotating disk on which the magnet (other than ring type) is installed should be within the range from 80mm to 120mm.
(10) If speed of the spindle exceeds 6000rpm, use a high speed type, high speed miniature type or high speed ring type magnet.
(11) For details of high speed ring type magnet, refer to the relevant description in the Page IV-69.

4.1.4 Caution on installation of sensor head

When the sensor is installed, pay attention to the following:

(1) Install the sensor head in accordance with 4.1.2 [CASE 1] to [CASE 7] (Page IV-60 to IV-63).
(2) Align the center line of the sensor head with the center of magnet.
(3) The gap between the magnet and the sensor head are listed in Table 1 to Table 3.
- When a standard type magnet is installed in accordance with [CASE 1] or [CASE 3], refer to Table 1.
- When a high speed standard magnet is installed in accordance with [CASE 1] or [CASE 3], refer to Table 1.
- When a standard magnet is installed in accordance with [CASE 2], refer to Table 2.
- When a high speed standard magnet is installed in accordance with [CASE 2], refer to Table 2.
- When a high speed miniature magnet is installed in accordance with [CASE 1] or [CASE 3], refer to Table 3.

For high speed ring type magnet, refer to the outside view in the Page IV-69.
* When magnets are mass-produced, it is recommended to prepare jigs for production.

(4) For connector used in the amplifier, BKO-C1810 type is oil-proof, but BKO-C1730 is not. It is recommended to place the connector in an oil-free location.
(5) The cable between the amplifier and the controller should be laid down away from high voltage cables.
(6) Check the connector wiring, securely engage the receptacle and tighten connector lock screws.

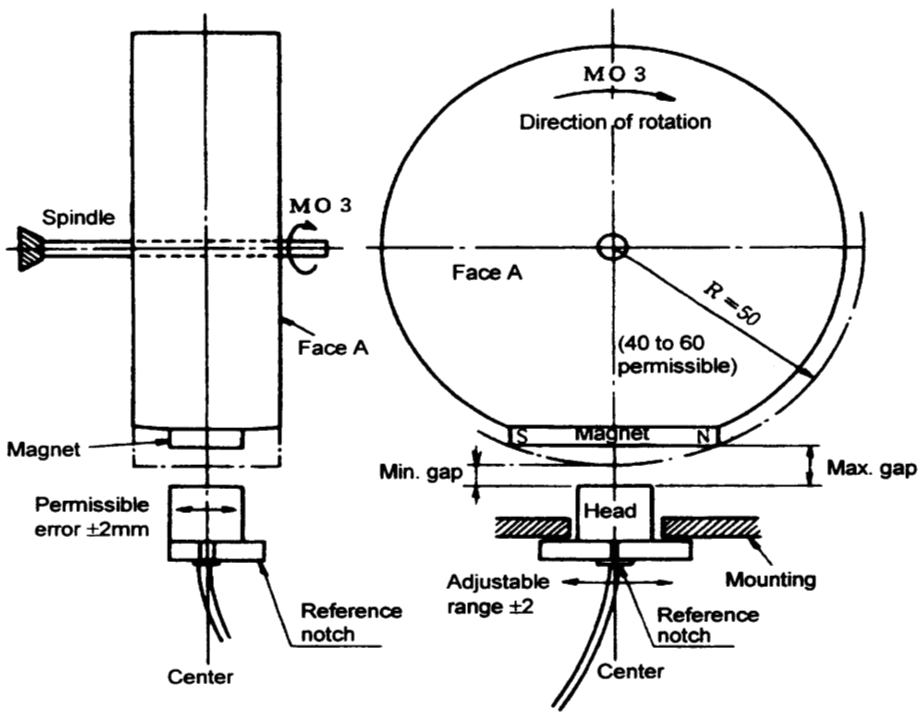


Table 1

	BKO-C1810H03 Standard		BKO-C1730H06 High speed standard	
Radius (R) mm	**Max. gap mm**	**Min. gap mm**	**Max. gap mm**	**Min. gap mm**
40	11.5 ± 0.5	2.7 ± 0.5	10 ± 0.5	1.22 ± 0.5
50	9.5 ± 0.5	2.8 ± 0.5	8 ± 0.5	1.31 ± 0.5
60	8.5 ± 0.5	3.0 ± 0.5	7 ± 0.5	1.5 ± 0.5
70	8.0 ± 0.5	3.4 ± 0.5	7 ± 0.5	2.38 ± 0.5

Table 2

	BKO-C1810H03 Standard	BKO-C1730H06 High speed standard
Radius (R) mm	**Gap mm**	**Gap mm**
40	6 ± 0.5	5 ± 0.5
50	6 ± 0.5	5 ± 0.5
60	6 ± 0.5	5 ± 0.5

Table 3

	BKO-C1730H09 High speed miniature	
Radius (R) mm	**Max. gap mm**	**Min. gap mm**
40	6.25 ± 0.5	3.3 ± 0.5
50	6.0 ± 0.5	3.7 ± 0.5
60	5.75 ± 0.5	3.85 ± 0.5
70	5.5 ± 0.5	3.87 ± 0.5

4.1.5 Types and outside dimensions of magnesensor

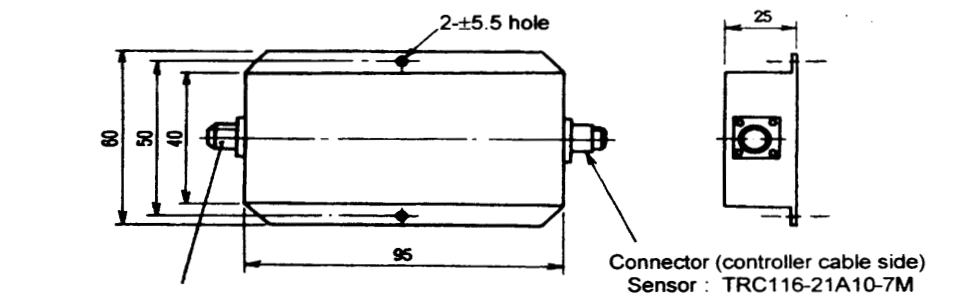
For oriented spindle stop, the following combinations of amplifier, sensor and magnet are available.

Type	Permissible speed [RPM]	Model	Combination		
			Amplifier	Sensor	Magnet
Standard	0 to 6000	MAGSENSOR BKO-C1810H01-3	H01	H02	H03
High-speed standard	0 to 12000	MAGSENSOR BKO-C1730H01.2.6	H01	H02	H06
High-speed miniature	0 to 12000	MAGSENSOR BKO-C1730H01.2.9	H01	H02	H09
High-speed ring	0 to 25000	MAGSENSOR BKO-C1730H01.2.11	H01	H02	H41
High-speed ring	0 to 25000	MAGSENSOR BKO-C1730H01.2.12	H01	H02	H42
High-speed ring	0 to 30000	MAGSENSOR BKO-C1730H01.2.13	H01	H02	H43
High-speed ring	0 to 30000	MAGSENSOR BKO-C1730H01.2.14	H01	H02	H44

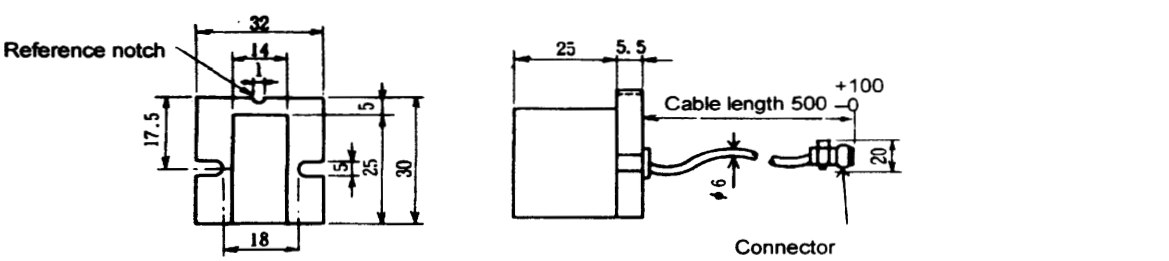
Note: Combination of amplifier, sensor and magnet is possible within the same model group (C1810 or C1730).

Outside dimensions:

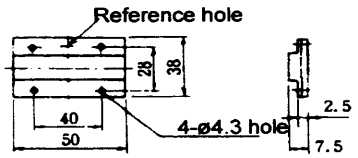
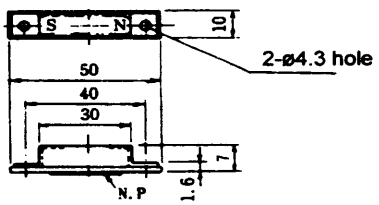
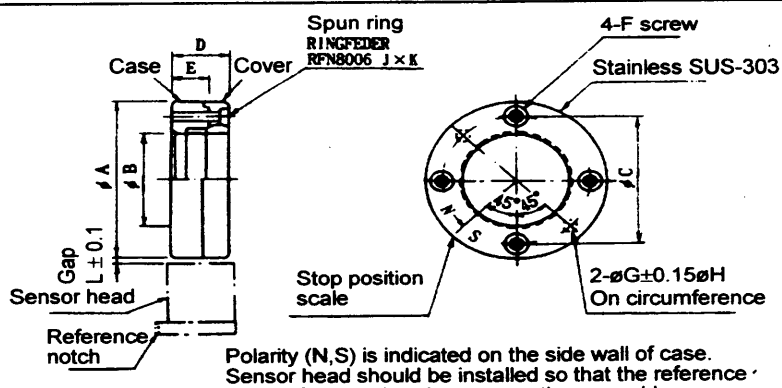
- **Amplifier H01**



- **Sensor H02**



● Magnet

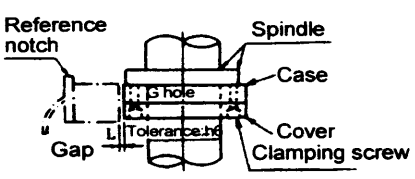
Part No.	Permissible speed [RPM]	Outline drawing
H03	0 to 6000	 Weight: 40± 1.5g Mounting screw : M4 screw
H06	0 to 12000	
H09	0 to 12000	 Weight: 14.8± 0.7g Mounting screw : M4 screw
H41	0 to 25000	
H42	0 to 25000	
H43	0 to 30000	
H44	0 to 30000	

Polarity (N,S) is indicated on the side wall of case.
Sensor head should be installed so that the reference notch of sensor head comes on the case side.
Refer to page 82 and following for details.

Magnet

Unit: mm

Type	Dimensions										
	A	B	C	D	E	F	G	H	J x X	L	Weight(g)
BKO-C1730H11	105	70H7+0.030 –0	90	28	19	M6×1.0	5	90	70×79	1	1024±4
BKO-C1730H12	94	60H7+0.030 –0	79	25	17	M5×0.8	5	79	60×68	1	768±4
BKO-C1730H13	78	50H7+0.025 –0	66	23	15	M5×0.8	5	66	50×57	1	478±4
BKO-C1730H14	66	40H7+0.025 –0	54	20	13	M4×0.7	5	54	40×45	1	322±4



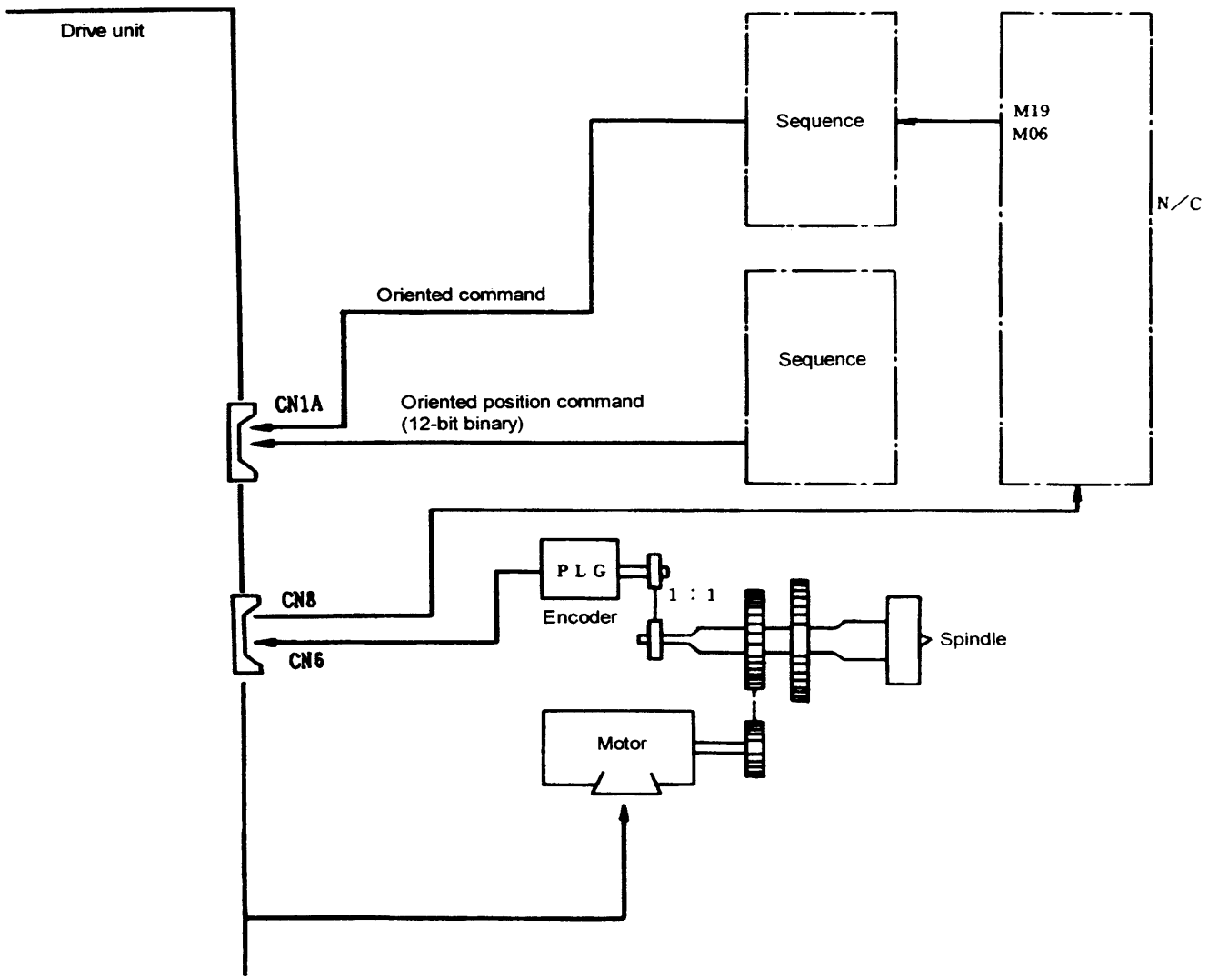
Installation of magnet

Caution on installation of H41~44

1. Tolerance to shaft dimension should be "h6".
2. 2-øG holes can be used for positioning of spindle and magnet.
3. Magnet shall be installed as shown to the left.
4. Misalignment between sensor head and magnet center line shall be within ±2mm.
5. NS is indicated on the cover sides. Assemble so that the sensor head's reference groove comes to the case side.

4.2 Encoder orientation (4096 points)

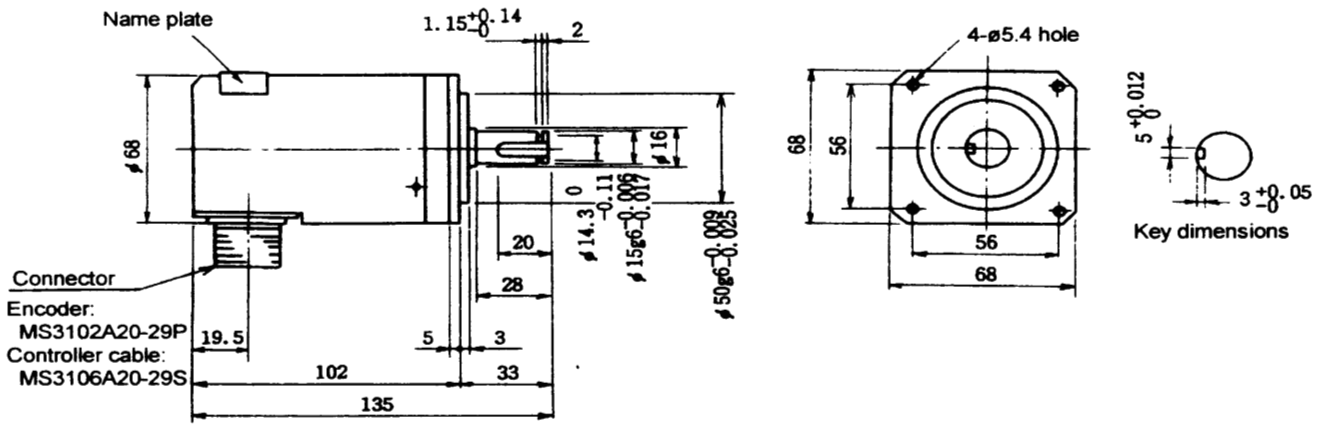
4.2.1 Configuration



Note
If vibration occurs during orientation before the orientation complete signal is received, change the parameter SP097 (SPEC0) encoder detector polarity bit.

4.2.2 Outside dimensions

	Encoder model	Tolerable rotation
Encoder (1024P/rev)	RFH-1024-22-1M-68	6000 rpm
	RFH-1024-22-1M-68-8	8000 rpm



Unit: mm

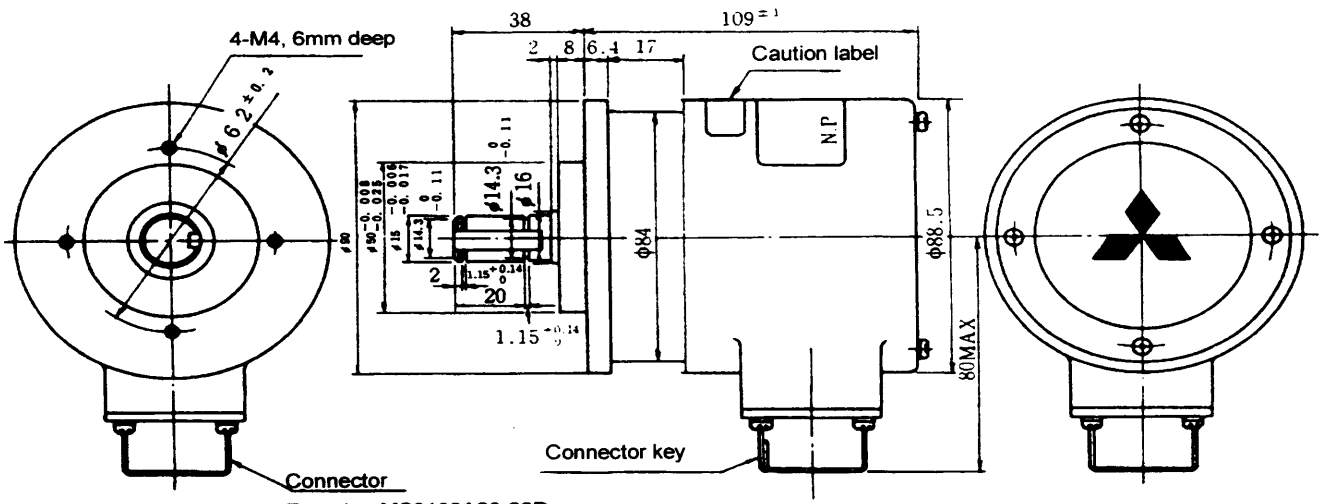
A	1chA	K	0V
B	2chZ	L	
C	1chB	M	
D		N	1ch$\overline{A}$
E	Case earth	P	2ch$\overline{Z}$
F		R	1ch$\overline{B}$
G		S	
H	+5V	T	
J			

5. Contour Control (C-axis Control) Encoder

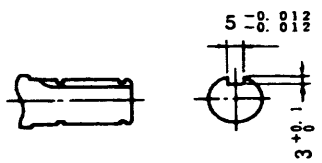
5.1 Separate stand-type encoder

5.1.1 Name : OSE90K+1024 BKO-NC6336H01

5.1.2 Outside dimensions



Encoder: MS3102A20-29P
Controller cable: MS3106A20-29S (user should prepare this connector)



Detailed view of shaft end

Note 1. The max. encoder speed must be set to 6,000rpm or less.
Note 2. The dimensional tolerances that are not indicated are +0.5mm.

5.1.3 Connectors

(1) Connector side: MS3102A20-29P Controller cable side: MS3106A20-29S

(2) Connection (Not supplied)

	Signal output	Remarks
1ch	1024 C/T	A • B phase $\overline{A}$ • $\overline{B}$ phase
2ch	1 C/T	Z phase • $\overline{Z}$ phase
3ch	90000 C/T	C • D phase $\overline{C}$ • $\overline{D}$ phase
4ch	1 C/T	Y phase • $\overline{Y}$ phase

Pin	Function
A	1ch A phase
B	2ch Z phase
C	1ch B phase
D	——
E	Case GND
F	3ch C phase
G	3ch D phase
H	DS +5V$^{+5\%}_{-10\%}$
J	0V

Pin	Function
K	0V
L	3ch $\overline{C}$ phase
M	3ch $\overline{D}$ phase
N	1ch $\overline{A}$ phase
P	2ch $\overline{Z}$ phase
R	1ch $\overline{B}$ phase
S	4ch Y phase
T	4ch $\overline{Y}$ phase

Admitted electrical speed is 166 rpm for signal in 3 channel (C, D phases, $\overline{C}$, $\overline{D}$ phases)

5.1.4 Mechanical specifications

(1) Rotational characteristics

a. Inertia : Max. 100 g-cm^2
b. Shaft frictional torque : Max. 1 kg-cm
c. Shaft angular acceleration : Max. 10^5 rad/sec^2
d. Permissible max. speed : 7,030 rpm

(2) Mechanical construction

a. Bearing : Reoiling is not required for 100,000 hr of operation at 2,000 rpm, and 20,000 hr of operation at 6,000 rpm.
b. Shaft runout : Max. 0.02mm at 15mm from shaft end
c. Permissible load : 10 kg (5 kg during operation) in thrust direction
20 kg (10 kg during operation) in radial direction
d. Weight : Max. 2 kg
e. Error in perpendicularity of flange surface against shaft : Max. 0.05 mm
f. Eccentricity in flange engagement : Max. 0.05 mm

(3) Environment

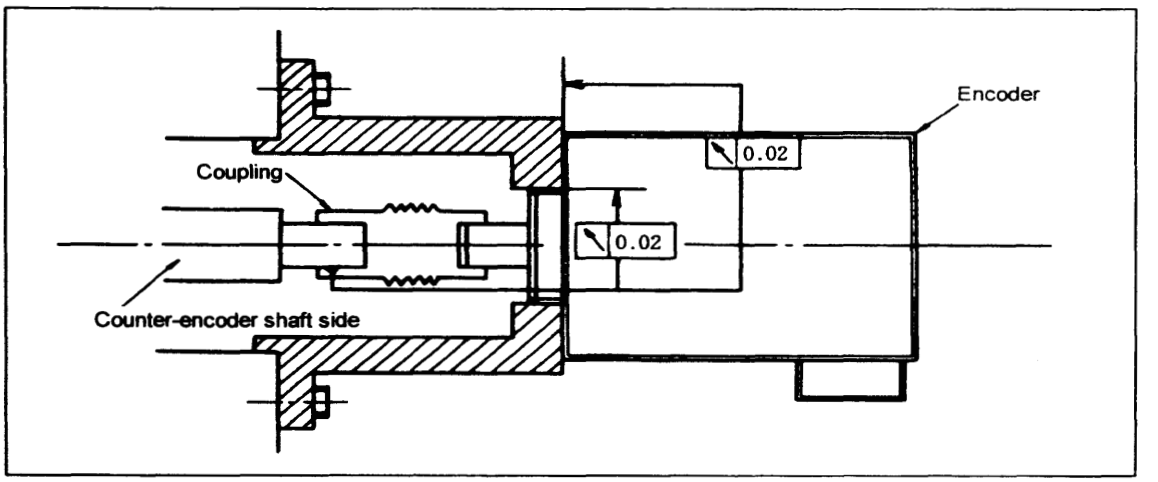
a. Operating temperature range : –5°C +55°C
b. Storage temperature range : –20°C +85°C
c. Humidity : 95%PH (at 45°C) for 8 hours
d. Vibration : 5 to 50 Hz, 1.5 mm full amplitude, 30 min. for each axis
e. Mechanical impact : 30G, 11 msec., 10 times for each axis

5.1.5 Handling, installation and operation of encoder

1. Installation of encoder

It is recommended that flexible coupling be used to connect the encoder to the spindle shaft to secure the encoder life and performance.

(1) Installation accuracy
Runout and misalignment in encoder connection should be within the following accuracy.



(2) Recommended coupling

		Example 1	Example 2
Manufacturer		TOKUSHU SEIKO	EAGLE
Model		Model M1	FCS38A
Resonance frequency		1,374 Hz	3,515 Hz
Error in position detection		0.8×10^{-3} deg.	1.2×10^{-3} deg.
Permissible speed		20,000 rpm	10,000 rpm
Misalignment	Eccentricity	0.7 mm	0.16 mm
	Angular displacement	1.5 deg.	1.5 deg.
Outside dimensions	Max. length	74.5 mm	33 mm
	Max. diameter	ø57 mm	ø38 mm

For details, refer to the relevant catalog.

2. Cable

⚠ CAUTION

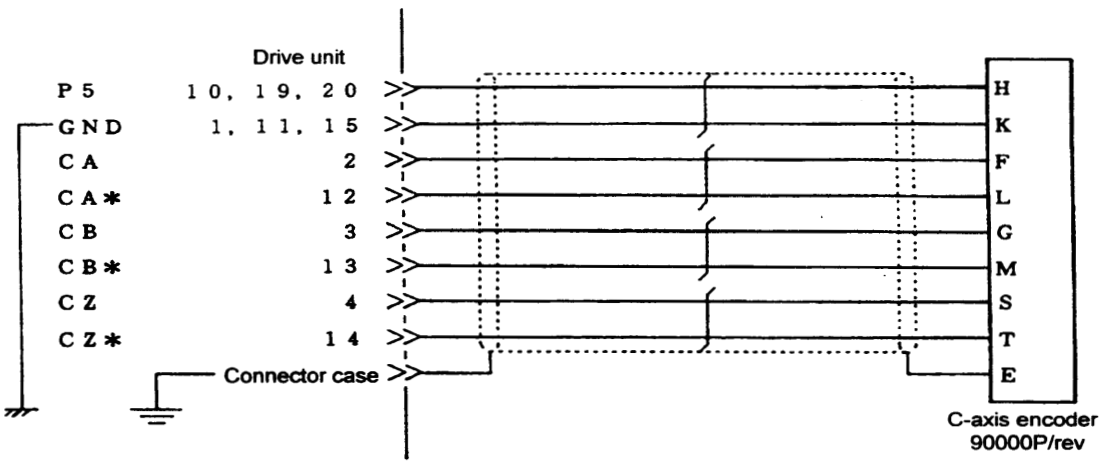
When manufacturing the detector cable, do not mistake the connection. Failure to observe this could lead to runaway of the encoder, and to injuries.

In order to assure the maximum performance of encoder, note the following:

(1) Power supply of encoder should be more than 4.5V .

1) Use larger wires for +5V and 0V lines.
2) Use two or more wires for +5V and 0V lines.
3) Use a cable as short as possible.

(2) In the connector (MS3106A20-29S) on the encoder side, short-circuit between pins Ⓔ and Ⓙ, or Ⓚ . (Use a short wire of 0.75 sq. ~ 1.25 sq.)



3. Others

(1) The encoder is a precision device, so take care not to apply strong shocks to it.
(2) Mistaken wiring may cause trouble. Confirm the connector name and pin Nos., etc., before wiring.

5.2 Built-in encoder

5.2.1 Model: MBE-90K

Refer to the MBE-90K (built-in C axis encoder) SPECIFICATIONS MANUAL [BNP-A2993-41].

5.2.2 Model: MHE-90K

Refer to the MHE-90K (built-in C axis encoder) SPECIFICATIONS MANUAL [BNP-A2993-44].

MDS-A/B-SP (H) parameters

Note: The parameters with no setting are handled as standard settings.

User ( ), Type ( ), Spindle amplifier (-SP-), Spindle motor (SJ-)

Class	Name	Abbr.	Standard setting	Setting
Spindle specifications	SP001	PGM	100	
	SP002	PGE	100	
	SP003	PGC0	15	
	SP004	OINP	16	
	SP005	OSP	0	
	SP006	CSP	20	
	SP007	OPST	0	
	SP008		0	
	SP009	PGT	15	
	SP010	PGS	15	
	SP011		0	
	SP012		0	
	SP013		0	
	SP014		0	
	SP015		0	
	SP016		0	
	SP017	TSP	6000	
	SP018	ZSP	50	
	SP019	CSN1	30	
	SP020	SDTS	600	
	SP021	TLM1	10	
	SP022	VGNP1	63	
	SP023	VGNI1	60	
	SP024		0	
	SP025	GRA1	1	
	SP026	GRA2	1	
	SP027	GRA3	1	
	SP028	GRA4	1	
	SP029	GRB1	1	
	SP030	GRB2	1	
	SP031	GRB3	1	
	SP032	GRB4	1	

Class	Name	Abbr.	Standard setting	Setting
Spindle/machine specifications	SP033	SFNC1	0000	
	SP034	SFNC2	0000	
	SP035	SFNC3	0000	
	SP036	SFNC4	0000	
	SP037	SFNC5	0000	
	SP038	SFNC6	0000	
	SP039	ATYP	0000	
	SP040	MTYP	0000	
	SP041	PTYP	0000	
	SP042	CRNG	0	
	SP043	TRNG	0	
	SP044	TRANS	0	
	SP045		0	
	SP046	CSN2	0	
	SP047	SDTR	30	
	SP048	SUT	15	
	SP049	TLM2	20	
	SP050	TLM3	30	
	SP051	TLM4	40	
	SP052	TLM5	50	
	SP053	TLM6	60	
	SP054	TLM7	70	
	SP055	SETM	12	
	SP056	PYVR	50	
	SP057		0	
	SP058	HSPT	6000	
	SP059	MKT	150	
	SP060	MKT2	500	
	SP061	MKIL	75	
	SP062		0	
	SP063	OLT	60	
	SP064	OLL	110	

Class	Name	Abbr.	Standard setting	Setting
Speed control	SP065	VCGN1	100	
	SP066	VCSN1	0	
	SP067	VIGWA	0	
	SP068	VIGWB	0	
	SP069	VIGN	0	
	SP070	FHz	0	
	SP071		0	
	SP072		0	
	SP073		0	
	SP074		0	
	SP075		0	
	SP076	FONS	0	
	SP077	TDSL	14	
	SP078		0	
	SP079		0	
	SP080		0	
	SP081		0	
	SP082		0	
	SP083		0	
	SP084		0	
	SP085		0	
	SP086		0	
	SP087	DIQM	75	
	SP088	DIQN	3000	
	SP089	VGHP	63	
	SP090	VGHI	60	
	SP091	OFSN	0	
	SP092	OFSI	0	
	SP093		0	
	SP094	LMAV	0	
	SP095	EGAR	0	
	SP096		0	

(1/4)

Class	Name	Abbr.	Standard setting	Setting
Motor constants	SP289	ICT	0000	
	SP290	KI1	0000	
	SP291	TI	0000	
	SP292	VPWM	0000	
	SP293		0000	
	SP294		0000	
	SP295		0000	
	SP296		0000	
	SP297		0000	
	SP298		0000	
	SP299		0000	
	SP300		0000	
	SP301	NPM	0000	
	SP302	NICNT	0000	
	SP303	NICT	0000	
	SP304	NCSN	0000	
	SP305	NWR1	0000	
	SP306	NWR2	0000	
	SP307	NWR3	0000	
	SP308	NEV0	0000	
	SP309	NEV1	0000	
	SP310	NEV2	0000	
	SP311	NEV3	0000	
	SP312		0000	
	SP313	ED0	0000	
	SP314	SPO	0000	
	SP315	SBS	0000	
	SP316	SIQ	0000	
	SP317	DPO	0000	
	SP318	DBS	0000	
	SP319	DIQ	0000	
	SP320	BSD	0000	

Class	Name	Abbr.	Standard setting	Setting
Motor constants (LOW coil)	SP321	RPML	0000	
	SP322	NRL	0000	
	SP323	NPL	0000	
	SP324	NBL	0000	
	SP325	NFL	0000	
	SP326	PML	0000	
	SP327	PLGL	0000	
	SP328	KVPL	0000	
	SP329	KVIL	0000	
	SP330	KVFL	0000	
	SP331	KFPL	0000	
	SP332	KFIL	0000	
	SP333	PYLTL	0000	
	SP334	KDPL	0000	
	SP335	KDIL	0000	
	SP336	KQPL	0000	
	SP337	KQIL	0000	
	SP338	IDSML	0000	
	SP339	IQSML	0000	
	SP340	KVDSL	0000	
	SP341	KVQSL	0000	
	SP342	TMLRL	0000	
	SP343	TMLDL	0000	
	SP344	TMLSL	0000	
	SP345	KWSL	0000	
	SP346	KWSRL	0000	
	SP347	IQ1L	0000	
	SP348	M0L	0000	
	SP349	M2L	0000	
	SP350	FLUXL	0000	
	SP351	KR2L	0000	
	SP352	LR2L	0000	

Class	Name	Abbr.	Standard setting	Setting
Motor constants (LOW coil)	SP353	ICTL	0000	
	SP354	KI1L	0000	
	SP355	TIL	0000	
	SP356	VPWML	0000	
	SP357		0000	
	SP358		0000	
	SP359		0000	
	SP360		0000	
	SP361		0000	
	SP362		0000	
	SP363		0000	
	SP364		0000	
	SP365		0000	
	SP366		0000	
	SP367		0000	
	SP368		0000	
	SP369		0000	
	SP370		0000	
	SP371		0000	
	SP372		0000	
	SP373		0000	
	SP374		0000	
	SP375		0000	
	SP376		0000	
	SP377	EDOL	0000	
	SP378	SPOL	0000	
	SP379	SBSL	0000	
	SP380	SIQL	0000	
	SP381	DPOL	0000	
	SP382	DBSL	0000	
	SP383	DIQL	0000	
	SP384	BSDL	0000	

(4/4)