MITSUBISHI ELECTRIC

Changes for the Better

MITSUBISHI CNC

Instruction Manual

MDS-D-SVJ3/SPJ3 Series

Introduction

Thank you for selecting the Mitsubishi numerical control unit. This instruction manual describes the handling and caution points for using this AC servo/spindle.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. Always store this manual in a safe place.
In order to confirm if all function specifications described in this manual are applicable, refer to the specifications for each CNC.

Notes on Reading This Manual

(1) Since the description of this specification manual deals with NC in general, for the specifications of individual machine tools, refer to the manuals issued by the respective machine manufacturers. The "restrictions" and "available functions" described in the manuals issued by the machine manufacturers have precedence to those in this manual.

(2) This manual describes as many special operations as possible, but it should be kept in mind that items not mentioned in this manual cannot be performed.

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".

⚠DANGER	When there is a potential risk of fatal or serious injuries if handling is mistaken.
⚠WARNING	When a dangerous situation, or fatal or serious injuries may occur if handling is mistaken.
⚠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 signs indicating prohibited and mandatory matters are explained below.

⊘	Indicates a prohibited matter. For example, "Fire Prohibited" is indicated as ⊘.
●	Indicates a mandatory matter. For example, grounding is indicated as ⏚.

The meaning of each pictorial sign is as follows.

⚠ **CAUTION**	⚠ **CAUTION rotated object**	⚠ **CAUTION HOT**	⚠ **Danger Electric shock risk**	⚠ **Danger explosive**
⊘ **Prohibited**	⊘ **Disassembly is prohibited**	⊘ **KEEP FIRE AWAY**	❗ **General instruction**	⏚ **Earth ground**

After reading this specifications and instructions manual, store it where the user can access it easily for reference.

The numeric control unit is configured of the control unit, operation board, servo drive unit, spindle drive unit, power supply, servomotor and spindle motor, etc.
In this section "Precautions for safety", the following items are generically called the "motor".

- Servomotor
- Linear servomotor
- Spindle motor

In this section "Precautions for safety", the following items are generically called the "unit".

- Servo drive unit
- Spindle drive unit
- Power supply unit
- Scale interface unit
- Magnetic pole detection unit

POINT Important matters that should be understood for operation of this machine are indicated as a POINT in this manual.

⚠ WARNING

1. Electric shock prevention

- Do not open the front cover while 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 and connector even when the power is OFF unless carrying out wiring work or periodic inspections. The inside of the units is charged, and can cause electric shocks.
- Since the high voltage is supplied to the main circuit connector while the power is ON or during operation, do not touch the main circuit connector with an adjustment screwdriver or the pen tip. Failure to observe this could lead to electric shocks.
- Wait at least 15 minutes after turning the power OFF, confirm that the CHARGE lamp has gone out, and check the voltage between P and N terminals with a tester, etc., before starting wiring, maintenance or inspections. Failure to observe this could lead to electric shocks.
- Ground the unit and motor following the standards set forth by each country.
- Wiring, maintenance and inspection work must be done by a qualified technician.
- Wire the servo drive unit 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 on the cables or get them caught. Failure to observe this could lead to electric shocks.
- After assembling the built-in IPM spindle motor, if the rotor is rotated by hand etc., voltage occurs between the terminals of lead. Take care not to get electric shocks.

2. Injury prevention

⚠ In the system where the optical communication with CNC is executed, do not see directly the light generated from CN1A/CN1B connector of drive unit or the end of cable. When the light gets into eye, you may feel something is wrong for eye.
(The light source of optical communication corresponds to class1 defined in JISC6802 or IEC60825-1.)

⚠ The linear servomotor, direct-drive motor and built-in IPM spindle motor uses permanent magnets in the rotor, so observe the following precautions.

(1)Handling

- The linear servomotor, direct-drive motor and built-in IPM spindle motor could adversely affect medical electronics such as pacemakers, etc., therefore, do not approach the rotor.
- Do not place magnetic materials as iron.
- When a magnetic material as iron is placed, take safety measure not to pinch fingers or hands due to the magnetic attraction force.
- Remove metal items such as watch, piercing jewelry, necklace, etc.
- Do not place portable items that could malfunction or fail due to the influence of the magnetic force.
- When the rotor is not securely fixed to the machine or device, do not leave it unattended but store it in the package properly.

(2)Transportation and storage

- Correctly store the rotor in the package to transport and store.
- During transportation and storage, draw people's attention by applying a notice saying "Strong magnet-Handle with care" to the package or storage shelf.
- Do not use a damaged package.

(3)Installation

- Take special care not to pinch fingers, etc., when installing (and unpacking) the linear servomotor.

⚠CAUTION

1. Fire prevention

- ⚠ Install the units, motors and regenerative resistor on non-combustible material. Direct installation on combustible material or near combustible materials could lead to fires.
- ⚠ Always install a circuit protector and contactor on the servo drive unit power input as explained in this manual. Refer to this manual and select the correct circuit protector and contactor. An incorrect selection could result in fire.
- ⚠ Shut off the power on the unit side if a fault occurs in the units. Fires could be caused if a large current continues to flow.
- ⚠ When using a regenerative resistor, provide a sequence that shuts off the power with the regenerative resistor's error signal. The regenerative resistor could abnormally overheat and cause a fire due to a fault in the regenerative transistor, etc.
- ⚠ The battery unit could heat up, ignite or rupture if submerged in water, or if the poles are incorrectly wired.
- ⚠ Cut off the main circuit power with the contactor when an alarm or emergency stop occurs.

2. Injury prevention

- ⚠ Do not apply a voltage other than that specified in this 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 radiation fin on unit back face, regenerative resistor or motor, etc., or place parts (cables, etc.) while the power is turned ON or immediately after turning the power OFF. These parts may reach high temperatures, and can cause burns or part damage.
- ⚠ Structure the cooling fan on the unit back face, etc., etc so that it cannot be touched after installation. Touching the cooling fan during operation could lead to injuries.

⚠ CAUTION

3. Various precautions

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

(1) Transportation and installation

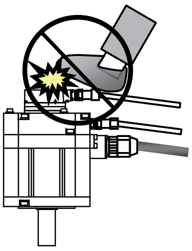
⚠ Correctly transport the product according to its weight.

❗ Use the motor's hanging bolts only when transporting the motor. Do not transport the machine when the motor is installed on the machine.

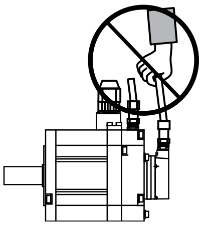
⚠ Do not stack the products above the tolerable number.

⚠ Follow this manual and install the unit or motor in a place where the weight can be borne.

⚠ Do not get on top of or place heavy objects on the unit.



⚠ Do not hold the cables, axis or detector when transporting the motor.



⚠ Do not hold the connected wires or cables when transporting the units.

⚠ Do not hold the front cover when transporting the unit. The unit could drop.

⚠ Always observe the installation directions of the units or motors.

⚠ Secure the specified distance between the units and control panel, or between the servo drive unit and other devices.

⚠ Do not install or run a unit or motor that is damaged or missing parts.

⚠ Do not block the intake or exhaust ports of the motor provided with a cooling fan.

⚠ Do not let foreign objects enter the units or motors. In particular, if conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter, rupture or breakage could occur.

⚠ Provide adequate protection using a material such as connector for conduit to prevent screws, metallic detritus, water and other conductive matter or oil and other combustible matter from entering the motor through the power line lead-out port.

⚠ The units, motors and detectors 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	Unit	Motor
Ambient temperature	Operation: 0 to 55°C(with no freezing), Storage / Transportation: -15°C to 70°C (with no freezing)	Operation: 0 to 40°C(with no freezing), Storage: -15°C to 70°C (Note2) (with no freezing)
Ambient humidity	Operation: 90%RH or less (with no dew condensation) Storage / Transportation: 90%RH or less (with no dew condensation)	Operation: 80%RH or less (with no dew condensation), Storage: 90%RH or less (with no dew condensation)
Atmosphere	Indoors (no direct sunlight) With no corrosive gas, inflammable gas, oil mist, dust or conductive fine particles	
Altitude	Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level	Operation: 1000 meters or less above sea level, Storage: 10000 meters or less above sea level
Vibration/impact	According to each unit or motor specification	

(Note 1) For details, confirm each unit or motor specifications in addition.
(Note 2) -15°C to 55°C for linear servomotor.

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

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

⚠ Structure the rotary sections of the motor so that it can never be touched during operation. Install a cover, etc., on the shaft.

⚠ When installing a 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.

⚠ Store the motor in the package box.

⚠ When inserting the shaft into the built-in IPM spindle motor, do not heat the rotor higher than 130°C. The magnet could be demagnetized, and the specifications characteristics will not be ensured.

⚠ Always use a nonmagnetic tool (explosion-proof beryllium copper alloy safety tool: NGK Insulators, etc.) when installing the linear servomotor.

⚠ Always provide a mechanical stopper on the end of the linear servomotor's travel path.

❗ If the unit has been stored for a long time, always check the operation before starting actual operation. Please contact the Service Center, Service Station, Sales Office or delayer.

(2) Wiring

⚠ Correctly and securely perform the wiring. Failure to do so could lead to abnormal operation of the motor.

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

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

⚠ When using a power regenerative power supply unit, always install an AC reactor for each power supply unit.

⚠ In the main circuit power supply side of the unit, always install an appropriate circuit protector or contactor for each unit. Circuit protector or contactor cannot be shared by several units.

⚠ CAUTION

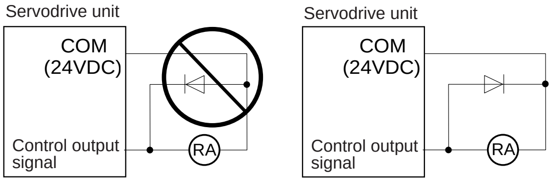
⚠ Always connect the motor to the drive unit's output terminals (U, V, W).

⚠ Do not directly connect a commercial power supply to the servomotor. Failure to observe this could result in a fault.

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

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

⚠ Do not reverse the direction of a diode which connect to a DC relay for the control output signals such as contractor and motor brake output, etc. to suppress a surge. Connecting it backwards could cause the drive unit to malfunction so that signals are not output, and emergency stop and other safety circuits are inoperable.



⚠ 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 using a shielded cable instructed in the instruction manual, 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.

(3) Trial operation and adjustment

⚠ 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 of parameter as the operation could become unstable.

⚠ The usable motor and unit combination is predetermined. Always check the models before starting trial operation.

⚠ The linear servomotor does not have a stopping device such as magnetic brakes. Install a stopping device on the machine side.

⚠CAUTION

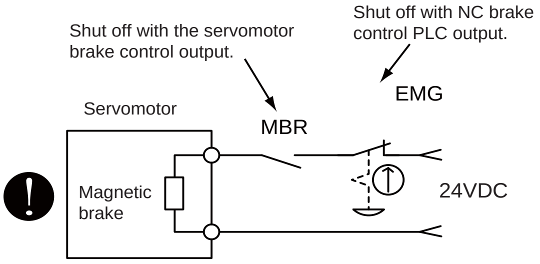
(4) Usage methods

- ❗ In abnormal state, 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 unit or motor.
- ⊘ Do not disassemble or repair this product.
- ⚠ Never make modifications.
- ⚠ When an alarm occurs, the machine will start suddenly if an alarm reset (RST) is carried out while an operation start signal (ST) is being input. Always confirm that the operation signal is OFF before carrying out an alarm reset. Failure to do so could lead to accidents or injuries.
- ⚠ Reduce magnetic damage by installing a noise filter. The electronic devices used near the unit could be affected by magnetic noise. Install a line noise filter, etc., if there is a risk of magnetic noise.
- ⚠ Use the unit, motor and regenerative resistor with the designated combination. Failure to do so could lead to fires or trouble.
- ⊘ The brake (magnetic brake) of 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, the machine construction (when ball screw and servomotor are coupled via a timing belt, etc.) or the magnetic brake's failure. Install a stop device to ensure safety on the machine side.
- ⚠ After changing the programs/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 each specification for the power (input voltage, input frequency, tolerable sudden power failure time, etc.).
- ⚠ Set all bits to "0" if they are indicated as not used or empty in the explanation on the bits.
- ⚠ Do not use the dynamic brakes except during the emergency stop. Continued use of the dynamic brakes could result in brake damage.
- ⚠ If a circuit protector for the main circuit power supply is shared by several units, the circuit protector may not activate when a short-circuit fault occurs in a small capacity unit. This is dangerous, so never share the circuit protector.

⚠ CAUTION

(5) Troubleshooting

- ⚠ 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 main circuit power of the motor OFF when an alarm occurs.
- ⚠ If an alarm occurs, remove the cause, and secure the safety before resetting the alarm.



(6) Maintenance, inspection and part replacement

- ⚠ Always backup the programs and parameters before starting maintenance or inspections.
- ⚠ The capacity of the electrolytic capacitor will drop over time due to self-discharging, etc. To prevent secondary disasters due to failures, replacing this part every five years when used under a normal environment is recommended. Contact the Service Center, Service Station, Sales Office or delayer for repairs or part replacement.
- ⚠ Do not perform a megger test (insulation resistance measurement) during inspections.
- ❗ If the battery low warning is issued, back up the machining programs, tool data and parameters with an input/output unit, and then replace the battery.
- ⚠ Do not short circuit, charge, overheat, incinerate or disassemble the battery.
- ⚠ For after-purchase servicing of the built-in motor (including the detector), supplies of servicing parts and repairs can only be offered.
- ⚠ For maintenance, part replacement, and services in case of failures in the built-in motor (including the detector), take necessary actions at your end. For spindle drive unit, Mitsubishi can offer the after-purchase servicing as with the general spindle drive unit.
- ⚠ When a failure has occurred in the built-in motor (including the detector), some period of time can be required to supply the servicing parts or repair. Prepare the spare parts at your end whenever possible.

(7) Disposal

- ⚠ Take the batteries and backlights for LCD, etc., off from the controller, drive unit and motor, and dispose of them as general industrial wastes.
- ⚠ Do not disassemble the unit or motor.
- ⚠ Dispose of the battery according to local laws.
- ⚠ Always return the secondary side (magnet side) of the linear servomotor to the Service Center or Service Station.
- ⚠ When incinerating optical communication cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of optical communication cable, request for specialized industrial waste disposal services that has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

⚠CAUTION

(8) Transportation

⚠ The unit and motor are precision parts and must be handled carefully.

⚠ According to a United Nations Advisory, the battery unit and battery must be transported according to the rules set forth by the International Civil Aviation Organization (ICAO), International Air Transportation Association (IATA), International Maritime Organization (IMO), and United States Department of Transportation (DOT), etc.

(9) General precautions

The drawings given in this 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.

Treatment of waste

The following two laws will apply when disposing of this product. Considerations must be made to each law. The following laws are in effect in Japan. Thus, when using this product overseas, the local laws will have a priority. If necessary, indicate or notify these laws to the final user of the product.

(1) Requirements for "Law for Promotion of Effective Utilization of Resources"
  (a) Recycle as much of this product as possible when finished with use.
  (b) When recycling, often parts are sorted into steel scraps and electric parts, etc., and sold to scrap contractors. Mitsubishi recommends sorting the product and selling the members to appropriate contractors.

(2) Requirements for "Law for Treatment of Waste and Cleaning"
  (a) Mitsubishi recommends recycling and selling the product when no longer needed according to item (1) above. The user should make an effort to reduce waste in this manner.
  (b) When disposing a product that cannot be resold, it shall be treated as a waste product.
  (c) The treatment of industrial waste must be commissioned to a licensed industrial waste treatment contractor, and appropriate measures, including a manifest control, must be taken.
  (d) Batteries correspond to "primary batteries", and must be disposed of according to local disposal laws.

Disposal

(Note) This symbol mark is for EU countries only.
This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:
Hg: mercury (0,0005%), Cd: cadmium (0,002%), Pb: lead (0,004%)
In the European Union there are separate collection systems for used batteries and accumulators.
Please, dispose of batteries and accumulators correctly at your local community waste collection/ recycling centre.

Please, help us to conserve the environment we live in!

本製品の取扱いについて

(日本語 /Japanese)
本製品は工業用 (クラス A) 電磁環境適合機器です。販売者あるいは使用者はこの点に注意し、住商業環境以外での使用をお願いいたします。

Handling of our product

(English)
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

본 제품의 취급에 대해서

(한국어 /Korean)
이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정외의 지역에서 사용하는 것을 목적으로 합니다 .

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Outline for MDS-D-SVJ3/SPJ3 Series Specifications Manual (IB-1500158-C)

Appendix 4 EMC Installation Guidelines

Appendix 5 EC Declaration of Conformity

Appendix 6 Instruction Manual for Compliance with UL/ c-UL Standard

Appendix 7 Compliance with Restrictions in China

📖 For outline dimension drawings, refer to "DRIVE SYSTEM DATA BOOK" (IB-1500273(ENG)).

Function specifications list

<Servo specification>

Item		MDS-D-V1/V2	MDS-DH-V1/V2	MDS-DM-V3	MDS-DM-SPV2F/3F MDS-DM-SPV2/3	MDS-D-SVJ3
1 Base functions	1-1 Full closed loop control	●	●	-	● (Note2)	●
	1-2 Position command synchronous control	●	●	●	●	●
	1-3 Speed command synchronous control	●	●	-	-	-
	1-4 Distance-coded reference position control	●	●	-	-	-
2 Servo control function	2-1 Torque limit function (stopper function)	●	●	●	●	●
	2-2 Variable speed loop gain control	●	●	●	●	●
	2-3 Gain changeover for synchronous tapping control	●	●	●	●	●
	2-4 Speed loop PID changeover control	●	●	●	●	●
	2-5 Disturbance torque observer	●	●	●	●	●
	2-6 Smooth High Gain control (SHG control)	●	●	●	●	●
	2-7 High-speed synchronous tapping control (OMR-DD control)	●	●	● (Only for 1-axis)	● (Only for 1-axis)	-
	2-8 Dual feedback control	●	●	-	● (Note2)	●
	2-9 HAS control	●	●	●	●	-
3 Compensation control	3-1 Jitter compensation	●	●	●	●	●
	3-2 Notch filter	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1
	3-3 Adaptive tracking-type notch filter	●	●	-	-	-
	3-4 Overshooting compensation	●	●	●	●	●
	3-5 Machine end compensation control	●	●	●	●	●
	3-6 Lost motion compensation type 2	●	●	●	●	●
	3-7 Lost motion compensation type 3	●	●	●	●	●
	3-8 Lost motion compensation type 4	●	●	-	-	-
4 Protection function	4-1 Deceleration control at emergency stop	●	●	●	●	●
	4-2 Vertical axis drop prevention/pull-up control	●	●	●	●	●
	4-3 Earth fault detection	●	●	●	●	●
	4-4 Collision detection function	●	●	●	●	●
	4-5 Safety observation function	●	●	●	●	●
5 Sequence function	5-1 Contactor control function	MDS-D-CV	MDS-DH-CV	MDS-D-CV	●	●
	5-2 Motor brake control function (Note 1)	●	●	●	●	●
	5-3 External emergency stop function	MDS-D-CV	MDS-DH-CV	MDS-D-CV	●	●
	5-4 Specified speed output	●	●	-	-	-
	5-5 Quick READY ON sequence	●	●	●	●	-
6 Diagnosis function	6-1 Monitor output function	●	●	●	●	●
	6-2 Machine resonance frequency display function	●	●	●	●	●
	6-3 Machine inertia display function	●	●	●	●	●
	6-4 Motor temperature display function (Only for linear or direct-drive motor)	●	●	-	-	● (Only for direct-drive motor)

(Note 1) For the multiaxis drive unit, a control by each axis is not available.
It is required to turn the servo of all axes OFF in the drive unit in order to enable a motor brake output.

(Note 2) For the drive unit MDS-DM-SPV2/3, this function is not available.

<Spindle specifications>

Item		MDS-D-SP	MDS-DH-SP	MDS-D-SP2	MDS-DM-SPV2F/3F MDS-DM-SPV2/3	MDS-D-SPJ3
1 Base functions	1-5 Spindle's continuous position loop control	●	●	●	●	●
	1-6 Coil changeover control	●	●	-	●	-
	1-7 Gear changeover control	●	●	●	●	●
	1-8 Orientation control	●	●	●	●	●
	1-9 Indexing control	●	●	●	●	●
	1-10 Synchronous tapping control	●	●	●	●	●
	1-11 Spindle synchronous control	●	●	●	●	●
	1-12 Spindle/C axis control	●	●	●	●	●
	1-13 Proximity switch orientation control	●	●	-	●	●
2 Spindle control functions	2-1 Torque limit function	●	●	●	●	●
	2-2 Variable speed loop gain control	●	●	●	●	●
	2-5 Disturbance torque observer	●	●	-	●	●
	2-6 Smooth High Gain control (SHG control)	●	●	●	●	●
	2-7 High-speed synchronous tapping control (OMR-DD control)	●	●	●	●	-
	2-8 Dual feedback control	●	●	●	●	●
	2-10 Control loop gain changeover	●	●	●	●	●
	2-11 Spindle output stabilizing control	●	●	●	●	●
	2-12 High-response spindle acceleration/deceleration function	●	●	●	●	●
3 Compensation controls	3-1 Jitter compensation	●	●	●	●	●
	3-2 Notch filter	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1	Variable frequency: 4 Fixed frequency: 1
	3-4 Overshooting compensation	●	●	●	●	●
	3-6 Lost motion compensation type 2	●	●	●	●	●
	3-7 Lost motion compensation type 3	●	●	-	-	-
	3-9 Spindle motor temperature compensation function	●	●	●	●	-
4 Protection function	4-1 Deceleration control at emergency stop	●	●	●	●	●
	4-3 Earth fault detection	●	●	●	●	●
	4-5 Safety observation function	●	●	●	●	●
5 Sequence functions	5-1 Contactor control function	MDS-D-CV	MDS-DH-CV	MDS-D-CV	●	●
	5-3 External emergency stop function	MDS-D-CV	MDS-DH-CV	MDS-D-CV	●	●
	5-4 Specified speed output	●	●	●	●	-
	5-5 Quick READY ON sequence	●	●	●	●	-
6 Diagnosis functions	6-1 Monitor output function	●	●	●	●	●
	6-2 Machine resonance frequency display function	●	●	●	●	●
	6-3 Machine inertia display function	●	●	●	●	●
	6-4 Motor temperature display function	●	●	●	●	●
	6-5 Load monitor output function	●	●	●	●	● (Note)
	6-6 Open loop control function	●	●	●	●	●

(Note) The motor output effective value cannot be displayed.

1

Installation

Contents

1 Installation

1-1 Installation of servomotor

⚠ **CAUTION**

1. Do not hold the cables, axis or detector when transporting the motor. Failure to observe this could lead to faults or injuries.
2. Securely fix the motor to the machine. Insufficient fixing could lead to the motor deviating during operation. Failure to observe this could lead to injuries.
3. When coupling to a servomotor shaft end, do not apply an impact by hammering, etc. The detector could be damaged.
4. Never touch the rotary sections of the motor during operations. Install a cover, etc., on the shaft.
5. Do not apply a load exceeding the tolerable load onto the servomotor shaft. The shaft could break. Failure to observe this could lead to injuries.
6. Do not connect or disconnect any of the connectors while the power is ON.

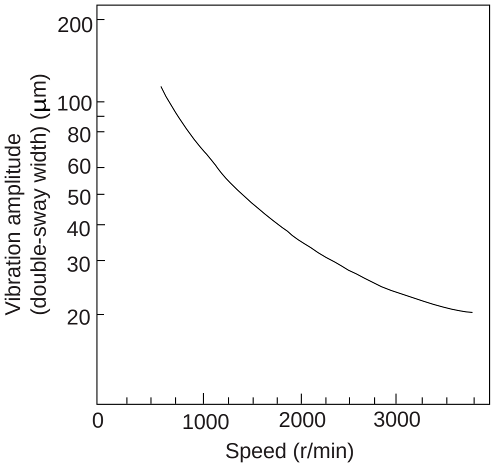
1-1-1 Environmental conditions

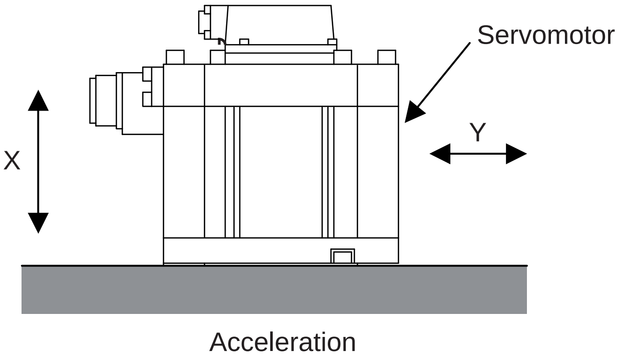
Environment	Conditions
Ambient temperature	0°C to +40°C (with no freezing)
Ambient humidity	80% RH or less (with no dew condensation)
Storage temperature	-15°C to +70°C (with no freezing)
Storage humidity	90% RH or less (with no dew condensation)
Atmosphere	Indoors (no direct sunlight) No corrosive gas, inflammable gas, oil mist or dust
Altitude	Operation / storage: 1000m or less above sea level Transportation: 10000m or less above sea level
Vibration	X:19.6m/s^2 (2G) Y:19.6m/s^2(2G)

1-1-2 Quakeproof level

Motor type	Acceleration direction	
	Axis direction (X)	Direction at right angle to axis (Y)
HF75, 105	24.5m/s^2 (2.5G) or less	24.5m/s^2 (2.5G) or less
HF54, 104, 154, 224, 123, 223, 142		
HF204, 354, 303, 302	24.5m/s^2 (2.5G) or less	29.4m/s^2 (3G) or less
HF-KP13, 23, 43, 73	49m/s^2 (5G) or less	49m/s^2 (5G) or less

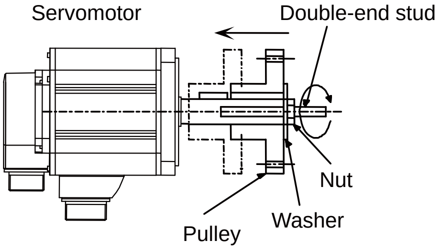
The vibration conditions are as shown below.



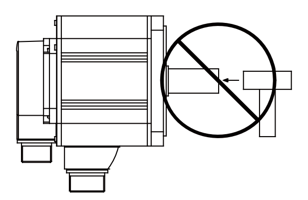


1-1-3 Cautions for mounting load (prevention of impact on shaft)

[1] When using the servomotor with key way, use the screw hole at the end of the shaft to mount the pulley onto the shaft. To install, first place the double-end stud into the shaft screw holes, contact the coupling end surface against the washer, and press in as if tightening with a nut. When the shaft does not have a key way, use a frictional coupling, etc.
[2] When removing the pulley, use a pulley remover, and make sure not to apply an impact on the shaft.
[3] Install a protective cover on the rotary sections such as the pulley installed on the shaft to ensure safety.
[4] The direction of the detector installed on the servomotor cannot be changed.

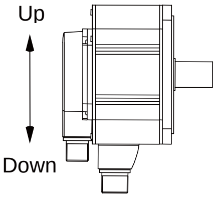


⚠ CAUTION Never hammer the end of the shaft during assembly.



1-1-4 Installation direction

[1] There are no restrictions on the installation direction. Installation in any direction is possible, but as a standard the motor is installed so that the motor power line and detector cable cannon plugs (lead-in wires) face downward. Installation in the standard direction is effective against dripping. Measure to prevent oil and water must be taken when not installing in the standard direction. When the motor is not installed in the standard direction, refer to section "1-1-8 Oil/water standards" and take the appropriate measures.
The brake plates may make a sliding sound when a servomotor with magnetic brake is installed with the shaft facing upward, but this is not a fault.



Standard installation direction

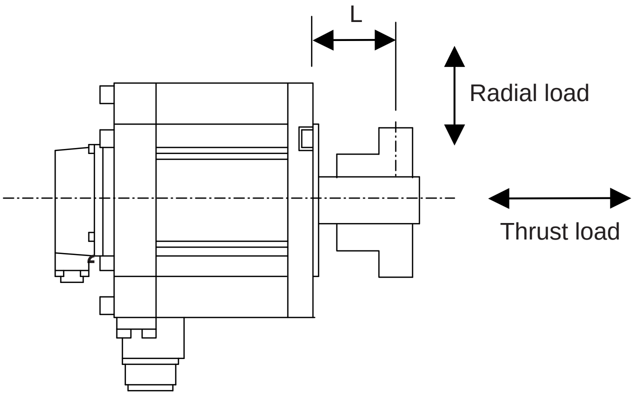
1-1-5 Shaft characteristics

There is a limit to the load that can be applied on the motor shaft. Make sure that the load applied on the radial direction and thrust direction, when mounted on the machine, is below the tolerable values given below. These loads may affect the motor output torque, so consider them when designing the machine.

Servomotor	Tolerable radial load	Tolerable thrust load
HF75T, 105T (Taper shaft)	245N (L=33)	147N
HF75S, 105S (Straight shaft)	245N (L=33)	147N
HF54T, 104T, 154T, 224T,123T, 223T, 142T (Taper shaft)	392N (L=58)	490N
HF54S, 104S, 154S, 224S,123S, 223S, 142S (Straight shaft)	980N (L=55)	490N
HF204S, 354S, 303S, 302S (Straight shaft)	2058N (L=79)	980N
HF-KP13 (Straight shaft)	88N (L=25)	59N
HF-KP23, 43 (Straight shaft)	245N (L=30)	98N
HF-KP73 (Straight shaft)	392N (L=40)	147N

(Note 1) The tolerable radial load and thrust load in the above table are values applied when each motor is used independently.

(Note 2) The symbol L in the table refers to the value of L below.



L : Length from flange installation surface to center of load weight [mm]

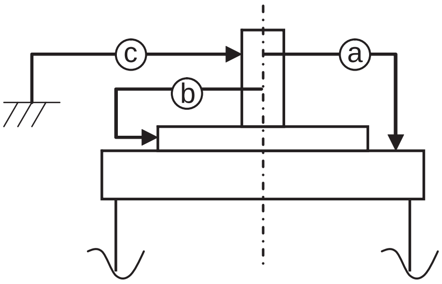
⚠ **CAUTION**

1. Use a flexible coupling when connecting with a ball screw, etc., and keep the shaft core deviation to below the tolerable radial load of the shaft.
2. When directly installing the gear on the motor shaft, the radial load increases as the diameter of the gear decreases. This should be carefully considered when designing the machine.
3. When directly installing the pulley on the motor shaft, carefully consider so that the radial load (double the tension) generated from the timing belt tension is less than the values shown in the table above.
4. In machines where thrust loads such as a worm gear are applied, carefully consider providing separate bearings, etc., on the machine side so that loads exceeding the tolerable thrust loads are not applied to the motor.

1-1-6 Machine accuracy

Machine accuracy of the servo motor's output shaft and around the installation part is as below. (Excluding special products)

Accuracy (mm)	Measurement point	Flange size [mm]			
		Less than 100	100 SQ., 130 SQ.	176 SQ. - 250 SQ.	280 or over
Amplitude of the flange surface to the output shaft	a	0.05	0.06	0.08	0.08
Amplitude of the flange surface's fitting outer diameter	b	0.04	0.04	0.06	0.08
Amplitude of the output shaft end	c	0.02	0.02	0.03	0.03



1-1-7 Coupling with the load

There are several ways to couple the motor shaft and machine, such as direct coupling with flexible coupling or rigid coupling, gear connection, timing belt connection, etc.
Summarized comparison is as follows.

	Noise	No lubri-cation	Back-lash	Rigidity	Reliability in coupling	Life	Torque increased at deceler-ation	Degree of freedom in motor in-stallation	Cautions in motor installation
Direct coupling with flexible coupling	○	○	○	○	○ Looseness of bolt	○	×	△	Shaft core deviation (In the case of single)
Direct coupling with rigid coupling	○	○	○	○	○ Looseness of bolt	○	×	×	Shaft core deviation Angle deviation
Gear	×	×	△	△	△ Tooth chipping	△	○	○	Backlash too small Pitch diameter too small
Timing belt	△	○	○	×	× Belt is broken	×	○	○	Belt stretched too much Pitch diameter too small

⚠ CAUTION If the cautions in motor installation in the above table are not observed, the motor will have a broken shaft, or the bearing will have a shorter life. Carry out design and installation adjustment so that the load on the motor shaft will be below the tolerable loads mentioned in "1-1-5 Shaft characteristics".

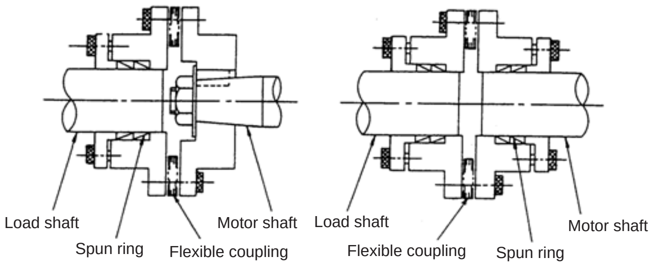
(1) Direct coupling - Flexible coupling

When coupling the load directly, a flexible coupling is recommended. The benefits of a flexible coupling are as below.

(a) Shaft's angle deviation and core deviation can be absorbed to some extent, so adjustment in motor installation is easier.
However, in the case of single, shaft core deviation cannot be allowed, so it is required to design and adjust so that the shaft cores of the motor and ball screw align. Check the specification of the coupling to use. If the shaft core deviation exceeds the coupling's tolerable level, the motor will have a broken shaft, or the bearing will have a shorter life. Thus, in order to simplify the installation adjustment, use a double flexible coupling.

(b) Less looseness produces less vibration and less noise at the coupling part.
On the other hand, if assembling is loose, lower rigidity may be caused. When using a coupling with lower rigidity, the accuracy in centering the core doesn't have to be high, however, it is undesirable for servo. In order to fully utilize the servo's efficiency to ensure the maximum durability of the equipments, it is required to use a highly rigid coupling, and to fully align the shaft cores in the initial installation. It is also required to select the optimum flexible coupling according to the working conditions, and use it correctly according to the manufacturer's specification manual.

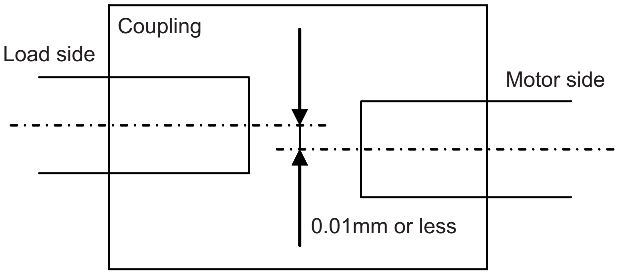
Example of direct coupling with load



(a) Taper shaft (b) Straight shaft

(2) Direct coupling - Rigid coupling

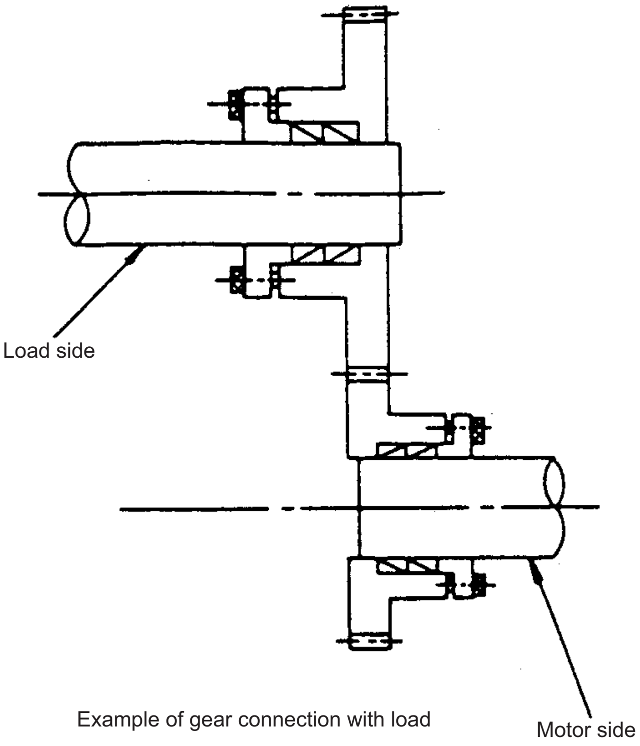
A rigid coupling has benefits such as high rigidity, and relatively lower price. However, shaft core deviation and angle deviation of the motor shaft and ball screw are not allowed, so full attention is required in installing the rigid coupling. Shaft core deviation is desired to be 0.01mm or less. If enough accuracy cannot be ensured, the motor will have a broken shaft, or the bearing will have a shorter life. In addition, note that a rigid coupling is not acceptable for HF-KP Series servo motors.



Also note that the motor side ball screw bearing must be locked so that to avoid the thrust load on the motor shaft due to expansion and contraction of the ball screw.

(3) Gear connection

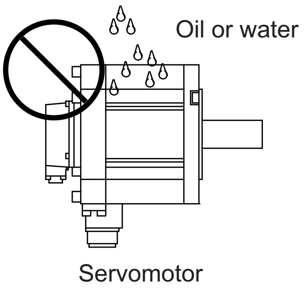
Gear's accuracy and backlash amount greatly affect on the machine's positioning accuracy and noise during operation. Thus, according to the machine's specification, appropriately select the accuracy and backlash amount. In gear connection, it is required to take measures against oil to enter the motor.



Example of gear connection with load

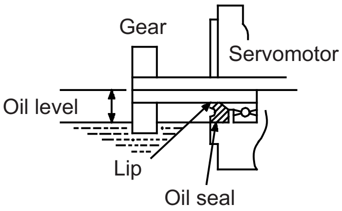
1-1-8 Oil/water standards

[1] The motor protective format uses the IP type, which complies with IEC Standard. However, these Standards are short-term performance specifications. They do not guarantee continuous environmental protection characteristics. Measures such as covers, etc., must be taken if there is any possibility that oil or water will fall on the motor, and the motor will be constantly wet and permeated by water. Note that the motor's IP-type is not indicated as corrosion-resistant.

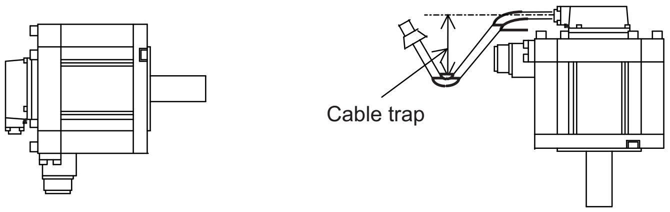


[2] When a gear box is installed on the servomotor, make sure that the oil level height from the center of the shaft is higher than the values given below. Open a breathing hole on the gear box so that the inner pressure does not rise.

Servomotor	Oil level (mm)
HF75, 105	15
HF54, 104, 154, 224, 123, 223, 142	22.5
HF204, 354, 303, 302	30
HF-KP13	9.5
HF-KP23, 43	12.5
HF-KP73	15



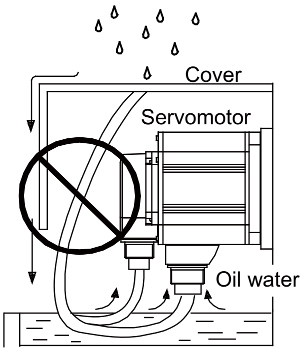
[3] When installing the servomotor horizontally, set the power cable and detector cable to face downward. When installing vertically or on an inclination, provide a cable trap.



⚠ **CAUTION**

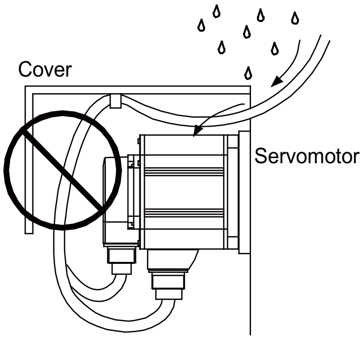
1. The servomotors, including those having IP65 specifications, do not have a completely waterproof (oil-proof) structure. Do not allow oil or water to constantly contact the motor, enter the motor, or accumulate on the motor. Oil can also enter the motor through cutting chip accumulation, so be careful of this also.
2. When the motor is installed facing upwards, take measures on the machine side so that gear oil, etc., does not flow onto the motor shaft.

[4] Do not use the unit with the cable submerged in oil or water. (Refer to following drawing.)



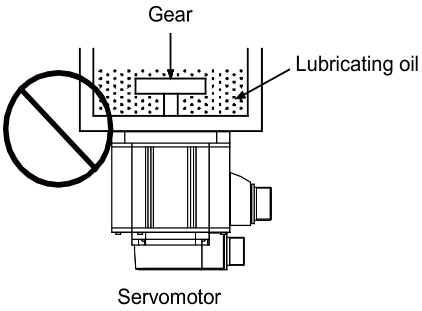
<Fault> Capillary tube phenomenon

[5] Make sure that oil and water do not flow along the cable into the motor or detector. (Refer to right drawing.)



<Fault> Respiration

[6] When installing on the top of the shaft end, make sure that oil from the gear box, etc., does not enter the servomotor. The servomotor does not have a waterproof structure.



1-1-9 Installation of servomotor

Mount the servo motor on a flange which has the following size or produces an equivalent or higher heat dissipation effect:

Flange size (mm)	Servo Motor
	HF, HF-KP
150x150x6	100W
250x250x6	200 to 400W
250x250x12	0.5 to 1.5kW
300x300x20	2.0 to 7.0kW
800x800x35	9.0 to 11.0kW

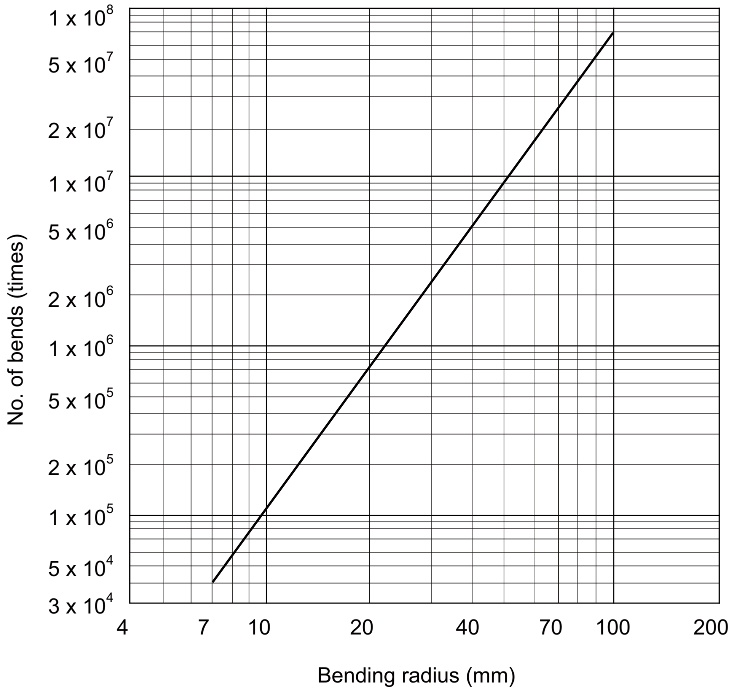
1-1-10 Cable stress

[1] Sufficiently consider the cable clamping method so that bending stress and the stress from the cable's own weight is not applied on the cable connection part.

[2] In applications where the servomotor moves, make sure that excessive stress is not applied on the cable.
If the detector cable and servomotor wiring are stored in a cable bear and the servomotor moves, make sure that the cable bending part is within the range of the optional detector cable.
Fix the detector cable and power cable enclosed with the servomotor.

[3] Make sure that the cable sheathes will not be cut by sharp cutting chips, worn or stepped on by workers or vehicles.

The bending life of the detector cable is as shown below. Regard this with a slight allowance. If the servomotor/spindle motor is installed on a machine that moves, make the bending radius as large as possible.



Detector cable bending life
(Material of Mitsubishi optional detector cable: A14B2343)

(Note) The values in this graph are calculated values and are not guaranteed.

1-2 Installation of spindle motor

⚠ **CAUTION**

1. Do not hold the cables, axis or detector when transporting the motor. Failure to observe this could lead to faults or injuries.
2. Securely fix the motor to the machine. Insufficient fixing could lead to the motor deviating during operation. Failure to observe this could lead to injuries.
3. When coupling to a servomotor shaft end, do not apply an impact by hammering, etc. The detector could be damaged.
4. Never touch the rotary sections of the motor during operations. Install a cover, etc., on the shaft.
5. Do not apply a load exceeding the tolerable load onto the servomotor shaft. The shaft could break. Failure to observe this could lead to injuries.
6. Do not connect or disconnect any of the connectors while the power is ON.

1-2-1 Environmental conditions

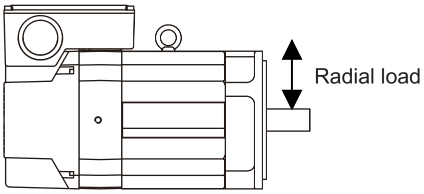
Environment	Conditions
Ambient temperature	0°C to +40°C (with no freezing)
Ambient humidity	90%RH or less (with no dew condensation)
Storage temperature	-20°C to +65°C (with no freezing)
Storage humidity	90%RH or less (with no dew condensation)
Atmosphere	Indoors (Where unit is not subject to direct sunlight) No corrosive gases, flammable gases, oil mist or dust
Altitude	Operation/storage: 1000m or less above sea level Transportation: 10000m or less above sea level

(Note) Refer to each spindle motor specifications for details on the spindle motor vibration conditions.

1-2-2 Shaft characteristics

There is a limit to the load that can be applied on the motor shaft. Make sure that the load applied on the radial direction, when mounted on the machine, is below the tolerable values given below. These loads also affect the motor output torque, so consider them when designing the machine.

Spindle motor	Tolerable radial load
SJ-VL2.2-02ZT	196N
SJ-VL11-10FZT	245N
SJ-VL0.75-01T, SJ-VL1.5-01T	490N
SJ-D3.7/100-01, SJ-DJ5.5/100-01 SJ-V2.2-01T, SJ-V3.7-01T, SJ-V5.5-01ZT, SJ-V7.5-01ZT, SJ-V7.5-03ZT, SJ-VL11-05FZT-S01, SJ-VL11-07ZT	980N
SJ-D5.5/100-01, SJ-DJ7.5/100-01	1470N
SJ-D7.5/100-01, SJ-D11/80-01, SJ-DJ11/100-01 SJ-V11-01ZT	1960N



(Note) The load point is at the one-half of the shaft length.

⚠CAUTION Consider on the machine side so that the thrust loads are not applied to the spindle motor.

1-3 Installation of tool spindle motor

1-3-1 Environmental conditions

Environment	Conditions
Ambient temperature	0°C to +40°C (with no freezing)
Ambient humidity	80% RH or less (with no dew condensation)
Storage temperature	-15°C to +70°C (with no freezing)
Storage humidity	90% RH or less (with no dew condensation)
Atmosphere	Indoors (no direct sunlight) No corrosive gas, inflammable gas, oil mist or dust
Altitude	Operation / storage: 1000m or less above sea level Transportation: 10000m or less above sea level
Vibration	X:19.6m/s^2 (2G) Y:19.6m/s^2(2G)

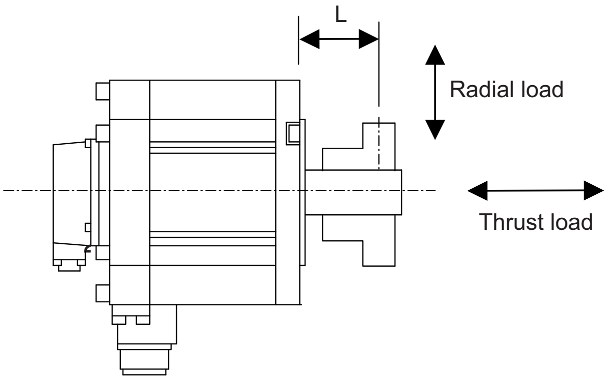
1-3-2 Shaft characteristics

There is a limit to the load that can be applied on the motor shaft. Make sure that the load applied on the radial direction and thrust direction, when mounted on the machine, is below the tolerable values given below. These loads may affect the motor output torque, so consider them when designing the machine.

Tool spindle motor	Tolerable radial load	Tolerable thrust load
HF-KP46, 56	245N (L=30)	98N
HF-KP96	392N (L=40)	147N
HF75S, 105S	245N (L=33)	147N
HF54S, 104S, 154S, 224S, 123S, 223S	980N (L=55)	490N
HF204S, 303S	2058N (L=79)	980N

(Note 1) The tolerable radial load and thrust load in the above table are values applied when each motor is used independently.

(Note 2) The symbol L in the table refers to the value of L below.



L: Length from flange installation surface to center of load mass [mm]

1-4 Installation of the drive unit

⚠ **CAUTION**

1. Install the unit on noncombustible material. Direct installation on combustible material or near combustible materials may lead to fires.
2. Follow the instructions in this manual and install the unit while allowing for the unit mass.
3. Do not get on top of the units or motor, or place heavy objects on the unit.
   Failure to observe this could lead to injuries.
4. Always use the unit within the designated environment conditions.
5. Do not let conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter the units.
6. Do not block the units intake and outtake ports. Doing so could lead to failure.
7. The units and servomotor are precision devices, so do not drop them or apply strong impacts to them.
8. Do not install or run units or servomotor that is damaged or missing parts.
9. When storing for a long time, please contact your dealer.
10. Always observe the installation directions. Failure to observe this could lead to faults.
11. Secure the specified distance between the units and panel, or between the units and other devices. Failure to observe this could lead to faults.

1-4-1 Environmental conditions

Environment	Conditions
Ambient temperature	0°C to +55°C (with no freezing)
Ambient humidity	90%RH or less (with no dew condensation)
Storage temperature	-15°C to +70°C (with no freezing)
Storage humidity	90%RH or less (with no dew condensation)
Atmosphere	Indoors (no direct sunlight); no corrosive gases, inflammable gases, oil mist, dust or conductive particles
Altitude	Operation/storage: 1,000m or less above sea level Transportation: 13,000m or less above sea level
Vibration	Operation/storage: 4.9m/s^2 (0.5G) or less Transportation: 49m/s^2 (5G) or less

(Note) When installing the machine at 1,000m or more above sea level, the heat dissipation characteristics will drop as the altitude increases.
The upper limit of the ambient temperature drops 1°C with every 100m increase in altitude.
(The ambient temperature at an altitude of 2,000m is between 0 and +45°C.)

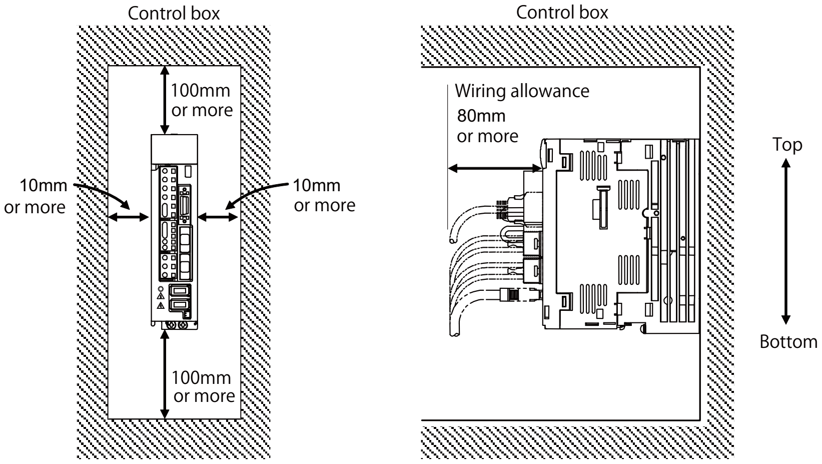
1-4-2 Installation direction and clearance

Wire each unit in consideration of the maintainability and the heat dissipation, as well as secure sufficient space for ventilation.

Installation clearance

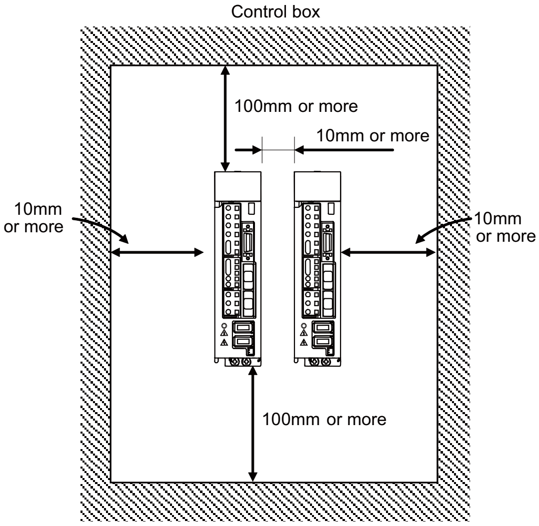
- For the heat radiation, secure the following dimensions around the unit.
- Secure the distance shown below for clearance between the unit side face and the device which is a noise source of power wire or relay, etc.,.
- Secure clearance for installing the unit so that the connector can be inserted or pull out.

(1) Installation of one drive unit



(2) Installation of two or more drive units

Leave a large clearance between the top of the drive unit and the internal surface of the control box, and install a fan to prevent the internal temperature of the control box from exceeding the environmental conditions.



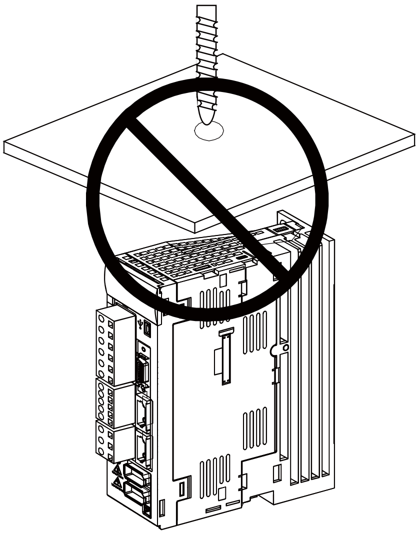
⚠ CAUTION

1. The ambient temperature condition for the drive units is 55°C or less.
2. Because heat can easily accumulate in the upper portion of the units, give sufficient consideration to heat dissipation when designing the panel. If required, install a fan in the panel to agitate the heat in the upper portion of the units.

1-4-3 Prevention of entering of foreign matter

Treat the cabinet with the following items.

(1) Make sure that the cable inlet is dust and oil proof by using packing, etc.
(2) Make sure that the external air does not enter inside by using head radiating holes, etc.
(3) Close all clearances of the cabinet.
(4) Securely install door packing.
(5) If there is a rear cover, always apply packing.
(6) Oil will tend to accumulate on the top. Take special measures such as oil-proofing to the top so that oil does not enter the cabinet from the screw holds.
(7) After installing each unit, avoid machining in the periphery. If cutting chips, etc., stick onto the electronic parts, trouble may occur.
(8) When using the unit in an area with toxic gases or high levels of dust, protect the unit with air purging (system to blow clean air so that the panel's inner pressure is higher than the outer pressure).



1-4-4 Heating value

Each heating value is calculated with the following values.
The values for the servo drive unit apply at 50% of the stall output. The values for the spindle drive unit apply for the continuous rated output.

Servo drive unit		Spindle drive unit	
Type MDS-D-SVJ3-	Heating value [W]	Type MDS-D-SVJ3-	Heating value [W]
	Inside panel		Inside panel
03NA	25	**075NA**	50
04NA	35	**22NA**	90
07NA	50	**37NA**	130
10NA	90	**55NA**	150
20NA	130	**75NA**	200
35NA	195	**110NA**	300

POINT

1. Design the panel's heating value taking the actual axis operation (load rate) into consideration.
2. The following table shows a load rate in a general machine tool.

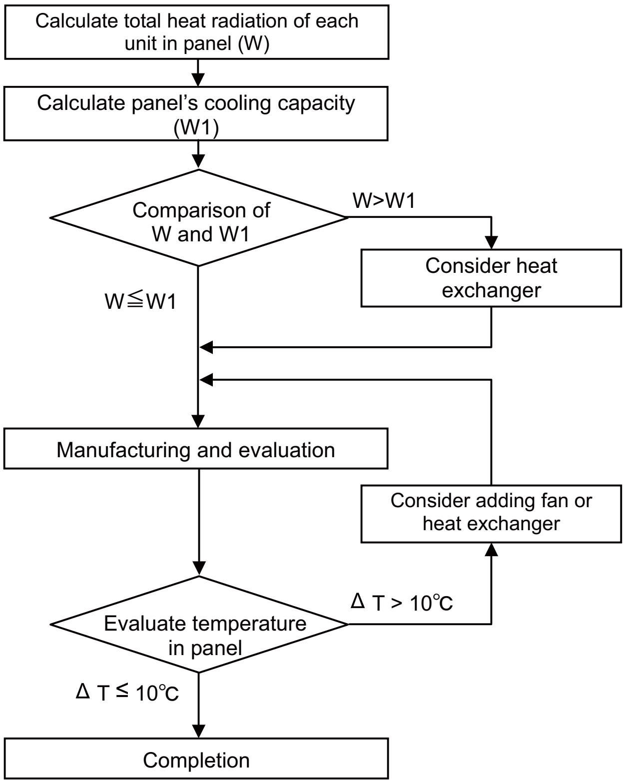
Unit	Load rate
Servo drive unit	50%
Spindle drive unit	100%

1-4-5 Heat radiation countermeasures

(1) Heat radiation countermeasures in the control panel

In order to secure reliability and life, design the temperature in the panel so that the ambient temperature of each unit is 55°C or less.
If the heat accumulates at the top of the unit, etc., install a fan or heat exchanger so that the temperature in the panel remains constant.

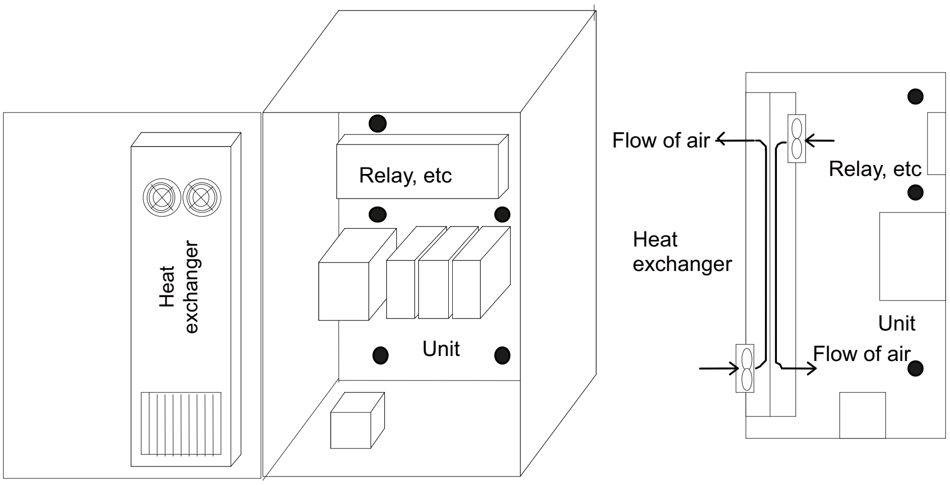
Please refer to following method for heat radiation countermeasures.



<Hypothetical conditions>
[1] Average temperature in panel: $T \leq 55°C$
[2] Panel peripheral temperature: $Ta \leq 0$ to 45°C
[3] Internal temperature rise value: $\Delta T=T-Ta_{max}=10°C$

<Point>
[1] Refer to the section "1-3-4 Heating value" for the heat generated by each unit.
[2] Refer to the following calculation for calculation W1 of the panel's cooling capacity (thin steel plate).
W1 = U x A x Δ T
U: $6W/m^2$ x °C (with internal agitating fan)
$4W/m^2$ x °C (without internal agitating fan)
A: Effective heat radiation area $[m^2]$
（Heat dissipation area in panel）
Sections contacting other objects are excluded.
ΔT: Internal temperature rise value (10°C)
[3] Points in manufacturing and evaluation
Understanding the temperature rise in the panel, and install a fan or heat exchanger.
ΔT (average value) ≤ 10°C
ΔT_{max} (maximum value) ≤ 15°C

Examples of mounting heat exchanger and temperature measurement positions (reference)

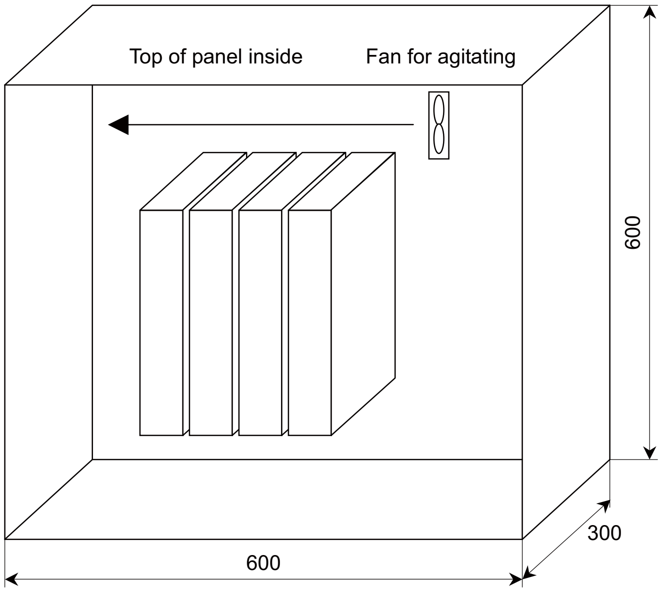


● Temperature measurement positions

The following shows a calculation example for considering heat radiation countermeasures.

<Control panel outline dimension (assumption) >

When installing four units which have the heating value in the panel of 15W



Heat radiation area (A): When a bottom section contacts with a machine

$$A = \underbrace{0.6 \times 0.3}_{\text{(Top face)}} + \underbrace{0.6 \times 0.6 \times 2}_{\text{(Front/back face)}} + \underbrace{0.6 \times 0.3 \times 2}_{\text{(Side face)}} = 1.26\ (m^2)$$

(Note) Actually, sections contacting other objects are excluded.

Heating value in panel (W): when installing four units which are 15W

W = 15 x 4 = 60 (W)

<Considering necessity of agitating fan>

1 Temperature standard

(1) Standard of temperature in panel (around each unit) T ≦ 55°C
(2) External peripheral temperature Ta = 0 to 45°C
(3) Internal temperature rise value DT = T - Ta (MAX) = 10°C

2 Cooling capacity of control panel (W1)

W1 = U x A x DT DT = Internal temperature rise value (=10°C)
U = 6W/m^2 ・°C (with internal agitating fan)
4W/m^2 ・°C (without internal agitating fan)
A = Effective heat radiation area (m^2)

(1) With internal agitating fan W1 = 6 x 1.26 x 10 = 75.6 (W) > 60 (W)
(2) Without internal agitating fan W1 = 4 x 1.26 x 10 = 50.4 (W) < 60 (W) -- Internal fan is required.

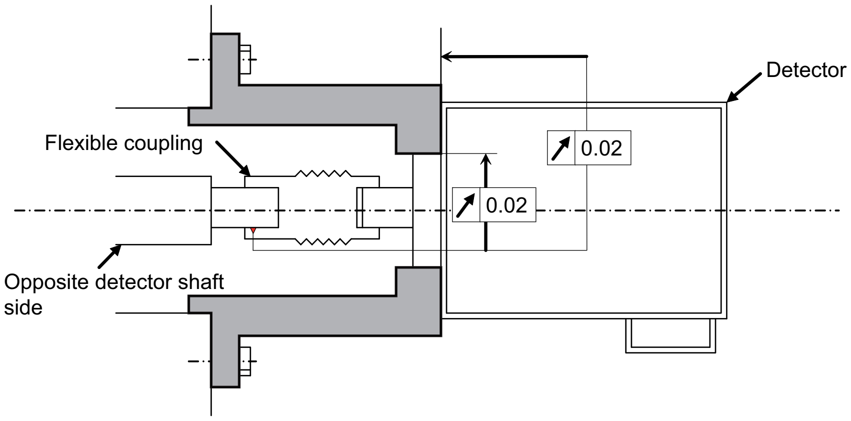
POINT

Measure an actual internal temperature, and install a fan or heat exchanger which agitates the heat at the top of the unit if the temperature rise exceeds 10°C.

1-5 Installation of the spindle detector

1-5-1 Spindle side ABZ pulse output detector (OSE-1024 Series)

To maintain the detector life and performance, a flexible coupling should be used to couple the spindle side detector and C-axis detector with the spindle.



Detector and coupling installation accuracy

Recommended coupling

		Recommendation 1	Recommendation 2
Manufacturer		Tokushu Seiko	Eagle
Model		Model M1	FCS38A
Resonance frequency		1374Hz	3515Hz
Position detection error		0.8×10^{-3} °	1.2×10^{-3} °
Tolerable speed		20,000r/min	10,000r/min
Mis-alignment	**Core deviation**	0.7mm	0.16mm
	Angle displacement	1.5°	1.5°
Outline dimensions	**Max. length**	74.5mm	33mm
	Max. diameter	φ57mm	φ38mm

⚠ **CAUTION** Confirm that the gear ratio (pulley ratio) of the spindle end to the detector is 1:1.

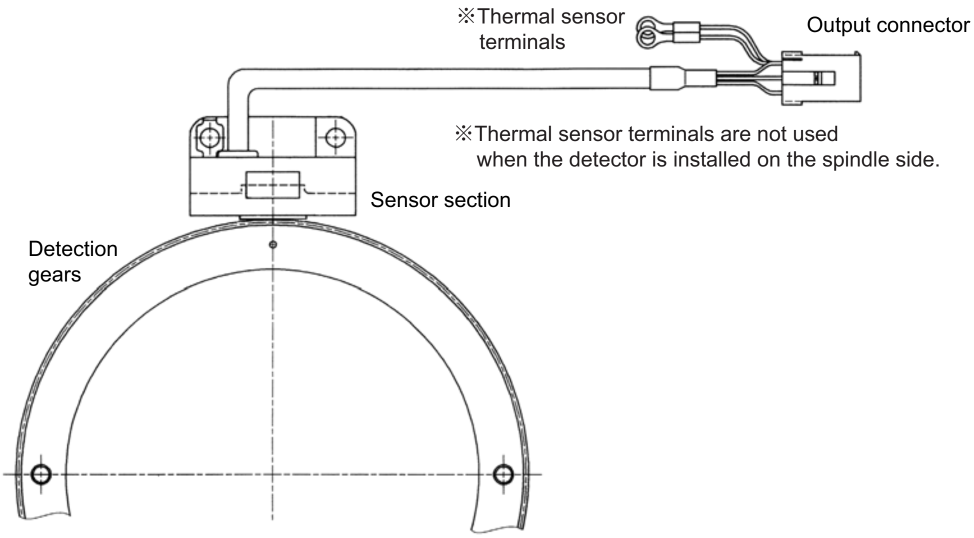
Refer to the coupling catalog, etc., for details on the coupling.

1-5-2 Spindle side PLG serial output detector (TS5690, MU1606 Series)

(1) Part configuration

The detector is configured of a sensor and detection gear. The sensor and detection gear must be used in the designated combination.

These are precision parts, and require care when handling. Do not apply an excessive force on the sensor's detection surface, as this could result in faults. Do not pull and apply a load on the lead wires. Make sure that foreign matters (iron chips, etc.) do not get on the sensor's detection surface or detection gears. If any foreign matter should get on these parts, carefully remove while taking care not to damage the parts. When handling the detection gears, take care not to damage or deform the teeth.



Spindle side PLG serial output detector TS5690 Series

(2) Installing the detection gears

[1] Install the detection gears so that the first gear's teeth side (Z phase) face the sensor's lead side.

[2] The detection gears and shaft or sleeve should be fixed with shrink fitting. Refer to the following table for the shrink fitting values. The detection gears should be heated evenly between 120 and 150°C using an electric furnace, etc.

Guideline for detection gear shrink fitting values

Inner diameter (mm)	Shrink fitting (mm)	Inner diameter (mm)	Shrink fitting (mm)
φ40	0.020 to 0.040	φ140	0.050 to 0.085
φ70	0.030 to 0.055	φ160	0.060 to 0.090
φ80	0.030 to 0.055	φ215	0.080 to 0.110
φ125	0.050 to 0.085		

[3] Keep the deflection of the outer diameter, when the detection gears are installed on the shaft, to 0.02mm or less.

[4] To remove a detection gear fixed with shrink fitting, use the screw holes opened in the axial direction for pulling (two M5 screw holes or two M8 screw holes), or push the end with a jig. Carry out this work carefully. Applying excessive force when pulling out the gears could cause the inner diameter of the detection gears to deform.

[5] Before reusing detection gears which have been removed, always measure the inner diameter dimensions, and carefully check that the inner diameter is not deformed, and that the sufficient tightening amount can be secured. Do not reuse the detection gears if the inner diameter is deformed, or if any abnormality such as damage to the teeth is found.

(3) Installing the sensor section

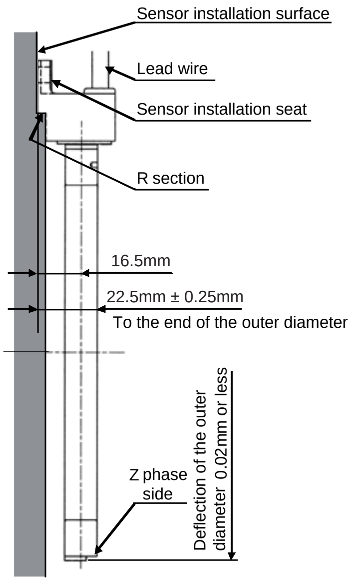
[1] Prepare the notched fitting section at the machine side's installation position to be of the specified dimensions in advance.

[2] With the sensor installation seat's R section butted against the notched fitting section, fix the sensor installation seat with a mounting screw (M5 x 0.8 screws). A locking agent should be applied on the mounting screw before it is tightened.

[3] Fix the sensor with its R section butted against the notched fitting section so that the position relation between the detection gear and sensor is kept constant. This ensures favorable accuracy of the sensor installation.

[4] Keep the deviation of the sensor center and outer diameter center of the detection gear to ±0.25mm or less. If the center deviation cannot be directly measured, set so that the dimension from the sensor installing surface to the outer diameter edge of the detection gears is 22.5±0.25mm. (Some detection gears have thickness at the inner diameter section.)

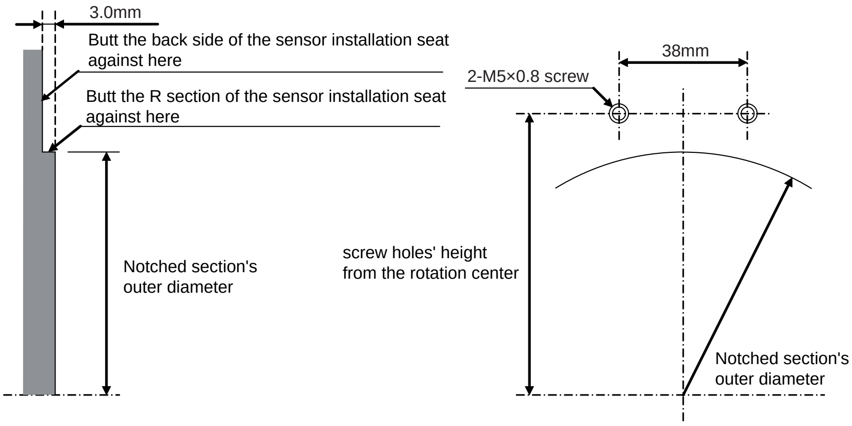
[5] Make sure that force is not constantly applied on the sensor's lead wires.



Installing the detector

POINT

To install the sensor section, the notched fitting section on the machine side must have the specified dimensions.
The sensor's installation accuracy is assured by adjusting the outside dimensions of the notched fitting section.



Shape of notched fitting section

Installing dimension of the sensor section

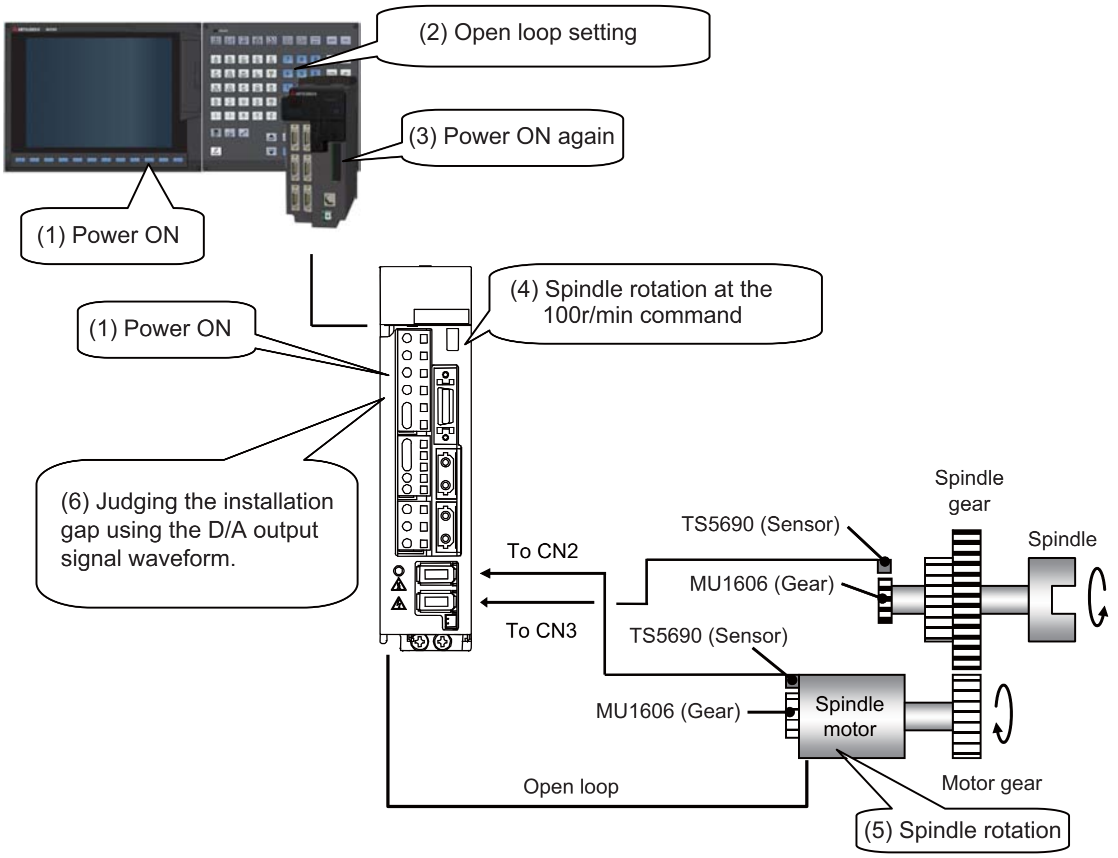
Sensor series type	Screw holes' height from the rotation center (mm)	Notched fitting section's outer diameter (mm)
TS5690N6400	51.4	φ72.0 $^{+0.060}_{-0.010}$
TS5690N1200	77.0	φ122.0 $^{+0.025}_{-0.025}$
TS5690N2500	128.2	φ223.6 $^{+0.025}_{-0.025}$

1-5-3 Installation accuracy diagnosis for PLG detector

(1) Outline

PLG detects the speed and position by the rotation of the gear installed at the motor end or spindle end. Adjustment-free PLG can be used without adjusting the waveform after installing the sensor section (TS5690 Series) on the machined notched fitting section. With this function, whether the PLG installation position is OK or not can be judged using the D/A output of the spindle drive unit while rotating the spindle in an open loop. For an IPM spindle motor, the waveform should be measured while rotating the spindle by hand because an open loop operation cannot be carried out.

⚠ CAUTION Make sure that the motor can be rotated freely in the unloaded state without being locked.



Example: For full closed mode

(2) Setting the parameters

The parameters related to the installation accuracy diagnosis for PLG detector are shown below.

【#13018(PR)】 SP018 SPEC2 Spindle specification 2

bit 1 : oplp Open loop

0: Disable 1: Enable

【#13113】 SP113 OPLP Current command value for open loop

Set the current command value for when the open loop control is enabled.
When "0" is set, the state will be the same as when "50" is set.
When not using, set to "0".
The open loop control is enabled when "SP018 (SPEC2)/bit1 (oplp)" is set to "1".

---Setting range---

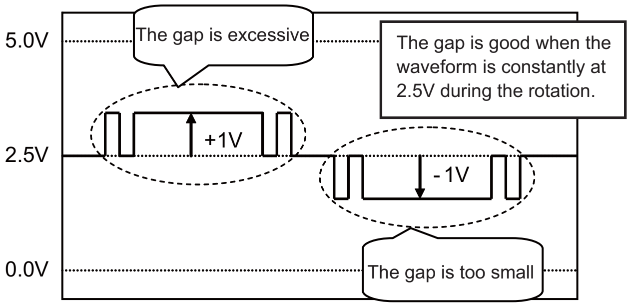
0 to 999 (Short-time rated %)

(3) Details for PLG installation diagnosis

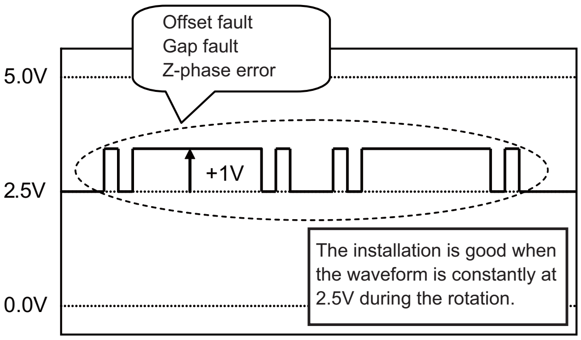
Installation error judgment of the adjustment-free PLG can be checked using the D/A output of the spindle drive unit. The setting numbers of D/A output are shown below. For the output waveform, 2.5V represents a normal state and +1V or -1V of the normal state represents an abnormal state.

*Set the D/A output numbers to the spindle parameters "#13125(SP125)" and "#13126(SP126)". Because the D/A output of the drive unit is 2ch, perform the check for both at the motor end and spindle end in full closed mode.

D/A output No.	Details	Description
120	Motor end PLG installation Gap diagnosis	The result of the quality judgement for the gap of the motor end PLG is output. When the gap is good, =2.5V is output. When the gap is excessive, =2.5+1V is output and when the gap is too small, =2.5-1V is output.
121	Motor end PLG installation All errors diagnosis	The result of the quality judgement for the installed position of the motor end PLG is output. When the sensor installation is good, =2.5V is output. When sensor installation is incorrect (such as a center deviation between a sensor and gear, and Z-phase error), =2.5+1V is output.
122	Spindle end PLG installation Gap diagnosis	The result of the quality judgement for the gap of the spindle end PLG is output. The output procedure is the same as that of motor end PLG.
123	Spindle end PLG installation All errors diagnosis	The result of the quality judgement for the installed position of the spindle end PLG is output. The output procedure is the same as that of motor end PLG.



Waveform example
when the gap is not good



Waveform example
when all results of the diagnosis are not good

POINT

When the D/A output parameter "#13125(SP125)" is set to 120(=D/A output of ch1), and "#13126(SP126)" is set to 121(=D/A output of ch2), the check is performed at the motor end detector. When the D/A output of ch1 is 2.5V and ch2 is 3.5V(=2.5+1V), for example, the gap is normal, however, the center deviation (offset) between a sensor and gear occurs, so check again after the sensor installed position is finely adjusted. Adjust until the two D/A outputs finally become 2.5V during spindle rotation.

⚠CAUTION

When the sensor installed position is finely adjusted, adjust after the power of the drive unit is turned OFF.

(4) Related alarms

There is no alarm related to the installation accuracy diagnosis for PLG detector.

1-6 Noise measures

Noise includes "propagation noise" generated from the relay, etc., and propagated along a cable causing the drive unit to malfunction, and "radiated noise" propagated through air from a peripheral device, etc., and causing the power supply unit or drive unit to malfunction.
Always implement these noise measures to prevent the peripheral devices and unit from malfunctioning. The measures differ according to the noise propagation path, so refer to the following explanation and take appropriate measures.

(1) General noise measures

(a) Avoid laying the drive unit's power line and signal wire in a parallel or bundled state. Always separate these wires. Use a twisted pair shielded wire for the detector cable and signal wires such as the communication cable connected with the NC unit, and accurately ground the devices.
(b) Use one-point grounding for the drive unit and motor.
(c) Accurately ground the AC reactor.

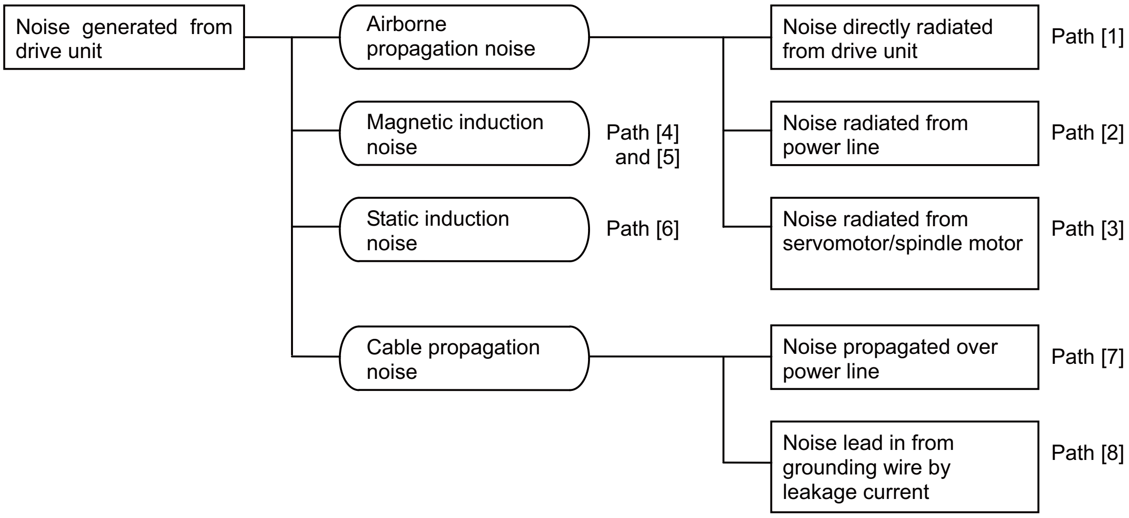
(2) Propagation noise measures

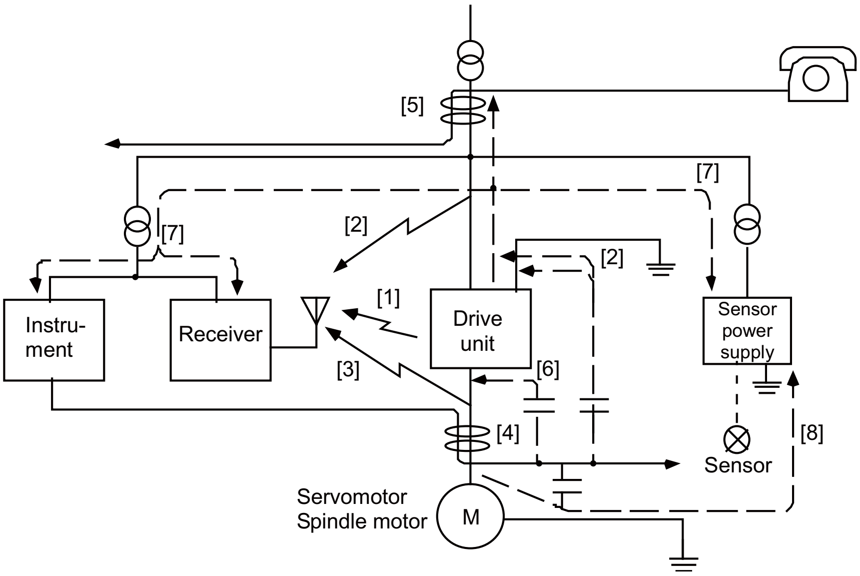
Take the following measures when noise generating devices are installed and the drive unit could malfunction.

(a) Install a surge killer on devices (magnetic contacts, relays, etc.) which generate high levels of noise.
(b) Install a power line filter in the stage before the drive unit.
(c) Install a ferrite core on the signal wire.
(d) Ground the shield of the servo detector's cable with a cable clamp.
(e) Wire the spindle PLG detector cable away from other wires.

(3) Measures against radiated noise

The types of propagation paths of the noise and the noise measures for each propagation path are shown below.





Generated noise of drive system

Noise propagation path	Measures
[1] [2] [3]	When devices such as instrument, receiver or sensor, which handle minute signals and are easily affected by noise, or the signal wire of these devices, are stored in the same panel as the drive units and the wiring is close, the device could malfunction due to airborne propagation of the noise. In this case, take the following measures. (a) Install devices easily affected as far away from the drive units as possible. (b) Lay devices easily affected as far away from the signal wire of the drive unit as possible. (c) Avoid laying the signal wire and power line in a parallel or bundled state. (d) Insert a line noise filter on the input/output wire or a radio filter on the input to suppress the noise radiated from the wires. (e) Use a shield wire for the signal wire and power line, or place in separate metal ducts.
[4] [5] [6]	If the signal wire is laid in parallel to the power line, or if it is bundled with the power line, the noise could be propagated to the signal wire and cause malfunction because of the magnetic induction noise or static induction noise. In this case, take the following measures. (a) Install devices easily affected as far away from the drive unit as possible. (b) Lay devices easily affected as far away from the signal wire of the drive unit as possible. (c) Avoid laying the signal wire and power line in a parallel or bundled state. (d) Use a shield wire for the signal wire and power line, or place in separate metal ducts.
[7]	If the power supply for the peripheral devices is connected to the drive unit in the same system as the drive units, the noise generated from the power supply unit could back flow over the power line and cause the devices to malfunction. In this case, take the following measures. (a) Install a radio filter on the drive unit's power line. (b) Install a power filter on the drive unit's power line.
[8]	If a closed loop is created by the peripheral device and drive unit's grounding wire, a leakage current could flow and cause the device to malfunction. In this case, change the device grounding methods and the grounding place.

2

Wiring and Connection

Contents

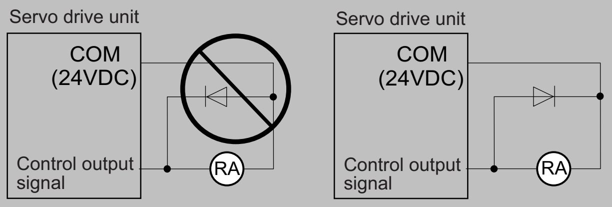
2 Wiring and Connection

⚠DANGER

1. Wiring work must be done by a qualified technician.
2. Wait at least 15 minutes after turning the power OFF and check the voltage with a tester, etc., before starting wiring. Failure to observe this could lead to electric shocks.
3. Securely ground the drive units and servo/spindle motor.
4. Wire the drive units and servo/spindle motor after installation. Failure to observe this could lead to electric shocks.
5. Do not damage, apply forcible stress, place heavy items on the cables or get them caught. Failure to observe this could lead to electric shocks.
6. Always insulate the power terminal connection section. Failure to observe this could lead to electric shocks.

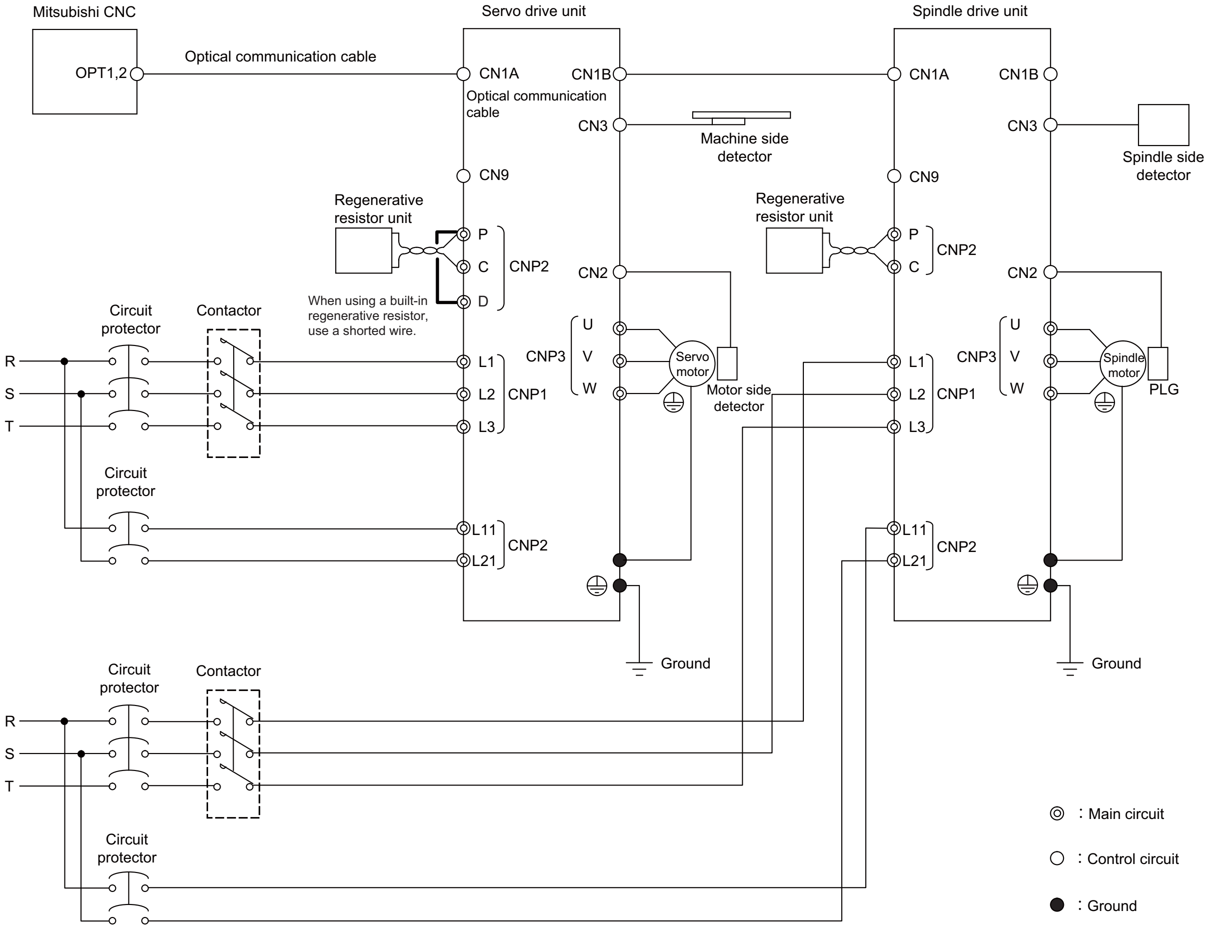
⚠CAUTION

1. Correctly and securely perform the wiring. Failure to do so could result in runaway of the servo/spindle motor or injury.
2. Do not mistake the terminal connections.
3. Do not mistake the polarity (+ , -). Failure to observe this item could lead to ruptures or damage, etc.
4. Do not mistake the direction of the diodes for the surge absorption installed on the DC relay for the motor brake and contactor (magnetic contactor) control. The signal might not be output when a failure occurs.



5. Electronic devices used near the drive units may receive magnetic obstruction. Reduce the effect of magnetic obstacles by installing a noise filter, etc.
6. Do not install a phase advancing capacitor, surge absorber or radio noise filter on the power line (U, V, W) of the servo/spindle motor.
7. Do not modify this unit.
8. If the connectors are connected incorrectly, faults could occur. Make sure that the connecting position and the connection are correct.
9. When grounding the motor, connect to the protective grounding terminal on the drive units, and ground from the other protective grounding terminal.(Use one-point grounding)
   Do not separately ground the connected motor and drive unit as noise could be generated.

2-1 Part system connection diagram



(Note 1) The total length of the optical communication cable from the NC must be within 30m and the minimum-bending radius within 80mm.
(Note 2) The connection method will differ according to the used motor.
(Note 3) Install the dedicated battery for the detector back up outside of the drive unit's bottom surface.
(Note 4) The main circuit (◎), control circuit (○) and ground (●) are safely separated.
(Note 5) Connect the ground of the motor to the ground of the connected drive unit.

2-2 Main circuit terminal block/control circuit connector

2-2-1 Names and applications of main circuit terminal block signals and control circuit connectors

The following table shows the details for each terminal block signal.

Name	Signal name	Description
L1 . L2 . L3	Main circuit power supply	Main circuit power supply input terminal Connect a 3-phase 200VAC (50Hz) or 200 to 230VAC (60Hz).
(N . P1 . P2)	Not used	Not used (Short between P1 and P2.)
P.C.D	Regenerative resistor	Regenerative resistor connection terminal When using the built-in regenerative resistor, short between P and D. P to D is wired at shipment. When using the external option regenerative resistor, disconnect the wire between P and D, and wire the external option regenerative resistor between P and C.
L11 L21	Control circuit power supply	Control circuit power supply input terminal Connect a single-phase 200VAC (50Hz) or 200 to 230VAC (60Hz).
U . V . W	Motor output	Servo/spindle motor power output terminal (3-phase AC output) The servo/spindle motor power terminal (U, V, W) is connected.
⏚	Protective grounding (PE)	Grounding terminal The servomotor/spindle motor grounding terminal is connected and grounded.

⚠ CAUTION

1. When sharing a circuit protector for several drive units, of a short-circuit fault occurs in a small capacity unit, the circuit protector could trip. This can be hazardous, so do not share the circuit protector.

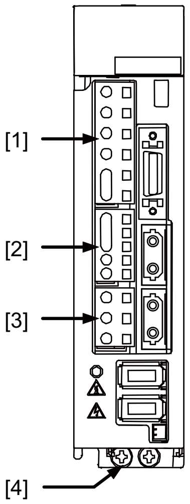
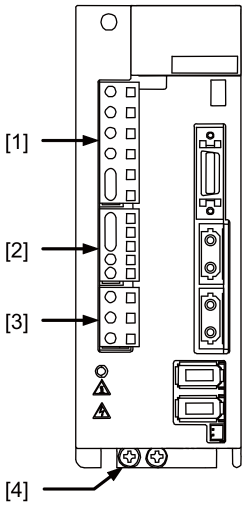
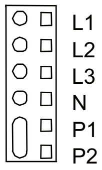
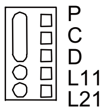
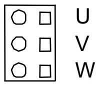
2. Be sure to use the circuit protector of proper capacity for each drive unit.

2-2-2 Connector pin assignment

⚠CAUTION Do not apply a voltage other than that specified in Instruction Manual on each terminal. Failure to observe this item could lead to rupture or damage, etc.

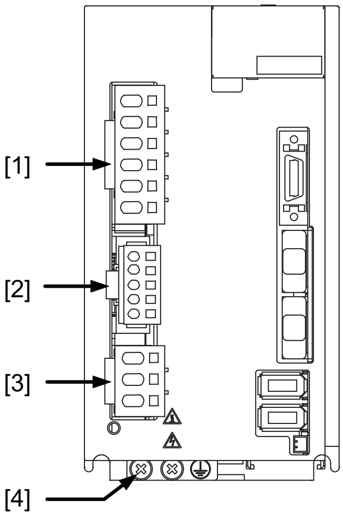
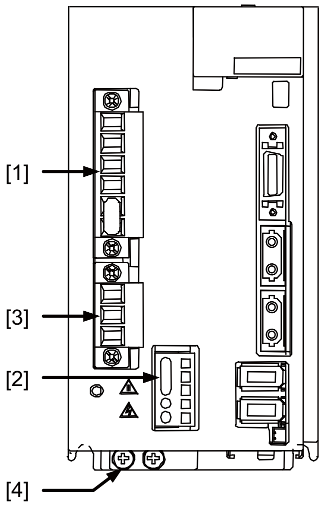
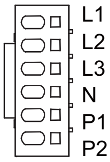
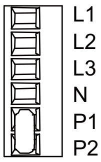
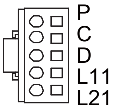
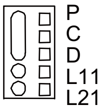
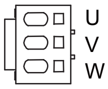
(1) Main circuit terminal block and connector

Power supply unit

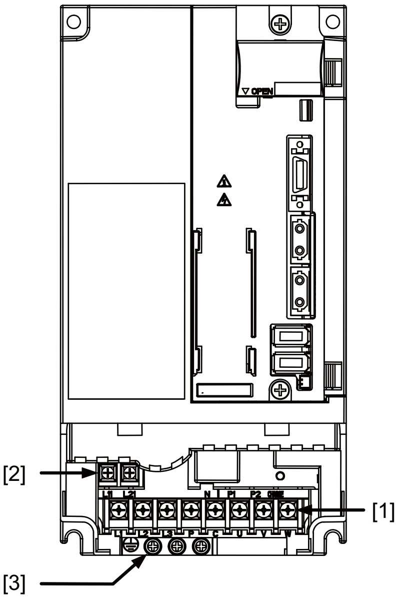
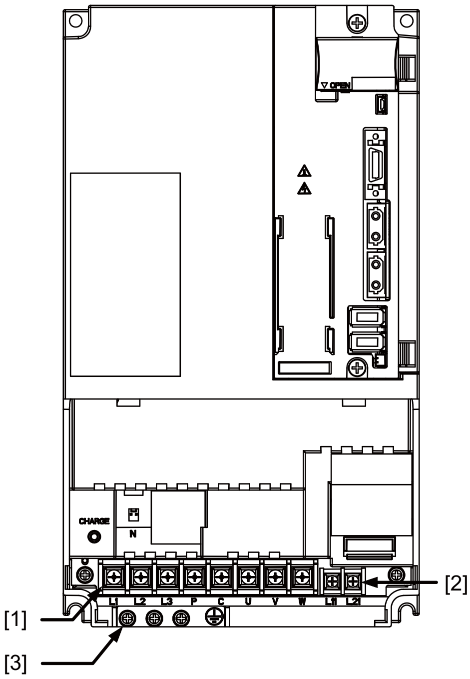
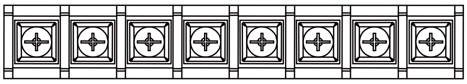
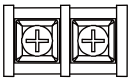
<table>
<tr><th colspan="2">Unit
Terminal</th><th>MDS-D-SVJ3-03NA to 04NA</th><th>MDS-D-SVJ3-07NA
MDS-D-SPJ3-075NA</th></tr>
<tr><td colspan="2">Terminal position</td><td> </td><td> </td></tr>
<tr><td rowspan="4">Terminal specification/ Pin assignment</td><td>[1] CNP1</td><td colspan="2"> </td></tr>
<tr><td>[2] CNP2</td><td colspan="2"> </td></tr>
<tr><td>[3] CNP3</td><td colspan="2"> </td></tr>
<tr><td>[4] ⏚</td><td colspan="2">Screw size: M4 x 10
Tightening torque: 1.2Nm</td></tr>
</table>

(Note) The illustrations of drive units are shown as an example.

2 Wiring and Connection

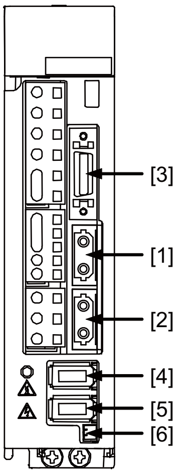
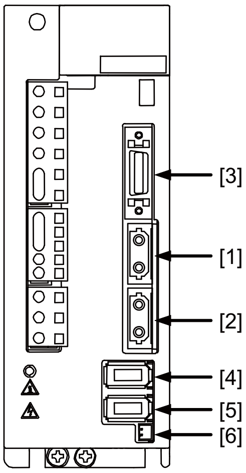
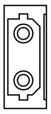
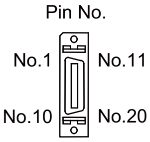
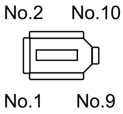
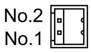
Terminal \ Unit		MDS-D-SVJ3-10NA to 20NA MDS-D-SPJ3-22NA	MDS-D-SVJ3-35NA MDS-D-SPJ3-37NA
Terminal position			
Terminal specification/ Pin assignment	**[1] CNP1**		
	[2] CNP2		
	[3] CNP3		
	[4] ⏚	Screw size: M4×10 Tightening torque: 1.2Nm	

(Note) The illustrations of drive units are shown as an example.

Unit Terminal		MDS-D-SPJ3-55NA to 75NA	MDS-D-SPJ3-110NA
Terminal position			
Terminal specification/ Pin assignment	**[1] TE1**		Screw size: M4 x 10 Tightening torque: 1.2Nm
	[2] TE2		Screw size: M3.5 x 6 Tightening torque: 0.8Nm
	[3] ⏚	Screw size: M4 x 10 Tightening torque: 1.2Nm	

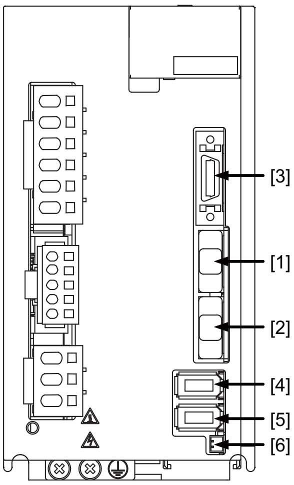
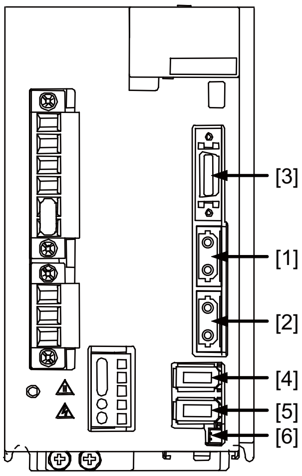
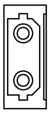
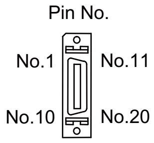
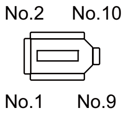
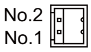
(Note) The illustrations of drive units are shown as an example.

(2) Control circuit connector

<table>
<tr><th colspan="2">Unit
Terminal</th><th>MDS-D-SVJ3-03NA to 04NA</th><th>MDS-D-SVJ3-07NA
MDS-D-SPJ3-075NA</th></tr>
<tr><td colspan="2">Connector position</td><td>
</td><td>
</td></tr>
<tr><td rowspan="4">Connector specification</td><td>[1] CN1A
[2] CN1B</td><td colspan="2">Optical communication connector
</td></tr>
<tr><td>[3] CN9</td><td colspan="2">DI/O or Maintenance connector

</td></tr>
<tr><td>[4] CN2
[5] CN3</td><td colspan="2">CN2: Motor side detector connector
CN3: Machine side / spindle side detector connector

</td></tr>
<tr><td>[6] BAT
(Note)</td><td colspan="2">Battery connector

</td></tr>
</table>

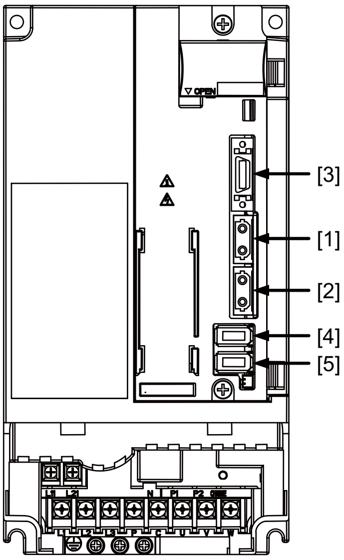
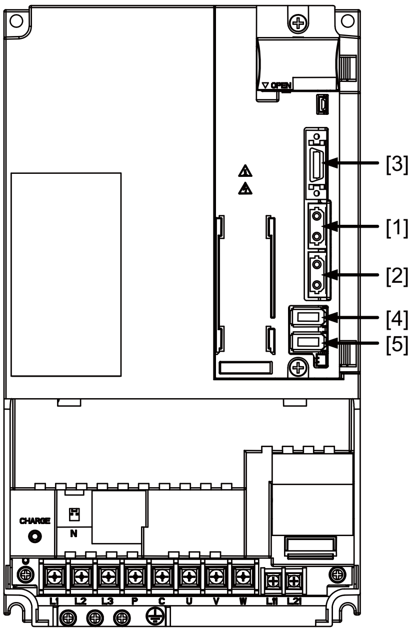
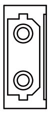
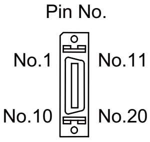
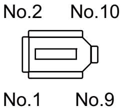
(Note 1) [6] connector is not used for the spindle drive unit.

(Note 2) The illustrations of drive units are shown as an example.

<table>
<tr><th colspan="2">Unit
Terminal</th><th>MDS-D-SVJ3-10NA to 20NA
MDS-D-SPJ3-22NA</th><th>MDS-D-SVJ3-35NA
MDS-D-SPJ3-37NA</th></tr>
<tr><td colspan="2">Connector position</td><td> </td><td> </td></tr>
<tr><td rowspan="4">Connector specification</td><td>[1] CN1A
[2] CN1B</td><td colspan="2">Optical communication connector
</td></tr>
<tr><td>[3] CN9</td><td colspan="2">DI/O or Maintenance connector
 </td></tr>
<tr><td>[4] CN2
[5] CN3</td><td colspan="2">CN2: Motor side detector connector
CN3: Machine side / spindle side detector connector
 </td></tr>
<tr><td>[6] BAT
(Note)</td><td colspan="2">Battery connector
 </td></tr>
</table>

(Note 1) [6] connector is not used for the spindle drive unit.

(Note 2) The illustrations of drive units are shown as an example.

Unit Terminal		MDS-D-SPJ3-55NA to 75NA	MDS-D-SPJ3-110NA
Connector position			
Connector specification	**[1] CN1A** **[2] CN1B**	**Optical communication connector** 	
	[3] CN9	**DI/O or Maintenance connector** 	
	[4] CN2 **[5] CN3**	**CN2: Motor side detector connector** **CN3: Machine side / spindle side detector connector** 	

(Note) The illustrations of drive units are shown as an example.

2-2-3 Main circuit connector (CNP1,CNP2,CNP3) wiring method

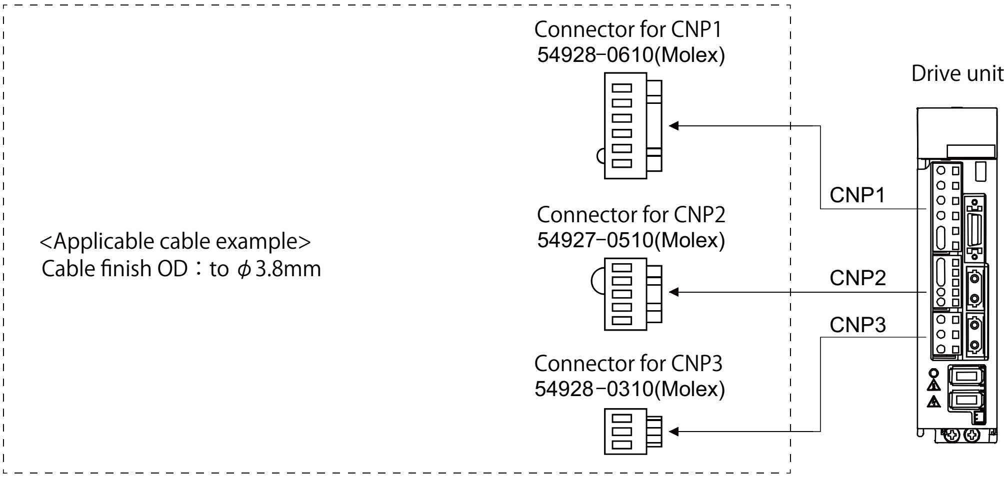
Use the supplied drive unit power supply connectors for wiring of CNP1, CNP2 and CNP3.

POINT

For the wire size used for wring, refer to the section "5-1 selection of wire" in MDS-D-SVJ3/SPJ3 Series Specifications Manual.
MDS-D-SPJ3-55NA/75NA/110NA does not have these connectors.

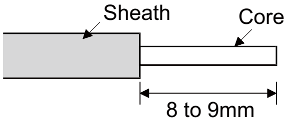
(1) MDS-D-SVJ3-03NA/04NA/07NA, MDS-D-SPJ3-075NA

(a) Drive unit power supply connectors



(b) Termination of the cables

Solid wire: After the sheath has been stripped, the cable can be used as it is.

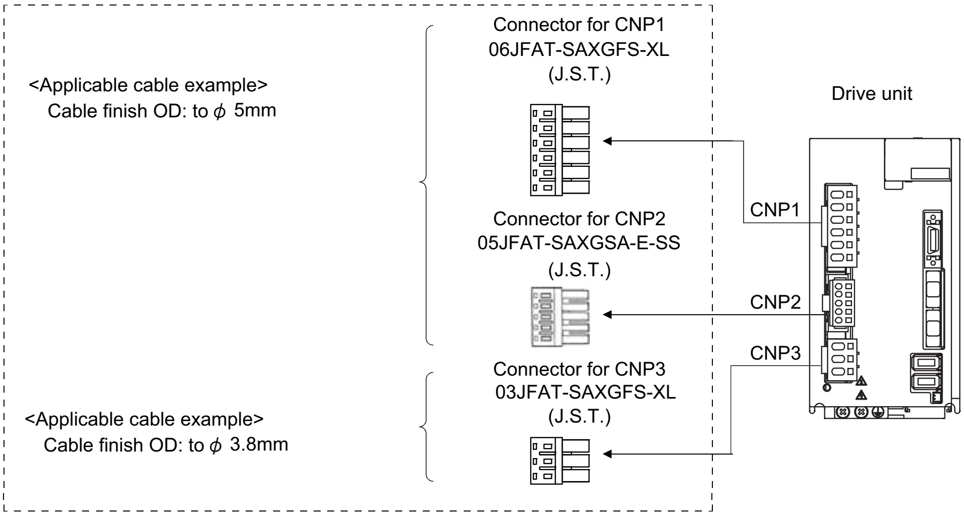


Twisted wire: Use the cable after stripping the sheath and not twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

Cable size		Bar terminal type		Crimping tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25	16	BT1.25-9-1	-	NH1	NICHIFU
		TUB-1.25	-	YHT-2210	Japan Solderless Terminal
1.5	16	AI1.5-8BK	AI-TWIN2×1.5-8BK AI-TWIN2×1.5-12BK	CRIMPFOX-UD6	Phoenix Contact
2	14	BT2-9-1	-	NH1	NICHIFU
		TUB-2	-	YHT-2210	Japan Solderless Terminal

(2) MDS-D-SVJ3-10NA/20NA, MDS-D-SPJ3-22NA

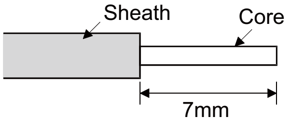
(a) Drive unit power supply connectors



(b) Termination of the cables

[1] CNP1, CNP3

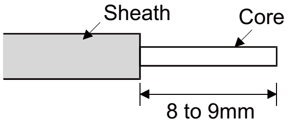
Solid wire: After the sheath has been stripped, the cable can be used as it is.



Twisted wire: Use the cable after stripping the sheath and not twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

[2] CNP2

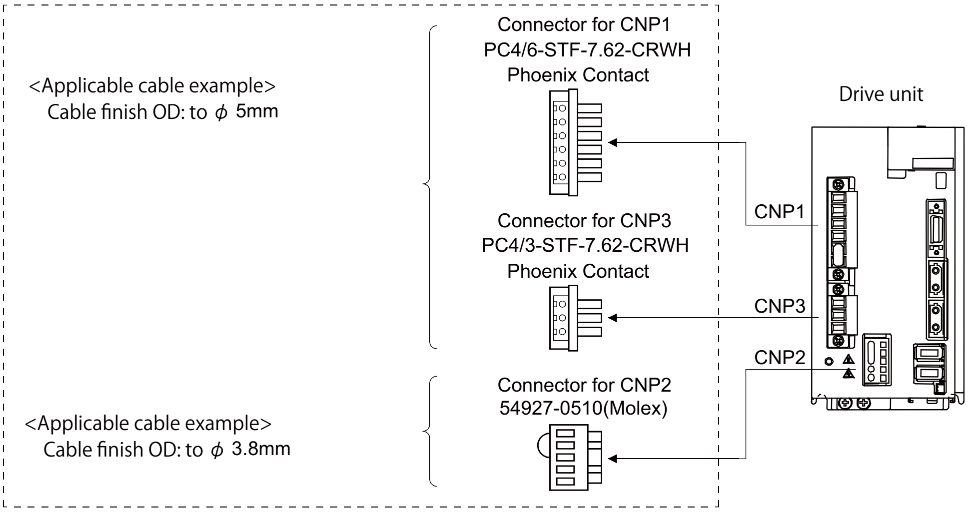
Solid wire: After the sheath has been stripped, the cable can be used as it is.



Twisted wire: Use the cable after stripping the sheath and not twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

(3) MDS-D-SVJ3-35NA, MDS-D-SPJ3-37NA

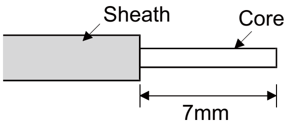
(a) Drive unit power supply connectors



(b) Termination of the cables

[1] CNP1, CNP3

Solid wire: After the sheath has been stripped, the cable can be used as it is.



Twisted wire: Use the cable after stripping the sheath and not twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

Cable size		Bar terminal type		Crimping tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
0.34	22	AI0.34-8TQ	-	CRIMPFOX-ZA3	Phoenix Contact
0.5	20	AI0.5-8WH	AI-TWIN2×0.5-8WH		
0.75	18	AI0.75-8GY	AI-TWIN2×0.75-8GY		
1	18	AI1-8RD	AI-TWIN2×1-8RD		
1.5	16	AI1.5-8BK	AI-TWIN2×1.5-8BK		
2.5	14	AI2.5-8BU	AI-TWIN2×2.5-10BU		

[2] CNP2

CNP2 is the same as MDS-D-SVJ3-03NA/04NA/07NA or MDS-D-SPJ3-075NA. Refer to (1) (b) in this section.

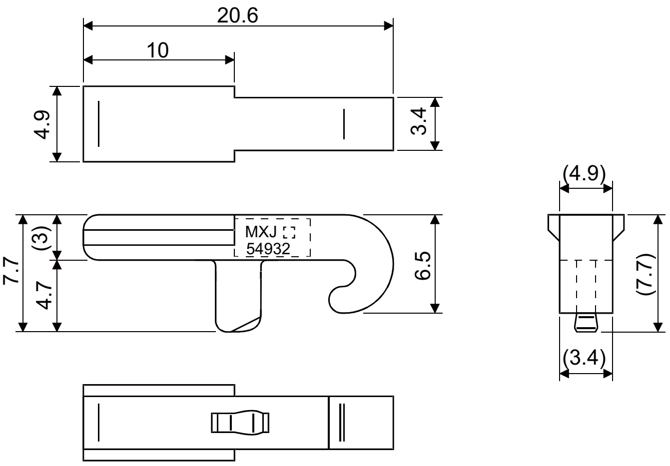
(4) How to insert the cable into 54928-0610, 54927-0510, and 54928-0310 (MOLEX) connector

How to connect a cable to the drive unit power supply connector is shown below.

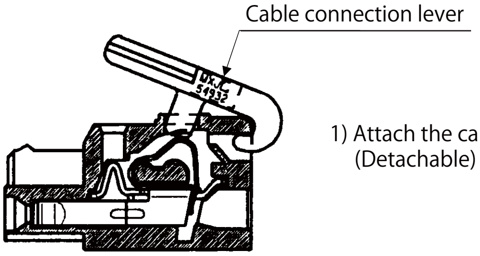
(a) When using the supplied cable connection lever

[1] The drive unit is packed with the cable connection lever 54932-0000 (MOLEX).

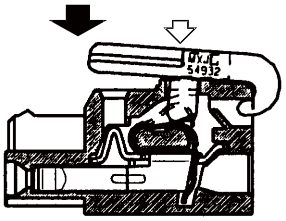
[Unit: mm]



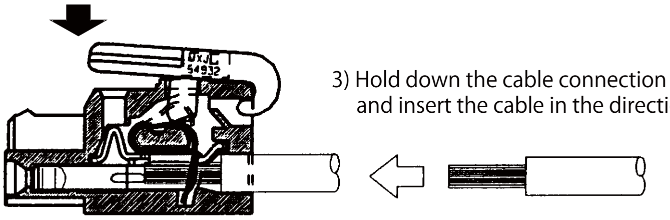
[2] Cable connection procedure



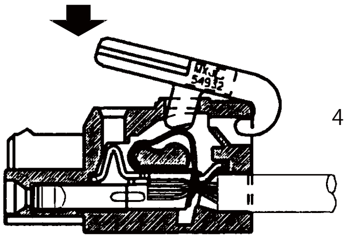
1) Attach the cable connection lever to the housing.
(Detachable)



2) Push the cable connection lever in the direction of arrow.



3) Hold down the cable connection lever
and insert the cable in the direction of arrow.



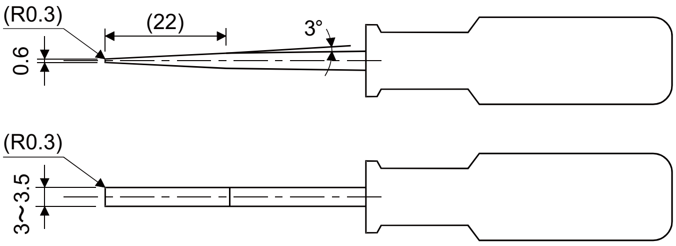
4) Release the cable connection lever.

(b) When using the flat-blade screwdriver

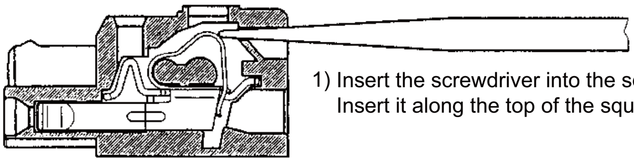
[1] Applicable flat-blade screwdriver dimensions

Always use the screwdriver shown here to do the work.

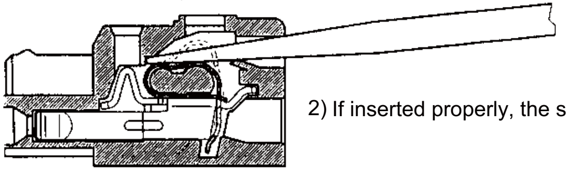
[Unit:mm]



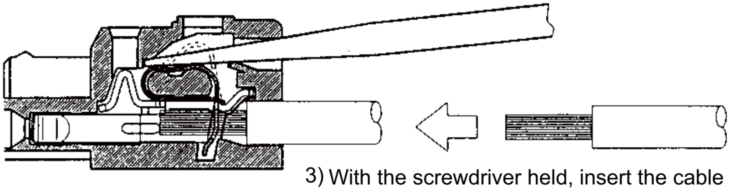
[2] Cable connection procedure



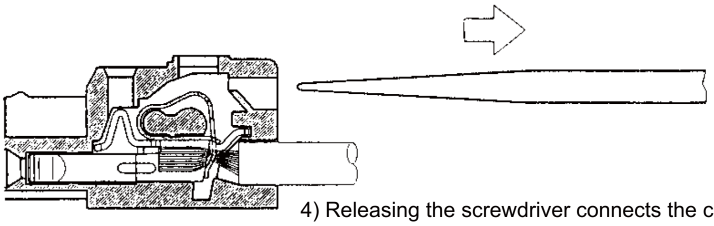
1) Insert the screwdriver into the square hole.
Insert it along the top of the square hole to insert it smoothly.



2) If inserted properly, the screwdriver is held.



3) With the screwdriver held, insert the cable in the direction of arrow.
(Insert the cable as far as it will go.)

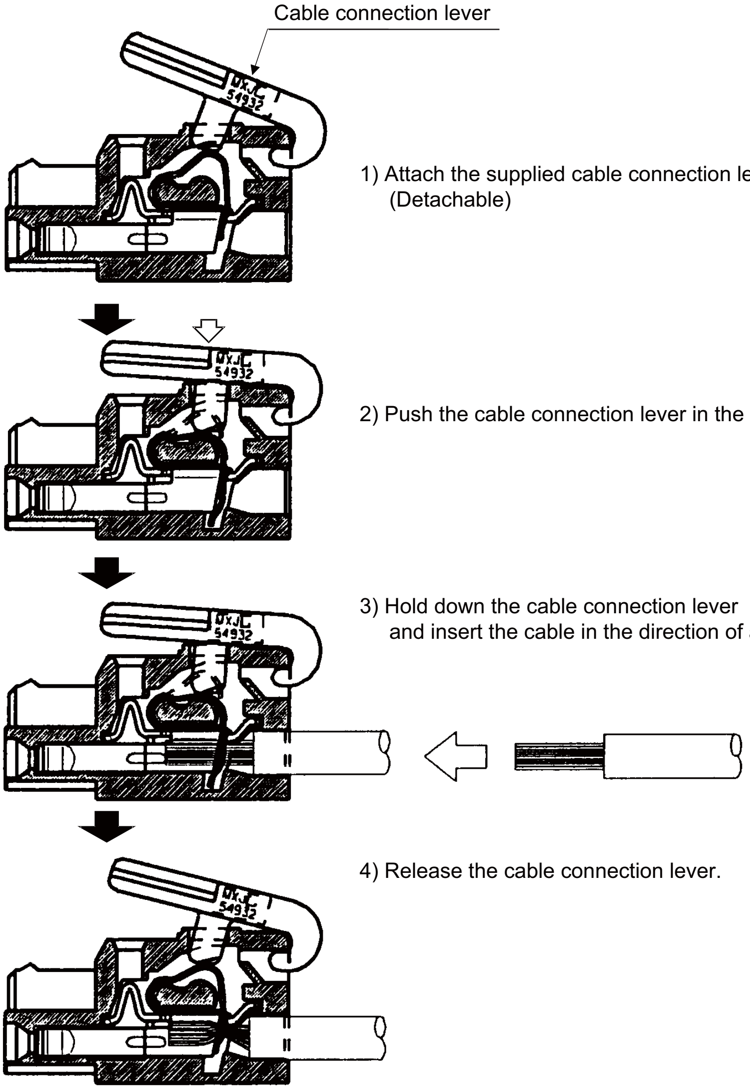


4) Releasing the screwdriver connects the cable.

(5) How to insert the cable into 03JFAT-SAXGFS-XL, 05JFAT-SAXGSA-E-SS and 06JFAT-SAXGFS-XL connector

Use the supplied cable connection lever.

The cable connection lever can be used for CNP1, 2 and 3.



1) Attach the supplied cable connection lever to the housing.
(Detachable)

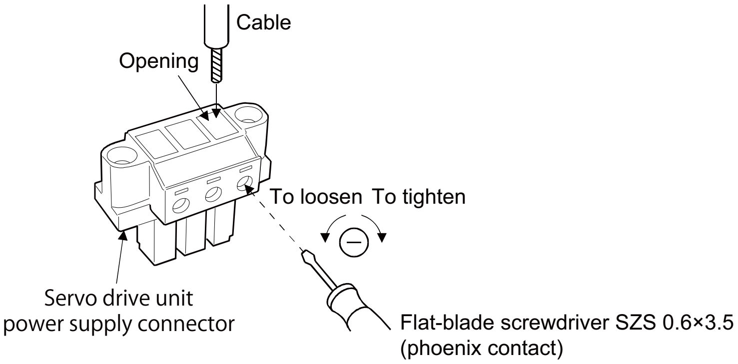
2) Push the cable connection lever in the direction of arrow.

3) Hold down the cable connection lever
and insert the cable in the direction of arrow.

4) Release the cable connection lever.

(6) How to insert the cable into PC4/6-STF-7.62-CRWH, and PC4/3-STF-7.62-CRWH connector

Insert the core of the cable into the opening and tighten the screw with a flat-blade screwdriver so that the cable does not come off. (Tightening torque: 0.5 to 0.6N m(4.425 to 5.31 lb in)) Before inserting the cable into the opening, make sure that the screw of the terminal is fully loose.
When using a cable of 1.5mm2 or less, two cables may be inserted into one opening.



⚠ CAUTION

Before inserting the wire to the connector, be sure to wait at least 15 minutes after turning the drive unit’s power OFF, confirm that the CHARGE lamp has gone out, and check the terminal voltage. Failure to observe this could lead to electric shocks.

2-3 NC and drive unit connection

Connect the optical communication cables from the NC to the each drive unit so that they run in a straight line from the NC to the drive unit that is a final axis. And up to 16 axes can be connected per system. Note that the number of connected axes is limited by the NC.

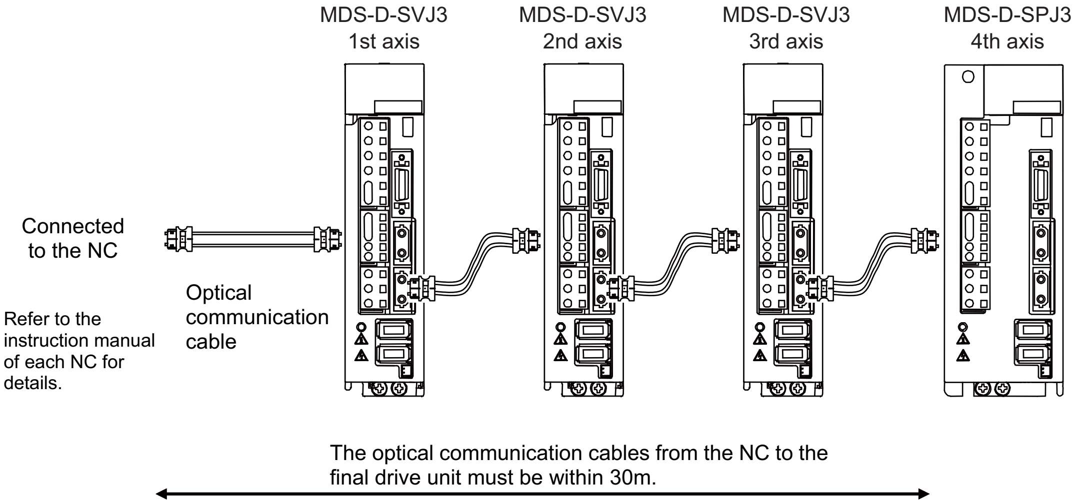
⚠ **CAUTION**	Connect the NC and the drive units by the optical communication cables. The distance between the NC and the final drive unit must be within 30m and the bending radius within 80mm.

POINT	Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to section "3-1-1 Setting the rotary switch".) The axis No. has no relation to the order for connecting to the NC.

< Connection >

CN1A : CN1B connector on NC or previous stage's drive unit

CN1B : CN1A connector on next stage's drive unit

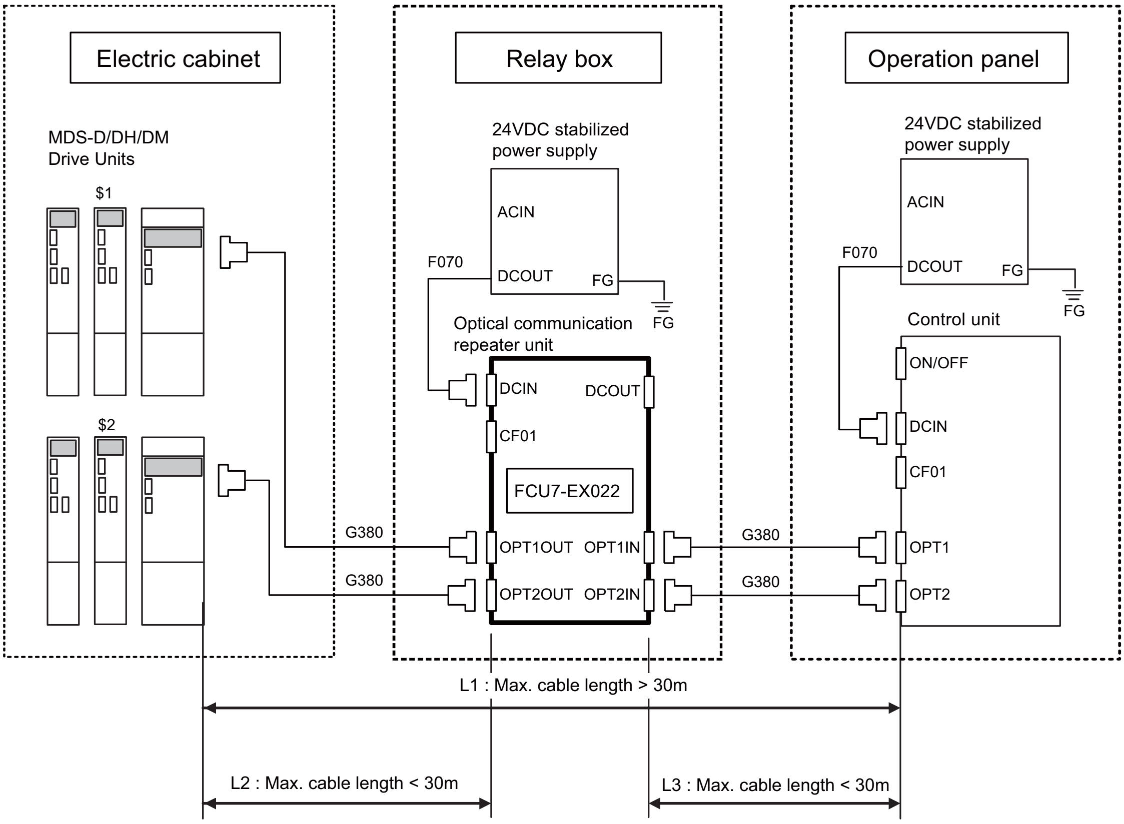


2-4 Connecting with optical communication repeater unit

⚠ **CAUTION** Optical Communication Repeater Unit cannot be used to connect between two Servo Drive Units.

(1) Connection example

For the 1st part system, connect the control unit to OPT1IN and the drive unit to OPT1OUT.
For the 2nd part system, connect the control unit to OPT2IN and the drive unit to OPT2OUT.
(Note) The figure below is an example of the two part system's optical communication.



L1: Distance between the drive unit and the control unit.
L2: Distance between the drive unit and the optical communication repeater unit. (The wire length of G380 cable)
L3: Distance between the optical communication repeater unit and the control unit. (The wire length of G380 cable)

<Related items>

Cable drawing "Cable: F070 Cable", "Cable: G380 Cable"
Connector pin assignment: "General Specifications: Optical Communication Repeater Unit" (DCIN connector, OPT1IN connector, OPT1OUT connector, OPT2IN connector, OPT2OUT connector)

(2) Power Supply Sequence

The diagram below shows the timing of power ON/OFF of the drive unit 200VAC (400VAC), the optical communication repeater unit, and the control unit.

[Power ON]

Turn the power ON in the following order; drive unit -> optical communication repeater unit -> control unit

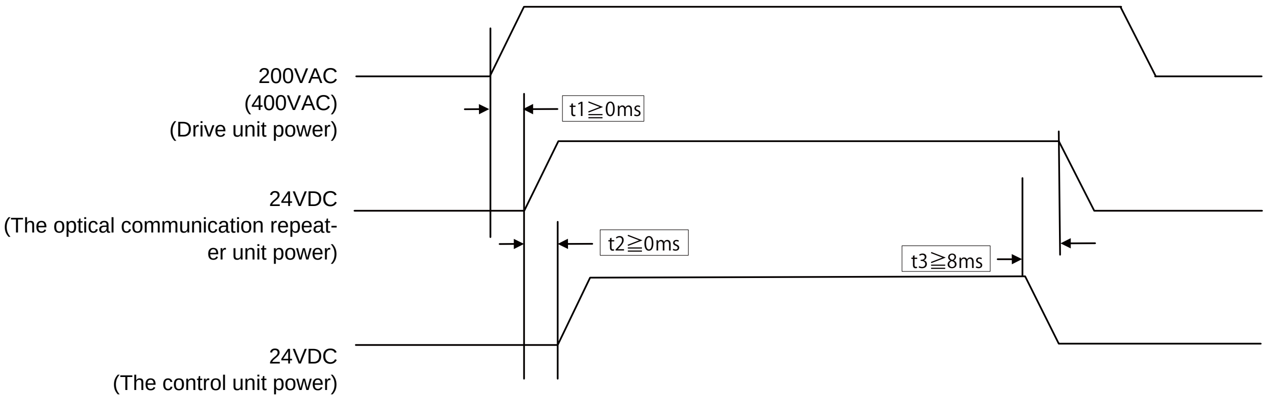
If the control unit is powered ON before the optical communication repeater unit, the initial communication with the drive unit may fail and cause an alarm.

[Power OFF]

Turn the power OFF in the following order; control unit -> optical communication repeater unit -> drive unit.

Set aside more than 8ms the time difference between the power OFF of the control unit and the power OFF of the optical communication repeater unit.

If the optical communication repeater unit is powered OFF before the drive unit, or the time lag is less than 8ms, data acquisition from the drive unit may fail and cause an alarm.



t1: Time lag between the power-ON of the drive unit and the optical communication repeater unit

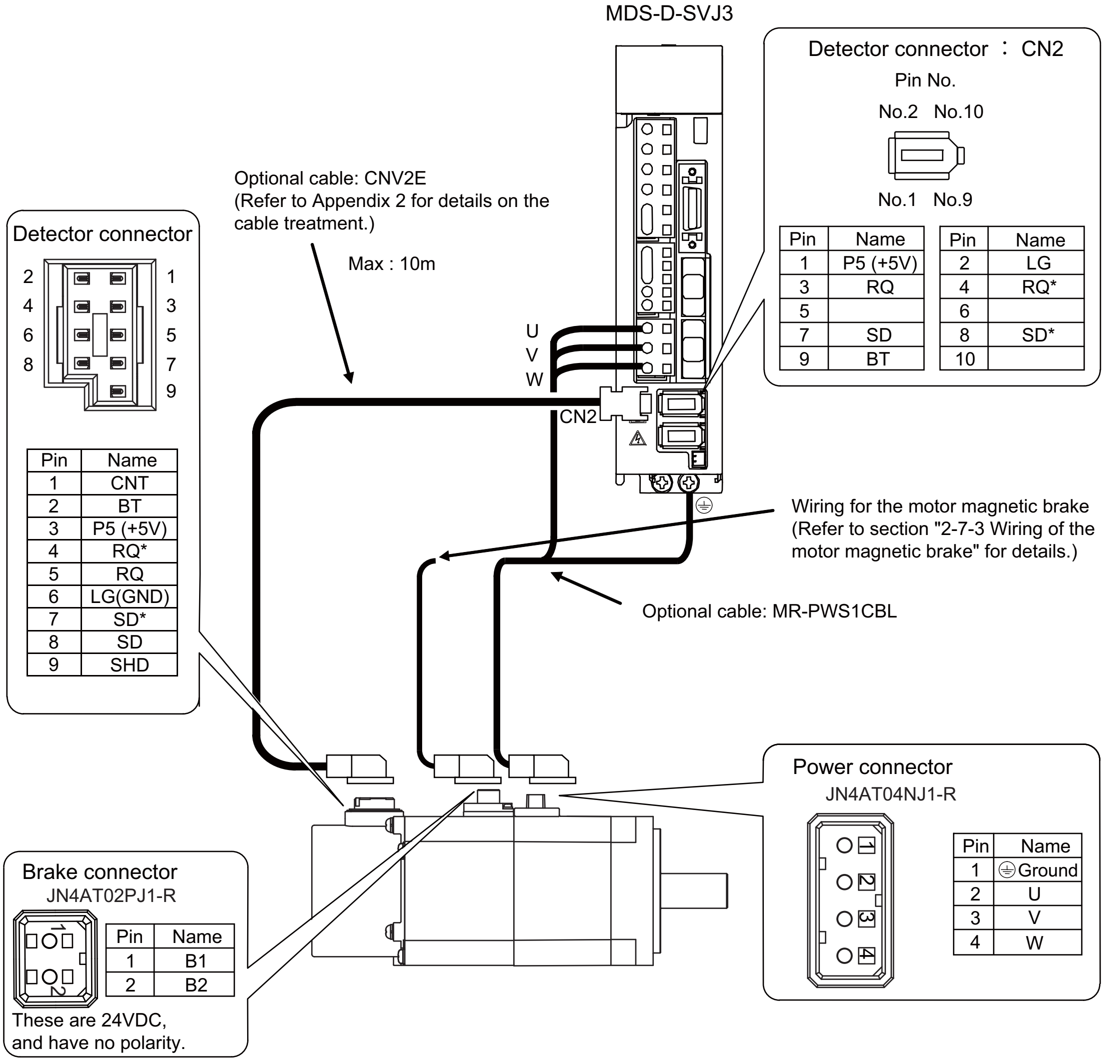
t2: Time lag between the power-ON of the optical communication repeater unit and the control unit

t3: Time lag between the power-OFF of the optical communication repeater unit and the control unit

2-5 Motor and detector connection

2-5-1 Connection of the servomotor

(1) Connecting the HF-KP13(B) / HF-KP23(B) / HF-KP43(B) / HF-KP73(B)



Detector connector ： CN2

Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

Detector connector

Pin	Name
1	CNT
2	BT
3	P5 (+5V)
4	RQ*
5	RQ
6	LG(GND)
7	SD*
8	SD
9	SHD

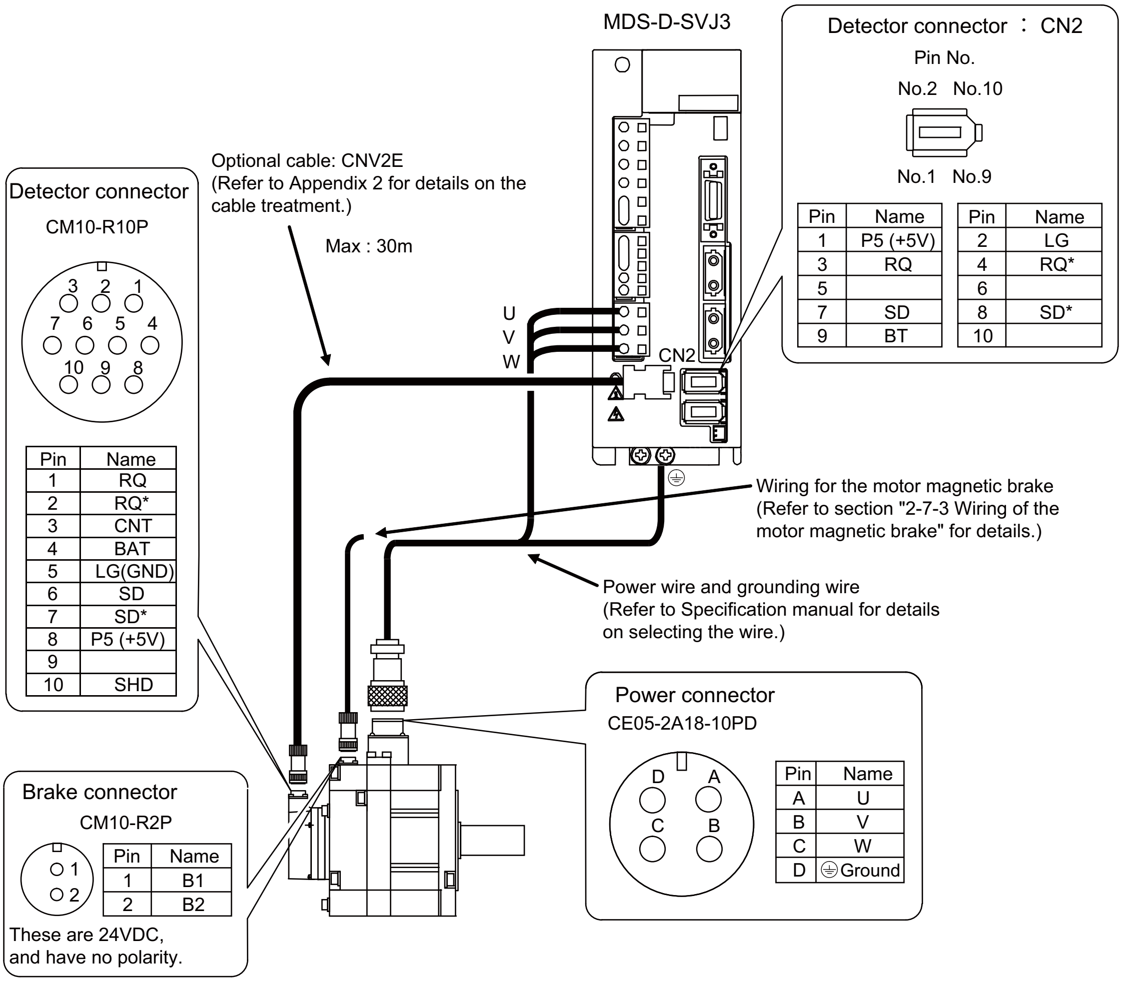
Power connector JN4AT04NJ1-R

Pin	Name
1	⏚Ground
2	U
3	V
4	W

Brake connector JN4AT02PJ1-R

Pin	Name
1	B1
2	B2

(2) Connecting the HF75(B) / HF105(B) / HF54(B) / HF104(B) / HF154(B) / HF224(B) / HF123(B) / HF223(B) /HF142(B)



Optional cable: CNV2E
(Refer to Appendix 2 for details on the cable treatment.)

Max : 30m

Wiring for the motor magnetic brake
(Refer to section "2-7-3 Wiring of the motor magnetic brake" for details.)

Power wire and grounding wire
(Refer to Specification manual for details on selecting the wire.)

Detector connector ： CN2

Pin No.

No.2 No.10

No.1 No.9

Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

Detector connector

CM10-R10P

Pin	Name
1	RQ
2	RQ*
3	CNT
4	BAT
5	LG(GND)
6	SD
7	SD*
8	P5 (+5V)
9	
10	SHD

Brake connector

CM10-R2P

Pin	Name
1	B1
2	B2

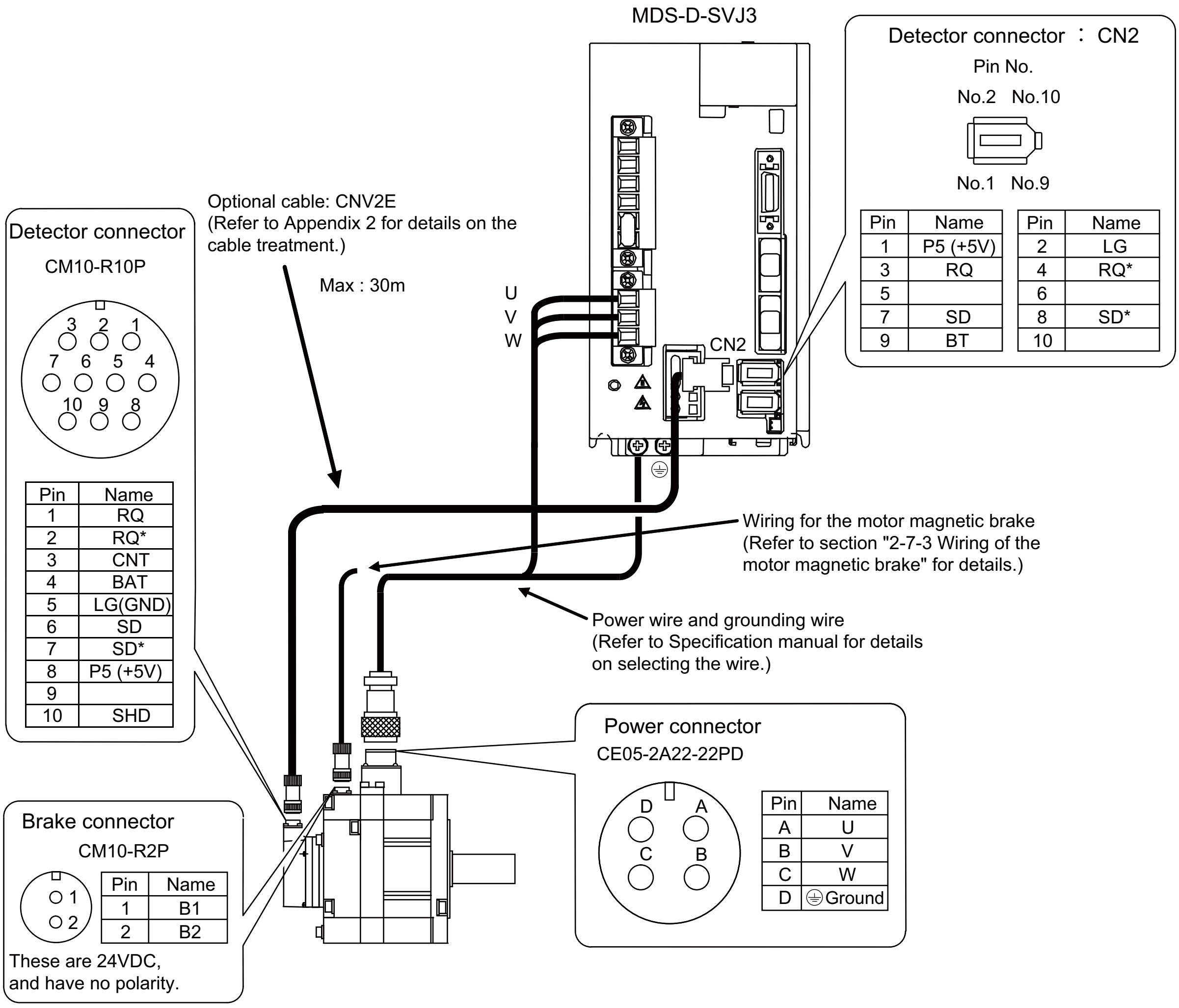
These are 24VDC,
and have no polarity.

Power connector

CE05-2A18-10PD

Pin	Name
A	U
B	V
C	W
D	⏚Ground

(3) Connecting the HF204(B) / HF303(B) / HF302(B) / HF354(B)



Optional cable: CNV2E
(Refer to Appendix 2 for details on the cable treatment.)

Max : 30m

Wiring for the motor magnetic brake
(Refer to section "2-7-3 Wiring of the motor magnetic brake" for details.)

Power wire and grounding wire
(Refer to Specification manual for details on selecting the wire.)

Detector connector ： CN2

Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

Detector connector

CM10-R10P

Pin	Name
1	RQ
2	RQ*
3	CNT
4	BAT
5	LG(GND)
6	SD
7	SD*
8	P5 (+5V)
9	
10	SHD

Power connector

CE05-2A22-22PD

Pin	Name
A	U
B	V
C	W
D	⏚ Ground

Brake connector

CM10-R2P

Pin	Name
1	B1
2	B2

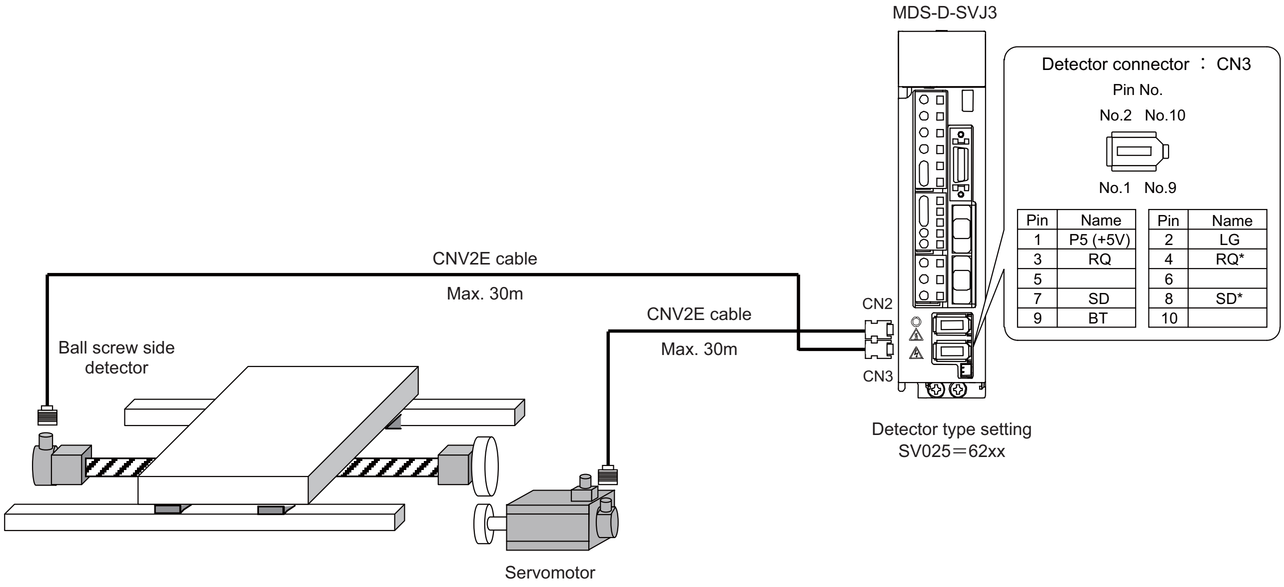
These are 24VDC,
and have no polarity.

2-5-2 Connection of the full-closed loop system

Refer to the section "2-4-1 Connecting the servomotor" for details on connecting each motor type and wiring the power line or the motor magnetic brake.

(1) Connecting the ball screw side detector

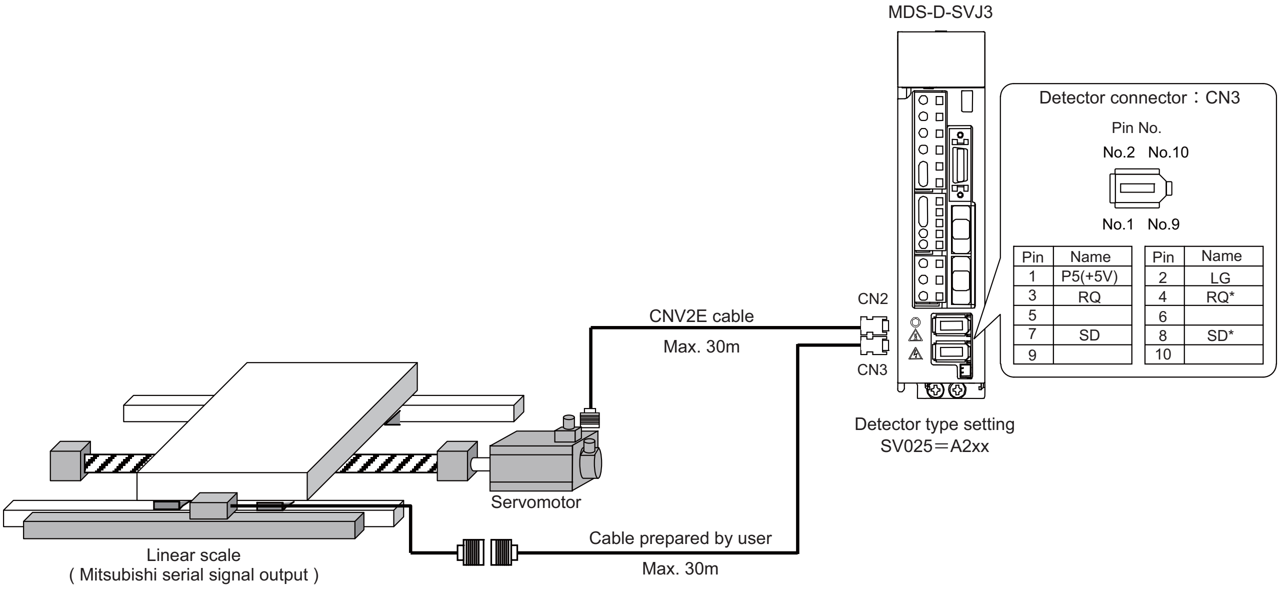
Connect the ball screw side detector cable to CN3. Option battery is required for the absolute position system.



Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

(2) Connecting the linear scale (For Mitsubishi serial signal output)

Mitsubishi serial signal output (including when SIN wave signal output is converted to Mitsubishi serial signal output with a scale manufacturer detector interface unit) can directly input to the drive unit.

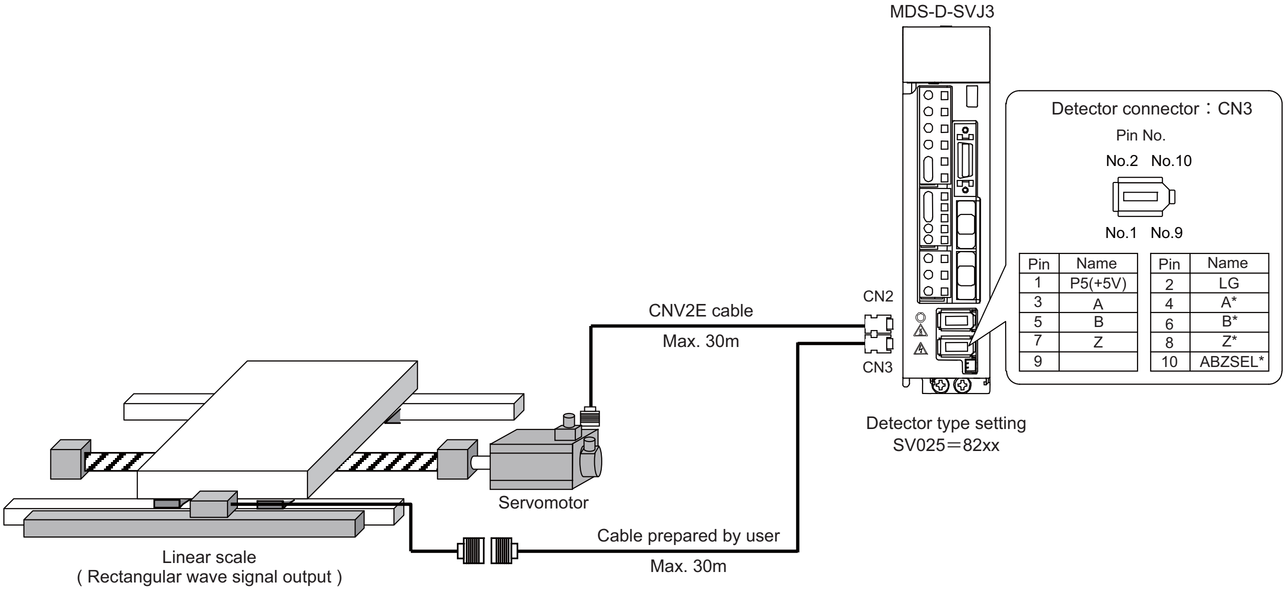


Pin	Name	Pin	Name
1	P5(+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9		10	

(Note) The conversion unit of the scale manufacturer is included.

(3) Connecting the linear scale (for rectangular wave signal output)

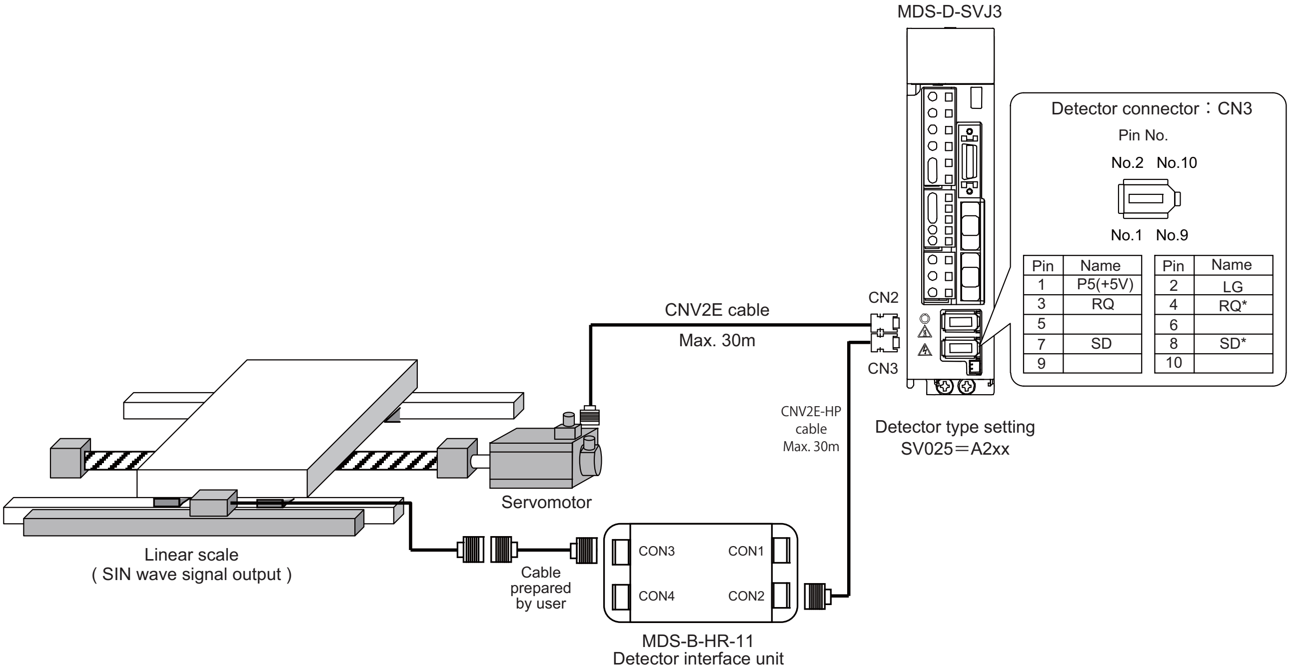
Rectangular wave signal output (including when SIN wave signal output is converted to the rectangular wave signal output with a scale manufacturer detector interface unit) can directly input to the drive unit.



Pin	Name	Pin	Name
1	P5(+5V)	2	LG
3	A	4	A*
5	B	6	B*
7	Z	8	Z*
9		10	ABZSEL*

(4) Connecting the linear scale (for SIN wave signal output)

SIN wave signal output is converted to Mitsubishi serial signal output with the detector interface unit (MDS-B-HR).

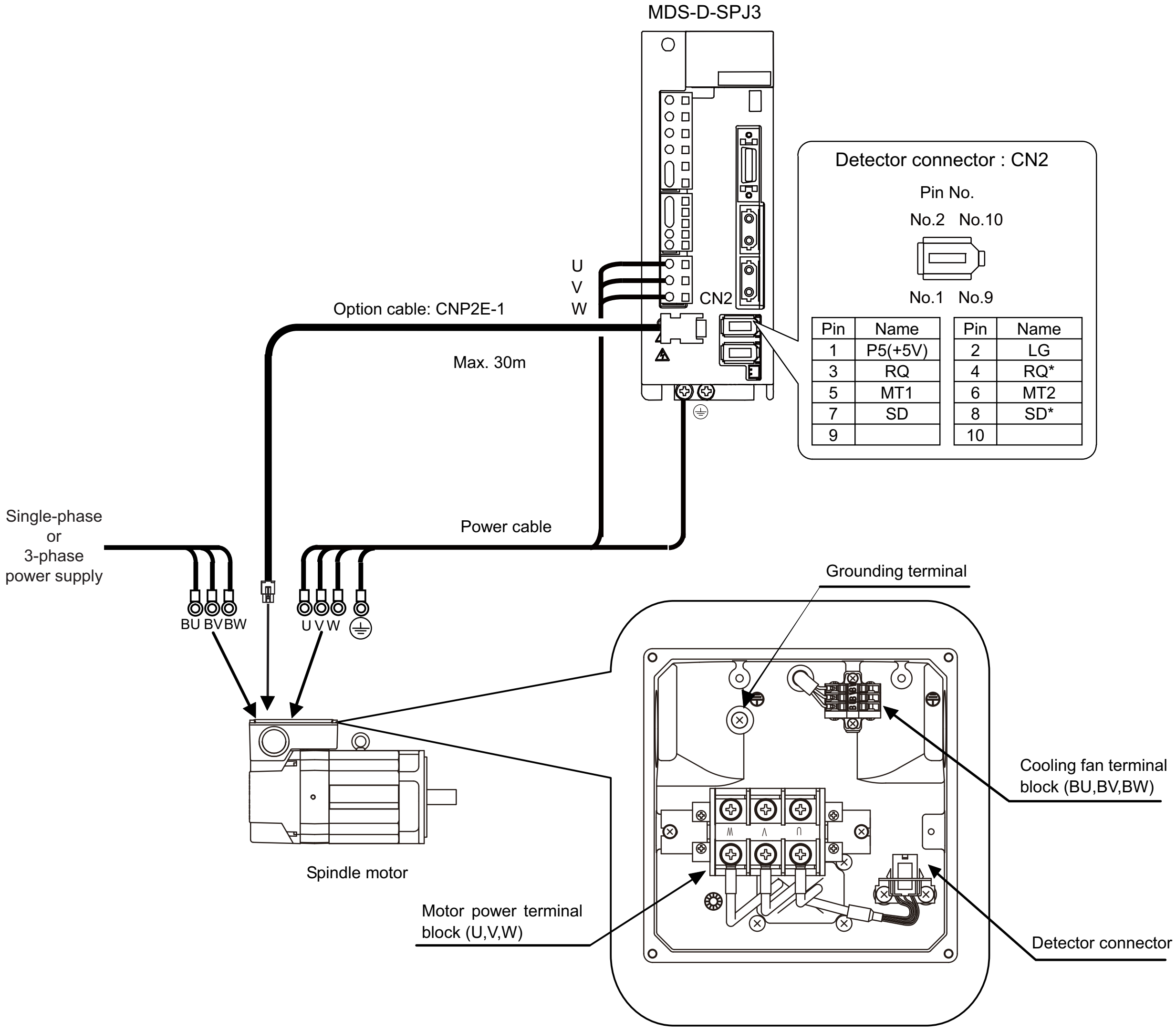


Pin	Name	Pin	Name
1	P5(+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9		10	

2-5-3 Connection of the spindle motor

Refer to each motor specifications for details on the motor side connection destination, specifications and outline, and for the spindle PLG detector specifications.

(1) Connecting the motor built-in PLG



Pin	Name	Pin	Name
1	P5(+5V)	2	LG
3	RQ	4	RQ*
5	MT1	6	MT2
7	SD	8	SD*
9		10	

Example for 3-phase cooling fan power supply

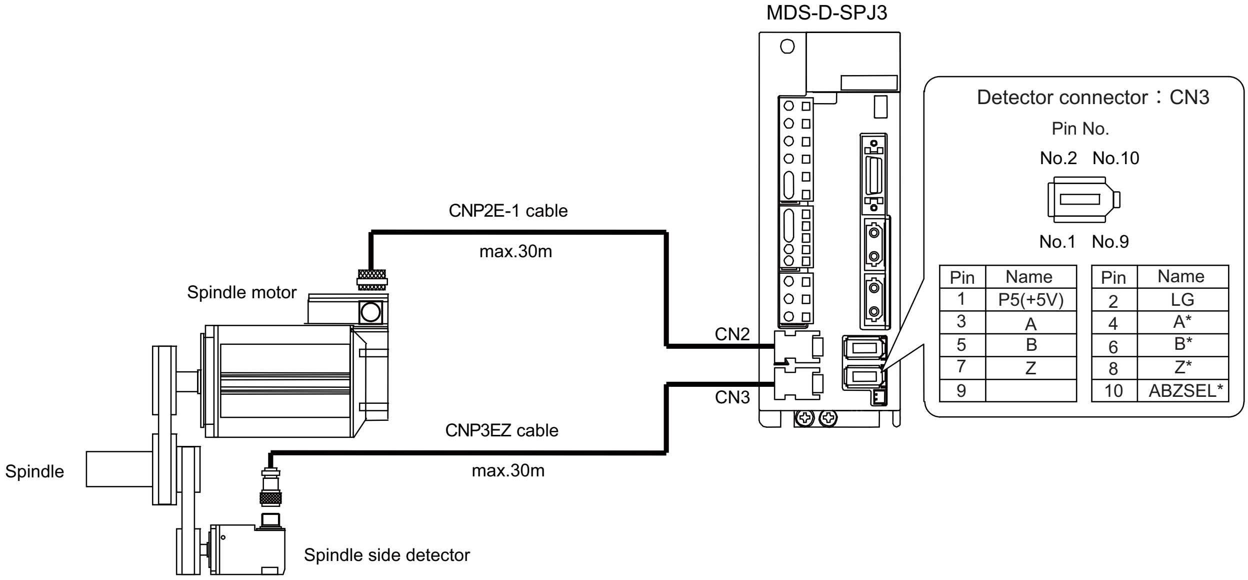
(Note) Either a single-phase or 3-phase power supply is used for the cooling fan.
Refer to the Spindle Motor Specifications for details.

⚠ CAUTION

For a 3-phase cooling fan, when the phase sequence of the 3-phase power supply is connected reversely, its cooling capacity degrades due to the reversed rotation direction. Make sure the air blowoff direction.

When the fan rotates reversely, reconnect BU and BW reversely, and then check the blowoff direction.

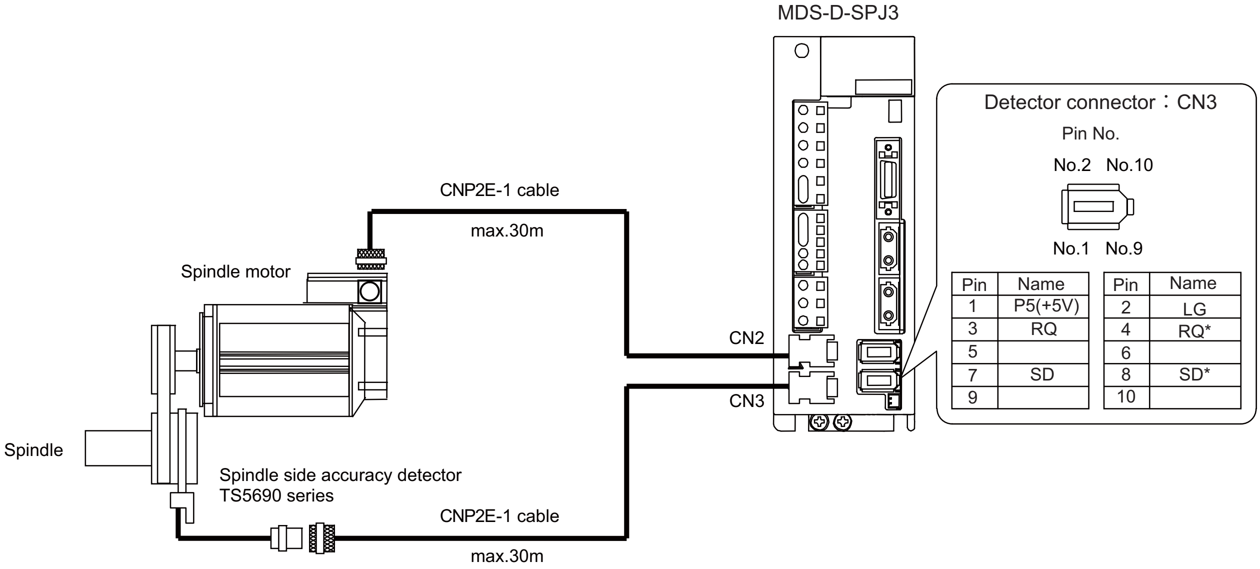
(2) Connecting the spindle side ABZ pulse output detector (OSE-1024-3-15-68, OSE-1024-3-15-68-8)



Pin	Name	Pin	Name
1	P5(+5V)	2	LG
3	A	4	A*
5	B	6	B*
7	Z	8	Z*
9		10	ABZSEL*

(Note) Confirm that the gear ratio (pulley ratio) of the spindle end to the detector is 1:1. Use a timing belt for connecting.

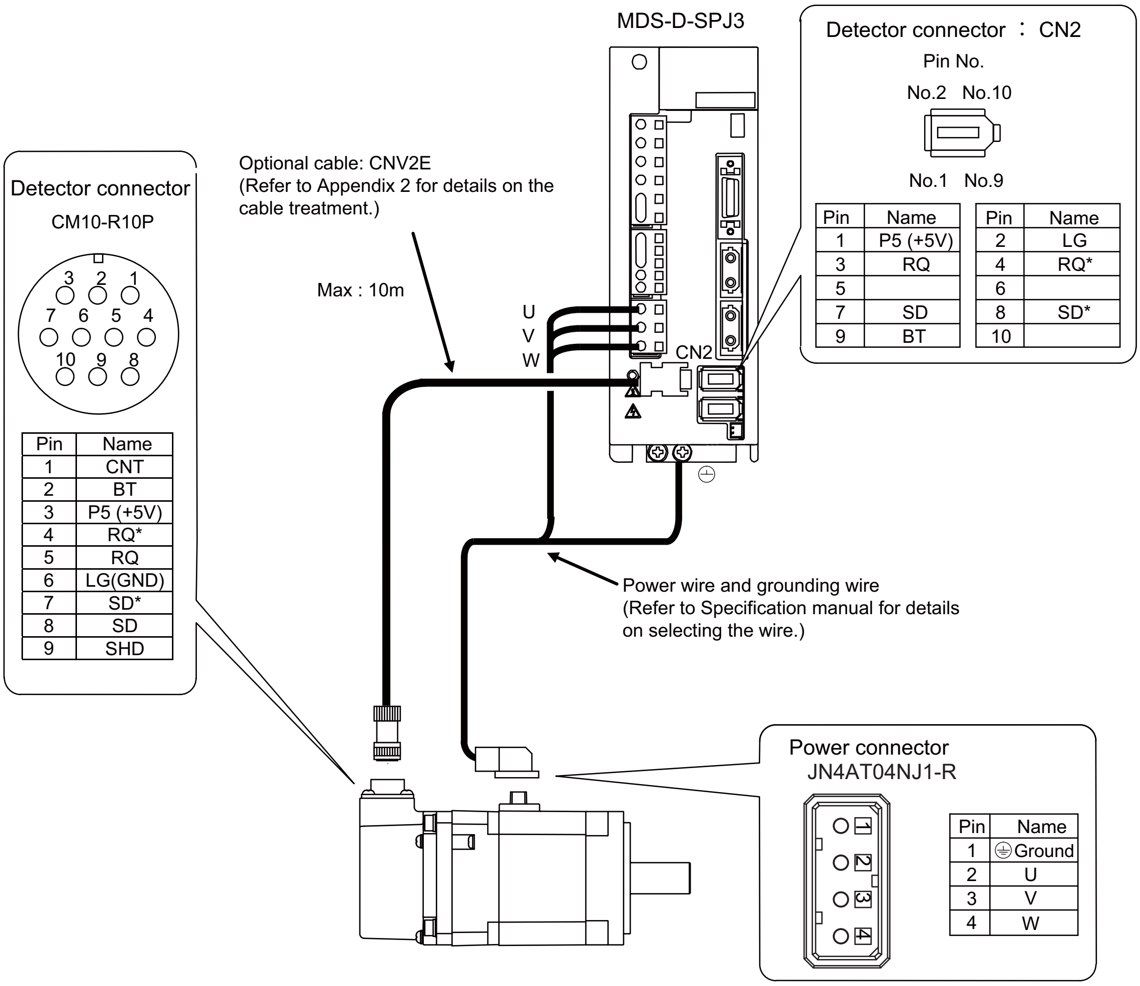
(3) Connecting the spindle side PLG serial output detector (TS5690 Series)



Pin	Name	Pin	Name
1	P5(+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9		10	

2-5-4 Connection of the tool spindle motor

(1) Connecting the HF-KP46 / HF-KP56 / HF-KP96



Optional cable: CNV2E
(Refer to Appendix 2 for details on the cable treatment.)

Max : 10m

Power wire and grounding wire
(Refer to Specification manual for details on selecting the wire.)

Detector connector : CN2

Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

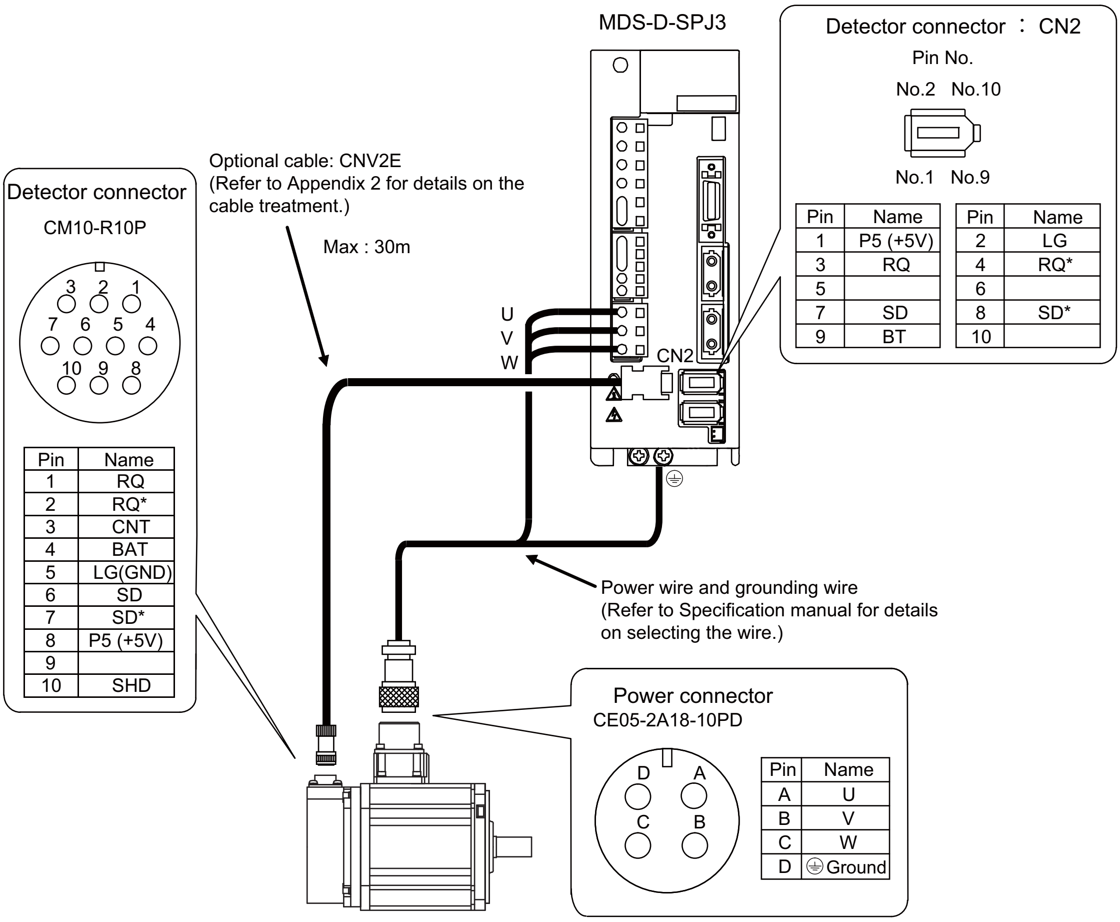
Detector connector
CM10-R10P

Pin	Name
1	CNT
2	BT
3	P5 (+5V)
4	RQ*
5	RQ
6	LG(GND)
7	SD*
8	SD
9	SHD

Power connector
JN4AT04NJ1-R

Pin	Name
1	⏚Ground
2	U
3	V
4	W

(2) Connecting the HF75 / HF105 / HF54 / HF104 / HF154 / HF224 / HF123 / HF223



Optional cable: CNV2E
(Refer to Appendix 2 for details on the cable treatment.)

Max : 30m

Power wire and grounding wire
(Refer to Specification manual for details on selecting the wire.)

Detector connector : CN2

Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

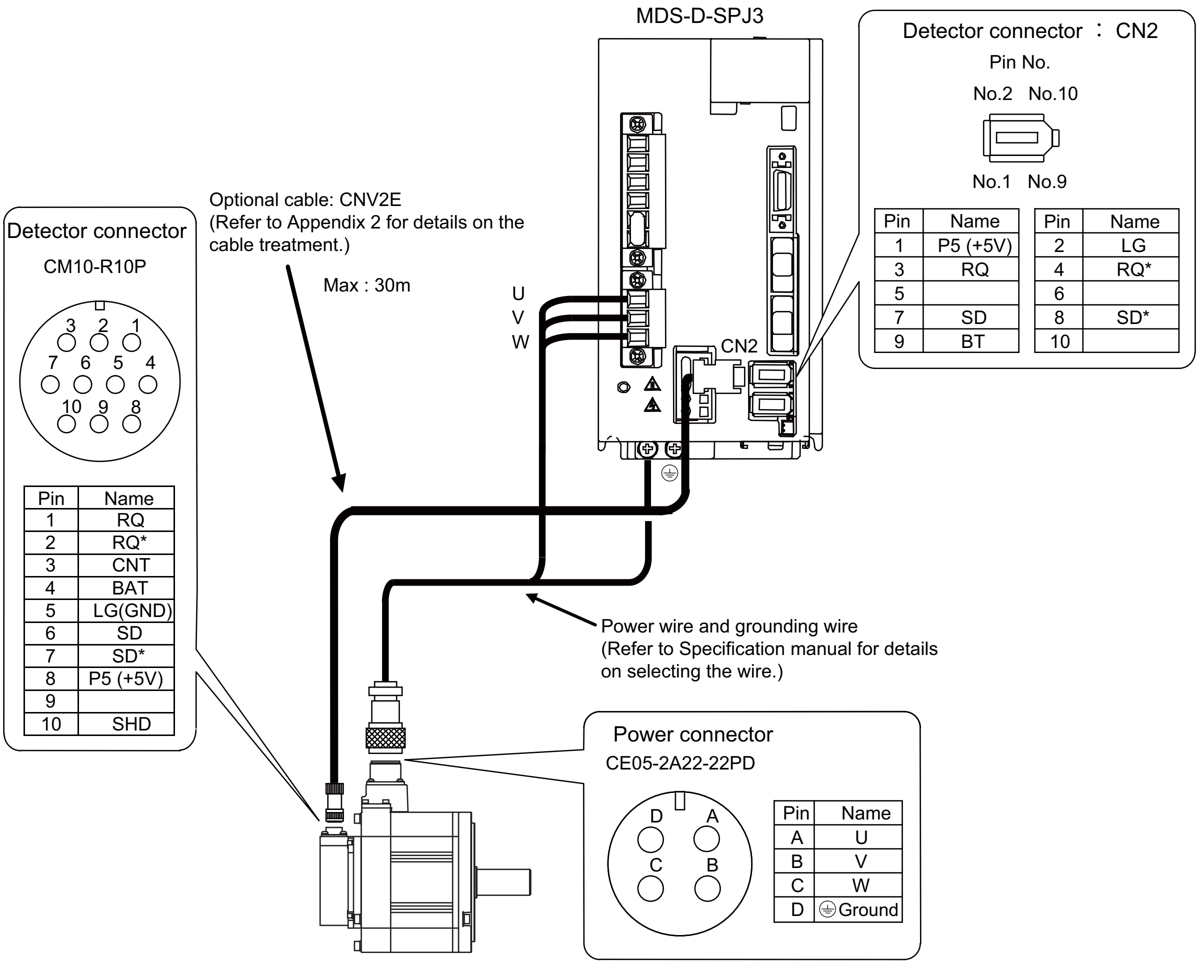
Detector connector
CM10-R10P

Pin	Name
1	RQ
2	RQ*
3	CNT
4	BAT
5	LG(GND)
6	SD
7	SD*
8	P5 (+5V)
9	
10	SHD

Power connector
CE05-2A18-10PD

Pin	Name
A	U
B	V
C	W
D	⏚ Ground

(3) Connecting the HF204 / HF303



Detector connector CM10-R10P

Pin	Name
1	RQ
2	RQ*
3	CNT
4	BAT
5	LG(GND)
6	SD
7	SD*
8	P5 (+5V)
9	
10	SHD

Detector connector ： CN2

Pin	Name	Pin	Name
1	P5 (+5V)	2	LG
3	RQ	4	RQ*
5		6	
7	SD	8	SD*
9	BT	10	

Power connector CE05-2A22-22PD

Pin	Name
A	U
B	V
C	W
D	⏚Ground

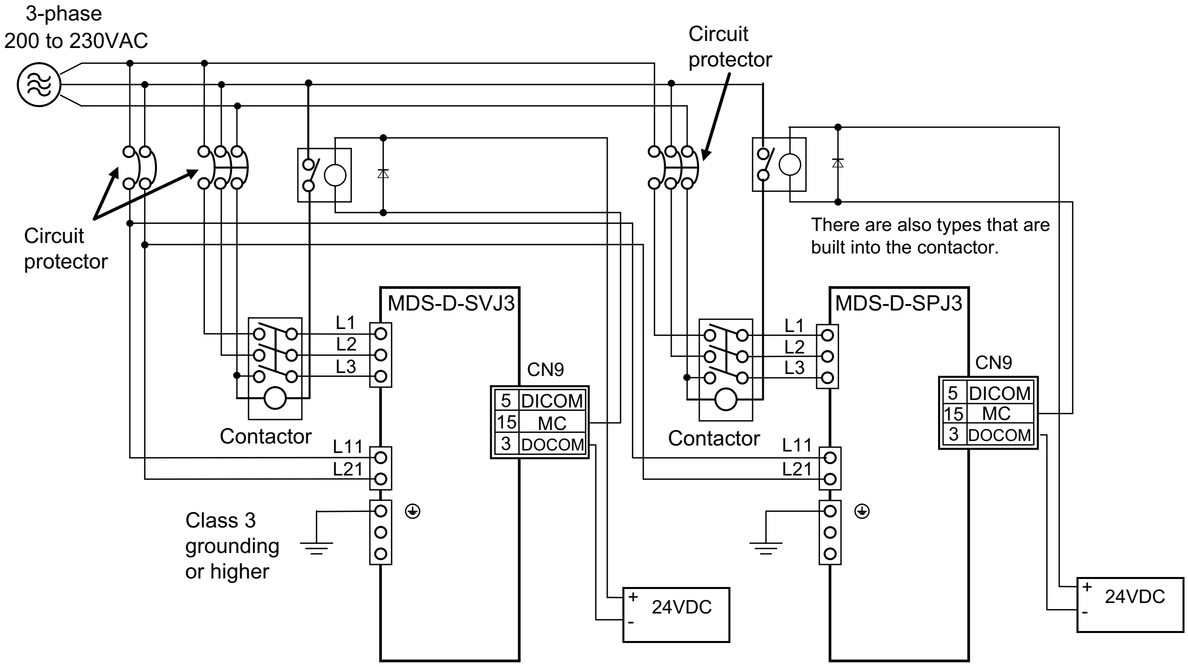
2-6 Connection of power supply

⚠ CAUTION

1. Make sure that the power supply voltage is within the specified range of each unit. Failure to observe this could lead to damage or faults.
2. For safety purposes, always install a circuit protector, and make sure that the circuit is cut off when an error occurs or during inspections.
3. The wire size will differ according to each drive unit capacity.
4. For safety purposes, always install a magnetic contactor (contactor) on the main circuit power supply input. Large rush currents will flow when the power is turned ON.

2-6-1 Power supply input connection

Drive the contactor via the relay from the contactor control output of the (MC) CN9 connector.

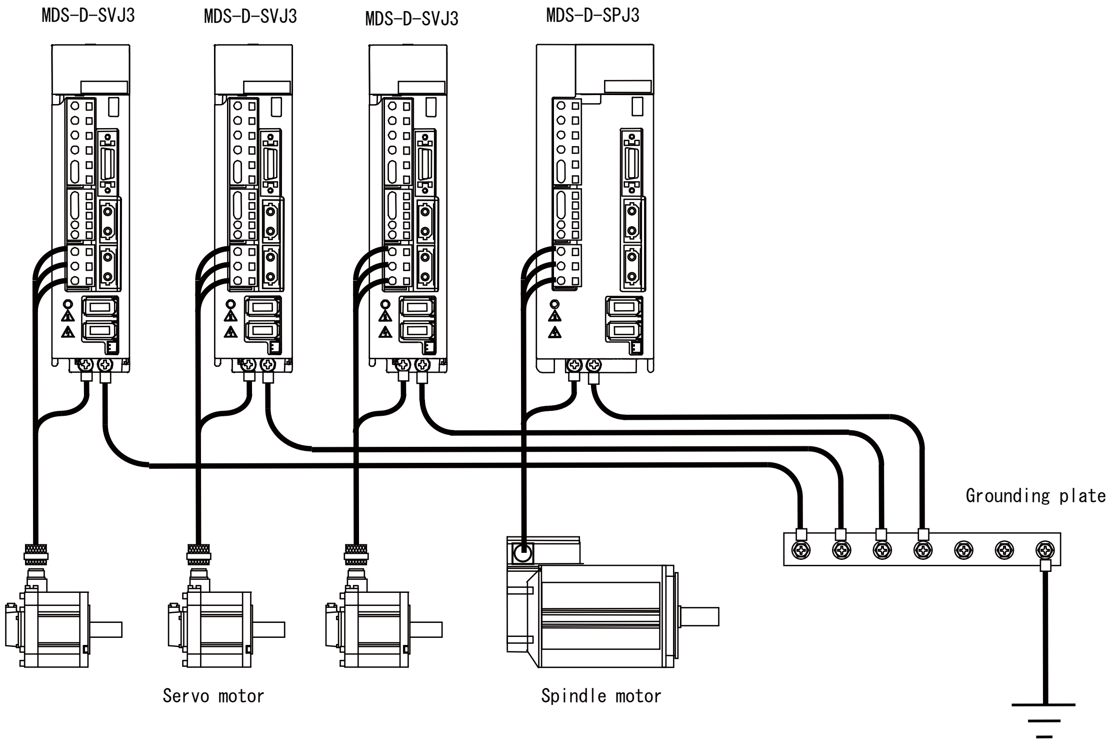


2-6-2 Connection of the grounding cable

(1) Connection of the protective grounding (PE) and frame ground (FG)

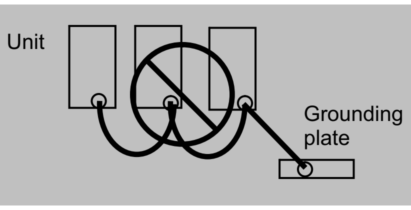
Each unit has a terminal or mounting hole to connect PE (⏚) or FG.
Please connect an earth wire to the main ground of a cabinet or a machine frame at one point.
Ground each device according to the grounding conditions set forth by each country. (Typically, a Y-connection neutral point ground is used in Europe.)

PE: Grounding to provide protection from electric shock, etc.
FG: Grounding to stabilize the operation of the devices, etc. (Suppress noise)



POINT

Do not connect the grounding cable from each unit directly to the grounding plate. Noise from other units could result in malfunctions.



(2) Grounding cable size

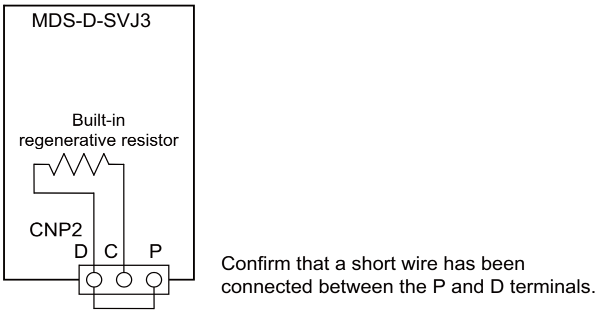
Earth wire size should follow the following table.

Subject Grounding cable	Grounding cable size (Required grounding)
Power supply grounding cable	Larger than thickness of wire connected to L1/L2/L3. (PE)
Motor grounding cable	Larger than thickness of wire connected to U/V/W. (PE)

2-7 Connection of regenerative resistor

2-7-1 Standard built-in regenerative resistor (Only for MDS-D-SVJ3)

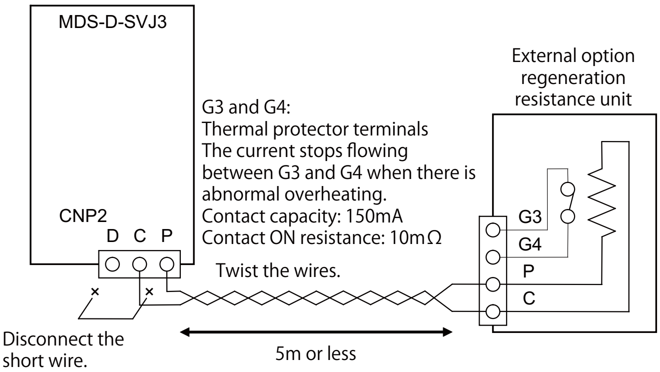
The built-in regenerative resistor is connected by short-circuiting between the P and D terminals of the control circuit terminal block (TE2). (Shipment state). Confirm that a short wire has been connected between the P and D terminals.



2-7-2 External option regenerative resistor

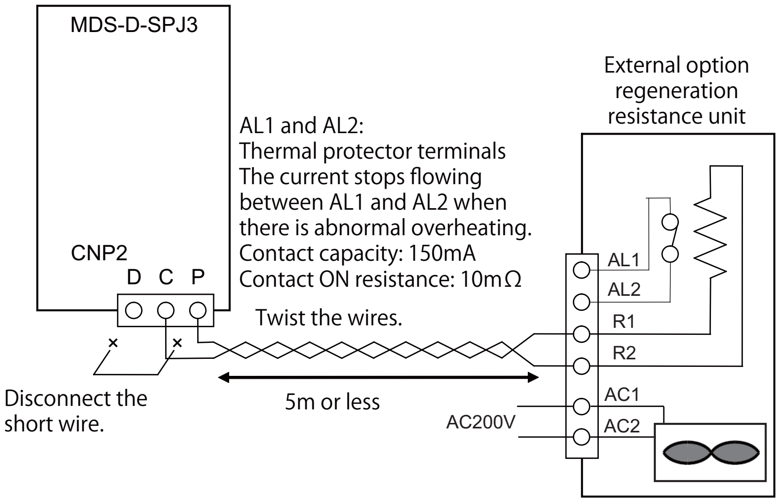
(1)Servo drive unit

Disconnect the short wire connected between the P and D terminals, and connect the external option regenerative resistor unit P-C between the P and C terminals. The drive unit has an internal regenerative resistor electronic thermal (software process), and when overheating of the regenerative resistor is detected, an over-regeneration (alarm 30) is detected. The thermal protector terminals (G3, G4) are used when double-protecting against overheating of the regenerative resistor. When double-protecting, construct a sequence in which an emergency stop occurs if a current stops flowing between G3 and G4.



(2) Spindle drive unit

Disconnect the short wire connected between the P and D terminals, and connect the external option regenerative resistor unit R1-R2 between the P and C terminals (There is no polarity). The drive unit has an internal regenerative resistor electronic thermal (software process), and when overheating of the regenerative resistor is detected, an over-regeneration (alarm 30) is detected. The thermal protector terminals (AL1, AL2) are used when double-protecting against overheating of the regenerative resistor. When double-protecting, construct a sequence in which an emergency stop occurs if a current stops flowing between AL1 and AL2.
MDS-D-SPJ3 has no built-in regenerative resistor. Be sure to connect the external option resistor to it.



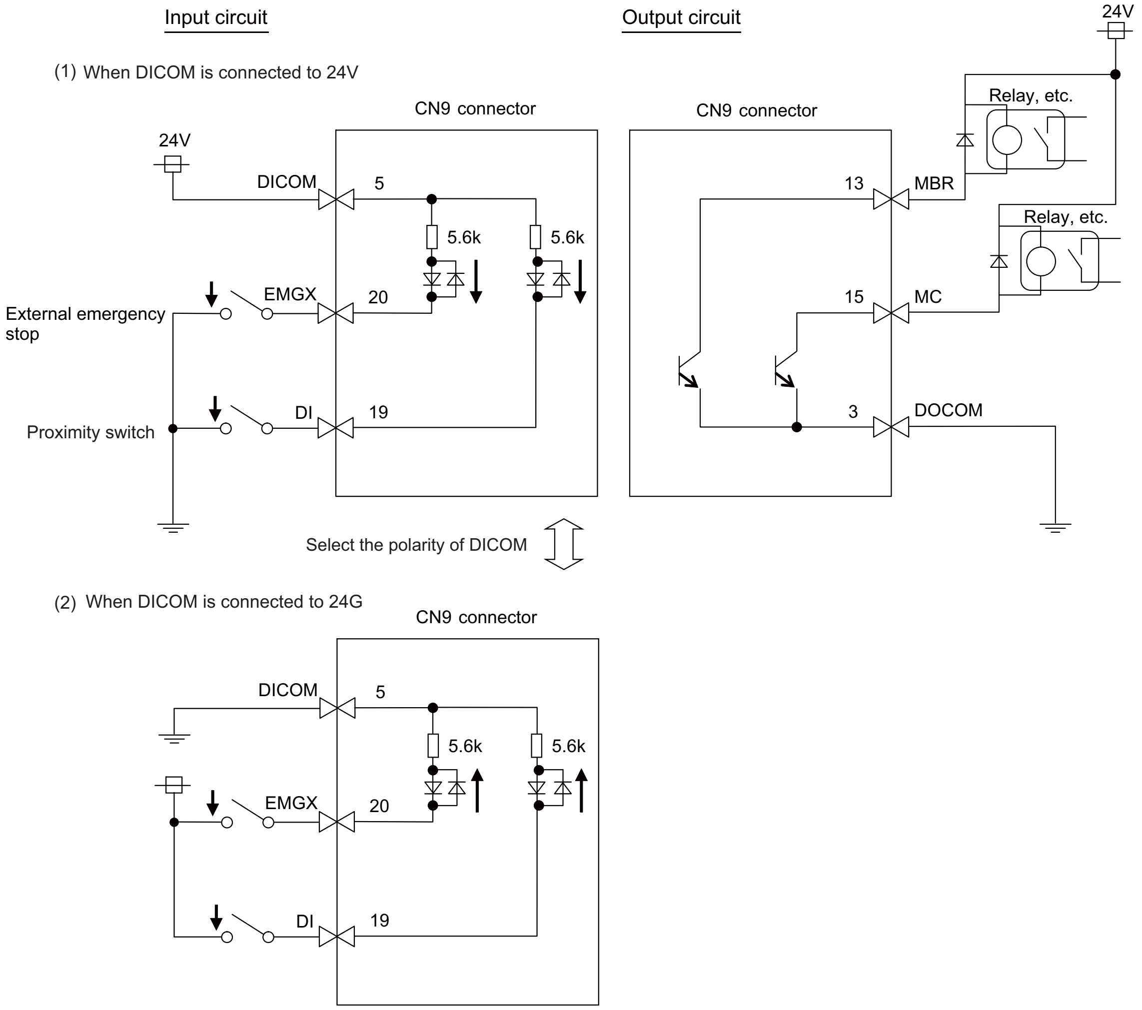
⚠DANGER	1. Be careful when selecting the installation location. Choose a location where foreign matter (cutting chips, cutting oil, etc.) does not adhere to the external regenerative resistor unit terminal. A short-circuit between the P and C terminals could lead to drive unit damage. 2. The regenerative resistor generates heat of approximately 100 degrees (or higher, depending on the installation conditions). Give sufficient consideration to heat dissipation and installation position. - Use flame resisting wire. - Make sure the wires do not contact the regenerative resistor unit.

⚠CAUTION	Always use twisted pair cable to connect to the drive unit, and keep the length of the wiring to 5m or less.

2-8 Wiring of the peripheral control

2-8-1 Wiring of the Input/output circuit

The input/output circuit to control the external signal such as external emergency stop input and relay changeover signal output is wired.
The input/output circuit for each unit is as follows.



(Note) For DICOM,
(1) the common input signal pattern (24V or 24G) is used.
(2) whichever polarity of the input can be used, however, the direction must be the same.

	Input condition		Output condition
Switch ON	18VDC to 25.2VDC 5mA or more	**Output voltage**	24VDC ±5%
		Tolerable output current Io	40mA or less
Switch OFF	4VDC or less 1mA or less		

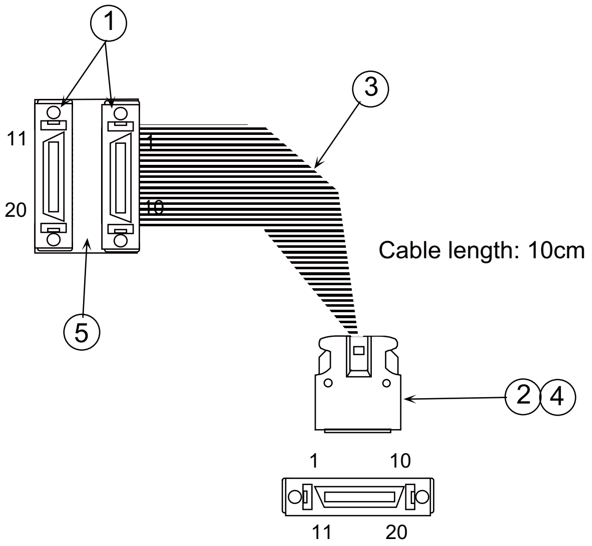
For a switch or relay to be wired, use a switch or relay that satisfies the input/output (voltage, current) conditions.

Interface name	Selection example
For digital input signal	Use a minute signal switch which is stably contacted and operated even with low voltage or current <Example> OMRON: G2A, G6B type, MY type, LY type
For digital output signal	Use a compact relay operated with rating of 24VDC, 50mA or less. <Example> OMROM: G6B type, MY type

2 Wiring and Connection

The following cable can simplify the wiring.

FCUA-R001



List of parts used

No.	Part name / model	Manufacturer	Q'ty
1	Connector 10220-0200EL	Sumitomo 3M	2
2	Connector 10120-3000VE	Sumitomo 3M	1
3	Wire material (flat cable) 1.27mm pitch flat		(1)
4	Connector case 10320-52F0-008	Sumitomo 3M	1
5	F installation plate N760D080H01	Mitsubishi Electric	1

F installation plate outline dimensio ns drawing

[Unit:mm]

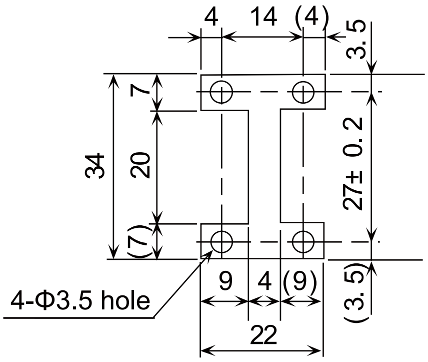


Plate thickness: 1.0mm

Connection drawing

The signal cable connection is a one-on-one connection (One pin is connected to one pin).
The case GND planes (connector housings) of each connector are connected using with an F installation plate.

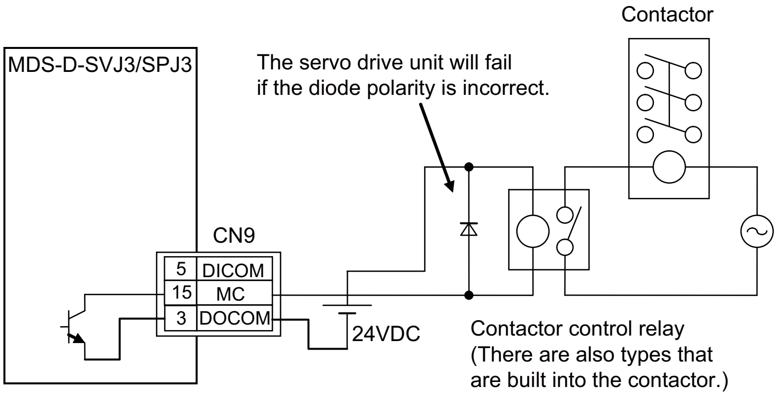
Precautions for manufacturing

The parts are those recommended by Mitsubishi, and can be replaced with equivalent parts that are compatible specification-wise.

2-8-2 Wiring of the contactor control

(1) Output circuit of contactor control

A relay or photo coupler can be driven. When using an inductive load, install a diode.
(Tolerable current: 40mA or less, rush current: 100mA or less)



(2) Parameter setting

Set the following parameters for the contactor control axis.

【#2282】 SV082 SSF5 Servo function 5

bit B-A:dos3 Digital signal output 3 selection

bitB,A=
00: Disable
01:Setting prohibited
10:Contactor control output (For MDS-D-SVJ3)
11:Setting prohibited

【#13227】 SP227 SFNC7 Spindle function 7

bit B-A:dos3 Select the digital signal output 3

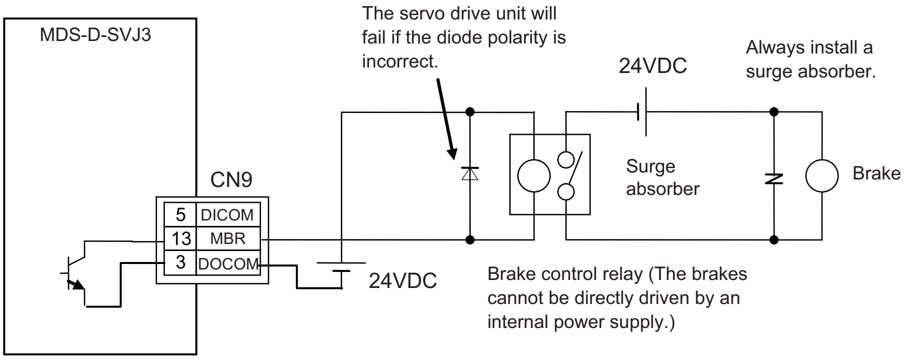
bitB,A=
00: Disable
01:Setting prohibited
10:Contactor control output (For MDS-D-SPJ3)
11:Setting prohibited

2-8-3 Wiring of the motor magnetic brake (MDS-D-SVJ3)

The magnetic brake of servomotors with a magnetic brake is controlled by the motor brake control signal (CN9-13 pin) of the servo drive unit. The servo drive unit releases the brake when the motor is ON.
(Servo ON means when torque is generated in the motor.)

(1) Output circuit of motor brake control

As shown in the illustration below, a motor brake power supply is controlled by the DO output of CN9 via a relay. As shown in the illustration below, always install a diode.
(Tolerable current: 40mA or less, rush current: 100mA or less)



CAUTION

1. Always install a surge absorber near the motor's brake terminal to eliminate noise and protect the contacts.
2. The brakes cannot be released just by connecting the CN9 and motor brake terminal. 24VDC must be supplied.
3. For the 24V power supply used in the motor brake circuit, use the one separated from the 24 power supply for the control circuit.

POINT

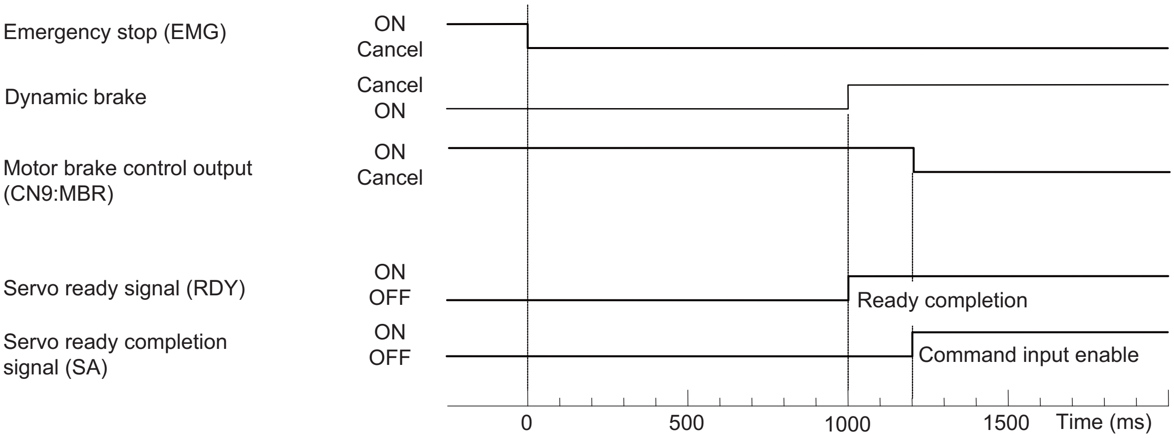
To ensure safety in an emergency, make sure that the magnetic brakes are applied in sequence with the emergency stop switch.

(2) Parameter settings

There is no parameter setting for the motor brake control signal. It is always output.

(3) Motor brake release sequence

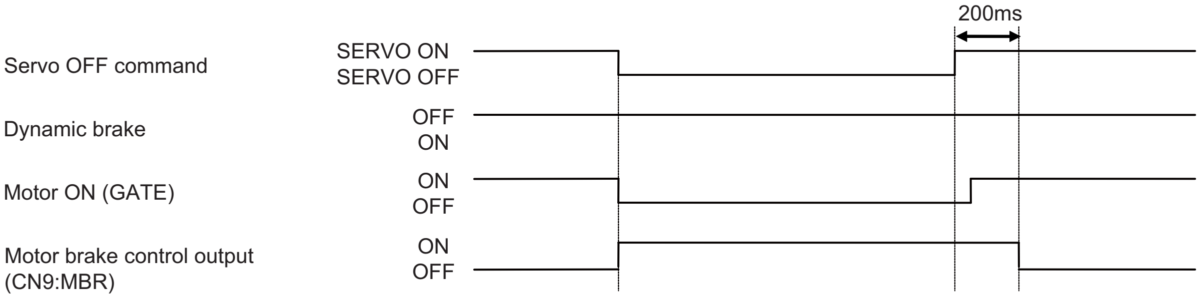
The motor brake control connector (CN9:MBR) releases the magnetic brake in the sequences in the following drawing when canceling the emergency stop. The brake is released after the start of the power ON to the servomotor.



Motor brake control sequences when an emergency stop is canceled

(4) Control during the servo OFF command

When a servo OFF command is input by an NC sequence input, the motor brake turns ON simultaneously when the motor ON is shut off. Note that the vertical axis drop prevention control is not validated, so a drop due to the brake operation lag occurs. When the servo OFF is canceled, a drop due to an uncontrolled state does not occur.



Motor brake control sequences when a servo OFF command is output

⚠ CAUTION The vertical axis drop prevention control only is performed during an emergency stop (including alarms and power failures). It is not performed when a servo OFF command is input.

(5) Operation sequences when an emergency stop occurs

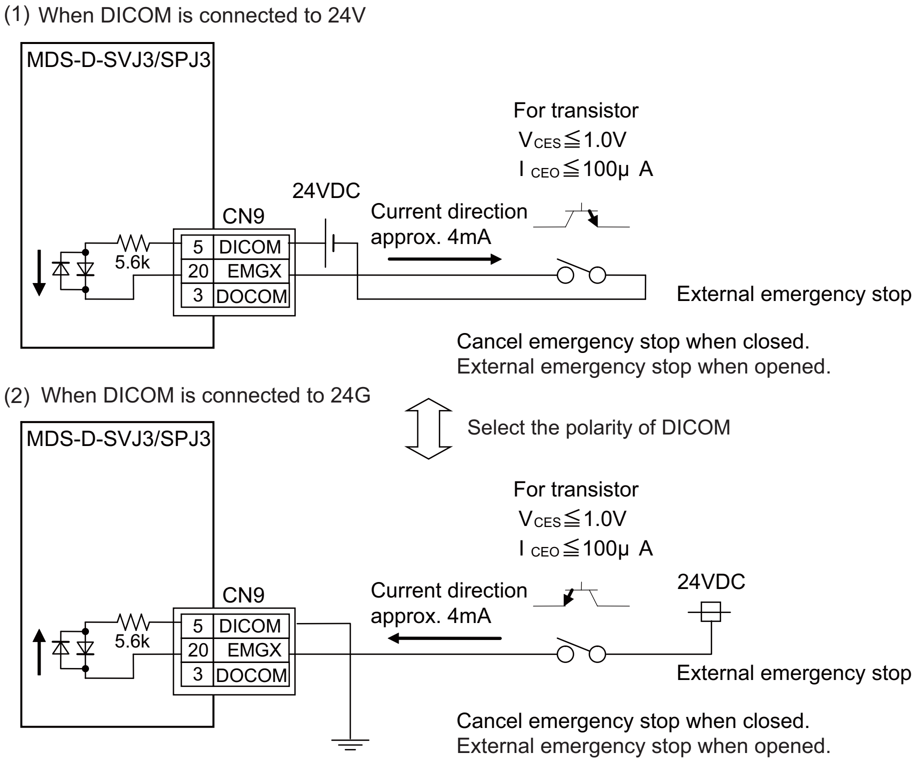
The motor brake control output operation when an emergency stop occurs differs according to the motor deceleration stop method. Refer to section "4-6 Setting for emergency stop" for details on the operation sequences for each stop method.

2-8-4 Wiring of an external emergency stop

The external emergency stop function of controls the contactor and turns off the power by directly receiving signals from the emergency stop switch.

(1) Input circuit of an external emergency stop

Besides the emergency stop input from the NC controller, double-protection when an emergency stop occurs can be provided by directly inputting an external emergency stop to the EMGX of CN9 connector on the servo/spindle drive unit. Even if the emergency stop is not input from CNC for some reason, the contactors will be shut off by the external emergency stop input from the EMGX of CN9 connector. When the external emergency stop input and contactor are installed, compliance with "EN60204-1 category1" is basically possible.



⚠CAUTION

1. Always input the external emergency stop signal to the drive unit controlling the contactors.
2. The emergency stop signal input to the CNC side cannot be used as a substitute for the external emergency stop function.
3. To provide double-protection when an emergency stop occurs, the emergency stop input of NC and the external emergency stop input are always wired from same emergency stop switch.

POINT

Stop Categories in EN60204-1
Category 0 : The power is instantly shut off using machine parts.
Category 1 : The drive section is stopped with the control (hardware/software or communication network), and then the power is instantly shut off using machine parts.
(Caution) Refer to the Standards for details.
Refer to Section 9.2.5.4.2 in EN60204-1: Safety of Machinery Electrical Equipment of Machines - Part 1.

(2) Parameter settings

When using the external emergency stop, set the following parameter to the axis to which the signal is input (contactor control axis).

<For MDS-D-SVJ3>

【#2236(PR)】SV036 PTYP Regenerative resistor type

bit 7-4 : emgx External emergency stop function

Set the external emergency stop function. (Do not set a value other than specified.)
0: Disable 4: Enable

<For MDS-D-SPJ3>

【#13032(PR)】SP032 PTYP Regenerative resistor type

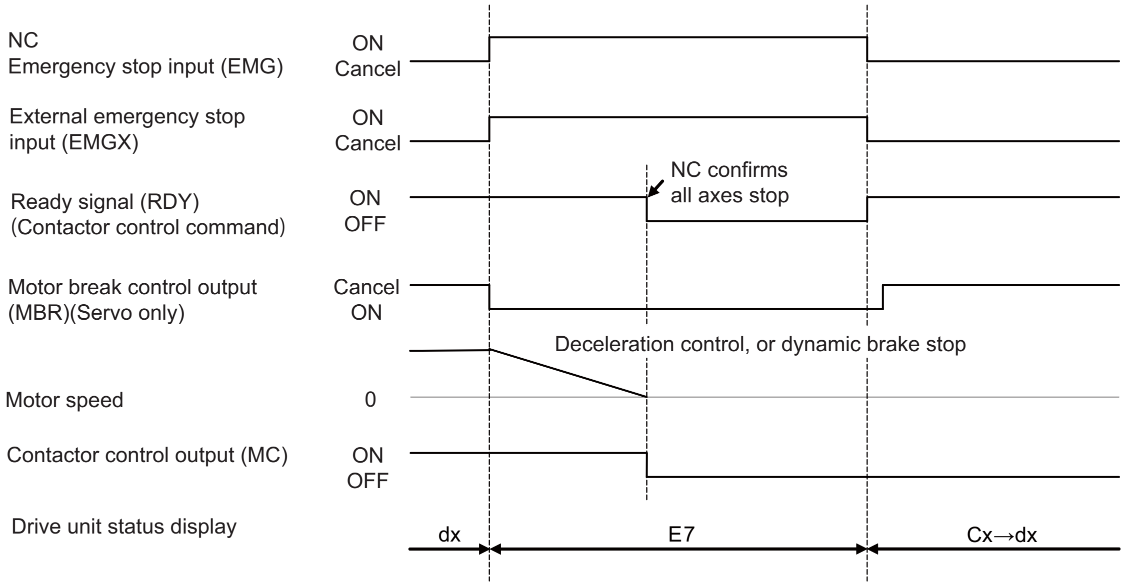
bit 7-4 : emgx External emergency stop function

Set the external emergency stop function. (Do not set a value other than specified.)
0: Disable 4: Enable

(3) Operation sequences of external emergency stop function

[1] Operation sequences of normal emergency stop

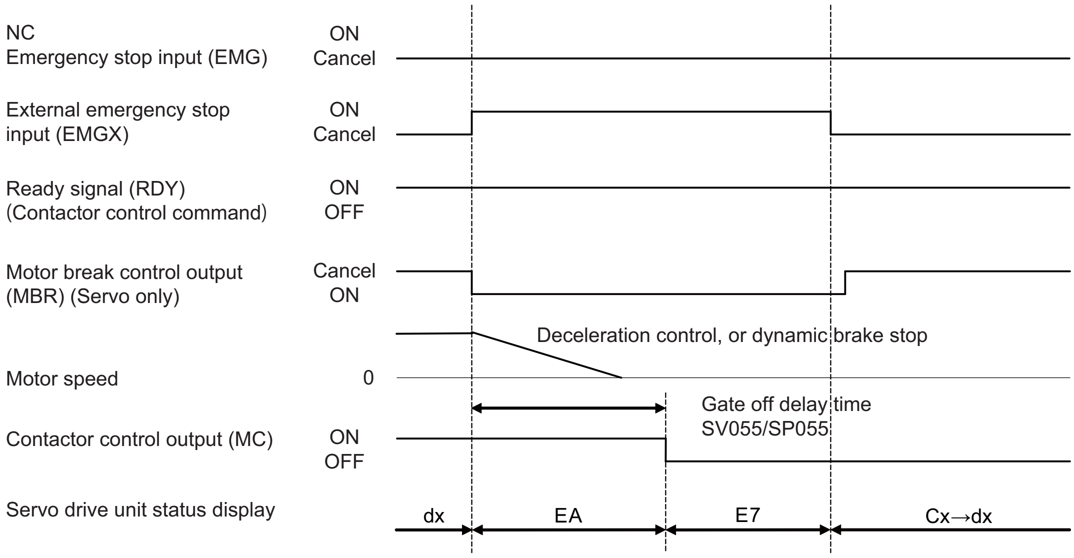
If the normal NC emergency stop and the external emergency stop are simultaneously input, the operation sequence will be the same as in the case of using only the NC emergency stop. Immediately after the emergency stop is input, deceleration control is carried out in spindle control, and dynamic brake stop in servo control in a standard case, or deceleration control when the parameter is set. The ready signal is turned OFF after the NC confirms all axes stop, and the contactor control axis turns the contactor OFF.
Even when the NC emergency stop signal and the external emergency stop signal are not simultaneously input, the operation sequence will be the same as that of the normal emergency stop provided that both signals are input before all axes stop.



Operation sequences of normal emergency stop

[2] When only the external emergency stop is input

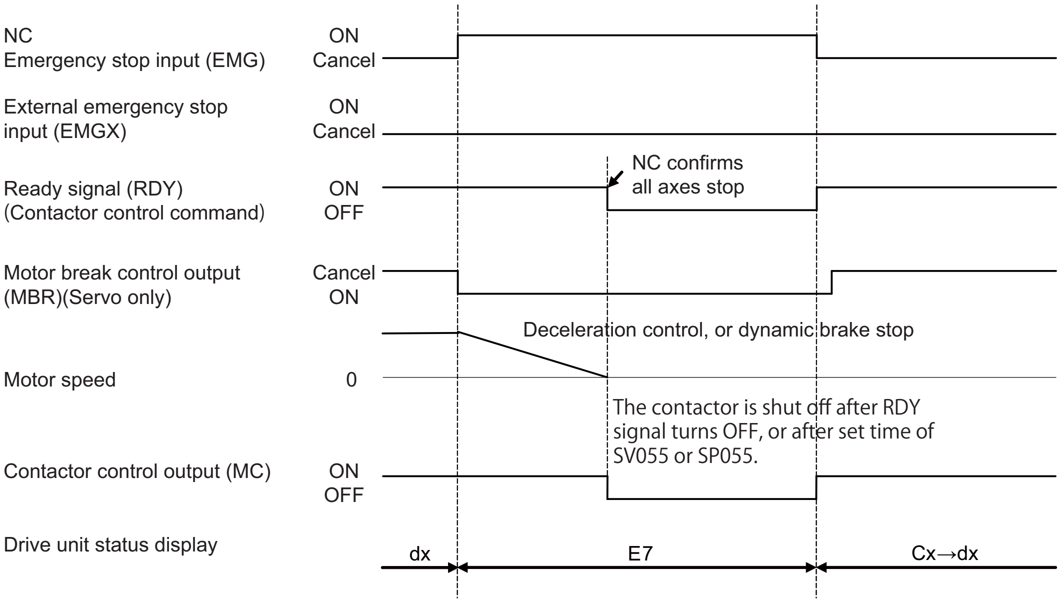
If only the external emergency stop is input, all the drive units that share one NC communication enter an emergency stop state and deceleration control (servo/spindle) or dynamic brake stop (servo) is executed. At this time, the axis to which the external emergency stop is input enters "in external emergency stop" (EA display). The contactor is turned OFF in accordance with the gate off delay time (SV055/SP055), as the NC emergency stop is not input and the ready signal is not turned OFF.



When only the external emergency stop is input

[3] When only the NC emergency stop is input

Motors of all axes enter deceleration stop in the same sequence as normal operation (when both NC and external emergency stop signals are input) and the contactor is shut off. In case that all axes stop is not confirmed and the ready signal is not turned OFF, the contactor is shut off in accordance with the max. gate off delay time (SV055/SP055) which is set to the contactor control axis.



When only the emergency stop of NC is input

2-8-5 Safety observation function

By using the safety observation function, the safety door, etc. can be opened during operation without shutting the power. This function contributes to reducing preparation time and improving operation. The safety is observed in the control section (NC) and drive section (servo drive unit and spindle drive unit). If safety conditions are not satisfied in either system, emergency stop operation is applied and the power is shut to secure the safety.

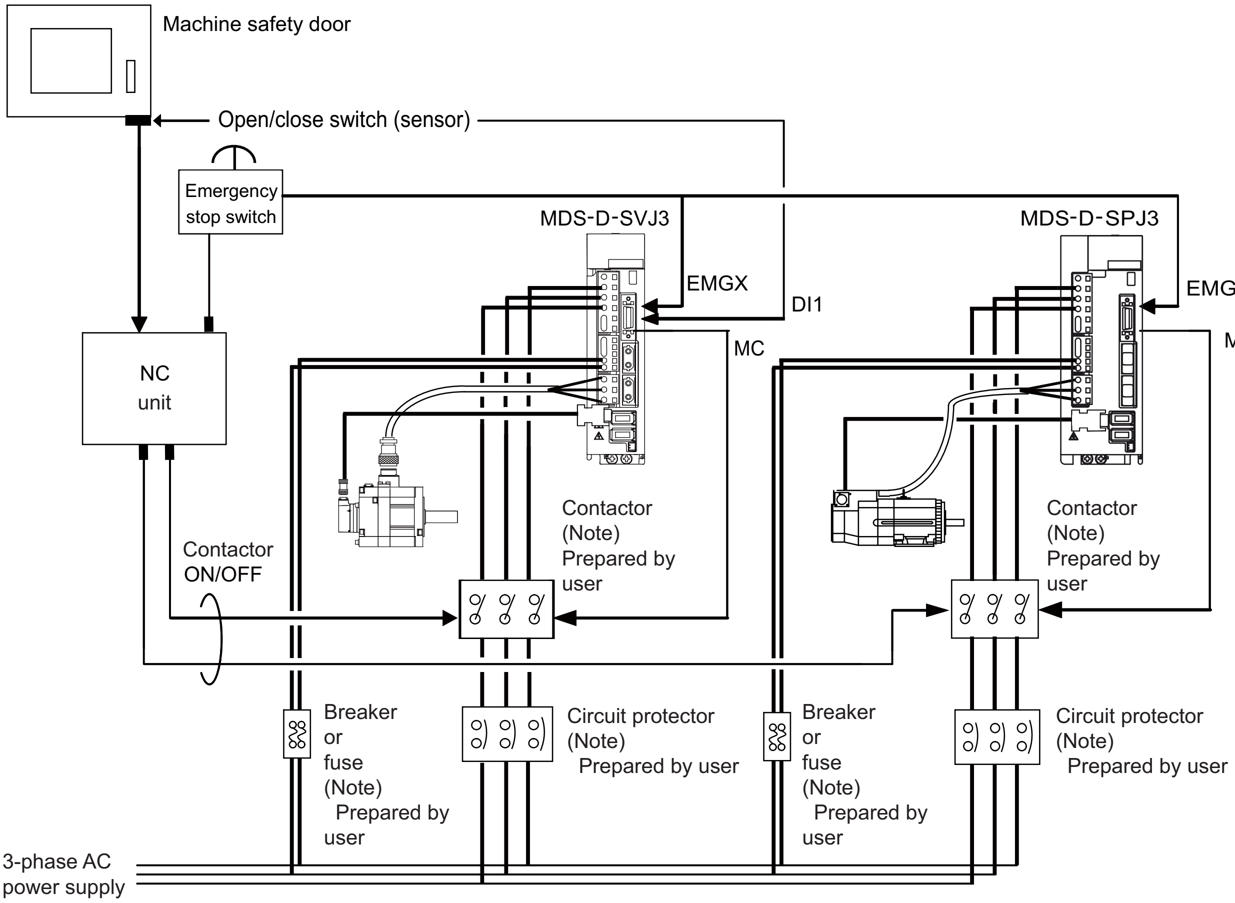
(1) Connection

The following three wirings are required for the safety observation.

[1] The state signal for the safety door of the machine is wired to both the NC unit side (DI) and drive unit side (CN9 connector DI1). The double-protection for the wiring must be provided by wiring the signal to each of the NC side and drive unit side as the following figure.

[2] Add the wiring to control the contactor in the NC unit side in order to shut the power when an error occurs.

[3] In addition to the emergency stop wiring for the NC unit, add the external emergency stop wiring for the CN3 connector.



⚠CAUTION

1. The safety observation function is NC option. Make sure the compatibility with this function.
2. Make sure to input one of the door status signal for each control system to CN9 connector of servo or spindle drive unit. In the control system, it is conveyed to the axis which is not directly connected via the NC.
3. Using the safety observation function, it is required to set parameter in addition to the wiring mentioned above. To prevent a certain axis from being involved in the safety observation function, set SV113/bitF or SP229/bitF to 0.
4. For details on this function, refer to the manual of NC system.

(2) Parameter setting for servo drive unit

Starts the safe observation function.

【#2313】 SV113 SSF8 Servo function 8

bit F : ssc Safety observation function

0: Stop　　1: Start

The digital signal input selection is set to "1" for the drive unit connected with the door state signal. The digital signal input selection is set to "0" for the other drive unit not connected with the signal.

【#2282】 SV082 SSF5 Servo function 5

bit F-C : dis Digital signal input selection

0: No signal
1: Safety observation function door state signal
2: Battery box voltage drop warning (It is not available for MDS-D-SVJ3 Series.)
3 to F: Setting prohibited

Sets the safety speed of the machine and motor for which the safety observation is executed.

【#2233】 SV033 SSF2 Servo function 2

bit D : rps Setting increment

Change the setting units of the specified speed signal output speed (SV073) and safety observation safety speed (SV238).

0: mm/min 1: 100mm/min

【#2438】 SV238 SSCFEED Safety observation Safety speed

Set the machine's safety speed for the safety observation function.
Set this parameter within the following setting ranges.
For linear axis: 2000mm/min or less
For rotary axis: 18000°/min (50r/min) or less
When not using, set to "0".

---Setting range---
0 to 18000 (mm/min) or (°/min)
However, when SV033/bitD=1, the setting range is from -32768 to 32767 (100 mm/min) or (100°/min).

【#2439】 SV239 SSCRPM Safety observation Safety motor speed

Set the motor's safety speed for the safety observation function.
Set a value to hold the following relationship.

SV239=(SV238/SV018) x (SV002/SV001)
Only when the product is 0, set to "1".

When not using, set to "0".

---Setting range---
0 to 32767 (r/min)

(Note) The value of the safety observation safety speed and safety observation safety motor speed must satisfy the following relation.
If this relation is not satisfied, the parameter error (37or E4) will occur.(Error parameter No. is 239.)
Checking this relation is executed when the drive unit is turned ON and parameter is changed and speed observation mode (states when a speed observation command is turned ON) is entered.

$$\frac{\text{SV238 :SSCFEED}}{\text{SV018 :PIT}} \text{ X } \frac{\text{SV002 :PC2}}{\text{SV001 :PC1}} = \text{SV239 :SSCRPM}$$

Note that "1 (r/min)" is applied when the calculation result is "0 (r/min)"

(3) Parameter setting for spindle drive unit

Starts the safe observation function.

【#13229】 SP229 SFNC9 Spindle function 9

bit F : ssc Safety observation function

0: Disable 1: Enable

bit D : rps Safety observation speed setting unit

0: Normal 1: 100°/min

The digital signal input selection is set to "1" for the drive unit connected with the door state signal. The digital signal input selection is set to "0" for the other drive unit not connected with the signal.

【#13227】 SP227 SFNC7 Spindle function 7

bit F-C : dis Digital signal input selection

0: No signal 1: Safety observation function door state signal 4: Proximity switch signal detection
Other settings: setting prohibited

Sets the safety speed of the machine and motor for which the safety observation is executed.

【#13238】 SP238 SSCFEED Safety observation Safety speed

Set the safety speed at the spindle end for the safety observation function.
When not using, set to "0".

---Setting range---

0 to 18000 (° /min)
However, when SP229/bitD is set to "1", the setting range is from -32768 to 32767 (100° /min).

【#13239】 SP239 SSCRPM Safety observation Safety motor speed

Set the motor's safety speed for the safety observation function.
When not using, set to "0".

---Setting range---

0 to 32767 (r/min)

(Note) The value of the safety observation safety speed and safety observation safety motor speed must satisfy the following relation.
If this relation is not satisfied, the parameter error (37or E4) will occur. (Error parameter No. is 239.)
Checking this relation is executed when the drive unit is turned ON and parameter is changed and speed observation mode (states when a speed observation command is turned ON) is entered.

$$\frac{\text{SP238 :SSCFEED}}{360} \times \frac{\text{SP057 :GRA1}}{\text{SP061 :GRB1}} = \text{SP239 :SSCRPM}$$

Note that "1 (r/min)" is applied when the calculation result is "0 (r/min)"

2-8-6 Specifications of proximity switch

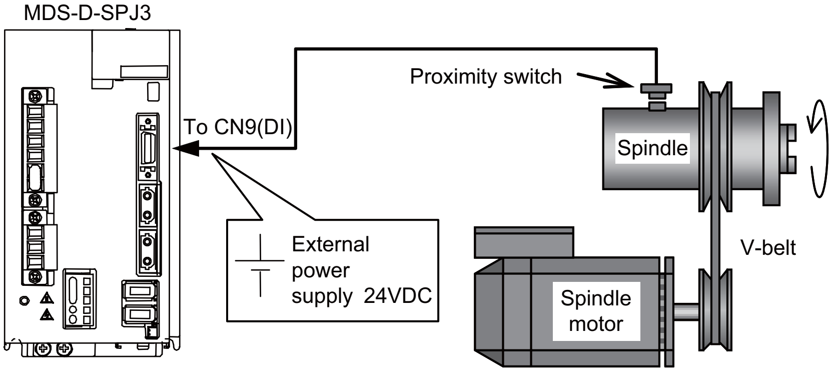
Use a proximity switch which satisfies the following specifications.

(1) Electrical specifications

Item	Specification
Output method	DC double wire system/three wire system
Power supply voltage	24V DC
Response frequency	400Hz or more
Load current	5mA or more
Residual voltage	4V or less
Leakage current	1mA or less

(2) Connection with drive unit

The connection with a drive unit is shown below.



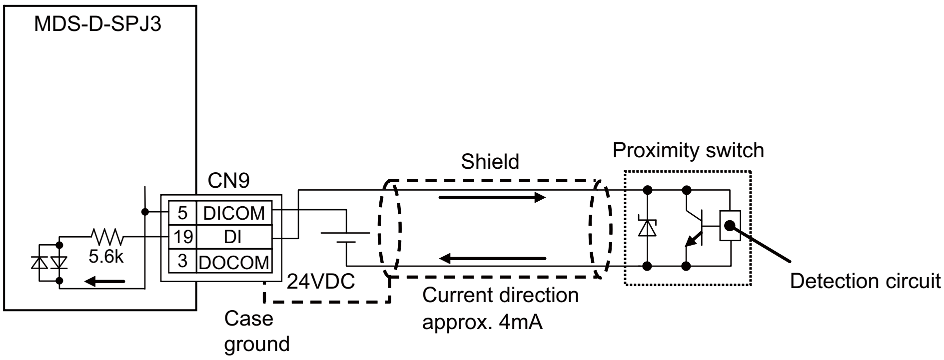
(a) Supply the 24VDC power externally.

(b) Install a proximity switch at the spot that rotates in the ratio of 1:1 to the spindle.

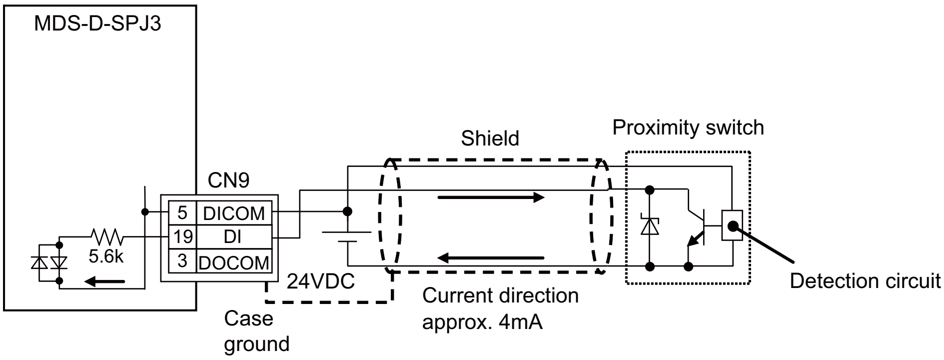
(c) Set the spindle parameter to the pulley ratio for belt drive or to the gear ratio for gear drive.

(a) When DICOM is connected to 24V

< Connection details: For proximity switch of two wire system >



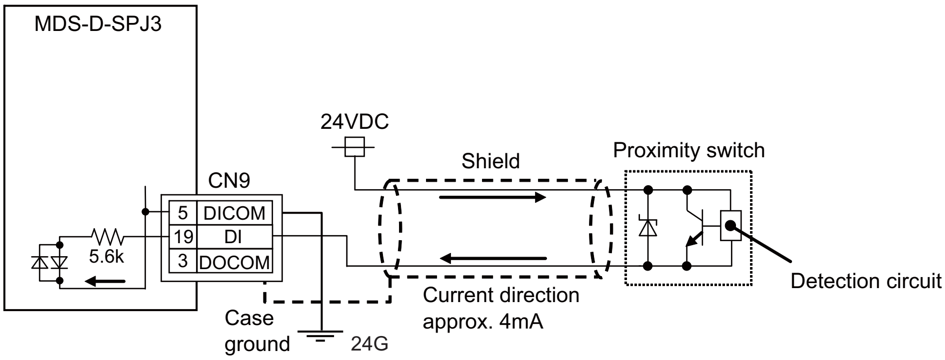
< Connection details: For proximity switch of three wire system >



⇕ Select the polarity of DICOM

(b) When DICOM is connected to 24G

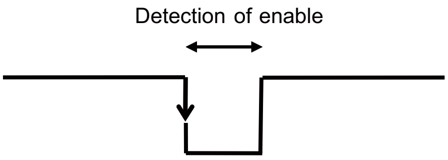
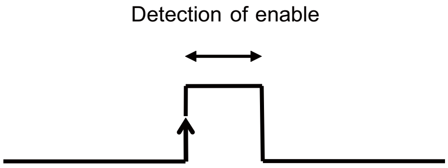
< Connection details: For proximity switch of two wire system >



< Connection details: For proximity switch of three wire system >
Not usable.

(3) Detection signal polarity

The table below is the polarities of the detections signals. According to the polarity, select the enable edge of the signals with the spindle parameter (SP225/bit5).

Sensor operation	Enable detection	Drive unit input signal polarity (CN9 connector 20pin)	Enable edge selection (SP225/bit5)
Normal open (NO)	Rising part		Falling edge (0)
Normal close (NC)	Falling part		
Normal open (NO)	Rising part		Rising edge (1)
Normal close (NC)	Falling part		

(4) Parameter setting

When using the proximity switch, set the following parameters to the spindle to be used.

【#3106】 zrn_typ Zero point return specifications

Select the zero point return specification.

bit F : Spindle zero point detection with contactless switch

0: Normal 1: Enable spindle zero point detection using proximity switch

bit E : Interpolation mode selection in orientation

0: Interpolation mode (Use the interpolation mode gain "SP002 PGN".)
1: Non-interpolation mode (Use the non-interpolation mode gain "SP001 PGV")
Select this when vibration occurs since the gain is too high during the orientation.

bit D-B :

Not used. Set to "0".

bit A-9 : Spindle/C axis zero point return direction

bitA,9=
00: Short-cut
01: Forward run
10: Reverse run

bit 8 : Designate zero point return/deceleration stop of spindle/C axis

0: Zero point return 1: Deceleration stop

bit 7 : Synchronous tapping command polarity

0: Forward direction 1: Reverse direction

bit 6-5 : Synchronous tapping zero point return direction

bit 6,5=
00: Short-cut
01: Forward run
10: Reverse run

bit 4 : Designate zero point return/deceleration stop in synchronous tapping

0: Zero point return 1: Deceleration stop

bit 3 :

Not used. Set to "0".

bit 2-1 : Orientation direction

bit 2,1=
00: Short-cut
01: Forward run
10: Reverse run

bit 0 : Z phase detection direction

0: Forward direction 1: Reverse direction

【#3108】 ori_sft In-position shift amount for orientation

Set the orientation stop position.
The clockwise direction when viewed from the load side is considered as minus (-).

---Setting range---
-35999 to 35999 (0.01°)

【#3109】 zdetspd Z phase detection speed

When "#3106/bitF = 0" (Normal), set the spindle speed at initial Z phase detection.

When "#3106/bitF = 1" (Spindle zero point proximity switch detection enabled), set the spindle speed at initial spindle zero point proximity switch detection.

(Note) When spindle zero point return proximity switch detection is enabled, the rotation direction of the orientation/zero point return (synchronous tapping, spindle/C axis, etc.) will follow Z phase detection direction. And the speed will follow Z phase detection speed (In order to prevent the influences of the delayed detection of the signal pulse edges).

【#3111】 tap_sft Synchronous tapping zero point return shift amount

Set the synchronous tapping zero point return shift amount.

---Setting range---
0.00 to 35999 (0.01°)

【#3113】 cax_sft Spindle C axis zero point return shift amount

Set the spindle C axis zero point return shift amount

---Setting range---
0.00 to 359999 (0.001°)

【#13225】 SP225 SFNC5 Spindle function 5

bit 5 : ddir Proximity switch signal enable edge

0: Falling edge 1: Rising edge

【#13227】 SP227 SFNC7 Spindle function 7

bit F-C : dis Digital signal input selection

0: No signal 1: Safety observation function door state signal 4: Proximity switch signal detection
Other settings: setting prohibited

<Related control signals>

Control input 5 bitD. Zero point re-detection request (ORC)
When ORC is changed from 0 to 1, the Z phase passed will be 0(control output2/bit0).

Control output 5 bitD. Zero point re-detection complete (ORF)
If the zero point re-detection is completed after the zero point re-detection request (control input5/bitD) is set to1, ORF=1 is set. If the zero point re-detection request is set to 0, ORF=0 is set.

3

Setup

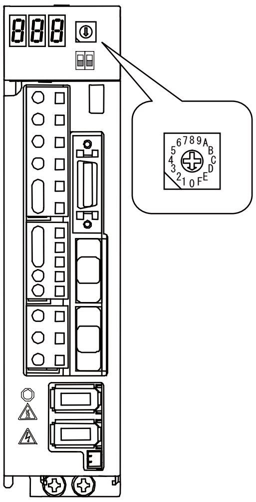
Contents

3-1 Initial setup

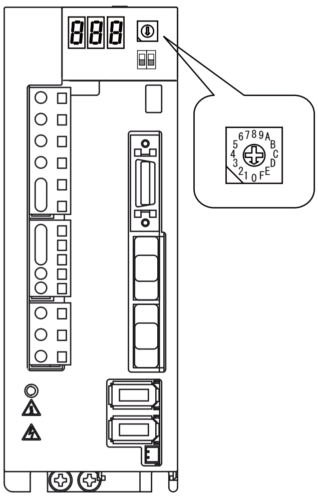
3-1-1 Setting the rotary switch

Before turning on the power, the axis No. must be set with the rotary switch. The rotary switch settings will be validated when the drive units are turned ON.

Servo drive unit
(MDS-D-SVJ3)



Spindle drive unit
(MDS-D-SPJ3)

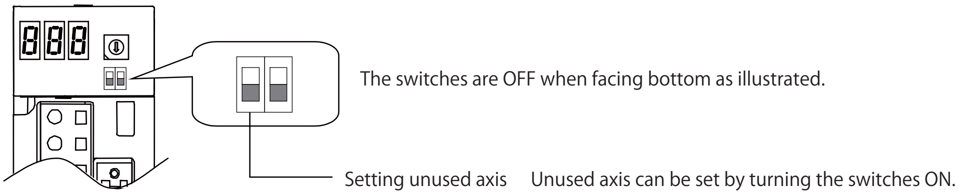


MDS-D-SVJ3/SPJ3 setting

AXIS NO.	Rotary switch setting
1st axis	0
2nd axis	1
3rd axis	2
4th axis	3
5th axis	4
6th axis	5
7th axis	6
8th axis	7
9th axis	8
10th axis	9
11th axis	A
12th axis	B
13th axis	C
14th axis	D
15th axis	E
16th axis	F

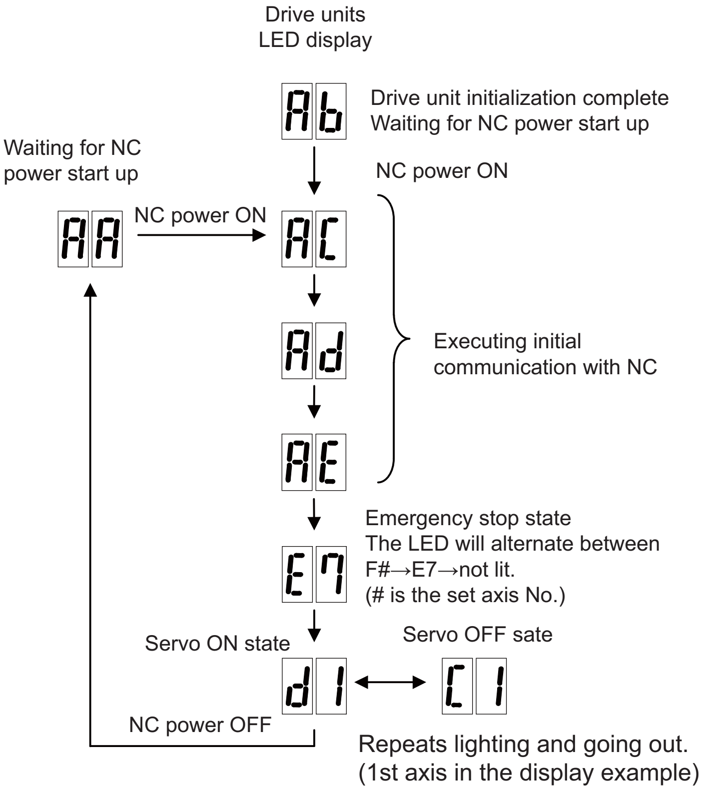
3-1-2 Setting DIP switch

Setting the DIP switches is necessary prior to turning ON the power. Setting of the DIP switches at the time of turning ON the power is validated. The DIP switches shall be as the standard setting (all the switches OFF).



3-1-3 Transition of LED display after power is turned ON

When CNC, each drive unit power have been turned ON, each unit will automatically execute self-diagnosis and initial settings for operation, etc. The LEDs on the front of the units will change as shown below according to the progression of these processes.
If an alarm occurs, the alarm No. will appear on the LEDs. Refer to section "LED display when alarm or warning occurs" for details on the alarm displays.



⚠CAUTION Always input emergency stop when starting the servo system.

3-2 Setting the initial parameters for the servo drive unit

The servo parameters must be set before the servo system can be started up. The servo parameters are input from the NC. The input method differs according to the NC being used, so refer to each NC Instruction Manual.
When setting the initial setting parameters, perform the following settings in each system.

<For semi closed loop control>

(1) Set the standard parameters in the section "3-2-3 List of standard parameters for each servomotor".
(2) "3-2-1 Setting of servo specification parameters"

<For full closed loop control>

(1) Set the standard parameters in the section "3-2-3 List of standard parameters for each servomotor".
(2) "3-2-1 Setting of servo specification parameters"
(3) "3-2-2 Setting of machine side detector"

(Note) For the position command synchronous control, set the parameters for each axis in the same way as the single-axis control.

Setting the initial parameters above enables the test operation for the servo axis (Ex. manual pulse feed, low-speed JOG feed). When machine resonance occurs, check the machine resonance frequency at AFLT frequency on the drive monitor screen and set to the following servo parameters (When the AFLT frequency displays "0", resonance is not occurring).

【#2238】 SV038 FHz1 Notch filter frequency 1

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)

---Setting range---

0 to 2250 (Hz)

3-2-1 Setting of servo specification parameters

(1) Basic specification parameters

When performing absolute position control, set the axis specification parameter #2049. When the setting value of #2049 is "1 to 4", "SV017/bit7" is automatically set to the absolute position control. It is not possible to set SV017/bit7 directly.

【#2049(PR)】 type Absolute position detection method

Select the absolute position zero point alignment method.

0: Not absolute position detection
1: Stopper method (push against mechanical stopper)
2: Marked point alignment method (align to alignment point)
3: Dog-type (align with dog and near point detection switch)
4: Marked point alignment method II (Align to alignment mark. Grid return won't be performed after marked point alignment)
9: Simple absolute position (Not absolute position detection, but the position when the power is turned off is registered.)

【#2217(PR)】 SV017 SPEC1 Servo specification 1

bit 7 : abs Position control

These parameters are set automatically by the NC system.

0: Incremental 1: Absolute position control

For C70 NC, set the following parameters. Ignore the unnecessary alarm history which occurs when the NC power is turned off.

【#2314】 SV114 SSF9 Servo function 9

bit 8 : nohis History of communication error alarm between NC and DRV (34, 36, 38, 39)

Set "1" for C70.

0: Enable 1: Disable

(2) Electronic gear related parameters

Servo control is performed by changing NC command unit to servo control unit with the following parameters (electric gear). Even if each parameter is within the setting range, overflow of the electric gear coefficient may be occur. When the overflow of the electric gear occurs, initial parameter error (servo alarm 37) will occur.

【#2201(PR)】 SV001 PC1 Motor side gear ratio

【#2202(PR)】 SV002 PC2 Machine side gear ratio

Set the gear ratio in the machine side when there is the gear between the servomotor's shaft and machine (ball screw, etc.).
For the rotary axis, set the total deceleration (acceleration) ratio.
Even if the gear ratio is within the setting range, the electronic gears may overflow and an initial parameter error (servo alarm 37) may occur.

【#2218(PR)】 SV018 PIT Ball screw pitch/Magnetic pole pitch

Set the ball screw pitch. For the rotary axis, set to "360".

【#2219(PR)】 SV019 RNG1 Sub side detector resolution

Set the same value as SV020.
For the full-closed loop control, refer to "3-2-2 Setting of machine side detector".

【#2220(PR)】 SV020 RNG2 Main side detector resolution

Set the number of pulses per revolution of the motor side detector.
OSA18 (-A48), HF-KP(260,000 p/rev) ------- SV020 = 260
OSA105 (-A51) (1,000,000 p/rev) ------------ SV020 = 1000

(3) Setting of regenerative resistor type

Set the regenerative resistor type according to the connected regenerative resistor.

【#2236(PR)】 SV036 PTYP Regenerative resistory type

Some combinations are restricted according to the drive unit's capacity.
When the external option regenerative resistor is not connected, always use the built-in resistor in the drive unit.

Resistor built-in drive unit	: 1000h
MR-RB032	: 1200h
MR-RB12 or GZG200W39OHMK	: 1300h
MR-RB32 or GZG200W120OHMK 3 units connected in parallel	: 1400h
MR-RB30 or GZG200W39OHMK 3 units connected in parallel	: 1500h
MR-RB50 or GZG300W39OHMK 3 units connected in parallel	: 1600h
MR-RB31 or GZG200W20OHMK 3 units connected in parallel	: 1700h
MR-MB51 or GZG300W20OHMK 3 units connected in parallel	: 1800h
FCUA-RB22	: 2400h
FCUA-RB37	: 2500h
FCUA-RB55	: 2600h
R-UNIT2	: 2900h
FCUA-RB55 2 units connected in parallel	: 2E00h
FCUA-RB75/2 2 units connected in parallel	: 2D00h

3-2-2 Setting of machine side detector

(1) Setting of the machine side detector specification

【#2225(PR)】 SV025 MTYP Motor/Detector type

Set the position detector type, according to the machine side detector specifications.

bit F-C: pen Position detector

OSA105-ET2	:	pen=6
Serial signal output rotary scale	:	pen=6
Rectangular wave signal output scale	:	pen=8
Serial signal output linear scale	:	pen=A

【#2219(PR)】 SV019 RNG1 Sub side detector resolution

For a ball screw end detector
OSA105-ET2: RNG1=1000
For a linear scale
Set the number of pulses per ball screw lead in one "kp" increments.
For a rotary scale
Set the number of pulses per revolution in one "kp" increments.

Note that the value must be input in increments of 10K pulses (the 1st digit of the setting value is "0").
If any restriction is imposed due to the above condition, also set SV117 in one pulse increments.

【#2317(PR)】 SV117 RNG1ex Expansion sub side detector resolution

To set the resolution of the machine side detector in one pulse increments, set the number of pulses of the detector by 4-byte data in total to SV117 (high-order 16bit) and SV019 (low-order 16bit).

SV117= Quotient of the number of pulses divided by 65536 (If the quotient is 0, set SV117 to -1).
SV019= Remainder of the number of pulses divided by 65536
(SV019 can be set in one pulse increments).

If the NC is C70 and SV019 is greater than 32767, enter the (negative) value obtained by subtracting 65536 from the above remainder in SV019.

(2) Setting table for each detector

Rectangular wave signal output detector

Manufacturer	Detector type	Interface unit type	Control resolution	SV025	SV019	SV117
MAGNESCALE	SR74 SR84	Not required	1.0µm	82□□	SV018 x 1000/1	-1
			0.5µm	82□□	SV018 x 1000/0.5	-1
			0.1µm	82□□	SV018/0.1	0
			0.05µm	82□□	SV018/0.05	0
HEIDENHAIN	LS187 LS487	IBV 101 (10 divisions)	0.5µm	82□□	SV018 x 1000/0.5	-1
		IBV 102 (100 divisions)	0.05µm	82□□	SV018/0.05	0
		IBV 660B (400 divisions)	0.0125µm	82□□	SV018/0.0125	0
Other manufacturers	Rectangular wave output scale	Not required	Signal frequency µm/4	82□□	(SV018 x 1000/(signal cycleµm/4)) /65536 = remainder	quotient

(Note) When the quotient is "0", "SV117 = -1" is applied.

Mitsubishi serial signal output detector (Incremental)

Manufacturer	Detector type	Interface unit type	Control resolution	SV025	SV019	SV117
MAGNESCALE	SR75 SR85	Not required	0.1µm	A2□□	SV018/0.1	0
			0.05µm	A2□□	SV018/0.05	0
			0.01µm	A2□□	SV018/0.01	0
HEIDENHAIN	LS187 LS487	EIB192M A4 20µm EIB392M A4 20µm	(20/16384) µm	A2□□	(SV018 x 819200)/65536 = remainder	quotient
	ERM280 1200	EIB192M C4 1200 EIB392M C4 1200	19,660,800p/rev	62□□	0	300
	ERM280 2048	EIB192M C6 2048 EIB392M C6 2048	33,554,432p/rev	62□□	0	512
Other manufacturers	SIN wave output linear scale	MDS-B-HR	Signal cycle µm/ 512	A2□□	(SV018 x 512000/signal cycle µm) /655356 = remainder	quotient
	SIN wave output rotary scale	MDS-B-HR	Signal frequency x 512p/rev	62□□	(Signal frequency x 512)/65536 = remainder	quotient

(Note 1) When the quotient is "0", "SV117 = -1" is applied.

(Note 2) The communication specification of EIB192M/392M is "MITSU02-4".

Mitsubishi serial signal output detector (Absolute position)

Manufacturer	Detector type	Interface unit type	Control resolution	SV025	SV019	SV117
MITSUBISHI ELECTRIC	OSA105-ET2	Not required	1,000,000p/rev	62□□	1000	0
MAGNESCALE	SR77 SR87	Not required	0.1µm	A2□□	SV018/0.1	0
			0.05µm	A2□□	SV018/0.05	0
			0.01µm	A2□□	SV018/0.01	0
	RU77	Not required	8,000,000p/rev	62□□	8000	0
			32,000,000p/rev	62□□	32000	0
HEIDENHAIN	LC193M LC493M	Not required	0.05µm	A2□□	SV018/0.05	0
			0.01µm	A2□□	SV018/0.01	0
	RCN223M	Not required	8,000,000p/rev	62□□	8000	0
	RCN227M	Not required	134,217,728p/rev	62□□	0	2048
	RCN727M RCN827M	Not required	134,217,728p/rev	62□□	0	2048
Mitutoyo	AT343	Not required	0.05µm	A2□□	SV018/0.05	0
	AT543	Not required	0.05µm	A2□□	SV018/0.05	0
	AT545	Not required	(20/4096) µm	A2□□	(SV018×204800)/65536 = remainder	quotient
MHI MACHINE TOOL ENGINEERING CO., LTD	MPRZ Series	ADB-20J71	8,000,000p/rev	62□□	8000	0
	MPS Series	ADB-20J60	0.05µm	A2□□	SV018/0.05	0
	MPI Series	ADB-20J60	7,200,000p/rev	A2□□	7200	0
		ADB-20J60	14,400,000p/rev	A2□□	14400	0
FAGOR	SAM Series	Not required	0.05µm	A2□□	SV018/0.05	0
	SVAM Series	Not required	0.05µm	A2□□	SV018/0.05	0
	GAM Series	Not required	0.05µm	A2□□	SV018/0.05	0
	LAM Series	Not required	0.1µm	A2□□	SV018/0.1	0

(Note) When the quotient is "0", "SV117 = -1" is applied.

For MPI scale, set the following parameters depends on the number of poles.

【#2217(PR)】 SV017 SPEC1 Servo specification 1

bit 8 : mp MPI scale pole number setting

0: 360 poles 1: 720 poles

(3) Setting of the mounting polarity of the machine side detector

Since the mounting polarity may not be judged from the detector appearance, confirm the mounting polarity of the machine side detector after the mounting.
If "Motor end FB" or "Machine end FB" on the NC drive monitor screen changes to the opposite polarity when the axis is moved, set"SV017/bit4" to "Reverse polarity".

【#2217(PR)】 SV017 SPEC1 Servo specification 1

bit 4 : sdir Sub side detector feedback

0: Forward polarity 1: Reverse polarity

(4) Setting of the machine side detector alarm detection

When using a rectangular wave linear scale, set the following parameters.

【#2235】 SV035 SSF4 Servo function 4

bit 7 : ckab No signal detection 2

Set this to use rectangular wave output linear scale.
This enables the detection of No signal 2 (alarm 21).
0: Disable 1: Enable

【#2398】 SV198 NSE No signal 2 special detection width

Set the special detection width for the no signal 2 (alarm 21).
When "0" is set, the detection will be performed with a 15μm width.
For MDS-D-SVJ3, this parameter setting is invalid and the detection width is fixed to 15μm.

---Setting range---

0 to 32767 (μm)

3-2-3 List of standard parameters for each servomotor

(1) Standard motor HF Series

			Motor	Standard motor HF Series							
Parameter				HF75	HF105	HF54	HF104	HF154	HF224	HF204	HF354
No.	Abbrev.	Details	MDS-D-SVJ3-	07NA	07NA	07NA	10NA	20NA	20NA	20NA	35NA
SV001	PC1	Motor side gear ratio		-	-	-	-	-	-	-	-
SV002	PC2	Machine side gear ratio		-	-	-	-	-	-	-	-
SV003	PGN1	Position loop gain 1		33	33	33	33	33	33	33	33
SV004	PGN2	Position loop gain 2		0	0	0	0	0	0	0	0
SV005	VGN1	Speed loop gain 1		22	50	45	45	40	60	90	110
SV006	VGN2	Speed loop gain 2		0	0	0	0	0	0	0	0
SV007	VIL	Speed loop delay compensation		0	0	0	0	0	0	0	0
SV008	VIA	Speed loop lead compensation		1364	1364	1364	1364	1364	1364	1364	1364
SV009	IQA	Current loop q axis lead compensation		20480	10240	20480	15360	15360	10240	8192	6144
SV010	IDA	Current loop d axis lead compensation		20480	10240	20480	15360	15360	10240	8192	6144
SV011	IQG	Current loop q axis gain		1792	1280	3072	2560	2560	1536	3072	2048
SV012	IDG	Current loop d axis gain		1792	1280	3072	2560	2560	1536	3072	2048
SV013	ILMT	Current limit value		800	800	800	800	800	800	800	800
SV014	ILMTsp	Current limit value in special control		800	800	800	800	800	800	800	800
SV015	FFC	Acceleration rate feed forward gain		0	0	0	0	0	0	0	0
SV016	LMC1	Lost motion compensation 1		0	0	0	0	0	0	0	0
SV017	SPEC1	Servo specification 1		1000	1000	1000	1000	1000	1000	1000	1000
SV018	PIT	Ball screw pitch/Magnetic pole pitch		-	-	-	-	-	-	-	-
SV019	RNG1	Sub side detector resolution		-	-	-	-	-	-	-	-
SV020	RNG2	Main side detector resolution		-	-	-	-	-	-	-	-
SV021	OLT	Overload detection time constant		60	60	60	60	60	60	60	60
SV022	OLL	Overload detection level		150	150	150	150	150	150	150	150
SV023	OD1	Excessive error detection width during servo ON		6	6	6	6	6	6	6	6
SV024	INP	In-position detection width		50	50	50	50	50	50	50	50
SV025	MTYP	Motor/Detector type		2201	2202	2203	2204	2205	2206	2207	2208
SV026	OD2	Excessive error detection width during servo OFF		6	6	6	6	6	6	6	6
SV027	SSF1	Servo function 1		4000	4000	4000	4000	4000	4000	4000	4000
SV028				0	0	0	0	0	0	0	0
SV029	VCS	Speed at the change of speed loop gain		0	0	0	0	0	0	0	0
SV030	IVC	Voltage non-sensitive band compensation		0	0	0	0	0	0	0	0
SV031	OVS1	Overshooting compensation 1		0	0	0	0	0	0	0	0
SV032	TOF	Torque offset		0	0	0	0	0	0	0	0
SV033	SSF2	Servo function 2		0000	0000	0000	0000	0000	0000	0000	0000
SV034	SSF3	Servo function 3		0000	0000	0000	0000	0000	0000	0000	0000
SV035	SSF4	Servo function 4		0000	0000	0000	0000	0000	0000	0000	0000
SV036	PTYP	Power supply type/ Regenerative resistor type		1000	1000	1000	1000	1000	1000	1000	1000
SV037	JL	Load inertia scale		0	0	0	0	0	0	0	0
SV038	FHz1	Notch filter frequency 1		0	0	0	0	0	0	0	0
SV039	LMCD	Lost motion compensation timing		0	0	0	0	0	0	0	0
SV040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0	0	0	0	0
SV041	LMC2	Lost motion compensation 2		0	0	0	0	0	0	0	0
SV042	OVS2	Overshooting compensation 2		0	0	0	0	0	0	0	0
SV043	OBS1	Disturbance observer filter frequency		0	0	0	0	0	0	0	0
SV044	OBS2	Disturbance observer gain		0	0	0	0	0	0	0	0
SV045	TRUB	Friction torque		0	0	0	0	0	0	0	0
SV046	FHz2	Notch filter frequency 2		0	0	0	0	0	0	0	0
SV047	EC	Inductive voltage compensation gain		100	100	100	100	100	100	100	100
SV048	EMGrt	Vertical axis drop prevention time		0	0	0	0	0	0	0	0
SV049	PGN1sp	Position loop gain 1 in spindle synchronous control		15	15	15	15	15	15	15	15
SV050	PGN2sp	Position loop gain 2 in spindle synchronous control		0	0	0	0	0	0	0	0
SV051	DFBT	Dual feedback control time constant		0	0	0	0	0	0	0	0
SV052	DFBN	Dual feedback control non-sensitive band		0	0	0	0	0	0	0	0
SV053	OD3	Excessive error detection width in special control		0	0	0	0	0	0	0	0
SV054	ORE	Overrun detection width in closed loop control		0	0	0	0	0	0	0	0
SV055	EMGx	Max. gate off delay time after emergency stop		0	0	0	0	0	0	0	0
SV056	EMGt	Deceleration time constant at emergency stop		0	0	0	0	0	0	0	0
SV057	SHGC	SHG control gain		0	0	0	0	0	0	0	0
SV058	SHGCsp	SHG control gain in spindle synchronous control		0	0	0	0	0	0	0	0
SV059	TCNV	Collision detection torque estimated gain		0	0	0	0	0	0	0	0
SV060	TLMT	Collision detection level		0	0	0	0	0	0	0	0
SV061	DA1NO	D/A output ch1 data No. for initial DC excitation level		0	0	0	0	0	0	0	0
SV062	DA2NO	D/A output ch2 data No. for final DC excitation level		0	0	0	0	0	0	0	0
SV063	DA1MPY	D/A output ch1 output scale for initial DC excitation time		0	0	0	0	0	0	0	0
SV064	DA2MPY	D/A output ch2 output scale		0	0	0	0	0	0	0	0
SV065	TLC	Machine end compensation gain		0	0	0	0	0	0	0	0

			Motor	Standard motor HF Series							
Parameter				HF75	HF105	HF54	HF104	HF154	HF224	HF204	HF354
No.	Abbrev.	Details	MDS-D-SVJ3-	07NA	07NA	07NA	10NA	20NA	20NA	20NA	35NA
(System parameter area)											
SV073	FEEDout	Specified speed output speed		0	0	0	0	0	0	0	0
(System parameter area)											
SV081	SPEC2	Servo specification 2		0200	0200	0200	0200	0200	0200	0200	0200
SV082	SSF5	Servo function 5		0000	0000	0000	0000	0000	0000	0000	0000
SV083	SSF6	Servo function 6		0000	0000	0000	0000	0000	0000	0000	0000
SV084	SSF7	Servo function 7		0000	0000	0000	0000	0000	0000	0000	0000
SV085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0	0	0	0	0
SV086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0	0	0	0	0
SV087	FHz4	Notch filter frequency 4		0	0	0	0	0	0	0	0
SV088	FHz5	Notch filter frequency 5		0	0	0	0	0	0	0	0
SV089				0	0	0	0	0	0	0	0
SV090				0	0	0	0	0	0	0	0
SV091	LMC4G	Lost motion compensation 4 gain		0	0	0	0	0	0	0	0
SV092				0	0	0	0	0	0	0	0
SV093				0	0	0	0	0	0	0	0
SV094	MPV	Magnetic pole position error detection speed		10	10	10	10	10	10	10	10
SV095	ZUPD	Vertical axis pull up distance		0	0	0	0	0	0	0	0
SV096				0	0	0	0	0	0	0	0
SV097				0	0	0	0	0	0	0	0
SV098				0	0	0	0	0	0	0	0
SV099				0	0	0	0	0	0	0	0
SV100				0	0	0	0	0	0	0	0
SV101 : SV256				0	0	0	0	0	0	0	0

3 Setup

			Motor	Standard motor HF Series				
Parameter				HF123	HF223	HF303	HF142	HF302
No.	Abbrev.	Details	MDS-D-SVJ3-	10NA	10NA	20NA	10NA	10NA
SV001	PC1	Motor side gear ratio		-	-	-	-	-
SV002	PC2	Machine side gear ratio		-	-	-	-	-
SV003	PGN1	Position loop gain 1		33	33	33	33	33
SV004	PGN2	Position loop gain 2		0	0	0	0	0
SV005	VGN1	Speed loop gain 1		36	70	110	34	140
SV006	VGN2	Speed loop gain 2		0	0	0	0	0
SV007	VIL	Speed loop delay compensation		0	0	0	0	0
SV008	VIA	Speed loop lead compensation		1364	1364	1364	1364	1364
SV009	IQA	Current loop q axis lead compensation		20480	10240	8192	20480	10240
SV010	IDA	Current loop d axis lead compensation		20480	10240	8192	20480	10240
SV011	IQG	Current loop q axis gain		4096	1536	2560	6144	3072
SV012	IDG	Current loop d axis gain		4096	1536	2560	6144	3072
SV013	ILMT	Current limit value		800	800	800	800	800
SV014	ILMTsp	Current limit value in special control		800	800	800	800	800
SV015	FFC	Acceleration rate feed forward gain		0	0	0	0	0
SV016	LMC1	Lost motion compensation 1		0	0	0	0	0
SV017	SPEC1	Servo specification 1		1000	1000	1000	1000	1000
SV018	PIT	Ball screw pitch/Magnetic pole pitch		-	-	-	-	-
SV019	RNG1	Sub side detector resolution		-	-	-	-	-
SV020	RNG2	Main side detector resolution		-	-	-	-	-
SV021	OLT	Overload detection time constant		60	60	60	60	60
SV022	OLL	Overload detection level		150	150	150	150	150
SV023	OD1	Excessive error detection width during servo ON		6	6	6	6	6
SV024	INP	In-position detection width		50	50	50	50	50
SV025	MTYP	Motor/Detector type		2224	2226	2228	2225	2227
SV026	OD2	Excessive error detection width during servo OFF		6	6	6	6	6
SV027	SSF1	Servo function 1		4000	4000	4000	4000	4000
SV028				0	0	0	0	0
SV029	VCS	Speed at the change of speed loop gain		0	0	0	0	0
SV030	IVC	Voltage non-sensitive band compensation		0	0	0	0	0
SV031	OVS1	Overshooting compensation 1		0	0	0	0	0
SV032	TOF	Torque offset		0	0	0	0	0
SV033	SSF2	Servo function 2		0000	0000	0000	0000	0000
SV034	SSF3	Servo function 3		0000	0000	0000	0000	0000
SV035	SSF4	Servo function 4		0000	0000	0000	0000	0000
SV036	PTYP	Power supply type/ Regenerative resistor type		1000	1000	1000	1000	1000
SV037	JL	Load inertia scale		0	0	0	0	0
SV038	FHz1	Notch filter frequency 1		0	0	0	0	0
SV039	LMCD	Lost motion compensation timing		0	0	0	0	0
SV040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0	0
SV041	LMC2	Lost motion compensation 2		0	0	0	0	0
SV042	OVS2	Overshooting compensation 2		0	0	0	0	0
SV043	OBS1	Disturbance observer filter frequency		0	0	0	0	0
SV044	OBS2	Disturbance observer gain		0	0	0	0	0
SV045	TRUB	Friction torque		0	0	0	0	0
SV046	FHz2	Notch filter frequency 2		0	0	0	0	0
SV047	EC	Inductive voltage compensation gain		100	100	100	100	100
SV048	EMGrt	Vertical axis drop prevention time		0	0	0	0	0
SV049	PGN1sp	Position loop gain 1 in spindle synchronous control		15	15	15	15	15
SV050	PGN2sp	Position loop gain 2 in spindle synchronous control		0	0	0	0	0
SV051	DFBT	Dual feedback control time constant		0	0	0	0	0
SV052	DFBN	Dual feedback control non-sensitive band		0	0	0	0	0
SV053	OD3	Excessive error detection width in special control		0	0	0	0	0
SV054	ORE	Overrun detection width in closed loop control		0	0	0	0	0
SV055	EMGx	Max. gate off delay time after emergency stop		0	0	0	0	0
SV056	EMGt	Deceleration time constant at emergency stop		0	0	0	0	0
SV057	SHGC	SHG control gain		0	0	0	0	0
SV058	SHGCsp	SHG control gain in spindle synchronous control		0	0	0	0	0
SV059	TCNV	Collision detection torque estimated gain		0	0	0	0	0
SV060	TLMT	Collision detection level		0	0	0	0	0
SV061	DA1NO	D/A output ch1 data No. for initial DC excitation level		0	0	0	0	0
SV062	DA2NO	D/A output ch2 data No. for final DC excitation level		0	0	0	0	0
SV063	DA1MPY	D/A output ch1 output scale for initial DC excitation time		0	0	0	0	0
SV064	DA2MPY	D/A output ch2 output scale		0	0	0	0	0
SV065	TLC	Machine end compensation gain		0	0	0	0	0

Parameter			Motor	Standard motor HF Series				
				HF123	HF223	HF303	HF142	HF302
No.	Abbrev.	Details	MDS-D-SVJ3-	10NA	10NA	20NA	10NA	10NA
(System parameter area)								
SV073	FEEDout	Specified speed output speed		0	0	0	0	0
(System parameter area)								
SV081	SPEC2	Servo specification 2		0200	0200	0200	0200	0200
SV082	SSF5	Servo function 5		0000	0000	0000	0000	0000
SV083	SSF6	Servo function 6		0000	0000	0000	0000	0000
SV084	SSF7	Servo function 7		0000	0000	0000	0000	0000
SV085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0	0
SV086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0	0
SV087	FHz4	Notch filter frequency 4		0	0	0	0	0
SV088	FHz5	Notch filter frequency 5		0	0	0	0	0
SV089				0	0	0	0	0
SV090				0	0	0	0	0
SV091	LMC4G	Lost motion compensation 4 gain		0	0	0	0	0
SV092				0	0	0	0	0
SV093				0	0	0	0	0
SV094	MPV	Magnetic pole position error detection speed		10	10	10	10	10
SV095	ZUPD	Vertical axis pull up distance		0	0	0	0	0
SV096				0	0	0	0	0
SV097				0	0	0	0	0
SV098				0	0	0	0	0
SV099				0	0	0	0	0
SV100				0	0	0	0	0
SV101 : SV256				0	0	0	0	0

(2) Standard motor HF-KP Series

Parameter			Motor	Standard motor HF-KP Series			
				HF-KP13J -S17	HF-KP23JW04-S6	HF-KP43JW04-S6	HF-KP73JW04-S6
No.	Abbrev.	Details	MDS-D-SVJ3-	03NA	03NA	04NA	07NA
SV001	PC1	Motor side gear ratio		-	-	-	-
SV002	PC2	Machine side gear ratio		-	-	-	-
SV003	PGN1	Position loop gain 1		33	33	33	33
SV004	PGN2	Position loop gain 2		0	0	0	0
SV005	VGN1	Speed loop gain 1		5	5	10	30
SV006	VGN2	Speed loop gain 2		0	0	0	0
SV007	VIL	Speed loop delay compensation		0	0	0	0
SV008	VIA	Speed loop lead compensation		1364	1364	1364	1364
SV009	IQA	Current loop q axis lead compensation		20480	20480	15360	4096
SV010	IDA	Current loop d axis lead compensation		20480	20480	15360	4096
SV011	IQG	Current loop q axis gain		1536	2048	1024	768
SV012	IDG	Current loop d axis gain		1536	2048	1024	768
SV013	ILMT	Current limit value		300	300	300	300
SV014	ILMTsp	Current limit value in special control		300	300	300	300
SV015	FFC	Acceleration rate feed forward gain		0	0	0	0
SV016	LMC1	Lost motion compensation 1		0	0	0	0
SV017	SPEC1	Servo specification 1		1000	1000	1000	1000
SV018	PIT	Ball screw pitch/Magnetic pole pitch		-	-	-	-
SV019	RNG1	Sub side detector resolution		260	260	260	260
SV020	RNG2	Main side detector resolution		260	260	260	260
SV021	OLT	Overload detection time constant		60	60	60	60
SV022	OLL	Overload detection level		150	150	150	150
SV023	OD1	Excessive error detection width during servo ON		6	6	6	6
SV024	INP	In-position detection width		50	50	50	50
SV025	MTYP	Motor/Detector type		22E9	22EA	22EB	22EC
SV026	OD2	Excessive error detection width during servo OFF		6	6	6	6
SV027	SSF1	Servo function 1		4000	4000	4000	4000
SV028				0	0	0	0
SV029	VCS	Speed at the change of speed loop gain		0	0	0	0
SV030	IVC	Voltage non-sensitive band compensation		0	0	0	0
SV031	OVS1	Overshooting compensation 1		0	0	0	0
SV032	TOF	Torque offset		0	0	0	0
SV033	SSF2	Servo function 2		0000	0000	0000	0000
SV034	SSF3	Servo function 3		0000	0000	0000	0000
SV035	SSF4	Servo function 4		0000	0000	0000	0000
SV036	PTYP	Power supply type/ Regenerative resistor type		1000	1000	1000	1000
SV037	JL	Load inertia scale		0	0	0	0
SV038	FHz1	Notch filter frequency 1		0	0	0	0
SV039	LMCD	Lost motion compensation timing		0	0	0	0
SV040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0
SV041	LMC2	Lost motion compensation 2		0	0	0	0
SV042	OVS2	Overshooting compensation 2		0	0	0	0
SV043	OBS1	Disturbance observer filter frequency		0	0	0	0
SV044	OBS2	Disturbance observer gain		0	0	0	0
SV045	TRUB	Friction torque		0	0	0	0
SV046	FHz2	Notch filter frequency 2		0	0	0	0
SV047	EC	Inductive voltage compensation gain		100	100	100	100
SV048	EMGrt	Vertical axis drop prevention time		0	0	0	0
SV049	PGN1sp	Position loop gain 1 in spindle synchronous control		15	15	15	15
SV050	PGN2sp	Position loop gain 2 in spindle synchronous control		0	0	0	0
SV051	DFBT	Dual feedback control time constant		0	0	0	0
SV052	DFBN	Dual feedback control non-sensitive band		0	0	0	0
SV053	OD3	Excessive error detection width in special control		0	0	0	0
SV054	ORE	Overrun detection width in closed loop control		0	0	0	0
SV055	EMGx	Max. gate off delay time after emergency stop		0	0	0	0
SV056	EMGt	Deceleration time constant at emergency stop		0	0	0	0
SV057	SHGC	SHG control gain		0	0	0	0
SV058	SHGCsp	SHG control gain in spindle synchronous control		0	0	0	0
SV059	TCNV	Collision detection torque estimated gain		0	0	0	0
SV060	TLMT	Collision detection level		0	0	0	0
SV061	DA1NO	D/A output ch1 data No. for initial DC excitation level		0	0	0	0
SV062	DA2NO	D/A output ch2 data No. for final DC excitation level		0	0	0	0
SV063	DA1MPY	D/A output ch1 output scale for initial DC excitation time		0	0	0	0
SV064	DA2MPY	D/A output ch2 output scale		0	0	0	0
SV065	TLC	Machine end compensation gain		0	0	0	0

			Motor	Standard motor HF-KP Series			
Parameter				HF-KP13J -S17	HF-KP23JW04-S6	HF-KP43JW04-S6	HF-KP73JW04-S6
No.	Abbrev.	Details	MDS-D-SVJ3-	03NA	03NA	04NA	07NA
		(System parameter area)					
SV073	FEEDout	Specified speed output speed		0	0	0	0
		(System parameter area)					
SV081	SPEC2	Servo specification 2		0200	0200	0200	0200
SV082	SSF5	Servo function 5		0000	0000	0000	0000
SV083	SSF6	Servo function 6		0000	0000	0000	0000
SV084	SSF7	Servo function 7		0000	0000	0000	0000
SV085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0
SV086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0
SV087	FHz4	Notch filter frequency 4		0	0	0	0
SV088	FHz5	Notch filter frequency 5		0	0	0	0
SV089				0	0	0	0
SV090				0	0	0	0
SV091	LMC4G	Lost motion compensation 4 gain		0	0	0	0
SV092				0	0	0	0
SV093				0	0	0	0
SV094	MPV	Magnetic pole position error detection speed		10	10	10	10
SV095	ZUPD	Vertical axis pull up distance		0	0	0	0
SV096				0	0	0	0
SV097				0	0	0	0
SV098				0	0	0	0
SV099				0	0	0	0
SV100				0	0	0	0
SV101 : SV256				0	0	0	0

3-2-4 Servo parameters

The parameters with "(PR)" requires the CNC to be turned OFF after the settings. Turn the power OFF and ON to enable the parameter settings.

【#2201(PR)】 SV001 PC1 Motor side gear ratio

Set the gear ratio in the motor side when there is the gear between the servomotor's shaft and machine (ball screw, etc.).
For the rotary axis, set the total deceleration (acceleration) ratio.
Even if the gear ratio is within the setting range, the electronic gears may overflow and an initial parameter error (servo alarm 37) may occur.

For linear servo system
Set to "1".

---Setting range---
1 to 32767

【#2202(PR)】 SV002 PC2 Machine side gear ratio

Set the gear ratio in the machine side when there is the gear between the servomotor's shaft and machine (ball screw, etc.).
For the rotary axis, set the total deceleration (acceleration) ratio.
Even if the gear ratio is within the setting range, the electronic gears may overflow and an initial parameter error (servo alarm 37) may occur.

For linear servo system
Set to "1".

---Setting range---
1 to 32767

【#2203】 SV003 PGN1 Position loop gain 1

Set the position loop gain. The standard setting is "33".
The higher the setting value is, the more accurately the command can be followed, and the shorter the settling time in positioning gets, however, note that a bigger shock will be applied to the machine during acceleration/deceleration.
When using the SHG control, also set SV004 (PGN2) and SV057 (SHGC).

---Setting range---
1 to 200 (rad/s)

【#2204】 SV004 PGN2 Position loop gain 2

When performing the SHG control, set the value of "SV003 x 8/3" to "SV004".
When not using the SHG control, set to "0".

Related parameters: SV003, SV057

---Setting range---
0 to 999 (rad/s)

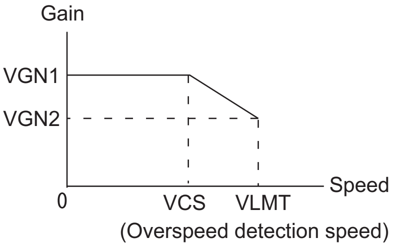
【#2205】 SV005 VGN1 Speed loop gain 1

Set the speed loop gain.
The higher the setting value is, the more accurate the control will be, however, vibration tends to occur.
If vibration occurs, adjust by lowering by 20 to 30%.
The value should be determined to the 70 to 80% of the value at which the vibration stops.
The value differs depending on servo motors.
Aim at the standard value determined by the servo motor type and load inertia ratio to adjust.

---Setting range---
1 to 9999

【#2206】 SV006 VGN2 Speed loop gain 2

Set the speed loop gain at the motor limitation speed VLMT (maximum rotation speed x 1.15) with "VCS(SV029: Speed at the change of speed loop gain)".
Use this to suppress noise at high speed rotation during rapid traverse, etc. Then, the speed loop gain decreases at faster speed than the setting value of VCS.
When not using, set to "0".



---Setting range---
-1000 to 9999

【#2207】 SV007 VIL Speed loop delay compensation

Set this when the limit cycle occurs in the full-closed loop, or overshooting occurs in positioning.
The speed loop delay compensation method can be selected with SV027/bit1,0.
Normally, use "Changeover type 2". Changeover type 2 controls the occurrence of overshooting by lowering the speed loop lead compensation after the position droop gets 0.
When setting this parameter, make sure to set the torque offset (SV032).

---Setting range---
0 to 32767

【#2208】 SV008 VIA Speed loop lead compensation

Set the gain of the speed loop integral control.
Standard setting: 1364
Standard setting in the SHG control: 1900
Adjust the value by increasing/decreasing this by about 100 at a time.
Raise this value to improve contour tracking accuracy in high-speed cutting.
Lower this value when the position droop does not stabilize (when the vibration of 10 to 20Hz occurs).

---Setting range---
1 to 9999

【#2209】 SV009 IQA Current loop q axis lead compensation

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 20480

【#2210】 SV010 IDA Current loop d axis lead compensation

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 20480

【#2211】 SV011 IQG Current loop q axis gain

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 8192

【#2212】 SV012 IDG Current loop d axis gain

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 8192

【#2213】 SV013 ILMT Current limit value

Set the current (torque) limit value in a normal operation.
This is a limit value in forward run and reverse run (for linear motors:forward and reverse direction).
When the standard setting value is "800", the maximum torque is determined by the specification of the motor.
Set this parameter as a proportion (%) to the stall current.

---Setting range---
0 - 999 (Stall current %)

【#2214】 SV014 ILMTsp Current limit value in special control

Set the current (torque) limit value in a special operation (absolute position initial setting, stopper control and etc.).
This is a limit value in forward and reverse directions.
Set to "800" when not using.
Set this parameter as a proportion (%) to the stall current.

---Setting range---
0 - 999 (Stall current %)
However, when SV084/bitB=1, the setting range is from 0 to 32767 (Stall current 0.01%).

【#2215】 SV015 FFC Acceleration rate feed forward gain

When a relative error in synchronous control is too large, set this parameter to the axis that is delaying.
The standard setting is "0". The standard setting in the SHG control is "100".
To adjust a relative error in acceleration/deceleration, increase the value by 50 - 100 at a time.

---Setting range---
0 to 999 (%)

【#2216】 SV016 LMC1 Lost motion compensation 1

Set this parameter when the protrusion (that occurs due to the non-sensitive band by friction, torsion, backlash, etc.) at quadrant change is too large. This sets the compensation torque at quadrant change (when an axis feed direction is reversed) by the proportion (%) to the stall torque. Whether to enable the lost motion compensation and the method can be set with other parameters.

Type 2: When SV027 (SSF1)/bit9, 8 (lmc) = 10 (Compatible with obsolete type)
Set the type 2 method compensation torque. The standard setting is double the friction torque.
Related parameters: SV027/bit9,8, SV033/bitF, SV039, SV040, SV041, SV082/bit2, SV113/bit7

Type 3: When SV082(SSF5)/bit1= 1
Set the compensation torque equivalent of dynamic friction amount of the type 3 method compensation amount. The standard setting is double the dynamic friction torque.
Related parameters: SV041, SV082/bit2,1, SV085, SV086, SV113/bit7

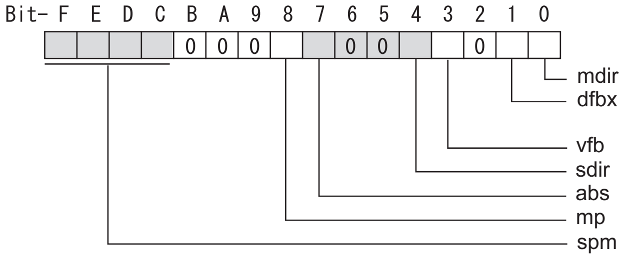
To vary compensation amount according to the direction.
When SV041 (LMC2) is "0", compensate with the value of SV016 (LMC1) in both +/-directions.
If you wish to change the compensation amount depending on the command direction, set this and SV041 (LMC2).
(SV016: + direction, SV041: - direction. However, the directions may be opposite depending on other settings.)
When "-1" is set, the compensation will not be performed in the direction of the command.

---Setting range---

-1 to 200 (Stall current %)
Note that when SV082/bit2 is "1", the setting range is between -1 and 20000 (Stall current 0.01%).

【#2217(PR)】 SV017 SPEC1 Servo specification 1

Select the servo specifications.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-C : spm Motor series selection

0: 200V HF, HP motor 1
1: 200V HF, HP motor 2 (Standard)
2: 400V HF-H, HP-H motor 1
3: 400V HF-H, HP-H motor 2 (Standard)
6: 200V LM-F linear motor
7: 200V direct-drive motor
8: 400V LM-F linear motor
9: 400V direct-drive motor

bit B :

Not used. Set to "0".

bit A : drvup Combined drive unit:

- For MDS-DM Series
  0: Normal setting (Combined drive unit: normal)
  1: Combined drive unit: one upgrade

In the following combination of the drive unit and servomotors, set to "bitA=1".
MDS-DM-V3-404040 --------- HF75, HF105, HF123, HF142
MDS-DM-SPV2/SPV3 --------- HF54, HF104, HF223, HF302

bit 9 :

Not used. Set to "0".

bit 8 : mp MPI scale pole number setting

0: 360 poles 1: 720 poles

bit 7 : abs Position control

These parameters are set automatically by the NC system.
0: Incremental 1: Absolute position control

bit 6-5 :

Not used. Set to "0".

bit 4 : sdir Sub side detector feedback

Set the machine side detector's installation polarity.
0: Forward polarity 1: Reverse polarity

bit 3 : vfb Speed feedback filter

0: Stop 1: Start (2250Hz)

bit 2 : seqh Ready on sequence

0: Normal 1: High-speed

bit 1 : dfbx Dual feedback control

Control the position FB signal in full closed control by the combination of a motor end detector and machine end detector.
0: Stop 1: Start

Related parameters: SV051, SV052

bit 0 : mdir Machine side detector feedback (for Linear/direct-drive motor)

Set the detector installation polarity in the linear servo and direct-drive motor control.
0: Forward polarity 1: Reverse polarity

【#2218(PR)】 SV018 PIT Ball screw pitch/Magnetic pole pitch

For servo motor:
Set the ball screw pitch. For the rotary axis, set to "360".

For direct-drive motor
Set to "360".

- For linear motor
Set the ball screw pitch. (For LM-F series, set to "48")

---Setting range---
For general motor: 1 to 32767 (mm/rev)
- For linear motor 1 to 32767 (mm)

【#2219(PR)】 SV019 RNG1 Sub side detector resolution

For semi-closed loop control
Set the same value as SV020.

For full-closed loop control
Set the number of pulses per ball screw pitch.

For direct-drive motor
Set the same value as SV020.

For 1000 pulse unit resolution detector, set the number of pulses in SV019 in increments of 1000 pulse (kp).
In this case, make sure to set "0" to SV117.
For high-accuracy binary resolution detector, set the number of pulses to four bite data of SV117 (high-order) and SV019 (low-order) in pulse (p) unit.
SV117 = number of pulses / 65536 (when =0, set "-1" to SV117)
SV019 = the remainder of number of "pulses / 65536"
When the NC is C70 and "SV019 > 32767", set "the reminder of above - 65536 (negative number)" to "SV019".

---Setting range---
When SV117?0, the setting range is from 0 to 32767 (kp)
When SV117≠0
M700V, M70V, M70: 0 to 65536 (p)
C70: -32768 to 32767 (p)

【#2220(PR)】 SV020 RNG2 Main side detector resolution

Set the number of pulses per revolution of the motor side detector.
OSA18 (-A48) (260,000 p/rev) ----------- SV020 = 260
OSA105 (-A51) (1,000,000 p/rev) ------- SV020 = 1000
OSA166 (-A74) (16,000,000 p/rev) ----- SV020 = 16000

For linear motor
Set the number of pulses of the detector per magnetic pole pitch with SV118.

For direct-drive motor
Set the number of pulses per revolution of the motor side detector.

For 1000 pulse unit resolution detector, set the number of pulses to SV020 in increments of 1000 pulse(kp).
In this case, make sure to set SV118 to "0".
For high-accuracy binary resolution detector, set the number of pulses to four bite data of SV118 (high-order) and SV020 (low-order) in pulse(p) unit.
SV118 = number of pulses / 65536 (when =0, set "-1" to SV118)
SV019 = the remainder of "number of pulses / 65536"
When the NC is C70 and "SV020 > 32767", set "the reminder of above - 65536 (negative number)" to "SV020".

---Setting range---

When SV118?0, the setting range is from 0 to 32767 (kp)
When SV118≠0
For M700V,M70V,M70: 0 to 65536 (p)
For C70: -32768 to 32767 (p)

【#2221】 SV021 OLT Overload detection time constant

Normally, set to "60". (For machine tool builder adjustment.)

Related parameters: SV022

---Setting range---

1 to 999 (s)

【#2222】 SV022 OLL Overload detection level

Set the "Overload 1" (Alarm 50) current detection level as percentage to the stall current.
Normally set this parameter to "150". (For machine tool builder adjustment.)

Related parameters: SV021

---Setting range---

110 to 500 (Stall current %)

【#2223】 SV023 OD1 Excessive error detection width during servo ON

Set the excessive error detection width in servo ON.
<Standard setting value>

OD1=OD2= (Rapid traverse rate [mm/min]) / (60×PGN1) / 2 [mm]

When set to "0", the excessive error alarm detection will be ignored.

Related parameters: SV026

---Setting range---

0 to 32767 (mm)
However, when SV084/bitC=1, the setting range is from 0 to 32767 (μm).
(Only for MDS-D/DH and MDS-DM)

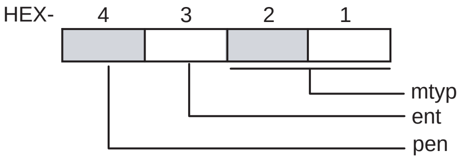
【#2224】 SV024 INP In-position detection width

Set the in-position detection width.
Set the positioning accuracy required for the machine.
The lower the setting is, the higher the positioning accuracy will be. However the cycle time (settling time) becomes longer.
The standard setting value is "50".

---Setting range---
0 to 32767 (μm)

【#2225(PR)】 SV025 MTYP Motor/Detector type

Set the position detector type, speed detector type and motor type.
The setting value is a four-digit hex (HEX).



bit F-C : pen(HEX-4) Position detector

Semi-closed loop control by general motor
pen=2

Full-closed loop control by general motor
- Ball screw end detector (OSA105-ET2, OSA166-ET2)
  pen=6
- For serial signal output rotary scale (including MDS-B-HR)
  pen=6
- For rectangular wave signal output scale
  pen=8
- For serial signal output linear scale (including MDS-B-HR and MPI scale)
  pen=A
- For speed command synchronization control
  Primary axis pen=A
  Secondary axis pen=D

For linear motor
pen=A

For direct-drive motor
pen=2

bit B-8 : ent(HEX-3) Speed detector

For general motor ent=2
For linear motor ent=A
For direct-drive motor ent=2

bit 7-0 : mtyp(HEX-2,1) Motor type

Set the motor type. Set this with SV017/bitF-C.

For SV017/bitF-C = 1 (200V standard motor series)

HF75 : 01h
HF105 : 02h
HF54 : 03h
HF104 : 04h
HF154 : 05h, 0Fh (Note 1)
HF224 : 06h
HF204 : 07h
HF354 : 08h
HF123 : 24h
HF223 : 26h, 2Dh (Note 2)
HF303 : 28h
HF453 : 09h
HF703 : 0Ah
HF903 : 0Bh
HF142 : 25h
HF302 : 27h, 2Eh (Note 2)

HP54 : 11h
HP104 : 12h
HP154 : 13h
HP224 : 1Bh
HP204 : 14h
HP354 : 15h
HP454 : 16h
HP704 : 17h
HP903 : 18h
HP1103 : 19h

HF-KP13 : E9h (Note 3)
HF-KP23 : EAh
HF-KP43 : EBh
HF-KP73 : ECh

(Note 1) When MDS-DM-V3 is connected
(Note 2) When MDS-DM-V3 M/S axis is connected
(Note 3) MDS-D-SVJ3 only

For SV017/bitF-C = 3 (400V standard motor series)

HF-H75 : 01h,
HF-H105 : 02h,
HF-H54 : 03h,
HF-H104 : 04h,
HF-H154 : 05h,
HF-H204 : 07h,
HF-H354 : 08h,
HF-H453 : 09h,
HF-H703 : 0Ah
HF-H903 : 0Bh,
HC-H1502: B9h

HP-H54 : 11h
HP-H104 : 12h
HP-H154 : 13h
HP-H204 : 14h
HP-H354 : 15h
HP-H454 : 16h
HP-H704 : 17h
HP-H903 : 18h
HP-H1103: 19h
HP-H224 : 1Bh

For linear motor and direct-drive motor, follow the settings stated in respective materials.

【#2226】 SV026 OD2 Excessive error detection width during servo OFF

Set the excessive error detection width during servo OFF.
<Standard setting value>
OD1=OD2= (Rapid traverse rate [mm/min]) / (60×PGN1) / 2 [mm]
When set to "0", the excessive error alarm detection will be ignored.

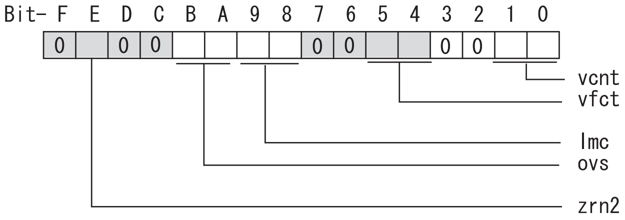
Related parameters: SV023

---Setting range---

0 to 32767 (mm)
However, when SV084/bitC=1, the setting range is from 0 to 32767 (μm).
(Only for MDS-D/DH and MDS-DM)

【#2227】 SV027 SSF1 Servo function 1

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F :

Not used. Set to "0".

bit E : zrn2

Set to "1". (Fixed)

bit D :

Not used. Set to "0".

bit C :

Not used. Set to "0".

bit B-A : ovs Overshooting compensation type selection

Set this if overshooting occurs during positioning.
bitB,A=
00: Compensation stop
01: Setting prohibited
10: Setting prohibited
11: Type 3
(Set the compensation amount in SV031 and SV042.)

Related parameters: SV031, SV042, SV034/bitF-C

bit 9-8 : lmc Lost motion compensation type selection

Type 2 has an obsolete type compatible control.
bit9,8=
00: Compensation stop
01: Setting prohibited
10: Type 2
11: Setting prohibited
(Set the compensation amount in SV016 and SV041.))
(Note) When "SV082/bit1=1", the lost motion compensation type 3 will be selected.

bit 7 :

Not used. Set to "0".

bit 6 :

Not used. Set to "0".

bit 5-4 : vfct Jitter compensation pulse number

Suppress vibration by machine backlash when axis stops.
bit5,4=
00: Disable
01: 1 pulse
10: 2 pulse
11: 3 pulses

bit 3 :

Not used. Set to "0".

bit 2 :

Not used. Set to "0".

bit 1-0 : vcnt Speed loop delay compensation changeover type selection

Normally, use "Changeover type 2".
bit1,0=
00: Disable
01: Changeover type 1
10: Changeover type 2
11: Setting prohibited

Related parameters: SV007

【#2228(PR)】 SV028 MSFT Magnetic pole shift amount (for linear/direct-drive motor)

Set this parameter to adjust the motor magnetic pole position and detector's installation phase when using linear motors or direct-drive motors.
During the DC excitation of the initial setup (SV034/bit4=1), set the same value displayed in "AFLT gain" on the NC monitor screen.

Related parameters: SV034/bit4, SV061, SV062, SV063

For general motor:
Not used. Set to "0".

---Setting range---
-18000 to 18000 (Mechanical angle 0.01°)

【#2229】 SV029 VCS Speed at the change of speed loop gain

Noise at high speed rotation including rapid traverse can be reduced by lowering the speed loop gain at high speeds.
Set the speed at which the speed loop gain changes. Use this with SV006 (VGN2).
When not using, set to "0".

---Setting range---
0 to 9999 (r/min)

【#2230】 SV030 IVC Voltage non-sensitive band compensation

When 100% is set, the voltage reduction amount equivalent to the logical non-energization in the PWM control will be compensated.
When "0" is set, 100% compensation will be performed.
Adjust in increments of 10% from the default value of 100%.
If increased too much, vibration or vibration noise may be generated.

---Setting range---
0 to 255 (%)

【#2231】 SV031 OVS1 Overshooting compensation 1

This compensates the motor torque when overshooting occurs during positioning. This is valid only when the overshooting compensation (SV027/bitB,A) is selected.

Type 3 SV027(SSF1)/bitB,A(ovs) = 11
Set the compensation amount based on the motor stall current. Observing positioning droop waveform, increase in increments of 1% and find the value where overshooting does not occur.

To vary compensation amount depending on the direction.
When SV042 (OVS2) is "0", change the SV031 (OVS1) value in both of the +/- directions to compensate.
To vary the compensation amount depending on the command direction, set this and SV042 (OVS2).
(SV031: + direction, SV042: - direction. However, the directions may be opposite depending on other settings.)
When "-1" is set, the compensation will not be performed in the direction of the command.

Related parameters: SV027/bitB,A, SV034/bitF-C, SV042, SV082/bit2

---Setting range---

-1 to 100 (Stall current %)
Note that the range will be "-1 - 10000" (Stall current 0.01%) when SV082/bit2 is "1".

【#2232】 SV032 TOF Torque offset

Set the unbalance torque on vertical axis and inclined axis.
When the vertical axis pull up function is enabled, the pull up compensation direction is determined by this parameter's sign. When set to "0", the vertical axis pull up will not be executed.
This can be used for speed loop delay compensation and collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, friction torque (SV045) and load inertia display enabling flag(SV035/bitF).

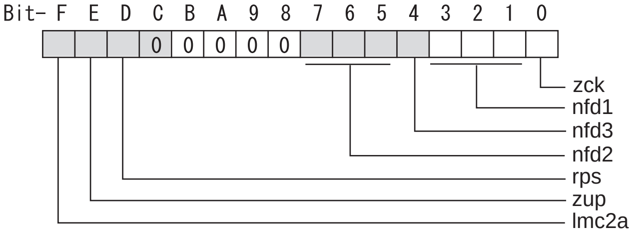
Related parameters: SV007, SV033/bitE, SV059

---Setting range---

-100 to 100 (Stall current %)

【#2233】 SV033 SSF2 Servo function 2

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F : lmc2a Lost motion compensation 2 timing

0: Normal 1: Change

bit E : zup Vertical axis pull up function

0: Stop 1: Enable

Related parameters: SV032, SV095

bit D : rps Speed setting increment

Change the setting units of the specified speed signal output speed (SV073) and safety observation safety speed (SV238).

0: mm/min 1: 100mm/min

Related parameters: SV073, SV238

bit C-8 :

Not used. Set to "0".

bit 7-5 : nfd2 Depth of Notch filter 2

Set the depth of Notch filter 2 (SV046).
bit7,6,5=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

Set the adaptive frequency of Notch filter 2 in "#2246 SV046 FHz2".

bit 4 : nfd3 Notch filter 3

0: Stop 1: Start (1,125Hz)

bit 3-1 : nfd1 Depth of Notch filter 1

Set the depth of Notch filter 1 (SV038).
bit3,2,1=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

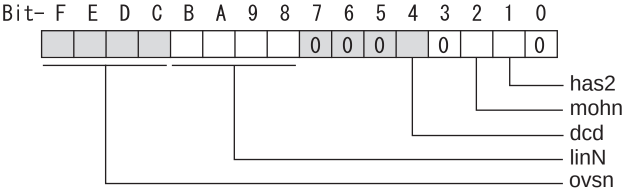
Set the adaptive frequency of Notch filter 1 in "#2238 SV038 FHz1".

bit 0 : zck Feedback error alarm 42 detection

This ignores the false detection of alarms when using multipoint Z phase scale including distance-coded reference scale.
0: Normal setting 1: Disable

【#2234】 SV034 SSF3 Servo function 3

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F-C: ovsn Overshooting compensation type 3 Non-sensitive band

Set the non-sensitive band of the model position droop overshooting amount in increments of 2μm. In the feed forward control, set the non-sensitive band of the model position droop and ignore the overshooting of the model.
0 : 0 μm, 1: 2 μm, 2: 4μm,---, E : 28 μm, F: 30μm

bit B-8 : linN The number of parallel connections when using linear motors (for linear)

Set to"2" to perform 1 amplifier 2 motor control by linear servo.

bit 7-5 :

Not used. Set to "0".

bit 4 : dcd (linear/direct-drive motor)

0: Normal setting 1: DC excitation mode

Related parameters: SV061, SV062, SV063

bit 3 :

Not used. Set to "0".

bit 2 : mohn Thermistor temperature detection (linear/direct-drive motor)

0: Normal setting 1: Disable

bit 1 : has HAS control

This stabilizes the speed overshooting by torque saturation phenomenon.
0: Normal setting 1: Enable

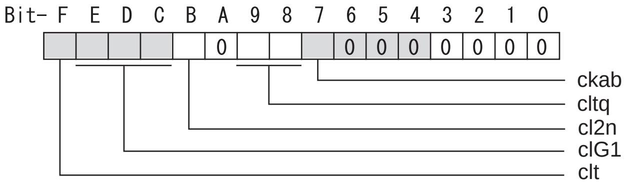
Related parameters: SV084/bitF

bit 0 :

Not used. Set to "0".

【#2235】 SV035 SSF4 Servo function 4

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F : clt Inertia ratio display

0: Setting for normal use
1: Display the total inertia ratio estimated at acceleration/deceleration at the inertia ratio on the servo monitor screen

To display it on the screen, set an imbalance torque and friction torque to both SV032 and SV045 and repeat acceleration/deceleration operations for several times.

bit E-C: clG1 G1 Collision detection level

Set the collision detection level in the collision detection method 1 during cutting feed (G1) in multiples of that of rapid traverse (G0). When set to "0", detection of collision detection method 1 during cutting feed will be ignored.

G1 Collision detection level = G0 collision detection level (SV060) × clG1

bit B : cl2n Collision detection method 2

0: Enable 1: Disable

bit A :

Not used. Set to "0".

bit 9-8 : cltq Retract torque in collision detection

Set the retract torque in collision detection using the ratio of motor's maximum torque.
bit9,8=
00: 100%
01: 90%
10: 80%(Standard)
11: 70%

bit 7 : ckab No signal detection 2

Set this to use rectangular wave output linear scale.
This enables the detection of No signal 2 (alarm 21).
0: Disable 1: Enable

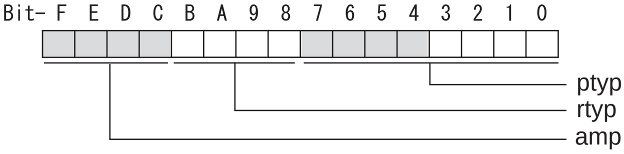
bit 6-0 :

Not used. Set to "0".

【#2236(PR)】 SV036 PTYP Power supply type/ Regenerative resistor type

MDS-D/DH Series: Power supply type

When connecting a power supply unit, set a code for each power supply unit.



bit F-C : amp

Not used. Set to "0".

bit B-8 : rtyp

Not used. Set to "0".

bit 7-0 : ptyp External emergency stop setting

When the emergency stop input signal of the power supply unit is "disabled"
Power supply unit is not connected : 00
MDS-D-CV-37 / MDS-DH-CV-37 : 04
MDS-D-CV-75 / MDS-DH-CV-75 : 08
MDS-D-CV-110 / MDS-DH-CV-110 : 11
MDS-D-CV-185 / MDS-DH-CV-185 : 19
MDS-D-CV-300 / MDS-DH-CV-300 : 30
MDS-D-CV-370 / MDS-DH-CV-370 : 37
MDS-D-CV-450 / MDS-DH-CV-450 : 45
MDS-D-CV-550 / MDS-DH-CV-550 : 55
MDS-DH-CV-750 : 75

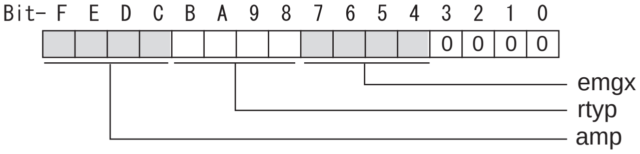
When the emergency stop input signal of the power supply unit is "enabled"
(Note) Set the power supply rotary switch to "4".
Power supply unit is not connected : 00
MDS-D-CV-37 / MDS-DH-CV-37 : 44
MDS-D-CV-75 / MDS-DH-CV-75 : 48
MDS-D-CV-110 / MDS-DH-CV-110 : 51
MDS-D-CV-185 / MDS-DH-CV-185 : 59
MDS-D-CV-300 / MDS-DH-CV-300 : 70
MDS-D-CV-370 / MDS-DH-CV-370 : 77
MDS-D-CV-450 / MDS-DH-CV-450 : 85
MDS-D-CV-550 / MDS-DH-CV-550 : 95
MDS-DH-CV-750 : B5

MDS-DM-SPV Series

Not used. Set to "0000".
Power supply type is set by spindle side.

MDS-D-SVJ3 Series: Regenerative resistor type

Set the regenerative resistor type.



bit F-8 : amp(bit F-C) / rtyp(bit B-8)

Resistor built-in drive unit : 10
Setting prohibited : 11
MR-RB032 : 12
MR-RB12 or GZG200W39OHMK : 13
MR-RB32 or GZG200W120OHMK 3 units connected in parallel : 14
MR-RB30 or GZG200W39OHMK 3 units connected in parallel : 15
MR-RB50 or GZG300W39OHMK 3 units connected in parallel : 16
MR-RB31 or GZG200W20OHMK 3 units connected in parallel : 17
MR-RB51 or GZG300W20OHMK 3 units connected in parallel : 18
Setting prohibited : 19-1F

Setting prohibited : 20-23
FCUA-RB22 : 24
FCUA-RB37 : 25
FCUA-RB55 : 26
Setting prohibited : 27
R-UNIT1 : 28
R-UNIT2 : 29
R-UNIT3 : 2A
R-UNIT4 : 2B
R-UNIT5 : 2C
FCUA-RB75/2 2 units connected in parallel : 2D
FCUA-RB55 2 units connected in parallel : 2E
Setting prohibited : 2F

bit 7-4 : emgx External emergency stop function

Set the external emergency stop function. (Do not set a value other than specified.)
0: Disable 4: Enable

bit 3-0 :

Not used. Set to "0".

【#2237】 SV037 JL Load inertia scale

Set the motor axis conversion total load inertia including motor itself in proportion to the motor inertia.

SV037(JL)=(Jm+Jl)/Jm×100
Jm: Motor inertia
Jl: Motor axis conversion load inertia

For linear motor, set the gross mass of the moving sections in kg unit.

<<Drive monitor load inertia ratio display>>
Set SV035/bitF=1 and imbalance torque and friction torque to both SV032 and SV045, and then repeat acceleration/deceleration for several times.

---Setting range---
For general motor: 0 to 5000 (%)
For linear motor 0 to 5000 (kg)

【#2238】 SV038 FHz1 Notch filter frequency 1

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

Related parameters: SV033/bit3-1, SV115

---Setting range---
0 to 2250 (Hz)

【#2239】 SV039 LMCD Lost motion compensation timing

Set this when the timing of lost motion compensation type 2 does not match.
Adjust increments of 10 at a time.

---Setting range---
0 to 2000 (ms)

【#2240】 SV040 LMCT Lost motion compensation non-sensitive band

Set the non-sensitive band of the lost motion compensation in the feed forward control.
When "0" is set, 2μm is the actual value to be set. Adjust increments of 1μm.

---Setting range---
0 to 255 (μm)

【#2241】 SV041 LMC2 Lost motion compensation 2

Set this with SV016 (LMC1) only when you wish to vary the lost motion compensation amount depending on the command directions.
Normally, set to "0".

Related parameters: SV016

---Setting range---
-1 to 200 (Stall current %)
Note that when SV082/bit2 is "1", the setting range is between -1 and 20000 (Stall current 0.01%).

【#2242】 SV042 OVS2 Overshooting compensation 2

Set this with SV031 (OVS1) only when you wish to vary the overshooting compensation amount depending on the command directions.
Normally, set to "0".

Related parameters: SV031

---Setting range---
-1 to 100 (Stall current %)
Note that when SV082/bit2 is "1", the setting range is between -1 and 10000 (Stall current 0.01%).

【#2243】 SV043 OBS1 Disturbance observer filter frequency

Set the disturbance observer filter band.
Normally, set to "100". Setting values of 49 or less is equal to "0" setting.
To use the disturbance observer, also set SV037 (JL) and SV044 (OBS2).
When disturbance observer related parameters are changed, lost motion compensation needs to be readjusted.
Set to "0" when not using.

---Setting range---
0 to 1000 (rad/s)

【#2244】 SV044 OBS2 Disturbance observer gain

Set the disturbance observer gain. The standard setting is "100 to 300".
To use the disturbance observer, also set SV037 (JL) and SV043 (OBS1).
When disturbance observer related parameters are changed, lost motion compensation needs to be readjusted.
Set to "0" when not using.

---Setting range---
0 to 500 (%)

【#2245】 SV045 TRUB Friction torque

Set the frictional torque when using the collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, imbalance torque (SV032) and load inertia display enabling flag (SV035/bitF).

---Setting range---
0 to 255 (Stall current %)

【#2246】 SV046 FHz2 Notch filter frequency 2

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

Related parameters: SV033/bit7-5, SV115

---Setting range---
0 to 2250 (Hz)

【#2247】 SV047 EC Inductive voltage compensation gain

Set the inductive voltage compensation gain. Standard setting value is "100".
If the current FB peak exceeds the current command peak, lower the gain.

---Setting range---
0 to 200 (%)

【#2248】 SV048 EMGrt Vertical axis drop prevention time

Input the time required to prevent the vertical axis from dropping by delaying READY OFF until the brake works at an emergency stop.
Increase in increments of 100ms at a time, find and set the value where the axis does not drop.
When using a motor with a break of HF(-H) Series or HP(-H) Series, set to "200ms" as a standard.
When the pull up function is enabled (SV033/bitE=1), the pull up is established during the drop prevention time.

Related parameters: SV033/bitE, SV055, SV056

---Setting range---
0 to 20000 (ms)

【#2249】 SV049 PGN1sp Position loop gain 1 in spindle synchronous control

Set the position loop gain during spindle synchronization control (synchronous tapping and synchronization control with spindle C-axis).
Set the same value as that of the position loop gain for spindle synchronous tapping control.
When performing the SHG control, set this parameter with SV050 (PGN2sp) and SV058 (SHGCsp).
When changing the value, change the value of "#2017 tap_g Axis servo gain".

---Setting range---
1 to 200 (rad/s)

【#2250】 SV050 PGN2sp Position loop gain 2 in spindle synchronous control

When using SHG control during spindle synchronous control (synchronous tapping and synchronization control with spindle C-axis), set this parameter with SV049 (PGN1sp) and SV058 (SHGCsp).
Make sure to set the value 8/3 times that of SV049.
When not using the SHG control, set to "0".

---Setting range---
0 to 999 (rad/s)

【#2251】 SV051 DFBT Dual feedback control time constant

Set the control time constant in dual feed back.
When "0" is set, it operates at 1ms.
The higher the time constant is, the closer it gets to the semi-closed control, so the limit of the position loop gain will be raised.

For linear servo/direct-drive motor system
Not used. Set to "0".

Related parameters: SV017/bit1, SV052

---Setting range---
0 to 9999 (ms)

【#2252】 SV052 DFBN Dual feedback control non-sensitive band

Set the non-sensitive band in the dual feedback control.
Normally, set to "0".

For linear servo/direct-drive motor system
Not used. Set to "0".

Related parameters: SV017/bit1, SV052

---Setting range---
0 to 9999 (μm)

【#2253】 SV053 OD3 Excessive error detection width in special control

Set the excessive error detection width when servo ON in a special control (initial absolute position setting, stopper control and etc.).
When "0" is set, excessive error detection will not be performed when servo ON during a special control.

---Setting range---
0 to 32767 (mm)
However, when SV084/bitC=1, the setting range is from 0 to 32767 (μm).
(Only for MDS-D/DH and MDS-DM)

【#2254】 SV054 ORE Overrun detection width in closed loop control

Set the overrun detection width in the full-closed loop control.
When the gap between the motor side detector and the linear scale (machine side detector) exceeds the value set by this parameter, it will be judged as overrun and "Alarm 43" will be detected.
When "-1" is set, the alarm detection will not be performed.
When "0" is set, overrun will be detected with a 2mm width.

For linear servo/direct-drive motor system
Not used. Set to "0".

---Setting range---
-1 to 32767 (mm)
However, when SV084/bitD=1, the setting range is from -1 to 32767 (μm).
(Only for MDS-D/DH and MDS-DM)

【#2255】 SV055 EMGx Max. gate off delay time after emergency stop

Set the time required between an emergency stop and forced READY OFF.
Set the maximum value "+ 100ms" of the SV056 setting value of the servo drive unit electrified by the same power supply unit.
When executing the vertical axis drop prevention, the gate off will be delayed for the length of time set at SV048 even when SV055's is smaller than that of SV048.

Related parameters: SV048, SV056

---Setting range---
0 to 20000 (ms)

【#2256】 SV056 EMGt Deceleration time constant at emergency stop

Set the time constant used for the deceleration control at emergency stop.
Set the time required to stop from rapid traverse rate (rapid).
The standard setting value is EMGt<=G0tL*0.9.
However, note that the standard setting value differs from the above-mentioned value when the setting value of "#2003:smgst Acceleration and deceleration modes bit 3-0:Rapid traverse acceleration/deceleration type" is 8 or F. Refer to Instruction Manual of the drive unit (section "Deceleration control") for details.
When the axis is used in the synchronous control, set the same value with minus sign to both axes.
If one of the axes switches to dynamic brake by an alarm during deceleration control, another axis will also switch.

Related parameters: SV048, SV055

---Setting range---
-20000 to 20000 (ms)

【#2257】 SV057 SHGC SHG control gain

When performing the SHG control, set to SV003(PGN1)*6.
When not using the SHG control, set to "0".

Related parameters: SV003, SV004

---Setting range---
0 to 1200 (rad/s)

【#2258】 SV058 SHGCsp SHG control gain in spindle synchronous control

When using SHG control during spindle synchronization control (synchronous tapping and synchronous control with spindle C-axis), set this parameter with SV049 (PGN1sp) and SV050 (PGN2sp).
Make sure to set the value 6 times that of SV049.
When not using the SHG control, set to "0".

---Setting range---
0 to 1200 (rad/s)

【#2259】 SV059 TCNV Collision detection torque estimated gain

Set the torque estimated gain when using the collision detection function.
The standard setting value is the same as the load inertia ratio (SV037 setting value) including motor inertia.
Set to "0" when not using the collision detection function.

Related parameters: SV032, SV035/bitF-8, SV037, SV045, SV060

<<Drive monitor load inertia ratio display>>
Set SV035/bitF=1 and imbalance torque and friction torque to both SV032 and SV045, and then repeat acceleration/deceleration for several times.

---Setting range---
For general motor: 0 to 5000 (%)
For linear motor: 0 to 5000 (kg)

【#2260】 SV060 TLMT Collision detection level

When using the collision detection function, set the collision detection level at the G0 feeding.
When "0" is set, none of the collision detection function will work.

Related parameters: SV032, SV035/bitF-8, SV037, SV045, SV059

---Setting range---
0 to 999 (Stall current %)

【#2261】 SV061 DA1NO D/A output ch1 data No. / Initial DC excitation level

Input the data number you wish to output to the D/A output channel 1.
When using the 2-axis drive unit, set "-1" to the axis that the data will not be output.

When the DC excitation is running (SV034/bit4=1):
Use this when the DC excitation is running (SV034/bit4=1) to adjust the initial magnetic pole position (when measuring the magnetic pole shift amount) for linear motor and direct-drive motor.
Set the initial excitation level in DC excitation control.
Set 5% as standard.
Related parameters: SV062, SV063

---Setting range---
-1 to 127
When the DC excitation is running (SV034/bit4=1): 0 to 100 (Stall current %)

【#2262】 SV062 DA2NO D/A output ch2 data No. / Final DC excitation level

Input the data number you wish to output to the D/A output channel 2.
When using the 2-axis drive unit, set "-1" to the axis that the data will not be output.

When the DC excitation is running (SV034/bit4=1):
Use this when the DC excitation is running (SV034/bit4=1) to adjust the initial magnetic pole position (when measuring the magnetic pole shift amount) for linear motor and direct-drive motor.
Set the final excitation level in DC excitation control.
Set 5% as standard.
When the magnetic pole shift amount measurement value is unsteady, adjust the value in increments of 5%.
Related parameters: SV061, SV063

---Setting range---
-1 to 127
When the DC excitation is running (SV034/bit4=1): 0 to 100 (Stall current %)

【#2263】 SV063 DA1MPY D/A output ch1 output scale / Initial DC excitation time

Set output scale of the D/A output channel 1 in increment of 1/100.
When "0" is set, the magnification is the same as when "100" is set.

When the DC excitation is running (SV034/bit4=1):
Use this when the DC excitation is running (SV034/bit4=1) to adjust the initial magnetic pole position (when measuring the magnetic pole shift amount) for linear motor and direct-drive motor.
Set the initial excitation time in DC excitation control.
Set 500ms as standard.
When the magnetic pole shift amount measurement value is unsteady, adjust the value in increments of 500ms.
Related parameters: SV061, SV062

---Setting range---
-32768 to 32767 (1/100-fold)
When the DC excitation is running (SV034/bit4=1): 0 to 10000 (ms)

【#2264】 SV064 DA2MPY D/A output ch2 output scale

Set output scale of the D/A output channel 2 in increment of 1/100.
When "0" is set, the magnification is the same as when "100" is set.

---Setting range---
-32768 to 32767 (1/100-fold)

【#2265】 SV065 TLC Machine end compensation gain

The shape of the machine end is compensated by compensating the spring effect from the machine end to the motor end.
Set the machine end compensation gain. Measure the error amount by roundness measurement and estimate the setting value by the following formula.

Compensation amount (μm) = Command speed F(mm/min)2 * SV065 / (Radius R(mm) * SV003 * 16,200,000)

Set to "0" when not using.

---Setting range---
-30000 to 30000?Acceleration ratio 0.1%?

【#2266-2272】 SV066 - SV072

This parameter is set automatically by the NC system.

【#2273(PR)】 SV073 FEEDout Specified speed output speed

Set the specified speed.
Also set SV082/bit9,8 to output digital signal.

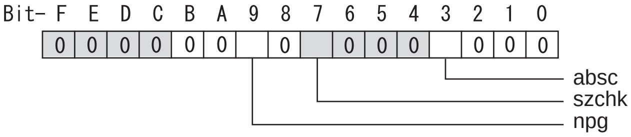
---Setting range---
-32768 to 32767 (r/min)
However, when SV033/bitD=1, the setting range is from -32768 to 32767 (100mm/min).

【#2274-2280】 SV074 - SV080

This parameter is set automatically by the NC system.

【#2281(PR)】 SV081 SPEC2 Servo specification 2

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F-A :

Not used. Set to "0".

bit 9 : npg Earth fault detection

0: Disable 1: Enable (standard)

bit 8 :

Not used. Set to "0".

bit 7 : szchk Distance-coded reference scale reference mark

0: Check at 4 points (standard) 1: Check at 3 points

bit 6-4 :

Not used. Set to "0".

bit 3 : absc Distance-coded reference scale

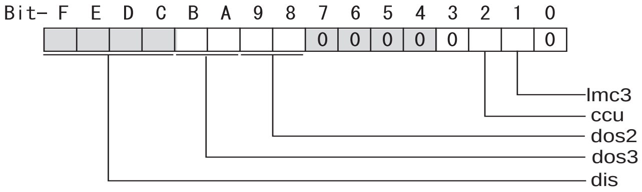
0: Disable 1: Enable

bit 2-0 :

Not used. Set to "0".

【#2282】 SV082 SSF5 Servo function 5

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F-C : dis Digital signal input selection

0: No signal
1: Safety observation function door state signal
2: Battery box voltage drop warning (It is not available for MDS-D-SVJ3 Series.)
3 to F: Setting prohibited

bit B-A : dos3 Digital signal output 3 selection

bitB,A=
00: Disable
01: Setting prohibited
10: Contactor control signal output (For MDS-D-SVJ3)
11: Setting prohibited

bit 9-8 : dos2 Digital signal output 2 selection

bit9,8=
00: Disable
01: Specified speed output
10: Setting prohibited
11: Setting prohibited

bit 7-3 :

Not used. Set to "0".

bit 2 : ccu Lost motion overshoot compensation compensation amount setting increment

0: Stall current % 1: Stall current 0.01%

bit 1 : lmc3 Lost motion compensation type 3

Set this when protrusion at a quadrant change is too big.
0: Stop 1: Start

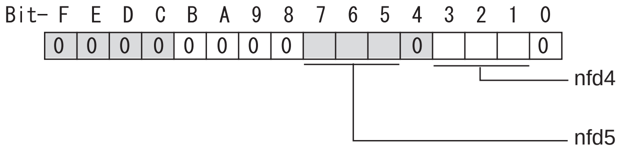
Related parameters: SV016, SV041, SV085, SV086

bit 0 :

Not used. Set to "0".

【#2283】 SV083 SSF6 Servo function 6

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F-8 :

Not used. Set to "0".

bit 7-5 : nfd5 Depth of Notch filter 5

Set the depth of Notch filter 5.
bit7,6,5=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

Set the adaptive frequency of Notch filter 5 in "#2288 SV088 FHz5".

bit 4 :

Not used. Set to "0".

bit 3-1 : nfd4 Depth of Notch filter 4

Set the depth of Notch filter 4.
bit3,2,1=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

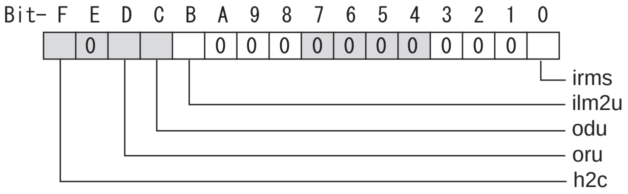
Set the adaptive frequency of Notch filter 4 in "#2287 SV087 FHz4".

bit 0 :

Not used. Set to "0".

【#2284】 SV084 SSF7 Servo function 7

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F : h2c HAS control cancel amount

0: 1/4 (standard) 1: 1/2

Related parameters: SV034/bit1

bit E :

Not used. Set to "0".

bit D : oru Overrun detection width unit (for MDS-D/DH and MDS-DM)

0: mm (normal setting) 1: µm
It is not available for MDS-D-SVJ3 Series.

bit C : odu Excessive error detection width unit (for MDS-D/DH and MDS-DM)

0: mm (normal setting) 1: µm
It is not available for MDS-D-SVJ3 Series.

bit B : ilm2u Current limit value (SV014) in special control setting unit

0: Stall current % (normal setting) 1: Stall current 0.01%

bit A-1 :

Not used. Set to "0".

bit 0 : irms Motor current display

0: Motor q axis current display (normal) 1: Motor effective current display

【#2285】 SV085 LMCk Lost motion compensation 3 spring constant

Set the machine system's spring constant when using lost motion compensation type 3.
When not using, set to "0".

Related parameters: SV016, SV041, SV082/bit2,1, SV086

---Setting range---
0 to 32767 (0.01%/µm)

【#2286】 SV086 LMCc Lost motion compensation 3 viscous coefficient

Set the machine system's viscous coefficient when using lost motion compensation type 3.
When not using, set to "0".

Related parameters: SV016, SV041, SV082/bit2,1, SV086

---Setting range---
0 to 32767 (0.01%/µm)

【#2287】 SV087 FHz4 Notch filter frequency 4

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

Related parameters: SV083/bit3-1, SV115

---Setting range---
0 to 2250 (Hz)

【#2288】 SV088 FHz5 Notch filter frequency 5

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

Related parameters: SV083/bit7-5, SV115

---Setting range---
0 to 2250 (Hz)

【#2289】 SV089

Not used. Set to "0".

【#2290】 SV090

Not used. Set to "0".

【#2291】 SV091 LMC4G Lost motion compensation 4 gain

Use this with LMC compensation type 3. As the delay in path tracking is monitored and compensated, the delay in path tracking will be minimized even if machine friction amount changes by aging. Use the lost motion compensation amount (SV016) * 5 (10% of the dynamic friction torque) as the target. The higher the setting value is, the more accurate the quadrant change be; however, the more likely vibrations occur.

---Setting range---
0 to 20000 (Stall current 0.01%)

【#2292】 SV092

Not used. Set to "0".

【#2293】 SV093

Not used. Set to "0".

【#2294】 SV094 MPV Magnetic pole position error detection speed

The magnetic pole position detection function monitors the command speed and motor speed at the position command stop and detects the magnetic pole position error alarm (3E) if any. Set the error detection level for the command speed and motor speed at the position command stop.
Be aware when setting the parameter as the setting units for general motors and linear motors are different.

<<For general motor>>
When the command speed error detection level is set to "0", the magnetic pole position error (3E) is detected at 10r/min.
Set "10" as standard.
This detects the magnetic pole position error (3E) when the motor rotation speed is 100r/min and more.

<<For linear motor>>
When the command motor speed level is set to "0", the magnetic pole position error (3E) is detected at 1mm/s.
Set "10" as standard.
This detects the magnetic pole position error (3E) when the motor speed is 10mm/s and more.

---Setting range---

0 to 31999

<<For general motor>>
Ten-thousands digit, Thousands digit ----------- Command speed error detection level (10r/min)
Hundreds digit, Tens digit, Ones digit ----------- Motor speed error detection level (10r/min)

<<For linear motor>>
Ten-thousands digit, Thousands digit ----------- Command speed error detection speed level (10r/min)
Hundreds digit, Tens digit, Ones digit ----------- Motor speed error detection level (10r/min)

【#2295】 SV095 ZUPD Vertical axis pull up distance

Set this parameter to adjust the pull up distance when the vertical axis pull up function is enabled.
When the pull up function is enabled and this parameter is set to "0", for a rotary motor, 8/1000 of a rotation at the motor end is internally set as the pull up distance, and for a linear motor, 80[μm] is set.

Related parameters:
SV032 : The pull up direction is determined. When "0" is set, pull up control is not executed.
SV033/bitE : Start-up of the pull up function
SV048 : Set the drop prevention time. When "0" is set, pull up control is not executed.

---Setting range---

0 to 2000 (μm)

【#2296】 SV096

Not used. Set to "0".

【#2297】 SV097

Not used. Set to "0".

【#2298】 SV098

Not used. Set to "0".

【#2299】 SV099

Not used. Set to "0".

【#2300】 SV100

Not used. Set to "0".

【#2301】 SV101

Not used. Set to "0".

【#2302】 SV102

Not used. Set to "0".

【#2303】 SV103

Not used. Set to "0".

【#2304】 SV104

Not used. Set to "0".

【#2305】 SV105

Not used. Set to "0".

【#2306】 SV106

Not used. Set to "0".

【#2307】 SV107

Not used. Set to "0".

【#2308】 SV108

Not used. Set to "0".

【#2309】 SV109

Not used. Set to "0".

【#2310】 SV110

Not used. Set to "0".

【#2311】 SV111

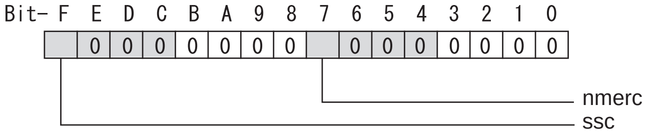
Not used. Set to "0".

【#2312】 SV112

Not used. Set to "0".

【#2313】 SV113 SSF8 Servo function 8

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F : ssc Safety observation function

0: Stop 1: Start

bit E-8 :

Not used. Set to "0".

bit 7 : nmerc Machine error compensation amount

When disabled, the machine error compensation amount including backlash and pitch error to be compensated by an NC will be ignored by the servo control.
Use this to adjust the lost motion compensation by the electric end roundness measurement.

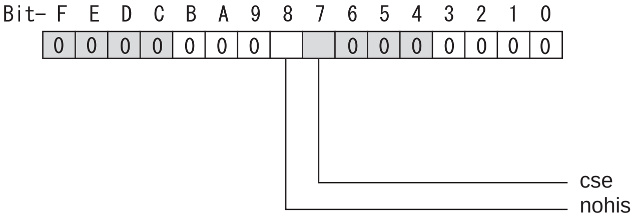
0: Normal setting 1: Disable

bit 6-0 :

Not used. Set to "0".

【#2314】 SV114 SSF9 Servo function 9

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F-9 :

Not used. Set to "0".

bit 8 : nohis History of communication error alarm between NC and DRV (34, 36, 38, 39)

Set "1" for C70.

0: Enable 1: Disable

bit 7 : cse Command speed monitoring function

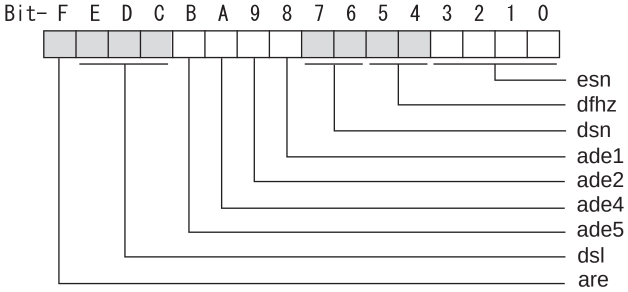
0: Normal setting 1: Enable

bit 6-0 :

Not used. Set to "0".

【#2315】 SV115 SSF10 Servo function 10

Select the servo functions.
A function is assigned to each bit.
Set this in hexadecimal format.



bit F : are Notch filter5 all frequencies adapted

When enabled, Notch filter5 all frequencies adaptive range is not limited regardless of SV115/bit4,5 setting.

0: Disable 1: Enable

bit E-C: dsl Notch filter frequency display

Switch the "AFLT frequency" display on drive monitor screen to check every notch filter frequency. When the selected notch filter is not used, "0" is displayed.

bitE,D,C=
000 : Estimated resonance frequency (Normal display)
001 : Notch filter 1 frequency
010 : Notch filter 2 frequency
011 : Notch filter 3 frequency (always displays 1125Hz)
100 : Notch filter 4 frequency
101 : Notch filter 5 frequency
Other settings: setting prohibited

bit B : ade5 Notch filter 5 / Adaptive follow-up function

0: Disable 1: Enable

bit A : ade4 Notch filter 4 / Adaptive follow-up function

0: Disable 1: Enable

bit 9 : ade2 Notch filter 2 / Adaptive follow-up function

0: Disable 1: Enable

bit 8 : ade1 Notch filter 1 / Adaptive follow-up function

0: Disable 1: Enable

bit 7-6 : dsn Estimated resonance frequency display holding time

Set the estimated resonance frequency display holding time to the "AFLT frequency" display on drive monitor screen.

bit7,6=
00: 4 [s]
01: 8 [s]
10: 12 [s]
11: 16 [s]

bit 5-4 : dfhz Notch filter frequency range

Set the adaptive range of the notch filter frequency. When the adaptive follow-up function is enabled and if the estimated resonance frequency exists in the set range, the notch filter will be adapted. Normally set this parameter to "00".

bit5,4=
00: -10 to 10 [%]
01: -20 to 20 [%]
10: -30 to 30 [%]
11: -40 to 40 [%]

bit 3-0 : esn Sensitivity of estimated resonance frequency

Set the sensitivity of the estimated resonance frequency. Smaller setting value enables to detect smaller vibration component, however, adaptive movement will be repeated frequently. Normally set this parameter to "0".

0 : Normal setting (same sensitivity as A) 1 : Sensitivity high to F : Sensitivity low

【#2316】 SV116 SSF11 Servo function 11

Not used. Set to "0000".

【#2317(PR)】 SV117 RNG1ex Expansion sub side detector resolution

For high-accuracy binary resolution detector, set the number of pulses to four bite data of SV117 (high-order) and SV019 (low-order) by pulse(p).
When SV117=0, the setting unit of SV019 is (kp).
Refer to SV019 for details.

Related parameters: SV019, SV020, SV118

---Setting range---
-1 to 32767

【#2318(PR)】 SV118 RNG2ex Expansion main side detector resolution

When using high-accuracy binary resolution detector, set the number of pulses to four bite data of SV118 (high-order) and SV020 (low-order) by pulse(p).
When SV118=0, the setting unit of SV020 is (kp).
Refer to SV020 for details.

Related parameters: SV019, SV020, SV117

---Setting range---
-1 to 32767

【#2319】 SV119

Not used. Set to "0".

【#2320】 SV120

Not used. Set to "0".

【#2321】 SV121

Not used. Set to "0".

【#2322】 SV122

Not used. Set to "0".

【#2323】 SV123

Not used. Set to "0".

【#2324】 SV124

Not used. Set to "0".

【#2325】 SV125

Not used. Set to "0".

【#2326】 SV126

Not used. Set to "0".

【#2327】 SV127

Not used. Set to "0".

【#2328】 SV128

Not used. Set to "0".

【#2329】 SV129 Kwf Synchronous control feed forward filter frequency

Set the acceleration rate feed forward filter frequency in high-speed synchronous tapping control.
The standard setting is "600".

Related parameters: SV244

---Setting range---
0 to 32767 (rad/s)

【#2330(PR)】 SV130 RPITS Base reference mark interval

Set the base reference mark intervals of distance-coded reference scale. When the distance-coded reference scale is not used, set to "0".
The interval of basic reference mark (SV130) and auxiliary interval (SV131) must be in the specified relationship. Other settings cause the initial parameter error (alarm 37).
Following is the specified relationship.

The quotient of (SV130×1000) / SV131 must be 4 or more and leaves no remainder.

Related parameters: SV081/bit7,3, SV131, SV134 to SV137

---Setting range---
0 to 32767 (mm)

【#2331(PR)】 SV131 DPITS Auxiliary reference mark interval

Set the auxiliary interval of reference mark in the distance-coded reference scale. When the distance-coded reference scale is not used, set to "0".
The interval of basic reference mark (SV130) and auxiliary interval (SV131) must be in the specified relationship. Other settings cause the initial parameter error (alarm 37).
Following is the specified relationship.

The quotient of (SV130×1000) / SV131 must be 4 or more and leaves no remainder.

Related parameters: SV081/bit7,3, SV130, SV134 to SV137

---Setting range---
0 to 32767 (μm)

【#2332】 SV132

Not used. Set to "0".

【#2333】 SV133

Not used. Set to "0".

【#2334】 SV134 RRn0 Distance-coded reference check / revolution counter

Set this parameter to operate distance-coded reference check when using distance-coded reference scale.
During the distance-coded reference check initial setup (SV137?RAER=-1), set the following items on the NC drive monitor screen after the distance-coded reference check initial setup warning A3 turns OFF.

SV134=Rn, SV135=Pn, SV136=MPOS

When reference point is set, the warning A3 turns OFF.
To enable the distance-coded reference check function, SV081/bit3=1setting and a battery option are needed.

Related parameters: SV081/bit3,7, SV130, SV131, SV134 to SV137

---Setting range---
-32768 to 32767

【#2335】 SV135 RPn0H Distance-coded reference check /position within one rotation High

Set this parameter to operate distance-coded reference check when using distance-coded reference scale.
During the distance-coded reference check initial setup (SV137?RAER=-1), set the following items on the NC drive monitor screen after the distance-coded reference check initial setup warning A3 turns OFF.

SV134=Rn, SV135=Pn, SV136=MPOS

When reference point is set, the warning A3 turns OFF.
To enable the distance-coded reference check function, SV081/bit3=1setting and a battery option are needed.

Related parameters: SV081/bit3,7, SV130, SV131, SV134 to SV137

---Setting range---
-32768 to 32767

【#2336】 SV136 RPn0L Distance-coded reference check / position within one rotation Low

Set this parameter to operate distance-coded reference check when using distance-coded reference scale.
During the distance-coded reference check initial setup (SV137?RAER=-1), set the following items on the NC drive monitor screen after the distance-coded reference check initial setup warning A3 turns OFF.

SV134=Rn, SV135=Pn, SV136=MPOS

When reference point is set, the warning A3 turns OFF.
To enable the distance-coded reference check function, SV081/bit3=1setting and a battery option are needed.

Related parameters: SV081/bit3,7, SV130, SV131, SV134 to SV137

---Setting range---
-32768 to 32767

【#2337】 SV137 RAER Distance-coded reference check allowable width

For the distance-coded reference check function when using distance-coded reference scale, set the allowable gap from the reference point position data calculated by the main side detector. When the gap exceeds the allowable range, reference point created by distance-code is judged as wrong and detects alarm 42.
The standard setting value is "basic reference mark interval (SV130) / 4".
SV137=0 setting carries out the same operation as the standard setting value.
SV137=-1 setting enables the distance-coded reference initial set up mode and displays setting values of SV134 to SV136 on NC drive monitor.
To enable the distance-coded reference check function, SV081/bit3=1setting and a battery option are needed.
When SV137=32767, the distance-coded reference check function is disabled.

Related parameters: SV081/bit3,7, SV130, SV131, SV134 to SV136

---Setting range---
-1 to 32767 (mm)

【#2338-2397】 SV138 - SV197

Not used. Set to "0".

【#2398】 SV198 NSE No signal 2 special detection width

Set the special detection width for the no signal 2 (alarm 21).
This detects no signal 2 (alarm 21) when machine side feedback is not invoked even if the motor side detector feedback exceeds this setting in the rectangular wave signal output linear scale.
When "0" is set, the detection will be performed with a 15µm width.
For MDS-D-SVJ3, this parameter setting is invalid and the detection width is fixed to 15µm.

---Setting range---
0 to 32767 (µm)

【#2399-2437】 SV199 - SV237

Not used. Set to "0".

【#2438】 SV238 SSCFEED Safety observation Safety speed

Set the machine's safety speed for the safety observation function.
Set this parameter within the following setting ranges.
For linear axis: 2000mm/min or less
For rotary axis: 18000°/min (50r/min) or less
When not using, set to "0".

Related parameters: SV033/bitD, SV113/bitF, SV239

---Setting range---
0 to 18000 (mm/min) or (°/min)
However, when SV033/bitD=1, the setting range is from -32768 to 32767 (100 mm/min) or (100°/min).

【#2439】 SV239 SSCRPM Safety observation Safety motor speed

Set the motor's safety speed for the safety observation function.
Set a value to hold the following relationship.

SV239=(SV238/SV018) x (SV002/SV001)
Only when the product is 0, set to "1".

When not using, set to "0".

Related parameters: SV033/bitD, SV113/bitF, SV239

---Setting range---
0 to 32767 (r/min)

【#2440-2443】 SV240 - SV243

Not used. Set to "0".

【#2444(PR)】 SV244 DUNIT Communication interpolation unit for communication among drive units

Set the communication interpolation unit among drive units.
When set to "0", it will be regarded as 20 (0.05μm) is set.

Related parameters: SV129

---Setting range---
0 to 2000 (1/μm)

【#2445-2456】 SV245 - SV256

Not used. Set to "0".

3-3 Setting the initial parameters for the spindle drive unit

The spindle specification parameters and spindle parameters must be set before the spindle system can be started up. The spindle related parameters are input from the NC. The input method differs according to the NC being used, so refer to each NC Instruction Manual.

CAUTION ! The configuration of the spindle specification parameters (#3001 to #3138) can differ depending on the NC.
This Instruction Manual explains using the configuration of the parameters for M700V/M70V Series.

3-3-1 Setting of parameters related to the spindle

The spindle specification parameters "#3001-#3138" and spindle parameters "#13001-#13256" must be set before the spindle is started up. Set the parameters depending on the spindle motor equipped to the machine and the machine specifications. The following parameters must be set for startup, so check the setting values.

< Common parameters set for starting >
Set the command time constant etc. up to the maximum rotation speed of the spindle end and the maximum rotation speed of the motor.
Especially the maximum rotation speed should be set not to exceed the machine specifications. In addition, acceleration/deceleration of the spindle is executed with the constant torque control, so the time depends on the inertia size.

(1) Setting of the maximum rotation speed

Set the maximum rotation speed of S commands (synchronous tapping, etc.).

【#3001】 slimt 1 Limit rotation speed (Gear: 00)

Set the spindle speed for maximum motor speed with gear 00.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3002】 slimt 2 Limit rotation speed (Gear: 01)

Set the spindle speed for maximum motor speed with gear 01.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3003】 slimt 3 Limit rotation speed (Gear: 10)

Set the spindle speed for maximum motor speed with gear 10.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3004】 slimt 4 Limit rotation speed (Gear: 11)

Set the spindle speed for maximum motor speed with gear 11.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3005】 smax 1 Maximum rotation speed (Gear: 00)

Set the maximum spindle speed with gear 00.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3006】 smax 2 Maximum rotation speed (Gear: 01)

Set the maximum spindle speed with gear 01.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3007】 smax 3 Maximum rotation speed (Gear: 10)

Set the maximum spindle speed with gear 10.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3008】 smax 4 Maximum rotation speed (Gear: 11)

Set the maximum spindle speed with gear 11.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

(2) Time constant settings during acceleration/deceleration

Set the time constant from the stopped state to reach S commands of smax.

【#3101】 sp_t 1 Time constant for spindle rotation with S command (Gear: 00)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 00 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3102】 sp_t 2 Time constant for spindle rotation with S command (Gear: 01)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 01 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3103】 sp_t 3 Time constant for spindle rotation with S command (Gear: 10)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 10 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3104】 sp_t 4 Time constant for spindle rotation with S command (Gear: 11)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear11 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

(3) Spindle speed settings for Z-phase detection when starting

At the first spindle rotation after the power ON (including turning the power ON again only for NC), the spindle rotates at the speed of setting parameters during Z-phase detection for the detector. Set the rotation speed.

【#3106】 zrn_typ Zero point return specifications

bit F : Spindle zero point detection with contactless switch

0: Normal 1: Enable spindle zero point detection using proximity switch

【#3109】 zdetspd Z phase detection speed

When "#3106/bitF = 0" (Normal), set the spindle speed at initial Z phase detection.
Guideline for the initial setting value is from 50 to 300.

When "#3106/bitF = 1" (Spindle zero point proximity switch detection enabled), set the spindle speed at initial spindle zero point proximity switch detection.

(Note) When spindle zero point proximity switch detection is enabled, the rotation direction of the orientation/zero point return (synchronous tapping, spindle/C axis) will follow Z phase detection direction. And the speed will follow Z phase detection speed. Guideline for the initial setting value is from 50 to 300.

---Setting range---
1 to 99999 (r/min)

(4) Parameters set depending on the connected NC

【#13230】 SP230 SFNC10 Spindle function 10

bit 8 : nohis Communication error alarm(34,36,38,39) between NC and DRV Specific alarm history disabled

0: Enable 1: Disable
For C70, set "1".

< Initial parameters set depending on the machine specifications >

Set the following parameters depending on the spindle drive method (direct, gear drive, etc.) or inertia size of rotary sections for machine specifications.

(1) Adjustment parameters in orientation mode

When the inertia ratio is large for the spindle motor such as large lathes, set the following parameters so that abnormal noise or machine sway does not occur during orientation control.

【#3106】 zrn_typ Zero point return specifications

bit E : Interpolation mode selection in orientation

0: Interpolation mode (Use the interpolation mode gain "SP002 PGN".)
1: Non-interpolation mode (Use the non-interpolation mode gain "SP001 PGV")
Select this when vibration occurs since the gain is too high during the orientation.

(2) Setting of the gear ratio

Set the following parameters depending on the spindle drive method (direct, gear drive, belt drive) for the machine.

【#13057(PR)】 SP057 GRA1 Spindle side gear ratio 1

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) "is set to "00".

---Setting range---
1 to 32767

【#13058(PR)】 SP058 GRA2 Spindle side gear ratio 2

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "01".

---Setting range---
1 to 32767

【#13059(PR)】 SP059 GRA3 Spindle side gear ratio 3

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "10".

---Setting range---
1 to 32767

【#13060(PR)】 SP060 GRA4 Spindle side gear ratio 4

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "11".

---Setting range---
1 to 32767

【#13061(PR)】 SP061 GRB1 Motor side gear ratio 1

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "00".

---Setting range---
1 to 32767

【#13062(PR)】 SP062 GRB2 Motor side gear ratio 2

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "01".

---Setting range---
1 to 32767

【#13063(PR)】 SP063 GRB3 Motor side gear ratio 3

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5)" is set to "10".

---Setting range---
1 to 32767

【#13064(PR)】 SP064 GRB4 Motor side gear ratio 4

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5)" is set to "11".

---Setting range---
1 to 32767

< Setting parameters for the detector with semi/full-closed loop control >

Set parameters depending on the detector configured in the machine. For semi-closed loop, set the same value to the main side and the sub side. For full-closed loop, set the detector of the main side and the sub side.

【#13019(PR)】 SP019 RNG1 Sub side detector resolution

[For semi-closed loop]
Set the same value as SP020 (RNG2). (Refer to the explanation of SP020.)

[For full-closed loop]
Set the number of pulses per revolution of the speed detector.
When using ABZ pulse encoder, used this with SP097(RNG1ex).

E.g.: The setting for ABZ pulse encoder "OSE-1024-3-15-68"
SP019 = 4096
SP097 = -1

---Setting range---
-32768 to 32767 (kp/rev)
When using SP097: (p/rev)

【#13020(PR)】 SP020 RNG2 Main side detector resolution

Set the number of pulses per revolution of the main side detector.
When using the serial changer MDS-B-HR, use this with SP098(RNG2ex).

Detector
TS5691(128 teeth): SP020 = 2000
TS5691(180 teeth): SP020 = 2880
TS5691(256 teeth): SP020 = 4000
TS5691(384 teeth): SP020 = 6000
TS5691(512 teeth): SP020 = 8000

TS5690(64 teeth): SP020 = 2000
TS5690(90 teeth): SP020 = 2880
TS5690(128 teeth): SP020 = 4000
TS5690(192 teeth): SP020 = 6000
TS5690(256 teeth): SP020 = 8000
TS5690(384 teeth): SP020 =12000

ERM280(1200 teeth): SP020 = 4800
ERM280(2048 teeth): SP020 = 8000

MPCI : SP020 = 7200
MBE205: SP020 = 2000

OSA18(-A48): SP020 = 260

---Setting range---
-32768 to 32767 (kp/rev)
When using SP098: (p/rev)

【#13097】 SP097 RNG1ex Sub side extension detector resolution

Normally set to "0".
When setting the sub side detector resolution in pulse (p) unit, set the number of pulses to four bite data of SP097 (upper 16 bits) and SP019 (lower 16 bits).

SP097 = number of pulses / 65536 (When = 0, set SP097 = -1)
SP019 = the remainder of "number of pulses / 65536" (values can be set by the pulse)
For detectors not using the upper 16 bits, set to "-1".

When "SP019 > 32767", set "the remainder of above - 65536 (negative number)"
to "SP019".

---Setting range---
-1,0 to 32767

【#13098】 SP098 RNG2ex Main side extension detector resolution

Normally set to "0".
When setting the main side detector resolution in pulse (p) unit, set the number of pulses to four bite data of SP098 (upper 16 bits) and SP020 (lower 16 bits).

SP098 = number of pulses / 65536 (When = 0, set SP098 = -1)
SP020 = the remainder of "number of pulses / 65536" (values can be set by the pulse)
For detectors not using the upper 16 bits, set to "-1".

When "SP020 > 32767", set "the remainder of above - 65536 (negative number)"
to "SP020".

---Setting range---
-1,0 to 32767

【#13031(PR)】 SP031 MTYP Motor type

Set the control system of the spindle drive unit.
2200: Semi closed loop control
4200: Full closed loop control by using spindle side ABZ pulse output detector
6200: Full closed loop control by using spindle side serial output detector

【#13054】 SP054 ORE Overrun detection width in closed loop control

Set the overrun detection width in the full-closed loop control.
When the gap between the main side detector and the sub side detector exceeds the set value, it is judged as an overrun and "Alarm 43" is detected.
When "-1" is set, the alarm detection will not be performed.
When "0" is set, overrun will be detected with 2°.
In the full-closed loop control, normally set this parameter to "360". During V-belt drive, set to "-1".

---Setting range---
-32768 to 32767 (°)

< Setting parameters of a proximity switch >

Set the following parameters when a proximity switch is equipped with the spindle end.

【#13227】 SP227 SFNC7 Spindle function 7

bit F-C : dis Digital signal input selection

0: No signal 1: Safety observation function door state signal 4: Proximity switch signal detection
Other settings: setting prohibited

【#13225】 SP225 SFNC5 Spindle function 5

bit 5 : ddir Proximity switch signal enable edge

0: Falling edge 1: Rising edge

【#3106】 zrn_typ Zero point return specifications

bit F : Spindle zero point detection with contactless switch

0: Normal 1: Enable spindle zero point detection using proximity switch

< Cautions for starting the spindle >

The test operation (acceleration/deceleration, orientation) of the spindle can be executed by setting the initial parameters, however, check the spindle operation with caution.

- Check the wiring and ensure the safety of the surroundings before starting the operation.
- Do not operate at high-speed rotation at first. After checking that there are no problems as abnormal noise, vibration, etc. from the spindle at start up with no-load and small S commands, raise the S commands gradually.
- When vibration or abnormal noise occurs during the test operation, adjust or set the speed gain or the notch filter.
- For the first check of the orientation, the orientation should be executed gradually from small S commands.

3-3-2 List of standard parameters for each spindle motor

(1) Standard motor SJ-D Series (Standard)

Parameter			Motor	SJ-D Series (Standard)			
				SJ-D3.7/100-01	SJ-D5.5/100-01	SJ-D7.5/100-01	SJ-D11/80-01
No.	Abbrev.	Details	MDS-D-SPJ3-	37NA	55NA	75NA	110NA
SP001	PGV	Position loop gain non-interpolation mode		15	15	15	15
SP002	PGN	Position loop gain interpolation mode		33	33	33	33
SP003	PGS	Position loop gain spindle synchronization		15	15	15	15
SP004				0	0	0	0
SP005	VGN1	Speed loop gain 1		150	150	150	150
SP006	VIA1	Speed loop lead compensation 1		1900	1900	1900	1900
SP007	VIL1	Speed loop delay compensation 1		0	0	0	0
SP008	VGN2	Speed loop gain 2		150	150	150	150
SP009	VIA2	Speed loop lead compensation 2		1900	1900	1900	1900
SP010	VIL2	Speed loop delay compensation 2		0	0	0	0
SP011				0	0	0	0
SP012				0	0	0	0
SP013				0	0	0	0
SP014	PY1	Minimum excitation rate 1		50	50	50	50
SP015	PY2	Minimum excitation rate 2		100	100	100	100
SP016	DDT	Phase alignment deceleration rate		20	20	20	20
SP017	SPEC1	Spindle specification 1		0008	0008	0008	0008
SP018	SPEC2	Spindle specification 2		0000	0000	0000	0000
SP019	RNG1	Sub side detector resolution		2000	2000	2000	2000
SP020	RNG2	Main side detector resolution		2000	2000	2000	2000
SP021	OLT	Overload detection time constant		60	60	60	60
SP022	OLL	Overload detection level		120	120	120	120
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	120	120	120
SP024	INP	In-position width		875	875	875	875
SP025	INP2	2nd in-position width		875	875	875	875
SP026	TSP	Maximum motor speed		10000	10000	10000	8000
SP027	ZSP	Motor zero speed		25	25	25	25
SP028	SDTS	Speed detection set value		1000	1000	1000	800
SP029	SDTR	Speed detection reset width		30	30	30	30
SP030	SDT2	2nd speed detection setting value		0	0	0	0
SP031	MTYP	Motor type		2200	2200	2200	2200
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	0000	0000	0000
SP033	SFNC1	Spindle function 1		0000	0000	0000	0000
SP034	SFNC2	Spindle function 2		0000	0000	0000	0000
SP035	SFNC3	Spindle function 3		1600	1600	1600	1600
SP036	SFNC4	Spindle function 4		0000	0000	0000	0000
SP037	JL	Load inertia scale		100	100	100	100
SP038	FHz1	Notch filter frequency 1		0	0	0	0
SP039	LMCD	Lost motion compensation timing		0	0	0	0
SP040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0
SP041	LMC2	Lost motion compensation 2		0	0	0	0
SP042	OVS2	Overshooting compensation 2		0	0	0	0
SP043	OVS1	Overshooting compensation 1		0	0	0	0
SP044	OBS2	Disturbance observer gain		0	0	0	0
SP045	OBS1	Disturbance observer filter frequency		0	0	0	0
SP046	FHz2	Notch filter frequency 2		0	0	0	0
SP047	EC	Inductive voltage compensation gain		100	100	100	100
SP048	LMC1	Lost motion compensation 1		0	0	0	0
SP049	FFC	Acceleration rate feed forward gain		0	0	0	0
SP050	TOF	Torque offset		0	0	0	0
SP051	DFBT	Dual feed back control time constant		0	0	0	0
SP052	DFBN	Dual feedback control non-sensitive band		0	0	0	0
SP053	ODS	Excessive error detection width (non-interpolation mode)		2000	2000	2000	1600
SP054	ORE	Overrun detection width in closed loop control		0	0	0	0
SP055	EMGx	Max. gate off delay time after emergency stop		20000	20000	20000	20000
SP056	EMGt	Deceleration time constant at emergency stop		300	300	300	300
SP057	GRA1	Spindle side gear ratio 1		1	1	1	1
SP058	GRA2	Spindle side gear ratio 2		1	1	1	1
SP059	GRA3	Spindle side gear ratio 3		1	1	1	1
SP060	GRA4	Spindle side gear ratio 4		1	1	1	1
SP061	GRB1	Motor side gear ratio 1		1	1	1	1
SP062	GRB2	Motor side gear ratio 2		1	1	1	1
SP063	GRB3	Motor side gear ratio 3		1	1	1	1
SP064	GRB4	Motor side gear ratio 4		1	1	1	1
SP065	TLM1	Torque limit 1		10	10	10	10
SP066	TLM2	Torque limit 2		10	10	10	10
SP067	TLM3	Torque limit 3		10	10	10	10
SP068	TLM4	Torque limit 4		10	10	10	10
SP069	PCMP	Phase alignment completion width		875	875	875	875
SP070	KDDT	Phase alignment deceleration rate scale		0	0	0	0

Parameter			Motor	SJ-D Series (Standard)			
				SJ-D3.7/100-01	SJ-D5.5/100-01	SJ-D7.5/100-01	SJ-D11/80-01
No.	Abbrev.	Details	MDS-D-SPJ3-	37NA	55NA	75NA	110NA
SP071	DIQM	Variable current limit during deceleration, lower limit value		60	60	50	45
SP072	DIQN	Variable current limit during deceleration, break point speed		6000	6000	5000	3700
SP073	VGVN	Variable speed gain target value		0	0	0	0
SP074	VGVS	Variable speed gain change start speed		0	0	0	0
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	0	0	0
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	0	0	0
SP077	IQA	Q axis current lead compensation		4096	4096	4096	4096
SP078	IDA	D axis current lead compensation		4096	4096	4096	4096
SP079	IQG	Q axis current gain		1024	1024	1024	1024
SP080	IDG	D axis current gain		1024	1024	1024	1024
SP081	IQAL	Q axis current lead compensation low-speed coil		0	0	0	0
SP082	IDAL	D axis current lead compensation low-speed coil		0	0	0	0
SP083	IQGL	Q axis current gain low-speed coil		0	0	0	0
SP084	IDGL	D axis current gain low-speed coil		0	0	0	0
SP085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0
SP087	FHz4	Notch filter frequency 4		0	0	0	0
SP088	FHz5	Notch filter frequency 5		0	0	0	0
SP089	TMKQ	Spindle output stabilizing gain Q axis		100	100	100	100
SP090	TMKD	Spindle output stabilizing gain D axis		0	0	0	0
SP091				0	0	0	0
:				:	:	:	:
SP093				0	0	0	0
SP094	MPV	Magnetic pole error detection speed		0	0	0	0
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	0	0	0
SP096	SDW	Speed slowdown allowable width		0	0	0	0
SP097	RNG1ex	Sub side extension detector resolution		0	0	0	0
SP098	RNG2ex	Main side extension detector resolution		0	0	0	0
SP099				0	0	0	0
:				:	:	:	:
SP112				0	0	0	0
SP113	OPLP	Current command value for open loop		0	0	0	0
SP114	MKT	Coil changeover gate cutoff timer		150	150	150	150
SP115	MKT2	Coil changeover current limit timer		250	250	250	250
SP116	MKIL	Coil changeover current limit value		120	120	120	120
SP117	SETM	Excessive speed deviation timer		12	12	12	12
SP118	MSFT	Magnetic pole shift amount		0	0	0	0
SP119	FSP4	Notch filter specifications 4		0	0	0	0
SP120	FSP5	Notch filter specifications 5		0	0	0	0
SP121	MP Kpp	Magnetic pole detection position loop gain		0	0	0	0
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	0	0	0
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	0	0	0
SP124	ILMTsp	Magnetic pole detection current limit value		0	0	0	0
SP125	DA1NO	D/A output ch1 data No.		0	0	0	0
SP126	DA2NO	D/A output ch2 data No.		0	0	0	0
SP127	DA1MPY	D/A output ch1 output scale		0	0	0	0
SP128	DA2MPY	D/A output ch2 output scale		0	0	0	0
SP129	PM	Motor unique constants (H)		2	2	2	2
SP130	JM	Motor unique constants (H)		8	13	22	29
SP131	ATYP	Motor unique constants (H)		80	100	120	160
SP132				0	0	0	0
SP133	NR	Motor unique constants (H)		10000	10000	10000	8000
SP134	NB	Motor unique constants (H)		1800	1800	1500	1500
SP135	NF	Motor unique constants (H)		1800	1800	1800	1800
SP136	KT	Motor unique constants (H)		1155	1234	1262	1338
SP137	KF1	Motor unique constants (H)		59	67	73	68
SP138	KF2	Motor unique constants (H)		3222	3330	3252	3208
SP139	KF3	Motor unique constants (H)		2478	2345	2427	2468
SP140	KF4	Motor unique constants (H)		1938	1961	1947	1942
SP141	KF5	Motor unique constants (H)		86	98	145	145
SP142	KF6	Motor unique constants (H)		0	0	0	0
SP143				0	0	0	0
SP144	TMIL	Motor unique constants (H)		0	0	0	0
SP145	TMBR	Motor unique constants (H)		388	335	369	339
SP146	TMBD	Motor unique constants (H)		423	428	434	432
SP147	KE	Motor unique constants (H)		71	66	74	75
SP148	LA	Motor unique constants (H)		1869	1186	969	811
SP149	IQSM	Motor unique constants (H)		2039	2837	3785	5233
SP150	IDSM	Motor unique constants (H)		784	1228	1742	2214
SP151	R1	Motor unique constants (H)		343	167	105	81
SP152	TMLR	Motor unique constants (H)		110	110	90	90

Parameter			Motor	SJ-D Series (Standard)			
				SJ-D3.7/100-01	SJ-D5.5/100-01	SJ-D7.5/100-01	SJ-D11/80-01
No.	Abbrev.	Details	MDS-D-SPJ3-	37NA	55NA	75NA	110NA
SP153	TMLD	Motor unique constants (H)		120	120	120	120
SP154	TMLS	Motor unique constants (H)		150	150	150	150
SP155	KI1	Motor unique constants (H)		1095	1083	1051	1051
SP156	PCNT	Motor unique constants (H)		0	0	0	0
SP157				0	0	0	0
SP158	DNB	Motor unique constants (H)		1500	1500	0	0
SP159	SNB	Motor unique constants (H)		1500	1500	0	0
SP160	BSD	Motor unique constants (H)		0	0	0	0
SP161				0	0	0	0
:				:	:	:	:
SP164				0	0	0	0
SP165	NRL	Motor unique constants (L)		0	0	0	0
SP166	NBL	Motor unique constants (L)		0	0	0	0
SP167	NFL	Motor unique constants (L)		0	0	0	0
SP168	KT	Motor unique constants (L)		0	0	0	0
SP169	KF1L	Motor unique constants (L)		0	0	0	0
SP170	KF2L	Motor unique constants (L)		0	0	0	0
SP171	KF3L	Motor unique constants (L)		0	0	0	0
SP172	KF4L	Motor unique constants (L)		0	0	0	0
SP173	KF5L	Motor unique constants (L)		0	0	0	0
SP174	KF6L	Motor unique constants (L)		0	0	0	0
SP175				0	0	0	0
SP176	TMILL	Motor unique constants (L)		0	0	0	0
SP177	TMBRL	Motor unique constants (L)		0	0	0	0
SP178	TMBDL	Motor unique constants (L)		0	0	0	0
SP179	KEL	Motor unique constants (L)		0	0	0	0
SP180	LAL	Motor unique constants (L)		0	0	0	0
SP181	IQSML	Motor unique constants (L)		0	0	0	0
SP182	IDSML	Motor unique constants (L)		0	0	0	0
SP183	R1L	Motor unique constants (L)		0	0	0	0
SP184				0	0	0	0
SP185	TMLRL	Motor unique constants (L)		0	0	0	0
SP186	TMLSL	Motor unique constants (L)		0	0	0	0
SP187	KI1L	Motor unique constants (L)		0	0	0	0
SP188	PCNTL	Motor unique constants (L)		0	0	0	0
SP189				0	0	0	0
SP190	DNBL	Motor unique constants (L)		0	0	0	0
SP191	SNBL	Motor unique constants (L)		0	0	0	0
SP192	BSDL	Motor unique constants (L)		0	0	0	0
SP193				0	0	0	0
:				:	:	:	:
SP224				0	0	0	0
SP225	SFNC5	Spindle function 5		0000	0000	0000	0000
SP226	SFNC6	Spindle function 6		1000	1000	1000	1000
SP227	SFNC7	Spindle function 7		0000	0000	0000	0000
SP228	SFNC8	Spindle function 8		0000	0000	0000	0000
SP229	SFNC9	Spindle function 9		0000	0000	0000	0000
SP230	SFNC10	Spindle function 10		0000	0000	0000	0000
SP231				0000	0000	0000	0000
SP232				0000	0000	0000	0000
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	0	0	0
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	0	0	0
SP235	R2H	Temperature compensation gain		0	0	0	0
SP236	WIH	Temperature compensation time constant		0	0	0	0
SP237	TCF	Torque command filter		500	500	500	500
SP238	SSCFEED	Safety observation Safety speed		0	0	0	0
SP239	SSCRPM	Safety observation Safety motor speed		0	0	0	0
SP240				0	0	0	0
:							
SP256							

(2) Standard motor SJ-DJ Series (Compact & Lightweight output)

Parameter			Motor	SJ-DJ Series (Compact & Lightweight output)		
				SJ-DJ5.5/100-01	SJ-DJ7.5/100-01	SJ-DJ11/100-01
No.	Abbrev.	Details	MDS-D-SPJ3-	55NA	75NA	110NA
SP001	PGV	Position loop gain non-interpolation mode		15	15	15
SP002	PGN	Position loop gain interpolation mode		33	33	33
SP003	PGS	Position loop gain spindle synchronization		15	15	15
SP004				0	0	0
SP005	VGN1	Speed loop gain 1		150	150	150
SP006	VIA1	Speed loop lead compensation 1		1900	1900	1900
SP007	VIL1	Speed loop delay compensation 1		0	0	0
SP008	VGN2	Speed loop gain 2		150	150	150
SP009	VIA2	Speed loop lead compensation 2		1900	1900	1900
SP010	VIL2	Speed loop delay compensation 2		0	0	0
SP011				0	0	0
SP012				0	0	0
SP013				0	0	0
SP014	PY1	Minimum excitation rate 1		50	50	50
SP015	PY2	Minimum excitation rate 2		100	100	100
SP016	DDT	Phase alignment deceleration rate		20	20	20
SP017	SPEC1	Spindle specification 1		0008	0008	0008
SP018	SPEC2	Spindle specification 2		0000	0000	0000
SP019	RNG1	Sub side detector resolution		2000	2000	2000
SP020	RNG2	Main side detector resolution		2000	2000	2000
SP021	OLT	Overload detection time constant		60	60	60
SP022	OLL	Overload detection level		120	120	120
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	120	120
SP024	INP	In-position width		875	875	875
SP025	INP2	2nd in-position width		875	875	875
SP026	TSP	Maximum motor speed		10000	10000	10000
SP027	ZSP	Motor zero speed		25	25	25
SP028	SDTS	Speed detection set value		1000	1000	1000
SP029	SDTR	Speed detection reset width		30	30	30
SP030	SDT2	2nd speed detection setting value		0	0	0
SP031	MTYP	Motor type		2200	2200	2200
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	0000	0000
SP033	SFNC1	Spindle function 1		0000	0000	0000
SP034	SFNC2	Spindle function 2		0000	0000	0000
SP035	SFNC3	Spindle function 3		1600	1600	1600
SP036	SFNC4	Spindle function 4		0000	0000	0000
SP037	JL	Load inertia scale		100	100	100
SP038	FHz1	Notch filter frequency 1		0	0	0
SP039	LMCD	Lost motion compensation timing		0	0	0
SP040	LMCT	Lost motion compensation non-sensitive band		0	0	0
SP041	LMC2	Lost motion compensation 2		0	0	0
SP042	OVS2	Overshooting compensation 2		0	0	0
SP043	OVS1	Overshooting compensation 1		0	0	0
SP044	OBS2	Disturbance observer gain		0	0	0
SP045	OBS1	Disturbance observer filter frequency		0	0	0
SP046	FHz2	Notch filter frequency 2		0	0	0
SP047	EC	Inductive voltage compensation gain		100	100	100
SP048	LMC1	Lost motion compensation 1		0	0	0
SP049	FFC	Acceleration rate feed forward gain		0	0	0
SP050	TOF	Torque offset		0	0	0
SP051	DFBT	Dual feed back control time constant		0	0	0
SP052	DFBN	Dual feedback control non-sensitive band		0	0	0
SP053	ODS	Excessive error detection width (non-interpolation mode)		2000	2000	2000
SP054	ORE	Overrun detection width in closed loop control		0	0	0
SP055	EMGx	Max. gate off delay time after emergency stop		20000	20000	20000
SP056	EMGt	Deceleration time constant at emergency stop		300	300	300
SP057	GRA1	Spindle side gear ratio 1		1	1	1
SP058	GRA2	Spindle side gear ratio 2		1	1	1
SP059	GRA3	Spindle side gear ratio 3		1	1	1
SP060	GRA4	Spindle side gear ratio 4		1	1	1
SP061	GRB1	Motor side gear ratio 1		1	1	1
SP062	GRB2	Motor side gear ratio 2		1	1	1
SP063	GRB3	Motor side gear ratio 3		1	1	1
SP064	GRB4	Motor side gear ratio 4		1	1	1
SP065	TLM1	Torque limit 1		10	10	10
SP066	TLM2	Torque limit 2		10	10	10
SP067	TLM3	Torque limit 3		10	10	10
SP068	TLM4	Torque limit 4		10	10	10
SP069	PCMP	Phase alignment completion width		875	875	875
SP070	KDDT	Phase alignment deceleration rate scale		0	0	0
SP071	DIQM	Variable current limit during deceleration, lower limit value		45	45	45

Parameter			Motor	SJ-DJ Series (Compact & Lightweight output)		
				SJ-DJ5.5/100-01	SJ-DJ7.5/100-01	SJ-DJ11/100-01
No.	Abbrev.	Details	MDS-D-SPJ3-	55NA	75NA	110NA
SP072	DIQN	Variable current limit during deceleration, break point speed		4500	4500	4500
SP073	VGVN	Variable speed gain target value		0	0	0
SP074	VGVS	Variable speed gain change start speed		0	0	0
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	0	0
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	0	0
SP077	IQA	Q axis current lead compensation		4096	4096	4096
SP078	IDA	D axis current lead compensation		4096	4096	4096
SP079	IQG	Q axis current gain		1024	1024	1024
SP080	IDG	D axis current gain		1024	1024	1024
SP081	IQAL	Q axis current lead compensation low-speed coil		0	0	0
SP082	IDAL	D axis current lead compensation low-speed coil		0	0	0
SP083	IQGL	Q axis current gain low-speed coil		0	0	0
SP084	IDGL	D axis current gain low-speed coil		0	0	0
SP085	LMCk	Lost motion compensation 3 spring constant		0	0	0
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0
SP087	FHz4	Notch filter frequency 4		0	0	0
SP088	FHz5	Notch filter frequency 5		0	0	0
SP089	TMKQ	Spindle output stabilizing gain Q axis		100	100	100
SP090	TMKD	Spindle output stabilizing gain D axis		0	0	0
SP091				0	0	0
:				:	:	:
SP093				0	0	0
SP094	MPV	Magnetic pole error detection speed		0	0	0
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	0	0
SP096	SDW	Speed slowdown allowable width		0	0	0
SP097	RNG1ex	Sub side extension detector resolution		0	0	0
SP098	RNG2ex	Main side extension detector resolution		0	0	0
SP099				0	0	0
:				:	:	:
SP112				0	0	0
SP113	OPLP	Current command value for open loop		0	0	0
SP114	MKT	Coil changeover gate cutoff timer		150	150	150
SP115	MKT2	Coil changeover current limit timer		250	250	250
SP116	MKIL	Coil changeover current limit value		120	120	120
SP117	SETM	Excessive speed deviation timer		12	12	12
SP118	MSFT	Magnetic pole shift amount		0	0	0
SP119	FSP4	Notch filter specifications 4		0	0	0
SP120	FSP5	Notch filter specifications 5		0	0	0
SP121	MP Kpp	Magnetic pole detection position loop gain		0	0	0
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	0	0
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	0	0
SP124	ILMTsp	Magnetic pole detection current limit value		0	0	0
SP125	DA1NO	D/A output ch1 data No.		0	0	0
SP126	DA2NO	D/A output ch2 data No.		0	0	0
SP127	DA1MPY	D/A output ch1 output scale		0	0	0
SP128	DA2MPY	D/A output ch2 output scale		0	0	0
SP129	PM	Motor unique constants (H)		2	2	2
SP130	JM	Motor unique constants (H)		8	13	24
SP131	ATYP	Motor unique constants (H)		100	120	160
SP132				0	0	0
SP133	NR	Motor unique constants (H)		10000	10000	10000
SP134	NB	Motor unique constants (H)		1800	1800	1800
SP135	NF	Motor unique constants (H)		1800	1800	1800
SP136	KT	Motor unique constants (H)		1123	1352	1377
SP137	KF1	Motor unique constants (H)		67	73	68
SP138	KF2	Motor unique constants (H)		2880	3023	2963
SP139	KF3	Motor unique constants (H)		2939	2652	2796
SP140	KF4	Motor unique constants (H)		1884	1922	1900
SP141	KF5	Motor unique constants (H)		72	88	127
SP142	KF6	Motor unique constants (H)		0	0	0
SP143				0	0	0
SP144	TMIL	Motor unique constants (H)		0	0	0
SP145	TMBR	Motor unique constants (H)		460	424	466
SP146	TMBD	Motor unique constants (H)		423	429	434
SP147	KE	Motor unique constants (H)		82	73	83
SP148	LA	Motor unique constants (H)		1405	1165	940
SP149	IQSM	Motor unique constants (H)		3118	3532	5085
SP150	IDSM	Motor unique constants (H)		1189	1525	2197
SP151	R1	Motor unique constants (H)		259	167	105
SP152	TMLR	Motor unique constants (H)		90	90	90
SP153	TMLD	Motor unique constants (H)		120	120	120
SP154	TMLS	Motor unique constants (H)		150	150	150

Parameter			Motor	SJ-DJ Series (Compact & Lightweight output)		
				SJ-DJ5.5/100-01	SJ-DJ7.5/100-01	SJ-DJ11/100-01
No.	Abbrev.	Details	MDS-D-SPJ3-	55NA	75NA	110NA
SP155	KI1	Motor unique constants (H)		1100	1065	1075
SP156	PCNT	Motor unique constants (H)		0	0	0
SP157				0	0	0
SP158	DNB	Motor unique constants (H)		1500	1500	1500
SP159	SNB	Motor unique constants (H)		1500	1500	1500
SP160	BSD	Motor unique constants (H)		0	0	0
SP161				0	0	0
:				:	:	:
SP164				0	0	0
SP165	NRL	Motor unique constants (L)		0	0	0
SP166	NBL	Motor unique constants (L)		0	0	0
SP167	NFL	Motor unique constants (L)		0	0	0
SP168	KT	Motor unique constants (L)		0	0	0
SP169	KF1L	Motor unique constants (L)		0	0	0
SP170	KF2L	Motor unique constants (L)		0	0	0
SP171	KF3L	Motor unique constants (L)		0	0	0
SP172	KF4L	Motor unique constants (L)		0	0	0
SP173	KF5L	Motor unique constants (L)		0	0	0
SP174	KF6L	Motor unique constants (L)		0	0	0
SP175				0	0	0
SP176	TMILL	Motor unique constants (L)		0	0	0
SP177	TMBRL	Motor unique constants (L)		0	0	0
SP178	TMBDL	Motor unique constants (L)		0	0	0
SP179	KEL	Motor unique constants (L)		0	0	0
SP180	LAL	Motor unique constants (L)		0	0	0
SP181	IQSML	Motor unique constants (L)		0	0	0
SP182	IDSML	Motor unique constants (L)		0	0	0
SP183	R1L	Motor unique constants (L)		0	0	0
SP184				0	0	0
SP185	TMLRL	Motor unique constants (L)		0	0	0
SP186	TMLSL	Motor unique constants (L)		0	0	0
SP187	KI1L	Motor unique constants (L)		0	0	0
SP188	PCNTL	Motor unique constants (L)		0	0	0
SP189				0	0	0
SP190	DNBL	Motor unique constants (L)		0	0	0
SP191	SNBL	Motor unique constants (L)		0	0	0
SP192	BSDL	Motor unique constants (L)		0	0	0
SP193				0	0	0
:				:	:	:
SP224				0	0	0
SP225	SFNC5	Spindle function 5		0000	0000	0000
SP226	SFNC6	Spindle function 6		1000	1000	1000
SP227	SFNC7	Spindle function 7		0000	0000	0000
SP228	SFNC8	Spindle function 8		0000	0000	0000
SP229	SFNC9	Spindle function 9		0000	0000	0000
SP230	SFNC10	Spindle function 10		0000	0000	0000
SP231				0000	0000	0000
SP232				0000	0000	0000
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	0	0
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	0	0
SP235	R2H	Temperature compensation gain		0	0	0
SP236	WIH	Temperature compensation time constant		0	0	0
SP237	TCF	Torque command filter		500	500	500
SP238	SSCFEED	Safety observation Safety speed		0	0	0
SP239	SSCRPM	Safety observation Safety motor speed		0	0	0
SP240				0	0	0
:						
SP256						

(3) Standard motor SJ-V Series (Standard)

Parameter			Motor	SJ-V Series (Standard)								
				SJ-VL0.75-01T	SJ-VL1.5-01T	SJ-V2.2-01T	SJ-V3.7-01T	SJ-V5.5-01ZT	SJ-V7.5-01ZT	SJ-V7.5-03ZT	SJ-V11-01ZT	SJ-V11-01T
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	22NA	22NA	37NA	55NA	75NA	110NA	110NA	110NA
SP001	PGV	Position loop gain non-interpolation mode		15	15	15	15	15	15	15	15	15
SP002	PGN	Position loop gain interpolation mode		33	33	33	33	33	33	33	33	33
SP003	PGS	Position loop gain spindle synchronization		15	15	15	15	15	15	15	15	15
SP004				0	0	0	0	0	0	0	0	0
SP005	VGN1	Speed loop gain 1		150	150	150	150	150	150	150	150	150
SP006	VIA1	Speed loop lead compensation 1		1900	1900	1900	1900	1900	1900	1900	1900	1900
SP007	VIL1	Speed loop delay compensation 1		0	0	0	0	0	0	0	0	0
SP008	VGN2	Speed loop gain 2		150	150	150	150	150	150	150	150	150
SP009	VIA2	Speed loop lead compensation 2		1900	1900	1900	1900	1900	1900	1900	1900	1900
SP010	VIL2	Speed loop delay compensation 2		0	0	0	0	0	0	0	0	0
SP011				0	0	0	0	0	0	0	0	0
SP012				0	0	0	0	0	0	0	0	0
SP013				0	0	0	0	0	0	0	0	0
SP014	PY1	Minimum excitation rate 1		50	50	50	50	50	50	50	50	50
SP015	PY2	Minimum excitation rate 2		100	100	100	100	100	100	100	100	100
SP016	DDT	Phase alignment deceleration rate		20	20	20	20	20	20	20	20	20
SP017	SPEC1	Spindle specification 1		0008	0008	0008	0008	0008	0008	0008	0008	0008
SP018	SPEC2	Spindle specification 2		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP019	RNG1	Sub side detector resolution		2000	2000	4000	4000	4000	4000	4000	4000	4000
SP020	RNG2	Main side detector resolution		2000	2000	4000	4000	4000	4000	4000	4000	4000
SP021	OLT	Overload detection time constant		60	60	60	60	60	60	60	60	60
SP022	OLL	Overload detection level		120	120	120	120	120	120	120	120	120
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	120	120	120	120	120	120	120	120
SP024	INP	In-position width		875	875	875	875	875	875	875	875	875
SP025	INP2	2nd in-position width		875	875	875	875	875	875	875	875	875
SP026	TSP	Maximum motor speed		10000	10000	10000	10000	12000	12000	12000	8000	6000
SP027	ZSP	Motor zero speed		25	25	25	25	25	25	25	25	25
SP028	SDTS	Speed detection set value		1000	1000	1000	1000	1200	1200	1200	800	600
SP029	SDTR	Speed detection reset width		30	30	30	30	30	30	30	30	30
SP030	SDT2	2nd speed detection setting value		0	0	0	0	0	0	0	0	0
SP031	MTYP	Motor type		2200	2200	2200	2200	2200	2200	2200	2200	2200
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP033	SFNC1	Spindle function 1		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP034	SFNC2	Spindle function 2		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP035	SFNC3	Spindle function 3		1600	1600	1600	1600	1600	1600	1600	1600	1600
SP036	SFNC4	Spindle function 4		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP037	JL	Load inertia scale		100	100	100	100	100	100	100	100	100
SP038	FHz1	Notch filter frequency 1		0	0	0	0	0	0	0	0	0
SP039	LMCD	Lost motion compensation timing		0	0	0	0	0	0	0	0	0
SP040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0	0	0	0	0	0
SP041	LMC2	Lost motion compensation 2		0	0	0	0	0	0	0	0	0
SP042	OVS2	Overshooting compensation 2		0	0	0	0	0	0	0	0	0
SP043	OVS1	Overshooting compensation 1		0	0	0	0	0	0	0	0	0
SP044	OBS2	Disturbance observer gain		0	0	0	0	0	0	0	0	0
SP045	OBS1	Disturbance observer filter frequency		0	0	0	0	0	0	0	0	0
SP046	FHz2	Notch filter frequency 2		0	0	0	0	0	0	0	0	0
SP047	EC	Inductive voltage compensation gain		100	100	100	100	100	100	100	100	100
SP048	LMC1	Lost motion compensation 1		0	0	0	0	0	0	0	0	0
SP049	FFC	Acceleration rate feed forward gain		0	0	0	0	0	0	0	0	0
SP050	TOF	Torque offset		0	0	0	0	0	0	0	0	0
SP051	DFBT	Dual feed back control time constant		0	0	0	0	0	0	0	0	0
SP052	DFBN	Dual feedback control non-sensitive band		0	0	0	0	0	0	0	0	0
SP053	ODS	Excessive error detection width (non-interpolation mode)		2000	2000	2000	2000	2400	2400	2400	1600	1200
SP054	ORE	Overrun detection width in closed loop control		0	0	0	0	0	0	0	0	0
SP055	EMGx	Max. gate off delay time after emergency stop		20000	20000	20000	20000	20000	20000	20000	20000	20000
SP056	EMGt	Deceleration time constant at emergency stop		300	300	300	300	300	300	300	300	300
SP057	GRA1	Spindle side gear ratio 1		1	1	1	1	1	1	1	1	1
SP058	GRA2	Spindle side gear ratio 2		1	1	1	1	1	1	1	1	1
SP059	GRA3	Spindle side gear ratio 3		1	1	1	1	1	1	1	1	1
SP060	GRA4	Spindle side gear ratio 4		1	1	1	1	1	1	1	1	1
SP061	GRB1	Motor side gear ratio 1		1	1	1	1	1	1	1	1	1
SP062	GRB2	Motor side gear ratio 2		1	1	1	1	1	1	1	1	1
SP063	GRB3	Motor side gear ratio 3		1	1	1	1	1	1	1	1	1
SP064	GRB4	Motor side gear ratio 4		1	1	1	1	1	1	1	1	1
SP065	TLM1	Torque limit 1		10	10	10	10	10	10	10	10	10
SP066	TLM2	Torque limit 2		10	10	10	10	10	10	10	10	10
SP067	TLM3	Torque limit 3		10	10	10	10	10	10	10	10	10
SP068	TLM4	Torque limit 4		10	10	10	10	10	10	10	10	10
SP069	PCMP	Phase alignment completion width		875	875	875	875	875	875	875	875	875
SP070	KDDT	Phase alignment deceleration rate scale		0	0	0	0	0	0	0	0	0

Parameter			Motor	SJ-V Series (Standard)								
				SJ-VL0.75-01T	SJ-VL1.5-01T	SJ-V2.2-01T	SJ-V3.7-01T	SJ-V5.5-01ZT	SJ-V7.5-01ZT	SJ-V7.5-03ZT	SJ-V11-01ZT	SJ-V11-01T
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	22NA	22NA	37NA	55NA	75NA	110NA	110NA	110NA
SP071	DIQM	Variable current limit during deceleration, lower limit value		50	50	50	50	40	40	55	45	60
SP072	DIQN	Variable current limit during deceleration, break point speed		5000	5000	5000	5000	5000	5000	7100	3700	3700
SP073	VGVN	Variable speed gain target value		0	0	0	0	0	0	0	0	0
SP074	VGVS	Variable speed gain change start speed		0	0	0	0	0	0	0	0	0
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	0	0	0	0	0	0	0	0
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	0	0	0	0	0	0	0	0
SP077	IQA	Q axis current lead compensation		4096	4096	4096	4096	4096	4096	4096	4096	4096
SP078	IDA	D axis current lead compensation		4096	4096	4096	4096	4096	4096	4096	4096	4096
SP079	IQG	Q axis current gain		1024	1024	1024	1024	1024	1024	1024	1024	1024
SP080	IDG	D axis current gain		1024	1024	1024	1024	1024	1024	1024	1024	1024
SP081	IQAL	Q axis current lead compensation low-speed coil		0	0	0	0	0	0	0	0	0
SP082	IDAL	D axis current lead compensation low-speed coil		0	0	0	0	0	0	0	0	0
SP083	IQGL	Q axis current gain low-speed coil		0	0	0	0	0	0	0	0	0
SP084	IDGL	D axis current gain low-speed coil		0	0	0	0	0	0	0	0	0
SP085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0	0	0	0	0	0
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0	0	0	0	0	0
SP087	FHz4	Notch filter frequency 4		0	0	0	0	0	0	0	0	0
SP088	FHz5	Notch filter frequency 5		0	0	0	0	0	0	0	0	0
SP089	TMKQ	Spindle output stabilizing gain Q axis		0	0	0	0	0	0	0	0	0
SP090	TMKD	Spindle output stabilizing gain D axis		0	0	0	0	0	0	0	0	0
SP091				0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:
SP093				0	0	0	0	0	0	0	0	0
SP094	MPV	Magnetic pole error detection speed		0	0	0	0	0	0	0	0	0
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	0	0	0	0	0	0	0	0
SP096	SDW	Speed slowdown allowable width		0	0	0	0	0	0	0	0	0
SP097	RNG1ex	Sub side extension detector resolution		0	0	0	0	0	0	0	0	0
SP098	RNG2ex	Main side extension detector resolution		0	0	0	0	0	0	0	0	0
SP099				0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:
SP112				0	0	0	0	0	0	0		0
SP113	OPLP	Current command value for open loop		0	0	0	0	0	0	0	0	0
SP114	MKT	Coil changeover gate cutoff timer		150	150	150	150	150	150	150	150	150
SP115	MKT2	Coil changeover current limit timer		250	250	250	250	250	250	250	250	250
SP116	MKIL	Coil changeover current limit value		120	120	120	120	120	120	120	120	120
SP117	SETM	Excessive speed deviation timer		12	12	12	12	12	12	12	12	12
SP118	MSFT	Magnetic pole shift amount		0	0	0	0	0	0	0	0	0
SP119	FSP4	Notch filter specifications 4		0	0	0	0	0	0	0	0	0
SP120	FSP5	Notch filter specifications 5		0	0	0	0	0	0	0	0	0
SP121	MP Kpp	Magnetic pole detection position loop gain		0	0	0	0	0	0	0	0	0
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	0	0	0	0	0	0	0	0
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	0	0	0	0	0	0	0	0
SP124	ILMTsp	Magnetic pole detection current limit value		0	0	0	0	0	0	0	0	0
SP125	DA1NO	D/A output ch1 data No.		0	0	0	0	0	0	0	0	0
SP126	DA2NO	D/A output ch2 data No.		0	0	0	0	0	0	0	0	0
SP127	DA1MPY	D/A output ch1 output scale		0	0	0	0	0	0	0	0	0
SP128	DA2MPY	D/A output ch2 output scale		0	0	0	0	0	0	0	0	0
SP129	PM	Motor unique constants (H)		1	1	2	2	2	2	2	2	2
SP130	JM	Motor unique constants (H)		1	2	7	9	14	24	25	30	30
SP131	ATYP	Motor unique constants (H)		20	40	40	80	100	120	160	160	160
SP132				0	0	0	0	0	0	0	0	0
SP133	NR	Motor unique constants (H)		10000	10000	10000	10000	12000	12000	12000	8000	6000
SP134	NB	Motor unique constants (H)		1500	1500	1500	1500	1500	1500	1500	1500	1500
SP135	NF	Motor unique constants (H)		1800	1800	1800	1800	1800	1800	2100	1800	1800
SP136	KT	Motor unique constants (H)		987	950	1176	1121	1305	1218	963	1326	1326
SP137	KF1	Motor unique constants (H)		53	50	68	59	67	73	73	68	68
SP138	KF2	Motor unique constants (H)		3065	3084	3035	2902	3174	3070	3058	2854	2854
SP139	KF3	Motor unique constants (H)		2642	2570	2662	2591	2519	2693	2683	2744	2744
SP140	KF4	Motor unique constants (H)		1919	1932	1918	1946	1934	1907	1911	1922	1922
SP141	KF5	Motor unique constants (H)		83	106	113	128	137	169	170	170	170
SP142	KF6	Motor unique constants (H)		0	0	0	0	0	0	0	0	0
SP143				0	0	0	0	0	0	0	0	0
SP144	TMIL	Motor unique constants (H)		0	0	0	0	0	0	0	0	0
SP145	TMBR	Motor unique constants (H)		174	157	325	327	430	460	362	366	266
SP146	TMBD	Motor unique constants (H)		212	196	415	422	433	440	440	437	362
SP147	KE	Motor unique constants (H)		42	36	67	61	60	63	63	64	64
SP148	LA	Motor unique constants (H)		7132	3163	2735	1805	1294	970	607	861	861
SP149	IQSM	Motor unique constants (H)		484	1005	1191	2102	2683	3921	4958	5280	5280
SP150	IDSM	Motor unique constants (H)		172	375	517	671	1081	1408	1773	1498	1498

Parameter			Motor	SJ-V Series (Standard)								
				SJ-VL0.75-01T	SJ-VL1.5-01T	SJ-V2.2-01T	SJ-V3.7-01T	SJ-V5.5-01ZT	SJ-V7.5-01ZT	SJ-V7.5-03ZT	SJ-V11-01ZT	SJ-V11-01T
No.	**Abbrev.**	**Details**	**MDS-D-SPJ3-**	**075NA**	**22NA**	**22NA**	**37NA**	**55NA**	**75NA**	**110NA**	**110NA**	**110NA**
SP151	R1	Motor unique constants (H)		3103	1020	650	344	187	79	50	64	64
SP152	TMLR	Motor unique constants (H)		90	90	90	90	90	90	90	90	90
SP153	TMLD	Motor unique constants (H)		120	120	120	120	120	120	120	120	120
SP154	TMLS	Motor unique constants (H)		150	150	150	150	150	150	150	150	150
SP155	KI1	Motor unique constants (H)		1511	1549	1092	1047	1051	1049	1048	1334	1334
SP156	PCNT	Motor unique constants (H)		0	0	0	0	0	0	0	0	0
SP157				0	0	0	0	0	0	0	0	0
SP158	DNB	Motor unique constants (H)		0	0	0	0	0	0	0	0	750
SP159	SNB	Motor unique constants (H)		0	0	0	0	0	0	0	0	750
SP160	BSD	Motor unique constants (H)		0	0	0	0	0	0	0	0	0
SP161				0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:
SP164				0	0	0	0	0	0	0	0	0
SP165	NRL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP166	NBL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP167	NFL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP168	KT	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP169	KF1L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP170	KF2L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP171	KF3L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP172	KF4L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP173	KF5L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP174	KF6L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP175				0	0	0	0	0	0	0	0	0
SP176	TMILL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP177	TMBRL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP178	TMBDL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP179	KEL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP180	LAL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP181	IQSML	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP182	IDSML	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP183	R1L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP184				0	0	0	0	0	0	0	0	0
SP185	TMLRL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP186	TMLSL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP187	KI1L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP188	PCNTL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP189				0	0	0	0	0	0	0	0	0
SP190	DNBL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP191	SNBL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP192	BSDL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0
SP193				0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:
SP224				0	0	0	0	0	0	0	0	0
SP225	SFNC5	Spindle function 5		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP226	SFNC6	Spindle function 6		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP227	SFNC7	Spindle function 7		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP228	SFNC8	Spindle function 8		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP229	SFNC9	Spindle function 9		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP230	SFNC10	Spindle function 10		0000	0000	0000	0000	0000	0000	0000	0000	0000
SP231				0000	0000	0000	0000	0000	0000	0000	0000	0000
SP232				0000	0000	0000	0000	0000	0000	0000	0000	0000
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	0	0	0	0	0	0	0	0
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	0	0	0	0	0	0	0	0
SP235	R2H	Temperature compensation gain		0	0	0	0	0	0	0	0	0
SP236	WIH	Temperature compensation time constant		0	0	0	0	0	0	0	0	0
SP237	TCF	Torque command filter		500	500	500	500	500	500	500	500	500
SP238	SSCFEED	Safety observation Safety speed		0	0	0	0	0	0	0	0	0
SP239	SSCRPM	Safety observation Safety motor speed		0	0	0	0	0	0	0	0	0
SP240				0	0	0	0	0	0	0	0	0
:												
SP256												

(4) Standard motor SJ-V Series (High-speed)

Parameter			Motor	SJ-V Series (High-speed)	
				SJ-VL2.2-02ZT	
No.	Abbrev.	Details	MDS-D-SPJ3-	37NA	
SP001	PGV	Position loop gain non-interpolation mode		15	
SP002	PGN	Position loop gain interpolation mode		33	
SP003	PGS	Position loop gain spindle synchronization		15	
SP004				0	
SP005	VGN1	Speed loop gain 1		150	
SP006	VIA1	Speed loop lead compensation 1		1900	
SP007	VIL1	Speed loop delay compensation 1		0	
SP008	VGN2	Speed loop gain 2		150	
SP009	VIA2	Speed loop lead compensation 2		1900	
SP010	VIL2	Speed loop delay compensation 2		0	
SP011				0	
SP012				0	
SP013				0	
SP014	PY1	Minimum excitation rate 1		50	
SP015	PY2	Minimum excitation rate 2		100	
SP016	DDT	Phase alignment deceleration rate		20	
SP017	SPEC1	Spindle specification 1		0008	
SP018	SPEC2	Spindle specification 2		0000	
SP019	RNG1	Sub side detector resolution		2000	
SP020	RNG2	Main side detector resolution		2000	
SP021	OLT	Overload detection time constant		60	
SP022	OLL	Overload detection level		120	
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	
SP024	INP	In-position width		875	
SP025	INP2	2nd in-position width		875	
SP026	TSP	Maximum motor speed		12000	
SP027	ZSP	Motor zero speed		25	
SP028	SDTS	Speed detection set value		1200	
SP029	SDTR	Speed detection reset width		30	
SP030	SDT2	2nd speed detection setting value		0	
SP031	MTYP	Motor type		2200	
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	
SP033	SFNC1	Spindle function 1		0000	
SP034	SFNC2	Spindle function 2		0000	
SP035	SFNC3	Spindle function 3		1600	
SP036	SFNC4	Spindle function 4		0000	
SP037	JL	Load inertia scale		100	
SP038	FHz1	Notch filter frequency 1		0	
SP039	LMCD	Lost motion compensation timing		0	
SP040	LMCT	Lost motion compensation non-sensitive band		0	
SP041	LMC2	Lost motion compensation 2		0	
SP042	OVS2	Overshooting compensation 2		0	
SP043	OVS1	Overshooting compensation 1		0	
SP044	OBS2	Disturbance observer gain		0	
SP045	OBS1	Disturbance observer filter frequency		0	
SP046	FHz2	Notch filter frequency 2		0	
SP047	EC	Inductive voltage compensation gain		100	
SP048	LMC1	Lost motion compensation 1		0	
SP049	FFC	Acceleration rate feed forward gain		0	
SP050	TOF	Torque offset		0	
SP051	DFBT	Dual feed back control time constant		0	
SP052	DFBN	Dual feedback control non-sensitive band		0	
SP053	ODS	Excessive error detection width (non-interpolation mode)		2400	
SP054	ORE	Overrun detection width in closed loop control		0	
SP055	EMGx	Max. gate off delay time after emergency stop		20000	
SP056	EMGt	Deceleration time constant at emergency stop		300	
SP057	GRA1	Spindle side gear ratio 1		1	
SP058	GRA2	Spindle side gear ratio 2		1	
SP059	GRA3	Spindle side gear ratio 3		1	
SP060	GRA4	Spindle side gear ratio 4		1	
SP061	GRB1	Motor side gear ratio 1		1	
SP062	GRB2	Motor side gear ratio 2		1	
SP063	GRB3	Motor side gear ratio 3		1	
SP064	GRB4	Motor side gear ratio 4		1	
SP065	TLM1	Torque limit 1		10	
SP066	TLM2	Torque limit 2		10	
SP067	TLM3	Torque limit 3		10	
SP068	TLM4	Torque limit 4		10	
SP069	PCMP	Phase alignment completion width		875	
SP070	KDDT	Phase alignment deceleration rate scale		0	
SP071	DIQM	Variable current limit during deceleration, lower limit value		100	

			Motor	SJ-V Series (High-speed)	
Parameter				SJ-VL2.2-02ZT	
No.	Abbrev.	Details	MDS-D-SPJ3-	37NA	
SP072	DIQN	Variable current limit during deceleration, break point speed		3000	
SP073	VGVN	Variable speed gain target value		0	
SP074	VGVS	Variable speed gain change start speed		0	
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	
SP077	IQA	Q axis current lead compensation		4096	
SP078	IDA	D axis current lead compensation		4096	
SP079	IQG	Q axis current gain		1024	
SP080	IDG	D axis current gain		1024	
SP081	IQAL	Q axis current lead compensation low-speed coil		0	
SP082	IDAL	D axis current lead compensation low-speed coil		0	
SP083	IQGL	Q axis current gain low-speed coil		0	
SP084	IDGL	D axis current gain low-speed coil		0	
SP085	LMCk	Lost motion compensation 3 spring constant		0	
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	
SP087	FHz4	Notch filter frequency 4		0	
SP088	FHz5	Notch filter frequency 5		0	
SP089	TMKQ	Spindle output stabilizing gain Q axis		0	
SP090	TMKD	Spindle output stabilizing gain D axis		0	
SP091				0	
:				:	
SP093				0	
SP094	MPV	Magnetic pole error detection speed		0	
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	
SP096	SDW	Speed slowdown allowable width		0	
SP097	RNG1ex	Sub side extension detector resolution		0	
SP098	RNG2ex	Main side extension detector resolution		0	
SP099				0	
:				:	
SP112				0	
SP113	OPLP	Current command value for open loop		0	
SP114	MKT	Coil changeover gate cutoff timer		150	
SP115	MKT2	Coil changeover current limit timer		250	
SP116	MKIL	Coil changeover current limit value		120	
SP117	SETM	Excessive speed deviation timer		12	
SP118	MSFT	Magnetic pole shift amount		0	
SP119	FSP4	Notch filter specifications 4		0	
SP120	FSP5	Notch filter specifications 5		0	
SP121	MP Kpp	Magnetic pole detection position loop gain		0	
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	
SP124	ILMTsp	Magnetic pole detection current limit value		0	
SP125	DA1NO	D/A output ch1 data No.		0	
SP126	DA2NO	D/A output ch2 data No.		0	
SP127	DA1MPY	D/A output ch1 output scale		0	
SP128	DA2MPY	D/A output ch2 output scale		0	
SP129	PM	Motor unique constants (H)		1	
SP130	JM	Motor unique constants (H)		2	
SP131	ATYP	Motor unique constants (H)		80	
SP132				0	
SP133	NR	Motor unique constants (H)		15000	
SP134	NB	Motor unique constants (H)		3000	
SP135	NF	Motor unique constants (H)		3600	
SP136	KT	Motor unique constants (H)		647	
SP137	KF1	Motor unique constants (H)		68	
SP138	KF2	Motor unique constants (H)		3123	
SP139	KF3	Motor unique constants (H)		2560	
SP140	KF4	Motor unique constants (H)		1930	
SP141	KF5	Motor unique constants (H)		105	
SP142	KF6	Motor unique constants (H)		0	
SP143				0	
SP144	TMIL	Motor unique constants (H)		0	
SP145	TMBR	Motor unique constants (H)		139	
SP146	TMBD	Motor unique constants (H)		176	
SP147	KE	Motor unique constants (H)		36	
SP148	LA	Motor unique constants (H)		1758	
SP149	IQSM	Motor unique constants (H)		1082	
SP150	IDSM	Motor unique constants (H)		460	
SP151	R1	Motor unique constants (H)		585	
SP152	TMLR	Motor unique constants (H)		90	
SP153	TMLD	Motor unique constants (H)		120	
SP154	TMLS	Motor unique constants (H)		150	

			Motor	SJ-V Series (High-speed)	
Parameter				SJ-VL2.2-02ZT	
No.	Abbrev.	Details	MDS-D-SPJ3-	37NA	
SP155	KI1	Motor unique constants (H)		1080	
SP156	PCNT	Motor unique constants (H)		0	
SP157				0	
SP158	DNB	Motor unique constants (H)		0	
SP159	SNB	Motor unique constants (H)		0	
SP160	BSD	Motor unique constants (H)		0	
SP161				0	
:				:	
SP164				0	
SP165	NRL	Motor unique constants (L)		0	
SP166	NBL	Motor unique constants (L)		0	
SP167	NFL	Motor unique constants (L)		0	
SP168	KT	Motor unique constants (L)		0	
SP169	KF1L	Motor unique constants (L)		0	
SP170	KF2L	Motor unique constants (L)		0	
SP171	KF3L	Motor unique constants (L)		0	
SP172	KF4L	Motor unique constants (L)		0	
SP173	KF5L	Motor unique constants (L)		0	
SP174	KF6L	Motor unique constants (L)		0	
SP175				0	
SP176	TMILL	Motor unique constants (L)		0	
SP177	TMBRL	Motor unique constants (L)		0	
SP178	TMBDL	Motor unique constants (L)		0	
SP179	KEL	Motor unique constants (L)		0	
SP180	LAL	Motor unique constants (L)		0	
SP181	IQSML	Motor unique constants (L)		0	
SP182	IDSML	Motor unique constants (L)		0	
SP183	R1L	Motor unique constants (L)		0	
SP184				0	
SP185	TMLRL	Motor unique constants (L)		0	
SP186	TMLSL	Motor unique constants (L)		0	
SP187	KI1L	Motor unique constants (L)		0	
SP188	PCNTL	Motor unique constants (L)		0	
SP189				0	
SP190	DNBL	Motor unique constants (L)		0	
SP191	SNBL	Motor unique constants (L)		0	
SP192	BSDL	Motor unique constants (L)		0	
SP193				0	
:				:	
SP224				0	
SP225	SFNC5	Spindle function 5		0000	
SP226	SFNC6	Spindle function 6		0000	
SP227	SFNC7	Spindle function 7		0000	
SP228	SFNC8	Spindle function 8		0000	
SP229	SFNC9	Spindle function 9		0000	
SP230	SFNC10	Spindle function 10		0000	
SP231				0000	
SP232				0000	
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	
SP235	R2H	Temperature compensation gain		0	
SP236	WIH	Temperature compensation time constant		0	
SP237	TCF	Torque command filter		500	
SP238	SSCFEED	Safety observation Safety speed		0	
SP239	SSCRPM	Safety observation Safety motor speed		0	
SP240				0	
:					
SP256					

(5) Standard motor SJ-VL Series (Low-inertia)

Parameter			Motor	SJ-VL Series (Low-inertia)			
				SJ-VL11-05FZT-S01	SJ-VL11-10FZT	SJ-VL11-07ZT	SJ-VL11-07ZT
No.	Abbrev.	Details	MDS-D-SPJ3-	110NA	110NA	110NA	110NA
SP001	PGV	Position loop gain non-interpolation mode		15	15	15	15
SP002	PGN	Position loop gain interpolation mode		33	33	33	33
SP003	PGS	Position loop gain spindle synchronization		15	15	15	15
SP004				0	0	0	0
SP005	VGN1	Speed loop gain 1		150	150	150	150
SP006	VIA1	Speed loop lead compensation 1		1900	1900	1900	1900
SP007	VIL1	Speed loop delay compensation 1		0	0	0	0
SP008	VGN2	Speed loop gain 2		150	150	150	150
SP009	VIA2	Speed loop lead compensation 2		1900	1900	1900	1900
SP010	VIL2	Speed loop delay compensation 2		0	0	0	0
SP011				0	0	0	0
SP012				0	0	0	0
SP013				0	0	0	0
SP014	PY1	Minimum excitation rate 1		50	50	50	50
SP015	PY2	Minimum excitation rate 2		100	100	100	100
SP016	DDT	Phase alignment deceleration rate		20	20	20	20
SP017	SPEC1	Spindle specification 1		0008	0008	0008	0008
SP018	SPEC2	Spindle specification 2		0000	0000	0000	0000
SP019	RNG1	Sub side detector resolution		2000	2000	4000	4000
SP020	RNG2	Main side detector resolution		2000	2000	4000	4000
SP021	OLT	Overload detection time constant		60	60	60	60
SP022	OLL	Overload detection level		120	120	120	120
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	120	120	120
SP024	INP	In-position width		875	875	875	875
SP025	INP2	2nd in-position width		875	875	875	875
SP026	TSP	Maximum motor speed		12000	12000	12000	12000
SP027	ZSP	Motor zero speed		25	25	25	25
SP028	SDTS	Speed detection set value		1200	1200	1200	1200
SP029	SDTR	Speed detection reset width		30	30	30	30
SP030	SDT2	2nd speed detection setting value		0	0	0	0
SP031	MTYP	Motor type		2200	2200	2200	2200
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	0000	0000	0000
SP033	SFNC1	Spindle function 1		0000	0000	0000	0000
SP034	SFNC2	Spindle function 2		0000	0000	0000	0000
SP035	SFNC3	Spindle function 3		1600	1600	1600	1600
SP036	SFNC4	Spindle function 4		0000	0000	0000	0000
SP037	JL	Load inertia scale		100	100	100	100
SP038	FHz1	Notch filter frequency 1		0	0	0	0
SP039	LMCD	Lost motion compensation timing		0	0	0	0
SP040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0
SP041	LMC2	Lost motion compensation 2		0	0	0	0
SP042	OVS2	Overshooting compensation 2		0	0	0	0
SP043	OVS1	Overshooting compensation 1		0	0	0	0
SP044	OBS2	Disturbance observer gain		0	0	0	0
SP045	OBS1	Disturbance observer filter frequency		0	0	0	0
SP046	FHz2	Notch filter frequency 2		0	0	0	0
SP047	EC	Inductive voltage compensation gain		100	100	100	100
SP048	LMC1	Lost motion compensation 1		0	0	0	0
SP049	FFC	Acceleration rate feed forward gain		0	0	0	0
SP050	TOF	Torque offset		0	0	0	0
SP051	DFBT	Dual feed back control time constant		0	0	0	0
SP052	DFBN	Dual feedback control non-sensitive band		0	0	0	0
SP053	ODS	Excessive error detection width (non-interpolation mode)		2400	2400	2400	2400
SP054	ORE	Overrun detection width in closed loop control		0	0	0	0
SP055	EMGx	Max. gate off delay time after emergency stop		20000	20000	20000	20000
SP056	EMGt	Deceleration time constant at emergency stop		300	300	300	300
SP057	GRA1	Spindle side gear ratio 1		1	1	1	1
SP058	GRA2	Spindle side gear ratio 2		1	1	1	1
SP059	GRA3	Spindle side gear ratio 3		1	1	1	1
SP060	GRA4	Spindle side gear ratio 4		1	1	1	1
SP061	GRB1	Motor side gear ratio 1		1	1	1	1
SP062	GRB2	Motor side gear ratio 2		1	1	1	1
SP063	GRB3	Motor side gear ratio 3		1	1	1	1
SP064	GRB4	Motor side gear ratio 4		1	1	1	1
SP065	TLM1	Torque limit 1		10	10	10	10
SP066	TLM2	Torque limit 2		10	10	10	10
SP067	TLM3	Torque limit 3		10	10	10	10
SP068	TLM4	Torque limit 4		10	10	10	10
SP069	PCMP	Phase alignment completion width		875	875	875	875
SP070	KDDT	Phase alignment deceleration rate scale		0	0	0	0
SP071	DIQM	Variable current limit during deceleration, lower limit value		75	80	65	65

Parameter			Motor	SJ-VL Series (Low-inertia)			
				SJ-VL11-05FZT-S01	SJ-VL11-10FZT	SJ-VL11-07ZT	SJ-VL11-07ZT
No.	Abbrev.	Details	MDS-D-SPJ3-	110NA	110NA	110NA	110NA
SP072	DIQN	Variable current limit during deceleration, break point speed		15000	12500	6600	6600
SP073	VGVN	Variable speed gain target value		0	0	0	0
SP074	VGVS	Variable speed gain change start speed		0	0	0	0
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	0	0	0
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	0	0	0
SP077	IQA	Q axis current lead compensation		4096	4096	4096	4096
SP078	IDA	D axis current lead compensation		4096	4096	4096	4096
SP079	IQG	Q axis current gain		1024	1024	1024	1024
SP080	IDG	D axis current gain		1024	1024	1024	1024
SP081	IQAL	Q axis current lead compensation low-speed coil		0	0	0	0
SP082	IDAL	D axis current lead compensation low-speed coil		0	0	0	0
SP083	IQGL	Q axis current gain low-speed coil		0	0	0	0
SP084	IDGL	D axis current gain low-speed coil		0	0	0	0
SP085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0
SP087	FHz4	Notch filter frequency 4		0	0	0	0
SP088	FHz5	Notch filter frequency 5		0	0	0	0
SP089	TMKQ	Spindle output stabilizing gain Q axis		0	0	0	0
SP090	TMKD	Spindle output stabilizing gain D axis		0	0	0	0
SP091				0	0	0	0
:				:	:	:	:
SP093				0	0	0	0
SP094	MPV	Magnetic pole error detection speed		0	0	0	0
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	0	0	0
SP096	SDW	Speed slowdown allowable width		0	0	0	0
SP097	RNG1ex	Sub side extension detector resolution		0	0	0	0
SP098	RNG2ex	Main side extension detector resolution		0	0	0	0
SP099				0	0	0	0
:				:	:	:	:
SP112				0	0	0	0
SP113	OPLP	Current command value for open loop		0	0	0	0
SP114	MKT	Coil changeover gate cutoff timer		150	150	150	150
SP115	MKT2	Coil changeover current limit timer		250	250	250	250
SP116	MKIL	Coil changeover current limit value		120	120	120	120
SP117	SETM	Excessive speed deviation timer		12	12	12	12
SP118	MSFT	Magnetic pole shift amount		0	0	0	0
SP119	FSP4	Notch filter specifications 4		0	0	0	0
SP120	FSP5	Notch filter specifications 5		0	0	0	0
SP121	MP Kpp	Magnetic pole detection position loop gain		0	0	0	0
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	0	0	0
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	0	0	0
SP124	ILMTsp	Magnetic pole detection current limit value		0	0	0	0
SP125	DA1NO	D/A output ch1 data No.		0	0	0	0
SP126	DA2NO	D/A output ch2 data No.		0	0	0	0
SP127	DA1MPY	D/A output ch1 output scale		0	0	0	0
SP128	DA2MPY	D/A output ch2 output scale		0	0	0	0
SP129	PM	Motor unique constants (H)		1	1	1	1
SP130	JM	Motor unique constants (H)		2	5	18	18
SP131	ATYP	Motor unique constants (H)		160	160	160	160
SP132				0	0	0	0
SP133	NR	Motor unique constants (H)		20000	15000	12000	12000
SP134	NB	Motor unique constants (H)		6000	5000	2200	2200
SP135	NF	Motor unique constants (H)		7200	6000	2640	2640
SP136	KT	Motor unique constants (H)		341	451	1019	1019
SP137	KF1	Motor unique constants (H)		68	68	68	68
SP138	KF2	Motor unique constants (H)		2897	2961	2888	2888
SP139	KF3	Motor unique constants (H)		3082	2847	3072	3072
SP140	KF4	Motor unique constants (H)		1855	1890	1858	1858
SP141	KF5	Motor unique constants (H)		87	192	300	300
SP142	KF6	Motor unique constants (H)		0	0	0	0
SP143				0	0	0	0
SP144	TMIL	Motor unique constants (H)		0	0	0	0
SP145	TMBR	Motor unique constants (H)		172	144	149	149
SP146	TMBD	Motor unique constants (H)		224	189	197	197
SP147	KE	Motor unique constants (H)		42	38	29	29
SP148	LA	Motor unique constants (H)		400	431	641	641
SP149	IQSM	Motor unique constants (H)		5131	4659	4686	4686
SP150	IDSM	Motor unique constants (H)		1260	1375	1593	1593
SP151	R1	Motor unique constants (H)		130	64	80	80
SP152	TMLR	Motor unique constants (H)		90	90	90	90
SP153	TMLD	Motor unique constants (H)		120	120	120	120

Parameter			Motor	SJ-VL Series (Low-inertia)			
				SJ-VL11-05FZT-S01	SJ-VL11-10FZT	SJ-VL11-07ZT	SJ-VL11-07ZT
No.	Abbrev.	Details	MDS-D-SPJ3-	110NA	110NA	110NA	110NA
SP154	TMLS	Motor unique constants (H)		150	150	150	150
SP155	KI1	Motor unique constants (H)		1068	1052	1042	1042
SP156	PCNT	Motor unique constants (H)		0	0	0	0
SP157				0	0	0	0
SP158	DNB	Motor unique constants (H)		0	0	0	0
SP159	SNB	Motor unique constants (H)		5000	1700	1500	0
SP160	BSD	Motor unique constants (H)		0	0	0	0
SP161				0	0	0	0
:				:	:	:	:
SP164				0	0	0	0
SP165	NRL	Motor unique constants (L)		0	0	0	0
SP166	NBL	Motor unique constants (L)		0	0	0	0
SP167	NFL	Motor unique constants (L)		0	0	0	0
SP168	KT	Motor unique constants (L)		0	0	0	0
SP169	KF1L	Motor unique constants (L)		0	0	0	0
SP170	KF2L	Motor unique constants (L)		0	0	0	0
SP171	KF3L	Motor unique constants (L)		0	0	0	0
SP172	KF4L	Motor unique constants (L)		0	0	0	0
SP173	KF5L	Motor unique constants (L)		0	0	0	0
SP174	KF6L	Motor unique constants (L)		0	0	0	0
SP175				0	0	0	0
SP176	TMILL	Motor unique constants (L)		0	0	0	0
SP177	TMBRL	Motor unique constants (L)		0	0	0	0
SP178	TMBDL	Motor unique constants (L)		0	0	0	0
SP179	KEL	Motor unique constants (L)		0	0	0	0
SP180	LAL	Motor unique constants (L)		0	0	0	0
SP181	IQSML	Motor unique constants (L)		0	0	0	0
SP182	IDSML	Motor unique constants (L)		0	0	0	0
SP183	R1L	Motor unique constants (L)		0	0	0	0
SP184				0	0	0	0
SP185	TMLRL	Motor unique constants (L)		0	0	0	0
SP186	TMLSL	Motor unique constants (L)		0	0	0	0
SP187	KI1L	Motor unique constants (L)		0	0	0	0
SP188	PCNTL	Motor unique constants (L)		0	0	0	0
SP189				0	0	0	0
SP190	DNBL	Motor unique constants (L)		0	0	0	0
SP191	SNBL	Motor unique constants (L)		0	0	0	0
SP192	BSDL	Motor unique constants (L)		0	0	0	0
SP193				0	0	0	0
:				:	:	:	:
SP224				0	0	0	0
SP225	SFNC5	Spindle function 5		0000	0000	0000	0000
SP226	SFNC6	Spindle function 6		0000	0000	0000	0000
SP227	SFNC7	Spindle function 7		0000	0000	0000	0000
SP228	SFNC8	Spindle function 8		0000	0000	0000	0000
SP229	SFNC9	Spindle function 9		0000	0000	0000	0000
SP230	SFNC10	Spindle function 10		0000	0000	0000	0000
SP231				0000	0000	0000	0000
SP232				0000	0000	0000	0000
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	0	0	0
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	0	0	0
SP235	R2H	Temperature compensation gain		0	0	0	0
SP236	WIH	Temperature compensation time constant		0	0	0	0
SP237	TCF	Torque command filter		500	500	500	500
SP238	SSCFEED	Safety observation Safety speed		0	0	0	0
SP239	SSCRPM	Safety observation Safety motor speed		0	0	0	0
SP240				0	0	0	0
:							
SP256							

(6) Tool spindle motor HF Series

Parameter			Motor	Tool spindle motor HF Series									
				HF75	HF105	HF54	HF104	HF154	HF224	HF204	HF123	HF223	HF303
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	075NA	075NA	110NA	37NA	37NA	37NA	075NA	22NA	37NA
SP001	PGV	Position loop gain non-interpolation mode		15	15	15	15	15	15	15	15	15	15
SP002	PGN	Position loop gain interpolation mode		33	33	33	33	33	33	33	33	33	33
SP003	PGS	Position loop gain spindle synchronization		15	15	15	15	15	15	15	15	15	15
SP004				0	0	0	0	0	0	0	0	0	0
SP005	VGN1	Speed loop gain 1		150	150	150	150	150	150	150	150	150	150
SP006	VIA1	Speed loop lead compensation 1		1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
SP007	VIL1	Speed loop delay compensation 1		0	0	0	0	0	0	0	0	0	0
SP008	VGN2	Speed loop gain 2		150	150	150	150	150	150	150	150	150	150
SP009	VIA2	Speed loop lead compensation 2		1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
SP010	VIL2	Speed loop delay compensation 2		0	0	0	0	0	0	0	0	0	0
SP011				0	0	0	0	0	0	0	0	0	0
SP012				0	0	0	0	0	0	0	0	0	0
SP013				0	0	0	0	0	0	0	0	0	0
SP014	PY1	Minimum excitation rate 1		0	0	0	0	0	0	0	0	0	0
SP015	PY2	Minimum excitation rate 2		0	0	0	0	0	0	0	0	0	0
SP016	DDT	Phase alignment deceleration rate		20	20	20	20	20	20	20	20	20	20
SP017	SPEC1	Spindle specification 1		4008	4008	4008	4008	4008	4008	4008	4008	4008	4008
SP018	SPEC2	Spindle specification 2		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP019	RNG1	Sub side detector resolution		260	260	260	260	260	260	260	260	260	260
SP020	RNG2	Main side detector resolution		260	260	260	260	260	260	260	260	260	260
SP021	OLT	Overload detection time constant		300	300	300	300	300	300	300	300	300	300
SP022	OLL	Overload detection level		100	100	100	100	100	100	100	100	100	100
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	120	120	120	120	120	120	120	120	120
SP024	INP	In-position width		875	875	875	875	875	875	875	875	875	875
SP025	INP2	2nd in-position width		875	875	875	875	875	875	875	875	875	875
SP026	TSP	Maximum motor speed		4000	4000	3000	3000	3000	3000	3000	2000	2000	2000
SP027	ZSP	Motor zero speed		25	25	25	25	25	25	25	25	25	25
SP028	SDTS	Speed detection set value		400	400	300	300	300	300	300	200	200	200
SP029	SDTR	Speed detection reset width		30	30	30	30	30	30	30	30	30	30
SP030	SDT2	2nd speed detection setting value		0	0	0	0	0	0	0	0	0	0
SP031	MTYP	Motor type		2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP033	SFNC1	Spindle function 1		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP034	SFNC2	Spindle function 2		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP035	SFNC3	Spindle function 3		1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
SP036	SFNC4	Spindle function 4		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP037	JL	Load inertia scale		100	100	100	100	100	100	100	100	100	100
SP038	FHz1	Notch filter frequency 1		0	0	0	0	0	0	0	0	0	0
SP039	LMCD	Lost motion compensation timing		0	0	0	0	0	0	0	0	0	0
SP040	LMCT	Lost motion compensation non-sensitive band		0	0	0	0	0	0	0	0	0	0
SP041	LMC2	Lost motion compensation 2		0	0	0	0	0	0	0	0	0	0
SP042	OVS2	Overshooting compensation 2		0	0	0	0	0	0	0	0	0	0
SP043	OVS1	Overshooting compensation 1		0	0	0	0	0	0	0	0	0	0
SP044	OBS2	Disturbance observer gain		0	0	0	0	0	0	0	0	0	0
SP045	OBS1	Disturbance observer filter frequency		0	0	0	0	0	0	0	0	0	0
SP046	FHz2	Notch filter frequency 2		0	0	0	0	0	0	0	0	0	0
SP047	EC	Inductive voltage compensation gain		100	100	100	100	100	100	100	100	100	100
SP048	LMC1	Lost motion compensation 1		0	0	0	0	0	0	0	0	0	0
SP049	FFC	Acceleration rate feed forward gain		0	0	0	0	0	0	0	0	0	0
SP050	TOF	Torque offset		0	0	0	0	0	0	0	0	0	0
SP051	DFBT	Dual feed back control time constant		0	0	0	0	0	0	0	0	0	0
SP052	DFBN	Dual feedback control non-sensitive band		0	0	0	0	0	0	0	0	0	0
SP053	ODS	Excessive error detection width (non-interpolation mode)		800	800	600	600	600	600	600	400	400	400
SP054	ORE	Overrun detection width in closed loop control		0	0	0	0	0	0	0	0	0	0
SP055	EMGx	Max. gate off delay time after emergency stop		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
SP056	EMGt	Deceleration time constant at emergency stop		300	300	300	300	300	300	300	300	300	300
SP057	GRA1	Spindle side gear ratio 1		1	1	1	1	1	1	1	1	1	1
SP058	GRA2	Spindle side gear ratio 2		1	1	1	1	1	1	1	1	1	1
SP059	GRA3	Spindle side gear ratio 3		1	1	1	1	1	1	1	1	1	1
SP060	GRA4	Spindle side gear ratio 4		1	1	1	1	1	1	1	1	1	1
SP061	GRB1	Motor side gear ratio 1		1	1	1	1	1	1	1	1	1	1
SP062	GRB2	Motor side gear ratio 2		1	1	1	1	1	1	1	1	1	1
SP063	GRB3	Motor side gear ratio 3		1	1	1	1	1	1	1	1	1	1
SP064	GRB4	Motor side gear ratio 4		1	1	1	1	1	1	1	1	1	1
SP065	TLM1	Torque limit 1		10	10	10	10	10	10	10	10	10	10
SP066	TLM2	Torque limit 2		10	10	10	10	10	10	10	10	10	10
SP067	TLM3	Torque limit 3		10	10	10	10	10	10	10	10	10	10
SP068	TLM4	Torque limit 4		10	10	10	10	10	10	10	10	10	10
SP069	PCMP	Phase alignment completion width		875	875	875	875	875	875	875	875	875	875
SP070	KDDT	Phase alignment deceleration rate scale		0	0	0	0	0	0	0	0	0	0
SP071	DIQM	Variable current limit during deceleration, lower limit value		60	60	60	60	60	60	60	60	60	60

Parameter			Motor	Tool spindle motor HF Series									
				HF75	HF105	HF54	HF104	HF154	HF224	HF204	HF123	HF223	HF303
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	075NA	075NA	110NA	37NA	37NA	37NA	075NA	22NA	37NA
SP072	DIQN	Variable current limit during deceleration, break point speed		1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
SP073	VGVN	Variable speed gain target value		0	0	0	0	0	0	0	0	0	0
SP074	VGVS	Variable speed gain change start speed		0	0	0	0	0	0	0	0	0	0
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	0	0	0	0	0	0	0	0	0
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	0	0	0	0	0	0	0	0	0
SP077	IQA	Q axis current lead compensation		1700	2100	700	820	630	2700	410	900	1400	1900
SP078	IDA	D axis current lead compensation		1700	2100	700	820	630	2700	410	900	1400	1900
SP079	IQG	Q axis current gain		510	850	850	820	760	3400	830	1070	1750	3050
SP080	IDG	D axis current gain		510	850	850	820	760	3400	830	1070	1750	3050
SP081	IQAL	Q axis current lead compensation low-speed coil		0	0	0	0	0	0	0	0	0	0
SP082	IDAL	D axis current lead compensation low-speed coil		0	0	0	0	0	0	0	0	0	0
SP083	IQGL	Q axis current gain low-speed coil		0	0	0	0	0	0	0	0	0	0
SP084	IDGL	D axis current gain low-speed coil		0	0	0	0	0	0	0	0	0	0
SP085	LMCk	Lost motion compensation 3 spring constant		0	0	0	0	0	0	0	0	0	0
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0	0	0	0	0	0	0	0
SP087	FHz4	Notch filter frequency 4		0	0	0	0	0	0	0	0	0	0
SP088	FHz5	Notch filter frequency 5		0	0	0	0	0	0	0	0	0	0
SP089	TMKQ	Spindle output stabilizing gain Q axis		100	100	100	100	100	100	100	100	100	100
SP090	TMKD	Spindle output stabilizing gain D axis		100	100	100	100	100	100	100	100	100	100
SP091				0	0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:	:
SP093				0	0	0	0	0	0	0	0	0	0
SP094	MPV	Magnetic pole error detection speed		0	0	0	0	0	0	0	0	0	0
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	0	0	0	0	0	0	0	0	0
SP096	SDW	Speed slowdown allowable width		0	0	0	0	0	0	0	0	0	0
SP097	RNG1ex	Sub side extension detector resolution		0	0	0	0	0	0	0	0	0	0
SP098	RNG2ex	Main side extension detector resolution		0	0	0	0	0	0	0	0	0	0
SP099				0	0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:	:
SP112				0	0	0	0	0	0	0	0	0	0
SP113	OPLP	Current command value for open loop		0	0	0	0	0	0	0	0	0	0
SP114	MKT	Coil changeover gate cutoff timer		0	0	0	0	0	0	0	0	0	0
SP115	MKT2	Coil changeover current limit timer		0	0	0	0	0	0	0	0	0	0
SP116	MKIL	Coil changeover current limit value		0	0	0	0	0	0	0	0	0	0
SP117	SETM	Excessive speed deviation timer		12	12	12	12	12	12	12	12	12	12
SP118	MSFT	Magnetic pole shift amount		0	0	0	0	0	0	0	0	0	0
SP119	FSP4	Notch filter specifications 4		0	0	0	0	0	0	0	0	0	0
SP120	FSP5	Notch filter specifications 5		0	0	0	0	0	0	0	0	0	0
SP121	MP Kpp	Magnetic pole detection position loop gain		0	0	0	0	0	0	0	0	0	0
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	0	0	0	0	0	0	0	0	0
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	0	0	0	0	0	0	0	0	0
SP124	ILMTsp	Magnetic pole detection current limit value		0	0	0	0	0	0	0	0	0	0
SP125	DA1NO	D/A output ch1 data No.		0	0	0	0	0	0	0	0	0	0
SP126	DA2NO	D/A output ch2 data No.		0	0	0	0	0	0	0	0	0	0
SP127	DA1MPY	D/A output ch1 output scale		0	0	0	0	0	0	0	0	0	0
SP128	DA2MPY	D/A output ch2 output scale		0	0	0	0	0	0	0	0	0	0
SP129	PM	Motor unique constants (H)		4	4	4	4	4	4	4	4	4	4
SP130	JM	Motor unique constants (H)		1	1	1	1	2	2	4	1	2	8
SP131	ATYP	Motor unique constants (H)		20	20	20	40	80	80	80	20	40	80
SP132				0	0	0	0	0	0	0	0	0	0
SP133	NR	Motor unique constants (H)		5000	5000	4000	4000	4000	4000	4000	3000	3000	3000
SP134	NB	Motor unique constants (H)		4000	4000	3000	3000	3000	3000	3000	2000	2000	2000
SP135	NF	Motor unique constants (H)		0	0	0	0	0	0	0	0	0	0
SP136	KT	Motor unique constants (H)		626	652	904	1284	818	824	1022	1102	1167	1339
SP137	KF1	Motor unique constants (H)		4096	4096	4096	4096	4096	4096	4096	4096	4096	4096
SP138	KF2	Motor unique constants (H)		1024	1024	1024	1024	1024	1024	1024	1024	1024	1024
SP139	KF3	Motor unique constants (H)		46	124	43	105	163	221	148	79	158	203
SP140	KF4	Motor unique constants (H)		1024	1024	1024	1024	1024	1024	1024	1024	1024	1024
SP141	KF5	Motor unique constants (H)		4139	1674	5311	2301	1480	1035	1819	3951	2007	1850
SP142	KF6	Motor unique constants (H)		0	0	0	0	0	0	0	0	0	0
SP143				0	0	0	0	0	0	0	0	0	0
SP144	TMIL	Motor unique constants (H)		1404	2481	1053	2384	3812	5445	3315	1936	3872	5082
SP145	TMBR	Motor unique constants (H)		899	331	899	899	899	899	899	530	498	899
SP146	TMBD	Motor unique constants (H)		810	485	832	842	851	855	871	750	619	872
SP147	KE	Motor unique constants (H)		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SP148	LA	Motor unique constants (H)		6600	2670	8470	3670	2360	1650	2900	6300	3200	2950
SP149	IQSM	Motor unique constants (H)		286	366	176	248	584	850	623	520	900	1070
SP150	IDSM	Motor unique constants (H)		0	0	0	0	0	0	0	0	0	0
SP151	R1	Motor unique constants (H)		2180	1200	1690	630	340	220	250	980	420	180
SP152	TMLR	Motor unique constants (H)		392	339	764	934	712	536	731	238	257	359
SP153	TMLD	Motor unique constants (H)		392	339	764	934	712	536	731	238	257	359
SP154	TMLS	Motor unique constants (H)		490	423	955	1169	890	671	915	298	322	449

3 Setup

			Motor	Tool spindle motor HF Series									
Parameter				HF75	HF105	HF54	HF104	HF154	HF224	HF204	HF123	HF223	HF303
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	075NA	075NA	110NA	37NA	37NA	37NA	075NA	22NA	37NA
SP155	KI1	Motor unique constants (H)		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SP156	PCNT	Motor unique constants (H)		100	100	100	100	100	100	100	100	100	100
SP157				0	0	0	0	0	0	0	0	0	0
SP158	DNB	Motor unique constants (H)		0	0	0	0	0	0	0	0	0	0
SP159	SNB	Motor unique constants (H)		0	0	0	0	0	0	0	0	0	0
SP160	BSD	Motor unique constants (H)		0	0	0	0	0	0	0	0	0	0
SP161				0	0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:	:
SP164				0	0	0	0	0	0	0	0	0	0
SP165	NRL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP166	NBL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP167	NFL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP168	KT	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP169	KF1L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP170	KF2L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP171	KF3L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP172	KF4L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP173	KF5L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP174	KF6L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP175				0	0	0	0	0	0	0	0	0	0
SP176	TMILL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP177	TMBRL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP178	TMBDL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP179	KEL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP180	LAL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP181	IQSML	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP182	IDSML	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP183	R1L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP184				0	0	0	0	0	0	0	0	0	0
SP185	TMLRL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP186	TMLSL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP187	KI1L	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP188	PCNTL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP189				0	0	0	0	0	0	0	0	0	0
SP190	DNBL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP191	SNBL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP192	BSDL	Motor unique constants (L)		0	0	0	0	0	0	0	0	0	0
SP193				0	0	0	0	0	0	0	0	0	0
:				:	:	:	:	:	:	:	:	:	:
SP224				0	0	0	0	0	0	0	0	0	0
SP225	SFNC5	Spindle function 5		0004	0004	0004	0004	0004	0004	0004	0004	0004	0004
SP226	SFNC6	Spindle function 6		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP227	SFNC7	Spindle function 7		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP228	SFNC8	Spindle function 8		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP229	SFNC9	Spindle function 9		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP230	SFNC10	Spindle function 10		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP231				0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP232				0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	0	0	0	0	0	0	0	0	0
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	0	0	0	0	0	0	0	0	0
SP235	R2H	Temperature compensation gain		0	0	0	0	0	0	0	0	0	0
SP236	WIH	Temperature compensation time constant		0	0	0	0	0	0	0	0	0	0
SP237	TCF	Torque command filter		500	500	500	500	500	500	500	500	500	500
SP238	SSCFEED	Safety observation Safety speed		0	0	0	0	0	0	0	0	0	0
SP239	SSCRPM	Safety observation Safety motor speed		0	0	0	0	0	0	0	0	0	0
SP240				0	0	0	0	0	0	0	0	0	0
:													
SP256													

(7) Tool spindle motor HF-KP Series

Parameter			Motor	Tool spindle motor HF-KP Series		
				HF-KP46	HF-KP56	HF-KP96
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	075NA	075NA
SP001	PGV	Position loop gain non-interpolation mode		15	15	15
SP002	PGN	Position loop gain interpolation mode		33	33	33
SP003	PGS	Position loop gain spindle synchronization		15	15	15
SP004				0	0	0
SP005	VGN1	Speed loop gain 1		10	10	20
SP006	VIA1	Speed loop lead compensation 1		40	70	270
SP007	VIL1	Speed loop delay compensation 1		0	0	0
SP008	VGN2	Speed loop gain 2		10	10	20
SP009	VIA2	Speed loop lead compensation 2		40	70	270
SP010	VIL2	Speed loop delay compensation 2		0	0	0
SP011				0	0	0
SP012				0	0	0
SP013				0	0	0
SP014	PY1	Minimum excitation rate 1		0	0	0
SP015	PY2	Minimum excitation rate 2		0	0	0
SP016	DDT	Phase alignment deceleration rate		20	20	20
SP017	SPEC1	Spindle specification 1		4008	4008	4008
SP018	SPEC2	Spindle specification 2		0000	0000	0000
SP019	RNG1	Sub side detector resolution		260	260	260
SP020	RNG2	Main side detector resolution		260	260	260
SP021	OLT	Overload detection time constant		40	40	40
SP022	OLL	Overload detection level		100	100	100
SP023	OD1	Excessive error detection width (interpolation mode - spindle synchronization)		120	120	120
SP024	INP	In-position width		875	875	875
SP025	INP2	2nd in-position width		875	875	875
SP026	TSP	Maximum motor speed		6000	6000	6000
SP027	ZSP	Motor zero speed		25	25	25
SP028	SDTS	Speed detection set value		600	600	600
SP029	SDTR	Speed detection reset width		30	30	30
SP030	SDT2	2nd speed detection setting value		0	0	0
SP031	MTYP	Motor type		2200	2200	2200
SP032	PTYP	Power supply type/ Regenerative resistor type		0000	0000	0000
SP033	SFNC1	Spindle function 1		0000	0000	0000
SP034	SFNC2	Spindle function 2		0100	0100	0100
SP035	SFNC3	Spindle function 3		1600	1600	1600
SP036	SFNC4	Spindle function 4		0000	0000	0000
SP037	JL	Load inertia scale		100	100	100
SP038	FHz1	Notch filter frequency 1		0	0	0
SP039	LMCD	Lost motion compensation timing		0	0	0
SP040	LMCT	Lost motion compensation non-sensitive band		0	0	0
SP041	LMC2	Lost motion compensation 2		0	0	0
SP042	OVS2	Overshooting compensation 2		0	0	0
SP043	OVS1	Overshooting compensation 1		0	0	0
SP044	OBS2	Disturbance observer gain		0	0	0
SP045	OBS1	Disturbance observer filter frequency		0	0	0
SP046	FHz2	Notch filter frequency 2		0	0	0
SP047	EC	Inductive voltage compensation gain		100	100	100
SP048	LMC1	Lost motion compensation 1		0	0	0
SP049	FFC	Acceleration rate feed forward gain		0	0	0
SP050	TOF	Torque offset		0	0	0
SP051	DFBT	Dual feed back control time constant		0	0	0
SP052	DFBN	Dual feedback control non-sensitive band		0	0	0
SP053	ODS	Excessive error detection width (non-interpolation mode)		1200	1200	1200
SP054	ORE	Overrun detection width in closed loop control		0	0	0
SP055	EMGx	Max. gate off delay time after emergency stop		20000	20000	20000
SP056	EMGt	Deceleration time constant at emergency stop		300	300	300
SP057	GRA1	Spindle side gear ratio 1		1	1	1
SP058	GRA2	Spindle side gear ratio 2		1	1	1
SP059	GRA3	Spindle side gear ratio 3		1	1	1
SP060	GRA4	Spindle side gear ratio 4		1	1	1
SP061	GRB1	Motor side gear ratio 1		1	1	1
SP062	GRB2	Motor side gear ratio 2		1	1	1
SP063	GRB3	Motor side gear ratio 3		1	1	1
SP064	GRB4	Motor side gear ratio 4		1	1	1
SP065	TLM1	Torque limit 1		10	10	10
SP066	TLM2	Torque limit 2		10	10	10
SP067	TLM3	Torque limit 3		10	10	10
SP068	TLM4	Torque limit 4		10	10	10
SP069	PCMP	Phase alignment completion width		875	875	875
SP070	KDDT	Phase alignment deceleration rate scale		0	0	0
SP071	DIQM	Variable current limit during deceleration, lower limit value		100	100	100

Parameter			Motor	Tool spindle motor HF-KP Series		
				HF-KP46	HF-KP56	HF-KP96
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	075NA	075NA
SP072	DIQN	Variable current limit during deceleration, break point speed		3000	3000	3000
SP073	VGVN	Variable speed gain target value		0	0	0
SP074	VGVS	Variable speed gain change start speed		0	0	0
SP075	DWSH	Slip compensation scale during regeneration high-speed coil		0	0	0
SP076	DWSL	Slip compensation scale during regeneration low-speed coil		0	0	0
SP077	IQA	Q axis current lead compensation		1000	1950	600
SP078	IDA	D axis current lead compensation		1000	1950	600
SP079	IQG	Q axis current gain		800	1024	900
SP080	IDG	D axis current gain		800	1024	900
SP081	IQAL	Q axis current lead compensation low-speed coil		0	0	0
SP082	IDAL	D axis current lead compensation low-speed coil		0	0	0
SP083	IQGL	Q axis current gain low-speed coil		0	0	0
SP084	IDGL	D axis current gain low-speed coil		0	0	0
SP085	LMCk	Lost motion compensation 3 spring constant		0	0	0
SP086	LMCc	Lost motion compensation 3 viscous coefficient		0	0	0
SP087	FHz4	Notch filter frequency 4		0	0	0
SP088	FHz5	Notch filter frequency 5		0	0	0
SP089	TMKQ	Spindle output stabilizing gain Q axis		100	100	100
SP090	TMKD	Spindle output stabilizing gain D axis		100	100	100
SP091				0	0	0
:				:	:	:
SP093				0	0	0
SP094	MPV	Magnetic pole error detection speed		0	0	0
SP095	VIAX	Lead compensation scale during high-response acceleration/deceleration		0	0	0
SP096	SDW	Speed slowdown allowable width		0	0	0
SP097	RNG1ex	Sub side extension detector resolution		0	0	0
SP098	RNG2ex	Main side extension detector resolution		0	0	0
SP099				0	0	0
:				:	:	:
SP112				0	0	0
SP113	OPLP	Current command value for open loop		0	0	0
SP114	MKT	Coil changeover gate cutoff timer		0	0	0
SP115	MKT2	Coil changeover current limit timer		0	0	0
SP116	MKIL	Coil changeover current limit value		0	0	0
SP117	SETM	Excessive speed deviation timer		12	12	12
SP118	MSFT	Magnetic pole shift amount		0	0	0
SP119	FSP4	Notch filter specifications 4		0	0	0
SP120	FSP5	Notch filter specifications 5		0	0	0
SP121	MP Kpp	Magnetic pole detection position loop gain		0	0	0
SP122	MP Kvp	Magnetic pole detection speed loop gain		0	0	0
SP123	MP Kvi	Magnetic pole detection speed loop lead compensation		0	0	0
SP124	ILMTsp	Magnetic pole detection current limit value		0	0	0
SP125	DA1NO	D/A output ch1 data No.		0	0	0
SP126	DA2NO	D/A output ch2 data No.		0	0	0
SP127	DA1MPY	D/A output ch1 output scale		0	0	0
SP128	DA2MPY	D/A output ch2 output scale		0	0	0
SP129	PM	Motor unique constants (H)		3	3	3
SP130	JM	Motor unique constants (H)		1	1	1
SP131	ATYP	Motor unique constants (H)		20	20	20
SP132				0	0	0
SP133	NR	Motor unique constants (H)		8000	8000	8000
SP134	NB	Motor unique constants (H)		6000	6000	6000
SP135	NF	Motor unique constants (H)		0	0	0
SP136	KT	Motor unique constants (H)		424	442	398
SP137	KF1	Motor unique constants (H)		4096	4096	4096
SP138	KF2	Motor unique constants (H)		1024	1024	1024
SP139	KF3	Motor unique constants (H)		25	66	74
SP140	KF4	Motor unique constants (H)		1024	1024	1024
SP141	KF5	Motor unique constants (H)		5345	2022	1806
SP142	KF6	Motor unique constants (H)		0	0	0
SP143				0	0	0
SP144	TMIL	Motor unique constants (H)		714	1609	2105
SP145	TMBR	Motor unique constants (H)		828	600	899
SP146	TMBD	Motor unique constants (H)		800	822	868
SP147	KE	Motor unique constants (H)		1000	1000	1000
SP148	LA	Motor unique constants (H)		11366	4299	3841
SP149	IQSM	Motor unique constants (H)		150	180	360
SP150	IDSM	Motor unique constants (H)		0	0	0
SP151	R1	Motor unique constants (H)		5062	1484	548
SP152	TMLR	Motor unique constants (H)		330	565	388
SP153	TMLD	Motor unique constants (H)		330	565	388
SP154	TMLS	Motor unique constants (H)		367	628	431

			Motor	Tool spindle motor HF-KP Series		
Parameter				HF-KP46	HF-KP56	HF-KP96
No.	Abbrev.	Details	MDS-D-SPJ3-	075NA	075NA	075NA
SP155	KI1	Motor unique constants (H)		1000	1000	1000
SP156	PCNT	Motor unique constants (H)		100	100	100
SP157				0	0	0
SP158	DNB	Motor unique constants (H)		0	0	0
SP159	SNB	Motor unique constants (H)		0	0	0
SP160	BSD	Motor unique constants (H)		0	0	0
SP161				0	0	0
:				:	:	:
SP164				0	0	0
SP165	NRL	Motor unique constants (L)		0	0	0
SP166	NBL	Motor unique constants (L)		0	0	0
SP167	NFL	Motor unique constants (L)		0	0	0
SP168	KT	Motor unique constants (L)		0	0	0
SP169	KF1L	Motor unique constants (L)		0	0	0
SP170	KF2L	Motor unique constants (L)		0	0	0
SP171	KF3L	Motor unique constants (L)		0	0	0
SP172	KF4L	Motor unique constants (L)		0	0	0
SP173	KF5L	Motor unique constants (L)		0	0	0
SP174	KF6L	Motor unique constants (L)		0	0	0
SP175				0	0	0
SP176	TMILL	Motor unique constants (L)		0	0	0
SP177	TMBRL	Motor unique constants (L)		0	0	0
SP178	TMBDL	Motor unique constants (L)		0	0	0
SP179	KEL	Motor unique constants (L)		0	0	0
SP180	LAL	Motor unique constants (L)		0	0	0
SP181	IQSML	Motor unique constants (L)		0	0	0
SP182	IDSML	Motor unique constants (L)		0	0	0
SP183	R1L	Motor unique constants (L)		0	0	0
SP184				0	0	0
SP185	TMLRL	Motor unique constants (L)		0	0	0
SP186	TMLSL	Motor unique constants (L)		0	0	0
SP187	KI1L	Motor unique constants (L)		0	0	0
SP188	PCNTL	Motor unique constants (L)		0	0	0
SP189				0	0	0
SP190	DNBL	Motor unique constants (L)		0	0	0
SP191	SNBL	Motor unique constants (L)		0	0	0
SP192	BSDL	Motor unique constants (L)		0	0	0
SP193				0	0	0
:				:	:	:
SP224				0	0	0
SP225	SFNC5	Spindle function 5		0004	0004	0004
SP226	SFNC6	Spindle function 6		0000	0000	0000
SP227	SFNC7	Spindle function 7		0000	0000	0000
SP228	SFNC8	Spindle function 8		0000	0000	0000
SP229	SFNC9	Spindle function 9		0000	0000	0000
SP230	SFNC10	Spindle function 10		0000	0000	0000
SP231				0000	0000	0000
SP232				0000	0000	0000
SP233	IVC/Icx	Voltage non-sensitive band compensation/ Current bias cx		0	0	0
SP234	Icy/Ib1	Current bias cy/Current bias b1		0	0	0
SP235	R2H	Temperature compensation gain		0	0	0
SP236	WIH	Temperature compensation time constant		0	0	0
SP237	TCF	Torque command filter		500	500	500
SP238	SSCFEED	Safety observation Safety speed		0	0	0
SP239	SSCRPM	Safety observation Safety motor speed		0	0	0
SP240				0	0	0
:						
SP256						

3-3-3 Spindle specification parameters

CAUTION !

The configuration of the spindle specification parameters (#3001 to #3138) can differ depending on the NC.

This Instruction Manual explains using the configuration of the parameters for M700V/M70V Series.

The parameters with "(PR)" requires the CNC to be turned OFF after the settings. Turn the power OFF and ON to enable the parameter settings.

【#3001】 slimt 1 Limit rotation speed (Gear: 00)

Set the spindle speed for maximum motor speed with gear 00.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3002】 slimt 2 Limit rotation speed (Gear: 01)

Set the spindle speed for maximum motor speed with gear 01.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3003】 slimt 3 Limit rotation speed (Gear: 10)

Set the spindle speed for maximum motor speed with gear 10.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3004】 slimt 4 Limit rotation speed (Gear: 11)

Set the spindle speed for maximum motor speed with gear 11.
(Set the spindle speed for the S analog output 10V.)

---Setting range---
0 to 99999 (r/min)

【#3005】 smax 1 Maximum rotation speed (Gear: 00)

Set the maximum spindle speed with gear 00.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3006】 smax 2 Maximum rotation speed (Gear: 01)

Set the maximum spindle speed with gear 01.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3007】 smax 3 Maximum rotation speed (Gear: 10)

Set the maximum spindle speed with gear 10.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3008】 smax 4 Maximum rotation speed (Gear: 11)

Set the maximum spindle speed with gear 11.
Set this as slimt >= smax.
By comparing the S command value and the values of gear 1 - 4, a spindle gear shift command will be output automatically.

---Setting range---
0 to 99999 (r/min)

【#3009】 ssift 1 Shift rotation speed (Gear: 00)

Set the spindle speed for gear shifting with gear 00.

(Note) Setting too large value may cause a gear nick when changing gears.

---Setting range---
0 to 32767 (r/min)

【#3010】 ssift 2 Shift rotation speed (Gear: 01)

Set the spindle speed for gear shifting with gear 01.

(Note) Setting too large value may cause a gear nick when changing gears.

---Setting range---
0 to 32767 (r/min)

【#3011】 ssift 3 Shift rotation speed (Gear: 10)

Set the spindle speed for gear shifting with gear 10.

(Note) Setting too large value may cause a gear nick when changing gears.

---Setting range---
0 to 32767 (r/min)

【#3012】 ssift 4 Shift rotation speed (Gear: 11)

Set the spindle speed for gear shifting with gear 11.

(Note) Setting too large value may cause a gear nick when changing gears.

---Setting range---
0 to 32767 (r/min)

【#3013】 stap 1 Tap rotation speed (Gear: 00)

Set the maximum spindle speed during tapping cycle with gear 00.

---Setting range---
0 to 99999 (r/min)

【#3014】 stap 2 Tap rotation speed (Gear: 01)

Set the maximum spindle speed during tapping cycle with gear 01.

---Setting range---
0 to 99999 (r/min)

【#3015】 stap 3 Tap rotation speed (Gear: 10)

Set the maximum spindle speed during tapping cycle with gear 10.

---Setting range---
0 to 99999 (r/min)

【#3016】 stap 4 Tap rotation speed (Gear: 11)

Set the maximum spindle speed during tapping cycle with gear 11.

---Setting range---
0 to 99999 (r/min)

【#3017】 stapt 1 Tap time constant (Gear: 00)

Set the time constant for constant inclination synchronous tapping cycle with gear 00 (linear acceleration/deceleration pattern).

---Setting range---
1 to 5000 (ms)

【#3018】 stapt 2 Tap time constant (Gear: 01)

Set the time constant for constant inclination synchronous tapping cycle with gear 01 (linear acceleration/deceleration pattern).

---Setting range---
1 to 5000 (ms)

【#3019】 stapt 3 Tap time constant (Gear: 10)

Set the time constant for constant inclination synchronous tapping cycle with gear 10 (linear acceleration/deceleration pattern).

---Setting range---
1 to 5000 (ms)

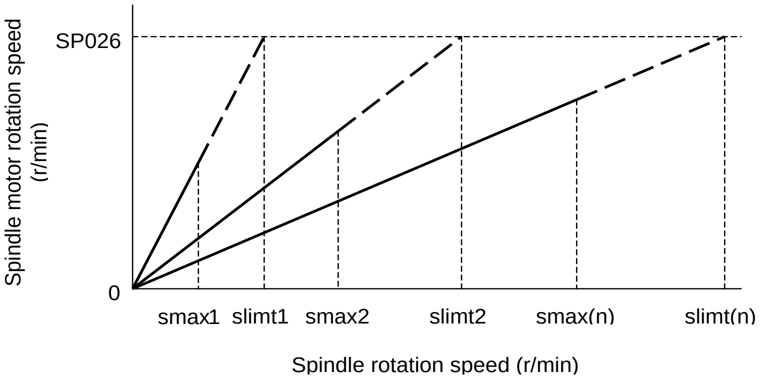
【#3020】 stapt 4 Tap time constant (Gear: 11)

Set the time constant for constant inclination synchronous tapping cycle with gear 11 (linear acceleration/deceleration pattern).

---Setting range---
1 to 5000 (ms)

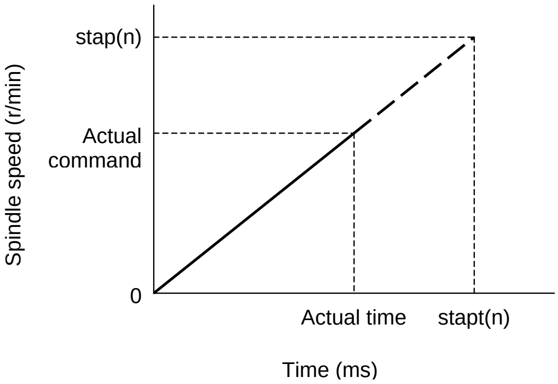
<Relation of spindle limit rotation speed and spindle maximum rotation speed>

The spindle rotation speed which can be attained at the spindle motor's maximum rotation speed is set for the limit rotation speed (slimt). This value is obtained by multiplying the gear ratio on the spindle motor maximum rotation speed (SP026). Set the maximum rotation speed (smax) when the rotation speed is to be limited according to the machine specifications, such as the spindle gear specifications. Up to four value can be set for gear changeover.



<Relation of tap time constant and actual acceleration/deceleration time constant>
(For constant inclination synchronous tap cycle)

Set the acceleration time up to the tap rotation speed (stap) in the tap time constant (stapt). Acceleration/deceleration is carried out at the same inclination for all speed commands. Up to four values can be set for gear changeover.



【#3021】 sori Orientation rotation speed

Set the spindle orientation speed.
Set the speed for when the spindle rotates at the constant speed.

---Setting range---
0 to 32767 (r/min)

【#3022】 sgear Encoder gear ratio

Set the gear ratio of the spindle to the detector.
Setting value 0 ---> Detector : Spindle = 1:1
Setting value 1 ---> Detector : Spindle = 1:2
Setting value 2 ---> Detector : Spindle = 1:4
Setting value 3 ---> Detector : Spindle = 1:8
This parameter is enabled only when "S-analog" is set by the spindle connection parameter "#3024 sout".

---Setting range---
0 to 3

【#3023】 smini Minimum rotation speed

Set the minimum spindle speed.
If an S command below this setting is issued, the spindle will rotate at the minimum speed set by this parameter.

---Setting range---
0 to 32767 (r/min)

【#3024(PR)】 sout Spindle connection

Select the type of interface with a spindle drive unit.
0: No connection with a spindle
1: Dedicated network, dedicated optical communication
2 - 5: S-analog

---Setting range---
0 to 5

【#3025(PR)】 enc-on Spindle encoder

Set the connection condition of a spindle's detector.
Setting 0 ---> Not connected
Setting 1 ---> Connected (Spindle detector connection check function is enabled.)
Setting 2 ---> Serially connected

---Setting range---
0 to 2

【#3026】 cs_ori Selection of winding in orientation mode

0: Perform orientation using the coil selected when the orientation command is issued.
1: Use the coil L whenever the orientation command is issued.

【#3027】 cs_syn Selection of winding in spindle synchronous mode

0: Select the coil H or L based on the actual spindle motor speed (calculated from commanded speed) when spindle synchronization starts. (Coil switch is not performed during spindle synchronous tapping control. This control is carried out using the coil selected at start.)
If the actual spindle motor speed is less than the setting of SP020, the coil L is selected. But if the actual speed exceeds the setting of SP020, the coil H is selected.
1: Use the coil H whenever the spindle synchronization command is issued.

【#3028】 sprcmm Tap cycle spindle forward run/reverse run M command

Set the M codes for the spindle forward run/reverse run commands.
High-order 3 digits: Set the M code for spindle forward run command.
Low-order 3 digits: Set the M code for spindle reverse run command.
When "0" is set, the M code for spindle forward run command is handled as "3" and the M code for spindle reverse run command as "4".

---Setting range---
0 to 999999

【#3029】 tapsel Asynchronous tap gear selection

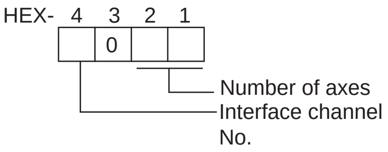
Select whether to use the tapping speed or maximum speed for the gear that is selected when an asynchronous tapping command is issued.
0: Tapping speed
1: Maximum speed
This parameter is enabled only when the M-function synchronous tapping cycle enable parameter "#1272 ext08/bit1" is ON.

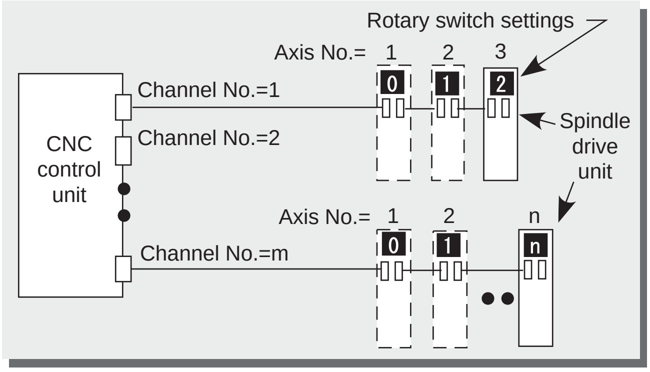
【#3030】

Not used. Set to "0".

【#3031(PR)】 smcp_no Drive unit I/F channel No. (spindle)

Set the interface channel No. of CNC control unit to which the spindle is connected and the axis No. within each channel.
Set this parameter in 4-digit (hexadecimal) format.





HEX-4 : Drive unit interface channel No.
HEX-3 : Not used. Set to "0".
HEX-2, 1 : Axis No.
For a spindle to be connected to CNC via analog interface, set to "0000".

---Setting range---
1001 to 1010, 2001 to 2010

- For MDS-DM-SPV2/SPV3 Series
These drive units have no rotary switches for axis No. selection.
The spindle axis No. is fixed to 1st axis, so set “01” as the number of axes. (last 2 digits).

【#3032】

Not used. Set to "0".

【#3035(PR)】 spunit Output unit

Select the data unit for communication with the spindle drive unit.
This selection is applied to the data communicated between the NC and spindle drive unit as well as the spindle movement data. Note, however, that this parameter is enabled only for the MDS-D Series spindle drive unit.
Spindle/C axis depends on this parameter setting and the C axis output unit (servo) is ignored.
When MDS-D Series is used, follow the setting of "#1003 ctrl_unit".

B: 1μm
C: 0.1μm
D: 10nm
E: 1nm

【#3037】 taps21 Synchronous tap switching spindle speed 2 (Gear: 00)

Set the spindle speed at which the 2nd step acceleration/deceleration time constant is to be switched with gear 00.

---Setting range---
0 to 99999 (r/min)

【#3038】 taps22 Synchronous tap switching spindle speed 2 (Gear: 01)

Set the spindle speed at which the 2nd step acceleration/deceleration time constant is to be switched with gear 01.

---Setting range---
0 to 99999 (r/min)

【#3039】 taps23 Synchronous tap switching spindle speed 2 (Gear: 10)

Set the spindle speed at which the 2nd step acceleration/deceleration time constant is to be switched with gear 10.

---Setting range---
0 to 99999 (r/min)

【#3040】 taps24 Synchronous tap switching spindle speed 2 (Gear: 11)

Set the spindle speed at which the 2nd step acceleration/deceleration time constant is to be switched with gear 11.

---Setting range---
0 to 99999 (r/min)

【#3041】 tapt21 Synchronous tap switching time constant 2 (Gear: 00)

Set the time constant to reach synchronous tapping switching spindle speed 2 (taps21- 24) with gear 00.

---Setting range---
1 to 5000 (ms)

【#3042】 tapt22 Synchronous tap switching time constant 2 (Gear: 01)

Set the time constant to reach synchronous tapping switching spindle rotation speed 2 (taps21 - 24) with gear 01.

---Setting range---
1 to 5000 (ms)

【#3043】 tapt23 Synchronous tap switching time constant 2 (Gear: 10)

Set the time constant to reach synchronous tapping switching spindle rotation speed 2 (taps21 - 24) with gear 10.

---Setting range---
1 to 5000 (ms)

【#3044】 tapt24 Synchronous tap switching time constant 2 (Gear: 11)

Set the time constant to reach synchronous tapping switching spindle rotation speed 2 (taps21 - 24) with gear 11.

---Setting range---
1 to 5000 (ms)

【#3045】 tapt31 Synchronous tap switching time constant 3 (Gear: 00)

Set the time constant to reach the maximum speed (smax1 - 4) with gear 00.

---Setting range---
1 to 5000 (ms)

【#3046】 tapt32 Synchronous tap switching time constant 3 (Gear: 01)

Set the time constant to reach the maximum speed (smax1 - 4) with gear 01.

---Setting range---
1 to 5000 (ms)

【#3047】 tapt33 Synchronous tap switching time constant 3 (Gear: 10)

Set the time constant to reach the maximum speed (smax1 - 4) with gear 10.

---Setting range---
1 to 5000 (ms)

【#3048】 tapt34 Synchronous tap switching time constant 3 (Gear: 11)

Set the time constant to reach the maximum speed (smax1 - 4) with gear 11.

---Setting range---
1 to 5000 (ms)

【#3049】 spt Spindle synchronization acceleration/deceleration time constant

Set the acceleration/deceleration time constant for when the commanded spindle synchronization speed changes under spindle synchronization control.

---Setting range---
0 to 9999 (ms)

【#3050】 sprlv Spindle synchronization rotation speed attainment level

Set the level of difference between the commanded synchronization spindle speeds and actual speeds of both the basic and synchronous spindles during spindle synchronization, below which the spindle speed synchronization complete signal will go ON.

---Setting range---
0 to 4095 (pulse) (1 pulse = 0.088°)

【#3051】 spplv Spindle phase synchronization attainment level

Set the level of phase difference between the basic and synchronous spindles during spindle synchronization, below which the spindle phase synchronization complete signal will go ON.

---Setting range---
0 to 4095 (pulse) (1 pulse = 0.088°)

【#3052】 spplr Spindle motor spindle relative polarity

Set the spindle motor and spindle's relative polarity.
0: Positive polarity
Spindle CW rotation at motor CW rotation
1: Negative polarity
Spindle CCW rotation at motor CW rotation

---Setting range---
0000/0001 (HEX)

【#3053】 sppst Spindle encoder Z -phase position

Set the deviation amount from the spindle's basic point to the spindle detector's Z phase.
Obtain the deviation amount, considering a clockwise direction as positive when viewed from the spindle's front side.

---Setting range---
0 to 359999 (1/1000°)

【#3054】 sptc1 Spindle synchronization multi-step acceleration/deceleration changeover speed 1

Set the spindle speed for changing the 1st step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3055】 sptc2 Spindle synchronization multi-step acceleration/deceleration changeover speed 2

Set the spindle speed for changing the 2nd step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3056】 sptc3 Spindle synchronization multi-step acceleration/deceleration changeover speed 3

Set the spindle speed for changing the 3rd step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3057】 sptc4 Spindle synchronization multi-step acceleration/deceleration changeover speed 4

Set the spindle speed for changing the 4th step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3058】 sptc5 Spindle synchronization multi-step acceleration/deceleration changeover speed 5

Set the spindle speed for changing the 5th step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3059】 sptc6 Spindle synchronization multi-step acceleration/deceleration changeover speed 6

Set the spindle speed for changing the 6th step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3060】 sptc7 Spindle synchronization multi-step acceleration/deceleration changeover speed 7

Set the spindle speed for changing the 7th step's acceleration/deceleration time constant.

---Setting range---
0 to 99999 (r/min)

【#3061】 spdiv1 Magnification for time constant changeover speed 1

Set the acceleration/deceleration time constant from the spindle synchronization multi-step acceleration/deceleration changeover speed 1 (sptc1) to the spindle synchronization multi-step acceleration/deceleration changeover speed 2 (sptc2). Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---
0 to 127

【#3062】 spdiv2 Magnification for time constant changeover speed 2

Set the acceleration/deceleration time constant from the spindle synchronization multi-step acceleration/deceleration changeover speed 2 (sptc2) to the spindle synchronization multi-step acceleration/deceleration changeover speed 3 (sptc3). Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---
0 to 127

【#3063】 spdiv3 Magnification for time constant changeover speed 3

Set the acceleration/deceleration time constant from the spindle synchronization multi-step acceleration/deceleration changeover speed 3 (sptc3) to the spindle synchronization multi-step acceleration/deceleration changeover speed 4 (sptc4). Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---
0 to 127

【#3064】 spdiv4 Magnification for time constant changeover speed 4

Set the acceleration/deceleration time constant from the spindle synchronization multi-step acceleration/deceleration changeover speed 4 (sptc4) to the spindle synchronization multi-step acceleration/deceleration changeover speed 5 (sptc5). Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---
0 to 127

【#3065】 spdiv5 Magnification for time constant changeover speed 5

Set the acceleration/deceleration time constant from the spindle synchronization multi-step acceleration/deceleration changeover speed 5 (sptc5) to the spindle synchronization multi-step acceleration/deceleration changeover speed 6 (sptc6). Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---
0 to 127

【#3066】 spdiv6 Magnification for time constant changeover speed 6

Set the acceleration/deceleration time constant from the spindle synchronization multi-step acceleration/deceleration changeover speed 6 (sptc6) to the spindle synchronization multi-step acceleration/deceleration changeover speed 7 (sptc7). Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---
0 to 127

【#3067】 spdiv7 Magnification for time constant changeover speed 7

Set the acceleration/deceleration time constant for the spindle synchronization multi-step acceleration/deceleration changeover speed 7 (sptc7) and higher. Set this as a magnification in relation to the spindle synchronization acceleration/deceleration time constant (spt).

---Setting range---

0 to 127

【#3068】 symtm1 Phase synchronization start confirmation time

Set the time to confirm that synchronization is attained before phase synchronization control is started.
When "0" is set, the time will be 0.5 seconds. When "100" or less is set, the time will be 100ms.

---Setting range---

0 to 9999 (ms)

【#3069】 symtm2 Phase synchronization end confirmation time

Set a period of waiting time for phase synchronization control's completion as a time in which the speed stays within the attainment range.
When "0" is set, the time will be 0.5 seconds. When "100" or less is set, the time will be 100ms.

---Setting range---

0 to 9999 (ms)

【#3070】 syprt Phase synchronization speed

Set the amount of speed fluctuation of synchronous spindle during phase synchronization control. Set this as a proportion to commanded speed.
When "0" is set, the amount will be 5%.

---Setting range---

0 to 100 (%)

【#3071(PR)】 SscDrSelSp Speed monitor Door selection

Select which door group of the speed monitoring a spindle belongs to.
0000: Belong to the door 1 group.
0001: Belong to the door 1 group.
0002: Belong to the door 2 group.
0003: Belong to the door 1 and 2 groups.

(Note) Speed monitoring is not executed when SP229:SFNC9/bitF is "OFF".

---Setting range---

0000 to 0003 (HEX)

【#3072(PR)】 Ssc Svof Filter Sp Speed monitor Error detection time during servo OFF

Set the error detection time for when an error of command speed monitoring or feedback speed monitoring is detected during servo OFF.
The alarm will occur if actual speed exceeds safe speed or safe rotation speed for a period of time longer than this setting.
When "0" is set, the detection time will be 200 (ms).

---Setting range---

0 to 9999 (ms)

【#3101】 sp_t 1 Time constant for spindle rotation with S command (Gear: 00)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 00 (Linear acceleration/deceleration pattern).

---Setting range---

0 to 30000 (ms)

【#3102】 sp_t 2 Time constant for spindle rotation with S command (Gear: 01)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 01 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3103】 sp_t 3 Time constant for spindle rotation with S command (Gear: 10)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 10 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3104】 sp_t 4 Time constant for spindle rotation with S command (Gear: 11)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear11 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

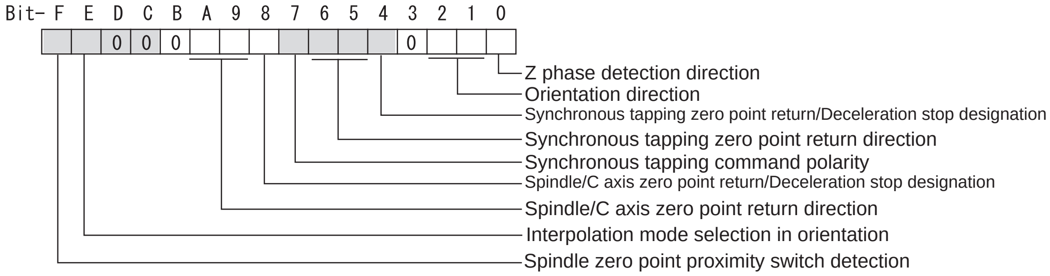
【#3105】 sut Speed reach range

Set the speed deviation rate with respect to the commanded speed, at which the speed reach signal will be output.
It will be 15% when set to "0".
If the speed deviation is smaller than 45r/min, it will be set as 45r/min.

---Setting range---
0 to 100 (%)

【#3106】 zrn_typ Zero point return specifications

Select the zero point return specification.
Functions are allocated to each bit.
Set this in hexadecimal format.



bit F : Spindle zero point detection with contactless switch

0: Normal 1: Enable spindle zero point detection using proximity switch

bit E : Interpolation mode selection in orientation

0: Interpolation mode (Use the interpolation mode gain "SP002 PGN".)
1: Non-interpolation mode (Use the non-interpolation mode gain "SP001 PGV")
Select this when vibration occurs since the gain is too high during the orientation.

bit D-B :

Not used. Set to "0".

bit A-9 : Spindle/C axis zero point return direction

bitA,9=
00: Short-cut
01: Forward run
10: Reverse run

bit 8 : Designate zero point return/deceleration stop of spindle/C axis

0: Zero point return 1: Deceleration stop

bit 7 : Synchronous tapping command polarity

0: Forward direction 1: Reverse direction

bit 6-5 : Synchronous tapping zero point return direction

bit 6,5=
00: Short-cut
01: Forward run
10: Reverse run

bit 4 : Designate zero point return/deceleration stop in synchronous tapping

0: Zero point return 1: Deceleration stop

bit 3 :

Not used. Set to "0".

bit 2-1 : Orientation direction

bit 2,1=
00: Short-cut
01: Forward run
10: Reverse run

bit 0 : Z phase detection direction

0: Forward direction 1: Reverse direction

【#3107】 ori_spd Orientation command speed

Set the spindle speed during orientation command.

---Setting range---
1 to 99999 (r/min)

【#3108】 ori_sft In-position shift amount for orientation

Set the orientation stop position.
The clockwise direction when viewed from the load side is considered as minus (-).

---Setting range---
-35999 to 35999 (0.01°)

【#3109】 zdetspd Z phase detection speed

When "#3106/bitF = 0" (Normal), set the spindle speed at initial Z phase detection.
Guideline for the initial setting value is from 50 to 300.

When "#3106/bitF = 1" (Spindle zero point proximity switch detection enabled), set the spindle speed at initial spindle zero point proximity switch detection.

(Note) When spindle zero point proximity switch detection is enabled, the rotation direction of the orientation/zero point return (synchronous tapping, spindle/C axis) will follow Z phase detection direction. And the speed will follow Z phase detection speed. Guideline for the initial setting value is from 50 to 300.

---Setting range---
1 to 99999 (r/min)

【#3110】 tap_spd Synchronous tapping zero point return speed

Set the synchronous tapping zero point return speed.

---Setting range---
1 to 99999 (r/min)

【#3111】 tap_sft Synchronous tapping zero point return shift amount

Set the synchronous tapping zero point return shift amount.

---Setting range---
0.00 to 35999 (0.01°)

【#3112】 cax_spd Spindle C axis zero point return speed

Set the spindle C axis zero point return speed.

---Setting range---
1 to 99999 (r/min)

【#3113】 cax_sft Spindle C axis zero point return shift amount

Set the spindle C axis zero point return shift amount

---Setting range---
0.00 to 359999 (0.001°)

【#3114】 cax_para_chg Spindle/C axis parameter switch

Select whether to switch detector's parameters between spindle control and C axis control during spindle/C axis control.
0: Not switch
1: Switch

---Setting range---
0/1 (Standard: 0)

【#3115】 sp2_t1 Time constant in orientation/position loop reference position return (Gear: 00)

Set the acceleration/deceleration time constant to reach the spindle's limit speed (slimt) when spindle rotates in orientation/position loop zero point return method (C axis, tapping) using gear 00 (Linear acceleration/deceleration pattern).

(Note) Set a value that is bigger than the values set by "#3101 sp_t1 - #3104 sp_t4".

---Setting range---

0 to 30000 (ms)

【#3116】 sp2_t2 Time constant in orientation/position loop reference position return (Gear: 01)

Set the acceleration/deceleration time constant to reach the spindle's limit speed (slimt), when spindle rotates in the orientation/position loop zero point return method (C axis, tapping) using gear 01 (Linear acceleration/deceleration pattern).

(Note) Set a value that is bigger than the values set by "#3101 sp_t1 - #3104 sp_t4".

---Setting range---

0 to 30000 (ms)

【#3117】 sp2_t3 Time constant in orientation/position loop reference position return (Gear: 10)

Set the acceleration/deceleration time constant to reach the spindle's limit speed (slimt), when spindle rotates in the orientation/position loop zero point return method (C axis, tapping) using gear 10 (Linear acceleration/deceleration pattern).

(Note) Set a value that is bigger than the values set by "#3101 sp_t1 - #3104 sp_t4".

---Setting range---

0 to 30000 (ms)

【#3118】 sp2_t4 Time constant in orientation/position loop reference position return (Gear: 11)

Set the acceleration/deceleration time constant to reach the spindle's limit speed (slimt), when spindle rotates in the orientation/position loop zero point return method (C axis, tapping) using gear 11 (Linear acceleration/deceleration pattern).

(Note) Set a value that is bigger than the values set by "#3101 sp_t1 - #3104 sp_t4".

---Setting range---

0 to 30000 (ms)

【#3120】 staptr Time constant reduction rate in high-speed synchronous tapping

When performing high-speed synchronous tapping, set the reduction rate of the time constant compared to the time constant in normal synchronous tapping.
(Setting "0"or "100" will be regarded as reduction rate zero, so the time constant won't be reduced.)
E.g.) When set to "10", time constant in high-speed synchronous tapping will be 90% of that in normal synchronous tapping.

---Setting range---

0 to 100(%)

【#3121】 tret Turret indexing

Select the validity of turret indexing.
0: Invalid
1: Valid

【#3122】 GRC Turret side gear ratio

Set the number of teeth on the turret side when the gear selection command (control input 4/bit6, 5) is set to 00. Set a value of GRC so that the ratio of GRC to the spindle side gear ratio (#13057 SP057) will be 1:N (an integer).
If this parameter is set to "0", it will be regarded as "1".

---Setting range---
0 to 32767

【#3123】 tret_spd Turret indexing speed

Set the turret end indexing speed when in turret indexing.
When this parameter is set to 0, the value of Orientation command speed (#3107 ori_spd) will be used for the turret indexing speed.

---Setting range---
0 to 32767(r/min)

【#3124】 tret_t Turret indexing time constant

Set the acceleration/deceleration time constant to reach Limit rotation speed (#3001 slimt) at gear 00 when in turret indexing (linear acceleration/deceleration pattern). Set this parameter to a larger value than #3115 sp2_t1 at gear 00.

---Setting range---
0 to 30000 (ms)

【#3125】 tret_inpos Turret indexing in-position width

Set the position error range in which the index positioning complete signal is output when in turret indexing. When this parameter is set to 0, the value of In-position width (#13024 SP024) will be used for this width.

---Setting range---
0 to 32767(1°/1000)

【#3126】 tret_fin_off Index positioning complete signal OFF time

Set the time to forcedly turn OFF the index positioning complete signal since the indexing start signal turns ON. If this period of time has not passed yet, the index positioning complete signal will not turn ON even at the completion of index positioning.

---Setting range---
0 to 10000 (ms)

【#3127】 SPECSP Spindle specification

bit0: Select the gear changeover method.

0: Gear change type 1
1: Gear change type 2

---Setting range---
0x0000 to 0xffff (hexadecimal)

【#3128】 ori_spec Orientation specification

bit0: Orientation imposition advance output

0: Invalid
1: Valid

---Setting range---
0x0000 to 0xffff (hexadecimal)

【#3129】 cax_spec Spindle/C axis specification

Not used. Set to "0".

【#3130】 syn_spec Spindle synchronization specification

bit0: Tool spindle synchronization II (hobbing) automatic compensation selection

1: Compensate hobbing axis delay (advance) with workpiece axis.
0: No compensation.

【#3131】 tap_spec Synchronous tapping specification

Not used. Set to "0".

【#3132】 ori_inp2 2nd in-position width for orientation

Use this when detecting a different in-position from the normal in-position detection, such as advancing the in-position signal. When using, set a bigger value than the value of the spindle parameter SP024.

---Setting range---
0 to 32767 (1deg/1000)

【#3133】 spherr Hobbing axis delay (advance) allowable angle

Set the allowable angle between the commanded position and actual position of hobbing axis when it is in tool spindle synchronization II (hobbing) mode (X18AE ON), and also when hobbing axis and workpiece axis are synchronizing (X18A9 ON).

---Setting range---
0 to 32767 (1deg/1000)

【#3134】 sphtc Primary delay time constant for hobbing axis automatic compensation

Set the primary delay time constant of hobbing axis automatic compensation primary delay filter control in tool spindle synchronization II (hobbing).
When set to 0, primary delay filter control is invalid.

---Setting range---
0 to 32767 (ms)

【#3135】 sfwd_g Feed forward gain for hobbing axis

Set the feed forward gain for the hobbing axis in tool spindle synchronization II (hobbing) mode.

---Setting range---
0 to 200 (%)

【#3137】 stap_ax_off High-speed synchronous tapping disabled axis

Set the high-speed synchronous tapping disabled axis.

bit 0-F : High-speed synchronous tapping disabled axis

0: Enabled
1: Disabled

If communication between drive units is disabled for a certain axis, set the axis's bits of all the spindles as disabled.
If communication between drive units is disabled for a certain spindle, set all the bits of the spindle as disabled (0xFFFF).

(Note) Each bit (bit0 -) corresponds to the order of the axis name parameter (#1013 axname) setting.

【#3138】 motor_type Spindle motor type

Set the spindle motor type. The set type will be displayed on the drive monitor screen, and it will be also output to the system configuration data.

---Setting range---
Character string within 26 characters including A-Z, a-z, 0-9, "." (decimal point), "-" (hyphen), "/" (slash)
(Cleared by inputting "0".)

【#3140(PR)】 S_DINSp Speed observation input door No.

Set the door signal input in the drive unit.
Use this parameter only when the axis with a door signal belongs to several door groups.
The correspondence between the door signals and bits are as follows.
bit0 : Door1 signal
bit1 : Door2 signal
If the axis does not receive any door signal, set to "0".
An error (Y20 0027) will occur in the following cases.
- Several bits are enabled.
- Any bit other than those set in "#3071 S_DSlSp" is enabled.

---Setting range---

0000 to 0002 (HEX)

3-3-4 Spindle parameters

These parameters are sent to the spindle drive unit when the NC power is turned ON. The standard parameters are designated with the "Spindle parameter setting list" enclosed when the spindle motor is delivered. There may be cases when the machine specifications are unclear, so the parameters determined by the machine specifications should be confirmed by the user.

The parameters with "(PR)" requires the CNC to be turned OFF after the settings. Turn the power OFF and ON to enable the parameter settings.

【#13001】 SP001 PGV Position loop gain non-interpolation mode

Set the position loop gain for "Non-interpolation" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 000" in control input 4.
(Note) The control mode is commanded by NC.

---Setting range---
1 to 200 (1/s)

【#13002】 SP002 PGN Position loop gain interpolation mode

Set the position loop gain for "interpolation" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 010 or 100" in control input 4.
(Note) The control mode is commanded by NC.
When carrying out the SHG control, set SP035(SFNC3) bitC to "1".

---Setting range---
1 to 200 (1/s)

【#13003】 SP003 PGS Position loop gain spindle synchronization

Set the position loop gain for "spindle synchronization" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 001" in control input 4.
(Note) The control mode is commanded by NC.
When carrying out the SHG control, set SP036(SFNC4) bit4 to "1".

---Setting range---
1 to 200 (1/s)

【#13004】 SP004

Not used. Set to "0".

【#13005】 SP005 VGN1 Speed loop gain 1

Set the speed loop gain.
Set this according to the load inertia size.
The higher setting value will increase the accuracy of control, however, vibration tends to occur.
If vibration occurs, adjust by lowering by 20 to 30%.
The final value should be 70 to 80% of the value at which the vibration stops.

---Setting range---
1 to 9999

【#13006】 SP006 VIA1 Speed loop lead compensation 1

Set the speed loop integral control gain.
The standard setting is "1900". Adjust the value by increasing/decreasing the value by about 100.
Raise this value to improve the contour tracking accuracy in high-speed cutting.
Lower this value when the position droop does not stabilize (when the vibration of 10 to 20Hz occurs).

---Setting range---
1 to 9999

【#13007】 SP007 VIL1 Speed loop delay compensation 1

Set this parameter when the limit cycle occurs in the full-closed loop or overshooting occurs in positioning.
For MDS-D/DH-SP, the control method can be selected by SP033(SFNC1)/bit1,0(vcnt).
Normally, use "Changeover type 2".
When setting this parameter, make sure to set the torque offset "SP050(TOF)".
When not using, set to "0".

---Setting range---
0 to 32767

【#13008】 SP008 VGN2 Speed loop gain 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---
1 to 9999

【#13009】 SP009 VIA2 Speed loop lead compensation 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---
1 to 9999

【#13010】 SP010 VIL2 Speed loop delay compensation 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---
0 to 32767

【#13011】 SP011

Not used. Set to "0".

【#13012】 SP012

Not used. Set to "0".

【#13013】 SP013

Not used. Set to "0".

【#13014】 SP014 PY1 Minimum excitation rate 1

Set the minimum value for the variable excitation rate. The standard setting is "50".
Set to "0" when using an IPM spindle motor.
If noise including gear noise is loud, select a small value. However, a larger setting value is more effective for impact response.

(Note) When setting a value at "50 or more", check if there is no problem with gear noise, motor excitation noise, vibration during low-speed rotation or vibration when the servo is locked during orientation stop, etc.
When setting a value at "less than 50", check if there is no problem with the impact load response or rigidity during servo lock.

---Setting range---

0 to 100 (%)

【#13015】 SP015 PY2 Minimum excitation rate 2

Normally, SP014(PY1) is used.
By setting "SP035(SFNC3)/bit2(pyin), SP035(SFNC3)/bitA(pyn) or SP036(SFNC4)/bit2(pys)=1", the excitation rate 2 can be used according to the application.
The excitation rate 2 can also be used by setting "the minimum excitation rate 2 changeover request (control input 5/ bitB) = 1". Refer to SP014(PY1) for procedures.
Set to "0" when using an IPM spindle motor.

---Setting range---

0 to 100 (%)

【#13016】 SP016 DDT Phase alignment deceleration rate

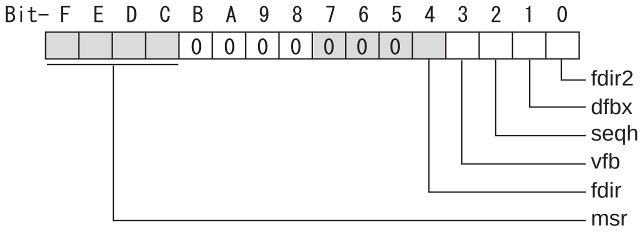
Set the single-rotation position alignment deceleration rate for orientation stopping, phase alignment while rotating and switching from non-interpolation mode to spindle synchronization mode while rotating.
When the load inertia is larger, the setting value should be smaller.
When the setting value is larger, the orientation in-position and single-rotation position alignment complete faster, but the impact applied on the machine will increase.
To change the deceleration rate only during rotation command (command F ? T ≠ 0), set this parameter together with SP070 (KDDT).

---Setting range---

1 to 32767 (0.1(r/min)/ms)

【#13017(PR)】 SP017 SPEC1 Spindle specification 1

Select the spindle specification.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-C : msr Motor series selection

0: 200V specification IM spindle motor
1: 200V specification IPM spindle motor
2: 400V specification IM spindle motor
3: 400V specification IPM spindle motor
4: 200V specification Tool spindle motor
Only "0" or "4" setting is available for MDS-D-SPJ3 Series.

- For MDS-DM Series
For MDS-DM-SPV2/SPV3, set to "0".

bit B-5 :

Not used. Set to "0".

bit 4 : fdir Position feedback

0: Forward polarity 1: Reverse polarity

bit 3 : vfb Speed feedback filter

0: Disable 1: Enable (2250Hz)

bit 2 : seqh READY ON sequence

0: Normal 1: High-speed

bit 1 : dfbx Dual feedback control

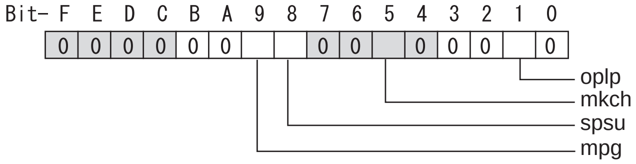
0: Stop 1: Start

bit 0 : fdir2 Speed feedback polarity

0: Forward polarity 1: Reverse polarity

【#13018(PR)】 SP018 SPEC2 Spindle specification 2

Select the spindle specification.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-A :

Not used. Set to "0".

bit 9 : mpg Earth fault detection

0: Normal (Earth fault detection by CV) 1: Enable
Set "0" and it is constantly "Enable" for MDS-D-SPJ3 Series.

bit 8 : spsu Speed setting unit

0: r/min 1: 4 r/min

bit 7-6 :

Not used. Set to "0".

bit 5 : mkch Coil switch function

0: Disable 1: Enable

bit 4-2 :

Not used. Set to "0".

bit 1 : oplp Open loop

0: Disable 1: Enable

bit 0 :

Not used. Set to "0".

【#13019(PR)】 SP019 RNG1 Sub side detector resolution

[For semi-closed loop]
Set the same value as SP020 (RNG2). (Refer to the explanation of SP020.)

[For full-closed loop]
Set the number of pulses per revolution of the speed detector.
When using ABZ pulse encoder, used this with SP097(RNG1ex).

E.g.: The setting for ABZ pulse encoder "OSE-1024-3-15-68"
SP019 = 4096
SP097 = -1

---Setting range---

-32768 to 32767 (kp/rev)
When using SP097: (p/rev)

【#13020(PR)】 SP020 RNG2 Main side detector resolution

Set the number of pulses per revolution of the main side detector.
When using the serial changer MDS-B-HR, use this with SP098(RNG2ex).

Detector
TS5691(128 teeth): SP020 = 2000
TS5691(180 teeth): SP020 = 2880
TS5691(256 teeth): SP020 = 4000
TS5691(384 teeth): SP020 = 6000
TS5691(512 teeth): SP020 = 8000

TS5690(64 teeth): SP020 = 2000
TS5690(90 teeth): SP020 = 2880
TS5690(128 teeth): SP020 = 4000
TS5690(192 teeth): SP020 = 6000
TS5690(256 teeth): SP020 = 8000
TS5690(384 teeth): SP020 =12000

ERM280(1200 teeth): SP020 = 4800
ERM280(2048 teeth): SP020 = 8000

MPCI : SP020 = 7200
MBE205: SP020 = 2000

OSA18(-A48): SP020 = 260

---Setting range---
-32768 to 32767 (kp/rev)
When using SP098: (p/rev)

【#13021(PR)】 SP021 OLT Overload detection time constant

Set the detection time constant of Overload 1 (Alarm 50). (For machine tool builder adjustment)
Normally, set to "60".
Set to "300" when using an IPM spindle motor.

---Setting range---
1 to 15300 (s)

【#13022】 SP022 OLL Overload detection level

Set the current detection level of "Overload 1" (Alarm 50) as a percentage against the motor short-time rated output current. (For machine tool builder adjustment)
Normally, set to "120".
Set to "100" when using an IPM spindle motor.

---Setting range---
1 to 200 (Short-time rated %)

【#13023】 SP023 OD1 Excessive error detection width (interpolation mode - spindle synchronization)

Set the excessive error detection width for the interpolation mode and spindle synchronization.
The standard setting is "120".
When set to "0", the excessive error detection will not be performed.

---Setting range---
1 to 32767 (°)

【#13024】 SP024 INP In-position width

Set the in-position detection width.
Set the positioning accuracy required to the machine.
Lower setting value increases the positioning accuracy, but makes the cycle time (settling time) longer.
The standard setting is "875".

---Setting range---
0 to 32767 (1°/1000)

【#13025】 SP025 INP2 2nd in-position width

Use this when detecting an in-position different from normal in-position width such as advancing the in-position signal.
The procedure is the same as SP024 (INP).
The standard setting is "875".

---Setting range---
0 to 32767 (1°/1000)

【#13026(PR)】 SP026 TSP Maximum motor speed

Set the maximum motor speed.
If the motor speed exceeds the set maximum speed, an overspeed alarm will occur.

---Setting range---
1 to 32767 (r/min)

【#13027】 SP027 ZSP Motor zero speed

Set the motor speed for detecting zero speed.
If the motor speed drops below the set speed, the zero speed detection turns ON.
The standard setting is "50".

---Setting range---
1 to 1000 (r/min)

【#13028】 SP028 SDTS Speed detection set value

Set the motor speed for detecting the speed.
If the motor speed drops below the set speed, the zero speed detection turns ON.
The standard setting is 10% of the maximum motor speed.

---Setting range---
10 to 32767 (r/min)

【#13029】 SP029 SDTR Speed detection reset width

Set the hysteresis width in which the speed detection changes from ON to OFF.
If the setting value is small, the speed detection will chatter easily.
The standard setting is "30".

---Setting range---
10 to 1000 (r/min)

【#13030】 SP030 SDT2 2nd speed detection setting value

Set the specified speed of the specified speed output.
When carrying out digital output of the specified speed output, set SP229(SFNC9)/bitC(sdt2) to "1".
It is not available for MDS-D-SPJ3 Series.

---Setting range---
-32768 to 32767 (r/min)

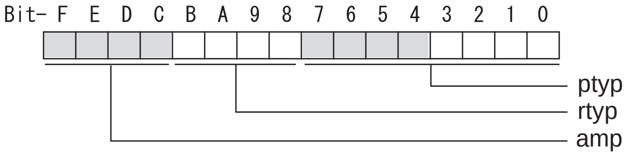
【#13031(PR)】 SP031 MTYP Motor type

Set the control system of the spindle drive unit.
2200: Semi closed loop control
4200: Full closed loop control by using spindle side ABZ pulse output detector
6200: Full closed loop control by using spindle side serial output detector

【#13032(PR)】 SP032 PTYP Power supply type/ Regenerative resistor type

MDS-D/DH Series: Power supply type

When connecting a power supply unit, set a code for each power supply unit.



bit F-C : amp

Not used. Set to "0".

bit B-8 : rtyp

Not used. Set to "0".

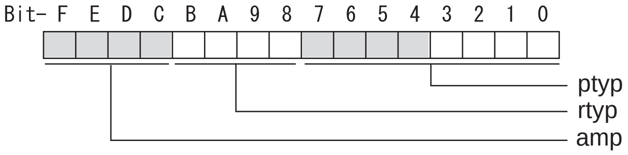
bit 7-0 : ptyp External emergency stop setting

When the emergency stop input signal of the power supply unit is "disabled"
Power supply unit is not connected : 00
MDS-D-CV-37 / MDS-DH-CV-37 : 04
MDS-D-CV-75 / MDS-DH-CV-75 : 08
MDS-D-CV-110 / MDS-DH-CV-110 : 11
MDS-D-CV-185 / MDS-DH-CV-185 : 19
MDS-D-CV-300 / MDS-DH-CV-300 : 30
MDS-D-CV-370 / MDS-DH-CV-370 : 37
MDS-D-CV-450 / MDS-DH-CV-450 : 45
MDS-D-CV-550 / MDS-DH-CV-550 : 55
MDS-DH-CV-750 : 75

When the emergency stop input signal of the power supply unit is "enabled"
(Note) Set the power supply rotary switch to "4".
Power supply unit is not connected : 00
MDS-D-CV-37 / MDS-DH-CV-37 : 44
MDS-D-CV-75 / MDS-DH-CV-75 : 48
MDS-D-CV-110 / MDS-DH-CV-110 : 51
MDS-D-CV-185 / MDS-DH-CV-185 : 59
MDS-D-CV-300 / MDS-DH-CV-300 : 70
MDS-D-CV-370 / MDS-DH-CV-370 : 77
MDS-D-CV-450 / MDS-DH-CV-450 : 85
MDS-D-CV-550 / MDS-DH-CV-550 : 95
MDS-DH-CV-750 : B5

MDS-DM-SPV Series: Power supply type

Set as follows for the spindle drive section of the MDS-DM-SPV.



bit F-C : amp

Not used. Set to "0".

bit B-8 : rtyp

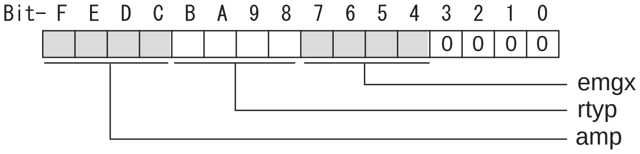
Not used. Set to "0".

bit 7-0 : ptyp External emergency stop setting

Normal : 19
External emergency stop function 59

MDS-D-SPJ3 Series: Regenerative resistor type

Set the regenerative resistor type.



bit F-8 : amp(bit F-C) / rtyp(bit B-8)

Setting prohibited : 10
Setting prohibited : 11
MR-RB032 : 12
MR-RB12 or GZG200W39OHMK : 13
MR-RB32 or GZG200W120OHMK 3 units connected in parallel : 14
MR-RB30 or GZG200W39OHMK 3 units connected in parallel : 15
MR-RB50 or GZG300W39OHMK 3 units connected in parallel : 16
MR-RB31 or GZG200W20OHMK 3 units connected in parallel : 17
MR-RB51 or GZG300W20OHMK 3 units connected in parallel : 18
Setting prohibited : 19-1F
Setting prohibited : 20-23
FCUA-RB22 : 24
FCUA-RB37 : 25
FCUA-RB55 : 26
FCUA-RB75/2 1 unit : 27
R-UNIT1 : 28
R-UNIT2 : 29
R-UNIT3 : 2A
R-UNIT4 : 2B
R-UNIT5 : 2C
FCUA-RB75/2 2 units connected in parallel: 2D
Setting prohibited : 2E,2F

bit 7-4 : emgx External emergency stop function

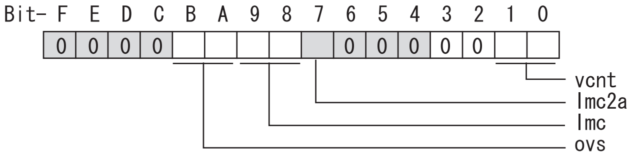
Set the external emergency stop function. (Do not set a value other than specified.)
0: Disable 4: Enable

bit 3-0 :

Not used. Set to "0".

【#13033】 SP033 SFNC1 Spindle function 1

Select the spindle specification.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-C :

Not used. Set to "0".

bit B-A : ovs Overshoot compensation

bitB,A=
00: Compensation stop
01: Setting prohibited
10: Setting prohibited
11: Compensation type 3

(Note) Set the compensation amount in SP043(OVS1) and SP042(OVS2).

bit 9-8 : lmc Lost motion compensation

bit9,8=
00: Compensation stop
01: Setting prohibited
10: Compensation type 2
11: Setting prohibited

(Note) Set the compensation amount in SP048(LMC1) and SP041(LMC2).
When "SP227/lmc3" is set to "1", the lost motion compensation type 3 is selected regardless of this setting.

bit 7 : lmc2a Lost motion compensation 2 timing

0: Normal timing 1: Timing changed

bit 6 :

Not used. Set to "0".

bit 5-4 :

Not used. Set to "0".

bit 3-2 :

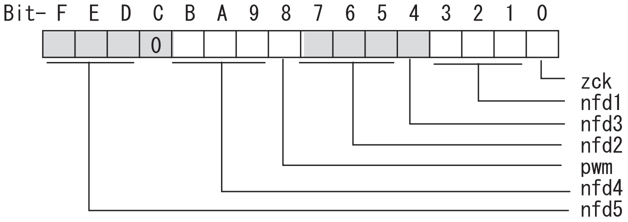
Not used. Set to "0".

bit 1-0 : vcnt Delay compensation changeover

bit1,0=
00: Disable
01: Changeover type 1
10: Changeover type 2
11: Changeover type 2

【#13034】 SP034 SFNC2 Spindle function 2

Select the spindle function.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-D : nfd5 Depth of Notch filter 5

Set the depth of Notch filter 5.
bit F,E,D=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit C :

Not used. Set to "0".

bit B-9 : nfd4 Depth of Notch filter 4

Set the depth of Notch filter 4.
bit B,A,9=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit 8 : pwm Current control

0: Standard current control 1: High frequency current control

bit 7-5 : nfd2 Depth of Notch filter 2

Set the depth of Notch filter 2.
bit7,6,5=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit 4 : nfd3 Notch filter 3(1125Hz)

0: Stop 1: Start

bit 3-1 : nfd1 Depth of Notch filter 1

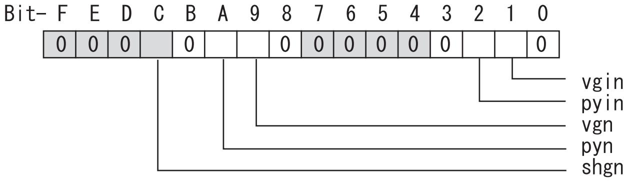
Set the depth of Notch filter 1.
bit3,2,1=
000: -∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit 0 : zck Z phase check (ALM42)

0: Enable   1: Disable

【#13035(PR)】 SP035   SFNC3   Spindle function 3

Select the spindle function.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-D :

Not used. Set to "0".

bit C : shgn SHG control

0: Stop   1: Start

bit B :

Not used. Set to "0".

bit A : pyn Excitation rate selection

0: Select Excitation rate 1   1: Select Excitation rate 2

bit 9 : vgn Speed loop gain set selection

0: Select Set 1   1: Select Set 2

bit 8 :

Not used. Set to "0".

bit 7 :

Not used. Set to "0".

bit 6-3 :

Not used. Set to "0".

bit 2 : pyin Excitation rate selection

The excitation rate after the in-position can be selected.
0: Select Excitation rate 1   1: Select Excitation rate 2

bit 1 : vgin Speed loop gain set selection

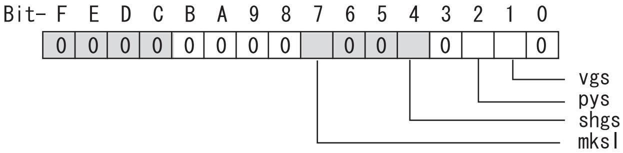
The speed loop gain set after the in-position can be selected.
0: Select Set 1   1: Select Set 2

bit 0 :

Not used. Set to "0".

【#13036(PR)】 SP036 SFNC4 Spindle function 4

Select the spindle function.
A function is allocated to each bit.
Set this in hexadecimal format.



bit F-8 :

Not used. Set to "0".

bit 7 : mksl Spindle coil selection

0: Select the coil commanded during synchronization 1: Select high-speed coil

bit 6-5 :

Not used. Set to "0".

bit 4 : shgs SHG control

0: Stop 1: Start

bit 3 :

Not used. Set to "0".

bit 2 : pys Excitation rate selection

0: Select Excitation rate 1 1: Select Excitation rate 2

bit 1 : vgs Speed loop gain set selection

0: Select Gain Set 1 1: Select Gain set 2

bit 0 :

Not used. Set to "0".

【#13037】 SP037 JL Load inertia scale

Set "the motor inertia + motor axis conversion load inertia" in proportion to the motor inertia.
SV037(JL)=(Jm+Jl)/Jm×100
Jm: Motor inertia
Jl: Motor axis conversion load inertia

---Setting range---
0 to 5000 (%)

【#13038】 SP038 FHz1 Notch filter frequency 1

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---
0 to 2250 (Hz)

【#13039】 SP039 LMCD Lost motion compensation timing

Set this parameter when the lost motion compensation timing does not match.
Adjust by increasing the value by 10 at a time.

---Setting range---
0 to 2000 (ms)

【#13040】 SP040 LMCT Lost motion compensation non-sensitive band

Set the non-sensitive band of the lost motion compensation in the feed forward control.
When "0" is set, 2°/1000 is set. Adjust by increasing the value by 1°/1000 at a time.

---Setting range---
-32768 to 32767 (1°/1000)

【#13041】 SP041 LMC2 Lost motion compensation 2

Set this parameter with SP048(LMC1) only to vary the lost motion compensation amount depending on the command directions.
Normally, set to "0".

---Setting range---
-1 to 200 (Short-time rated %)
Note that when SP227/bit2 is "1", the range will be -1 to 20000 (Short-time rated 0.01%).

【#13042】 SP042 OVS2 Overshooting compensation 2

Set this parameter with SP043(OVS1) only to vary the lost motion compensation amount depending on the command directions.
Normally, set to "0".

---Setting range---
-1 to 100 (Short-time rated %)
Note that when SP227/bit2 is "1", the range will be -1 to 10000 (Short-time rated 0.01%).

【#13043】 SP043 OVS1 Overshooting compensation 1

Set this parameter when overshooting occurs during positioning. This compensates the motor torque during positioning.
This is valid only when the overshooting compensation SP033 (SFNC1/ovs) is selected.

[Type 3 "When SP033(SFNC1)/ bitB,A(ovs)=11"]
Use this when performing overshoot compensation in the feed forward control during arc cutting mode.
Set the compensation amount based on the motor short-time rated current.
Increase the value in increments of 1% to find the value where overshooting ceases.

[To vary compensation amount depending on the direction]
When SV042 (OVS2) is "0", change the SP043 (OVS1) value in both +/- directions to compensate.
To change the compensation amount depending on the command direction, set this with SP042 (OVS2).
(SP043: + direction, SP042: - direction, However, the directions may be opposite depending on other settings.)
When "-1" is set, the compensation will not be performed in the command direction.

---Setting range---
-1 to 100 (Short-time rated %)
Note that when SP227/bit2 is "1", the range will be -1 to 10000 (Short-time rated 0.01%).

【#13044】 SP044 OBS2 Disturbance observer gain

Set the disturbance observer gain. The standard setting is "100".
To use the disturbance observer, also set SP037(JL), SP045(OBS1) and SP226(SFNC6)/ bitE(obs).
When not using, set to "0".

---Setting range---
0 to 500 (%)

【#13045】 SP045 OBS1 Disturbance observer filter frequency

Set the disturbance observer filter band.
Normally, set to "100".
To use the disturbance observer, also set SP037(JL), SP044(OBS2) and SP226(SFNC6)/ bitE(obs).
When not using, set to "0".

---Setting range---
0 to 1000 (rad/s)

【#13046】 SP046 FHz2 Notch filter frequency 2

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---
0 to 2250 (Hz)

【#13047】 SP047 EC Inductive voltage compensation gain

Set the inductive voltage compensation gain. Normally, set to "100".
Lower the gain when the current FB peak exceeds the current command peak.

---Setting range---
0 to 200 (%)

【#13048】 SP048 LMC1 Lost motion compensation 1

Set this parameter when the protrusion (that occurs due to the non-sensitive band by friction, torsion, backlash, etc.) at quadrant change is too large.
This compensates the torque at quadrant change.
This is valid only when the overshooting compensation SP033 (SFNC1/lmc) is selected.

[Type 2 "When SP033(SFNC1)/bit9,8(lmc)=10"]
Set the compensation amount based on the motor short-time rated current.
The standard setting is double of the friction torque. The compensation amount will be 0 when "0" is set.

[Other than type 2 "When SP033(SFNC1)/bit9,8(lmc)≠10"]
Lost motion compensation (Type 2) is not executed.

[To vary compensation amount depending on the direction]
When SP041 (LMC2) is "0", change SP048 (LMC1) value in both of +/- directions to compensate.
To vary the compensation amount depending on the command direction, set this with SP041 (LMC2).
(SP048: + direction, SP041: - direction, However, the directions may be opposite depending on other settings.)
When "-1" is set, the compensation will not be performed in the command direction.

---Setting range---
-1 to 200 (Short-time rated %)
Note that when SP227/bit2 is "1", the range will be -1 to 20000 (Short-time rated 0.01%).

【#13049】 SP049 FFC Acceleration rate feed forward gain

When a relative error in the synchronous control is too large, set this parameter to the axis that is delaying.
The standard setting is "0".
The standard setting in the SHG control is "100".
Adjust relative errors in acceleration/deceleration by increasing the value by 50 to 100.

---Setting range---
0 to 999 (%)

【#13050】 SP050 TOF Torque offset

Set the imbalance torque.

---Setting range---
-100 to 100 (Short-time rated %)

【#13051】 SP051 DFBT Dual feed back control time constant

Set the control time constant in dual feed back.
When the function is valid, the standard setting is "100". When "0" is set, the value is 1 ms.
When the time constant is increased, the operation will get closer to the semi-closed control and the limit of the position loop gain will be raised.
However, this cannot be used when the spindle slip occurs in machine configuration such as V-belt drive.

---Setting range---
0 to 9999 (ms)

【#13052】 SP052 DFBN Dual feedback control non-sensitive band

Set the non-sensitive band in the dual feedback control.
Normally set to "0".

---Setting range---
0 to 9999 (1/1000")

【#13053】 SP053 ODS Excessive error detection width (non-interpolation mode)

Set the excessive error detection width in non-interpolation mode.
Standard setting value: ODS = Maximum motor speed [r/min] × 6/PGV/2

When set to "0", the excessive error detection will not be performed.

---Setting range---
0 to 32767 (°)

【#13054】 SP054 ORE Overrun detection width in closed loop control

Set the overrun detection width in the full-closed loop control.
When the gap between the main side detector and the sub side detector exceeds the set value, it is judged as an overrun and "Alarm 43" is detected.
When "-1" is set, the alarm detection will not be performed.
When "0" is set, overrun will be detected with 2°.
In the full-closed loop control, normally set this parameter to "360". During V-belt drive, set to "-1".

---Setting range---
-32768 to 32767 (°)

【#13055】 SP055 EMGx Max. gate off delay time after emergency stop

Set the time required to forcibly execute READY OFF after the emergency stop is input.
Normally set to "20000".
When "0" is set, READY OFF is forcibly executed with "7000ms".
When the set time is shorter than the time to decelerate and stop, the spindle will stop with the dynamic brake after the set time is out.

---Setting range---
0 to 29900 (ms)

【#13056】 SP056 EMGt Deceleration time constant at emergency stop

Set the time constant used for the deceleration control at emergency stop. Set the time required to stop from the maximum motor speed (TSP).
When "0" is set, the deceleration control is executed with "7000ms".

---Setting range---
-29900 to 29900 (ms)

【#13057(PR)】 SP057 GRA1 Spindle side gear ratio 1

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) "is set to "00".

---Setting range---
1 to 32767

【#13058(PR)】 SP058 GRA2 Spindle side gear ratio 2

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "01".

---Setting range---

1 to 32767

【#13059(PR)】 SP059 GRA3 Spindle side gear ratio 3

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "10".

---Setting range---

1 to 32767

【#13060(PR)】 SP060 GRA4 Spindle side gear ratio 4

Set the number of teeth on the spindle side when "the gear selection command (control input 4/bit6, 5) " is set to "11".

---Setting range---

1 to 32767

【#13061(PR)】 SP061 GRB1 Motor side gear ratio 1

Set the number of teeth on the motor side when "the gear selection command (control input 4/bit6, 5) " is set to "00".

---Setting range---

1 to 32767

【#13062(PR)】 SP062 GRB2 Motor side gear ratio 2

Set the number of teeth on the motor side when "the gear selection command (control input 4/bit6, 5) " is set to "01".

---Setting range---

1 to 32767

【#13063(PR)】 SP063 GRB3 Motor side gear ratio 3

Set the number of teeth on the motor side when "the gear selection command (control input 4/bit6, 5)" is set to "10".

---Setting range---

1 to 32767

【#13064(PR)】 SP064 GRB4 Motor side gear ratio 4

Set the number of teeth on the motor side when "the gear selection command (control input 4/bit6, 5)" is set to "11".

---Setting range---

1 to 32767

【#13065】 SP065 TLM1 Torque limit 1

Set the torque limit value when "the torque limit (control input 1/bitA, 9, 8) " is set to "001".

---Setting range---

0 to 999 (Short-time rated %)

【#13066】 SP066 TLM2 Torque limit 2

Set the torque limit value when "the torque limit (control input 1/bitA, 9, 8)" is set to "010".

---Setting range---

0 to 999 (Short-time rated %)

【#13067】 SP067 TLM3 Torque limit 3

Set the torque limit value when "the torque limit (control input 1/bitA, 9, 8) " is set to "011".

---Setting range---
0 to 999 (Short-time rated %)

【#13068】 SP068 TLM4 Torque limit 4

Set the torque limit value when "the torque limit (control input 1/bitA, 9, 8) " is set to "100".

---Setting range---
0 to 999 (Short-time rated %)

【#13069】 SP069 PCMP Phase alignment completion width

Set the single-rotation position alignment completion width for phase alignment and changing from non-interpolation to spindle synchronization mode during rotation.
Set the rotation error that is required to the machine.
When the setting value decreases, the rotation error will decrease, but the cycle time (settling time) will get longer. The standard setting is "875".

---Setting range---
0 to 32767 (1°/1000)

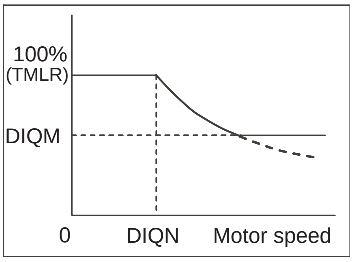
【#13070】 SP070 KDDT Phase alignment deceleration rate scale

Set the scale for SP016 (DDT) to change the deceleration rate only during rotation command (command F ⊿ T ≠ 0).
When the setting value increases, the single-rotation position alignment will be completed faster, but the impact to the machine will also increase. When not using, set to "0".

---Setting range---
0 to 255 (1/16-fold)

【#13071】 SP071 DIQM Variable current limit during deceleration, lower limit value

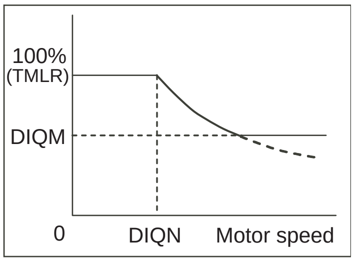
Set this parameter to adjust the deceleration time by changing the current limit value during deceleration depending on the motor speed.
As shown below, set the lower limit rate of the current limit in SP071 (DIQM), and use with SP072 (DIQN).
When DIQM is set to 100%, the current limit value in deceleration (TMRL) set in the motor constants is applied.



---Setting range---
0 to 999 (%)

【#13072】 SP072 DIQN Variable current limit during deceleration, break point speed

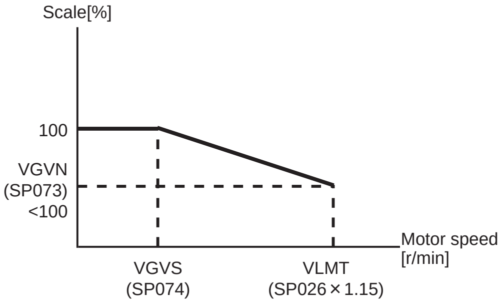
Set this parameter to adjust the deceleration time by changing the current limit value during deceleration depending on the motor speed.
As shown below, set the lower limit rate of the current limit in SP071 (DIQM), and use with SP072 (DIQN).
When DIQM is set to 100%, the current limit value in deceleration (TMRL) set in the motor constants is applied.



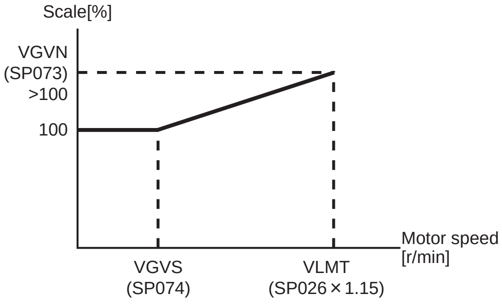
---Setting range---
1 to 32767 (r/min)

【#13073】 SP073 VGVN Variable speed gain target value

If noise is bothersome during high speed rotation, it may be reduced by lowering the speed loop gain at high speed.
Set this value to ensure the adequate response by suppressing noise and vibration at low speeds and increasing the speed loop gain at high speeds for a high-speed spindle of machining center, etc.
As shown below, set the speed loop gain rate for the overspeed detection speed in SP073 (VGVN), and use with SP074 (VGVS).
When not using, set to "0".
The overspeed detection speed (VLMT) is 115% of the maximum motor speed (TSP).
This function can be used when either VGN1 or VGN2 is selected.



When lowering the speed loop gain at high speed

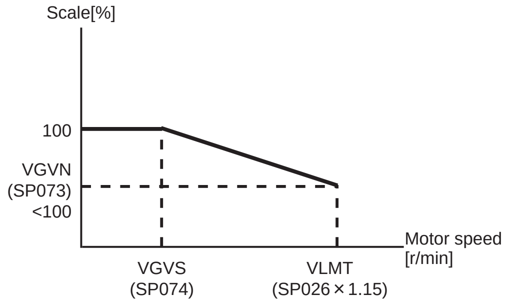


When increasing the speed loop gain at high speed

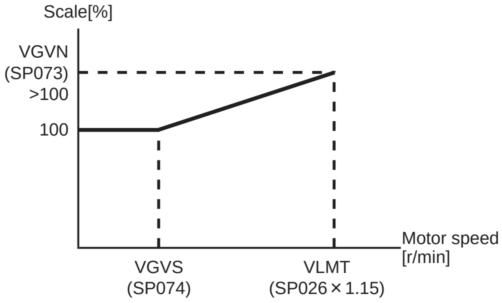
---Setting range---
0 to 999 (%)

【#13074】 SP074 VGVS Variable speed gain change start speed

If noise is bothersome during high speed rotation, it may be reduced by lowering the speed loop gain at high speed.
Set this value to ensure the adequate response by suppressing noise and vibration at low speeds and increasing the speed loop gain at high speeds for a high-speed spindle of machining center, etc.
As shown below, set the speed loop gain rate for the overspeed detection speed in SP073 (VGVN), and use with SP074 (VGVS).
When not using, set to "0".
The overspeed detection speed (VLMT) is 115% of the maximum motor speed (TSP).
This function can be used when either VGN1 or VGN2 is selected.



When lowering the speed loop gain at high speed



When increasing the speed loop gain at high speed

---Setting range---
0 to 32767 (r/min)

【#13075】 SP075 DWSH Slip compensation scale during regeneration high-speed coil

Set the slip frequency scale during deceleration.
Normally, set to "0". (For machine tool builder adjustment)

---Setting range---
0 to 255 (1/16-fold)

【#13076】 SP076 DWSL Slip compensation scale during regeneration low-speed coil

Set the slip frequency scale at deceleration when using the low-speed coil.
Normally, set to "0". (For machine tool builder adjustment)

---Setting range---
0 to 255 (1/16-fold)

【#13077】 SP077 IQA Q axis current lead compensation

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13078】 SP078 IDA D axis current lead compensation

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13079】 SP079 IQG Q axis current gain

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13080】 SP080 IDG D axis current gain

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13081】 SP081 IQAL Q axis current lead compensation low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13082】 SP082 IDAL D axis current lead compensation low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13083】 SP083 IQGL Q axis current gain low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13084】 SP084 IDGL D axis current gain low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13085】 SP085 LMCk Lost motion compensation 3 spring constant

Set the compensation amount for the spring constant when using lost motion compensation type 3.
When not using, set to "0".

---Setting range---
0 to 32767 (0.01%/0.001°)

【#13086】 SP086 LMCc Lost motion compensation 3 viscous coefficient

Set the compensation amount for the viscous coefficient when using lost motion compensation type 3.
When not using, set to "0".

---Setting range---
0 to 32767 (0.01% - s/ 1°)

【#13087】 SP087 FHz4 Notch filter frequency 4

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---
0 to 2250 (Hz)

【#13088】 SP088 FHz5 Notch filter frequency 5

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---
0 to 2250 (Hz)

【#13089】 SP089 TMKQ Spindle output stabilizing gain Q axis

Set the magnification of the torque current stabilizing gain. (For machine tool builder adjustment)
When set to "0", the torque current stabilization is disabled.
When not using, set to "0".

---Setting range---
0 to 32767

【#13090】 SP090 TMKD Spindle output stabilizing gain D axis

Set the magnification of the excitation current stabilizing gain. (For machine tool builder adjustment)
When set to "0", the excitation current stabilization is disabled.
When not using, set to "0".

---Setting range---
0 to 32767

【#13091】 SP091

Not used. Set to "0".

【#13092】 SP092

Not used. Set to "0".

【#13093】 SP093

Not used. Set to "0".

【#13094】 SP094 MPV Magnetic pole error detection speed

When not using, set to "0".
In the magnetic pole position detection function, the command motor speed and motor speed during the position command stop are monitored.
Set the command motor speed level and motor speed level during the position command stop in "r/min" unit.
When the command motor speed level is set to "0", the magnetic pole position error is detected at 10r/min.
Set to "10" as a standard setting when the magnetic pole position error detection function is enabled.
This detects the magnetic pole position error when the motor speed is "100r/min".

Ten-thousands digit, Thousands digit ------------ Command motor speed level (10r/min)
Hundreds digit, Tens digit, Ones digit ----------- Motor speed level (10r/min)

---Setting range---
0 to 31999

【#13095】 SP095 VIAX Lead compensation scale during high-response acceleration/deceleration

Set the magnification against delay/lead compensation (SP006) of the high-response acceleration/deceleration (valid when SP226(SFNC6)/ bitD (vup) is set to "1").
Normally, set to "0". Set this parameter to suppress overshooting when the speed is reached.

---Setting range---
0 to 10000 (0.01%)

【#13096】 SP096 SDW Speed slowdown allowable width

When the spindle slows down due to multiple cutting, set the processable speed as percentage against the NC command speed.
When "0" is set, the magnification is the same as when "85" is set. When set to "-1", the allowable width will be disabled.

---Setting range---
-1,0 to 100(%)

【#13097】 SP097 RNG1ex Sub side extension detector resolution

Normally set to "0".
When setting the sub side detector resolution in pulse (p) unit, set the number of pulses to four bite data of SP097 (upper 16 bits) and SP019 (lower 16 bits).

SP097 = number of pulses / 65536 (When = 0, set SP097 = -1)
SP019 = the remainder of "number of pulses / 65536" (values can be set by the pulse)
For detectors not using the upper 16 bits, set to "-1".

When "SP019 > 32767", set "the remainder of above - 65536 (negative number)"
to "SP019".

---Setting range---
-1,0 to 32767

【#13098】 SP098 RNG2ex Main side extension detector resolution

Normally set to "0".
When setting the main side detector resolution in pulse (p) unit, set the number of pulses to four bite data of SP098 (upper 16 bits) and SP020 (lower 16 bits).

SP098 = number of pulses / 65536 (When = 0, set SP098 = -1)
SP020 = the remainder of "number of pulses / 65536" (values can be set by the pulse)
For detectors not using the upper 16 bits, set to "-1".

When "SP020 > 32767", set "the remainder of above - 65536 (negative number)"
to "SP020".

---Setting range---
-1,0 to 32767

【#13099】 SP099

Not used. Set to "0".

【#13100】 SP100

Not used. Set to "0".

【#13101】 SP101

Not used. Set to "0".

【#13102】 SP102

Not used. Set to "0".

【#13103】 SP103

Not used. Set to "0".

【#13104】 SP104

Not used. Set to "0".

【#13105】 SP105

Not used. Set to "0".

【#13106】 SP106

Not used. Set to "0".

【#13107】 SP107

Not used. Set to "0".

【#13108】 SP108

Not used. Set to "0".

【#13109】 SP109

Not used. Set to "0".

【#13110】 SP110

Not used. Set to "0".

【#13111】 SP111

Not used. Set to "0".

【#13112】 SP112

Not used. Set to "0".

【#13113】 SP113 OPLP Current command value for open loop

Set the current command value for when the open loop control is enabled.
When "0" is set, the state will be the same as when "50" is set.
When not using, set to "0".
The open loop control is enabled when "SP018 (SPEC2)/bit1 (oplp)" is set to "1".

---Setting range---

0 to 999 (Short-time rated %)

【#13114】 SP114 MKT Coil changeover gate cutoff timer

Set the time required to cut off the gate when turning OFF/ON the coil switch contactor.
The value should be longer than the coil switch contactor's OFF/ON time.
The standard setting is "150".

---Setting range---
0 to 3500 (ms)

【#13115】 SP115 MKT2 Coil changeover current limit timer

Set the time required to limit the current immediately after the coil switch contactor ON/OFF is completed and the gate is turned ON.
The standard setting is "250".

---Setting range---
0 to 3500 (ms)

【#13116】 SP116 MKIL Coil changeover current limit value

Set the time required to limit the current immediately after the coil switch contactor ON/OFF is completed and the gate is turned ON.
The standard setting is "120".

---Setting range---
0 to 999 (Short-time rated %)

【#13117】 SP117 SETM Excessive speed deviation timer

Set the time to detect the speed excessive error alarm.
Set the time required to the machine.
The standard setting is "12".

---Setting range---
0 to 60 (s)

【#13118(PR)】 SP118 MSFT Magnetic pole shift amount

Set the magnetic pole shift amount of IPM spindle motor.
During DC excitation of the initial setup: Set the same value displayed in the "AFLT gain" on the NC monitor screen in SP225(SFNC5)/bit4(dcd)=1.
When not using, set to "0".

---Setting range---
-18000 to 18000 (electrical angle 0.01°)

【#13119】 SP119 FSP4 Notch filter specifications 4

When not using, set to "0".
Set the target attenuation and damping coefficient of the notch filter.
To determine the value, multiply the damping coefficient by 10000, and add it to the absolute value of the target attenuation -dB.
The setting range of each coefficient is as follows.
Damping coefficient: 0.01 - 1.00 (Increment: 0.01)
When "0" is set, the actual value to be set is 1.00.
Target attenuation: -80db - -1db (Increment: 1dB)
When "0" is set, the actual value to be set is -80.
E.g.: When the target attenuation is -40dB, and damping coefficient is 1.00
1.00×10000 + ABS(-40) = 10040

---Setting range---
0 to 32767

【#13120】 SP120 FSP5 Notch filter specifications 5

When not using, set to "0".
Set the target attenuation and damping coefficient of the notch filter.
To determine the value, multiply the damping coefficient by 10000, and add it to the absolute value of the target attenuation -dB.
The setting range of each coefficient is as follows.
Damping coefficient: 0.01 - 1.00 (Increment: 0.01)
When "0" is set, the actual value to be set is 1.00.
Target attenuation: -80db - -1db (Increment: 1dB)
When "0" is set, the actual value to be set is -80.
E.g.: When the target attenuation is -40dB, and damping coefficient is 1.00
1.00×10000 + ABS(-40) = 10040

---Setting range---
0 to 32767

【#13121】 SP121 MP Kpp Magnetic pole detection position loop gain

Set the position loop gain in the magnetic polar detection loop.
This is used in the initial magnetic polar detection when the IPM spindle motor is turned ON.
Set to "0" when using an IM spindle motor.

---Setting range---
0 to 32767

【#13122】 SP122 MP Kvp Magnetic pole detection speed loop gain

Set the speed loop gain in the magnetic polar detection loop.
This is used in the initial magnetic polar detection when the IPM spindle motor is turned ON.
Set to "0" when using an IM spindle motor.

---Setting range---
0 to 32767

【#13123】 SP123 MP Kvi Magnetic pole detection speed loop lead compensation

Set the speed loop lead compensation in the magnetic polar detection loop.
This is used in the initial magnetic polar detection when the IPM spindle motor is turned ON.
Set to "0" when using an IM spindle motor.

---Setting range---
0 to 32767

【#13124】 SP124 ILMTsp Magnetic pole detection current limit value

Set the current limit value for the magnetic polar detection loop.
This is used in the initial magnetic polar detection when the IPM spindle motor is turned ON.
Set to "0" when using an IM spindle motor.

---Setting range---
0 to 999 (Short-time rated %)

【#13125】 SP125 DA1NO D/A output ch1 data No. / Initial DC excitation level

Input the desired data number to D/A output channel.

[When driving an IPM spindle motor (MDS-D/DH Series)]
Use in the DC excitation function.
DC excitation: Set the initial excitation level when SP225(SFNC5)/bit4(dcd)=1.
When "0" is set, the state will be the same as when "20" is set.

---Setting range---
-32768 to 32767

【#13126】 SP126 DA2NO D/A output ch2 data No. / Final DC excitation level

Input the desired data number to D/A output channel.

[When driving an IPM spindle motor (MDS-D/DH Series)]
Use in the DC excitation function.
DC excitation: Set the final excitation level when SP225(SFNC5)/bit4(dcd)=1.
When "0" is set, the state will be the same as when "50" is set.

---Setting range---
-32768 to 32767

【#13127】 SP127 DA1MPY D/A output ch1 output scale / Initial DC excitation time

Set the output scale in increments of 1/100.
When "0" is set, the scale is the same as when "100" is set.

[When driving an IPM spindle motor (MDS-D/DH Series)]
Use in the DC excitation function.
DC excitation: Set the initial excitation time when SP225(SFNC5)/bit4(dcd)=1.
When "0" is set, the state will be the same as when "10000" is set.

---Setting range---
-32768 to 32767 (1/100-fold)

【#13128】 SP128 DA2MPY D/A output ch2 output scale

Set the output scale in increments of 1/100.
When "0" is set, the scale is the same as when "100" is set.

---Setting range---
-32768 to 32767 (1/100-fold)

【#13129(PR)】 SP129

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13130(PR)】 SP130

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13131(PR)】 SP131

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13132(PR)】 SP132

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13133(PR)】 SP133

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13134(PR)】 SP134

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13135(PR)】 SP135

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13136(PR)】 SP136

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13137(PR)】 SP137

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13138(PR)】 SP138

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13139(PR)】 SP139

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13140(PR)】 SP140

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13141(PR)】 SP141

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13142(PR)】 SP142

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.
For IPM spindle motor
This parameter is used in initial magnetic pole detection of IPM spindle motor.
(1) Pulse application time: Set it in [μs] unit.(0 < application time < 350)
(2) Pulse application coil: To select a low-speed coil, add 1000 to the pulse application time.
(3) Polarity of estimated magnetic pole: When it is set to the reverse polarity, add "-" to the total of (1) and (2).
E.g.: When performing 333μs pulse-applied magnetic pole estimation in a low-speed coil and selecting the reverse polarity for the estimated polarity

SP142 = -(333+1000) = -1333

【#13143(PR)】 SP143

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13144(PR)】 SP144

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13145(PR)】 SP145

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13146(PR)】 SP146

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13147(PR)】 SP147

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13148(PR)】 SP148

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13149(PR)】 SP149

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13150(PR)】 SP150

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13151(PR)】 SP151

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13152(PR)】 SP152

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13153(PR)】 SP153

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13154(PR)】 SP154

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13155(PR)】 SP155

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13156(PR)】 SP156

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13157(PR)】 SP157

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13158(PR)】 SP158

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13159(PR)】 SP159

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13160(PR)】 SP160

Set the unique constants for the spindle motor. (High-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13161(PR)】 SP161

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13162(PR)】 SP162

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13163(PR)】 SP163

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13164(PR)】 SP164

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13165(PR)】 SP165

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13166(PR)】 SP166

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13167(PR)】 SP167

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13168(PR)】 SP168

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13169(PR)】 SP169

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13170(PR)】 SP170

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13171(PR)】 SP171

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13172(PR)】 SP172

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13173(PR)】 SP173

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13174(PR)】 SP174

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13175(PR)】 SP175

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13176(PR)】 SP176

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13177(PR)】 SP177

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13178(PR)】 SP178

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13179(PR)】 SP179

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13180(PR)】 SP180

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13181(PR)】 SP181

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13182(PR)】 SP182

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13183(PR)】 SP183

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13184(PR)】 SP184

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13185(PR)】 SP185

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13186(PR)】 SP186

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13187(PR)】 SP187

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13188(PR)】 SP188

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13189(PR)】 SP189

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13190(PR)】 SP190

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13191(PR)】 SP191

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13192(PR)】 SP192

Set the unique constants for the spindle motor. (Low-speed coil)
The setting value is determined by the motor's mechanical and electrical characteristics and specifications, so normally set the value given in the spindle parameter list.

【#13193】 SP193 LMR Change magnification for load meter standard output (High-speed coil)

Set the standard output to be displayed as 100% in load meter using the short-time rated output ratio.
To display the continuous rated output as 100%, set as follows.
Continuous rated output/Short-time rated output × 100
When "0" is set, normal display will be applied.
It is not available for MDS-D-SPJ3 Series.

---Setting range---
0 to 100 (%)

【#13194】 SP194 LMN Base speed for load meter standard output (High-speed coil)

Set the base speed of the standard output to be displayed as 100% in load meter.
When "0" is set, the base speed of the short-time rated output will be applied.
It is not available for MDS-D-SPJ3 Series.

---Setting range---
0 to 32767 (r/min)

【#13195】 SP195 LMRL Change magnification for load meter standard output (Low-speed coil)

Set the standard output to be displayed as 100% in load meter using the short-time rated output ratio.
To display the continuous rated output as 100%, set as follows.
Continuous rated output/Short-time rated output × 100
When "0" is set, normal display will be applied.
It is not available for MDS-D-SPJ3 Series.

---Setting range---
0 to 100 (%)

【#13196】 SP196 LMNL Base speed for load meter standard output (Low-speed coil)

Set the base speed of the standard output to be displayed as 100% in load meter.
When "0" is set, the base speed of the short-time rated output will be applied.
It is not available for MDS-D-SPJ3 Series.

---Setting range---
0 to 32767 (r/min)

【#13197】 SP197

Not used. Set to "0".

【#13198】 SP198

Not used. Set to "0".

【#13199】 SP199

Not used. Set to "0".

【#13200】 SP200

Not used. Set to "0".

【#13201】 SP201

Not used. Set to "0".

【#13202】 SP202

Not used. Set to "0".

【#13203】 SP203

Not used. Set to "0".

【#13204】 SP204

Not used. Set to "0".

【#13205】 SP205

Not used. Set to "0".

【#13206】 SP206

Not used. Set to "0".

【#13207】 SP207

Not used. Set to "0".

【#13208】 SP208

Not used. Set to "0".

【#13209】 SP209

Not used. Set to "0".

【#13210】 SP210

Not used. Set to "0".

【#13211】 SP211

Not used. Set to "0".

【#13212】 SP212

Not used. Set to "0".

【#13213】 SP213

Not used. Set to "0".

【#13214】 SP214

Not used. Set to "0".

【#13215】 SP215

Not used. Set to "0".

【#13216】 SP216

Not used. Set to "0".

【#13217】 SP217

Not used. Set to "0".

【#13218】 SP218

Not used. Set to "0".

【#13219】 SP219

Not used. Set to "0".

【#13220】 SP220

Not used. Set to "0".

【#13221】 SP221

Not used. Set to "0".

【#13222】 SP222

Not used. Set to "0".

【#13223】 SP223

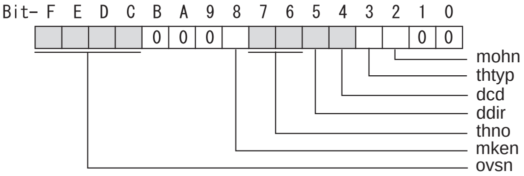
Not used. Set to "0".

【#13224】 SP224

Not used. Set to "0".

【#13225】 SP225 SFNC5 Spindle function 5

Select the spindle functions.
Functions are allocated to each bit.
Set this in hexadecimal format.



bit F-C : ovsn Overshooting compensation type 3 non-sensitive band

Set the non-sensitive band of the overshooting compensation type 3 in increments of 2°/1000.
In the feed forward control, set the non-sensitive band for the model position droop and ignore the model overshooting. Set to "2°/1000" as a standard.

bit B-9 :

Not used. Set to "0".

bit 8 : mken Coil switch allowance in deceleration control

This enables a coil changeover while decelerating after an emergency stop for a spindle motor with coil changeover specification. A coil changeover may enable an excessive load inertia to stop within the maximum delay time.
0: Normal (Disable) 1: Enable

bit 7-6 : thno

Select the thermistor characteristics.
When SP225/bit3=0 (N type) is selected
bit7,6=
00: For Mitsubishi spindle motor
01: Setting prohibited
10: Setting prohibited
11: Setting prohibitedWhen SP225/bit3=1 (P type) is selected
00: KTY84-130 (Manufactured by Philips)
01: Setting prohibited
10: Setting prohibited
11: Setting prohibited

bit 5 : ddir Proximity switch signal enable edge

0: Falling edge 1: Rising edge

bit 4 : dcd DC excitation mode

0: Normal 1: Start

bit 3 : thtyp

Select the thermistor type.
0: Type N thermistor (Mitsubishi standard)?1: Type P thermistor

bit 2 : mohn Thermistor temperature detection

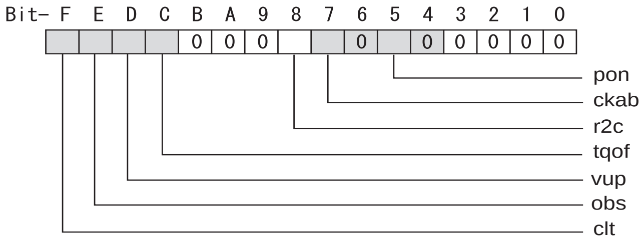
0: Normal 1: Disable (Except for TS5690/5691)

bit 1-0 :

Not used. Set to "0".

【#13226】 SP226 SFNC6 Spindle function 6

Select the spindle functions.
Functions are allocated to each bit.
Set this in hexadecimal format.



bit F : clt Spindle monitor load inertia ratio

0: Normal 1: Display

bit E : obs Disturbance observer

0: Normal 1: Enable

bit D : vup High response acceleration / deceleration

This suppresses a temporal delay which occurs when the target speed is attained from acceleration and when the spindle stops from deceleration.
0: Normal acceleration/deceleration 1: High response acceleration/deceleration Enable

bit C : tqof Spindle output stabilization during acceleration

0: Normal 1: Disable

bit B-9 :

Not used. Set to "0".

bit 8 : r2c Temperature compensation adjustment indicator

0: Normal 1: Display

bit 7 : ckab No signal detection 2

0: Disable 1: Enable

- For MDS-DM Series
Not used. Set to "0".

bit 6 :

Not used. Set to "0".

bit 5 : pon IPM spindle pulse application magnetic pole estimation

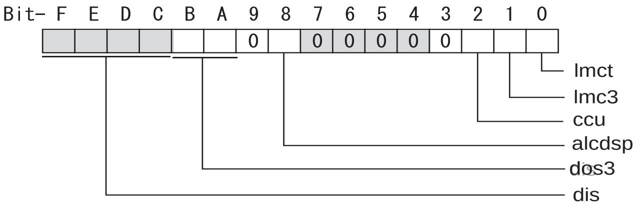
0: Normal 1: Enable
It is not available for MDS-D-SPJ3 Series.

bit 4-0 :

Not used. Set to "0".

【#13227】 SP227 SFNC7 Spindle function 7

Select the spindle functions.
Functions are allocated to each bit.
Set this in hexadecimal format.



bit F-C : dis Digital signal input selection

0: No signal 1: Safety observation function door state signal 4: Proximity switch signal detection
Other settings: setting prohibited

bit B-A : dos3 Digital signal output 3 selection

bitB,A=
00: Disable
01: Setting prohibited
10: Contactor control signal output (For MDS-D-SPJ3)
11: Setting prohibited

bit 9 :

Not used. Set to "0".

bit 8 : alcdsp

0: Display alarm history 1: Display alarm counter

- For MDS-DM Series
Not used. Set to "0".

bit 7-3 :

Not used. Set to "0".

bit 2 : ccu Lost motion/overshoot compensation compensation amount setting unit

0: Short-time rated % 1: Short-time rated 0.01%

bit 1 : lmc3 Lost motion compensation 3

0: Disable 1: Enable

bit 0 : lmct Lost motion compensation 3 adjustment time measurement

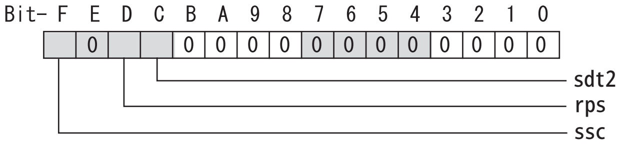
0: Disable 1: Enable

【#13228】 SP228 SFNC8 Spindle function 8

Not used. Set to "0000".

【#13229】 SP229 SFNC9 Spindle function 9

Select the spindle functions.
Functions are allocated to each bit.
Set this in hexadecimal format.



bit F : ssc Safety observation function

0: Disable 1: Enable

bit E :

Not used. Set to "0".

bit D : rps Safety observation speed setting unit

0: Normal 1: 100°/min

bit C : sdt2 Specified speed output digital signal 2 output

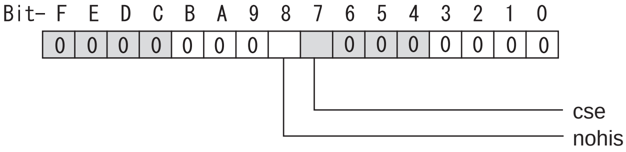
0: Normal 1: Enable

bit B-0 :

Not used. Set to "0".

【#13230】 SP230 SFNC10 Spindle function 10

Select the spindle functions.
Functions are allocated to each bit.
Set this in hexadecimal format.



bit F-9 :

Not used. Set to "0".

bit 8 : nohis Communication error alarm(34,36,38,39) between NC and DRV Specific alarm history disabled

0: Enable 1: Disable
For C70, set "1".

bit 7 : cse Spindle C axis command speed monitoring function

0: Normal setting (function disabled) 1: Function enabled
It is not available for MDS-D-SPJ3 Series.

bit 6-0 :

Not used. Set to "0".

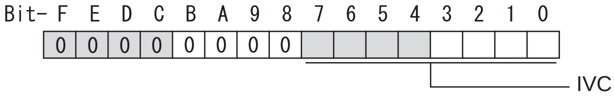
【#13231】 SP231

Not used. Set to "0".

【#13232】 SP232

Not used. Set to "0".

【#13233】 SP233 IVC/Icx Voltage non-sensitive band compensation/Current bias cx



bit F-8 :

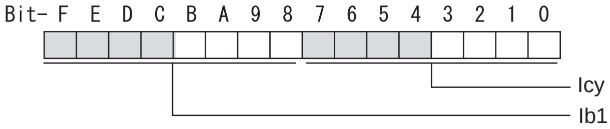
Not used. Set to "0".

bit 7-0 : IVC Voltage non-sensitive band compensation

When 100% is set, the voltage equivalent to the logical non-energized time will be compensated.
When "0" is set, 100% compensation will be performed.
Adjust in increments of 10% from the default value 100%.
If the value is too large, vibration or vibration noise may be generated.

---Setting range---
0 to 255 (%)

【#13234】 SP234 Icy/Ib1 Current bias cy/Current bias b1



bit F-8 : Ib1 Current bias 1

Normally, set to "0". (For machine tool builder adjustment)
When using this parameter, use this with SP233(Icx), SP234(Icy).

---Setting range---
0 to 255

bit 7-0 : Icy Current bias

Normally, set to "0". (For machine tool builder adjustment)
When using this parameter, use this with SP233(Icx), SP234(Ib1).

---Setting range---
0 to 255

【#13235(PR)】 SP235 R2H Temperature compensation gain

Set the magnification in converting the thermistor temperature to the control compensation amount.
When "0" is set, the temperature compensation function is disabled.
When not using, or when using an IPM spindle motor, set to "0".

---Setting range---
0 to 400 (%)

【#13236(PR)】 SP236 WIH Temperature compensation time constant

Set the delay time constant from the thermistor temperature to the control compensation amount.
When "0" is set, the delay time constant is disabled.
When not using, or when using an IPM spindle motor, set to "0".

---Setting range---
0 to 150 (min)

【#13237(PR)】 SP237 TCF Torque command filter

Set the filter for the torque command.
When not using, set to "0".
The standard value is "500" when using the motor side detector TS5690 or TS5691.

---Setting range---
0 to 4500 (Hz)

【#13238】 SP238 SSCFEED Safety observation Safety speed

Set the safety speed at the spindle end for the safety observation function.
When not using, set to "0".

---Setting range---
0 to 18000 (°/min)
However, when SP229/bitD is set to "1", the setting range is from -32768 to 32767 (100°/min).

【#13239】 SP239 SSCRPM Safety observation Safety motor speed

Set the motor's safety speed for the safety observation function.
When not using, set to "0".

---Setting range---
0 to 32767 (r/min)

【#13240(PR)】 SP240

Not used. Set to "0".

【#13241(PR)】 SP241

This is automatically set by the NC system.

【#13242(PR)】 SP242

This is automatically set by the NC system.

【#13243(PR)】 SP243

This is automatically set by the NC system.

【#13244(PR)】 SP244

This is automatically set by the NC system.

【#13245(PR)】 SP245

This is automatically set by the NC system.

【#13246(PR)】 SP246

This is automatically set by the NC system.

【#13247(PR)】 SP247

This is automatically set by the NC system.

【#13248(PR)】 SP248

This is automatically set by the NC system.

【#13249(PR)】 SP249

This is automatically set by the NC system.

【#13250(PR)】 SP250

This is automatically set by the NC system.

【#13251(PR)】 SP251

This is automatically set by the NC system.

【#13252(PR)】 SP252

This is automatically set by the NC system.

【#13253(PR)】 SP253

This is automatically set by the NC system.

【#13254(PR)】 SP254

This is automatically set by the NC system.

【#13255(PR)】 SP255

This is automatically set by the NC system.

【#13256(PR)】 SP256

This is automatically set by the NC system.

4

Servo Adjustment

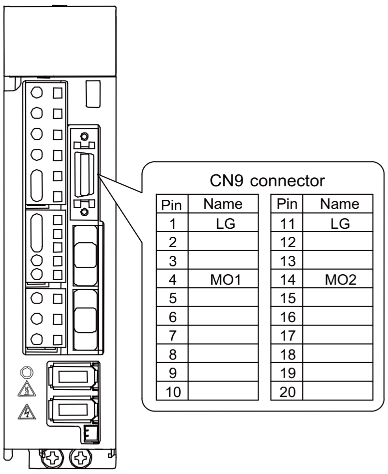
Contents

4 Servo Adjustment

4-1 D/A output specifications for servo drive unit

Drive unit has a function to D/A output the various control data.
The servo adjustment data required for setting the servo parameters to match the machine can be D/A output. Measure using a high-speed waveform recorder, oscilloscope, etc.

4-1-1 D/A output specifications

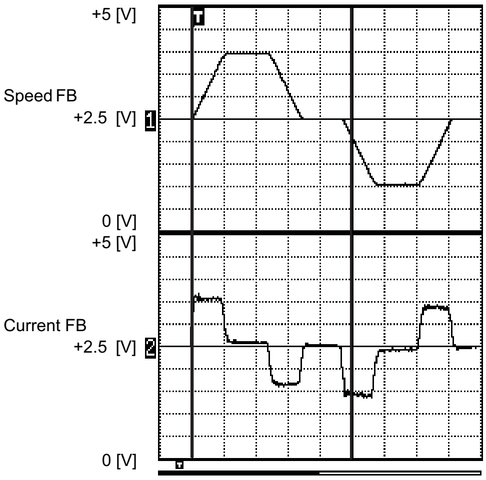

CN9 connector

Pin	Name	Pin	Name
1	LG	11	LG
2		12	
3		13	
4	MO1	14	MO2
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

MDS-D-SVJ3

Item	Explanation
No. of channels	2ch
Output cycle	0.8ms (min. value)
Output precision	10bit
Output voltage range	0V to 2.5V (zero) to +5V
Output magnification setting	-32768 to 32767 (1/100-fold)
Output pin (CN9, CN9B connector)	MO1 = Pin 9, MO2 = Pin 19, LG = Pin 1,11

When the output data is 0, the offset voltage is 2.5V. If there is an offset voltage, adjust the zero level position in the measuring instrument side.



Example of D/A output waveform

4-1-2 Output data settings

<Standard output>

【#2261】 SV061 DA1NO D/A output ch1 data No.

Input the data number you wish to output to the D/A output channel 1.
When using the 2-axis drive unit, set "-1" to the axis that the data will not be output.

---Setting range---
-1 to 127

【#2262】 SV062 DA2NO D/A output ch2 data No.

Input the data number you wish to output to the D/A output channel 2.
When using the 2-axis drive unit, set "-1" to the axis that the data will not be output.

---Setting range---
-1 to 127

No.	Output data	Standard output unit		Output cycle
		Linear axis	Rotary axis	
-1	**D/A output not selected**	For 2nd axis or 3rd axis drive unit.Set the parameters to the other axes in the drive unit that is not D/A output.		
0	**Commanded rotation speed**	1000(r/min)/V		0.8ms
1	**Motor rotation speed**	1000(r/min)/V		0.8ms
2	**Torque command**	Motor stall rated ratio 100%/V		0.8ms
3	**Torque feedback**	Motor stall rated ratio 100%/V		0.8ms
6	**Effective current command**	100%/V		0.8ms
7	**Effective current feedback**	100%/V		0.8ms
8	**Machine vibration frequency**	500Hz/V		0.8ms
9	**HAS control droop cancel amount**	1mm/V	1°/V	0.8ms
30	**Collision detection estimated torque**	100%/V		0.8ms
31	**Collision detection disturbance estimated torque**	100%/V		0.8ms
32	**Estimated load inertia ratio or moving sections gross weight**	100%/V or 100kg/V (Note)		0.8ms
35	**Disturbance observer estimated disturbance torque**	100%/V		0.8ms
50	**Position droop**	1μm/V	1/1000°/V	0.8ms
51	**Position command**	1μm/V	1/1000°/V	0.8ms
52	**Position feedback**	1μm/V	1/1000°/V	0.8ms
53	**Position FΔT**	1μm/s/V	1/1000°/s/V	0.8ms
54	**Deviation from ideal position (considering servo tracking delay)**	1μm/V	1/1000°/V	0.8ms
60	**Position droop**	1mm/V	1°/V	0.8ms
61	**Position command**	1mm/V	1°/V	0.8ms
62	**Position feedback**	1mm/V	1°/V	0.8ms
63	**Position FΔT**	1mm/s/V	1°/s/V	0.8ms
64	**Deviation from ideal position (considering servo tracking delay)**	1mm/V	1°/V	0.8ms
70	**Position droop**	1m/V	1000°/V	0.8ms
71	**Position command**	1m/V	1000°/V	0.8ms
72	**Position feedback**	1m/V	1000°/V	0.8ms
73	**Position FΔT**	1m/s/V	1000°/s/V	0.8ms
74	**Deviation from ideal position (considering servo tracking delay)**	1m/V	1000°/V	0.8ms
126	**Saw tooth wave**	0V to 5V		0.8ms
127	**2.5V test data**	2.5V		0.8ms

(Note) The estimated load inertia ratio (unit: 100%/V) is applied for the rotary motor.

< Servo control signal>

Servo control input (NC to Servo)			Servo control output (Servo to NC)		
No.	**Details**		**No.**	**Details**	
16384	Servo control input 1-0	READY ON command	**16480**	Servo control output 1-0	In READY ON
16385	Servo control input 1-1	Servo ON command	**16481**	Servo control output 1-1	In servo ON
16388	Servo control input 1-4	Position loop gain changeover command	**16484**	Servo control output 1-4	In position loop gain changeover
16390	Servo control input 1-6	Excessive error detection width changeover command	**16486**	Servo control output 1-6	In excessive error detection width changeover
16391	Servo control input 1-7	Alarm reset command	**16487**	Servo control output 1-7	In alarm
16392	Servo control input 1-8	Current limit selection command	**16488**	Servo control output 1-8	In current limit selection
			16492	Servo control output 1-C	In in-position
			16493	Servo control output 1-D	In current limit
			16494	Servo control output 1-E	In absolute position data loss
			16495	Servo control output 1-F	In warning
			16496	Servo control output 2-0	Z phase passed
			16499	Servo control output 2-3	In zero speed
			16503	Servo control output 2-7	In external emergency stop
16416	Servo control input 3-0	Control axis detachment command	**16512**	Servo control output 3-0	In control axis detachment

(Note) For details on the servo signals, refer to the section "4-8 Servo control signal".

4-1-3 Setting the output magnification

Set when outputting other than the standard output unit. When "0" is set, the magnification will be the same as "100".

(Example 1) When SV061=1 and SV063=50
The motor rotation speed is output at 2000(r/min)/V.
(Example 2) When SV062=3 and SV064=50
The torque feedback is output to D/A output channel 2 with 200%/V unit.

【#2263】 SV063 DA1MPY D/A output ch1 output scale

Set output scale of the D/A output channel 1 in increment of 1/100.
When "0" is set, the magnification is the same as when "100" is set.

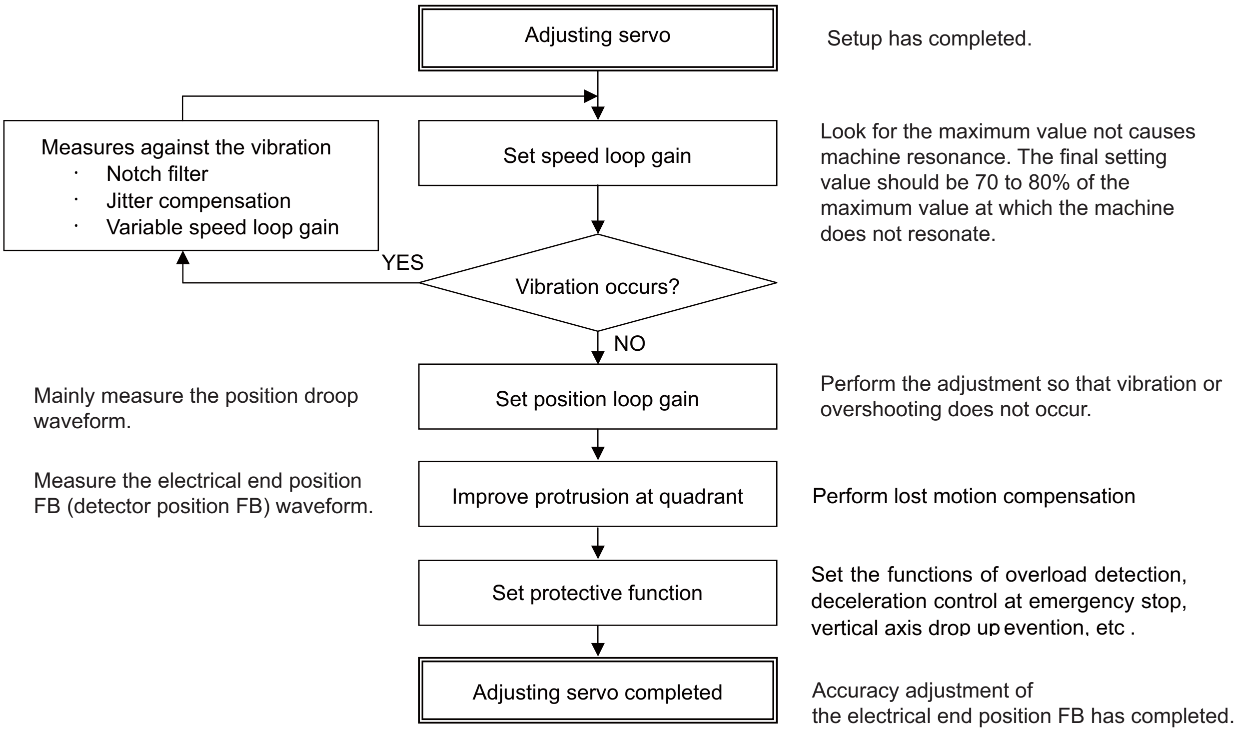
---Setting range---
-32768 to 32767 (1/100-fold)

【#2264】 SV064 DA2MPY D/A output ch 2 output scale

Set output scale of the D/A output channel 2 in accruement of 1/100.
When "0" is set, the magnification is the same as when "100" is set.

---Setting range---
-32768 to 32767 (1/100-fold)

4-2 Servo adjustment procedure



Setup has completed.

Look for the maximum value not causes machine resonance. The final setting value should be 70 to 80% of the maximum value at which the machine does not resonate.

Mainly measure the position droop waveform.

Perform the adjustment so that vibration or overshooting does not occur.

Measure the electrical end position FB (detector position FB) waveform.

Perform lost motion compensation

Set the functions of overload detection, deceleration control at emergency stop, vertical axis drop up evention, etc .

Accuracy adjustment of the electrical end position FB has completed.

⚠ **CAUTION** Perform adjusting the servo in the factory configuration of the machine. When the servo is adjusted without having an enough running-in or a cover, friction torque, machine resonance frequency or resonance gain may be different, resulting in an incorrect adjustment.

4-3 Gain adjustment

4-3-1 Current loop gain

【#2209】 SV009 IQA Current loop q axis lead compensation

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 20480

【#2210】 SV010 IDA Current loop d axis lead compensation

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 20480

【#2211】 SV011 IQG Current loop q axis gain

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 8192

【#2212】 SV012 IDG Current loop d axis gain

Set the fixed value of each motor.
Set the standard value for each motor described in the standard parameter list.

---Setting range---
1 to 8192

4-3-2 Speed loop gain

(1) Setting the speed loop gain

The speed loop gain 1 (SV005: VGN1) is an important parameter for determining the responsiveness of the servo control. During servo adjustment, the highest extent that this value can be set to becomes important. The setting value has a large influence on the machine cutting precision and cycle time.

[1] Refer to the following standard VGN1 graphs and set the standard VGN1 according to the size of the entire load inertia (motor and machine load inertia).

[2] If the standard VGN1 setting value is exceeded, the current command fluctuation will increase even if the speed feedback fluctuates by one pulse. This can cause the machine to vibrate easily, so set a lower value to increase the machine stability.

<When machine resonance does not occur at the standard VGN1>

Set the standard VGN1. Use the standard value if no problem (such as machine resonance) occurs. If sufficient cutting precision cannot be obtained at the standard VGN1, VGN1 can be raised above the standard value as long as a 70 percent margin in respect to the machine resonance occurrence limit is maintained. The cutting accuracy can also be improved by adjusting with the disturbance observer.

<When machine resonance occurs at the standard VGN1>

Machine resonance is occurring if the shaft makes abnormal sounds when operating or stopping, and a fine vibration can be felt when the machine is touched while stopped. Machine resonance occurs because the servo control responsiveness includes the machine resonance points. (Speed control resonance points occur, for example, at parts close to the motor such as ball screws.) Machine resonance can be suppressed by lowering VGN1 and the servo control responsiveness, but the cutting precision and cycle time are sacrificed. Thus, set a vibration suppression filter and suppress the machine resonance (Refer to section "4-4-2 Vibration suppression measures"), and set a value as close as possible to the standard VGN1. If the machine resonance cannot be sufficiently eliminated even by using a vibration suppression filter, then lower the VGN1.

【#2205】 SV005 VGN1 Speed loop gain 1

Set the speed loop gain.
The higher the setting value is, the more accurate the control will be, however, vibration tends to occur.
If vibration occurs, adjust by lowering by 20 to 30%.
The value should be determined to the 70 to 80% of the value at which the vibration stops.
The value differs depending on servo motors.
Aim at the standard value determined by the servo motor type and load inertia ratio to adjust.

---Setting range---
1 to 9999

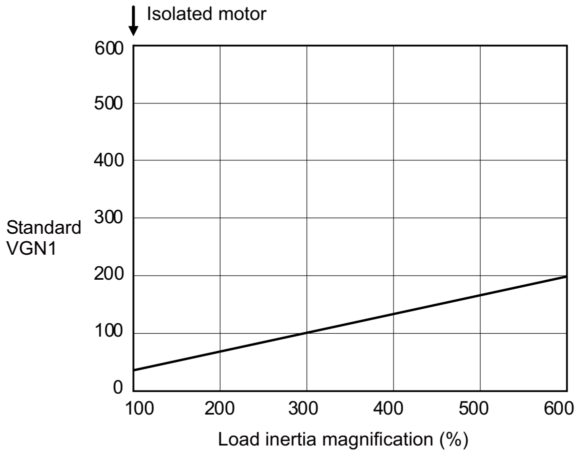
POINT Suppressing the resonance with the vibration suppression function and increasing the VGN1 setting is effective for adjusting the servo later.

Load inertia ratio display

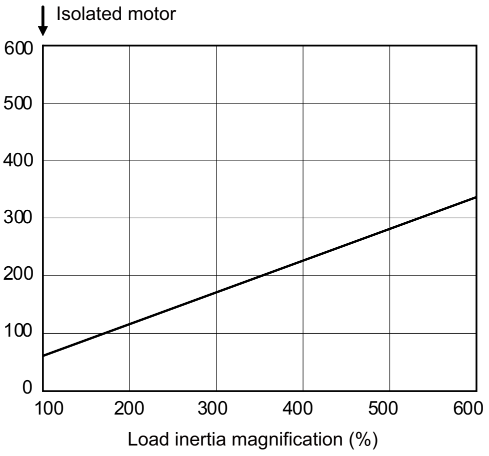
Perform the measurement in the section "4-4-5 (1) Measuring unbalance torque and frictional torque", and set a torque offset (SV032) and frictional torque (SV045).
When an acceleration/deceleration operation is executed with the setting of SV035/bitF=1, an estimated load inertia ratio will be displayed in "load inertia ratio " on the drive monitor screen.

Standard VGN1 graph (servo motor HF, HF-KP Series)

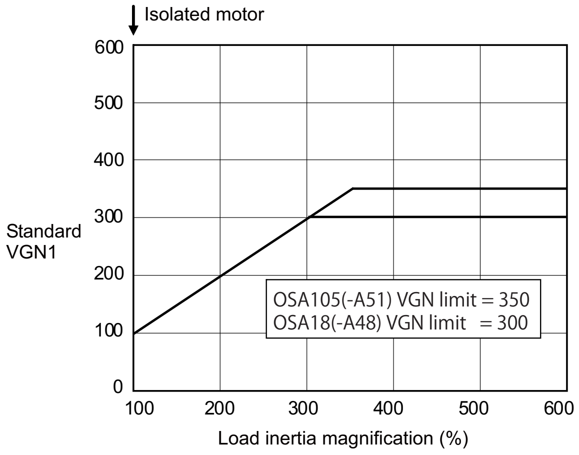
[HF75, HF54]



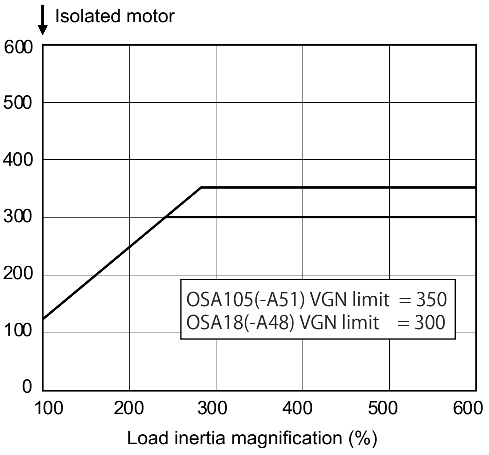
[HF105, HF104, HF154, HF224]



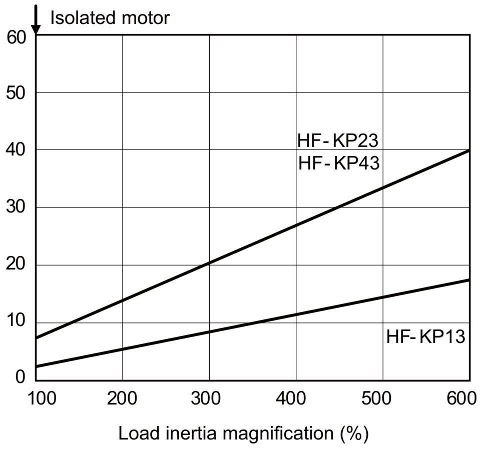
[HF204, HF354, HF123, HF142, HF223]



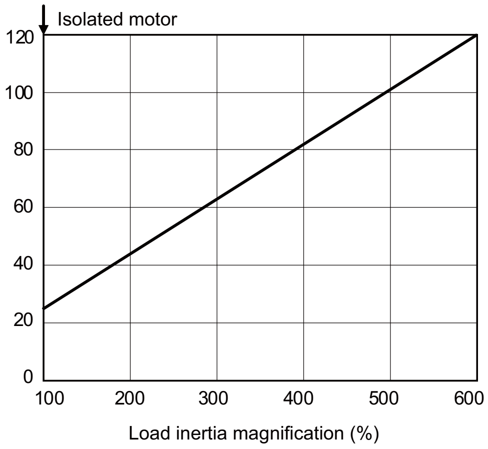
[HF302, HF303]



[HF-KP13, HF-KP23, HF-KP43]



[HF-KP73]

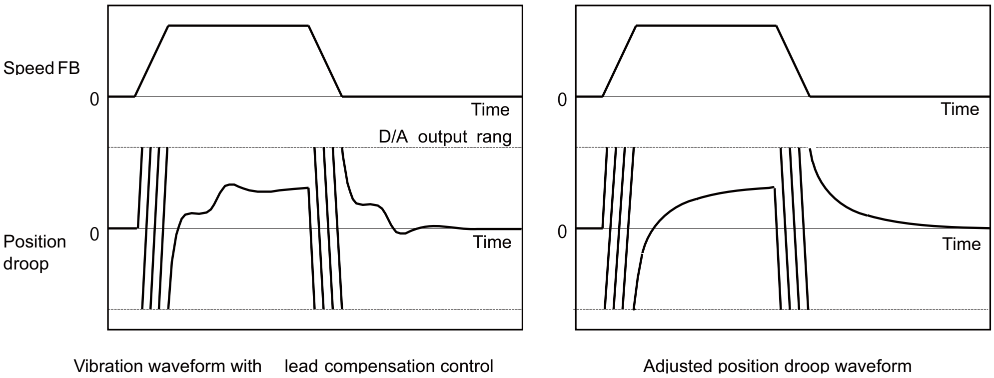


(2) Setting the speed loop lead compensation

The speed loop lead compensation (SV008: VIA) determines the characteristics of the speed loop mainly at low frequency regions. 1364 is set as a standard, and 1900 is set as a standard during SHG control. The standard value may drop in respect to loads with a large inertia.

When the VGN1 is set lower than the standard value because the load inertia is large or because machine resonance occurred, the speed loop control band is lowered. If the standard value is set in the leading compensation in this status, the leading compensation control itself will induce vibration. In concrete terms, a vibration of 10 to 20Hz could be caused during acceleration/ deceleration or stopping, and the position droop waveform could be disturbed when accelerating to a constant speed and when stopped. (Refer to lower left drawing)

This vibration cannot be suppressed by the vibration suppression functions. Lower the VIA in increments of 100 from the standard setting value. Set a value where vibration does not occur and the position droop waveform converges smoothly. Because lowering the VIA causes a drop in the position control's trackability, the vibration suppression is improved even when a disturbance observer is used without lowering the VIA. (Be careful of machine resonance occurrence at this time.)



Vibration waveform with lead compensation control

Adjusted position droop waveform

If VIA is lowered, the position droop waveform becomes smooth and overshooting does not occur. However, because the trackability in respect to the position commands becomes worse, the positioning time and accuracy are sacrificed. VIA must be kept high (set the standard value) to guarantee precision, especially in high-speed contour cutting (generally F = 1000 or higher). In other words, in a machine aiming for high speed and high accuracy, a large enough value must be set in VGN1 so that VIA does not need to be lowered. When adjusting, the cutting precision will be better if adjustment is carried out to a degree where overshooting does not occur and a high VIA is maintained, without pursuing position droop smoothness.

If there are no vibration or overshooting problems, the high-speed contour cutting precision can be further improved by setting the VIA higher than the standard value. In this case, adjust by raising the VIA in increments of 100 from the standard value.

Setting a higher VIA improves the trackability regarding position commands in machines for which cycle time is important, and the time to when the position droop converges on the in-position width is shortened.

It is easier to adjust the VIA to improve precision and cycle time if a large value (a value near the standard value) can be set in VGN1, or if VGN1 can be raised equivalently using the disturbance observer.

【#2208】 SV008 VIA Speed loop lead compensation

Set the gain of the speed loop integral control.
Standard setting: 1364
Standard setting in the SHG control: 1900
Adjust the value by increasing/decreasing this by about 100 at a time.
Raise this value to improve contour tracking accuracy in high-speed cutting.
Lower this value when the position droop does not stabilize (when the vibration of 10 to 20Hz occurs).

---Setting range---
1 to 9999

POINT Position droop vibration of 10Hz or less is not leading compensation control vibration. The position loop gain must be adjusted.

4-3-3 Position loop gain

(1) Setting the position loop gain

The position loop gain 1 (SV003: PGN1) is a parameter that determines the trackability to the command position. 33 is set as a standard. Set the same position loop gain value between interpolation axes. When PGN1 is raised, the trackability will be raised and the settling time will be shortened, but a speed loop that has a responsiveness that can track the position loop gain with increased response will be required. If the speed loop responsiveness is insufficient, several Hz of vibration or overshooting will occur during acceleration/deceleration. Vibration or overshooting will also occur when VGN1 is smaller than the standard value during VIA adjustment, but the vibration in the position loop occurs generally 10Hz or less. (The VIA vibration occurs from 10 to 20Hz.) When the position control includes machine resonance points (Position control machine resonance points occur at the tool end parts, etc.) because of insufficient machine rigidity, the machine will vibrate during positioning, etc. In either case, lower PGN1 and adjust so that vibration does not occur.
If the machine also vibrates due to machine backlash when the motor stops, the vibration can be suppressed by lowering the PGN1 and smoothly stopping.
If SHG control is used, an equivalently high position loop gain can be maintained while suppressing these vibrations. Adjust SHG control by raising the gain gradually after setting PGN1 as 1/2 a value of PGN1 at which a vibration does not occur under the normal control. If the PGN1 setting value is more than 1/2 of the normal control PGN1 when SHG control is used, there is an improvement effect in position control. (Note that for the settling time the improvement effect is at $1/\sqrt{2}$ or more.)

【#2203】 SV003 PGN1 Position loop gain 1

Set the position loop gain. The standard setting is "33".
The higher the setting value is, the more accurately the command can be followed, and the shorter the settling time in positioning gets, however, note that a bigger shock will be applied to the machine during acceleration/deceleration.
When using the SHG control, also set SV004 (PGN2) and SV057 (SHGC).

---Setting range---
1 to 200 (rad/s)

【#2204】 SV004 PGN2 Position loop gain 2

When performing the SHG control, set the value of "SV003 x 8/3" to "SV004".
When not using the SHG control, set to "0".

---Setting range---
0 to 999 (rad/s)

【#2257】 SV057 SHGC SHG control gain

When performing the SHG control, set to SV003(PGN1)*6.
When not using the SHG control, set to "0".

---Setting range---
0 to 1200 (rad/s)

⚠ **CAUTION** Always set the same value for the position loop gain between the interpolation axes.

(2) Setting the position loop gain for spindle synchronous control

During spindle synchronous control (synchronous tapping control, etc.), there are three sets of position loop gain parameters besides the normal control.

【#2249】 SV049 PGN1sp Position loop gain 1 in spindle synchronous control

Set the position loop gain during spindle synchronization control (synchronous tapping and synchronization control with spindle C-axis).
Set the same value as that of the position loop gain for spindle synchronous tapping control.
When performing the SHG control, set this parameter with SV050 (PGN2sp) and SV058 (SHGCsp).

---Setting range---
1 to 200 (rad/s)

【#2250】 SV050 PGN2sp Position loop gain 2 in spindle synchronous control

When using SHG control during spindle synchronous control (synchronous tapping and synchronization control with spindle C-axis), set this parameter with SV049 (PGN1sp) and SV058 (SHGCsp).
Make sure to set the value 8/3 times that of SV049.
When not using the SHG control, set to "0".

---Setting range---
0 to 999 (rad/s)

【#2258】 SV058 SHGCsp SHG control gain in spindle synchronous control

When using SHG control during spindle synchronization control (synchronous tapping and synchronous control with spindle C-axis), set this parameter with SV049 (PGN1sp) and SV050 (PGN2sp).
Make sure to set the value 6 times that of SV049.
When not using the SHG control, set to "0".

---Setting range---
0 to 1200 (rad/s)

⚠CAUTION Always set the same value for the position loop gain between the spindle and servo synchronous axes.

(3) SHG control

If the position loop gain is increased or feed forward control (NC function) is used to shorten the settling time or increase the precision, the machine system may vibrate easily.

SHG control changes the position loop to a high-gain by stably compensating the servo system position loop through a delay. This allows the settling time to be reduced and a high precision to be achieved.

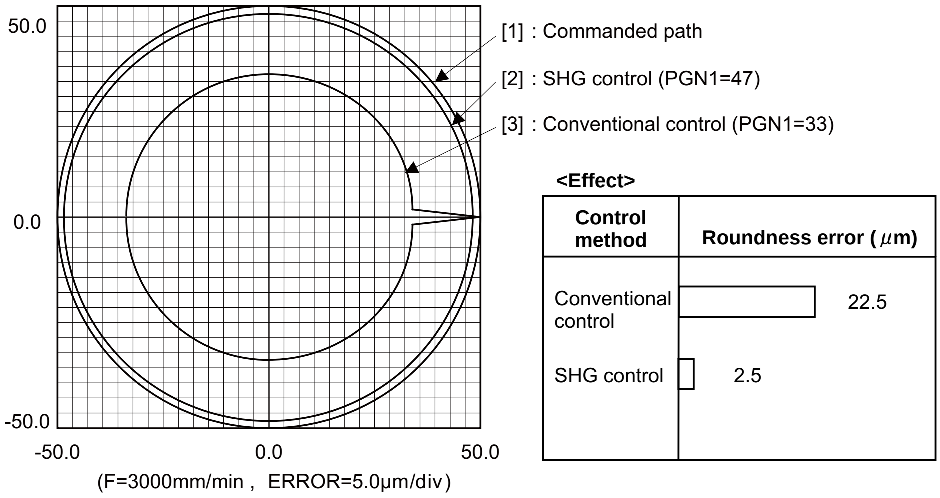
(SHG: Smooth High-Gain)

(Feature 1) When the SHG control is set, even if PGN1 is set to the same value as the conventional gain, the position loop gain will be doubled.

(Feature 2) The SHG control response is smoother than conventional position control during acceleration/deceleration, so the gain can be increased further with SHG control compared to the conventional position control.

(Feature 3)With SHG control, a high gain is achieved so a high precision can be obtained during contour control.

The following drawing shows an example of the improvement in roundness characteristics with SHG control.



Shape error characteristics

During SHG control, PGN1, PGN2 and SHGC are set with the following ratio.

PGN1 : PGN2 : SHGC = 1 : 8/3 : 6

During SHG control even if the PGN1 setting value is the same, the actual position loop gain will be higher, so the speed loop must have a sufficient response. If the speed loop response is low, vibration or overshooting could occur during acceleration/deceleration in the same manner as conventional control. If the speed loop gain has been lowered because machine resonance occurs, lower the position loop gain and adjust.

No.	Abbrev.	Parameter name	Setting ratio	Setting example					Explanation	Setting range
SV003 (SV049)	PGN1 (PGN1sp)	Position loop gain 1	1	21	27	33	39	48	Always set with a combination of these three parameters.	1 to 200 (rad/s)
SV004 (SV050)	PGN2 (PGN2sp)	Position loop gain 2	8/3	56	72	88	104	128		0 to 999 (rad/s)
SV057 (SV058)	SHGC (SHGCsp)	SHG control gain	6	126	162	198	234	288		0 to 1200 (rad/s)

【#2208】 SV008 VIA Speed loop lead compensation

Set the gain of the speed loop integral control.
Standard setting: 1364
Standard setting in the SHG control: 1900
Adjust the value by increasing/decreasing this by about 100 at a time.
Raise this value to improve contour tracking accuracy in high-speed cutting.
Lower this value when the position droop does not stabilize (when the vibration of 10 to 20Hz occurs).

---Setting range---
1 to 9999

【#2215】 SV015 FFC Acceleration rate feed forward gain

When a relative error in synchronous control is too large, set this parameter to the axis that is delaying.
The standard setting is "0". The standard setting in the SHG control is "100".
To adjust a relative error in acceleration/deceleration, increase the value by 50 - 100 at a time.

---Setting range---
0 to 999 (%)

4-4 Characteristics improvement

4-4-1 Optimal adjustment of cycle time

The following items must be adjusted to adjust the cycle time. Refer to the Instruction Manuals provided with each CNC for the acceleration/deceleration pattern.

[1] Rapid traverse rate (rapid) : This will affect the maximum speed during positioning.
[2] Clamp speed (clamp) : This will affect the maximum speed during cutting.
[3] Acceleration/deceleration time constant (G0t*, G1t*) : Set the time to reach the feedrate.
[4] In-position width (SV024) : This will affect each block's movement command end time.
[5] Position loop gain (SV003) : This will affect each block's movement command settling time.

(1) Adjusting the rapid traverse

To adjust the rapid traverse, the CNC axis specification parameter rapid traverse rate (rapid) and acceleration/deceleration time constant (G0t*) are adjusted. The rapid traverse rate is set so that the motor speed matches the machine specifications in the range below the maximum speed in the motor specifications. For the acceleration/deceleration time constants, carry out rapid traverse reciprocation operation, and set so that the maximum current command value at acceleration/deceleration is within the range shown below. The output torque is limited at areas near the maximum speed, so monitor the current FB waveform during acceleration/deceleration and adjust so that the torque is within the specified range.

If the drive unit's input voltage is less than the rated voltage, the torque will easily become insufficient, and excessive errors will occur easily during acceleration/deceleration.

Maximum tolerable current command value when adjusting the rapid traverse acceleration/deceleration time constant

Motor model	Max. tolerable current command value	Motor model	Max. tolerable current command value
HF75	Within 350%	HF-KP13	Within 240%
HF105	Within 270%	HF-KP23	Within 250%
HF54	Within 420%	HF-KP43	Within 250%
HF104	Within 350%	HF-KP73	Within 240%
HF154	Within 380%		
HF224	Within 310%		
HF204	Within 280%		
HF354	Within 230%		
HF123	Within 190%		
HF223	Within 230%		
HF303	Within 240%		
HF142	Within 190%		
HF302	Within 210%		

(2) Adjusting the cutting feed

To adjust the cutting rate, the NC axis specification parameter clamp speed (clamp) and acceleration/ deceleration time constant (G1t*) are adjusted. The in-position width at this time must be set to the same value as actual cutting.

- Determining the clamp rate and adjusting the acceleration/deceleration time constant

(Features)The maximum cutting rate (clamp speed) can be determined freely.

(Adjustment)Carry out cutting feed reciprocation operation with dwell at the maximum cutting rate and adjust the acceleration/deceleration time constant so that the maximum current command value during acceleration/deceleration is within the range shown below.

- Setting the step acceleration/deceleration and adjusting the clamp speed

(Features)The acceleration/deceleration time constant is determined with the position loop in the servo, so the acceleration/deceleration FΔT can be reduced.

(Adjustment)Set 1 (step) for the acceleration/deceleration time constant and carry out cutting feed reciprocation operation with dwell. Adjust the cutting feed rate so that the maximum current command value during acceleration/deceleration is within the range shown below, and then set the value in the clamp speed.

Maximum tolerable current command value when adjusting the cutting feed acceleration/deceleration time constant

Motor model	Max. tolerable current command value	Motor model	Max. tolerable current command value
HF75	Within 245%	**HF-KP13**	Within 168%
HF105	Within 189%	**HF-KP23**	Within 175%
HF54	Within 294%	**HF-KP43**	Within 175%
HF104	Within 245%	**HF-KP73**	Within 168%
HF154	Within 266%		
HF224	Within 217%		
HF204	Within 196%		
HF354	Within 161%		
HF123	Within 133%		
HF223	Within 161%		
HF303	Within 168%		
HF142	Within 133%		
HF302	Within 147%		

(3) Adjusting the in-position width

Because there is a response delay in the servomotor drive due to position loop control, a "settling time" is also required for the motor to actually stop after the command speed from the CNC reaches 0.

The movement command in the next block is generally started after it is confirmed that the machine has entered the "in-position width" range set for the machine.

Set the precision required for the machine as the in-position width. If a high precision is set needlessly, the cycle time will increase due to a delay in the settling time.

The in-position width is validated with the servo parameter settings, but there may be cases when it is validated with the NC parameters. Refer to each NC Instruction Manual.

【#2224】 SV024 INP In-position detection width

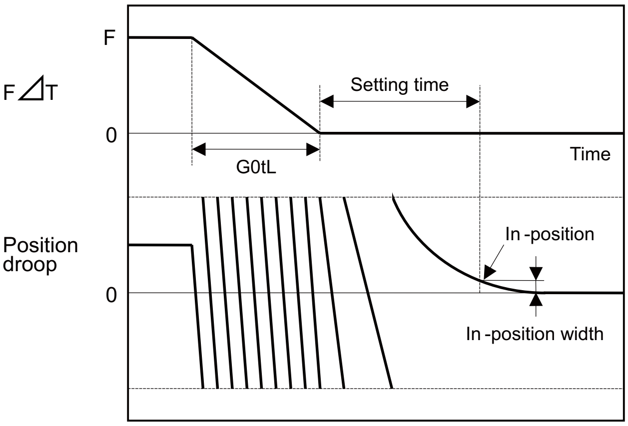
Set the in-position detection width.
Set the positioning accuracy required for the machine.
The lower the setting is, the higher the positioning accuracy will be. However the cycle time (settling time) becomes longer.
The standard setting value is "50".

---Setting range---
0 to 32767 (μm)

POINT The in-position width setting and confirmation availability depend on the CNC parameters.

(4) Adjusting the settling time

The settling time is the time required for the position droop to enter the in-position width after the feed command (FΔT) from the CNC reaches 0.
The settling time can be shortened by raising the position loop gain or using SHG control. However, a sufficient response (sufficiently large VGN1 setting) for the speed loop is required to carry out stable control.
The settling time during normal control when the CNC is set to linear acceleration/ deceleration can be calculated using the following equation. During SHG control, estimate the settling time by multiplying PGN1 by . $\sqrt{2}$



$$\text{Settling time (ms)} = \frac{10^3}{\mathrm{PGN1}} \cdot ln \left(\frac{\dfrac{F \times 10^6}{60 \times \mathrm{G0tL} \times \mathrm{PGN1}^2} \times \left[1 - \exp\left[-\dfrac{\mathrm{PGN1} \times \mathrm{G0tL}}{10^3}\right]\right]}{\mathrm{INP}} \right)$$

PGN1 : Position loop gain1 (SV003) (rad/s)
F : Rapid traverse rate (mm/min)
G0tL : Rapid traverse linear acceleration/ deceleration time constant (ms)
INP : In-position width (SV024) (μm)

4-4-2 Vibration suppression measures

If vibration (machine resonance) occurs, it can be suppressed by lowering the speed loop gain 1 (VGN1). However, cutting precision and cycle time will be sacrificed. (Refer to "4-3-2 Speed loop gain".) Thus, try to maintain the VGN1 as high as possible, and suppress the vibration using the vibration suppression functions.
If the VGN1 is lowered and adjusted because vibration cannot be sufficiently suppressed with the vibration suppression functions, adjust the entire gain (including the position loop gain) again.

(Examples of vibration occurrence)

- A fine vibration is felt when the machine is touched, or a groaning sound is heard.
- Vibration or noise occurs during rapid traverse.

If machine resonance occurs, the resonance frequency can be confirmed at AFLT frequency on NC drive monitor screen. Based on this frequency, the notch filter frequency can be set. When "0" is displayed, resonance is not occurring.

POINT Suppress the vibration using the vibration suppression functions, and maintain the speed loop gain (SV005) as high as possible.

<Notch filter>

This servo drive unit mounts 5 notch filters. Measure the resonance frequency with AFLT frequency display on NC drive monitor screen and the current feedback analog output function, and set that frequency in parameter.
However, if the notch filter is set to a particularly low frequency, another resonance frequency that did not vibrate initially may occur. If the notch filter's depth compensation (SV033, nfd1, nfd2) is adjusted so that the filter does not operate unless necessary, the servo control will be stabilized.
Notch filter 3 is a filter with frequency fixed to 1125Hz, and has no depth compensation.

<Setting method>

[1] Set the resonance frequency in the notch filter frequency (1, 2, 4, 5).
[2] If the machine starts to vibrate at another frequency, raise (make shallower) the notch filter depth compensation value, and adjust to the optimum value at which the resonance can be eliminated.
[3] When the vibration cannot be completely eliminated, use also another notch filter for this frequency.

【#2233】 SV033 SSF2 Servo function 2

bit 7-5 : nfd2 Depth of Notch filter 2

Set the depth of Notch filter 2 (SV046).
bit7,6,5=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

Set the adaptive frequency of Notch filter 2 in "#2246 SV046 FHz2".

bit 4 : nfd3 Notch filter 3

0: Stop 1: Start (1,125Hz)

bit 3-1 : nfd1 Depth of Notch filter 1

Set the depth of Notch filter 1 (SV038).
bit3,2,1=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

Set the adaptive frequency of Notch filter 1 in "#2238 SV038 FHz1".

【#2238】 SV038 FHz1 Notch filter frequency 1

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

---Setting range---
0 to 2250 (Hz)

【#2246】 SV046 FHz2 Notch filter frequency 2

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

---Setting range---
0 to 2250 (Hz)

【#2283】 SV083 SSF6 Servo function 6

bit 7-5 : nfd5 Depth of Notch filter 5

Set the depth of Notch filter 5.
bit7,6,5=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

Set the adaptive frequency of Notch filter 5 in "#2288 SV088 FHz5".

bit 3-1 : nfd4 Depth of Notch filter 4

Set the depth of Notch filter 4.
bit3,2,1=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

Set the adaptive frequency of Notch filter 4 in "#2287 SV087 FHz4".

【#2287】 SV087 FHz4 Notch filter frequency 4

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

---Setting range---
0 to 2250 (Hz)

【#2288】 SV088 FHz5 Notch filter frequency 5

Set the vibration frequency to suppress when machine vibration occurs.
(Normally, do not set 80 or less.)
Set to "0" when not using.

---Setting range---
0 to 2250 (Hz)

<Jitter compensation (Vibration control when motor is stopped.)>

The load inertia becomes much smaller than usual if the motor position enters the machine backlash when the motor is stopped. Because this means that an extremely large VGN1 is set for the load inertia, vibration may occur.

Jitter compensation can suppress the vibration that occurs at the motor stop by ignoring the backlash amount of speed feedback pulses when the speed feedback polarity changes.

Increase the number of ignored pulses by one pulse at a time, and set a value at which the vibration can be suppressed. (Because the position feedback is controlled normally, there is no worry of positional deviation.)

When jitter compensation is set to an axis that is not vibrating is set, vibration could be induced, so take care.

【#2227】 SV027 SSF1 Servo function 1

bit 5-4 : vfct Jitter compensation pulse number

Suppress vibration by machine backlash when axis stops.

bit5,4=
00: Disable
01: 1 pulse
10: 2 pulse
11: 3 pulses

POINT Jitter compensation vibration suppression is only effective when the motor is stopped.

<Variable speed loop gain control>

If vibration occurs when the motor is rotating at a high speed, such during rapid traverse, or if disturbing noise occurs, the state can be improved by lowering the speed loop gain during high-speed rotation. The low-speed region speed loop gain used for cutting feed (G1 feed), etc., is maintained at a high level, so the vibration can be improved without dropping the machining accuracy.

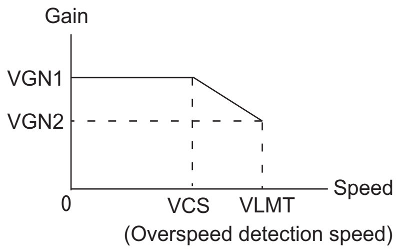
【#2205】 SV005 VGN1 Speed loop gain 1

Set the speed loop gain.
The higher the setting value is, the more accurate the control will be, however, vibration tends to occur.
If vibration occurs, adjust by lowering by 20 to 30%.
The value should be determined to the 70 to 80% of the value at which the vibration stops.
The value differs depending on servo motors.
Aim at the standard value determined by the servo motor type and load inertia ratio to adjust.

---Setting range---
1 to 9999

【#2206】 SV006 VGN2 Speed loop gain 2

Set the speed loop gain at the motor limitation speed VLMT (maximum rotation speed x 1.15) with "VCS(SV029: Speed at the change of speed loop gain)".
Use this to suppress noise at high speed rotation during rapid traverse, etc. Then, the speed loop gain decreases at faster speed than the setting value of VCS.
When not using, set to "0".



---Setting range---
-1000 to 9999

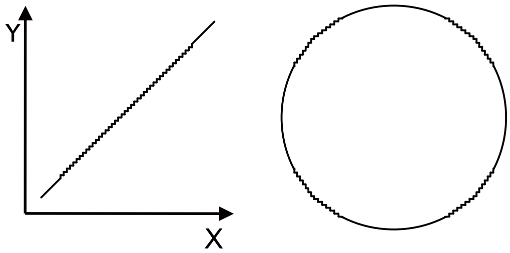
【#2229】 SV029 VCS Speed at the change of speed loop gain

Noise at high speed rotation including rapid traverse can be reduced by lowering the speed loop gain at high speeds.
Set the speed at which the speed loop gain changes. Use this with SV006 (VGN2).
When not using, set to "0".

---Setting range---
0 to 9999 (r/min)

4-4-3 Improving the cutting surface precision

If the cutting surface precision or roundness is poor, these can be improved by increasing the speed loop gain (VGN1, VIA) or by using the disturbance observer function.



<Examples of faults>

- The surface precision in the 45° direction of a taper or arc is poor.
- The load fluctuation during cutting is large, causing vibration or surface precision defects to occur.

POINT Adjust by raising the speed loop gain equivalently to improve cutting surface precision, even if the measures differ. In this case, it is important how much the machine resonance can be controlled, so adjust making sufficient use of vibration suppression functions.

(1) Adjusting the speed loop gain (VGN1)

If the speed loop gain is increased, the cutting surface precision will be improved but the machine will resonate easily.
The final VGN1 setting should be approx. 70 to 80% of the maximum value where resonance does not occur. (Refer to "4-3-2 (1) Setting the speed loop gain")

(2) Adjusting the speed loop leading compensation (VIA)

The VIA has a large influence on the position trackability, particularly during high-speed cutting (generally F1000 or more). Raising the setting value improves the position trackability, and the contour precision during high-speed cutting can be improved. For high-speed high-precision cutting machines, adjust so that a value equal to or higher than the standard value can be set.
When VIA is set lower than the standard value and set to a value differing between interpolation axes, the roundness may worsen (the circle may distort). This is due to differences occurring in the position trackability between interpolation axes. The distortion can be improved by matching the VIA with the smaller of the values. Note that because the position trackability is not improved, the surface precision will not be improved.
(Refer to "4-3-2 (2) Setting the speed loop leading compensation")

【#2205】 SV005 VGN1 Speed loop gain 1

Set the speed loop gain.
The higher the setting value is, the more accurate the control will be, however, vibration tends to occur.
If vibration occurs, adjust by lowering by 20 to 30%.
The value should be determined to the 70 to 80% of the value at which the vibration stops.
The value differs depending on servo motors.
Aim at the standard value determined by the servo motor type and load inertia ratio to adjust.

---Setting range---
1 to 9999

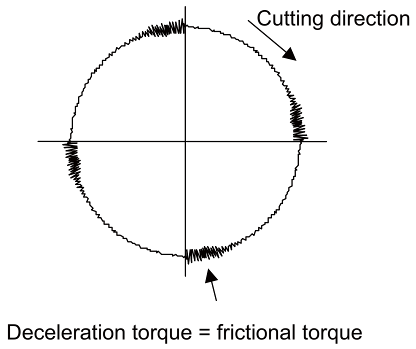
【#2208】 SV008 VIA Speed loop lead compensation

Set the gain of the speed loop integral control.
Standard setting: 1364
Standard setting in the SHG control: 1900
Adjust the value by increasing/decreasing this by about 100 at a time.
Raise this value to improve contour tracking accuracy in high-speed cutting.
Lower this value when the position droop does not stabilize (when the vibration of 10 to 20Hz occurs).

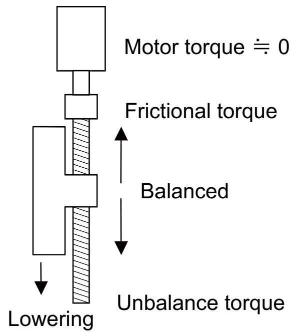
---Setting range---
1 to 9999

(3) Voltage non-sensitive zone (Td) compensation

With the PWM control of the inverter circuit, a dead time (non-energized time) is set to prevent short-circuits caused by simultaneous energizing of the P side and N side transistors having the same phase. The dead time has a non-sensitive zone for particularly low voltage commands. Thus, when feeding with a low speed and a low torque, the control may be unstable.
When an unbalanced axis is lowering, the frictional torque and unbalance torque, and the frictional torque and deceleration torque before the quadrant changes during circle cutting, are balanced. The motor output torque will be approximately zero, and the control accuracy may drop. In this case, the control accuracy can be improved by using the voltage non-sensitive band compensation. Note that this may cause vibration to be increased while the motor is running.



For circle cutting



For unbalance torque

【#2230】 SV030 IVC Voltage non-sensitive band compensation

When 100% is set, the voltage reduction amount equivalent to the logical non-energization in the PWM control will be compensated.
When "0" is set, 100% compensation will be performed.
Adjust in increments of 10% from the default value of 100%.
If increased too much, vibration or vibration noise may be generated.

---Setting range---
0 to 255 (%)

(4) Disturbance observer

The disturbance observer can reduce the effect caused by disturbance, frictional resistance or torsion vibration during cutting by estimating the disturbance torque and compensating it. It also is effective in suppressing the vibration caused by speed leading compensation control.

<Setting method>

[1] Adjust VGN1 to the value where vibration does not occur, and then lower it 10 to 20%.
[2] Set the load inertia scale (SV037: JL) with a percentage in respect to the motor inertia of the total load inertia.
[3] Set the observer filter band (observer pole) in the disturbance observer filter frequency (SV043: OBS1), and suppress the high frequency disturbance estimate to suppress the vibration. Set "100" as a standard.
[4] Set the observer gain in disturbance observer gain (SV044: OBS2). The disturbance observer will function here for the first time. Set 100 first, and if vibration does not occur, increase the setting by 50 at a time to increase the observer effect.

【#2237】 SV037 JL Load inertia scale

Set the motor axis conversion total load inertia including motor itself in proportion to the motor inertia.

SV037(JL)=(Jm+Jl)/Jm×100
Jm: Motor inertia
Jl: Motor axis conversion load inertia

For linear motor, set the gross mass of the moving sections in kg unit.

<<Drive monitor load inertia ratio display>>
Set SV035/bitF=1 and imbalance torque and friction torque to both SV032 and SV045, and then repeat acceleration/deceleration for several times.

---Setting range---
For general motor: 0 to 5000 (%)
For linear motor 0 to 5000 (kg)

【#2243】 SV043 OBS1 Disturbance observer filter frequency

Set the disturbance observer filter band.
Normally, set to "100". Setting values of 49 or less is equal to "0" setting.
To use the disturbance observer, also set SV037 (JL) and SV044 (OBS2).
When disturbance observer related parameters are changed, lost motion compensation needs to be readjusted.
Set to "0" when not using.

---Setting range---
0 to 1000 (rad/s)

【#2244】 SV044 OBS2 Disturbance observer gain

Set the disturbance observer gain. The standard setting is "100 to 300".
To use the disturbance observer, also set SV037 (JL) and SV043 (OBS1).
When disturbance observer related parameters are changed, lost motion compensation needs to be readjusted.
Set to "0" when not using.

---Setting range---
0 to 500 (%)

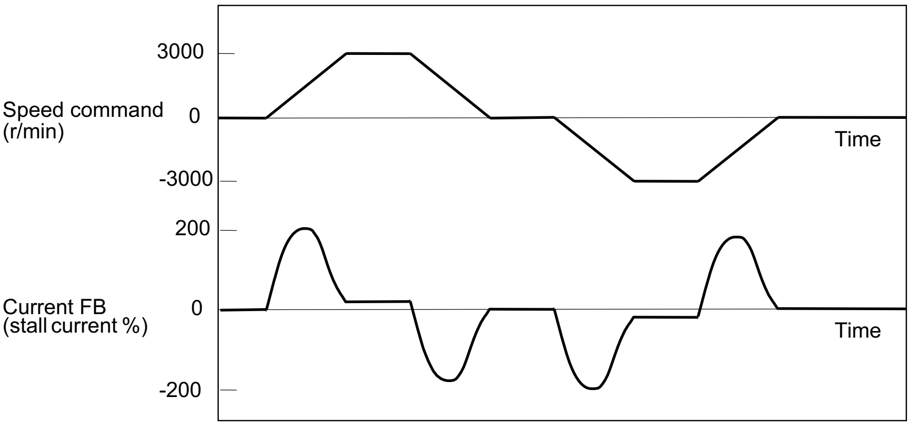
POINT The lost motion compensation must be readjusted when the disturbance observer is started.

4-4-4 Improvement of characteristics during acceleration/deceleration

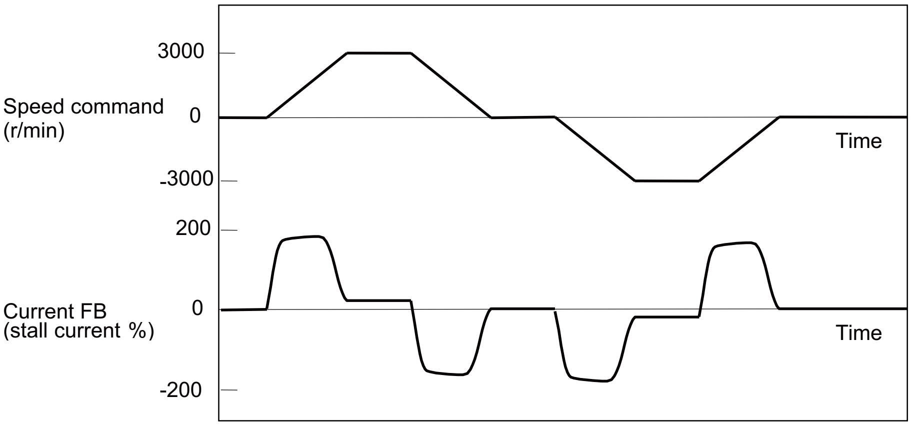
<SHG control>

Because SHG control has a smoother response during acceleration/deceleration than conventional position controls, the acceleration/deceleration torque (current FB) has more ideal output characteristics (A constant torque is output during acceleration/deceleration.) The peak torque is kept low by the same acceleration/deceleration time constant, enabling the time constant to be shortened.

Refer to item "(3) SHG control" in section "4-2-3 Position loop gain" for details on setting SHG control.



Acceleration/deceleration characteristics during conventional control

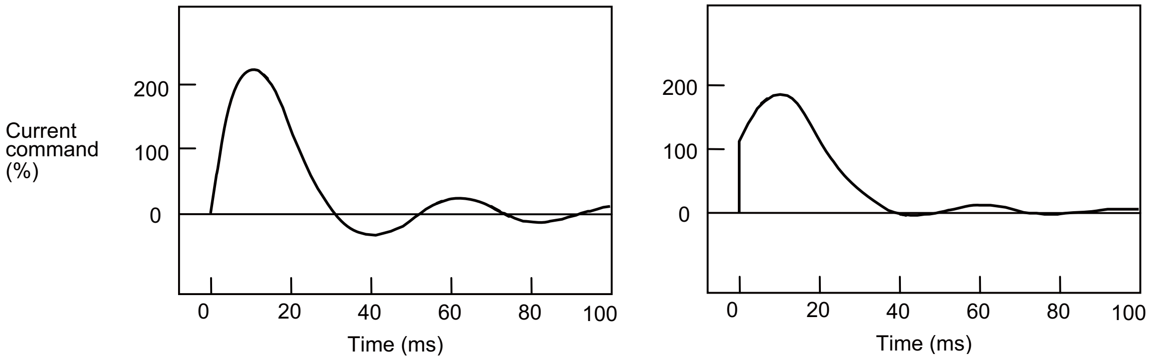


Acceleration/deceler ation characteristics during SHG control

No.	Abbrev.	Parameter name	Setting ratio	Setting example					Explanation	Setting range
SV003 (SV049)	PGN1 (PGN1sp)	Position loop gain 1	1	21	27	33	39	48	Always set with a combination of these three parameters.	1 to 200 (rad/s)
SV004 (SV050)	PGN2 (PGN2sp)	Position loop gain 2	8/3	56	72	88	104	128		0 to 999 (rad/s)
SV057 (SV058)	SHGC (SHGCsp)	SHG control gain	6	126	162	198	234	288		0 to 1200 (rad/s)

<Acceleration feed forward>

Vibration may occur at 10 to 20 Hz during acceleration/deceleration when a short time constant of 30 ms or less is applied, and a position loop gain (PGN1) higher than the general standard value or SHG control is used. This is because the torque is insufficient when starting or when starting deceleration, and can be resolved by setting the acceleration rate feed forward gain (SV015: FFC). This is also effective in reducing the peak current (torque).
While measuring the current command waveform, increase FFC by 50 to 100 at a time and set the value where vibration does not occur.



No FFC setting

With FFC setting

Acceleration rate feed forward gain means that the speed loop gain during acceleration/deceleration is raised equivalently. Thus, the torque (current command) required during acceleration/deceleration starts sooner. The synchronization precision will improve if the FFC of the delayed side axis is raised between axes for which high-precision synchronous control (such as synchronous tapping control and superimposition control).

【#2215】 SV015 FFC Acceleration rate feed forward gain

When a relative error in synchronous control is too large, set this parameter to the axis that is delaying.
The standard setting is "0". The standard setting in the SHG control is "50".
To adjust a relative error in acceleration/deceleration, increase the value by 50 - 100 at a time.

---Setting range---
0 to 999 (%)

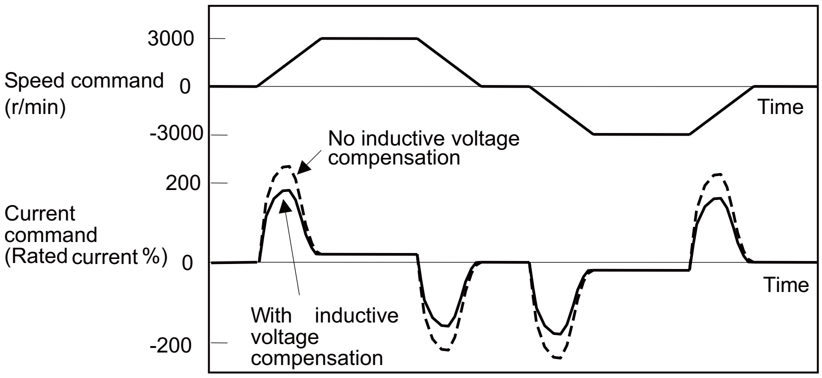
POINT Overshooting occurs easily when a value above the standard value is set during SHG control.

<Inductive voltage compensation>

The current loop response is improved by compensating the back electromotive force element induced by the motor rotation. This improved the current command efficiency, and allows the acceleration/ deceleration time constant to the shortened.

<Adjustment method>

While accelerating/decelerating at rapid traverse, adjust the inductive voltage compensation gain (SV047: EC) so that the current FB peak (MAX current 3) is a few % smaller than the current command peak (MAX current 2).



Inductive voltage compensation

【#2247】 SV047 EC Inductive voltage compensation gain

Set the inductive voltage compensation gain. Standard setting value is "100".
If the current FB peak exceeds the current command peak, lower the gain.

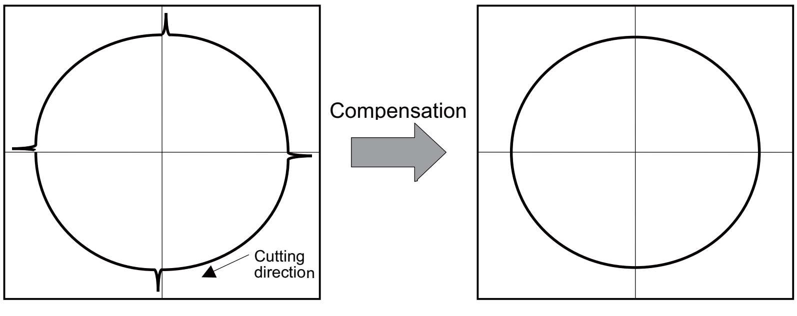
---Setting range---
0 to 200 (%)

POINT

If the current FB peak (MAX current 3) becomes larger than the current command peak (MAX current 2) (over compensation), an overcurrent (alarm 3A) will occur easily. Note that over compensation will occur easily if the load inertia is large.

4-4-5 Improvement of protrusion at quadrant changeover

The response delay (caused by dead band from friction, torsion, expansion/contraction, backlash, etc.) caused when the machine advance direction reverses is compensated with the lost motion compensation (LMC compensation) function.
With this, the protrusions that occur at the quadrant changeover in the DBB measurement method, or the streaks that occur when the quadrant changes during circular cutting can be improved.



Circle cutting path before compensation   Circle cutting path after compensation

DBB: Double Ball Bar

[1] LMC compensation type 2
This is an obsolete compensation method. When performing new adjustment, use LMC compensation type 3.

[2] LMC compensation type 3
In addition to frictional torque influence, this type compensates torsion and expansion/contraction influences in the machine system in which compensation amount is changed by travel speed. A mechanical system viscosity coefficient setting further enhances the compensation accuracy even if the travel speed is changed. Adjustment requires a machine roundness measurement.

[3] LMC compensation type 4
This is used in combination with LMC compensation type 3. Compensation is performed by monitoring path tracking delay. Therefore, even if the machine friction amount has changed due to aged deterioration, the path tracking delay is controlled so that it will be minimum.

POINT

1. LMC compensation performs adjustment while measuring the electrical end roundness waveform (detector position FB). Disable the NC side machine error compensation (pitch error compensation, relative position compensation, backlash compensation).
2. After the compensation adjustment is completed, adjust the machine error compensation while measuring the machine error compensation with DBB measurement method, etc.

(1) Measuring unbalance torque and frictional torque

Machine unbalance torque and frictional torque measurements are required before the LMC compensation can be set. However, the horizontal axis unbalance torque is necessarily "0".
Carry out the reciprocating operation (approx. F1000) with the measured axis, and the load current % value during constant-speed feed is measured at the NC servo monitor screen. The unbalance torque and frictional torque at that time are expressed by the following formulas.

$$\text{Unbalance torque (\%)} = \frac{(+\text{ feed load current \%}) + (-\text{ feed load current \%})}{2}$$

$$\text{Frictional torque (\%)} = \frac{|(+\text{ feed load current \%}) - (-\text{ feed load current \%})|}{2}$$

(Example)

Assume that the load current % was -55% in the + direction and -25% in the - direction when JOG feed was carried out at approx. F1000. The unbalance torque and frictional torque are as shown below.

$$\text{Unbalance torque (\%)} = \frac{(-55) + (-25)}{2} = -40\%$$

$$\text{Friction torque (\%)} = \frac{|(-55) - (-25)|}{2} = 15\%$$

The measurement values are not used for LMC compensation type 3. However, since they are used for other controls, set them to the following parameters.

【#2232】 SV032 TOF Torque offset

Set the unbalance torque on vertical axis and inclined axis.
When the vertical axis pull up function is enabled, the pull up compensation direction is determined by this parameter's sign. When set to "0", the vertical axis pull up will not be executed.
This can be used for speed loop delay compensation and collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, friction torque (SV045) and load inertia display enabling flag(SV035/bitF).

Related parameters: SV007, SV033/bitE, SV059

---Setting range---
-100 to 100 (Stall current %)

【#2245】 SV045 TRUB Friction torque

Set the frictional torque when using the collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, imbalance torque (SV032) and load inertia display enabling flag (SV035/bitF).

---Setting range---
0 to 255 (Stall current %)

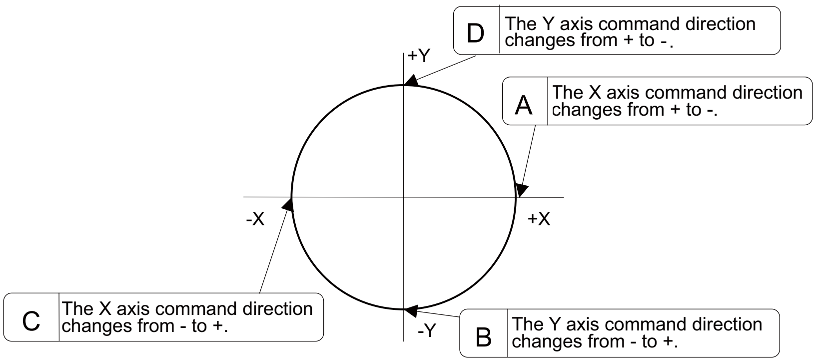
(2) Setting and adjusting LMC compensation type 3

LCM compensation type 3 can be used to accommodate quadrant projection changes that accompany feed rate and circular radius changes which could not be accommodated by LCM compensation type 2. In this case, on a machine model where the travel direction is reversed, the effect caused by torsion or expansion and contraction on the machine system are also considered in addition to the friction, with compensation occurring in accordance with the changes in the cutting conditions.
Adjust Compensation parameter (SV016, SV041), a basis of compensation, while measuring roundness at low speed. Then adjust viscous coefficient (SV086) while measuring roundness at high speed.
LMC compensation type 3 parameter adjustments should be made while measuring an electrical end position FB waveform by the NC sampling function.

<Adjustment method>

[1] Turn the NC side machine error compensation (pitch error compensation, relative position compensation or backlash compensation) OFF.
(Even if SV113/bit7=1 is applied, the machine error compensation can be ignored.)
[2] Set servo function selection 5 SV082/ bit=1. (The LMC compensation type 3 will start).
[3] Set a value double the friction torque to the lost motion compensation 1 (SV016). The SV016 setting value will be used for compensation in the positive and negative directions when the lost motion compensation 2 (SV041) is 0.
[4] Set the initial value, SV016 x 200 to the lost motion compensation viscous coefficient (SV086).
[5] Perform a roundness measurement at such speed as radius R=100mm and feedrate F=1000mm/min and adjust SV016 value.
[6] Set SV041, when changing the compensation amount in the direction for compensation. The setting of the compensation direction is shown below with the setting of CW/CCW in the NC parameter. If compensating only one direction, set –1 to the side not to be compensated.

Compensation point	CW	CCW
A	X axis: SV041	X axis: SV016
B	Y axis: SV016	Y axis: SV041
C	X axis: SV016	X axis: SV041
D	Y axis: SV041	Y axis: SV016



[7] Perform a roundness measurement at such speed as radius, R=100mm and feedrate, F=5000mm/min. (Select a condition to be used for the actual cutting according to the machine's specification.)
Adjust viscous coefficient (SV086) by increasing and reducing it approx. ±500 gradually to have minimum quadrant protrusion.
[8] After adjusting SV086, verify its accuracy by performing roundness measurement at low speed again.
[9] At this time, if requiring to improve the accuracy further, adjust the spring constant (SV085) in increments of about 50 while performing the machine roundness measurement at low speed.

POINT

1. As the acceleration of circular feed increases, the quadrant protrusion tends to get larger. Therefore, the quadrant protrusion gets larger as the circular feedrate increases for the same radius and as radius gets smaller for the same feedrate.
2. Torque offset (SV032) does not work for LMC compensation type 3.
3. Always set 0 to the lost motion compensation timing (SV039:LMCD).

【#2216】 SV016 LMC1 Lost motion compensation 1

Set this parameter when the protrusion (that occurs due to the non-sensitive band by friction, torsion, backlash, etc.) at quadrant change is too large. This sets the compensation torque at quadrant change (when an axis feed direction is reversed) by the proportion (%) to the stall torque. Whether to enable the lost motion compensation and the method can be set with other parameters.

Type 2: When SV027 (SSF1)/bit9, 8 (lmc) = 10 (Compatible with obsolete type)
Set the type 2 method compensation torque. The standard setting is double the friction torque.

Type 3: When SV082(SSF5)/bit1= 1
Set the compensation torque equivalent of dynamic friction amount of the type 3 method compensation amount. The standard setting is double the dynamic friction torque.

To vary compensation amount according to the direction.
When SV041 (LMC2) is "0", compensate with the value of SV016 (LMC1) in both +/-directions.
If you wish to change the compensation amount depending on the command direction, set this and SV041 (LMC2).
(SV016: + direction, SV041: - direction. However, the directions may be opposite depending on other settings.)
When "-1" is set, the compensation will not be performed in the direction of the command.

---Setting range---

-1 to 200 (Stall current %)
Note that when SV082/bit2 is "1", the setting range is between -1 and 20000 (Stall current 0.01%).

【#2241】 SV041 LMC2 Lost motion compensation 2

Set this with SV016 (LMC1) only when you wish to vary the lost motion compensation amount depending on the command directions.
Normally, set to "0".

---Setting range---

-1 to 200 (Stall current %)
Note that when SV082/bit2 is "1", the setting range is between -1 and 20000 (Stall current 0.01%).

【#2282】 SV082 SSF5 Servo function 5

bit 2 : ccu Lost motion overshoot compensation compensation amount setting increment

0: Stall current % 1: Stall current 0.01%

bit 1 : lmc3 Lost motion compensation type 3

Set this when protrusion at a quadrant change is too big.
0: Stop 1: Start

【#2285】 SV085 LMCk Lost motion compensation 3 spring constant

Set the machine system's spring constant when using lost motion compensation type 3.
When not using, set to "0".

---Setting range---

0 to 32767 (0.01%/μm)

【#2286】 SV086 LMCc Lost motion compensation 3 viscous coefficient

Set the machine system's viscous coefficient when using lost motion compensation type 3.
When not using, set to "0".

---Setting range---
0 to 32767 (0.01%/μm)

【#2313】 SV113 SSF8 Servo function 8

bit 7 : nmerc Machine error compensation amount

When disabled, the machine error compensation amount including backlash and pitch error to be compensated by an NC will be ignored by the servo control.
Use this to adjust the lost motion compensation by the electric end roundness measurement.

0: Normal setting 1:Disable

(3) Setting and adjusting LMC compensation type 4

LMC compensation type 4 is enabled by being used with LMC compensation type 3. Make sure to adjust the LMC compensation type 3 before setting the LMC compensation type 4.

<Adjustment method>

[1] Set about 5-fold SV016 setting value in SV091. (Set about 10% of machine friction.)
[2] Increase SV0091 in increments of about 20%, and confirm the limit value where vibration does not occur. Note that the limit value is about 500.
[3] Set 50% of the limit value.

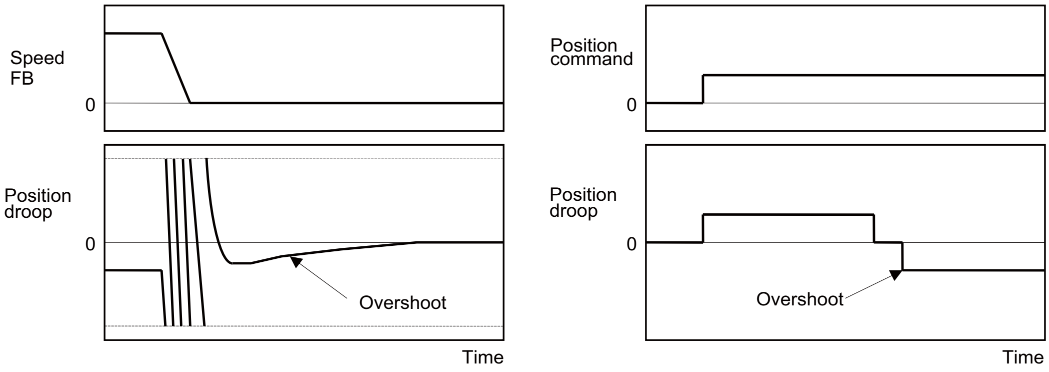
【#2291】 SV091 LMC4G Lost motion compensation 4 gain

Use this with LMC compensation type 3. As the delay in path tracking is monitored and compensated, the delay in path tracking will be minimized even if machine friction amount changes by aging. Use the lost motion compensation amount (SV016) * 5 (10% of the dynamic friction torque) as the target. The higher the setting value is, the more accurate the quadrant change be; however, the more likely vibrations occur.

---Setting range---
0 to 20000 (Stall current 0.01%)

4-4-6 Improvement of overshooting

The phenomenon when the machine position goes past or exceeds the command during feed stopping is called overshooting. Overshooting is compensated by overshooting compensation (OVS compensation). Overshooting occurs due to the following two causes.
[1] Machine system torsion: Overshooting will occur mainly during rapid traverse settling.
[2] Machine system friction: Overshooting will occur mainly during one pulse feed.
Either phenomenon can be confirmed by measuring the position droop.



[1] Overshooting during rapid traverse settling

[2] Overshooting during pulse feed

(1) Overshooting compensation (OVS compensation)

In OVS compensation, the overshooting is suppressed by subtracting the torque command set in the parameters when the motor stops.
OVS compensation type 3 has a compensation effect for the overshooting during either rapid traverse settling or pulse feed. To compensate overshooting during feed forward control, refer to the following section "(2) Adjusting for feed forward control".

<Setting and adjustment methods>

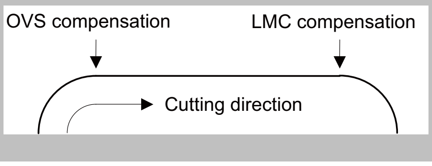
[1] Set the servo function selection 1 (SV027: SSF1)/bit A, B. (OVS compensation type 3 will start.)

[2] Observe the position droop waveform using the D/A output, and increase the overshooting compensation 1 (SV031: OVS1) value 1% at a time. Set the smallest value where the overshooting does not occur. If SV042 (OVS2) is 0, the overshooting will be compensated in both the forward/ reverse directions with the OVS1 setting value.

[3] If the compensation amount is to be changed in the direction to be compensated, set the + direction compensation value in OVS1 and the - direction compensation value in OVS2. If only one direction is to be compensated, set the side not to be compensated as -1. The compensation direction setting will be as reversed with the NC parameter CW/CCW setting.

POINT

1. When either parameter SV031: OVS1 or SV042: OVS2 is set to 0, the same amount of compensation is carried out in both the positive and negative direction, using the setting value of the other parameter (the parameter not set to 0).
2. To compensate in only one direction, set -1 in the parameter (OVS1 or OVS2) for the direction in which compensation is prohibited.
3. For contour cutting, the projection at the arc end point is compensated with OVS compensation. LMC compensation is carried out at the arc starting point.



(2) Adjusting for feed forward control

When using feed forward control (high-speed high-accuracy control), the feed forward control must be stopped (fwd_g =0) before adjusting the overshooting compensation. After adjusting the overshooting compensation with normal control, set the overshooting compensation non-sensitive zone (SV034 (SSF3)/bitC to F (ovsn) to 1 (2µm) and start up feed forward control.

If overshooting compensation is used during feed forward control, the overshooting will increase, or protrusions could appear during arc cutting. This is because, when the NC is carrying out feed forward (fwd) control, overshooting equivalent to the operation fraction unit occurs in the position command, and the OVS compensation is recognized as a change in the command direction, resulting in compensation in the reverse direction. This can be improved by setting the overshooting compensation non-sensitive zone width.

If overshooting does not occur during normal control, and occurs only during feed forward control, adjust the feed forward gain (fwd_g).

【#2231】 SV031 OVS1 Overshooting compensation 1

This compensates the motor torque when overshooting occurs during positioning. This is valid only when the overshooting compensation (SV027/bitB,A) is selected.

Type 3 SV027(SSF1)/bitB,A(ovs) = 11
Set the compensation amount based on the motor stall current. Observing positioning droop waveform, increase in increments of 1% and find the value where overshooting does not occur.

To vary compensation amount depending on the direction.
When SV042 (OVS2) is "0", change the SV031 (OVS1) value in both of the +/-directions to compensate.
To vary the compensation amount depending on the command direction, set this and SV042 (OVS2).
(SV031: + direction, SV042: - direction. However, the directions may be opposite depending on other settings.)
When "-1" is set, the compensation will not be performed in the direction of the command.

---Setting range---

-1 to 100 (Stall current %)
Note that the range will be "-1 - 10000" (Stall current 0.01%) when SV082/bit2 is "1".

【#2242】 SV042 OVS2 Overshooting compensation 2

Set this with SV031 (OVS1) only when you wish to vary the overshooting compensation amount depending on the command directions.
Normally, set to "0".

---Setting range---

-1 to 100 (Stall current %)
Note that when SV082/bit2 is "1", the setting range is between -1 and 10000 (Stall current 0.01%).

【#2227】 SV027 SSF1 Servo function 1

bit B-A : ovs Overshooting compensation type selection

Set this if overshooting occurs during positioning.
bitB,A=
00: Compensation stop
01: Setting prohibited
10: Setting prohibited
11: Type 3
(Set the compensation amount in SV031 and SV042.)

Related parameters: SV031, SV042, SV034/bitF-C

【#2234】 SV034 SSF3 Servo function 3

bit F-C: ovsn Overshooting compensation type 3 Non-sensitive band

Set the non-sensitive band of the model position droop overshooting amount in increments of 2μm.
In the feed forward control, set the non-sensitive band of the model position droop and ignore the overshooting of the model.
0 : 0 μm, 1: 2 μm, 2: 4μm,---, E : 28 μm, F: 30μm

【#2282】 SV082 SSF5 Servo function 5

bit 2 : ccu Lost motion overshoot compensation compensation amount setting increment

0: Stall current % 1: Stall current 0.01%

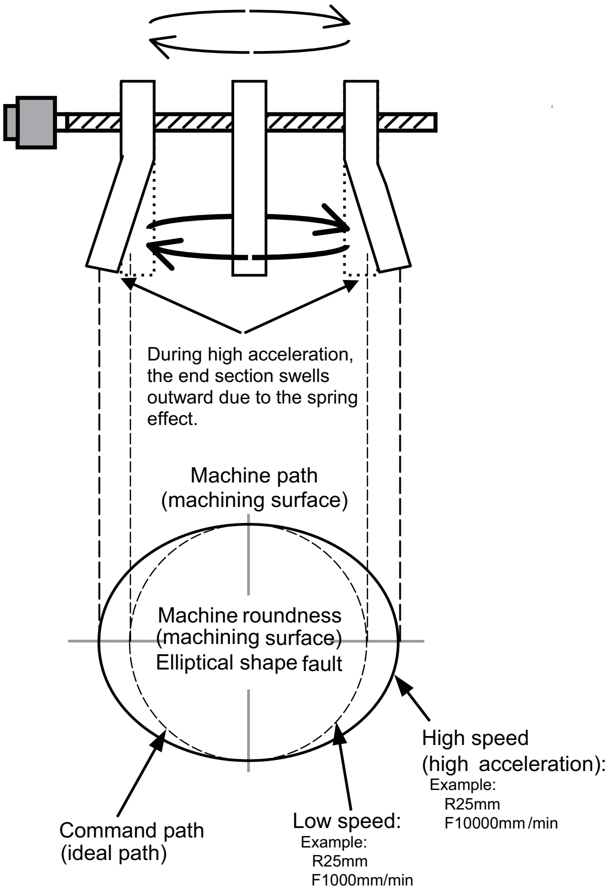
POINT

When using feed forward control (high-speed high-accuracy control), stop the feed forward control (fwd_g=0) before adjusting the overshooting compensation. If overshooting occurs during subsequent feed forward control, adjust the feed forward gain (fwd_g).

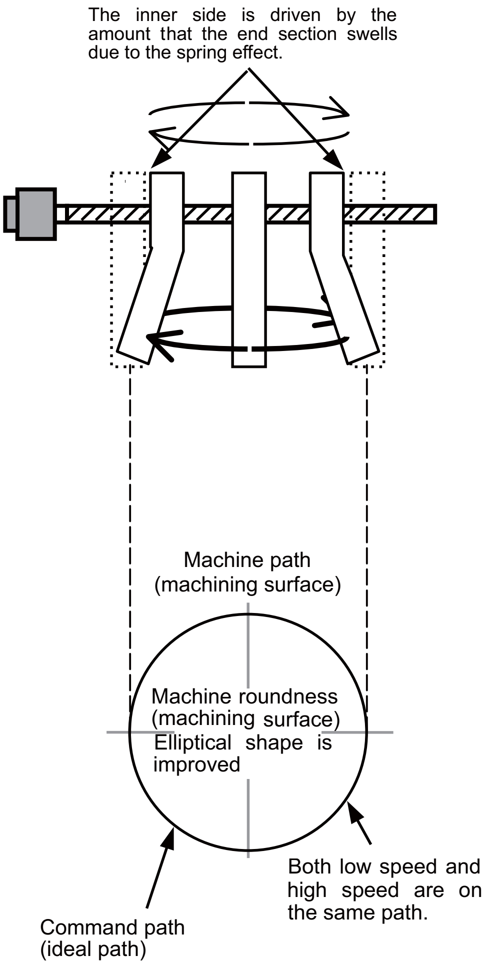
4-4-7 Improvement of the interpolation control path

(1) Machine end compensation control

The machine end compensation control compensates the shape of the tool end during high-speed and high-speed acceleration/deceleration. The spring effect from the machine (spindle) end to the motor (scale) end is compensated. If the machine has a large spring effect, the shape may be fine during low-speed operation. However, at high speeds (specially when using a small radius), the section from the machine (spindle) end to the outer sides of the motor (scale) end could swell, and cause the shape to become elliptical during measurement of the roundness. The machine end compensation control compensates the motor end position according to the acceleration size, so the tool end position is always controlled to the commanded position.



Without machine end compensation control



With machine end compensation control

POINT

1. Always evaluate the roundness accuracy at the machine side.
2. Adjust the parameter after adjusting the electrical end roundness accuracy.

<Adjustment methods>

[1] Confirm that the motor side circle accuracy measured with the NC sampling function is appropriate.

[2] In this state, measure the machine side low-speed and high-speed circle path without machine end compensation control. The difference of the high-speed circle path and low-speed circle path is the amount that path has swelled due to the spring effect of the machine system. Calculate the SV065 setting value with the following expression using this amount as the compensation amount.

$$\text{SV065} = \frac{\text{Compensation amount [μm] x radius R [mm] x SV003 x 16,200,000}}{(\text{command speed F [mm/min]})^{2}}$$

[3] Input the value calculated in step [2] into SV065. Measure the high-speed circle path. If the shape is still elliptical, adjust by increasing/decreasing the SV065 value in 1/10 units.

[4] Confirm that there is no problem with the low-speed circle path.

Example of low-speed and high-speed roundness measurement for adjusting machine compensation

	When using grid encoder	When using DBB measurement	Acceleration
Low speed (reference circle)	R=25 [mm], F=500 [mm/min]	R=100 [mm], F=1000 [mm/min]	0.00028G
High-speed (when adjusting compensation amount)	R=25 [mm], F=10000 [mm/min]	R=100 [mm], F=20000 [mm/min]	0.11G

【#2265】 SV065 TLC Machine end compensation gain

The shape of the machine end is compensated by compensating the spring effect from the machine end to the motor end.
Set the machine end compensation gain. Measure the error amount by roundness measurement and estimate the setting value by the following formula.

Compensation amount (μm) = Command speed F(mm/min)2 * SV065 / (Radius R(mm) * SV003 * 16,200,000)

Set to "0" when not using.

---Setting range---
-30000 to 30000 (Acceleration ratio 0.1%)

POINT

1. To confirm the machine's spring element, adjust the electrical end roundness, and then machine roundness while changing the cutting speed. Confirm that the error increases with the speed.
2. The electrical roundness will have an error on the inner side when machine end compensation control is used.

⚠CAUTION

If an excessive value is set in the machine end compensation gain (SV065), the machine could vibrate when stopping, resulting in a dangerous state.

4-5 Adjustment during full closed loop control

4-5-1 Outline

(1) Full closed loop control

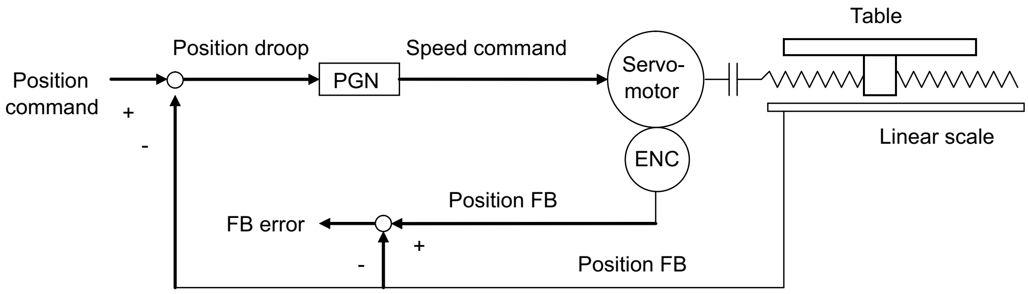
The servo control is all closed loop control using the detector's feedback. "Full closed loop control" is the system that directly detects the machine position using a linear scale, whereas the general "semi-closed loop" is the one that detects the motor position.
In a machine that drives a table with a ball screw, the following factors exist between the motor and table end:

[1] Coupling or ball screw table bracket's backlash
[2] Ball screw pitch error

These can adversely affect the accuracy. If the table position is directly detected with a linear scale, high-accuracy position control which is not affected by backlash or pitch error is possible. However, with the full closed loop system, the machine system is also directly included in the position loop control.
Thus, if the machine's rigidity is not high, the gain cannot be increased, and the required high accuracy cannot be attained.
The procedures for adjusting the servo with the full closed loop system are the same as the semi-closed loop system. Vibration or overshooting will occur easily, so the position loop gain is generally lower than the semi-closed loop.

(2) Overrun detection

With the full closed system, the position feedback (FB) detected with the linear scale is used for the position control. However, the motor position FB is detected at the same time, and the error of both FB is observed. If this FB error exceeds the servo parameter SV054 setting value, alarm 43 will be detected and the system will stop to prevent overrunning due to a scale FB error from occurring.



Overrun detection control

【#2254】 SV054 ORE Overrun detection width in closed loop control

Set the overrun detection width in the full-closed loop control.
When the gap between the motor side detector and the linear scale (machine side detector) exceeds the value set by this parameter, it will be judged as overrun and "Alarm 43" will be detected.
When "-1" is set, the alarm detection will not be performed.
When "0" is set, overrun will be detected with a 2mm width.

For linear servo/DDM system
Not used. Set to "0".

---Setting range---
-1 to 32767 (mm)

4-5-2 Speed loop delay compensation

Generally, the machine position follows the operation later than the motor position. With full closed loop position loop control, the machine position is used for position feedback, so the motor position could advance too far and cause the machine position to overshoot easily. Speed loop delay compensation suppresses overshooting by weakening the speed loop PI control (weakening lead compensation = delaying). If the compensation is too large and PI control is weakened too far, the positioning time could increase, or the position droop will remain when the motor is stopped.

<Adjustment method>

[1] Set the servo function selection 1 (SV027: SSF1)/bit1, bit0 to 10. (Select delay compensation changeover type 2)

[2] Set the axis unbalance torque to the torque offset (SV032: TOF). (Refer to "4-4-5 (1) Measuring unbalance torque and frictional torque" for details on measuring the unbalance torque.)

[3] Observe the position droop waveform, and confirm the overshooting. Increase SV007 (VIL) in increments of 5, and adjust so that the overshooting is improved. If set too high, the position droop will remain when the axis is stopped.

【#2207】 SV007 VIL Speed loop delay compensation

Set this when the limit cycle occurs in the full-closed loop, or overshooting occurs in positioning.
The speed loop delay compensation method can be selected with SV027/bit1,0.
Normally, use "Changeover type 2". Changeover type 2 controls the occurrence of overshooting by lowering the speed loop lead compensation after the position droop gets 0.
When setting this parameter, make sure to set the torque offset (SV032).

---Setting range---
0 to 32767

【#2232】 SV032 TOF Torque offset

Set the unbalance torque on vertical axis and inclined axis.
When the vertical axis pull up function is enabled, the pull up compensation direction is determined by this parameter's sign. When set to "0", the vertical axis pull up will not be executed.
This can be used for speed loop delay compensation and collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, friction torque (SV045) and load inertia display enabling flag(SV035/bitF).

---Setting range---
-100 to 100 (Stall current %)

【#2227】 SV027 SSF1 Servo function 1

bit 1-0 : vcnt Speed loop delay compensation changeover type selection

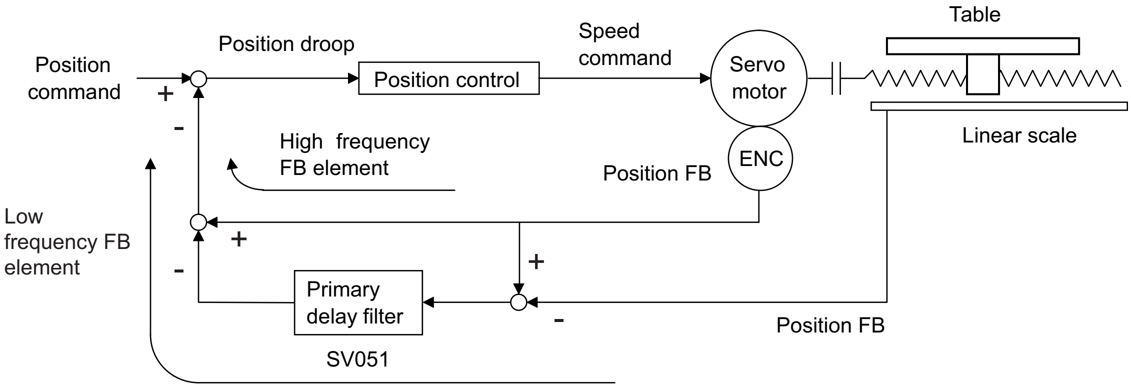
Normally, use "Changeover type 2".
bit1,0=
00: Disable
01: Changeover type 1
10: Changeover type 2
11: Setting prohibited

Related parameters: SV007

⚠ **CAUTION** The position droop will remain if SV007 is set too high.

4-5-3 Dual feedback control

If the motor and machine coupling or machine system's rigidity is low (ex. large machine, etc.) when using a closed loop system, the response during acceleration/deceleration will vibrate and cause overshooting. This can cause the position loop gain from increasing. The dual feedback function is effective in this case.
To validate the dual feedback function, use position feedback with a motor side detector in ranges with high acceleration to enable stable control. In ranges with low acceleration, use position feedback with the machine side detector (scale). This will make it possible to increase the position loop gain.



Dual feedback control

The state will approach the semi-closed loop system as the primary delay filter's time constant increases, so the position loop gain limit will increase. Note that the limit of the position loop gain increased with the dual feedback function is the same as the position loop gain limit for a semi-closed system that does not use a machine side detector (scale, etc.). In addition, the positioning time will increase as the primary delay filter time constant increases.

POINT

1. Dual feedback control is a function that compensates symptoms resulting from insufficient machine rigidity. If there are items that can be improved on the machine (improvement of scale installation position, etc.) improve those first.
2. The position loop gain limit will not increase compared to the semi-closed loop system even when using dual feedback control.

<Adjustment method>

[1] Set the servo specifications (SV017: SPEC)/bit1 to 1, and turn the NC power ON again.

[2] Measure the position droop overshooting while increasing the dual feedback control time constant (SV051: DFBT) in increments of 5ms. Adjust to the time constant where overshooting does not occur.

[3] For the final setting value, set a value 1.5 to 2-fold the value adjusted in 3.

【#2217(PR)】 SV017 SPEC1 Servo specification 1

bit 1 : dfbx Dual feedback control

Control the position FB signal in full closed control by the combination of a motor end detector and machine end detector.
0: Stop 1: Start

【#2251】 SV051 DFBT Dual feedback control time constant

Set the control time constant in dual feed back.
When "0" is set, it operates at 1ms.
The higher the time constant is, the closer it gets to the semi-closed control, so the limit of the position loop gain will be raised.

For linear servo/direct-drive motor system
Not used. Set to "0".

---Setting range---
0 to 9999 (ms)

【#2252】 SV052 DFBN Dual feedback control non-sensitive band

Set the non-sensitive band in the dual feedback control.
Normally, set to "0".

For linear servo/direct-drive motor system
Not used. Set to "0".

---Setting range---
0 to 9999 (μm)

4-6 Settings for emergency stop

Emergency stop in this section refers to the following states.

[1] Emergency stop was input (including other axis alarms)
[2] NC power down was detected
[3] A drive unit alarm was detected

4-6-1 Deceleration control

With the servo drive unit, if the deceleration stop function is validated, the motor will decelerate following the set time constant while maintaining the READY ON state. READY will turn OFF and the dynamic brakes will function after stopping.
If an alarm, for which dynamic brakes are designated as the stopping method, occurs, the motor will stop with the dynamic brakes.

<Features>

When the load inertia is large, deceleration stop can be executed at a shorter time than the dynamic brakes.
(The stop time for the normal acceleration/deceleration time constants will be achieved.)

(1) Setting the deceleration control time constant

Set the time for stopping from the rapid traverse rate (rapid: axis specification parameter) in the deceleration time constant for emergency stop (SV056: EMGt). The operation stops with the position loop step when 0 is set.
For the standard setting value of SV056, refer to the following table.
When applying this setting to the synchronous control axes, set the same value with negative symbol to the both axes. Even if the dynamic break stop is applied to either axis, it is also applied to the other axis.

Standard setting value of SV056

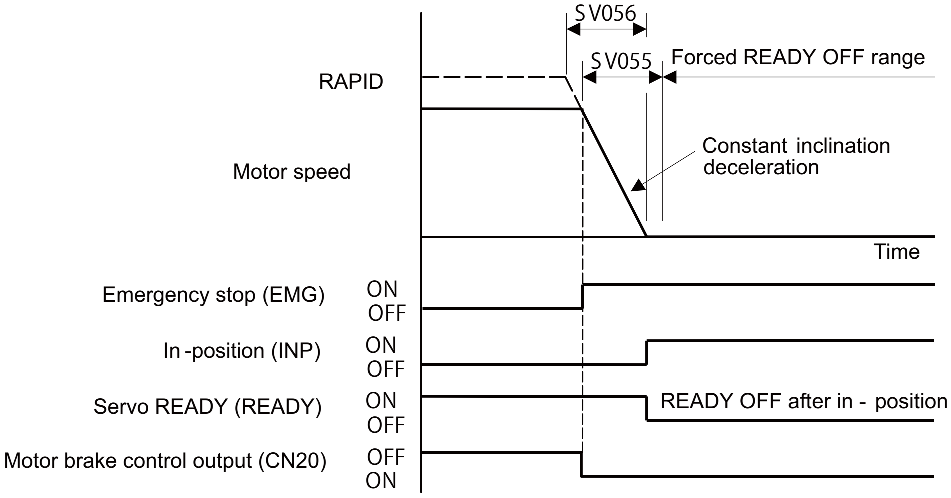
#2003: smgst Acceleration and deceleration modes bit 3-0: Rapid traverse acceleration/deceleration type (hexadecimal)			SV056: EMGt Deceleration time constant at emergency stop Standard setting value
1:Linear acceleration/deceleration			EMGt<=G0tL*0.9
8:Exponential acceleration and linear deceleration			EMGt<=(2*G0t1)*0.9
F:Soft acceleration/ deceleration	#1219:aux03 bit 7:Time constant setting changeover for soft acceleration/ deceleration	0:Accelerating time is G0tL	EMGt<=(G0tL-G0t1)*0.9
		1:Accelerating time is obtained by G0tL+G0t1	EMGt<=G0tL*0.9
A value other than the above			EMGt<=G0tL*0.9

#2004: G0tL G0 time constant (linear)
#2005: G0t1 G0 time constant (primary delay) / Second-step time constant for soft acceleration/deceleration

⚠CAUTION If the deceleration control time constant at emergency stop (EMGt) is set to a value longer than the above value, the soft limit point (stroke end point) may be exceeded. Take care as the axis could collide the machine.

<Operation>

When an emergency stop occurs, the motor will decelerate at the same inclination from each speed.



Deceleration control sequence

【#2255】 SV055 EMGx Max. gate off delay time after emergency stop

Set the time required between an emergency stop and forced READY OFF.
Set the maximum value "+ 100ms" of the SV056 setting value of the servo drive unit electrified by the same power supply unit.
When executing the vertical axis drop prevention, the gate off will be delayed for the length of time set at SV048 even when SV055's is smaller than that of SV048.

---Setting range---

0 to 20000 (ms)

【#2256】 SV056 EMGt Deceleration time constant at emergency stop

Set the time constant used for the deceleration control at emergency stop.
Set the time required to stop from rapid traverse rate (rapid).
The standard setting value is EMGt<=G0tL*0.9.
However, note that the standard setting value differs from the above-mentioned value when the setting value of "#2003:smgst Acceleration and deceleration modes bit 3-0:Rapid traverse acceleration/deceleration type" is 8 or F. Refer to Instruction Manual of the drive unit (section "Deceleration control") for details.
When the axis is used in the synchronous control, set the same value with minus sign to both axis.
If one of the axis switches to dynamic brake by an alarm during deceleration control, another axis will also switch.

---Setting range---

-20000 to 20000 (ms)

(2) Deceleration control stop distance

The stopping distance LEMG when the motor is stopped with deceleration control during an emergency stop can be approximated with the following expression. Note that the value will be higher than this if the current is limited during deceleration.

$$L_{emg} = \frac{F}{PGN1 \times 60} + \frac{1}{2} \times \frac{F}{60} \times \frac{F \times EMGt}{rapid \times 1000} \quad (mm)$$

F :Feedrate during emergency stop (mm/min)
rapid :Rapid traverse rate (mm/min)
PGN1 :Position loop gain 1 (SV003) (rad/s)
EMGt :Deceleration time constant for emergency stop (SV056) (ms)

POINT

1. Deceleration control will not take place when a servo alarm, for which the stopping method is dynamic, occurs. The motor will stop with dynamic braking regardless of the parameter setting.
2. If the power fails and the deceleration time constant is set to a relatively long time, the braking method may change from deceleration control to dynamic braking due to a drop in the bus voltage in the drive unit.

⚠ CAUTION

If the deceleration control time constant (EMGt) is set to a value longer than the acceleration/ deceleration time constant, the soft limit point (stroke end point) may be exceeded.
Take care as the axis could collide the machine.

4-6-2 Vertical axis drop prevention control

The vertical axis drop prevention control is a function that prevents the vertical axis from dropping due to a delay in the brake operation when an emergency stop occurs. The no-control time until the brakes activate can be eliminated by delaying the servo READY OFF state by the time set in the parameters when an emergency stop occurs.
Always use this function together with deceleration control.

<Setting procedures>

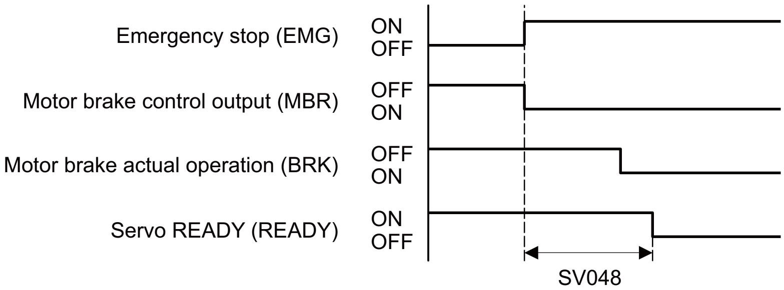
[1] Apply emergency stop while viewing the current position on the NC screen. Adjust the vertical axis drop prevention time (SV048), and set the 1.5-fold minimum delay time at which the axis does not drop.
When using a motor with a break, confirm that the axis will not drop at the 150ms setting, and set 200ms.

[2] Set the value of the normal acceleration/deceleration time constant plus 100ms for the max. gate off delay time at emergency stop (SV055), and standard setting value of the axis for the deceleration control time constant at emergency stop (SV056). Refer to "4-6-1 Deceleration control" for details.

[3-1] When the contactor is controlled by the MDS-D-SVJ3 unit, to which the vertical axis drop prevention control is set
The parameter setting is completed.

[3-2]When the contactor of MDS-D-SVJ3, to which the vertical axis drop prevention control is set, is controlled by the MDS-D-CV unit
Set the spindle parameters SP055 and SP056 of the spindle drive unit that controls the MDS-D-CV unit.

[3-3]When the contactor of the MDS-D-SVJ3 unit, to which the vertical axis drop prevention control is set, is controlled by the MDS-D-SPJ3 unit
Set the spindle parameters SP055 and SP056 of the MDS-D-SPJ3 unit.



Vertical axis drop prevention control sequence

⚠ **CAUTION**

1. Always set deceleration control when using the vertical axis drop prevention control setting.
2. In the system with MDS-D-SVJ3 unit only, configure so that the contactor is controlled directly by the axis which controls the vertical axis drop prevention control.
3. If an alarm, for which dynamic brake stopping is designated, occurs with the axis for which vertical axis drop prevention control is active, the function will not activate. To prevent axis dropping under all conditions, provide measures on the machine side by installing a balance unit, etc.
4. In consideration of the relay delay time for the break control, set the vertical axis drop prevention time.

【#2248】 SV048 EMGrt Vertical axis drop prevention time

Input the time required to prevent the vertical axis from dropping by delaying READY OFF until the brake works at an emergency stop.
Increase in increments of 100ms at a time, find and set the value where the axis does not drop.
When using a motor with a break, set to "200ms" as a standard.
When the pull up function is enabled (SV033/bitE=1), the pull up is established during the drop prevention time.

---Setting range---
0 to 20000 (ms)

【#2255】 SV055 EMGx Max. gate off delay time after emergency stop

Set the time required between an emergency stop and forced READY OFF.
Set the maximum value "+ 100ms" of the SV056 setting value of the servo drive unit electrified by the same power supply unit.
When executing the vertical axis drop prevention, the gate off will be delayed for the length of time set at SV048 even when SV055's is smaller than that of SV048.

---Setting range---
0 to 20000 (ms)

【#2256】 SV056 EMGt Deceleration time constant at emergency stop

Set the time constant used for the deceleration control at emergency stop.
Set the time required to stop from rapid traverse rate (rapid).
The standard setting value is EMGt<=G0tL*0.9.
However, note that the standard setting value differs from the above-mentioned value when the setting value of "#2003:smgst Acceleration and deceleration modes bit 3-0:Rapid traverse acceleration/deceleration type" is 8 or F. Refer to Instruction Manual of the drive unit (section "Deceleration control") for details.
When the axis is used in the synchronous control, set the same value with minus sign to both axis.
If one of the axis switches to dynamic brake by an alarm during deceleration control, another axis will also switch.

---Setting range---
-20000 to 20000 (ms)

POINT

1. If an alarm, for which dynamic brake stopping is designated, occurs with the axis for which vertical axis drop prevention control is active, the function will not activate.
2. A drop amount of several µm to several 10µm may be generated due to brake play.

⚠ CAUTION

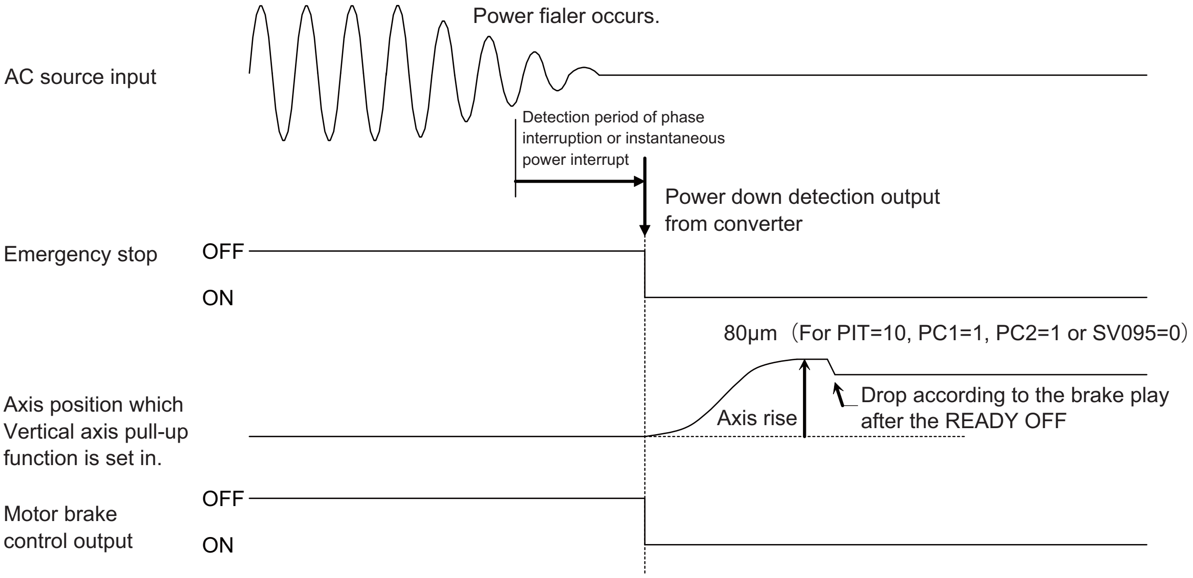
1. Do not set the vertical axis drop prevention time longer than required. The servo control and brakes could collide, resulting in an overload alarm or drive unit damage. There is no problem if the overlapping time is within 100ms.
2. Vertical axis drop prevention control (including deceleration control) longer than 100ms will not be guaranteed during a power failure. The operation will change to dynamic brakes.
3. If only SV048 and SV055 are set, and SV056 is set to 0, the deceleration stop will be a stepped stop and could result in collision with the machine.

4-6-3 Vertical axis pull-up control

Even when the vertical axis drop prevention control is applied, the axis will drop several μm due to the mechanical play of the motor brakes. Work could be damaged especially when the power fails during machining. For the vertical machining center, etc., vertical axis pull-up control protect works from collision by slightly pulling the vertical axis when an emergency stop (including the power failure) occurs.
If the pull-up control itself has possibility to cause interference during synchronous tapping machining or soft limit's stop, vertical axis pull-up control suppression command (servo control input 4/bit2) is input from NC and stops the pull-up control.

< Adjustment procedure >

[1] Set "4-6-2 Vertical axis drop prevention control".
[2] Set servo function selection 2 SV033/bitE = 1 (Vertical axis drop prevention control will start).
[3] Set the torque offset SV032. The pull-up directions is distinguished by this setting value's sign. Refer to "4-4-5 (1) Measuring unbalance torque and frictional torque measurement" for details on the setting.
[4] Input emergency stop when axes stop and confirm the subject axis to be retracted upward.
[5] If the pull-up range is insufficient, adjust vertical axis pull-up distance SV095.



Vertical axis pull-up control operation sequences when the power fails

⚠ CAUTION This function is valid for Z axis in the vertical machining center. Basically it cannot be used with the horizontal machining center's Y axis or the lathe's X axis as collisions could occur. Check the machine's working conditions carefully before using this function.

【#2232】 SV032 TOF Torque offset

Set the unbalance torque on vertical axis and inclined axis.
When the vertical axis pull up function is enabled, the pull up compensation direction is determined by this parameter's sign. When set to "0", the vertical axis pull up will not be executed.
This can be used for speed loop delay compensation and collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, friction torque (SV045) and load inertia display enabling flag(SV035/bitF).

---Setting range---
-100 to 100 (Stall current %)

【#2233】 SV033 SSF2 Servo function 2

bit E : zup Vertical axis pull up function

0: Stop 1: Enable

【#2248】 SV048 EMGrt Vertical axis drop prevention time

Input the time required to prevent the vertical axis from dropping by delaying READY OFF until the brake works at an emergency stop.
Increase in increments of 100ms at a time, find and set the value where the axis does not drop.
When using a motor with a break, set to "200ms" as a standard.
When the pull up function is enabled (SV033/bitE=1), the pull up is established during the drop prevention time.

---Setting range---
0 to 20000 (ms)

【#2295】 SV095 ZUPD Vertical axis pull up distance

Set this parameter to adjust the pull up distance when the vertical axis pull up function is enabled.
When the pull up function is enabled and this parameter is set to "0", for a rotary motor, 8/1000 of a rotation at the motor end is internally set as the pull up distance, and for a linear motor, 80[μm] is set.

---Setting range---
0 to 2000 (μm)

4-7 Protective functions

4-7-1 Overload detection

The servo drive unit is equipped with an electronic thermal that protects the servomotor and servo drive unit from overload conditions. The overload 1 alarm (alarm 50) is detected if an overload condition occurs, and the overload 2 alarm (alarm 51) is detected if 95% or more of the maximum current is commanded continuously for 1 second or longer due to a machine collision, etc. The parameters shown below are for machine tool builder adjustment purposes only, and should be kept at their standard settings (SV021=60, SV022=150).

For details concerning the overload protection characteristics, refer to the MDS-D-SVJ3/SPJ3 Series Specifications Manual (IB-1500158).

【#2221】 SV021 OLT Overload detection time constant

Normally, set to "60". (For machine tool builder adjustment.)

---Setting range---
1 to 999 (s)

【#2222】 SV022 OLL Overload detection level

Set the "Overload 1" (Alarm 50) current detection level as percentage to the stall current.
Normally set this parameter to "150". (For machine tool builder adjustment.)

---Setting range---
110 to 500 (Stall current %)

4-7-2 Excessive error detection

An excessive error (alarms 52, 53, 54) is detected when the difference between the servo's commanded position and the FB position exceeds the value set by parameter. Separate excessive error detection width can be set for servo ON (SV023) and servo OFF (SV026) statuses. When a wider excessive error detection width than that used for standard control is required in stopper control, etc., the detection width setting can be changed to the SV053 setting value by NC command.
Follow-up control (NC commanded position tracks servo FB position) is used during emergency stop and during a servo OFF command, and so there is no excessive error detection at those times, although the follow-up control during a servo OFF status can be disabled by an NC system parameter setting.

【#2223】 SV023 OD1 Excessive error detection width during servo ON

Set the excessive error detection width in servo ON.
<Standard setting value>
OD1=OD2= (Rapid traverse rate [mm/min]) / (60×PGN1) / 2 [mm]
When set to "0", the excessive error alarm detection will be ignored.

---Setting range---
0 to 32767 (mm)

【#2226】 SV026 OD2 Excessive error detection width during servo OFF

Set the excessive error detection width during servo OFF.
<Standard setting value>
OD1=OD2= (Rapid traverse rate [mm/min]) / (60×PGN1) / 2 [mm]
When set to "0", the excessive error alarm detention will be ignored.

---Setting range---
0 to 32767 (mm)

【#2253】 SV053 OD3 Excessive error detection width in special control

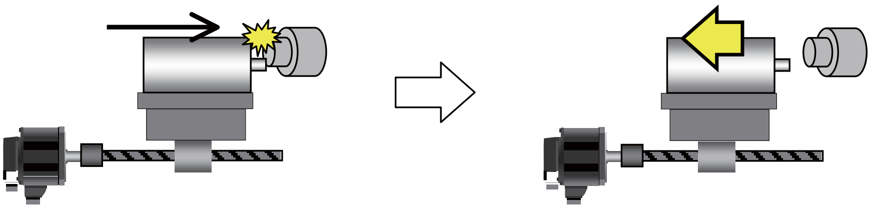
Set the excessive error detection width when servo ON in a special control (initial absolute position setting, stopper control and etc.).
When "0" is set, excessive error detection will not be performed when servo ON during a special control.

---Setting range---
0 to 32767 (mm)

4-7-3 Collision detection function

Collision detection function quickly detects a collision of the motor shaft, and decelerates and stops the motor. This suppresses the generation of an excessive torque in the machine tool, and helps to prevent an abnormal state from occurring. Impact at a collision will not be prevented by using this collision detection function, so this function does not necessarily guarantee that the machine tool will not be damaged or that the machine accuracy will be maintained after a collision. The same caution as during regular operation is required to prevent the machine from colliding.

Collision detection function outline



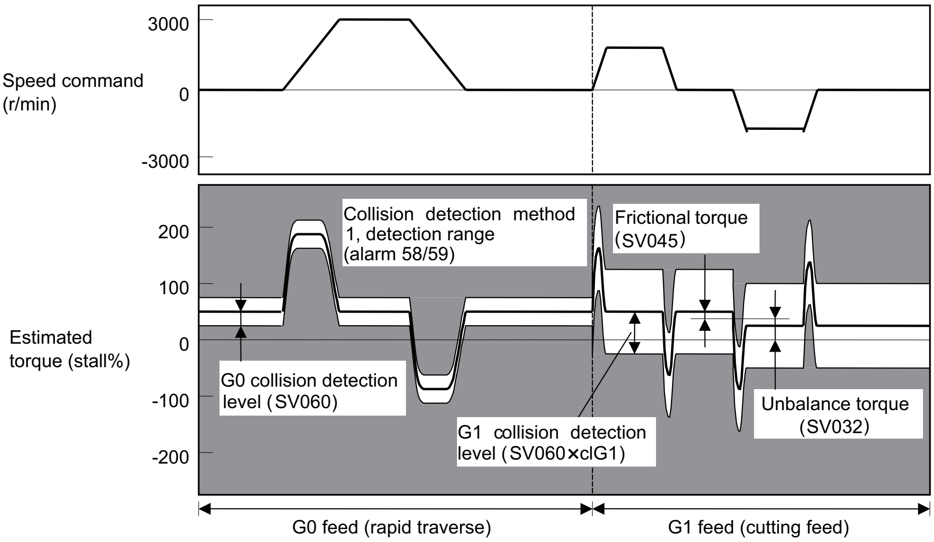
(a) A collision of machine is detected.

(b) A retracting torque is generated.
The collision of machine is reduced.

(1) Collision detection method 1

The required torque for the command is estimated from the position command issued from the NC, and the disturbance torque is obtained from the difference with the actual torque. When this disturbance torque exceeds the collision detection level set with the parameters, the motor will decelerate to a stop with a torque 80% (standard) value of the motor's maximum torque. After decelerating to a stop, alarm 58 or 59 will occur, and the system will stop.
The collision detection level for rapid traverse (G0) is set with SV060: TLMT. The collision detection level for cutting feed (G1) is set to 0 to 7-fold (SV35.clG1) based on the collision detection level for rapid traverse. When clG1 is set to 0, collision detection method 1 will not function during cutting feed. If SV060 is set to 0, all collision detection (including methods 1 and 2) will not function.

	Collision detection level setting parameter	Detected alarm
During rapid traverse (During G0 feed)	SV060	Alarm 58
During cutting feed (During G1 feed)	SV060 × c1G1 (SV035)	Alarm 59



Alarm detection range for collision detection method 1

⚠ CAUTION The collision detection function does not guarantee safety or machine accuracy when a collision occurs. Thus, the same caution as during regular operation is required to prevent the machine from colliding.

(2) Collision detection method 2

When the current command reaches the motor's maximum current, the motor will decelerate and stop at a torque 80% (standard value) of the motor's maximum torque. After decelerating to a stop, alarm 5A will occur, and the system will stop. If the acceleration/deceleration time constant is short and incorrect detections easily occur during normal operation, lengthen the acceleration/ deceleration time constant and adjust so that the current is not saturated (does not reach the maximum current) during acceleration.

If the acceleration/deceleration time constant cannot be lengthened, set parameter SV035/bitB (SSF4.c12n) to 1 to ignore collision detection method 2.

(3) Retracting torque

In each collision detection method, impact after a collision is reduced by generating the retracting torque after the collision is detected.

The retracting torque is a torque 70% to 100% which is set with SV035: SSF4/cltq (bit8, bit9) based on the current of the motor maximum ability.

POINT

1. Always validate SHG control when using the collision detection function, or when carrying out SV059 setting value operation.
2. Provide an allowance in the detection level setting to prevent incorrect detections.
3. All collision detection functions will be disabled when SV60 is set to 0.
4. Collision detection method 2 will function if a value other than 0 is set in SV060. Note that the detection can be ignored by setting the parameter (SV035/bitB).
5. The torque estimated gain (SV059) must be readjusted when there are changes in the detector replacement following maintenance, etc., in the detector resolution, or in the position control system such as detector loop gain (PGN),etc. (closed loop control and semi-closed loop has been changed).
6. The retracting torque generated when a collision is detected outputs the motor maximum torque. If the torque limitation is required in order to protect the machine, set "SV035: SSF4/cltq (bit8, bit9)".

<Setting and adjustment methods>

[1] Confirm that SHG control is active. Collision detection function is valid only during SHG control.

[2] Set the axis unbalanced torque to the torque offset (SV032: TOF). (Refer to "4-4-5 (1) Measuring unbalance torque and frictional torque" for details on measuring the unbalance torque.)

[3] Measure the frictional torque and set in the frictional torque (SV045: TRUB). Carry out reciprocation operation (approx. F1000) with the axis to be adjusted, and measure the load current % when the axis is fed at the constant speed on the NC SERVO MONITOR screen. This frictional torque is expressed with the following expression.

$$\text{Frictional torque (\%)} = \left| \frac{\text{(+ feed load current \%) - (- feed load current \%)}}{2} \right|$$

[4] Set SV035: SSF4.clt (bitF) to 1 for the axis being adjusted, and move in both directions with JOG, etc., at the rapid traverse rate. When the load inertia ratio display on the NC SERVO MONITOR screen has stabilized, set that value for the torque estimated gain (SV059: TCNV). Return SV035: SSF4.clt (bitF) to 0.

[5] If the acceleration/deceleration time is short, and the current is limited, set SV035: SSF4.c12n (bitB) to 1 to invalidate collision detection method 2.

[6] Adjust the collision detection level (SV060: TLMT). First set 100. If operation at the rapid traverse rate results in an alarm, increase the setting value by approx. 20. If an alarm does not occur, lower the setting value by approx. 10. When SV60 is set, the estimated disturbance torque value on the servo monitor screen will indicate the estimated disturbance torque peak value for the latest two seconds. This value can be used as reference. Set the final setting value to a value approx. 1.5-fold the limit value at which an alarm does not occur.

[7] Divide the maximum cutting load with the value set for the collision detection level (SV060: TLMT). (Round up the decimal) Set this value in SV035: SSF4.clG1 (bitC-E).
(Example) For maximum cutting load: 200%, SV060: TLMT setting value: 80%
200/80=2.5 -> The detection level is 3 (-fold), so set SV035:SSF4 to "3xxx".

[8] Set the retracting torque when the a collision is detected to SV035: SSF4.cltq (bit8,9).
(Example) To set the retracting torque to 70% of the motor maximum torque:
Set SV035:SSF4 to "x3xx".

【#2232】 SV032 TOF Torque offset

Set the unbalance torque on vertical axis and inclined axis.
When the vertical axis pull up function is enabled, the pull up compensation direction is determined by this parameter's sign. When set to "0", the vertical axis pull up will not be executed.
This can be used for speed loop delay compensation and collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, friction torque (SV045) and load inertia display enabling flag(SV035/bitF).

---Setting range---
-100 to 100 (Stall current %)

【#2235】 SV035 SSF4 Servo function 4

bit F : clt Inertia ratio display

0: Setting for normal use
1: Display the total inertia ratio estimated at acceleration/deceleration at the inertia ratio on the servo monitor screen

To display it on the screen, set an imbalance torque and friction torque to both SV032 and SV045 and repeat acceleration/deceleration operations for several times.

bit E-C: clG1 G1 Collision detection level

Set the collision detection level in the collision detection method 1 during cutting feed (G1) in multiples of that of rapid traverse (G0). When set to "0", detection of collision detection method 1 during cutting feed will be ignored.

G1 Collision detection level = G0 collision detection level (SV060) × clG1

bit B : cl2n Collision detection method 2

0: Enable 1: Disable

bit 9-8 : cltq Retract torque in collision detection

Set the retract torque in collision detection using the ratio of motor's maximum torque.

bit9,8=
00: 100%
01: 90%
10: 80%(Standard)
11: 70%

【#2245】 SV045 TRUB Friction torque

Set the frictional torque when using the collision detection function.
To use load inertia estimation function (drive monitor display), set this parameter, imbalance torque (SV032) and load inertia display enabling flag (SV035/bitF).

---Setting range---
0 to 255 (Stall current %)

【#2259】 SV059 TCNV Collision detection torque estimated gain

Set the torque estimated gain when using the collision detection function.
The standard setting value is the same as the load inertia ratio (SV037 setting value) including motor inertia.
Set to "0" when not using the collision detection function.

<<Drive monitor load inertia ratio display>>
Set SV035/bitF=1 and imbalance torque and friction torque to both SV032 and SV045, and then repeat acceleration/deceleration for several times.

---Setting range---
For general motor: 0 to 5000 (%)
For linear motor: 0 to 5000 (kg)

【#2260】 SV060 TLMT Collision detection level

When using the collision detection function, set the collision detection level at the G0 feeding.
When "0" is set, none of the collision detection function will work.

---Setting range---
0 to 999 (Stall current %)

4-8 Servo control signal

The sequence input/output signals exchanged between the NC and servo drive unit are explained in this section. The status of each signal is displayed on the NC SERVO MONITOR screen.

4-8-1 Servo control input (NC to Servo)

(1) Servo control input 1

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Servo control input 1</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>IL1</td><td>ALMR</td><td>EOM</td><td></td><td>KPM</td><td></td><td></td><td>SRV</td><td>RDY</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>RDY</td><td>READY ON command</td></tr>
<tr><td>1</td><td>SRV</td><td>Servo ON command</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>KPM</td><td>Position loop gain changeover command</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>EOM</td><td>Excessive error detection width changeover command</td></tr>
<tr><td>7</td><td>ALMR</td><td>Alarm reset command</td></tr>
<tr><td>8</td><td>IL1</td><td>Current limit selection command</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. READY ON command (RDY)
Status turns to ready ON at RDY=1.

bit1. Servo ON command (SRV)
[1] Drive unit turns ON at SRV=1 (servo ON status).
[2] Drive unit turns OFF at SRV=0 (servo OFF status).

bit4. Position loop gain changeover command (KPM)
[1] The position loop gain (SV049/SV050/SV058) for spindle synchronous (synchronous tapping, synchronous control with spindle C-axis, etc.) is selected at KPM=1.
[2] The normal position loop gain (SV003/SV004/SV057) is selected at KPM=0.

bit6. Excessive error detection width changeover command (EOM)
[1] The excessive error width (SV053) for the special control (initial absolute position setting, stopper control, etc.) is selected at EOM =1.
[2] The normal excessive error width (SV023) is selected at EOM =0.

bit7. Alarm reset command (ALMR)
NR alarm is reset at ALMR=1.

bit8. Current limit selection command (IL1)

[1] The current (torque) limit (SV014) for the special control (initial absolute position setting, stopper control, etc.) is selected at IL1 =1.
[2] The normal current (torque) limit (SV013) is selected at IL1 =0.

(Note) The bits other than those above are used for maintenance.

(2) Servo control input 2

This is used for maintenance.

(3) Servo control input 3

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Servo control input 3</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>AXF</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>AXF</td><td>Control axis detachment command</td></tr>
<tr><td>1</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>7</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. Control axis detachment command (AXF)
The control axis is detached at AXF=1.

(Note) The bits other than those above are used for maintenance.

(4) Servo control input 4

This is used for maintenance.

(5) Servo control input 5

This is used for maintenance.

(6) Servo control input 6

This is used for maintenance.

4-8-2 Servo control output (Servo to NC)

(1) Servo control output 1

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Servo control output 1</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>WRN</td><td>AER</td><td>LMT</td><td>INP</td><td></td><td></td><td></td><td>IL1</td><td>ALMR</td><td>EOM</td><td></td><td>KPM</td><td></td><td></td><td>SRV</td><td>RDY</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>RDY</td><td>In READY ON</td></tr>
<tr><td>1</td><td>SRV</td><td>In servo ON</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>KPM</td><td>In position loop gain changeover</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>EOM</td><td>In excessive error detection width changeover</td></tr>
<tr><td>7</td><td>ALMR</td><td>In alarm</td></tr>
<tr><td>8</td><td>IL1</td><td>In current limit selection</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>INP</td><td>In in-position</td></tr>
<tr><td>D</td><td>LMT</td><td>In current limit</td></tr>
<tr><td>E</td><td>AER</td><td>In absolute position data loss</td></tr>
<tr><td>F</td><td>WRN</td><td>In warning</td></tr>
</table>
</td></tr>
</table>

bit0. In ready ON (RDY)
It indicates that the status is in ready ON at RDN=1.

bit1. In servo ON (SRV)
It indicates that the drive unit turns ON (servo ON) at SRV=1.

bit4. In position loop gain changeover (KPM)
[1] The position loop gain (SV049/SV050/SV058) for spindle synchronous (synchronous tapping, synchronous control with spindle C-axis, etc.) is being selected at KPM=1.
[2] The normal position loop gain (SV003/SV004/SV057) is being selected at KPM=0.

bit6. In excessive error detection width changeover (EOM)
[1] The excessive error width (SV053) for the special control (initial absolute position setting, stopper control, etc.) is being selected at EOM =1.
[2] The normal excessive error width (SV023) is being selected at EOM =0.

bit7. In alarm (ALMR)
It indicates that drive unit is in some alarm state at ALM=1.

bit8. In current limit selection (IL1)
[1] The current (torque) limit (SV014) for the special control (initial absolute position setting, stopper control, etc.) is being selected at IL1 =1.
[2] The normal current (torque) limit (SV013) is being selected at IL1 =0.

bitC. In in-position (INP)
The status changes to INP=1 when position droop exists within the in-position area set by parameter SP024 (INP) regardless of serve ON or OFF.

bitD. In current limit (LMT)
It indicates that the drive unit is in current limit at LMT=1.

bitE. In absolute position data loss (AER)
It indicates that the drive unit is in absolute position data loss at AER=1.

bitF. In warning (WRN)
It indicates that drive unit is in some warning state at WRN=1.

(Note) The bits other than those above are used for maintenance.

(2) Servo control output 2

Name	Details
Servo control output 2	

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
								EXEMG				ZS			ZCN

bit		Details
0	ZCN	Z phase passed
1	-	(For maintenance)
2	-	(For maintenance)
3	ZS	In zero speed
4	-	(For maintenance)
5	-	(For maintenance)
6	-	(For maintenance)
7	EXEMG	In external emergency stop
8	-	(For maintenance)
9	-	(For maintenance)
A	-	(For maintenance)
B	-	(For maintenance)
C	-	(For maintenance)
D	-	(For maintenance)
E	-	(For maintenance)
F	-	(For maintenance)

bit0. Z phase passed (ZCN)
ZCN is set to "1" after passing the Z phase at ZCN=0.

bit3. In zero speed (ZS)
It indicates that the servomotor is stopping at ZS=1.

bit7. In external emergency stop
It indicates that an external stop input to the drive unit is being input.

(Note) The bits other than those above are used for maintenance.

(3) Servo control output 3

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Servo control output 3</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>AXF</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>AXF</td><td>In control axis detachment</td></tr>
<tr><td>1</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>7</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. In control axis detachment (AXF)
The control axis is being detached at AXF=1.

(Note) The bits other than those above are used for maintenance.

(4) Servo control output 4

This is used for maintenance.

(5) Servo control output 5

This is used for maintenance.

(6) Servo control output 6

This is used for maintenance.

5

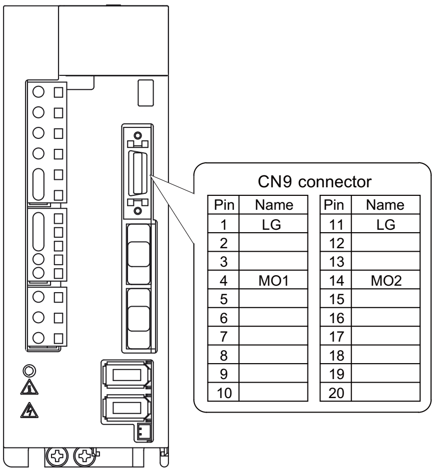
Spindle Adjustment

Contents

5-1 D/A output specifications for spindle drive unit

The drive unit has a function to D/A output each control data. The spindle adjustment data required to set the spindle parameters matching the machine can be D/A output. The data can be measured with a high-speed waveform recorder or oscilloscope, etc.

5-1-1 D/A output specifications



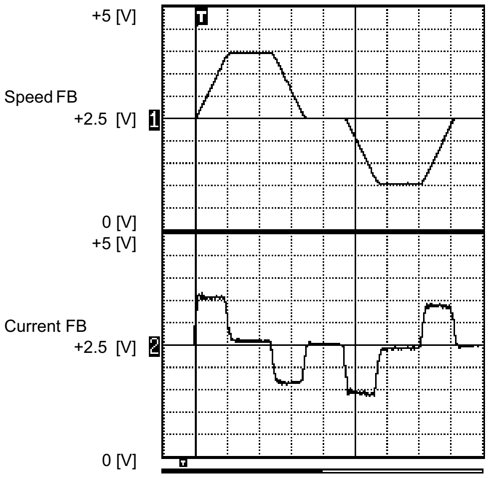
CN9 connector

Pin	Name	Pin	Name
1	LG	11	LG
2		12	
3		13	
4	MO1	14	MO2
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

MDS-D-SPJ3

Item	Explanation
No. of channels	2ch
Output cycle	0.8ms (min. value)
Output precision	10bit
Output voltage range	0V to 2.5V (zero) to +5V
Output magnification setting	-32768 to 32767 (1/100-fold)
Output pin (CN9 connector)	MO1 = Pin 4, MO2 = Pin 14, LG = Pin 1,11

When the output data is 0, the offset voltage is 2.5V. If there is an offset voltage, adjust the zero level position in the measuring instrument side.



Example of D/A output waveform

5-1-2 Setting the output data

<Standard output>

【#13125】 SP125 DA1NO D/A output ch1 data No.

Input the desired data number to D/A output channel.

---Setting range---
-32768 to 32767

【#13126】 SP126 DA2NO D/A output ch2 data No.

Input the desired data number to D/A output channel.

---Setting range---
-32768 to 32767

No.	Output data	Output unit for standard setting	Output cycle
-1	D/A output stop	-	
0	Commanded motor rotation speed	1000(r/min)/V	0.8ms(min)
1	Motor rotation speed	1000(r/min)/V	0.8ms(min)
2	Torque current command	Short time rated ratio 100%/V	0.8ms(min)
3	Torque current feedback	Short time rated ratio 100%/V	0.8ms(min)
35	Disturbance observer estimated disturbance torque	Short time rated torque current value ratio 100%/V	0.8ms(min)
50	Position droop	1/1000°/V	0.8ms(min)
51	Position command	1/1000°/V	0.8ms(min)
52	Position feedback	1/1000°/V	0.8ms(min)
53	Position FΔT	1/1000°/s/V	0.8ms(min)
54	Deviation from ideal position (considering spindle tracking delay)	1/1000°/V	0.8ms(min)
60	Position droop	1°/V	0.8ms(min)
61	Position command	1°/V	0.8ms(min)
62	Position feedback	1°/V	0.8ms(min)
63	Position FΔT	1°/s/V	0.8ms(min)
64	Deviation from ideal position (considering spindle tracking delay)	1°/V	0.8ms(min)
70	Position droop	1000°/V	0.8ms(min)
71	Position command	1000°/V	0.8ms(min)
72	Position feedback	1000°/V	0.8ms(min)
73	Position FΔT	1000°/s/V	0.8ms(min)
74	Deviation from ideal position (considering spindle tracking delay)	1000°/V	0.8ms(min)
110	3.0V output load meter (Note)	40%/V, 120%/3V	0.8ms(min)
126	Saw tooth wave	0V to 5V	0.8ms(min)
127	2.5V test data output	2.5V	0.8ms(min)

(Note) Load meter displays "100%(=2.5V)" when the control power turns ON and the NC is starting. After the NC has been run, it displays "0%(=0V%)".

<Special output>

The result of PLG(TS5690) installation accuracy diagnosis is output to D/A output. D/A output magnification:SP127(DA1MPY) and SP128(DA2MPY) is 0.

PLG installation diagnosis function can be enabled during the rotation, when open loop control is enabled:SP018(SPEC2)/bit1=1.

D/A output No.	Details	Description
120	Motor end PLG installation Gap diagnosis	Motor end PLG installation gap is diagnosed. When the gap is good, 2.5V is output. When the gap is excessive, 2.5V+1V is output. When the gap is too small, 2.5V-1V is output.
121	Motor end PLG installation All errors diagnosis	Motor end PLG installation error (including the gap) is diagnosed. When the installation is good, 2.5V is output. When the installation is incorrect, 2.5V+1V is output.
122	Spindle end PLG installation Gap diagnosis	Spindle end PLG installation gap is diagnosed. Diagnostic procedure is the same as that of motor end PLG.
123	Spindle end PLG installation All errors diagnosis	Spindle end PLG installation error (including the gap) is diagnosed. Diagnostic procedure is the same as that of motor end PLG.

< Spindle control signal>

Spindle control input (NC to Spindle)			Spindle control output (Spindle to NC)		
No.	**Details**		**No.**	**Details**	
16384	Spindle control input 1-0	READY ON command	**16480**	Spindle control output 1-0	In ready ON
16385	Spindle control input 1-1	Servo ON command	**16481**	Spindle control output 1-1	In servo ON
16391	Spindle control input 1-7	Alarm reset command	**16487**	Spindle control output 1-7	In alarm
16392	Spindle control input 1-8	Torque limit 1 selection command	**16488**	Spindle control output 1-8	In torque limit 1 selection
16393	Spindle control input 1-9	Torque limit 2 selection command	**16489**	Spindle control output 1-9	In torque limit 2 selection
16394	Spindle control input 1-A	Torque limit 3 selection command	**16490**	Spindle control output 1-A	In torque limit 3 selection
			16492	Spindle control output 1-C	In in-position
			16495	Spindle control output 1-F	In warning
			16496	Spindle control output 2-0	Z phase passed
			16499	Spindle control output 2-3	In zero speed
			16503	Spindle control output 2-7	In external emergency stop
16432	Spindle control input 4-0	Spindle control mode selection command 1	**16528**	Spindle control output 4-0	In spindle control mode selection 1
16433	Spindle control input 4-1	Spindle control mode selection command 2	**16529**	Spindle control output 4-1	In spindle control mode selection 2
16434	Spindle control input 4-2	Spindle control mode selection command 3	**16530**	Spindle control output 4-2	In spindle control mode selection 3
16436	Spindle control input 4-4	Gear changeover command	**16532**	Spindle control output 4-4	In gear changeover command
16437	Spindle control input 4-5	Gear selection command 1	**16533**	Spindle control output 4-5	In gear selection 1
16438	Spindle control input 4-6	Gear selection command 2	**16534**	Spindle control output 4-6	In gear selection 2
			16545	Spindle control output 5-1	Speed detection
16459	Spindle control input 5-B	Minimum excitation rate 2 changeover request	**16555**	Spindle control output 5-B	In minimum excitation rate 2 selection
16460	Spindle control input 5-C	Speed gain set 2 changeover request	**16556**	Spindle control output 5-C	In speed gain set 2 selection
16461	Spindle control input 5-D	Zero point re-detection request	**16557**	Spindle control output 5-D	Zero point re-detection complete
16462	Spindle control input 5-E	Spindle holding force up	**16558**	Spindle control output 5-E	Spindle holding force up completed
			16559	Spindle control output 5-F	In 2nd in-position

(Note 1) Control signal is bit output. Setting the No. of the table above to the data output(SP125, SP126), and when the scale (SP127, SP128) is set to "0", the output is "0V" for bit 0, and "2.5V" for bit 1.

(Note 2) Refer to "5-3 Spindle control signal" for details on the spindle control signal.

5-1-3 Setting the output magnification

Internal data output (Data No. -1 to 3, 50, 60, 127)

Set when outputting data other than in standard magnification (the magnification is 1). When "0" is set, the magnification will be 1, which is the same as when "100" is set.

(Example 1) When SP125=1, SP127=50
Commanded motor rotation speed is output to D/A output channel 1 in increments of 2000r/min/V.

(Example 2) When SP126=2, SP128=200
The torque axis current command is output to D/A output channel 2 in increments of 50%/V.

【#13127】 SP127 DA1MPY D/A output ch1 output scale

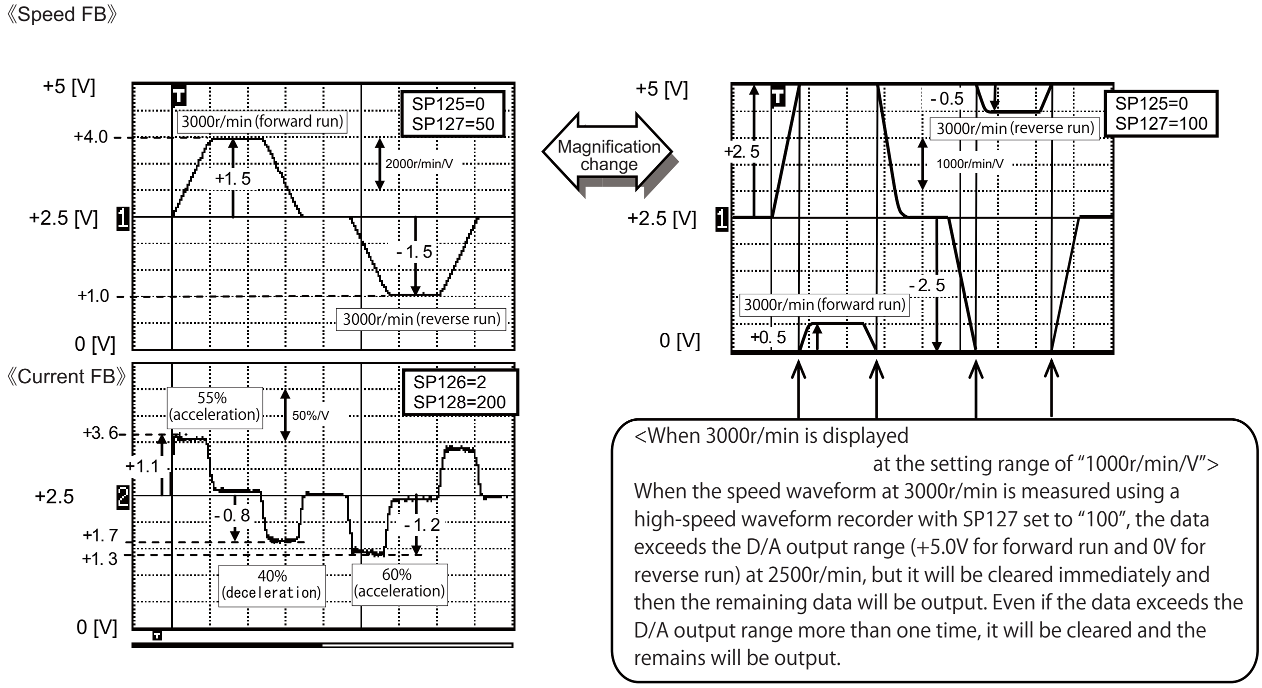
Set the output scale in increments of 1/100.
When "0" is set, the scale is the same as when "100" is set.

---Setting range---
-32768 to 32767 (1/100-fold)

【#13128】 SP128 DA2MPY D/A output ch2 output scale

Set the output scale in increments of 1/100.
When "0" is set, the scale is the same as when "100" is set.

---Setting range---
-32768 to 32767 (1/100-fold)



<When 3000r/min is displayed at the setting range of "1000r/min/V">
When the speed waveform at 3000r/min is measured using a high-speed waveform recorder with SP127 set to "100", the data exceeds the D/A output range (+5.0V for forward run and 0V for reverse run) at 2500r/min, but it will be cleared immediately and then the remaining data will be output. Even if the data exceeds the D/A output range more than one time, it will be cleared and the remains will be output.

Example of D/A output waveform: 3000r/min during acceleration and deceleration

5-2 Adjustment procedures for each control

⚠CAUTION

1. Do not adjust when possible risks associated with adjustment procedures are not thoroughly taken into consideration.
2. Be careful when touching rotating section, or your hand may be caught in or cut.
3. Changing of parameters has to be done carefully.

5-2-1 Basic adjustments

(1) Items to check during trial operation

[1] When the power is ON for the first time, check the wiring. When the machine is operated for the first time, check the set parameters again.

[2] Confirm that the values of the NC side parameters "slimt1 to 4", "smax1 to 4", and "smini" comply with the machine specification.

[3] When the machine running-in has not been completed, gradually raise the rotation speed (in increments of 1000r/min) for the spindle. Raise the speed at the timing when the load meter value is stabilized during rotation.
If the load meter value is higher than the normal value, stop the operation and check the spindle section of the machine.

[4] Confirm that the command (S command) speed and actual speed match during running-in. When gear ratio is set, the spindle end speed and motor speed differ.

[5] Confirm that there is no abnormal noise, odor or motor overheat during running-in.

(2) Adjusting the spindle rotation speed

When the spindle motor and the spindle end are coupled using a gear or pulley, the rotation speeds of the spindle motor and the spindle end may not match. Adjust the command and the rotation speed of spindle end with the following method.

Apply the following adjustment methods [1] to [3] individually to each of the gears 00 to 11. Confirm that the machine's gear changes correctly before the adjustment.

[1] Set the spindle specification parameters, "slimt1 to 4".
Calculation expression:
slimt1 to 4 = SP026 × (deceleration rate of the gears 00 to 11 between the motor and spindle end)

[2] Set the S command to half of the maximum spindle rotation speed and confirm the rotation speed of the spindle end. Adjust slimt1 to 4 until the rotation speed matches.

[3] Set the S command to the maximum spindle end rotation speed and confirm that the S command speed and the spindle end speed match.

5-2-2 Gain adjustment

(1) Checking the current loop gain

Check to see if the settings of following parameters, SP077 to SP084, are the standard setting. Basically, parameters for current loop gain do not need to be changed.

【#13077】 SP077 IQA Q axis current lead compensation

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13078】 SP078 IDA D axis current lead compensation

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13079】 SP079 IQG Q axis current gain

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13080】 SP080 IDG D axis current gain

Set the current loop gain.
To use the coil switch function, set the current loop gain for when the high-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13081】 SP081 IQAL Q axis current lead compensation low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13082】 SP082 IDAL D axis current lead compensation low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 20480

【#13083】 SP083 IQGL Q axis current gain low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

【#13084】 SP084 IDGL D axis current gain low-speed coil

When using coil switch function, set the current loop gain for when the low-speed coil is selected.
The setting value is determined by the motor's electrical characteristics so that the value is fixed to each motor used.
Set the value given in the spindle parameter list. (For machine tool builder adjustment)

---Setting range---
1 to 8192

(Note) Low-speed coil setting SP081, SP082, SP083 and SP084 are set to "0" when coil changeover specification is not available.

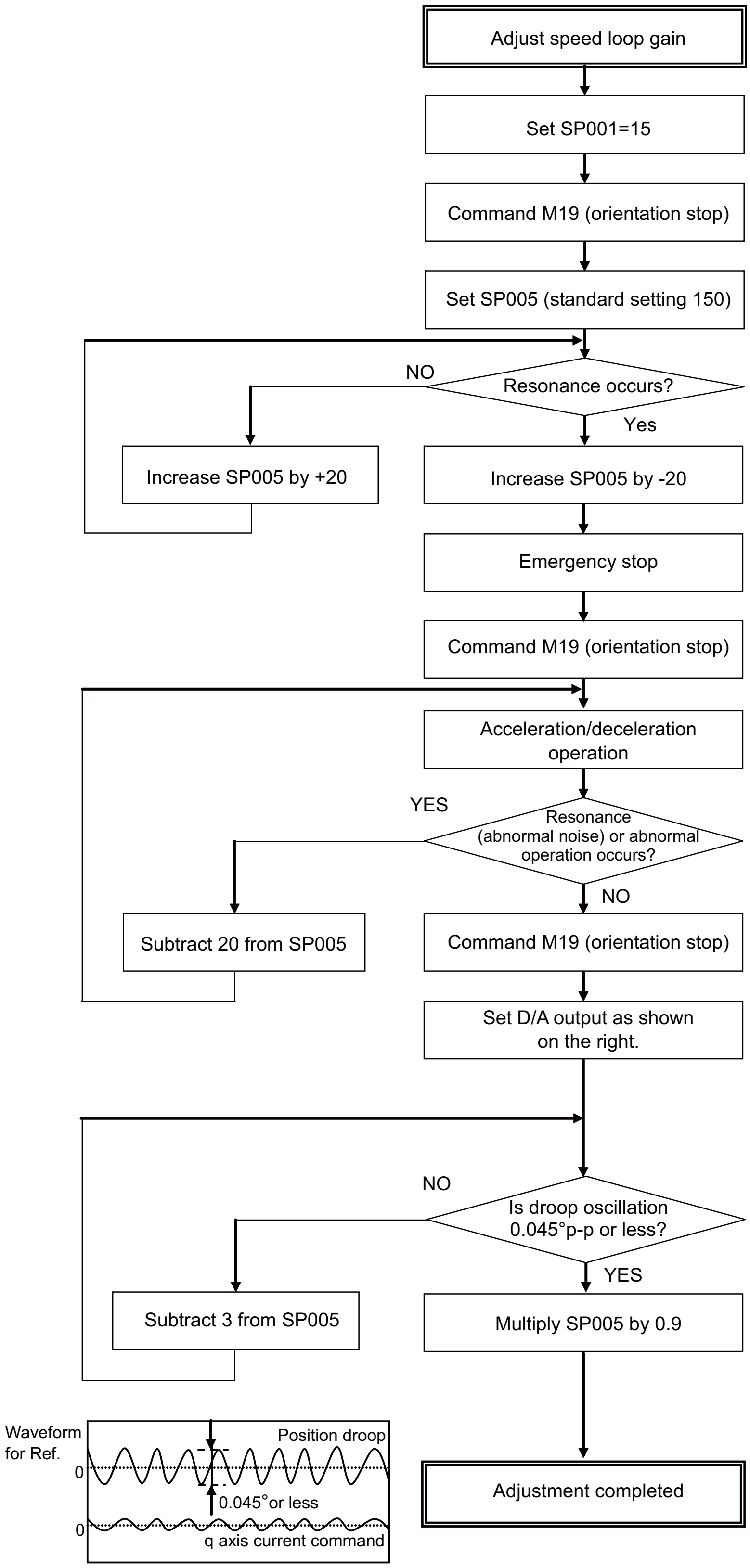
(2) Adjusting the gain parameter

Adjust the gain parameters as usual or by application in accordance with the chart below.

Control item Gain	Regular adjustment	By-application adjustment (compensation)			
	Acceleration/deceleration or orientation (Note 3)	**Synchronous tapping**	**Spindle C axis adjustment**	**Orientation (Note 4)**	**Spindle synchronization**
Position loop gain	SP001	SP002			SP003
Speed loop gain	SP005, SP006, SP007 →Set 1	SP008, SP009, SP010 →Set 2			SP005, SP006, SP007 →Set 1
	[1]Valid for SP035 bit9=0 [2]Switch the speed loop gain in the orientation stop to Set 2 with SP035 bit1=1	Valid for SP035 bit9=1			Valid for SP035 bit9=0

(Note 1) The speed loop gain can switch from Set 1 to Set 2 with the bit selection for SP035.
(Note 2) Position and speed loop gain is switched depend on the control item, so set the parameter correctly.
(Note 3) When "#3106 bitE" is set to "1".
(Note 4) When "#3106 bitE" is set to "0".

(3) Adjusting the speed loop parameter



Stops at servo ON status

Increase the value up to where resonance occurs.

Executes acceleration/deceleration operation in phase up to maximum rotation speed from 0.

(Note)
hen the maximum speed is 10000r/min, executes in approx. 1000r/min increments, divided by 10.

Ch1	Output waveform：Position droop	SP125：60	SP127：4000 (0.025°/V)
Ch2	Output waveform：q axis current command	SP126：2	SP128:1000 (10%/V)

Note that the maximum setting value is as follows:
SP005(max)□150 x inertia ratio
(Inertia ratio：total inertia/motor inertia)

(Example)
When inertia rate is double and the determined gain is 350, the setting value for SP005 is 315, which is 90% of the determined gain, however,the setting value for SP005 should be 300, because the maximum setting value is 150x2(inertia rate)=300.

【#13005】 SP005 VGN1 Speed loop gain 1

Set the speed loop gain.
Set this according to the load inertia size.
The higher setting value will increase the accuracy of control, however, vibration tends to occur.
If vibration occurs, adjust by lowering by 20 to 30%.
The final value should be 70 to 80% of the value at which the vibration stops.

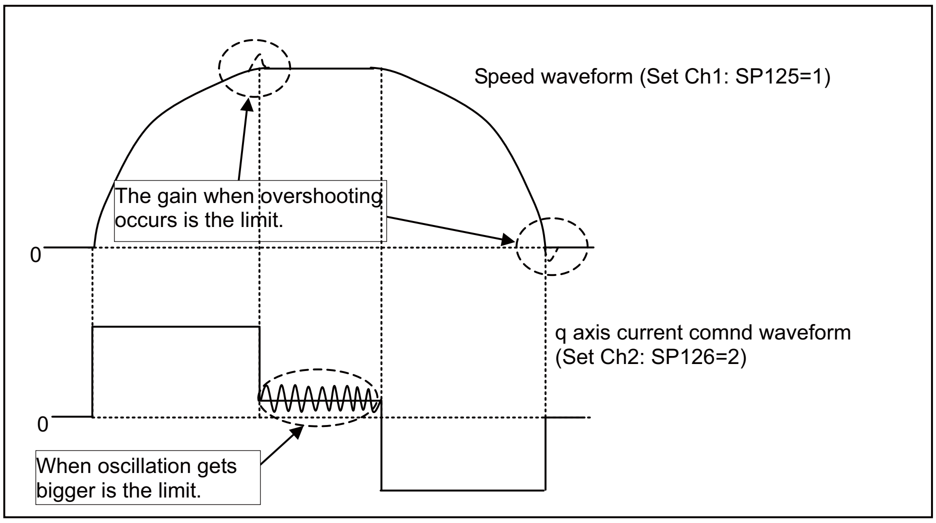
---Setting range---
1 to 9999

(4) Adjusting the position loop gain (SP001: PGV non-interpolation mode position loop gain)

After setting the speed gain, in order to perform acceleration/deceleration operation, set the position loop gain (SP001) by increasing its setting value from 15. When overshooting occurs at the time of acceleration/deceleration completion, or when oscillation of the q axis current command gets bigger during a set rotation, the position loop gain is in limit state. Note that standard position loop gain below is set for the setting gain.

CAUTION ! Change "Excessive error detection width" (SP053) when "Position loop gain" (SP001) is changed.

Method for checking the limitation of position loop gain



(Example)As the closest value should be selected from the standard setting range shown below, set 47 to SP001 when the limit gain is 55.

Standard position loop gain	15	18	21	23	26	33	38	47	60	70

【#13001】 SP001 PGV Position loop gain non-interpolation mode

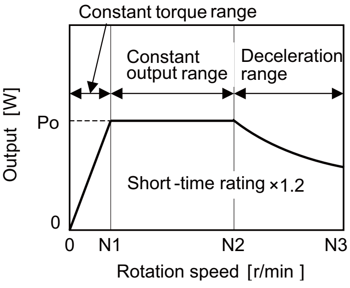
Set the position loop gain for "Non-interpolation" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 000" in control input 4.
(Note) The control mode is commanded by NC.

---Setting range---
1 to 200 (1/s)

5-2-3 Adjusting the acceleration/deceleration operation

(1) Calculating the theoretical acceleration/deceleration time

The spindle motor output characteristics (shown on the right) have three ranges, which are constant torque, constant output, and deceleration ranges. Each range has different calculation method. The acceleration/deceleration time is calculated using the calculation expression which corresponds to each range of the rotation speed for calculation. Note that the load torque (friction torque) is not considered in the calculation expression, so the result may slightly differ from the actual acceleration/ deceleration time.



Output characteristics for acceleration/deceleration

(a) Maximum motor output during acceleration/deceleration: Po

During acceleration/deceleration, the output is 1.2-fold the short-time rating.
The output Po during acceleration/deceleration follows the expression below.
Po = (Short-time rated output) x 1.2 [W]
Substitute this value into Po of the expression.

(b) Total load inertia: J_{all}

Total load inertia means the total inertia of the spindle motor and of the components which are rotated the motor (shaft, etc.).

J_{all} = (Motor inertia) + (Spindle conversion inertia) [kg•m^2]

The values obtained in (a) and (b) are substituted into the following calculation expressions.
To calculate the acceleration/deceleration time of the rotation speed N (r/min), use the expression (c), (d) or (e) which is selected depending on the range that corresponds to the speed N.

(c) Acceleration/deceleration time for constant torque range: t1···0 to N [r/min] (0 ≦ N ≦ N1) (For N>N1, apply N=N1 and also calculate t2 or t3.)

$$t1 = \frac{1.097 \times 10^{-2} \times J_{all} \times N1 \times N}{Po} \quad [s] \quad \text{(Caution 1)}$$

(d) Acceleration/deceleration time for constant output range: t2···N1 to N [r/min] (N1<N ≦ N2) (For N>N2, apply N=N2 and also calculate t3.)

$$t2 = \frac{1.097 \times 10^{-2} \times J_{all} \times (N^2 - N1^2)}{2 \times Po} \quad [s] \quad \text{(Caution 1)}$$

(e) Acceleration/deceleration time in deceleration output range: t3···N2 to N [r/min] (N2<N ≦ N3)

$$t3 = \frac{1.097 \times 10^{-2} \times J_{all} \times (N^3 - N2^3)}{3 \times Po \times N2} \quad [s] \quad \text{(Caution 1)}$$

Based on the above expressions, the acceleration/deceleration time: t from 0 to N3 [r/min] is:

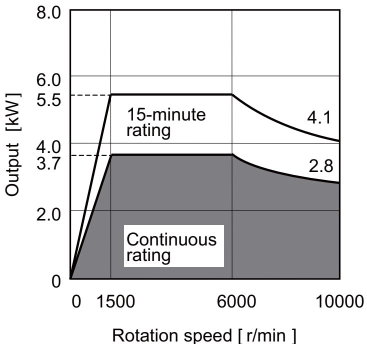
t = t1 + t2 + t3 [s] (Caution 2)

⚠ CAUTION

1. Note that the inertia (J) is a quarter of "GD^2".
   Ex.) When "GD^2" is 0.2 [kg•m^2], the inertia is "0.2 / 4 = 0.05 [kg•m^2]".
2. If the AC input power voltage to the spindle drive unit is low, or if the input power impedance is high, the acceleration/deceleration time may be long. (Especially, the acceleration/deceleration time of the deceleration output range may be long.)
3. For the actual measurement in comparison with the theoretical value, perform under the same condition as the calculated load inertia of Jall. The acceleration/deceleration time differs according to the inertia. When performing the measurement with a workpiece or tool installed to the spindle, confirm that the acceleration/deceleration time has been calculated when the total inertia is included in the installed workpiece and tool.

[Calculation example]

Calculate the acceleration/deceleration time from 0 to 10000[r/min] for an spindle motor having the output characteristics shown on the right when the motor inertia is 0.0148 [kg•m^2], and when the motor shaft conversion load inertia is 0.05 [kg•m^2].



Spindle motor characteristics

Po = (Short-time rated output) x 1.2 = 5500 x 1.2 = 6600 [W]

J_{all} = (Motor inertia) + (load inertia)
= 0.0148 + 0.05 =0.0648 [kg•m^2]

$$t1 = \frac{1.097 \times 10^{-2} \times J_{all} \times N1^2}{Po} = \frac{1.097 \times 10^{-2} \times 0.0648 \times 1500^2}{6600} = 0.242\ [s]$$

$$t2 = \frac{1.097 \times 10^{-2} \times J_{all} \times (N2^2 - N1^2)}{2 \times Po} = \frac{1.097 \times 10^{-2} \times 0.0648 \times (6000^2 - 1500^2)}{2 \times 6600} = 1.818\ [s]$$

$$t3 = \frac{1.097 \times 10^{-2} \times J_{all} \times (N3^3 - N2^3)}{3 \times Po \times N2} = \frac{1.097 \times 10^{-2} \times 0.0648 \times (10000^3 - 6000^3)}{3 \times 6600 \times 6000} = 4.691\ [s]$$

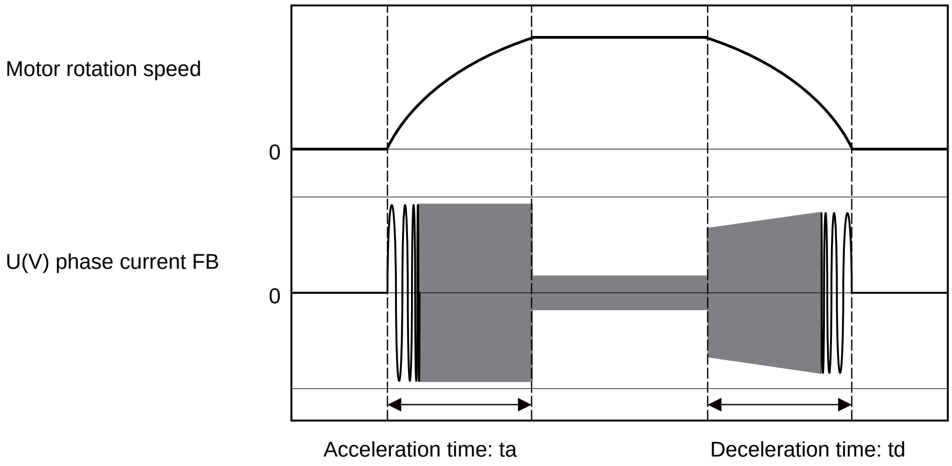
Thus,
t = t1 + t2 + t3 = 0.242 + 1.818 + 4.691 = 6.751 [s]

(2) Measuring the acceleration/deceleration waveforms

Outputs the motor rotation speed by using the spindle drive unit's D/A output function and check if theoretical acceleration/deceleration time is within ±15%. Refer to "5-1 D/A output specifications for spindle drive unit" for details on D/A output functions.

Phase current FB output can be measured by the waveform for either U or V phase FB.

The motor phase current cannot be measured on D/A output. Thus, measure the current in the motor wire, using a measuring device, current clamp meter.



Acceleration/deceleration waveforms of spindle motor

When acceleration/deceleration time does not match the theoretical value (an error rate 15% or more), check the following items.

[1] There may be an error in calculating load inertia for the motor axis conversion used when calculating the theoretical acceleration/deceleration time. Check the load inertia again.

[2] When acceleration time is long and deceleration time is short, friction torque is thought to be large. Check load meter value at the maximum speed (spindle monitor screen). If the load is 10% or more, friction torque is thought to be relatively large. Mechanical friction, such as bearing friction or timing belt friction, is assumed to be large. Measure the acceleration/deceleration time again following trial run.

[3] Even if the problems above are not found, when acceleration/deceleration time does not match, there may be a possibility of using spindle motor and spindle drive unit that are not specified, or using wrong parameters. Check the spindle motor type and spindle drive unit type again, as well as the spindle parameter settings.

POINT

There are cases where acceleration/deceleration waveforms change depending on the spindle temperature. Check the waveforms when the spindle temperature is high (after continuous operation) and when it is low.

⚠ CAUTION

When performing measurement with a workpiece or tool installed, be careful during the operation at the maximum rotation speed, which may be dangerous because of the increase of inertia.

(3) Adjustment when the load inertia is large

When the load inertia is large and acceleration time is 10s or more, excessive speed deviation alarm (ALM23) may occur because the time in which deviation between speed command and speed FB, which is the actual spindle motor rotation speed, exists is prolonged. In this case, increase the time constant (3101 to 3104) during spindle rotation by S command. When the acceleration time is 10s or less, use the standard value 300 (300ms).
Alarm can be avoided by adjusting excessive speed deviation timer (SP117). However, in this case, alarm detection will be delayed during constant speed operation.
In order to improve current ripple waveforms during acceleration/deceleration, adjust by using speed command dual cushion explained later.

【#13117】 SP117 SETM Excessive speed deviation timer

Set the time to detect the speed excessive error alarm.
Set the time required to the machine.
The standard setting is "12".

---Setting range---
0 to 60 (s)

【#3101】 sp_t 1 Time constant for spindle rotation with S command (Gear: 00)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 00 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3102】 sp_t 2 Time constant for spindle rotation with S command (Gear: 01)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 01 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3103】 sp_t 3 Time constant for spindle rotation with S command (Gear: 10)

Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear 10 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

【#3104】 sp_t 4 Time constant for spindle rotation with S command (Gear: 11)

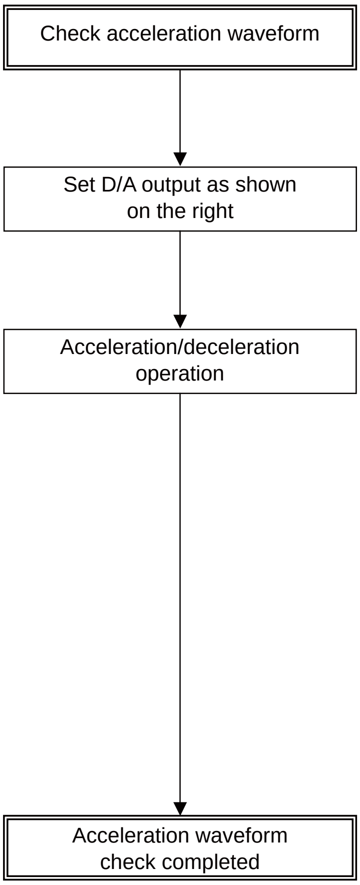
Set the acceleration/deceleration time constant for spindle rotation using the S command (spindle control mode = speed operation mode) with gear11 (Linear acceleration/deceleration pattern).

---Setting range---
0 to 30000 (ms)

(4) Acceleration/deceleration adjustment

Checks acceleration waveform and adjusts deceleration time.

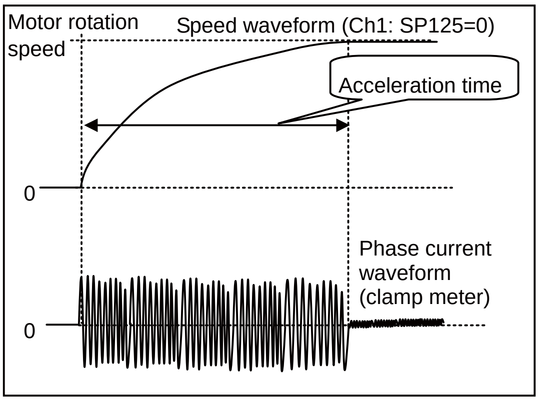
(a) Checking acceleration waveform



Ch1	Output waveform: Motor rotation speed	SP125:1	SP127: Set so that the maximum rotation speed is displayed.

Set the measuring device so that U phase current can be measured by a clamp meter.

Perform acceleration/deceleration operation from the maximum rotation speed in 1000 rotations increments.



(b) Adjusting deceleration time

Adjusts deceleration time in the same manner as acceleration time by using SP071 (variable current limit during deceleration, lower limit value) and SP072 (variable current limit during deceleration, break point speed).

Adjust deceleration time

↓

Set D/A output as shown on the right

Ch1	Output waveform: Motor rotation speed	SP125:1	SP127: Set so that the maximum rotation speed is displayed.

Set the measuring device so that U phase current can be measured by a clamp meter.

↓

Set SP071 and SP072

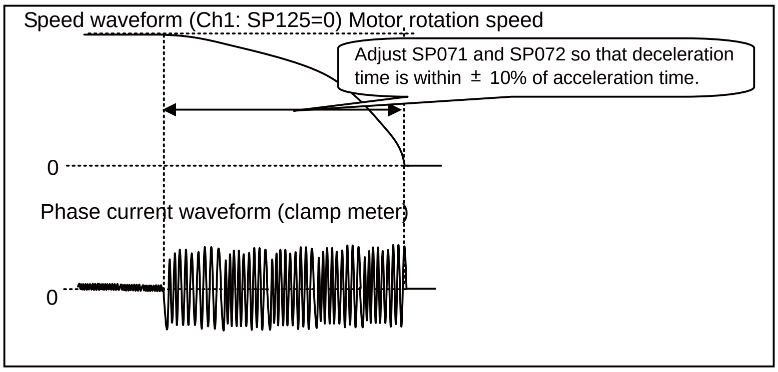
When SP071=100 is set, current limit during deceleration is constant regardless of the speed. When setting SP071 to 100 or less and SP072 to maximum rotation speed or less, deceleration time will be longer as current limit during deceleration may be variable depending on the speed.

* Although a value more than 100 can be set to SP071, basically, 100 or less should be set.

↓

Acceleration/deceleration operation

Execute M5 stop operation from the maximum rotation speed.



Speed waveform (Ch1: SP125=0) Motor rotation speed

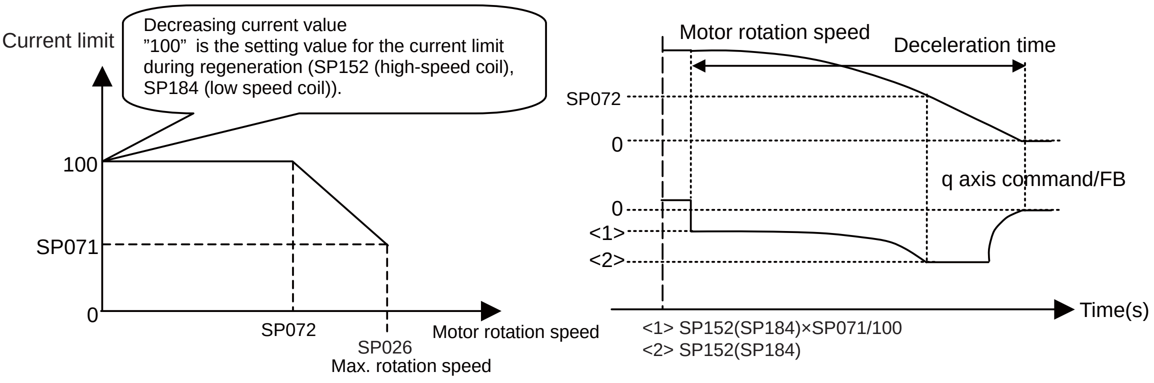
Adjust SP071 and SP072 so that deceleration time is within ± 10% of acceleration time.

Phase current waveform (clamp meter)

↓

Deceleration time adjustment completed

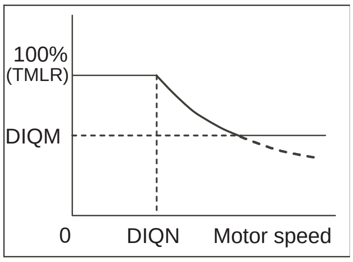
Relation between SP071 (variable current limit during deceleration, lower limit value) and SP072 (variable current limit during deceleration, break point speed)



(1) Rotation speed – Decreasing current value curve (2) Rotation speed/current command ● FB waveform

【#13071】 SP071 DIQM Variable current limit during deceleration, lower limit value

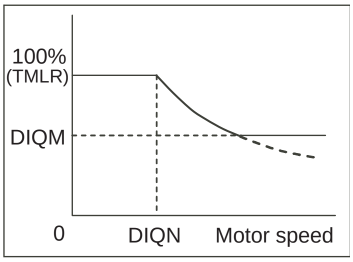
Set this parameter to adjust the deceleration time by changing the current limit value during deceleration depending on the motor speed.
As shown below, set the lower limit rate of the current limit in SP071 (DIQM), and use with SP072 (DIQN).
When DIQM is set to 100%, the current limit value in deceleration (TMRL) set in the motor constants is applied.



---Setting range---
0 to 999 (%)

【#13072】 SP072 DIQN Variable current limit during deceleration, break point speed

Set this parameter to adjust the deceleration time by changing the current limit value during deceleration depending on the motor speed.
As shown below, set the lower limit rate of the current limit in SP071 (DIQM), and use with SP072 (DIQN).
When DIQM is set to 100%, the current limit value in deceleration (TMRL) set in the motor constants is applied.



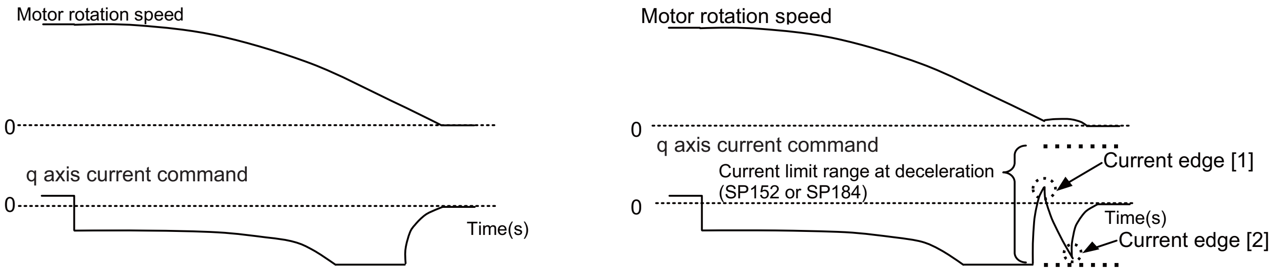
---Setting range---
1 to 32767 (r/min)

5-2-4 Orientation adjustment

Adjusts orientation time by adjusting SP016.

(1)Orientation characteristics

When decelerating to stop is executed with orientation, the remaining distance to the orientation stop position is compensated within one rotation. Thus, as shown in Case 1 below, when the remaining distance in deceleration is about "0", orientation time would be the shortest (time required to decelerate and stop + 0s), and as shown in Case 2 below, when the remaining distance in deceleration is about as much as one rotation amount, orientation time would be the longest.



q axis current command (SP126: 1 SP128: 100)

Case1: Remaining distance at deceleration ≒ 0 rotation

Case2: Remaining distance at deceleration ≒ 1 rotation

【#13016】 SP016 DDT Phase alignment deceleration rate

Set the single-rotation position alignment deceleration rate for orientation stopping, phase alignment while rotating and switching from non-interpolation mode to spindle synchronization mode while rotating.
When the load inertia is larger, the setting value should be smaller.
When the setting value is larger, the orientation in-position and single-rotation position alignment complete faster, but the impact applied on the machine will increase.
To change the deceleration rate only during rotation command (command F Δ T ≠ 0), set this parameter together with SP070 (KDDT).

---Setting range---
1 to 32767 (0.1(r/min)/ms)

【#13035(PR)】 SP035 SFNC3 Spindle function 3

bit 2 : pyin Excitation rate selection

The excitation rate after the in-position can be selected.
0: Select Excitation rate 1 1: Select Excitation rate 2

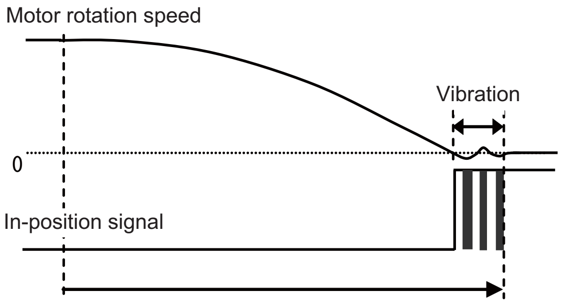
bit 1 : vgin Speed loop gain set selection

The speed loop gain set after the in-position can be selected.
0: Select Set 1 1: Select Set 2

(2) Confirmation in orientation stop at deceleration ?0 rotation according to spindle specification

If orientation stop is performed with the load inertia increased due to an excessive workpiece or tool installed to the spindle, the spindle may start vibrating by trying to reverse after overshooting the stop position and stop after converging the vibrations (refer to the waveform below).

In this case, the orientation completion time is extended by the time to converge the spindle vibrations. Thus, the adjustment to suppress the reversing and vibrations at stop is required.



<Adjustment method>

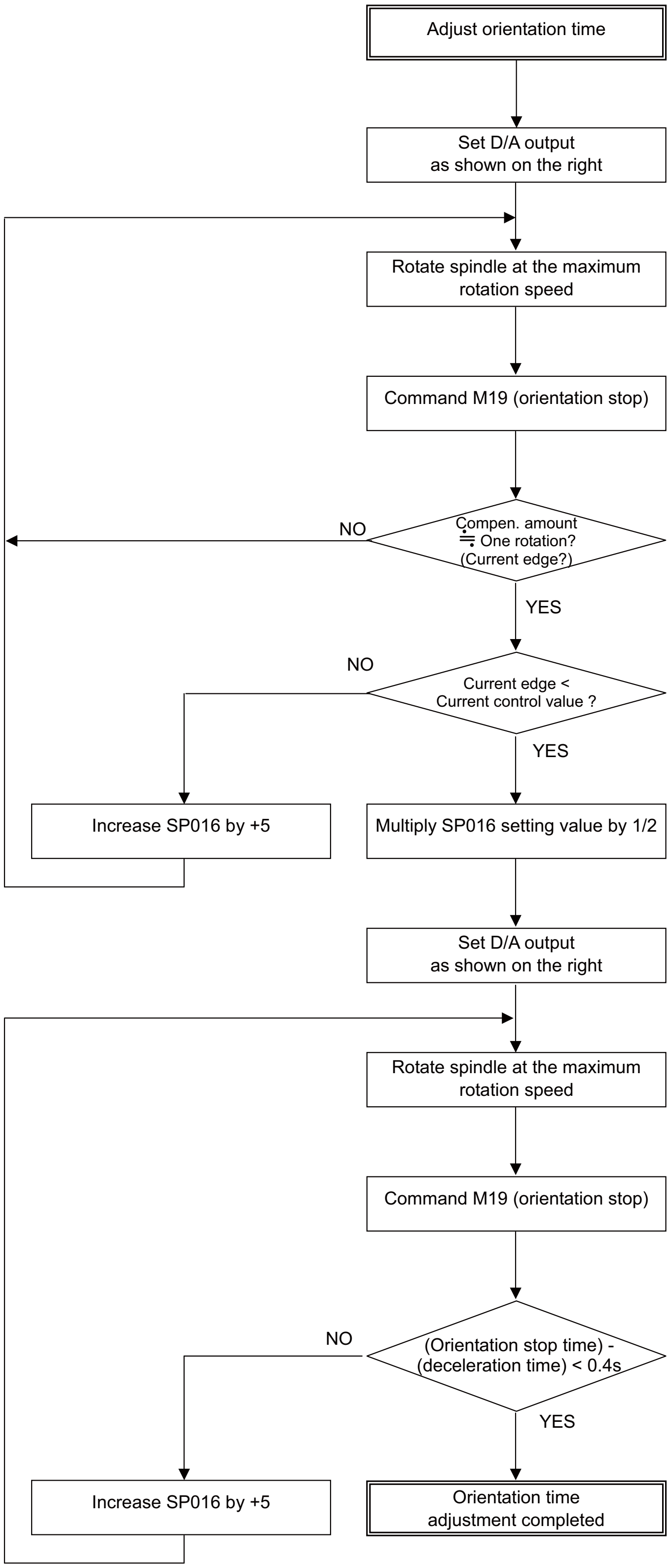
(1) Set SP016: Lower the setting value by 5. By lowering, the inclination of the speed becomes gradual. Set the optimum value while observing the speed waveform so that the speed will not vibrate.

(2) Lower the position loop gain.
By lowering the position loop gain, a sway that exceeds the stop position is suppressed.

(3) Adjust the speed gain (SP005, SP006).
The converging time becomes shorter if the rigidity during orientation stop is higher. However this affects the speed stability during constant feed, thus it is required to confirm the speed waveform at the constant speed and the machining surface during cutting.

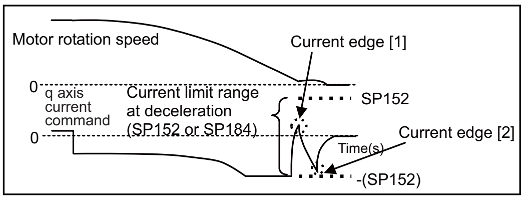
(1) Orientation time adjustment method

(a) Orientation adjustment from maximum rotation speed



Ch1	Ouput waveform: Motor rotation speed	SP125:1	SP127: Set so that the maximum rotation speed is displayed.
Ch2	Ouput waveform: q axis current command	SP126:2	SP128:100(100%/V)

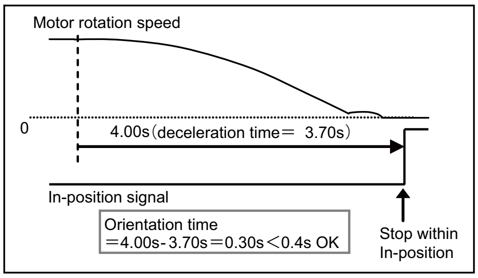
orientation stop waveform example(≒1 rotation)



Set to SP016 as recovery time constant.

Ch1	Ouput waveform: Motor rotation speed	SP125:1	SP127: Set so that the maximum rotation speed is displayed.
Ch2	Ouput waveform: In-position signal	SP126：16492	SP128:100(100%/V)

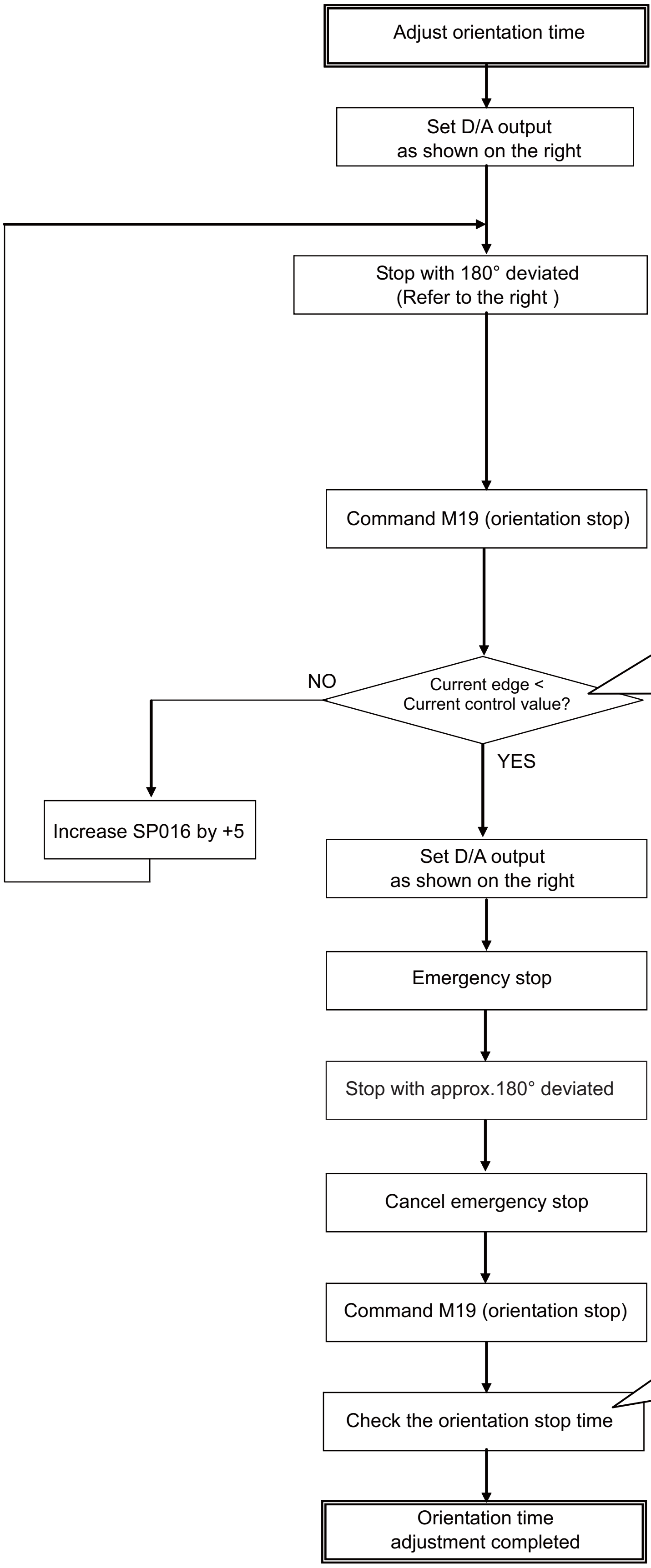
orientation stop waveform example(≒1 rotation)



POINT

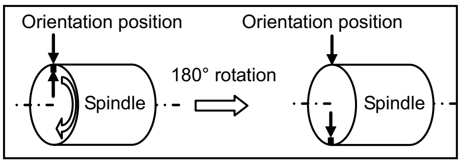
Check the orientation operation with the maximum inertia by installing a workpiece or tool to the spindle head. However, if it is dangerous to check the operation at the maximum speed, slow down to the safe speed to check.

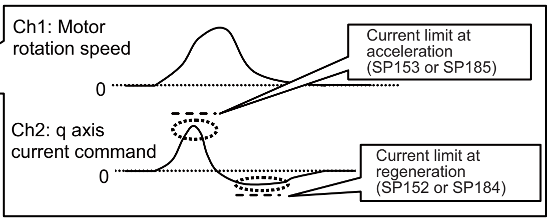
(b) Orientation adjustment from stop mode



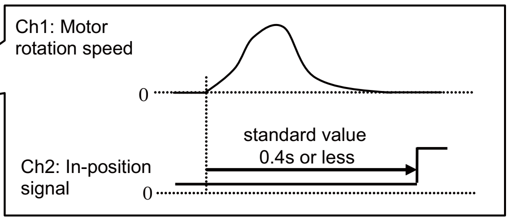
Ch1	Output waveform: Motor rotation speed	SP125：1	SP127: Set so that the maximum rotation speed is displayed.
Ch2	Output waveform: q axis current commandv	SP126：2	SP128: 100(100%/V)

Screen operation
[1] Press the NC function key DIAGN.
[2] Press the NC menu key I/F diagn.
[3] Press the NC menu key 1-shot output.
[4] Input “R7009/4650” with the NC key.
[5] Command M19 (orientation stop).
<-Stop at the side opposite to the orientation stop position (with 180° deviated).
[6] Press the NC menu key 1-shot output.
[7] Input “R7009/0”with the NC key.





Ch1	Output waveform: Motor rotation speed	SP125：1	SP127: 200(500r/min/V)
Ch2	Output waveform: In-position signal	SP126：16492	SP128:100



5-2-5 Synchronous tapping adjustment

(1) Gain setting and time constant determination

[1] For speed loop gain during synchronous tapping, speed loop gain set 2, which consists of SP008 (speed loop gain 2), SP009 (speed loop lead compensation 2), and SP010 (speed loop delay compensation 2), is used. Thus, SP035 has to be set as follows. For position loop gain, set standard 33 to SP002 (position loop gain interpolation mode).

<List of parameters used for adjustment>

Parameter	Setting value
SP002	33
SP008	Value in SP005 set at "5-3-2" (Initial setting value: 150)
SP009	1900
SP010	0
SP035	0200: Speed loop gain set 2 selection (Validate bit9)

<Related servo parameters>

Set the spindle and interpolation axis by tapping.

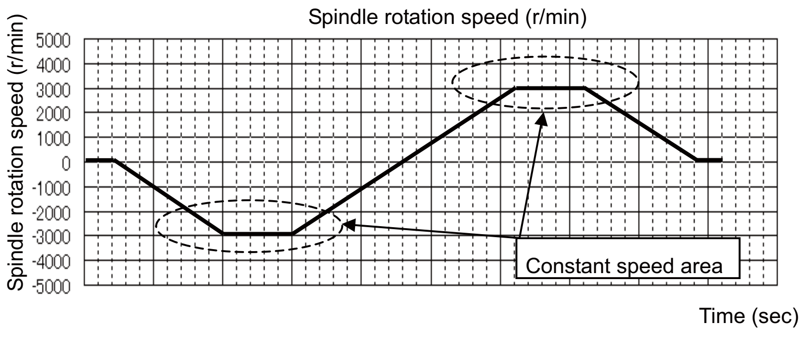
Parameter	Setting value
SV049	Set the same value as spindle parameter "SP002"
SV050	Set it when using SHG control (when not using, set to "0")
SV058	Set it when using SHG control (when not using, set to "0")

[2] Create a NC program so that the synchronous tapping operation program has 3000r/min of spindle speed, 1mm (equivalent of M6 screw) of screw pitch size, and depths at which the following two different operation patterns are generated.
(Note that the operation conditions, such as spindle speed and screw pitch, may be specified by the machine manufacturer.)

<table>
<tr><td>

Operation pattern 1

</td><td>



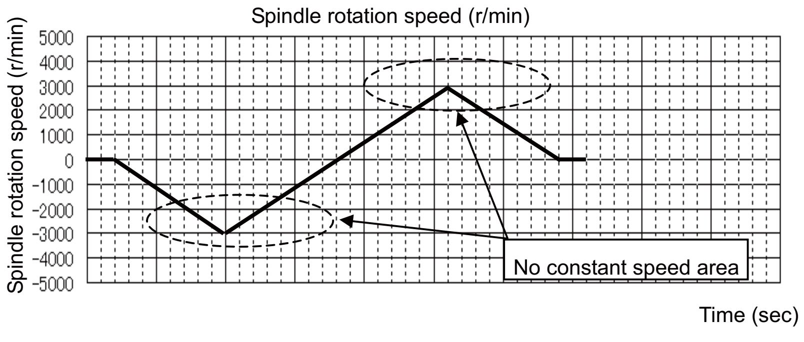
A

djust depth so that motor rotation speed waveform shapes trapezoids

</td></tr>
<tr><td>

Operation pattern 2

</td><td>



A

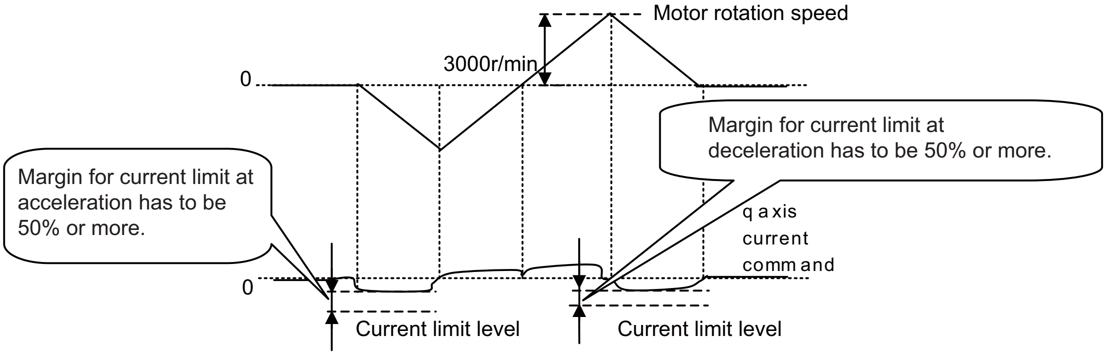
djust depth so that motor rotation speed waveform shapes mountain-valley

</td></tr>
</table>

[3] Execute D/A output to Ch1 and Ch2, and perform synchronous tapping operations with the operation pattern 2 above.

	Output name	Output value (Setting parameter: Value)	Magnification (Setting parameter: Value)
CH1 Output	Motor rotation speed	SP125: 1	SP127: 50 (2000r/min/V)
CH2 Output	q axis current command	SP126: 2	SP128: 100 (100%/V)

[4] Check the waveform and adjust the synchronous tapping time constant so that the margin for current limit at acceleration/deceleration is 50% or more.

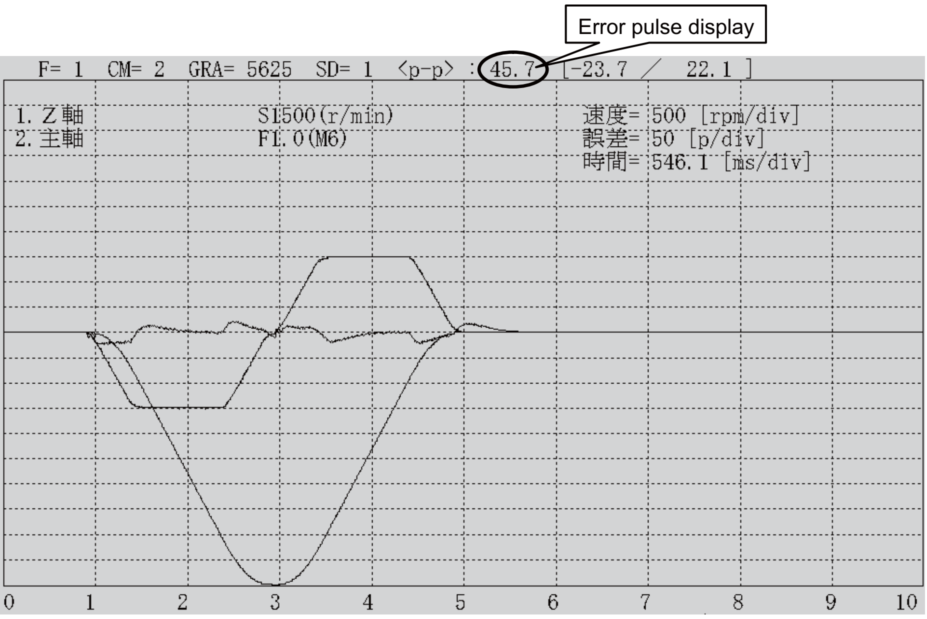


Output waveform example during synchronized tapping

(2) Accuracy test using synchronous tapping accuracy test tool

[1] Perform synchronous tapping operations using the time constant determined in (1) above.

[2] Check the synchronous tapping accuracy (for both operation pattern 1 and 2) by using the synchronous tapping accuracy check tool.



```
F= 1  CM= 2  GRA= 5625  SD= 1  <p-p> :45.7 [-23.7 ／  22.1 ]
1. Z軸              S1500(r/min)          速度= 500 [rpm/div]
2. 主軸              F1.0(M6)              誤差= 50 [p/div]
                                          時間= 546.1 [ms/div]
```

Synchronous tapping accuracy test tool data sample

[3] If the number of error pulse is 100 (p-p) or less, satisfactory accuracy is secured, and the check is completed.

[4] If the number of error pulse exceeds 100, increase SP008 (VGN2) by 10 increments, and adjust so that the error pulse is 100 or less. Note that the maximum setting value is 150 x [inertia ratio].

【#13002】 SP002 PGN Position loop gain interpolation mode

Set the position loop gain for "interpolation" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 010 or 100" in control input 4.
(Note) The control mode is commanded by NC.
When carrying out the SHG control, set SP035(SFNC3) bitC to "1".

---Setting range---

1 to 200 (1/s)

【#13008】 SP008 VGN2 Speed loop gain 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---

1 to 9999

【#13009】 SP009 VIA2 Speed loop lead compensation 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---

1 to 9999

【#13010】 SP010 VIL2 Speed loop delay compensation 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---

0 to 32767

【#13035(PR)】 SP035 SFNC3 Spindle function 3

bit C : shgn SHG control

0: Stop 1: Start

bit A : pyn Excitation rate selection

0: Select Excitation rate 1 1: Select Excitation rate 2

bit 9 : vgn Speed loop gain set selection

0: Select Set 1 1: Select Set 2

5-2-6 Spindle C axis adjustment (For lathe system)

(1) Setting the gain

For spindle C axis speed loop gain, SP008 (speed loop gain 2), speed loop gain set 2, which consists of SP009 (speed loop lead compensation 2), and SP010 (speed loop delay compensation 2), is used. Thus, SP035 has to be set as follows. For position loop gain, set standard 33 to SP002 (position loop gain, interpolation mode).

Parameter	Setting value
SP002	33
SP008	SP005 setting value set in "5-2-1" (Initial setting value: 150)
SP009	1900
SP010	0
SP035	0200: Speed loop gain set 2 selection (validate bit9)

<Related servo parameters>

Set the spindle and interpolation axis.

Parameter	Setting value
SV003	Set the same value as spindle parameter "SP002"
SV004	Set it when using SHG control (when not using, set to "0")
SV057	Set it when using SHG control (when not using, set to "0")

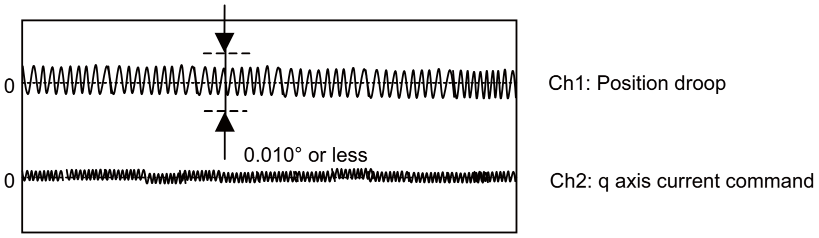
(2) Gain adjustment and accuracy test during C axis operation

[1] Set the D/A output as follows during stopped in C axis mode (servo ON status) or when executing cutting feed with G01 F20. Then check the droop fluctuation is within 10°/1000.

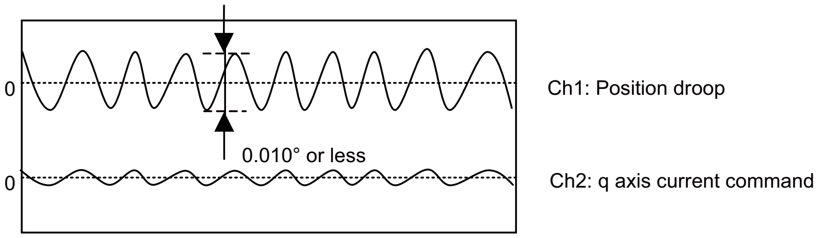
	Output name	Setting value (Setting parameter: Value)	Magnification (Setting parameter: Value)
CH1 output	Position droop	SP125 : 60	SP127 = 10000 (0.01°/V)
CH2 output	Current command	SP126 : 2	SP128 = 1000 (10%/V)

Offset is 2.5V.

*** Waveform during stopped in C axis (Reference)**



*** Waveform when executing cutting feed with G01 F20 (Reference)**



[2] When satisfactory accuracy is not secured, increase SP008 (VGN2) by 10 increments and adjust so that the accuracy level meets the standard. Note that the maximum setting value is 150 x [inertia ratio].

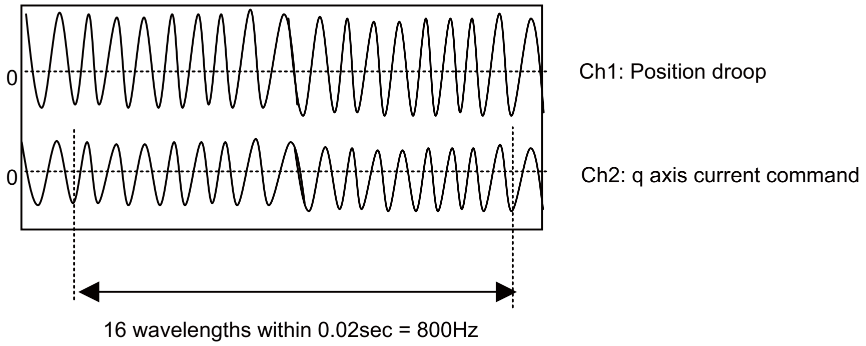
(3) Setting the notch filter

During spindle C axis operation, there are times where motor is rotated while brake is applied, resulting in resonance occurred. In this case, measure resonance frequency from q axis current command waveform and set the value to SP038 (notch filter 1). Also, depending on the set frequency, filter depth must be set to SP034. When notch filter is set, perform acceleration/deceleration operation at the maximum speed and confirm that no abnormal oscillation or noise is found.

Notch filter's set frequency and standard depth setting

SP034 **Notch filter 1 Depth setting**	bit3=0 bit2=0 bit1=0 Setting value: XXX0	bit3=0 bit2=1 bit1=0 Setting value: XXX4	bit3=1 bit2=0 bit1=0 Setting value: XXX8
SP038 **Notch filter 1 Setting frequency**	2000(Hz) to 400(Hz)	399(Hz) to 200(Hz)	190(Hz) or lower

Setting example: When there are 16 wavelengths within 0.02 sec.



Set 800 to SP038 and XXX0 to SP034. Measure position droop and current command at this time, and adjust notch filter's frequency and depth so that the position droop is within standard range.

POINT

1. When incorrect frequency is set, suddenly resonance can occur and big abnormal noise can be generated. Input the appropriate value.
2. Do not set the value to low-frequency (50Hz).

【#13002】 SP002 PGN Position loop gain interpolation mode

Set the position loop gain for "interpolation" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 010 or 100" in control input 4.
(Note) The control mode is commanded by NC.
When carrying out the SHG control, set SP035(SFNC3) bitC to "1".

---Setting range---
1 to 200 (1/s)

【#13008】 SP008 VGN2 Speed loop gain 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---
1 to 9999

【#13009】 SP009 VIA2 Speed loop lead compensation 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---
1 to 9999

【#13010】 SP010 VIL2 Speed loop delay compensation 2

Normally SP005(VGN1), SP006(VIA1), SP007(VIL1) are used.
By setting "SP035(SFNC3)/bit1(vgin), SP035(SFNC3)/bit9(vgn) or SP036(SFNC4)/bit1(vgs)=1", gain 2 can be used according to the application.
Gain 2 can also be used by setting "Speed gain set 2 changeover request (control input 5/ bitC) = 1".
Refer to SP005(VGN1), SP006(VIA1), SP007(VIL1) for procedures.

---Setting range---
0 to 32767

【#13034】 SP034 SFNC2 Spindle function 2

bit F-D : nfd5 Depth of Notch filter 5

Set the depth of Notch filter 5.

bit F,E,D=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit B-9 : nfd4 Depth of Notch filter 4

Set the depth of Notch filter 4.

bit B,A,9=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit 7-5 : nfd2 Depth of Notch filter 2

Set the depth of Notch filter 2.

bit7,6,5=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

bit 4 : nfd3 Notch filter 3(1125Hz)

0: Stop 1: Start

bit 3-1 : nfd1 Depth of Notch filter 1

Set the depth of Notch filter 1.

bit3,2,1=
000: - ∞
001: -18.1[dB]
010: -12.0[dB]
011: -8.5[dB]
100: -6.0[dB]
101: -4.1[dB]
110: -2.5[dB]
111: -1.2[dB]

【#13035(PR)】 SP035 SFNC3 Spindle function 3

bit C : shgn SHG control

0: Stop 1: Start

bit A : pyn Excitation rate selection

0: Select Excitation rate 1 1: Select Excitation rate 2

bit 9 : vgn Speed loop gain set selection

0: Select Set 1 1: Select Set 2

bit 7 :

Not used. Set to "0".

【#13038】 SP038 FHz1 Notch filter frequency 1

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---
0 to 2250 (Hz)

【#13046】 SP046 FHz2 Notch filter frequency 2

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---

0 to 2250 (Hz)

【#13087】 SP087 FHz4 Notch filter frequency 4

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---

0 to 2250 (Hz)

【#13088】 SP088 FHz5 Notch filter frequency 5

Set the vibration frequency to suppress when machine vibration occurs.
(Enabled at 50 or more.)
When not using, set to "0".

---Setting range---

0 to 2250 (Hz)

5-2-7 Spindle synchronization adjustment (For lathe system)

(1) Setting the gain, changeover rotation speed and time constant

[1] For speed loop gain during spindle synchronization, SP005 (speed loop gain 1), SP006 (speed loop lead compensation 1), and SP007 (speed loop delay compensation 2) are used. For position loop gain, set standard 15 to SP003 (position loop gain spindle synchronization).

Parameter	Setting value
SP003	15
SP036	0000

(Note1) To change the setting value of SP003, set the synchronous and basic spindles to the same value.

(Note2) For the adjustment of SP005, SP006 and SP007, conduct "5-2-2 Gain adjustment" as a single unit beforehand.

[2] Set rotation speed and time constant during acceleration/deceleration figured by theoretical calculations.

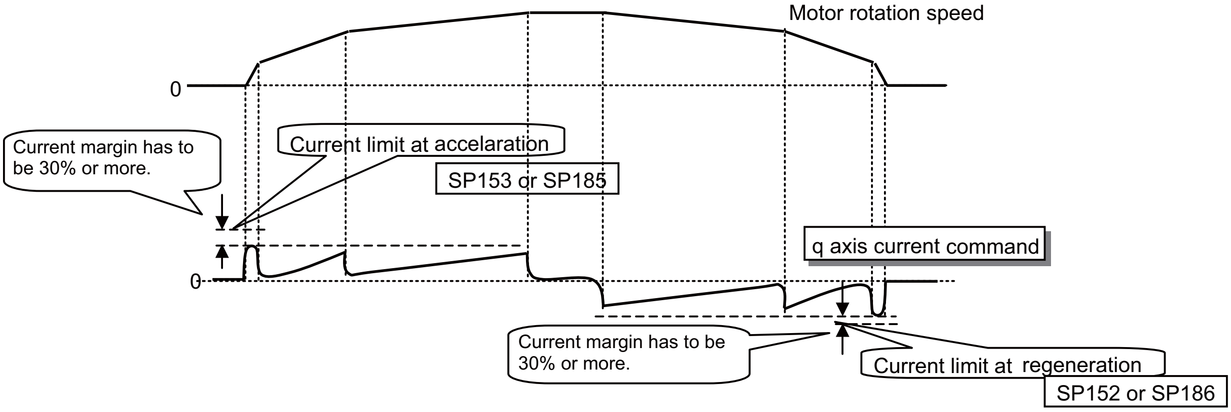
[3] Set D/A output as follows and output motor rotation speed and q axis current command.

Ch1 output	Motor rotation speed	SP125: 1	SP127: Set so that the maximum motor speed is displayed
Ch2 output	q axis current command	SP126: 2	SP128: 100 (100%/V)

(2) Confirming the current margin

Perform acceleration/deceleration up to the maximum current speed in spindle synchronization mode. At this time, confirm that the current value for both acceleration side and deceleration side secure 30% or more of margin in respect to the current limit value. Also, confirm that no oscillation, etc. are found in the current waveforms.

(Note) If a margin is 30% or less, extend the acceleration/deceleration time constant so that the margin is adjusted to 30% or more.



output waveform example in spindle synchronous mode

【#13003】 SP003 PGS Position loop gain spindle synchronization

Set the position loop gain for "spindle synchronization" control mode.
When the setting value increases, the command tracking ability will enhance and the positioning settling time can be shorter. However, the impact on the machine during acceleration/deceleration will increase.
Use the selection command, the control mode "bit 2, 1, 0 = 001" in control input 4.
(Note) The control mode is commanded by NC.
When carrying out the SHG control, set SP036(SFNC4) bit4 to "1".

---Setting range---
1 to 200 (1/s)

【#13036(PR)】 SP036 SFNC4 Spindle function 4

bit 4 : shgs SHG control

0: Stop 1: Start

bit 2 : pys Excitation rate selection

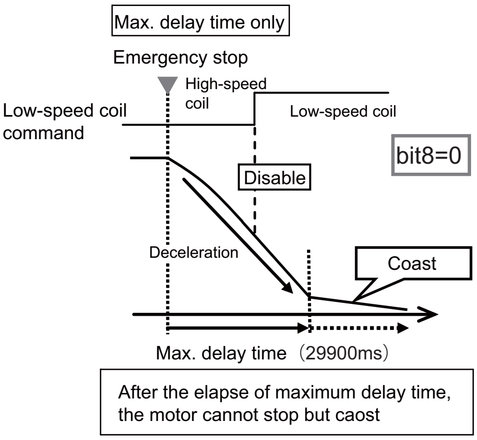
0: Select Excitation rate 1 1: Select Excitation rate 2

bit 1 : vgs Speed loop gain set selection

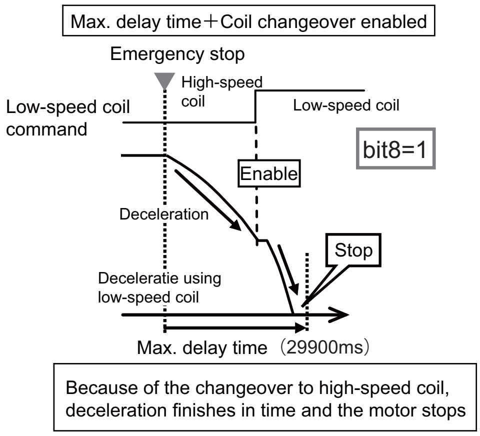
0: Select Gain Set 1 1: Select Gain set 2

5-2-8 Deceleration coil changeover valid function by emergency stop

If a large workpiece is mounted on a large workpiece chuck in lathe, the acceleration/deceleration time increases because of the increase of the total inertia. When the deceleration stop time at emergency stop exceeds the upper limit value (29900ms) of the gate shutoff delay time (SP055), the spindle motor will coast. This function enables the coil changeover motor to change to low-speed coil during emergency stop and if the deceleration time is reduced to complete within the gate shutoff time, the spindle enters an emergency stop state.



After the elapse of maximum delay time, the motor cannot stop but caost



Because of the changeover to high-speed coil, deceleration finishes in time and the motor stops

【#13225】 SP225 SFNC5 Spindle function 5

bit 8 : mken Coil switch allowance in deceleration control

This enables a coil changeover while decelerating after an emergency stop for a spindle motor with coil changeover specification. A coil changeover may enable an excessive load inertia to stop within the maximum delay time.
0: Normal (Disable)   1: Enable

【#13055】 SP055 EMGx Max. gate off delay time after emergency stop

Set the time required to forcibly execute READY OFF after the emergency stop is input.
Normally set to "20000".
When "0" is set, READY OFF is forcibly executed with "7000ms".
When the set time is shorter than the time to decelerate and stop, the spindle will stop with the dynamic brake after the set time is out.

---Setting range---
0 to 29900 (ms)

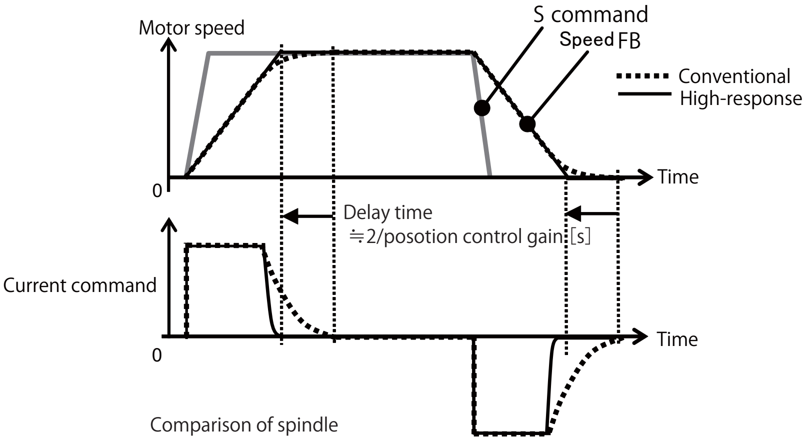
【#13056】 SP056 EMGt Deceleration time constant at emergency stop

Set the time constant used for the deceleration control at emergency stop. Set the time required to stop from the maximum motor speed (TSP).
When "0" is set, the deceleration control is executed with "7000ms".

---Setting range---
-29900 to 29900 (ms)

5-2-9 High-response acceleration/deceleration function

Under continuous position control method makes position droop is set with primary delay depending on the position control gain during the acceleration/deceleration by S command. If the position gain is set lower, the zero speed detection which indicates the spindle stop is more conspicuously delayed.
This function enables the position droop’s primary delay to be shorter and the zero speed detection to be faster.



Comparison of spindle acceleration/deceleration by S command

【#13095】 SP095 VIAX Lead compensation scale during high-response acceleration/ deceleration

Set the magnification against delay/lead compensation (SP006) of the high-response acceleration/ deceleration (valid when SP226(SFNC6)/ bitD (vup) is set to "1").
Normally, set to "0". Set this parameter to suppress overshooting when the speed is reached.

---Setting range---
0 to 10000 (0.01%)

【#13226】 SP226 SFNC6 Spindle function 6

bit D : vup High response acceleration / deceleration

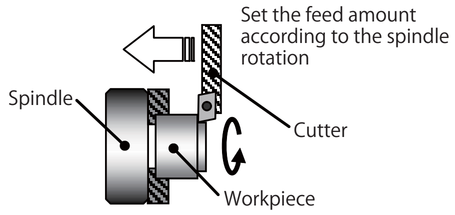
This suppresses a temporal delay which occurs when the target speed is attained from acceleration and when the spindle stops from deceleration.
0: Normal acceleration/deceleration 1: High response acceleration/deceleration Enable

POINT

This function is invalid during orientation and interpolation control (spindle synchronous/C axis/ synchronous tapping control) even when it is set.

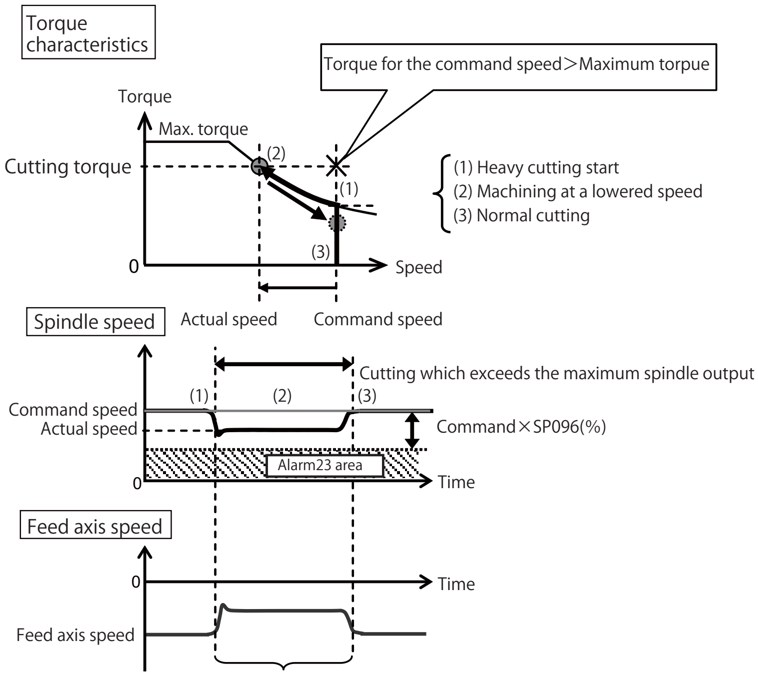
5-2-10 Spindle cutting withstand level improvement

Conventionally, the spindle rotation speed was slowed down due to heavy cutting that exceeds the spindle output characteristics, and this caused the alarm (Excessive error 52, Overload command 51) to stop the machining.
This function enables setting of the dropping speed allowable value by parameter. As long as the speed is the set value or higher, machining can be executed within the output characteristics without being stopped by the alarm.
Even when the parameter setting value is the normal value of 0, the standard value of 85 is applied. This can improve the efficiency of heavy cutting (feed per revolution).
If excessive speed dropping occurs and the speed exceeds the allowable range, the excessive speed deviation alarm 23 is output to reduce the damage to the machine.



When the spindle speed is lowered by machining which exceeds the maximum torque, the feed axis speed is also lowered.

Controls so that the cutting torque is maintained and the finished surface has even cut marks.



Allows the speed lowering and continues the machining

【#13096】 SP096 SDW Speed slowdown allowable width

When the spindle slows down due to multiple cutting, set the processable speed as percentage against the NC command speed.
If the speed reduces below the tolerable range, the alarm 23 (Excessive speed error) will occur.
E.g.] When set to 90 [%]
If S1000 is commanded, the speed reduced by 900r/min (=1000r/min × 90%) is the allowable lower limit. Thus if the spindle speed reduces to 100r/min or below, the alarm will occur.
When "0" is set, the magnification is the same as when "85" is set. When set to "-1", the allowable width will be disabled.

---Setting range---
-1,0 to 100(%)

5-3 Settings for emergency stop

Emergency stop in this section refers to the following states.

[1] Emergency stop was input (including other axis alarms)
[2] NC power down was detected
[3] A drive unit alarm was detected

5-3-1 Deceleration control

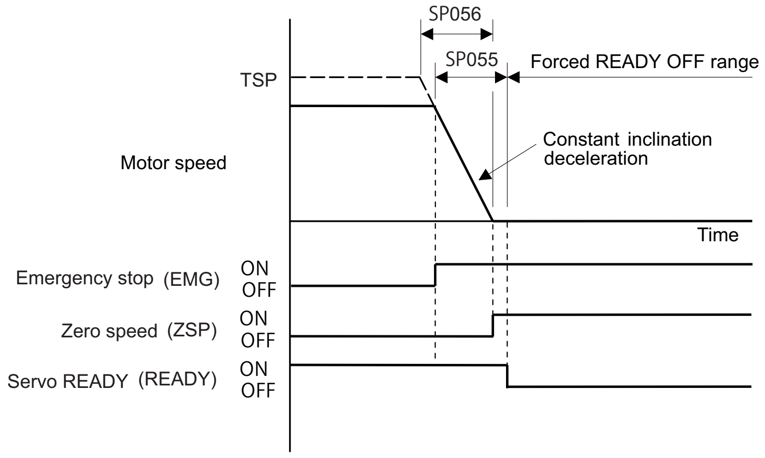
With the MDS-D-SPJ3 spindle drive unit, the motor will decelerate following the time constant set at emergency stop. When the CNC confirms the zero speed of all axes, contactor of the spindle drive unit is turned OFF.

(1) Setting the deceleration control time constant

Set the time for stopping from the maximum motor speed (TSP) in the deceleration time constant for emergency stop (SV056: EMGt). When "0" is set, the deceleration stop is executed with "7000ms".

<Operation>

When an emergency stop occurs, the motor will decelerate at the same inclination from each speed.



Deceleration control sequence

(Note) If the setting value of SP056 is longer than the value of SP055, the motor will coast.

【#13055】 SP055 EMGx Max. gate off delay time after emergency stop

Set the time required to forcibly execute READY OFF after the emergency stop is input.
Normally set to "20000".
When "0" is set, READY OFF is forcibly executed with "7000ms".
When the set time is shorter than the time to decelerate and stop, the spindle will stop with the dynamic brake after the set time is out.

---Setting range---
0 to 29900 (ms)

【#13056】 SP056 EMGt Deceleration time constant at emergency stop

Set the time constant used for the deceleration control at emergency stop. Set the time required to stop from the maximum motor speed (TSP).
When "0" is set, the deceleration control is executed with "7000ms".

---Setting range---
-29900 to 29900 (ms)

5-4 Spindle control signal

The sequence input/output signals exchanged between the NC and spindle drive unit are explained in this section. The status of each signal is displayed on the NC SPINDLE MONITOR screen.

5-4-1 Spindle control input (NC to Spindle)

(1) Spindle control input 1

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Spindle control input 1</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>TL3</td><td>TL2</td><td>TL1</td><td>ALMR</td><td></td><td></td><td></td><td></td><td></td><td>SRV</td><td>RDY</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>RDY</td><td>READY ON command</td></tr>
<tr><td>1</td><td>SRV</td><td>Servo ON command</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>7</td><td>ALMR</td><td>Alarm reset command</td></tr>
<tr><td>8</td><td>TL1</td><td>Torque limit 1 selection command</td></tr>
<tr><td>9</td><td>TL2</td><td>Torque limit 2 selection command</td></tr>
<tr><td>A</td><td>TL3</td><td>Torque limit 3 selection command</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. READY ON command (RDY)

Status turns to ready ON at RDY=1.

bit1. Servo ON command (SRV)

[1] Drive unit turns ON at SRV=1 (gate ON status), and rotation control starts.
Plus or minus of the rotation direction is determined depending on +/- of the NC command FΔT.

[2] Servo immediately turns OFF (SON=0) at SRV=0 during rotation control. Drive unit also turns OFF (gate OFF status) at this time.

bit7. Alarm reset command (ALMR)

NR alarm is reset at ALMR=1.

bit8. Torque limit 1 selection command (TL1)

bit9. Torque limit 2 selection command (TL2)

bitA. Torque limit 3 selection command (TL3)

The following 4 types of torque limit are available depending on TL1, TL2 and TL3 bit combinations.

TL3	TL2	TL1	Torque limit value
0	0	1	Torque limit value (%) set with parameter SP065
0	1	0	Torque limit value (%) set with parameter SP066
0	1	1	Torque limit value (%) set with parameter SP067
1	0	0	Torque limit value (%) set with parameter SP068

(Note) The ratio to motor short time rated torque (load meter 100%) is indicated in %.

(Note) The bits other than those above are used for maintenance.

(2) Spindle control input 2

This is used for maintenance.

(3) Spindle control input 3

This is used for maintenance.

(4) Spindle control input 4

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Spindle control input 4</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>GR2</td><td>GR1</td><td>GKC</td><td></td><td>SC3</td><td>SC2</td><td>SC1</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>SC1</td><td>Spindle control mode selection command 1</td></tr>
<tr><td>1</td><td>SC2</td><td>Spindle control mode selection command 2</td></tr>
<tr><td>2</td><td>SC3</td><td>Spindle control mode selection command 3</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>GKC</td><td>Gear changeover command</td></tr>
<tr><td>5</td><td>GR1</td><td>Gear selection command 1</td></tr>
<tr><td>6</td><td>GR2</td><td>Gear selection command 2</td></tr>
<tr><td>7</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. Spindle control mode selection command 1 (SC1)
bit1. Spindle control mode selection command 2 (SC2)
bit2. Spindle control mode selection command 3 (SC3)

[1] Drive unit operation mode can be selected with the bit correspondences below.

[2] Mode changeover is valid during in-position (INP=1) or other than during droop cancel / phase compensation (DCSL=PCMP=0).

SC3	SC2	SC1	Operation mode	
			Conventional method	New method
0	0	0	Speed/orientation control	Non interpolation control
0	0	1	Spindle synchronization	Spindle synchronization
0	1	0	C-axis control	Interpolation control
1	0	0	Synchronous tapping control	

(Note) When selecting bits other than above, control mode error (4E) occurs.

[3] Continuity cannot be guaranteed for the value of position FB in non-interpolation mode. (Position may be skipped for multiple rotations due to droop cancel or phase compensation.)

bit4. In gear changeover command (GKC)

By inputting GKC=1, the gear ratio is changed to the gear ratio specified with the gear selection command (GR1, GR2). This command is invalid during the interpolation mode.

bit5. Gear selection command 1 (GR1)

bit6. Gear selection command 2 (GR2)

[1] The following 4 types of gear ratio are available depending on GR1 and GR2 2-bit input combinations.

[2] Gear specifications in semi-closed position control do not secure a position within one rotation of the spindle.

GR2	GR1	Parameters requiring gear ratio setting
0	0	SP057 (GRA1), SP061 (GRB1)
0	1	SP058 (GRA2), SP062 (GRB2)
1	0	SP059 (GRA3), SP063 (GRB3)
1	1	SP060 (GRA4), SP064 (GRB4)

(Note) The bits other than those above are used for maintenance.

(5) Spindle control input 5

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Spindle control input 5</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td>TLUP</td><td>ORC</td><td>VG2</td><td>PY2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>1</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>7</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>PY2</td><td>Minimum excitation rate 2 changeover request</td></tr>
<tr><td>C</td><td>VG2</td><td>Speed gain set 2 changeover request</td></tr>
<tr><td>D</td><td>ORC</td><td>Zero point re-detection request</td></tr>
<tr><td>E</td><td>TLUP</td><td>Spindle holding force up</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bitB. Minimum excitation rate 2 changeover request (PY2)

[1] When PY2=1 is set, the minimum excitation rate 2 (SP015) is selected.
[2] When PY2=0 is set, the minimum excitation rate 1(SP014) is selected.

bitC. Speed gain set 2 changeover request (VG2)

[1] When VG2=1 is set, the gain parameter (SP008/SP009/SP010) used in the speed loop is selected.
[2] When VG2=0 is set, the gain parameter (SP005/SP006/SP007) used in the speed loop is selected.
[3] The speed gain set changeover is valid during the in-position.

bitD. Zero point re-detection request (ORC)

When ORC is changed from 0 to 1, the Z phase passed will be 0 (control output2/bit0).

bitE. Spindle holding force up (TLUP)

Spindle holding force up (disturbance observer) starts at TLUP=1 and that state is retained during TLUP=1.

(Note) The bits other than those above are used for maintenance.

(6) Spindle control input 6

This is used for maintenance.

5-4-2 Spindle control output (Spindle to NC)

(1) Spindle control output 1

Name	Details
Spindle control output 1	

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WRN			INP		TL3	TL2	TL1	ALMR						SRV	RDY

bit		Details
0	RDY	In READY ON
1	SRV	In servo ON
2	-	(For maintenance)
3	-	(For maintenance)
4	-	(For maintenance)
5	-	(For maintenance)
6	-	(For maintenance)
7	ALMR	In alarm
8	TL1	In torque limit 1 selection
9	TL2	In torque limit 2 selection
A	TL3	In torque limit 3 selection
B	-	(For maintenance)
C	INP	In in-position
D	-	(For maintenance)
E	-	(For maintenance)
F	WRN	In warning

bit0. In ready ON (RDY)

It indicates that the status is in ready ON at RDY=1.

bit1. In servo ON (SRV)

[1] It indicates that the status is in servo ON at SRV=1.
[2] NC position command executes a followed up during SRV=0.

bit7. In alarm (ALMR)

It indicates that drive unit is in some alarm state at ALMR=1.

bit8. In torque limit 1 selection (TL1)
bit9. In torque limit 2 selection (TL2)
bitA. In torque limit 3 selection (TL3)

These are the answer outputs for torque limit 1, 2 and 3 (TL1, TL2 and TL3).

bitC. In in-position (INP)

The status changes to INP=1 when position droop exists within the in-position area set by parameter SP024 (INP) regardless of serve ON or OFF.

bitF. In warning (WRN)

It indicates that drive unit is in some warning state at WRN=1.

(Note) The bits other than those above are used for maintenance.

(2) Spindle control output 2

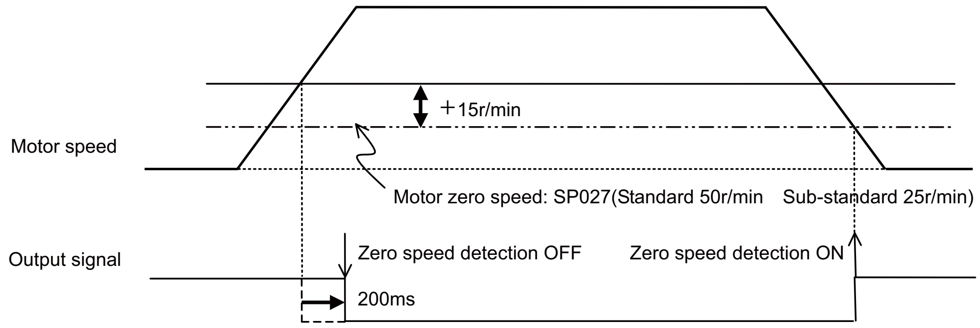
<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Spindle control output 2</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>EXEMG</td><td></td><td></td><td></td><td>ZS</td><td></td><td></td><td>ZCN</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>ZCN</td><td>Z phase passed</td></tr>
<tr><td>1</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>ZS</td><td>In zero speed</td></tr>
<tr><td>4</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>7</td><td>EXEMG</td><td>In external emergency stop</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. Z phase passed (ZCN)

[1] When Z phase is passed, ZCN=0 is turned to ZCN=1.
[2] Grid amount (within one rotation) is transmitted when ZCN =0 is changed to ZCN =1.
[3] When the zero point re-detection request (control input5/bitD) is changed from 0 to 1, ZCN=0 is set.

bit3. In zero speed (ZS)

[1] Approximately 200ms after the motor speed reaches parameter SP027 (ZSP) + 15r/min, ZS=0 is set.
[2] When the motor speed becomes slower than the speed set by parameter SP027 (ZSP), ZS=1 is set. ZS signal is detected by the motor speed absolute value regardless of the rotation direction.



bit7. In external emergency stop

It indicates that an external stop input to the drive unit is being input.

(Note) The bits other than those above are used for maintenance.

(3) Spindle control output 3

This is used for maintenance.

(4) Spindle control output 4

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Spindle control output 4</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>GR2</td><td>GR1</td><td>GKC</td><td></td><td>SC3</td><td>SC2</td><td>SC1</td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>SC1</td><td>In spindle control mode selection 1</td></tr>
<tr><td>1</td><td>SC2</td><td>In spindle control mode selection 2</td></tr>
<tr><td>2</td><td>SC3</td><td>In spindle control mode selection 3</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>GKC</td><td>In gear changeover command</td></tr>
<tr><td>5</td><td>GR1</td><td>In gear selection 1</td></tr>
<tr><td>6</td><td>GR2</td><td>In gear selection 2</td></tr>
<tr><td>7</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>C</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>D</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>E</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>F</td><td>-</td><td>(For maintenance)</td></tr>
</table>
</td></tr>
</table>

bit0. In spindle control mode selection 1 (SC1)
bit1. In spindle control mode selection 2 (SC2)
bit2. In spindle control mode selection 3 (SC3)

These are the answer outputs for control mode selection command 1, 2, 3 (SC1, SC2, SC3).

bit4. In gear changeover command (GKC)

[1] This is an answerer output for the gear changeover command.
[2] The position feedback is generated from the speed detector at GKC=1.

bit5. In gear selection 1 (GR1)
bit6. In gear selection 2 (GR2)

These are the answer outputs for gear selection command 1 and 2 (GR1 and GR2).

(Note) The bits other than those above are used for maintenance.

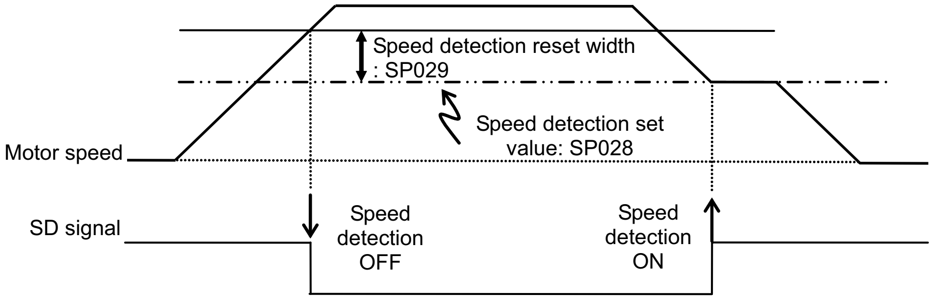
(5) Spindle control output 5

<table>
<tr><th>Name</th><th>Details</th></tr>
<tr><td>Spindle control output 5</td><td>
<table>
<tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>INP2</td><td>TLUP</td><td>ORF</td><td>VG2</td><td>PY2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>MD</td><td></td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th>Details</th></tr>
<tr><td>0</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>1</td><td>MD</td><td>Speed detection</td></tr>
<tr><td>2</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>3</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>4</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>5</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>6</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>7</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>8</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>9</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>A</td><td>-</td><td>(For maintenance)</td></tr>
<tr><td>B</td><td>PY2</td><td>In minimum excitation rate 2 selection</td></tr>
<tr><td>C</td><td>VG2</td><td>In speed gain set 2 selection</td></tr>
<tr><td>D</td><td>ORF</td><td>Zero point re-detection request</td></tr>
<tr><td>E</td><td>TLUP</td><td>Spindle holding force up</td></tr>
<tr><td>F</td><td>INP2</td><td>In 2nd in-position</td></tr>
</table>
</td></tr>
</table>

bit1. Speed detection (MD)

[1] When motor speed exceeds the speed set by parameter SP028 (SDTS) + SP029 (SDTR), SD=0 is set.

[2] When motor speed becomes slower than the speed set by parameter SP028 (SDTS), SD=1 is set. SD signal is detected by the motor speed absolute value regardless of rotation direction.



bitB. In minimum excitation rate 2 selection (PY2)

[1] When PY2=1 is set, the minimum excitation rate 2 (SP015) is being selected.

[2] When PY2=0 is set, the minimum excitation rate 1(SP014) is being selected.

bitC. In speed gain set 2 selection (VG2)

[1] When VG2=1 is set, the gain parameter (SP008/SP009/SP010) used in the speed loop isbeing selected.

[2] When VG2=0 is set, the gain parameter (SP005/SP006/SP007) used in the speed loop isbeing selected.

bitD. Zero point re-detection complete

If the zero point re-detection is completed after the zero point re-detection request (control input5/ bitD) is set to1, ORF=1 is set. If the zero point re-detection request is set to 0, ORF=0 is set.

bitE. In spindle holding force up (TLUP)

It indicates that spindle holding force up (disturbance observer) is in running at TLUA=1.

bitF. In 2nd in-position (INP2)

The status changes to INP2=1 when position droop exists within the in-position area set by parameter SP025 (INP2) regardless of serve ON or OFF.

(Note) The bits other than those above are used for maintenance.

(6) Spindle control output 6

This is used for maintenance.

6

Troubleshooting

Contents

6 Troubleshooting

6-1 Points of caution and confirmation

If an error occurs in the drive unit, the warning or alarm will occur. When a warning or alarm occurs, check the state while observing the following points, and inspect or remedy the unit according to the details given in this section.

<Points of confirmation>

[1] What is the alarm code display?
[2] Can the error or trouble be repeated? (Check alarm history)
[3] Is the motor and servo drive unit temperature and ambient temperature normal?
[4] Are the servo drive unit, control unit and motor grounded?
[5] Was the unit accelerating, decelerating or running at a set speed? What was the speed?
[6] Is there any difference during forward and backward run?
[7] Was there a momentary power failure?
[8] Did the trouble occur during a specific operation or command?
[9] At what frequency does the trouble occur?
[10] Is a load applied or removed?
[11] Has the drive unit been replaced, parts replaced or emergency measures taken?
[12] How many years has the unit been operating?
[13] Is the power supply voltage normal? Does the state change greatly according to the time band?

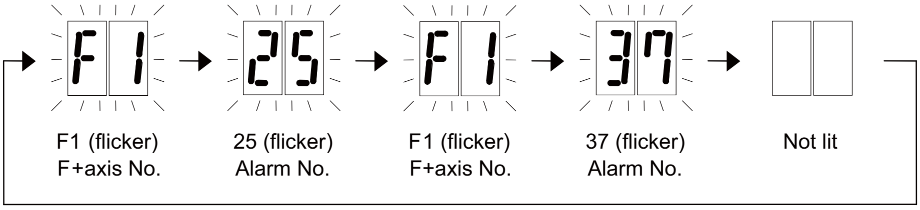
⚠ CAUTION

1. This drive unit uses a large capacity electrolytic capacitor. When the CHARGE lamp on the front of the power supply unit is lit, voltage is still present. Do not touch the terminal block in this state.
2. Before replacing the unit, etc., always confirm that there is no voltage with a tester or wait at least 15 minutes after turning the main power OFF.
3. The conductivity in the unit cannot be checked.
4. Never carry out a megger test on the drive unit as the unit could be damaged.

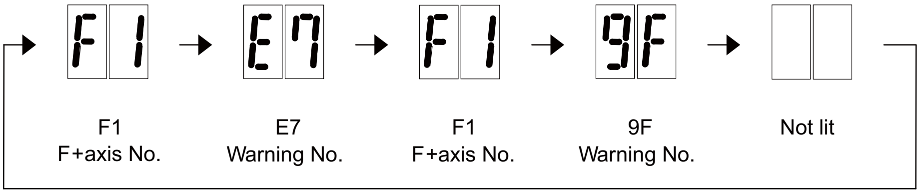
6-1-1 LED display when alarm or warning occurs

(1) Servo and spindle drive unit

The axis No. and alarm/warning No. alternate on the display. The display flickers when an alarm occurs.

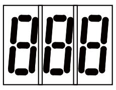


LED display during servo alarm or spindle alarm



LED display during servo warning or spindle warning

When the watchdog alarm of alarm No. "88" occurs, "888" is lit as follows.



Display during watchdog alarm

Numbers displayed on LED

No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
LED display	0	1	2	3	4	5	6	7	8	9	A	b	C	d	E	F

6-2 Protective functions list of units

6-2-1 List of alarms

When an alarm occurs, the servo drive unit will make the motor stop by the deceleration control or dynamic brake. The spindle drive unit will coast to a stop or will decelerate to a stop. At the same time, the alarm No. will appear on the NC monitor screen and with the LEDs on the front of the drive unit. Check the alarm No., and remove the cause of the alarm by following this list.

(1) Drive unit alarm

No.	Name	Details	Reset method	Servo stop method	Spindle stop method
10	Insufficient voltage	A drop of bus voltage was detected in main circuit.	PR	Dynamic stop	Coast to a stop
11	Axis selection error	The axis selection rotary switch has been incorrectly set.	AR	Initial error	Initial error
12	Memory error 1	A hardware error was detected during the power ON self-check.	AR	Initial error	Initial error
13	Software processing error 1	An error was detected for the software execution state.	PR	Dynamic stop	Coast to a stop
16	Initial magnetic pole position detection error	In the built-in motor which uses the absolute position detector, the servo ON has been set before the magnetic pole shift amount is set. The magnetic pole position, detected in the initial magnetic pole position detection control, is not correctly set.	PR	Dynamic stop	Coast to a stop
17	A/D converter error	A current feedback error was detected.	PR	Dynamic stop	Coast to a stop
18	Main side detector: Initial communication error	An error was detected in the initial communication with the motor side detector.	PR	Initial error	Initial error
19	Detector communication error in synchronous control	An error of the shared detector on the machine side was detected on the secondary axis of the speed command synchronization control.	PR	Dynamic stop	-
1A	Sub side detector: Initial communication error	An error was detected in the initial communication with the machine side detector.	PR	Initial error	Initial error
1B	Sub side detector: Error 1	An error was detected by the detector connected to the machine side. The error details are different according to the detector type. Refer to "Detector alarm" for details.		Dynamic stop	Coast to a stop
1C	Sub side detector: Error 2				
1D	Sub side detector: Error 3				
1E	Sub side detector: Error 4				
1F	Sub side detector: Communication error	An error was detected in the communication with the machine side detector.	PR	Dynamic stop	Coast to a stop
21	Sub side detector no signal 2	In the machine side detector, ABZ-phase feedback cannot be returned even when the motor moves.	PR	Dynamic stop	Coast to a stop
22	Detector data error	An error was detected in the feedback data from the position detector.	AR	Dynamic stop	-
23	Excessive speed error	The state that there is a difference between the actual speed and command speed continued for longer than the excessive speed deviation timer setting.	NR	-	Coast to a stop
24	Grounding	The motor power cable is in contact with FG (Frame Ground).	PR	Dynamic stop	Coast to a stop
25	Absolute position data lost	The absolute position data was lost in the detector.	AR	Initial error	-
26	Unused axis error	In the multiaxis drive unit, there is an axis set to free, and the other axis detected a power module error.	PR	Dynamic stop	Coast to a stop
27	Sub side detector: Error 5	An error was detected by the detector connected to the machine side. The error details are different according to the detector type. Refer to "Detector alarm" for details.		Dynamic stop	Coast to a stop
28	Sub side detector: Error 6				
29	Sub side detector: Error 7				
2A	Sub side detector: Error 8				
2B	Main side detector: Error 1	An error was detected by the detector connected to the motor side. The error details are different according to the detector type. Refer to "Detector alarm" for details.		Dynamic stop	Coast to a stop
2C	Main side detector: Error 2				
2D	Main side detector: Error 3				
2E	Main side detector: Error 4				
2F	Main side detector: Communication error	An error was detected in the communication with the motor side detector.	PR	Dynamic stop	Coast to a stop
30	Over regeneration	Over-regeneration level exceeded 100%. The regenerative resistor is overloaded.	PR	Dynamic stop	Coast to a stop
31	Overspeed	The motor speed exceeded the allowable speed.	PR	Deceleration stop enabled	Deceleration stop enabled

(Note1) Definitions of terms in the table are as follows.
Main side detector: Detector connected to CN2 Sub side detector: Detector connected to CN3

(Note2) Resetting methods
NR: Reset with the NC RESET button. This alarm can also be reset with the PR and AR resetting conditions.
PR: Reset by turning the NC power ON again. This alarm can also be reset with the AR resetting conditions.
When the control axis is removed, this alarm can be reset with the NC RESET button. (Excluding alarms 32 and 37.)
AR: Reset by turning the servo drive unit power ON again.

No.	Name	Details	Reset method	Servo stop method	Spindle stop method
32	Power module error (overcurrent)	The power module detected the overcurrent.	PR	Dynamic stop	Coast to a stop
33	Overvoltage	The bus voltage in main circuit exceeded the allowable value.	PR	Dynamic stop	Coast to a stop
34	NC communication: CRC error	The data received from the NC was outside the setting range.	PR	Deceleration stop enabled	Deceleration stop enabled
35	NC command error	The travel command data received from the NC was excessive.	PR	Deceleration stop enabled	Deceleration stop enabled
36	NC communication: Communication error	The communication with the NC was interrupted.	PR	Deceleration stop enabled	Deceleration stop enabled
37	Initial parameter error	An incorrect set value was detected among the parameters send from the NC at the power ON. In the safety observation function, an error was detected in the relation between the safety speed and safety rotation number in the speed observation mode.	PR	Initial error	Initial error
38	NC communication: Protocol error 1	An error was detected in the communication frames received from the NC. Or, removing an axis or changing an axis was performed in the synchronous control.	PR	Deceleration stop enabled	Deceleration stop enabled
39	NC communication: Protocol error 2	An error was detected in the axis data received from the NC. Or, in changing an axis, the parameter setting of the synchronous control was applied when the axis was installed.	PR	Deceleration stop enabled	Deceleration stop enabled
3A	Overcurrent	Excessive motor drive current was detected.	PR	Dynamic stop	Coast to a stop
3B	Power module error (overheat)	The power module detected an overheat.	PR	Dynamic stop	Coast to a stop
3C	Regeneration circuit error	An error was detected in the regenerative transistor or in the regenerative resistor.	PR	Dynamic stop	-
3D	Power supply voltage error at acceleration/deceleration	A motor control error during acceleration/deceleration, due to a power voltage failure, was detected.	PR	Dynamic stop	-
3E	Magnetic pole position detection error	The magnetic pole position, detected in the magnetic pole position detection control, is not correctly detected.	AR	Dynamic stop	Coast to a stop
41	Feedback error 3	Either a missed feedback pulse in the motor side detector or an error in the Z-phase was detected in the full closed loop system.	PR	Dynamic stop	Coast to a stop
42	Feedback error 1	Either a missed feedback pulse in the position detection or an error in the Z-phase was detected. Or the distance-coded reference check error exceeded the allowable value when the distance-coded reference scale was used.	PR	Dynamic stop	Coast to a stop
43	Feedback error 2	An excessive difference in feedback was detected between the machine side detector and the motor side detector.	PR	Dynamic stop	Coast to a stop
45	Fan stop	An overheat of the power module was detected during the cooling fan stopping.	PR	Dynamic stop	Coast to a stop
46	Motor overheat / Thermal error	Either the motor or the motor side detector detected an overheat. Or, the thermistor signal receiving circuit of the linear motor or direct-drive motor was disconnected. Or, the thermistor signal receiving circuit was short-circuited.	NR	Deceleration stop enabled	Deceleration stop enabled
48	Main side detector: Error 5	An error was detected by the detector connected to the main side. The error details are different according to the connected detector. Refer to "Detector alarm".		Dynamic stop	Coast to a stop
49	Main side detector: Error 6				
4A	Main side detector: Error 7				
4B	Main side detector: Error 8				
4C	Current error at initial magnetic pole estimate	Current detection failed at the initial magnetic pole estimation.	NR	Dynamic stop	Coast to a stop
4E	NC command mode error	An error was detected in the control mode send from the NC.	NR	Deceleration stop enabled	Deceleration stop enabled
4F	Instantaneous power interrupt	The control power supply has been shut down for 50ms or more.	NR	Deceleration stop enabled	Deceleration stop enabled
50	Overload 1	Overload detection level became 100% or more. The motor or the drive unit is overloaded.	NR	Deceleration stop enabled	Deceleration stop enabled
51	Overload 2	In a servo system, current command of 95% or more of the unit's max. current was given continuously for 1 second or longer. In a spindle system, current command of 95% or more of the motor's max. current was given continuously for 1 second or longer.	NR	Deceleration stop enabled	Deceleration stop enabled
52	Excessive error 1	A position tracking error during servo ON was excessive.	NR	Deceleration stop enabled	Deceleration stop enabled
53	Excessive error 2	A position tracking error during servo OFF was excessive.	NR	Dynamic stop	-

(Note1) Definitions of terms in the table are as follows.
Main side detector: Detector connected to CN2 Sub side detector: Detector connected to CN3

(Note2) Resetting methods
NR: Reset with the NC RESET button. This alarm can also be reset with the PR and AR resetting conditions.
PR: Reset by turning the NC power ON again. This alarm can also be reset with the AR resetting conditions.
When the control axis is removed, this alarm can be reset with the NC RESET button. (Excluding alarms 32 and 37.)
AR: Reset by turning the servo drive unit power ON again.

No.	Name	Details	Reset method	Servo stop method	Spindle stop method
54	Excessive error 3	There was no motor current feedback when the alarm "Excessive error 1" was detected.	NR	Dynamic stop	Coast to a stop
56	Commanded speed error	In the C-axis control mode, excessive speed error was detected.	NR	-	Deceleration stop enabled
58	Collision detection 1: G0	A disturbance torque exceeded the allowable value in rapid traverse modal (G0).	NR	Maximum capacity deceleration stop	-
59	Collision detection 1: G1	A disturbance torque exceeded the allowable value in the cutting feed modal (G1).	NR	Maximum capacity deceleration stop	-
5A	Collision detection 2	A current command with the maximum drive unit current value was detected.	NR	Maximum capacity deceleration stop	-
5B	Safety observation: Commanded speed monitoring error	A commanded speed exceeding the safe speed was detected in the safety observation mode.	PR	Deceleration stop enabled	Deceleration stop enabled
5D	Safety observation: Door state error	The door state signal input in the NC does not coincide with the door state signal input in the drive unit in the safety observation mode. Otherwise, door open state was detected in normal mode.	PR	Deceleration stop enabled	Deceleration stop enabled
5E	Safety observation: Speed feedback monitoring error	A motor speed exceeding the safe speed was detected in the safety observation mode.	PR	Deceleration stop enabled	Deceleration stop enabled
5F	External contactor error	A contact of the external contactor is welding.	NR	Deceleration stop enabled	Deceleration stop enabled
60 to 77	Power supply alarm	The power supply unit detected an error. The error details are different according to the connected power supply unit.		Dynamic stop	Coast to a stop
80	Main side detector cable error	The cable type of the motor side detector cable is for rectangular wave signal.	AR	Initial error	-
81	Sub side detector cable error	The cable type of the machine side detector cable does not coincide with the detector type which is set by the parameter.	AR	Initial error	-
87	Drivers communication error	The communication frame between drive units was aborted.	PR	Dynamic stop	Coast to a stop
88	Watchdog	The drive unit does not operate correctly. "888" is displayed for MDS-D-SVJ3/SPJ3.	AR	Dynamic stop	Coast to a stop
8A	Drivers communication data error 1	The communication data 1 between drivers exceeded the tolerable value in the communication between drive units.	PR	Dynamic stop	Coast to a stop
8B	Drivers communication data error 2	The communication data 2 between drivers exceeded the tolerable value in the communication between drive units.	PR	Dynamic stop	Coast to a stop

(Note1) Definitions of terms in the table are as follows.
Main side detector: Detector connected to CN2 Sub side detector: Detector connected to CN3

(Note2) Resetting methods
NR: Reset with the NC RESET button. This alarm can also be reset with the PR and AR resetting conditions.
PR: Reset by turning the NC power ON again. This alarm can also be reset with the AR resetting conditions.
When the control axis is removed, this alarm can be reset with the NC RESET button. (Excluding alarms 32 and 37.)
AR: Reset by turning the servo drive unit power ON again.

Detector alarm (Servo drive unit)

Alarm number when the detector is connected to CN2 side		**2B**	**2C**	**2D**	**2E**	**48**	**49**	**4A**	**4B**
Alarm number when the detector is connected to CN3 side		**1B**	**1C**	**1D**	**1E**	**27**	**28**	**29**	**2A**
OSA105, OSA105-ET2 OSA166, OSA166-ET2	**MITSUBISHI**	Memory alarm	LED alarm	Data alarm	-	-	-	-	-
OSA18		CPU alarm	-	Data alarm	-	-	-	-	-
MDS-B-HR		Memory error	-	Data error	-	Scale not connected	-	-	-
AT343 AT543 AT545	**Mitsutoyo**	Initialization error	EEPROM error	Photoelectric type, static capacity type data mismatch	ROM/RAM error	CPU error	Photoelectric type overspeed	Static capacity type error	Photoelectric type error
LC193M, LC493M RCN223M, RCN227M RCN727M, RCN827M EIB Series	**HEIDENHAIN**	Initialization error	EEPROM error	Relative/ absolute position data mismatch	ROM/RAM error	CPU error	Overspeed	Absolute position data error	Relative position data error
MPRZ Series	**MHI**	Installation accuracy fault	-	Detection position deviance	Scale breaking	Absolute value detection fault	-	Gain fault	Phase fault
SR75, SR85 SR77, SR87 RU77	**MAGNE-SCALE**	Laser diode error	System memory error	Encoder mismatch error	-	-	Over speed	Absolute position data error	Relative position data error
SAM/SVAM/ GAM/LAM Series	**FAGOR**	-	-	Absolute value detection error	H/W error	CPU error	-	-	-

(Note) A driver processes all reset types of alarms as "PR". However, "AR" will be applied according to the detector.

Detector alarm (Spindle drive unit)

Alarm number when the detector is connected toCN2 side		**2B**	**2C**	**2D**	**2E**	**48**	**49**	**4A**	**4B**
Alarm number when the detector is connected to CN3 side		**1B**	**1C**	**1D**	**1E**	**27**	**28**	**29**	**2A**
TS5690 TS5691	**MITSUBISHI**	Memory error	Waveform error	-	-	-	Overspeed	-	Relative position data error
MDS-B-HR		Initialization error	-	Data error	-	Connection error	-	-	-
OSA18		CPU error	-	Data error	-	-	-	-	-
EIB Series	**HEIDEN-HAIN**	Initialization error	EEPROM error	-	-	CPU error	Overspeed	-	Relative position data error
MPCI scale	**MHI**	Installation accuracy fault	-	Detection position deviance	Scale breaking	-	-	Gain fault	Phase fault

(Note) A driver processes all reset types of alarms as "PR". However, "AR" will be applied according to the detector.

6-2-2 List of warnings

When a warning occurs, a warning No. will appear on the NC monitor screen and with the LEDs on the front of the drive unit. Check the warning No., and remove the cause of the warning by following this list.

(1) Drive unit warning

No.	Name	Details	Reset method	Stop method
96	Scale feedback error	An excessive difference in feedback amount was detected between the main side detector and the MPI scale in MPI scale absolute position detection system.	*	-
97	Scale offset error	An error was detected in the offset data that is read at the NC power-ON in MPI scale absolute position detection system.	PR	-
9B	Incremental detector/ magnetic pole shift warning	The difference between the magnetic pole position after the phase Z has been passed (magnetic pole shift amount:SV028) and the initially detected position is excessive in the built-in motor's incremental control system.The magnetic pole is controlled by the initial detection value.	*	-
9E	Absolute position detector: Revolution counter error	An error was detected in the revolution counter data of the absolute position detector. The accuracy of absolute position is not guaranteed.	*	-
9F	Battery voltage drop	The battery voltage to be supplied to the absolute position detector is dropping.	*	-
A3	Distance-coded reference check / initial setup warning	This warning is detected until the axis reaches the reference position during the initial setup of the distance-coded reference check function. This warning turns OFF after the axis has reached the position, thus set the value displayed on the drive monitor to the parameter.	*	-
A6	Fan stop warning	A cooling fan in the drive unit stopped.	*	-
E0	Overregeneration warning	Over-regeneration detection level exceeded 80%.	*	-
E1	Overload warning	A level of 80% of the Overload 1 alarm state was detected.	*	-
E4	Parameter warning	An incorrect set value was detected among the parameters send from the NC in the normal operation.	*	-
E6	Control axis detachment warning	A control axis is being detached. (State display)	*	-
E7	NC emergency stop	In NC emergency stop. (State display)	*	Deceleration stop enabled
E8 to EF	Power supply warning	The power supply unit detected a warning. The error details are different according to the connected power supply unit.	*	- *EA: Deceleration stop enabled
E9	Instantaneous power interruption warning	The control power was shut OFF for 25ms or more.	-	-
EA	In external emergency stop state	External emergency stop signal was input.	-	-

(Note1) Definitions of terms in the table are as follows.
Main side detector: Detector connected to CN2 Sub side detector: Detector connected to CN3

(Note 2) Resetting methods
* : Automatically reset once the cause of the warning is removed.
NR: Reset with the NC RESET button. This warning can also be reset with the PR and AR resetting conditions.
PR: Reset by turning the NC power ON again. This warning can also be reset with the AR resetting conditions.
When the control axis is removed, this warning can be reset with the NC RESET button. (Excluding warning 93.)
AR: Reset by turning the servo drive unit power ON again.

(Note 3) Servo and spindle motor do not stop when the warning occurs.

(Note 4) When an emergency stop is input, servo and spindle motor decelerate to a stop.
(When SV048, SV055 or SV056 is set for servo and when SP055 or SP056 is set for spindle.)

6-3 Troubleshooting

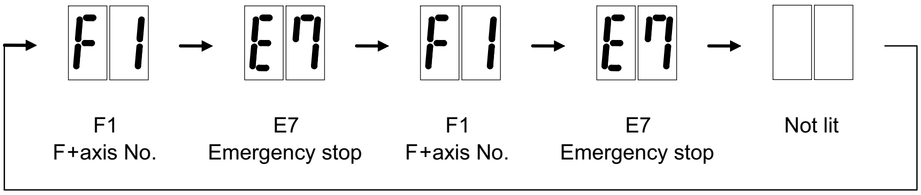
Follow this section to troubleshoot the alarms that occur during start up or while the machine is operating. If the state is not improved with the following investigations, the drive unit may be faulty. Exchange the unit with another unit of the same capacity, and check whether the state is improved.

6-3-1 Troubleshooting at power ON

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

LED display	Symptom	Cause of occurrence	Investigation method	Remedy
AA	Initial communication with the CNC was not completed correctly.	The drive unit axis No. setting is incorrect.	Is there any other drive unit that has the same axis No. set?	Set correctly.
		The CNC setting is incorrect.	Is the No. of CNC controlled axes correct?	Set correctly.
		Communication with CNC is incorrect.	Is the connector (CN1A, CN1B) connected?	Connect correctly.
			Is the cable broken?	Replace the cable.
Ab	Initial communication with the CNC was not carried out.	The axis is not used, the setting is for use inhibiting.	Is the DIP switch set correctly?	Set correctly.
		Communication with CNC is incorrect.	Is the connector (CN1A, CN1B) connected?	Connect correctly.
			Is the cable broken?	Replace the cable.
12	An error was detected in the unit's memory and IC during the self-diagnosis at power ON.	The CPU peripheral circuit is abnormal.	Check the repeatability.	Replace the unit.
			Check whether there is any abnormality with the unit's surrounding environment, etc.	Improve the surrounding environment.

The drive unit has started up normally if the following type of emergency stop (E7) is displayed on the display unit's LED display.



Normal drive unit LED display at NC power ON (for 1st axis)

6-3-2 Troubleshooting for each alarm No.

Alarm No. **10**	**Insufficient voltage** Insufficient bus voltage was detected in main circuit.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the timing when the alarm occurs.	The moment of READY ON	Check the investigation item No. 2.	○	○
		During operation	Increase the power supply capacity (KVA).		
2	Did the external contactor turn ON at the READY ON?	The external contactor did not turn ON.	Check the investigation item No. 3.	○	○
		The external contactor turned ON, but the alarm occurred immediately.	Check the investigation item No. 4.		
3	Check the wiring of contactor excitation circuit.	The wiring is correct.	Replace the contactor.	○	○
		The wiring is not correct.	Rewire.		
4	Check the input voltage of the drive unit by a tester. (Voltage between L1 and L2, L2 and L3, L1 and L3)	The input voltage is normal.	Replace the drive unit.	○	○
		The input voltage is abnormal. The measured voltage fluctuates.	Increase the power supply capacity (KVA). Replace the power supply.		

Alarm No. **11**	**Axis selection error** The axis selection rotary switch is incorrectly set.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the setting of the axis selection switch (rotary switch) on the top of the unit.	The same axis No. is set for the L and M axes.	Correctly set the axis No. 0 = No. 1 axis, 1 = No. 2 axis, ...	○	○
		The value is duplicated with other axis.	Correctly set the axis No. 0 = No. 1 axis, 1 = No. 2 axis, ...		
		The axis No. is correctly set.	Replace the drive unit.		

Alarm No. **12**	**Memory error 1** Hardware error (a CPU or an internal memory error was detected during the power ON self-check.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 2.		
2	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. **13**	**Software processing error 1** An error was detected in the software execution state. Software processing has not finished within the specified time.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 2.		
2	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment. [1] Machine grounding check		○	○

Alarm No. 16	**Initial magnetic pole position detection error**
	In linear motor or IPM spindle motor using absolute position detector, the servo ON has been set before the magnetic pole shift amount(servo:SV028,spindle:SP118) is set. In the initial magnetic pole position detection control, the pole position was not correctly set.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the parameters, SV028 (for the servo) and SP118(for the spindle).	The parameters have not been set.	Set the magnetic shift pole amount(SP118).		○
		The parameters have been set, but the alarm occurs.	Carry out the magnetic pole estimation again, as the setting value is wrong.		
		The setting parameter value is the same even when initial magnetic pole function was executed again.	Check the investigation item No. 2.		
2	Check the repeatability.	The error is always repeated.	Replace the drive unit.		○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 3.		
3	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment. [1] Machine grounding check [2] Shield connection of the cable			○

Alarm No. 17	**A/D converter error**
	An error was detected in the current FB.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal, but occurs thereafter.	Check the investigation item No. 2.		
2	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 18	**Main side detector: Initial communication error**
	An error was detected in the initial communication with the motor side detector.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the servo parameter (SV025.ent) setting value. Check the spindle parameter(SP020) setting value.	The value is not set correctly.	Correctly set SV025 for the servo, and SP020 for the spindle.	○	○
		The value is set correctly.	Check the investigation item No. 3.		
2	Check the detector. Check if a pulse detector is used for serial detector specifications.	The pulse detector is used.	Replace the detector to the serial.	○	○
		The serial detector is used.	Check the investigation item No. 3.		
3	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	○
		The connector is not disconnected.	Check the investigation item No. 4.		
4	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty.	Replace the detector cable.	○	○
		The connection is normal.	Check the investigation item No. 5.		
5	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the detector side.	Check the investigation item No. 6.		
6	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment. [1] Machine grounding check [2] Shield connection of the cable		○	○

6 Troubleshooting

Alarm No. 19	**Detector communication error in synchronous control:** An error was detected in the machine side detector of the secondary axis at the speed command synchronization control.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the servo parameter value of secondary axis (SV025.pen:position detector).	The value is not set correctly.	Correctly set.	○	
		The value is set correctly.	Check the investigation item No. 2.		
2	Check if there are no problems in the connection between the detector (linear scale) and MDS-B-HR.	The screw connected to MDS-B-HR is winded down.	Tighten up the screw.	○	
		No problems found in the connector connection.	Check the investigation item No. 3.		
3	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	
		The connector is not disconnected.	Check the investigation item No. 3.		
4	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty.	Replace the detector cable.	○	
		The connection is normal.	Check the investigation item No. 4.		
5	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	
		The alarm is on the detector side.	Check the investigation item No. 5.		
6	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment. [1] Machine grounding check [2] Shield connection of the cable		○	

Alarm No. 1A	**Sub side detector: Initial communication error** Initial communication with the machine side detector failed.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the servo parameter (SV025.pen:position detector) setting value. Check the spindle parameter(SP019) setting value. Are the serial communication type detector parameters set for the pulse type detector?	The value is not set correctly.	Correctly set SV025.	○	
		The value is set correctly.	Check the investigation item No. 2.		
2	Check the detector. Check if the pulse detector is used for the detector specified to be serial.	The pulse detector is used.	Replace the detector.	○	○
		The serial detector is used.	Check the investigation item No. 3.		
3	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	
		The connector is not disconnected.	Check the investigation item No. 4.		
4	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty.	Replace the detector cable.	○	
		The connection is normal.	Check the investigation item No. 5.		
5	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	
		The alarm is on the detector side.	Check the investigation item No. 6.		
6	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	

Alarm No. 1B	**Sub side detector: Error 1**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	**Investigation results**	**Remedies**	**SV**	**SP**
1	Check whether the servo axis has moved and the spindle has rotated when an alarm occurred.	The axis has operated.	Check the investigation item No. 3.	○	○
		The axis has not operated.	Check the investigation item No. 2.		
2	Check whether the operation at low speed is normal.	The operation is normal.	Check the investigation item No. 3.	○	○
		The operation is not normal.	Check the cautions at power ON. [1] Wiring check [2] Parameter check		
3	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	○
		The connector is not disconnected.	Check the investigation item No. 4.		
4	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty.	Replace the detector cable.	○	○
		The connection is normal.	Check the investigation item No. 5.		
5	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the detector side.	Check the investigation item No. 6.		
6	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 1C	**Sub side detector: Error 2**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	**Investigation results**	**Remedies**	**SV**	**SP**
1	Check the alarm No. "1B" items.			○	

Alarm No. 1D	**Sub side detector: Error 3**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	**Investigation results**	**Remedies**	**SV**	**SP**
1	Check the alarm No. "1B" items.			○	

Alarm No. 1E	**Sub side detector: Error 4**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	**Investigation results**	**Remedies**	**SV**	**SP**
1	Check the alarm No. "1B" items.			○	

Alarm No. 1F	**Sub side detector: Communication error**
	An error was detected in communication data with the linear scale or the ball screw side detector. Or the communication was interrupted.

	Investigation details	Investigation results	Remedies	SV	SP
1	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	
		The connector is not disconnected.	Check the investigation item No. 2.		
2	Is the detector cable wired in the same conduit as the motor's power cable, or are the two cables laid in parallel near each other?	The cables are wired near each other. (Noise is entering from the power cable.)	Wire the detector cable away from the power cable. Shield the power cable.	○	
		The wires are sufficiently separated.	Check the investigation item No. 3.		
3	Is the motor FG wire connected only to the drive unit which drives it? (Is the motor grounded to one point?)	The motor FG wire is grounded on the motor side.	Ground the motor to one point, connecting the wires together on the drive unit side.	○	
		The motor is grounded to one point.	Check the investigation item No. 4.		
4	Turn the power OFF, and check the detector cable connection with a tester. (Is the cable shielded?)	The connection is faulty.	Replace the detector cable.	○	
		The connection is normal.	Check the investigation item No. 5.		
5	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	
		The alarm is on the detector side.	Check the investigation item No. 6.		
6	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	

Alarm No. 21	**Sub side detector: No signal2**
	When an excessive error alarm occurred, no signal from the machine side detector was detected. An error was detected in the ABZ-phase in the full closed loop control system.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the servo parameter (SV025. pen:machine end detector), and spindle parameter (SP019) setting value. Are the pulse type detector parameters set for a serial communication type detector?	The value is not set correctly.	Correctly set SV025.pen for the servo and SP019 for the spindle (including SP097 for pulse type).	○	
		The value is set correctly.	Check the investigation item No. 3.		
2	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	
		The connector is not disconnected.	Check the investigation item No. 4.		
3	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty.	Replace the detector cable.	○	
		The connection is normal.	Check the investigation item No. 5.		
4	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	
		The alarm is on the detector side.	Replace the detector.		
5	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	

Alarm No. 22	**Detector data error:**
	Drive unit received a wrong feedback data (scattered data) from the detector and position deviation occurred.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the installation of the detector is loosened.	It is loosened.	Tightly install the detector.	○	
		It is not loosened.	Check the investigation item No. 2.		
2	Check if an excessive vibration is occurring during machining.	An excessive vibration is occurring.	Check the installation of the machine.	○	
		An excessive vibration is not occurring.	Check the investigation item No. 3.		
3	Check the investigation item No.2 or subsequent items in Alarm No.21.			○	

Alarm No. 23	**Excessive speed error** A difference between the speed command and speed feedback was continuously exceeding 50 r/min for longer than the setting time.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the U, V and W wiring connected to the spindle drive unit.	The wires are not correctly connected.	Correctly connect.		○
		The wires are correctly connected.	Check the investigation item No. 2.		
2	Check the spindle parameter SP020, SP026, SP027, from SP057 to SP064 and spindle specification parameters from slimit1 to slimit4 setting value.	The correct values are not set.	Correctly set.		○
		The correct values are set.	Check the investigation item No. 3.		
3	Measure the acceleration/ deceleration time from 0 to the point where the spindle speed reaches its maximum. If the alarm occurs when forward run is changed to reverse run, measure the acceleration/ deceleration time from the forward to reverse. Also measure it from the reverse to forward.	12sec or more. (SP117 setting value or more.)	Increase the spindle acceleration/deceleration time constant setting value(sp_t1 to sp_t4). Reduce the load inertia.		○
		Less than 12sec.	Check the investigation item No. 4.		
4	Check the load amount when the alarm occurred during cutting.	The speed deterioration due to load amount has exceeded the tolerable range which is determined by the parameter SP096. -If SP096 is set to 0, it is regarded as 85%. Thus a speed of 85% of the machining speed or faster will be the tolerable speed.	Reduce the cutting load to mitigate the speed deterioration. Replace the tool.		○
		The load amount is within the SP096 setting value.	Check the investigation item No. 5.		
5	Check the fluctuation of the input voltage into the power supply unit with a tester.	Voltage drop during acceleration is 200V or less	Review the power supply capacity.		○
		Voltage drop during acceleration is 200V or more	Check the investigation item No.6.		
6	Check the capacity of the drive unit.	The capacity does not satisfy the motor output.	Change the capacity to the selected one.		○
		The capacity satisfies the motor output.	Replace the unit.		

Alarm No. 24	**Grounding** The motor power cable is in contact with FG (Frame Ground).

	Investigation details	Investigation results	Remedies	SV	SP
1	Measure the insulation across the power cables (U,V,W) for connected motors and the ground. (Carry out a megger test.) (Note) When the insulation is measured, disconnect wires from the drive unit.	Less than 1MΩ.	The motor or power cable may be ground faulted.	○	○
		1MΩ or more.	Check the investigation item No. 2.		
2	Has oil come in contact with the motor or power cable?	Oil has come in contact.	Take measures so that oil does not come in contact. Check the motor's cannon connector and the inside of the terminal box, and clean as necessary.	○	○
		Oil has not come in contact.	Check the investigation item No. 3.		
3	Measure the insulation again.	Less than 1MΩ.	Replace the motor or cable.	○	○
		1MΩ or more.	Check the investigation item No. 4.		
4	Measure the resistance across the U, V, W phase terminals of the servo/ spindle drive unit and the ground with a tester. (Note) Do not measure the insulation as the unit is damaged.	Less than 100kΩ.	Replace the drive unit.	○	○
		100kΩ or more.	Replace the power supply unit.		

Alarm No. 25	**Absolute position data lost**
	The absolute position was lost, as the backup battery voltage dropped in the absolute position detector.

	Investigation details	Investigation results	Remedies	SV	SP
1	Is warning 9F occurring at the same time?	The warning is occurring.	Check the investigation item No. 2.	○	
		The warning is not occurring.	Check the investigation item No. 3.		
2	Measure the battery voltage with a tester at the DC range.	Less than 3V.	Replace the battery, and establish the zero point.	○	
		3V or more.	Check the NC bus cable connection.		
3	Did alarm No.18 occur when the power was turned ON the last time?	Alarm No.18 occurred.	Turn the drive unit control power ON again, and establish the zero point.	○	
		Alarm No.18 did not occur.	Check the investigation item No. 4.		
4	Was the detector cable or battery cable left disconnected from the unit for a long time?	The unit was left disconnected for a long time. Guide at delivery: 20 hours or more After 5 years: 10 hours or more	Turn the drive unit control power ON again, and establish the zero point.	○	
		The cables were not left disconnected.	Check the investigation item No. 5.		
5	Check the detector cable or battery cable connection with a tester.	The connection is faulty.	Replace the cable.	○	
		The connection is normal.	Replace the drive unit.		

Alarm No. 26	**Unused axis error**
	A power module error occurred in the axis whose axis No. selection switch was set to "F" (free axis).

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 2.		
2	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 27	**Sub side detector: Error 5**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	

Alarm No. 28	**Sub side detector: Error 6**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	

Alarm No. 29	**Sub side detector: Error 7**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	

Alarm No. 2A	**Sub side detector: Error 8**
	The machine side detector (CN3 side) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	

Alarm No. 2B	**Main side detector: Error 1**
	The motor side detector (CN2 side) detected an error. (Note) It includes the linear scale in the case of linear motor. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 2C	**Main side detector: Error 2**
	The motor side detector (CN2 side) detected an error. (Note) It includes the linear scale in the case of linear motor. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 2D	**Main side detector: Error 3**
	The motor side detector (CN2 side) detected an error. (Note) It includes the linear scale in the case of linear motor. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 2E	**Main side detector: Error 4**
	The motor side detector (CN2 side) detected an error. (Note) It includes the linear scale in the case of linear motor. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 2F	**Main side detector: Communication error**
	An error was detected in communication data with the motor side detector or with the linear scale of a linear servo system. Or the communication was interrupted.

	Investigation details	Investigation results	Remedies	SV	SP
1	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	○
		The connector is not disconnected.	Check the investigation item No. 2.		
2	Is the detector cable wired in the same conduit as the motor's power cable, or are the two cables laid in parallel near each other?	The cables are wired near each other. (Noise is entering from the power cable.)	Improve the cable wiring.	○	○
		The wires are sufficiently separated.	Check the investigation item No. 3.		
3	Is the motor FG wire connected only to the drive unit which drives it? (Is the motor grounded to one point?)	The motor FG wire is grounded on the motor side.	Ground the motor to one point, connecting the wires together on the drive unit side.	○	○
		The motor is grounded to one point.	Check the investigation item No. 4.		
4	Turn the power OFF, and check the detector cable connection with a tester. (Is the cable shielded?)	The connection is faulty.	Replace the detector cable.	○	○
		The connection is normal.	Check the investigation item No. 5.		
5	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the detector side.	Check the investigation item No. 6.		
6	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 30	**Over regeneration:**
	Over-regeneration detection level became over 100%. The regenerative resistor is overloaded.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the regenerative capacity exceeds the regenerative resistor tolerable capacity.	The regenerative capacity exceeds the regenerative resistor tolerable capacity.	Add the option regenerative resistor or replace it.	○	○
		The regenerative resistor selection is appropriate.	Check the investigation item No. 2.		
2	Check if the parameter is set incorrectly, and check the values of sv036 and sp032.	The parameters are set incorrectly.	Change the parameters.	○	○
		The parameters are correct.	Check the investigation item No. 3.		
3	Is an external regenerative resistor used?	An external regenerative resistor is used.	Check the investigation item No. 5.	○	
		A built-in regenerative resistor is used.	Check the investigation item No. 4.		
4	Is the short wire connected between P and D terminal? Are there any problems with the connection condition?	The wire is not connected.	Connect the wire.	○	
		The connector is disconnected. The connector has a contact fault.	Reconnect the connector. Replace the connector.		
5	Is the connection of the regenerative resistor or regeneration resistor cable correct?	The connection is incorrect.	Rewire.	○	○
		The connection is correct.	Check the investigation item No. 6.		
6	Is the regeneration resistor or the regeneration resistor cable broken? Disconnect the regenerative resistor terminal and check the resistance value with a tester.	The regeneration resistor is broken. Or the resistance value is large.	Replace the regenerative resistor.	○	○
		The regeneration resistor cable is broken.	Replace the cable.		
		The resistance value is normal.	Check the investigation item No. 7.		
7	Check if the power supply voltage is too high.	The power supply voltage exceeded 253V.	Review the power supply.	○	○
		The power supply voltage is normal.	Replace the drive unit.		

Alarm No. 31	**Overspeed**
	The motor was detected to rotate at a speed exceeding the allowable speed (In the case of linear motor, it was detected to move at a speed exceeding the allowable speed).

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the unit in which the alarm was detected is servo or spindle.	The alarm was detected in servo.	Check the investigation item No. 2.	○	○
		The alarm was detected in spindle.	Check the investigation item No. 3.		
2	Check the servo parameters SV001 (PC1), SV002 (PC2), SV018 (PIT) and SV025 (MTYP) settings.	The settings are incorrect.	Correctly set.	○	
		Correctly set.	Check the investigation item No. 5.		
3	Check the spindle parameter SP026 (TSP) setting.	The setting is incorrect. The alarm is detected at 115% of SP026.	Correctly set.		○
		Correctly set.	Check the investigation item No. 4.		
4	Check the PLG output waveform.	There is a problem.	Adjust the PLG output waveform.	○	○
		Normal.	Check the investigation item No. 5.		
5	Check whether the speed waveform is overshooting.	The waveform is overshooting.	Increase the acceleration/ deceleration time constant. Lower the load inertia.	○	○
		The waveform is not overshooting.	Check if there is any abnormality in the unit's ambient environment. (Ex.: Ambient temperature, noise, grounding)		
			Check the investigation item No. 6.		
6	Check the repeatability.	[1] The alarm occurs when the motor is stopped. [2] The rotation speed displayed on the drive monitor varies when the motor is stopped.	Replace the detector or detector cable.	○	○
		The alarm occurs at all time.	Replace the drive unit.		

Alarm No. 32	**Power module overcurrent**
	Overcurrent protection function in the power module has started its operation.

	Investigation details	Investigation results	Remedies	SV	SP
1	Disconnect the power cable (U, V, W) from the unit's terminal block and motor, and check whether a short-circuit between the power cable or whether conduction at both end of wiring occurs with a tester.	[1] Before disconnecting the power cable, the cable connector or screw has been loosened. [2] The short-circuit condition persists even after disconnecting the cable from the unit and motor.	[1] Tighten it. [2] Check the motor wiring. [3] Replace the power cable.	○	○
		There is no problem.	Check the investigation item No. 2.		
2	Check the motor insulation with a (megger) tester. -Between motor power and ground earth	Less than 1MΩ. (Grounding)	Replace the motor.	○	○
		1MΩ or more. (Normal)	Check the investigation item No. 3.		
	Check the unit capacity. [1] The same size but smaller than the selected capacity. [2] The combination of the motor and axis is alternated in a 2-axis unit.	The capacity is small. The smaller capacity side was used in 2-axis unit.	Replace to the unit of the selected capacity or change the axis.	○	○
		The motor meets the selected capacity.	Check the investigation item No. 3.		
3	Check the current loop gain parameters.	Different from the standard parameter settings.	Adjust the value to the standard setting.	○	○
		Equivalent to the standard parameter settings.	Check the investigation item No. 4.		
4	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	○
		The connector is not disconnected.	Check the investigation item No. 5.		
5	Turn the power OFF, and check the detector cable connection with a tester.	Connection is faulty.	Replace the detector cable.	○	○
		Connection is normal.	Check the investigation item No. 6.		
6	Check the repeatability.	The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 8.	○	○
		The error is always repeated.	Check the investigation item No. 7.		
7	Replace with another unit, and check whether the fault is on the drive unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the detector side.	Replace the detector.		
8	Check for any abnormalities in the unit's ambient environment. (Ex.: Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 33	**Overvoltage:**
	The main circuit bus voltage exceeded the tolerable value.

	Investigation details	Investigation results	Remedies	SV	SP
1	Is an external regenerative resistor used?	An external regenerative resistor is used.	Check the investigation item No. 3.	○	
		A built-in regenerative resistor is used.	Check the investigation item No. 2.		
2	Is the short wire connected between P and D terminal? Are there any problems with the connection condition?	The wire is not connected.	Connect the wire.	○	
		The connector is disconnected. The connector has a contact fault.	Reconnect the connector. Replace the connector.		
		The connection is correct.	Check the investigation item No.6.		
3	Is the combination of the used regenerative resistor and drive unit appropriate?	The combination is incorrect.	Replace the correct regenerative resistor.	○	○
		The combination is normal.	Check the investigation item No. 4.		
4	Is the connection of the regenerative resistor or regeneration resistor cable correct?	The connection is incorrect.	Rewire.	○	○
		The connection is correct.	Check the investigation item No. 5.		
5	Is the regeneration resistor or the regeneration resistor cable broken? Disconnect the regenerative resistor terminal and check the resistance value with a tester.	The regeneration resistor is broken. Or the resistance value is large.	Replace the regenerative resistor.	○	○
		The regeneration resistor cable is broken.	Replace the cable.		
		The resistance value is normal.	Check the investigation item No. 6.		
6	The acceleration/deceleration time constant is too short. At acceleration/deceleration, has the speed overshoot reached to the current limit?	Reached to the current limit. The speed overshoot is applied.	Increase the acceleration/deceleration time constant.	○	○
		The connection is normal.	Replace the drive unit.		

Alarm No. 34	**NC-DRV communication: CRC error**
	An error was detected in the data received from the CNC.

	Investigation details	Investigation results	Remedies	SV	SP
1	Gently shake the connectors of the optical cables by hand that link between NC and drive unit or between drive units to check for loosening and disconnection. Also check if an excessive force is not applied on them.	The connector is loose or nearly disconnected. The tab of the connector is damaged.	Correctly install. Replace the cable.	○	○
		The connector is not disconnected.	Check the investigation item No. 2.		
2	Check for damages at the ends of the optical communication cable. Replace the cable.	The damage is found at the end of the cable.	Replace the communication cable.	○	○
		The connection is normal.	Check the investigation item No. 3.		
3	Check whether the NC or drive unit software version was changed recently.	The version was changed.	Change software version back to the original.	○	○
		The version was not changed.	Check the investigation item No. 4.		
4	Replace with another drive unit, and check whether the fault is on the NC side or drive unit side.	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the unit connections.	Check the investigation item No. 5.		
5	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No.	**NC command error**
35	The travel command data that was received from the CNC was excessive.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "34" items.			○	○

Alarm No.	**NC-DRV communication: Communication error**
36	The communication with the CNC was interrupted.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "34" items.			○	○

Alarm No.	**Initial parameter error**
37	An incorrect parameter was detected among the parameters received from the CNC at the power ON.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the unit in which the alarm was detected is servo axis or spindle.	The alarm was detected in servo axis.	Check the investigation item No. 2.	○	○
		The alarm was detected in spindle.	Check the investigation item No. 3.		
2	Check the error parameters displayed on the NC diagnosis screen. Servo parameters: SV001 to SV065, SV082	Wrong parameters were set.	Correct the parameter setting. Set the value within the designated setting range.	○	
		The electronic gears are overflowing.	Set SV001, SV002 and SV018 so that they meet the machine specifications.		
		The absolute position detection parameter is valid when OSE104 and OSE105 are connected. (Absolute position control cannot be used.)	In order to use the absolute position control function, an absolute position option is required.		
		SV082/bitC to F are the same setting in one unit.	Correct the setting of SV082/bit0 to B.		
		SV082/bitC to F are not the same setting in one unit.	Correct to the same setting.		
		Correct parameters were set.	Check the investigation item No. 4.		
3	Check the error parameters displayed on the NC diagnosis screen. Spindle parameters: SP001 to SP240	The setting is wrong.	Correct the parameter setting. Set the value within the designated setting range.		
		The set parameters are correct.	Check the investigation item No. 4.		
		The set parameter value is different from that of the machine specified detector.	Change the setting to meet the machine specifications.		○
4	Check the alarm No. "34" items.			○	○

Alarm No.	**NC-DRV communication: Protocol error 1**
38	An error was detected in the communication frames received from the CNC.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "34" items.			○	○

Alarm No.	**NC-DRV communication: Protocol error 2**
39	An error was detected in the axis information data received from the CNC.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "34" items.			○	○

Alarm No. 3A	Overcurrent
	Excessive current was detected in the motor drive current.

	Investigation details	Investigation results	Remedies	SV	SP
1	[1] Check whether vibration is occurring at the table or spindle. [2] Check if the vibration caused by the load fluctuation is occurring.	Vibration is occurring.	[1] Set a filter. [2] Lower the speed loop gain (SV005/ SP005).	○	○
		There is no vibration.	Check the investigation item No. 2.		
2	Check the repeatability of the alarm at the rapid traverse feed for the servo and at acceleration/deceleration for the spindle. (Note) Check the phenomenon caused by the load fluctuation.	The alarm occurs.	Lower the speed loop gain (SV005/ SP005) to the level at which the alarm does not occur.	○	○
		The alarm does not occur.	Check the investigation item No. 3.		
3	For the servo, perform the rapid traverse feed repeatedly and check if the max. current value is within the tolerable value. For the spindle, check the load meter value at the unloaded max. rotation speed.	The displayed value is high.	Increase the current loop gain. Servo: SV009 to 012 Spindle: SP077 to 080 and SP081 to 084	○	○
		The displayed value is appropriate.	Check the investigation item No. 4.		
4	Disconnect the power cable (U,V,W) from the terminal block and the cannon plug from the motor. Check the insulation of the cable and motor with a tester.	The resistance value of the power cable for each phase is not "∞".	Replace the motor power cable.	○	○
		The resistance value of the motor terminal and unit (shaft) is 1MΩ or less.	Replace the motor.(Note) For the motors equipped with the absolute position detector, the zero point must be established.		
		The values below are met when measured with a tester. Cable: ∞ Motor terminal - unit:1MΩ or more	Check the investigation item No. 5.		
5	Check the insulation between the motor power cable and FG.	There is a ground fault at the power cable.	Replace the motor power cable.	○	○
		There is no problem.	Check the investigation item No. 6.		
6	Check if there is any abnormality in the motor's ambient environment. (Ex. Ambient temperature, cutting water)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 3B	Power module overheat
	Thermal protection function in the power module has started its operation.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check that the fan of the drive unit is rotating correctly.	Large amounts of cutting oil or cutting chips, etc., are adhered to the fan, or the rotation is slow.	Clean or replace the fan.	○	○
		The fan is rotating properly.	Check the investigation item No. 2.		
2	Check whether the heat dissipating fins are dirty.	Cutting oil or cutting chips, etc., are adhered, and the fins are clogged.	Clean the fins.	○	○
		Cutting chips etc. are not adhered to the fins.	Check the investigation item No. 3.		
3	Measure the drive unit's ambient temperature.	55°C or more.	Improve the efficiency cooling for the power distribution panel.	○	○
		Less than 55°C.	Check the investigation item No. 4.		
4	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 3C	**Regeneration circuit error:**
	An error was detected in the regenerative transistor or in the regenerative resistor.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if an external regenerative resistor is used.	An external regenerative resistor is used.	Check the investigation item No. 3.	○	
		A built-in regenerative resistor is used.	Check the investigation item No. 2.		
2	Is the short wire connected between P and D terminal? Are there any problems with the connection condition? (looseness of the screw)	The wire is not connected.	Connect the wire.	○	
		The connector is disconnected. The connector has a contact fault.	Reconnect the connector. Replace the connector.		
		The connection is correct.	Replace the drive unit.		
3	Is the connection of the regenerative resistor or regeneration resistor cable correct?	The wire is not connected.	Connect the wire.	○	○
		The connection is correct.	Check the investigation item No. 4.		
4	Is the regeneration resistor or the regeneration resistor cable broken? Disconnect the regenerative resistor terminal and check the resistance value with a tester.	The regeneration resistor is broken. Or the resistance value is different from the specified value.	Replace the regenerative resistor.	○	○
		The regeneration resistor cable is broken.	Replace the cable.		
		The resistance value is normal.	Replace the drive unit.		

Alarm No. 3D	**Power supply voltage error at acceleration/deceleration:**
	A motor control error was detected at acceleration/deceleration due to an input voltage drop.

	Investigation details	Investigation results	Remedies	SV	SP
1	Measure the input voltage during operations with a tester.	During operations, the voltage fluctuates widely.	Increase the power capacity (KVA).	○	-
		During operations, the voltage is stable.	Check the investigation item No. 2.		
2	Check the load inertia.	The load inertia (workpiece etc.) is excessive.	[1] Lower the load inertia. [2] Extend the rapid traverse time constant for G0/G1.	○	-
		The load inertia is normal.	Replace the drive unit.		

Alarm No. 3E	**Magnetic pole position detection error:**
	The magnetic pole position is not reliable in the magnetic pole position detection control. This alarm occurs at the detection level which is set in SV094.

	Investigation details	Investigation results	Remedies	SV	SP
1	Adjust the setting value of the servo parameter SV094 and detect the magnetic pole position.	Set SV094.	Set SV094. The standard value for a rotary motor is 100. The standard value for a linear motor is 10.	○	-
		SV094 is set.	Set the optimal value allowing for the coasting distance (Increase the value).		

Alarm No. 41	**Feedback error 3**
	Either a missed feedback pulse in the main side incremental detector or an error in the Z-phase was detected in the full closed loop system. In the servo, Z-phase was not detected by a rotary detector within 2 rotations.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the connection condition of the cable and detector. - Check if the cable is disconnected.	The cable is disconnected.	Replace the cable.	○	○
		The cable is normal.	Check for dirt on the connector terminal and reconnect it.		
		The alarm occurs even after it is reconnected.	Replace the detector.		

Alarm No. 42	**Feedback error 1** An error was detected in the sub side detector (feedback signals of the position detector in a servo system, or PLG's feedback signals in a spindle system).

	Investigation details	Investigation results	Remedies	SV	SP
1	Check SP019 and SP020.	Parameter is set incorrectly.	Correctly set.		○
		Parameter is set correctly.	Check the investigation item No. 2.		
2	Check the alarm No. "2C" items.				○

Alarm No. 43	**Feedback error 2** Excessive difference was detected in position data between the motor side detector and the machine side detector.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the connecting pulley ratio of the spindle end to ABZ pulse encoder meets the machine specifications.	The pulley ratio of the spindle end to encoder is 1:1.	Check the parameter setting.		○
		The spindle end and encoder are not equal in the pulley ratio.	Check the parameter setting. When the encoder is smaller than the spindle end in the pulley ratio, replace the pulley.		
		No problem.	Check the investigation item No. 2.		
2	Check the setting value of the spindle parameter from SP057 to SP064.	The correct values are not set.	Correctly set.		○
		The correct values are set.	Check the investigation item No. 3.		
3	Check the spindle parameter SP054 setting value.	V-belt is used for the spindle end driving.	Set "-1" to the spindle parameter "SP054".		○
		Other than V-belt (gears or timing belt) is used for the spindle end driving.	Set "360" to the spindle parameter "SP054".		
		SP054 is set corresponding to the machine specifications.	Check the investigation item No. 4.		
4	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	○
		The connector is not disconnected.	Check the investigation item No. 5.		
5	Is the detector cable wired in the same conduit as the motor's power cable, or are the two cables laid in parallel near each other?	The cables are wired near each other. Noise is entering from the power cable.	Improve the cable wiring. Divide it by a FG shield.	○	○
		The wires are sufficiently separated.	Check the investigation item No. 6.		
6	Is the motor FG wire connected only to the drive unit which drives it? (Is the motor grounded to one point?)	The motor FG wire is grounded on the motor side.	Ground the motor to one point, connecting the wires together on the drive unit side.	○	○
		The motor is grounded to one point.	Check the investigation item No. 7.		
7	Turn the power OFF, and check the detector cable connection with a tester. (Is the cable shielded?)	The connection is faulty.	Replace the detector cable.	○	○
		The connection is normal.	Check the investigation item No. 8.		
8	Replace with another unit, and check whether the fault is on the unit side or detector side.	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the detector side.	Check the investigation item No. 9.		
9	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○
10	Check SP019, SP020, SV019, and SV020.	Parameter is set incorrectly.	Correctly set.	○	○
		Parameter is set correctly.	Check the investigation item No. 11.		
11	Check the alarm No. "1B" items.			○	

Alarm No. 45	**Fan stop** A cooling fan built in the drive unit stopped, and overheat occurred in the power module.				
	Investigation details	**Investigation results**	**Remedies**	**SV**	**SP**
1	Turn the unit power ON again, and confirm the rotation of the fan. Note) Assure more than 10 seconds for the time from when the power is turned OFF till when it is turned ON. For the fan used for the drive unit, assuring more than 10 seconds for the time from when the power is turned OFF till when it is turned ON is required.	The fan is rotating, and an alarm did not occur again.	Continue to use. The power may be turned ON without assuring more than 10 seconds for the time from when the power is turned OFF till when it is turned ON. Leave for more than 10 seconds, and turn the power ON again.	○	○
		The fan did not rotate. Or, an alarm occurred again.	Check the investigation item No. 2.		
2	Check if the connector connected to a fan is loosened or disconnected in the unit.	[1]The connector is loosened. [2]The connector is disconnected.	Correctly connect the connector. Replace the fan.	○	○
		[1]The connector is not loosened. [2]The connector is not disconnected.	Check the investigation item No. 3.		
3	Check if oil or cutting chips are adhered to the fan.	Oil or cutting chips are adhered.	Improve the use environment and replace the drive unit.	○	○
		Oil or cutting chips are not adhered. The cable may be broken.	Replace the fan. Replace the drive unit.		

Alarm No. 46	Motor overheat / Thermal error
	Thermal protection function of the motor or in the detector, has started its operation.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the repeatability. (Note) For the spindle, check the "temperature" of the "spindle unit" displayed on the drive monitor screen.	[1] The alarm occurs before operation. [2] The "temperature" displayed on the drive monitor screen is different from ambient temperature.	Check the investigation item No. 2.	○	○
		[1] The alarm occurs after the operation continues for a while. [2] The "temperature" displayed on the drive monitor screen rises drastically during the spindle operation.	Check the investigation item No. 5.		
2	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connector is disconnected (or loose).	Correctly install.	○	○
		The connector is not disconnected.	Check the investigation item No. 3.		
3	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty.	Replace the cable.	○	○
		The connection is normal.	Check the investigation item No. 4.		
4	When using MDS-B-HR, check if the motor is validated even if a motor thermal is not provided?	SV034/bit2 = 0	Set SP034/bit2 to 1.	○	
		SV034/bit2 = 1	Check the investigation item No. 5.		
5	Check the overload % (servo) or load meter (spindle).	The load is large.	Servo: Check the investigation item No. 6. Spindle: Check the investigation item No. 8.	○	○
		The load is not large.	Check the investigation item No. 9.		
6	Is the unbalance torque high?	The constant load torque (friction + unbalance) is 60% or more.	Select the motor so that the constant load torque is 60% or less.	○	
		The constant load torque is less than 60%.	Check the investigation item No. 7.		
7	Was the overload alarm (50) forcibly reset by turning the drive unit power OFF?	The alarm was forcibly reset.	Do not turn the drive unit's power OFF when an overload alarm occurs. (The NC power can be turned OFF.)	○	○
		The alarm was not forcibly reset.	Check the investigation item No. 9.		
8	Check the parameter settings.	The parameter is not set correctly.	Correctly set.		○
		The parameter is set correctly.	Check the investigation item No. 9.		
9	Measure the motor temperature when the alarm occurs. (Note) For the spindle motor, check the "temperature" of the "spindle unit" shown on the drive monitor screen.	The motor unit is hot.	Check the investigation item No. 10.	○	○
		The motor is not hot.	Check the investigation item No. 12.		
10	When using a motor with fan, check whether the fan is stopped, or it is clogged with dust, etc.	The motor fan was stopped.	Check the investigation item No. 11.	○	○
		The motor fan wind flow is poor.	Clean the fan and ventilation holes inside of the motor.		
		The direction of the ventilation is opposite.	Change the connected phase sequence.		
11	Check the fan wiring.	There is no problem.	Check the investigation item No. 12.	○	○
		The cable is broken.	Replace the cable.		
		The cable is not broken.	Replace the fan.		
12	Replace the drive unit or motor with another drive unit or motor, and check whether the fault is on the drive unit side or motor side	The alarm is on the drive unit side.	Replace the drive unit.	○	○
		The alarm is on the motor side.	Replace the motor.		
13	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. 48	Motor side detector: Error 5
	The motor side detector (linear scale in the case of linear motor) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 49	**Motor side detector: Error 6**
	The motor side detector (linear scale in the case of linear motor) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	

Alarm No. 4A	**Motor side detector: Error 7**
	The motor side detector (linear scale in the case of linear motor) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 4B	**Motor side detector: Error 8**
	The motor side detector (linear scale in the case of linear motor) detected an error. As details differ for each detector, refer to "Detector alarm" in 6-2-1.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "1B" items.			○	○

Alarm No. 4C	**Current error at magnetic pole estimate**
	Current detection failed at the pulse-applied magnetic pole estimation by IPM spindle motor.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the pulse-applied time.	The pulse-applied time can be short.	Set the pulse-applied time longer. Setting parameter:SP142 1) The pulse-applied time (0 to 350) 2) For low-speed coil:1)+1000 3) The polarity of magnetic pole estimate: Reverse polarity is "-" After the adjustment, perform the magnetic pole detection control again.	-	○
		The alarm also occurs after the pulse-applied time is set.	Replace the unit.		

Alarm No. 4E	**NC command mode error**
	The mode outside the specification was input in spindle control mode selection.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the wiring and setting environment. 1) Correctly grounded? 2) Any noise generating devices around the unit? 3) Are the speed/position detector cables correctly shielded?	1) The grounding is incomplete.	Correctly ground.		○
		2) The alarm occurs easily when a specific device operates.	Use noise measures on the device described on the left.		
		3) The cable is not correctly shielded.	Correctly shield the cable.		
		No abnormality is found in particular.	Replace the drive unit.		

Alarm No. 4F	**Instantaneous power interrupt**
	The control power supply has been shut down for 50ms or more.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the repeatability.	The alarm occurs occasionally.	Check the power facilities.	-	○
			Check the wiring of the control power.		

Alarm No. 50	**Overload 1**
	Overload detection level became over 100%. The motor or the drive unit is overloaded.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the overload parameters. Servo:SV021, SV022 Spindle:SP021,SP022	The standard values (below) are not set. Servo:SV021 = 60, SV022 = 150 Spindle:SP021=60,SP022=120 IPM:SP021=300,SP022=100	Set the standard values.	○	○
		The standard values are set.	Investigate item 2.		
2	Check the items below displayed on the drive monitor screen during operation. <Servo> Max.current 3 (%) Overload(%) <Spindle> Load meter(%)	Perform the machining such as rapid traverse, where an alarm occurs. The examples are below. <Servo> [1] Max.current 3 constantly displays the maximum value. [2] Overload increases at a rapid speed. <Spindle> [1] The time to display 120% lasts long. [2] The value is higher than normal.	Servo [1] Mount a smaller workpiece. [2] Increase the time constant. [3] Check the investigation item No.6.		
			Spindle [1] Lower the cutting amount. [2] Extend the cycle time.	○	○
		The value is within the supposed level and there is no problem.	Investigate item 3.		
3	Check whether machine resonance is occurring. Check for vibration and abnormal noise at the spindle and table.	Resonance is occurring when a tool or workpiece is mounted or during machining. (The load inertia changes)	Adjust the parameters. [1] Set the optimal notch filter. [2] Lower VGN1 (SV005,SP005).	○	
		Resonance is not occurring.	Investigate item 4.		
4	Check whether the shaft sways when the motor is stopped. "Hunting" of the spindle "Vibration" of the table	The motor is hunting.	Adjust the parameters. [1] Increase VGN1 (SV005, SP005). [2] Lower VIA (SV008, SP008).	○	
		The motor is not hunting.	Servo: Investigate item 5 Spindle: Investigate item 7		
5	Check the brake operation. [1] Check the brake relay. [2] Check the connector (CN20) connection.	The motor brakes are not released.	Correct the faulty section.	○	
		The motor brake operation is normal.	Investigate item 6.		
6	Check the load current with the NC Servo Monitor, and investigate the machine load.	The cutting load is large.	Lower the cutting load.	○	
		There is interference with the positioning pin.	When using the positioning pin, turn the servo OFF when stopped.		
		An excessive force is applied from the machine.	Check whether the ball screw is bent, or whether there is a fault in the guide.		
		The machine load is not large.	Investigate item 8.		
7	Check the PLG output waveform. TS5690 cannot be checked.	There is a problem.	Adjust the PLG output waveform. For TS5690, reinstall.		○
		Normal	Investigate item 8.		
8	Confirm the motor capacity selection again.	The motor performance is insufficient.	Lower the acceleration/deceleration rate or cutting load.	○	○
		The motor performance is sufficient.	Check the tool mounted on the spindle. - The service life is reached. Increase the number of teeth (chips) of the milling cutter, etc. Investigate item 9.		
9	Try replacing the drive unit.	Improved.	Use as it is.	○	○
		Not improved.	Replace the motor.		

(Note) NR and PR resetting are not possible when the overload level is 50% or more. Do not forcibly reset (AR) by turning the unit power OFF. If AR resetting is used at 50% or higher, the level is set to 80% when the power is turned ON next. (Servo)

Alarm No.	Overload 2
51	Current command of more than 95% of the unit's max. current was being continuously given for longer than 1 second in a servo system. In a spindle system, current command of more than 95% of the motor's max. current was being continuously given for longer than 1 second.

	Investigation details	Investigation results	Remedies	SV	SP
1	Did the alarm occur immediately after READY ON?	The alarm occurred after ready ON before operation starts.	Investigate item 2.	○	
		The alarm occurred after normal operation.	Investigate item 5.		
2	Check that the PN voltage is supplied to the drive unit. MDS-D-SVJ3 Series is not connected to the power supply unit, so investigate item 3 for MDS-D-SVJ3. [1] Is the CHARGE lamp ON?	The CHARGE lamp becomes dark. L+ or L- screw was loosened.	Increase the capacity of power supply. Tighten the L+ and L- screws.	○	
		Approx. 300V is correctly supplied.	Investigate item 3.		
3	Check the motor power cable (U, V, W phases). [1] The power cable is not connected. [2] Is the cable connected to the motor for another axis?	The connections are incorrect. Connected to the incorrect axis.	Connect correctly.	○	
		The connections are correct.	Investigate item 4.		
4	Check the detector cable connection. [1] Is the cable connected to the motor for another axis?	The connections are incorrect.	Connect correctly.	○	
		The connections are correct.	Investigate item 5.		
5	Check whether the machine has collided.	The machine has collided.	Check the machining program and soft limit settings.	○	
		The machine has not collided.	Investigate item 6.		
6	Check whether the current value on the NC Servo Monitor screen is saturated during acceleration/deceleration.	The current is saturated during acceleration/deceleration.	Increase the acceleration/ deceleration time constant.	○	
		The current value during acceleration/ deceleration is appropriate.	Investigate item 7.		
7	Check the detector Feedback.	The Feedback signal is abnormal. - The droop does not stabilize.	Replace the detector. (With the absolute position system, the zero point must be established.)	○	
		The Feedback signal is normal.	Replace the drive unit.		
8	Check the load meter value.	The value is large.	Lower the load.		○
		The value is normal.	Investigate item 9.		
9	Check the PLG output waveform. For TS5690, waveform cannot be checked.	There is a problem.	Adjust the PLG output waveform.		○
		Normal	Replace the drive unit.		

Alarm No.	Excessive error 1
52	A difference between the actual and theoretical motor positions during servo ON exceeded the setting value.

	Investigation details	Investigation results	Remedies	SV	SP
1	The load inertia is large. The unbalance torque in the Z (gravity) direction is high. An excessive workpiece or tool is mounted on the spindle.	The load inertia is excessive.	[1] Lower the machine weight applied to the servo motors (by the unbalance torque). [2] Lower the weight of the workpiece.	○	○
		The load inertia is normal.	Investigate item 2.		
2	Check the excessive error detection width. Servo SV053 Spindle SP023 (Interpolation, spindle synchronization)SP053 (Non-interpolation)	The excessive error detection width is too small. Servo standard value: SV053 ={RAPID/(60*PGN1)}/2 Spindle standard value: No alarm is set at SP023 =120:0 SP053 =motor max. speed×6/PGV/2	Set appropriate values.	○	○
		Appropriate values are set.	Investigate item 3.		
3	Check the position detector polarity. SV017/bit4 (Servo) SP017/bit4 (Spindle: position FB) SP017/bit0 (Spindle: speed FB) #3106/bit7 (Synchronous tap control)	The polarity is reversed.	Correctly set the parameters.	○	○
		Normal.	Investigate item 4.		
4	Check the alarm No. "51" items.			○	○

Alarm No. 53	Excessive error 2 A difference between the actual and theoretical motor positions during servo OFF exceeded the setting value.			

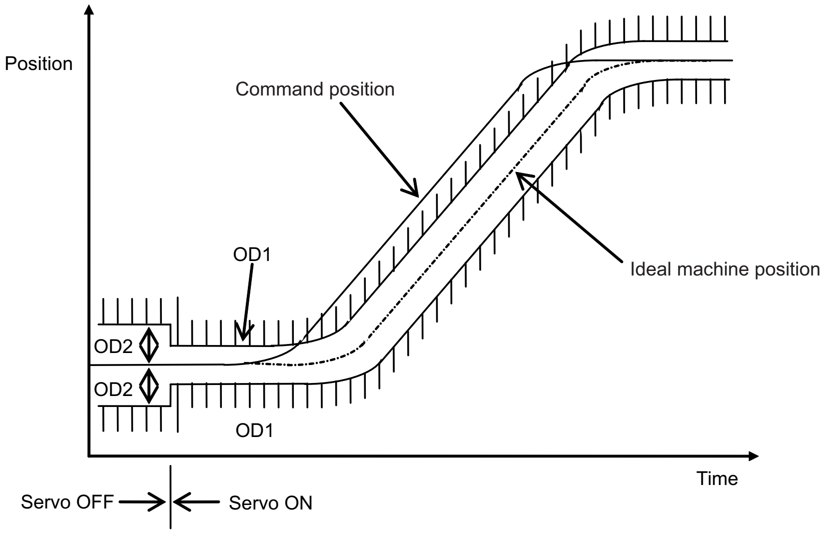
	Investigation details	Investigation results	Remedies	SV	SP
1	Check the follow-up function while the NC is in the servo OFF state.	The axis detachment function (NC parameter) is invalid. (Note) For the axis detachment function, refer to the NC manual.	Check the investigation item No. 2.	○	
		The axis detachment function (NC parameter) is valid. (Note) For the axis detachment function, refer to the NC manual.	Check the investigation item No. 3.		
2	Check whether the axis has moved during servo OFF (either by visual inspection or monitor the position droop waveform). [1] Check if the motor brake is released in the middle. [2] Check if the axis moves because the servo OFF is applied during the C axis mode.	[1] The axis has moved. [2] The servo OFF is applied during the mode.	[1] Adjust the brakes, etc. so that the axis does not move. [2] Avoid the servo OFF from being applied during position control.	○	
		The axis has not moved.	Check the investigation item No. 3.		
3	Check the excessive error detection width. SV026 (Servo) (Note) Set the same value to SV023.	The excessive error detection width is too small. SV026 ={RAPID/(60*PGN1)}/2	Set an appropriate value.	○	
		An appropriate value is set.	Check for problems on the NC side, such as the position FB follow-up control.		

Alarm No. 54	Excessive error 3 When an excessive error 1 occurred, detection of the motor current failed.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check that the PN voltage is supplied to the drive unit. [1] Is the CHARGE lamp ON?	The voltage is not supplied.	Correctly supply the PN voltage.	○	○
		It is correctly supplied (DC300V).	Investigate item 2.		
2	Check the motor power cable (U, V, W phases). [1] The power cable is not connected. [2] Is the cable connected to the motor for another axis?	The connections are incorrect.	Connect correctly.	○	○
		The connections are correct.	Replace the drive unit.		

Supplement (servo)

Depending on the ideal machine position in respect to the command position, the actual machine position could enter the actual shaded section shown below, which is separated more than the distance set in OD1.



Alarm No. 56	**Commanded speed error**
	In C axis control mode, excessive NC commanded speed was detected.(In C axis control mode)

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the rotation speed displayed on the spindle drive monitor to see if the C axis rotation speed exceeds 1.15 times of the set speed during rapid traverse.	Exceed.	Increase the rapid traverse time constant.		○
		Not exceed.			

Alarm No. 58	**Collision detection 1: G0**
	When collision detection function (set to SV060) was valid, the disturbance torque in rapid traverse (G0) exceeded the collision detection level.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check whether the machine has collided during G0 operation.	A collision has occurred at the table, turret or spindle head in the machine during movement.	Check the machining program and soft limit settings.	○	
		There is no collision at the table, turret and spindle head in the machine during movement	Adjust the tolerable disturbance torque SV060. (Note) Set the detection level to be 1.5 times or more of the maximum torque.		

Alarm No. 59	**Collision detection 1: G1**
	When collision detection function was valid (SV035.c1G1 was set), the disturbance torque in cutting feed (G1) exceeded the collision detection level.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check whether the machine has collided during G0 operation.	The machine has collided during movement.	Check the machining program and soft limit settings.	○	
		The machine has not collided.	Increase the detection level (SV035. clG1). G1 collision detection level =SV060×c1G1(001 to 111) (Note) Set the detection level larger than the maximum cutting load.		

Alarm No. 5A	**Collision detection 2**
	When collision detection function was valid, the command torque reached the max. motor torque.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check whether the machine has collided.	The machine has collided.	Check the machining program and soft limit settings.	○	
		The machine has not collided.	Check the investigation item No. 2.		
2	Check whether the current value on the NC Servo Monitor screen is saturated during acceleration/deceleration.	The current is saturated during acceleration/deceleration.	Check the investigation item No. 3.	○	
		The current value during acceleration/ deceleration is appropriate.	Investigate the cause of the load fluctuation.		
3	Can the acceleration/deceleration time constant be changed?	The constant can be changed.	Increase the acceleration/ deceleration time constant.	○	
		The constant cannot be changed.	Set to ignore collision detection method 2.		

Alarm No. 5B	**Safety observation: Commanded speed error**
	In safety monitoring mode, the commanded speed was detected to exceed the safe speed.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the commanded speed on the NC side.	The commanded speed and safe speed limit value are the same.	Reduce the commanded speed on the NC side or increase the safe speed limit value.	○	○
		The commanded speed is slower than the safe speed.	Replace the drive unit.		

Alarm No. 5D	**Safety observation: Door state error**
	In safety monitoring mode, the door state signal from the NC and the same signal from the drive unit don't match. Otherwise, door open state was detected in normal mode.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the DI input timing.	Both NC side and drive unit side input timings match one another within 500ms.	Review the DI input sequence. Check if the cable for the DI input signal is broken.	○	○
		NC side and drive unit side inputs do not match one another within 500ms.	Investigate the wiring and connection environment.		

Alarm No. 5E	**Safety observation: Feedback speed error**
	In safety monitoring mode, the motor speed was detected to exceed the safe speed.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the DI input timing.	The feedback speed and safe speed limit value are the same.	Reduce the commanded speed on the NC side or increase the safe speed limit value.	○	○
		The feedback speed is slower than the safe speed.	Replace the drive unit.		
2	Check the wiring and setting environment. 1) Correctly grounded? 2) Any noise generating devices around the unit? 3) Are the speed/position detector cables correctly shielded?	1) The grounding is incomplete.	Correctly ground.	○	○
		2) The alarm occurs easily when a specific device operates.	Use noise measures on the device described on the left.		
		3) The cable is not correctly shielded.	Correctly shield the cable.		
		No abnormality is found in particular.	Replace the drive unit.		

Alarm No. 5F	**External contactor error**
	A contact of the external contactor is welding.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check whether the contactor's contact has melted.	The contactor is melted.	Replace the contactor.	○	○
		The contactor is not melted.	Check the investigation item No. 2.		
2	Check whether the axis where an alarm occurred was a contactor control axis.	The alarm occurred at the axis where the contactor control is not executed.	Check the parameter.(SVJ3/SPJ3) With contactor control Servo:SV082, Spindle:SP227 0800h is added to the setting value. Without contactor control Change "Bit A,B" to "00" in the parameter above.	○	○
		The alarm occurred at the axis where the contactor control is executed.	Replace the drive unit.		

Alarm No. 80	**Main side detector cable error**
	A pulse type cable is used for the motor side detector.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the parameters. Servo:SV025 = "x200" Spindle:SP031 = "x200" And then, check the connected cable and the detector.	The cable type is pulse.	Replace the cable to the serial type.	○	○
		There is no problem with the selection of the detector and cable.	Replace the detector or cable.		

Alarm No.	**Sub side detector cable error**
81	The cable type of machine side detector does not match the detector specifications set by the parameter.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the below parameters match the connected detector and cable. Servo: SV025 Spindle: SP031	The detector does not match the specifications.	Replace the detector.	○	○
		The parameter is not correct.	Set the parameters so that they meet the machine side detector. <Servo:SV025> - Rotary Pulse 2xxx Serial 6xxx - Scale Pulse 8xxx Serial Axxx <Spindle:SP031> Pulse 4200 Serial 6200		
		There is no problem with the selection of the detector and cable.	Replace the detector or cable.		

Alarm No.	**Drive unit communication error**
87	The communication frame between drive units was aborted.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the connection of the optical communication cable between drive units.	The cable and connector were loose.	Connect again so as not to be loosened.	○	○
		The cable and connector were not loose.	Replace the cable. Check the investigation item No. 2.		
2	Check the repeatability.	The error is always repeated (in high-speed synchronous tapping).	Replace the servo drive or spindle drive unit that is used for high-speed synchronous tapping.	○	○

Alarm No.	**Watchdog**
88	The system does not operate correctly.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check whether the servo or spindle software version was changed recently.	The version was changed.	Change software version back to the original.	○	○
		The version was not changed.	Check the investigation item No. 2.		
2	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 3.		
3	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

(Note) For MDS-D-SVJ3/SPJ3 Series, "888" is displayed.

Alarm No.	**Drive unit communication data error 1**
8A	The communication data 1 between drive units exceeded the tolerable value in the communication between drive units.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the error has occurred during high-speed synchronous tapping.	The error occurs during the synchronous tapping.	[1]Check the tool. [2]Adjust the tapping.	○	○
		The error does not occur during the synchronous tapping.	Check the investigation item No. 2.		
2	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 3.		
3	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

Alarm No. **8B**	**Drive unit communication data error 2** The communication data 2 between drive units exceeded the tolerable value in the communication between drive units.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the error was occurred during the synchronous tapping.	The error occurs during the synchronous tapping.	[1]Check the tool. [2]Adjust the tapping.	○	○
		Check if the error has occurred during high-speed synchronous tapping.	Check the investigation item No. 2.		
2	Check the repeatability.	The error is always repeated.	Replace the drive unit.	○	○
		The state returns to normal once, but occurs sometimes thereafter.	Check the investigation item No. 3.		
3	Check if there is any abnormality in the unit's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	○

6-3-3 Troubleshooting for each warning No.

Warning No. **96**	**Scale feedback error** An excessive difference in feedback amount was detected between the main side detector and the MPI scale in MPI scale absolute position detection system.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	
2	Check the repeatability.	Occurs frequently.	Replace the detector.	○	○
		Is not repeated.	Check the investigation item No. 1.		

Warning No. **97**	**Scale offset error** An error was detected in the offset data that is read at the NC power-ON in MPI scale absolute position detection system.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	
2	Check the repeatability.	Occurs frequently.	Replace the detector.	○	○
		Is not repeated.	Check the investigation item No. 1.		

Warning No. **9B**	**Incremental detector/magnetic pole shift warning** For the incremental detector, an error was detected in the magnetic pole shift amount set in the magnetic pole shift amount parameter "SV028".

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	
2	Check the repeatability.	Occurs occasionally.	Execute magnetic pole detection control again and reset SV028.	○	○
		Is not repeated.	Check the investigation item No. 1.		

Warning No. **9E**	**Absolute position detector: Revolution counter error** An error was detected in the revolution counter of the absolute position detector. The absolute position data cannot be compensated.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if there is any abnormality in the detector's ambient environment. (Ex. Ambient temperature, noise, grounding)	Take remedies according to the causes of the abnormality in the ambient environment.		○	
2	Check the repeatability.	Occurs frequently.	Replace the detector.	○	○
		Is not repeated.	Check the investigation item No. 1.		

Warning No. 9F	**Battery voltage drop**
	The battery voltage that is supplied to the absolute position detector dropped. The absolute position data is retained.

	Investigation details	Investigation results	Remedies	SV	SP
1	Change the used battery and check whether the warning does not occur. (Turning the power OFF and ON is required.)	The warning does not occur.	The battery has been drained.	○	
		The warning occurs.	Check the investigation item No. 2.		
2	Check whether the battery cable is disconnected, broken, or wired incorrectly.	The connection is faulty.	Correct the connection. Replace the cable.	○	
		The connection is normal.	Check the investigation item No. 3.		
3	Measure the new battery voltage.	Less than 3.4V.	Replace the battery.	○	
		3.4V or more.	Check the investigation item No. 6. When a battery box is used, check the investigation item No. 4.		
4	Check whether the cable connecting between the battery box and CN9 is short-circuited, broken, or wired incorrectly.	The connection is faulty.	Correct the connection. Replace the cable.	○	
		The connection is normal.	Check the investigation item No. 5.		
5	Disconnect the BT-LG cable of the battery box, and then measure the voltage between DO(ALM) and DO-COM terminals at power ON.	Low voltage.	Replace the battery box.	○	
		Equivalent of 24V.	Check the investigation item No. 6.		
6	Perform a conductivity check with the detector cable between BT and LG of the drive unit in which the warning was detected. (Note) Make sure that the detector side connector is disconnected.	Resistance value is low.	Replace the cable.	○	
		Resistance value is 100MΩ or more.	Replace the detector. (With the absolute position system, the zero point must be established.)		

(Note) When warning 9F occurs, do not turn the drive unit power OFF to ensure that the absolute position data is held.
Replace the battery with the drive unit power ON.

Warning No. A3	**Distance-coded reference check / initial setup warning**
	When the detector with distance-coded reference marks is used, this warning is issued until the axis reaches the reference position during the initial setup of the distance-coded reference check function. This warning disappears after the axis has reached the position.

	Investigation details	Investigation results	Remedies	SV	SP
1	Warning does not disappear.	Stopped on the way to the reference position.	Setup again.	○	-

Warning No. A6	**Fan stop warning**
	A cooling fan built in the drive unit stopped.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the alarm No. "45" items.			○	○

Warning No. E0	**Over regeneration warning**
	Over-regeneration detection level exceeded 80%.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the acceleration/deceleration cycle.	The cycle operation being conducted is severe for the average output.	Extend the cycle operation time to the length that will not cause a warning.	○	○
		No problem.	Check the investigation item No. 2.		
2	Check the load inertia.	The load inertia is large.	Lower the load inertia.		

Warning No. **E1**	**Overload warning** Overload detection level exceeded 80%.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the motor is hot.	Motor is hot.	Check the alarm No. "50" items.		○
		Motor is not hot.	Check the investigation item No. 2.		
2	Check if an error occurs when executing acceleration/deceleration operation.	Error is not found in operation. Thus, operation is possible.	Ease the operation patter, if possible. If no alarm occurs, operation can be continued as it is.		○
		Error is found in operation.	Check the investigation item 3 or later of Alarm No. 50.		
3	Check the alarm No. "50" items.			○	○

Warning No. **E4**	**Set parameter warning** An incorrect parameter was detected among the parameters received from the CNC.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check the error parameter No.	SV001 to SV256 SP001 to SP256	Set the value within the designated setting range.	○	○
2	Check the spindle control input 4/bit 0 to 2.	Selected other than 000, 001, 010 and 100 when the alarm occurred.	Correctly select.		○

Warning No. **E6**	**Control axis detachment warning** Control axis detachment was commanded.

	Investigation details	Investigation results	Remedies	SV	SP
1	The status in which removal of the control axis was commanded from the NC is indicated.			○	

Warning No. **E7**	**In NC emergency stop state** Emergency stop was input from the CNC.

	Investigation details	Investigation results	Remedies	SV	SP
1	Check if the emergency stop is applied on the NC side.	The emergency stop is applied.	Check the investigation item No. 2.	○	○
		The emergency stop is cancelled.	Check the investigation item No. 3.		
2	Cancel the emergency stop.	Normally starts up.	Normal.	○	○
		"E7" remains displayed.	Check the investigation item No. 3.		
3	Check whether an alarm is occurring in another drive unit.	An alarm is occurring in another drive unit.	Reset the alarm in the other drive unit.	○	○
		An alarm is not occurring.	Check the investigation item No. 4.		
4	Turn the power of NC and 200VAC (400V) ON again			○	○

Warning No. **E9**	**Instantaneous power interruption warning** The power was momentarily interrupted.

	Investigation details	Investigation results	Remedies	CV
1	Check the alarm No. "71" items.			○

Warning No. **EA**	**In external emergency stop state** External emergency stop signal was input.

	Investigation details	Investigation results	Remedies	CV
1	Check whether the specifications allow use of the external emergency stop.	Use is not allowed.	Invalidate the external emergency stop.	○
		Use is allowed.	Check the investigation item No. 2.	
2	Measure the input voltage of the CN23 connector. (While emergency stop is cancelled.)	24V is input.	Replace the power supply unit.	○
		24V is not input.	Check whether the external emergency stop cable is broken, or check the external contact operation.	

6-3-4 Parameter numbers during initial parameter error

If an initial parameter error (alarm 37) occurs, the alarm and the No. of the parameter set exceeding the setting range will appear on the NC Diagnosis screen as shown below.

S02 Initial parameter error ○○○○□
○○○○ : Error parameter No.
□ : Axis name

If an error No. larger than the servo parameter No. is displayed for the servo drive unit, the alarm is occurring for several related parameters. Refer to the following table, and correctly set the parameters.

Error parameter No.	Details	Related parameters
2301	The following settings are overflowing. [1] Electronic gears [2] Position loop gain [3] Speed feedback	SV001, SV002 SV003, SV018 SV019, SV020 SV049
2302	The absolute position parameter is valid when a high-speed serial incremental detector (OSE104 or OSE105) is connected. [1] Replace the detector to the one with absolute position specification.	SV017, SV025
2303	No servo option is found. [1] The closed loop (including the ball screw end) [2] Dual feedback control function	SV025 SV017
2304	No servo option is found. [1] SHG control function	SV057 SV058
2305	No servo option is found. [1] Adaptive filtering function	SV027
13001 to 13256	Parameter error The parameter value is outside the tolerable range. The alarm No. is the No. of the spindle parameter where an error occurred.	Check the indicated spindle parameter.

6-3-5 Troubleshooting the spindle system when there is no alarm or warning

If an abnormality is observed in the spindle system but no alarm or warning has occurred, refer to the following table and check the state.

[1] The rotation speed command and actual rotation speed do not match.

	Investigation item	Investigation results	Remedies
1	Check the commanded speed and the spindle rotation speed displayed on the drive monitor screen.	The speed command is not input correctly.	Input the correct speed command.
		The speed command is correct.	Check the investigation item No. 2.
2	Check whether there is slipping between the motor and spindle. (When connected with a belt or clutch.)	There is slipping.	Repair the machine side.
		No particular problems found.	Check the investigation item No. 3.
3	Check the spindle parameters (SP026, SP129 and following).	The correct values are not set.	Set the correct values.
		The correct values are set.	Replace the spindle drive unit.

[2] The acceleration/deceleration time is long or has increased in length.

	Investigation item	Investigation results	Remedies
1	Check whether the friction torque or load inertia has increased.	The friction torque has increased.	Repair the machine side.
		No particular problems found.	Check the investigation item No. 2.
2	Check if there is any abnormality in the motor's rotation during coasting.	The bearings do not rotate smoothly.	Replace the spindle motor.
		The bearings rotate smoothly.	Check the investigation item No. 3.
3	Check whether the torque limit signal has been input.	The signal has been input.	Release the input signal.
		The signal is not input.	Replace the drive unit.

[3] The motor stops during cutting.

	Investigation item	Investigation results	Remedies
1	Check the load rate (load meter value) during cutting.	The load meter sways over 120% during cutting.	Reduce the cutting amount.
		No particular problems found.	Check the investigation item No. 2.
2	Carry out the same investigations and remedies as section (4).		

[4] The vibration and noise (gear noise), etc., are large.

	Investigation item	Investigation results	Remedies
1	Check the machine's dynamic balance. (Coast from the maximum speed.)	The same noise is heard during coasting.	Repair the machine side.
		No particular problems found.	Check the investigation item No. 2.
2	Check whether there is a resonance point in the machine. (Coast from the maximum speed.)	Vibration and noise increase at a set rotation speed during coasting.	Repair the machine side.
		No particular problems found.	Check the investigation item No. 3.
3	Check the machine's backlash.	The backlash is great.	Repair the machine side.
		No particular problems found.	Check the investigation item No. 4.
4	Change the setting of the speed loop parameter (SP005:VGN1).	The vibration and noise are lost when the setting value is lowered by approx.100.	Change to the setting value. (Note) The impact response will drop.
		The symptoms do not change even if the above value is set.	Return the setting values to the original values. Check the investigation item No. 5.
5	Jiggle the detector connectors (drive unit side and detector side) and check if they are disconnected.	The connection is loosened.	Correctly connect the connector.
		The connector fixing is normal.	Check the investigation item No. 6.
6	Turn the power OFF, and check the connection of the speed detector cable with a tester.	The connection is faulty or disconnected.	Replace the detector cable. Correct the connection.
		The connection is normal.	Replace the drive unit.

[5] The spindle coasts during deceleration.

	Investigation item	Investigation results	Remedies
1	When connected with a belt or clutch, check whether there is slipping between the motor and spindle.	There is slipping.	Check the machine side and repair it.
		No particular problems found.	Replace the drive unit.

[6] The rotation does not stabilize.

	Investigation item	Investigation results	Remedies
1	Check the spindle parameter SP005 (SP008) settings.	The rotation stabilizes when the settings values are both set to approx. double.	Change the setting value. Note that the gear noise may increase.
		The symptoms do not change even when the above value is set.	Return the setting values to the original values. Check the investigation item No. 2.
2	Manually shake the speed detector connectors (spindle drive unit side and speed detector side) to check if they are disconnected.	The connector is disconnected (or loose).	Correctly connect the connector.
		The connector is not disconnected (or loose).	Check the investigation item No. 3.
3	Turn the power OFF, and check the connection of the speed detector cable with a tester. (Especially check the shield wiring.)	The connection is faulty.	Replace the detector cable. Correct the connection.
		The connection is normal.	Check the investigation item No. 4.
4	Investigate the wiring and installation environment. 1) Is the ground correctly connected? 2) Are there any noise-generating devices near the drive unit?	1) The grounding is incomplete.	Correctly ground.
		2) The alarm occurs easily when a specific device operates.	Use noise measures on the device described on the left.
		No particular problems found.	Replace the spindle drive unit.

[7] The speed does not rise above the command speed sometimes.

	Investigation item	Investigation results	Remedies
1	Check the speed command. Check whether the override input is input from the machine operation panel.	The speed command is not input correctly.	Input the correct speed command.
		The speed command is input correctly.	Check the investigation item No. 2.
2	Check whether the load has suddenly become heavier.	The load has become heavier.	Repair the machine side.
		No particular problems found.	Check the investigation item No. 3.
3	Manually rotate the motor bearings and check the movement.	The bearings do not rotate smoothly.	Replace the spindle motor.
		The bearings rotate smoothly.	Check the investigation item No. 4.
4	Manually shake the speed detector connectors (spindle drive unit side and speed detector side) to check if they are disconnected.	The connector is disconnected (or loose).	Correctly connect the connector.
		The connector is not disconnected (or loose).	Check the investigation item No. 5.
5	Turn the power OFF, and check the connection of the speed detector cable with a tester. (Especially check the shield wiring.)	The connection is faulty.	Replace the detector cable. Correct the connection.
		The waveform is normal.	Replace the spindle drive unit.

7

Maintenance

Contents

7 Maintenance

⚠WARNING

1. Before starting maintenance or inspections, turn the main circuit power and control power both OFF. Wait at least fifteen minutes for the CHARGE lamp to turn OFF, and then using a tester, confirm that the input and output voltage are zero. Failure to observe this could lead to electric shocks.
2. Inspections must be carried out by a qualified technician. Failure to observe this could lead to electric shocks. Contact your nearest Mitsubishi branch or dealer for repairs and part replacement.

⚠CAUTION

1. Never perform a megger test (measure the insulation resistance) of the servo drive unit. Failure to observe this could lead to faults.
2. The user must never disassemble or modify this product.

7-1 Periodic inspections

7-1-1 Inspections

Periodic inspection of the following items is recommended.

[1] Are any of the screws on the terminal block loose? If loose, tighten them.
[2] Is any abnormal noise heard from the servomotor bearings or brake section?
[3] Are any of the cables damaged or cracked? If the cables move with the machine, periodically inspect the cables according to the working conditions.
[4] Is the core of the load coupling shaft deviated?

7-1-2 Cleaning of spindle motor

If you continue to use the spindle motor with dirt such as oil mist and dust adhered, its cooling performance degrades and the motor is unable to fully exercise its performance, which may cause the spindle motor overheat alarm. In some cases this may result in damage to the bearing or cooling fan. To ensure the cooling capability of the spindle motor's fan, carry out periodical cleaning of the spindle motor and its cooling fan according to the following cleaning procedure.
Note that the spindle motor SJ-VL Series is used as an example in this procedure. When cleaning the other spindle motors, carry it out based on this procedure.

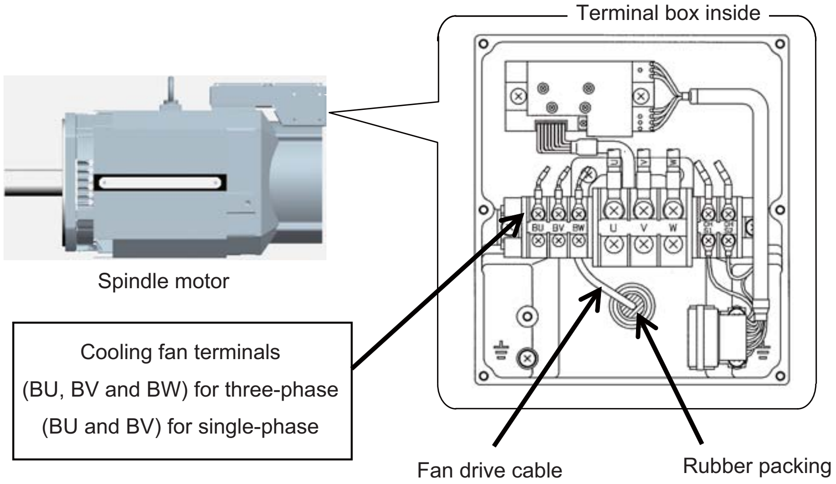
⚠CAUTION

Do not touch the motor for some time after turning OFF the power, as the motor remains at a high temperature. This may lead to burns.

(1) Detaching the cooling fan unit

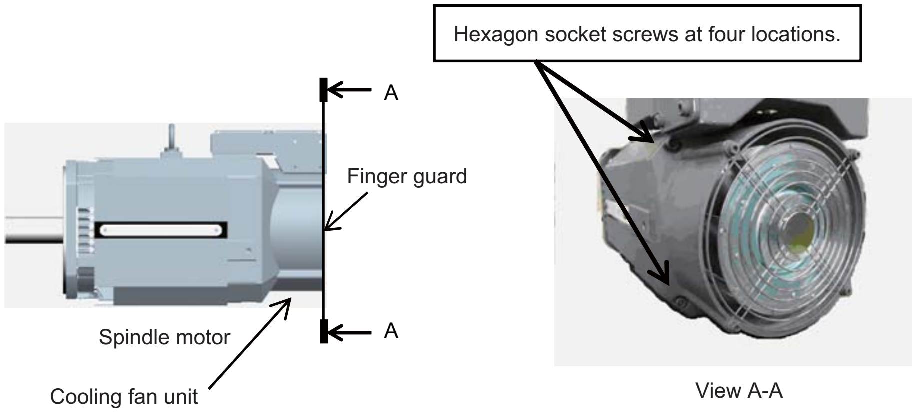
Remove the cooling fan unit from the spindle motor.

[1] Disconnect the cooling fan's terminals from the terminal block (See the diagram below).



[2] Detach the cooling fan unit from the spindle motor.

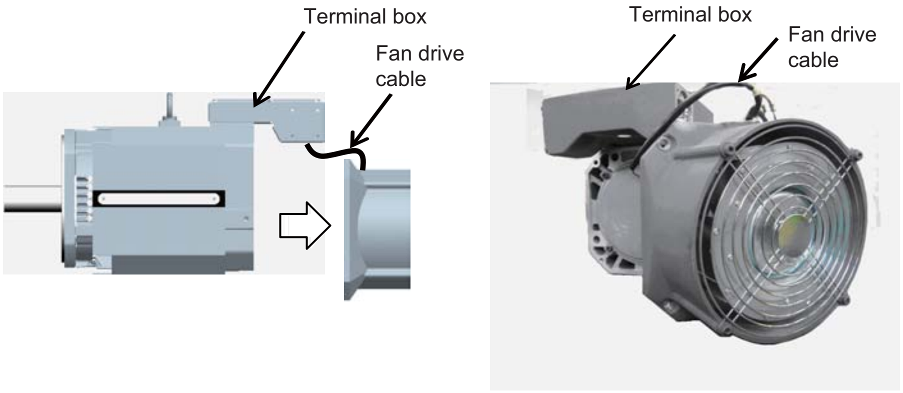
Remove the four hexagon socket screws used to secure the cooling fan unit to the spindle motor.



When slowly removing the cooling fan unit from the spindle motor, also unplug the fan drive cable slowly with the rubber packing left in the terminal box.

(Note 1) Pull out the solderless terminals one by one as the hole on the terminal box is small.

(Note 2) Take extra care not to damage the cable.



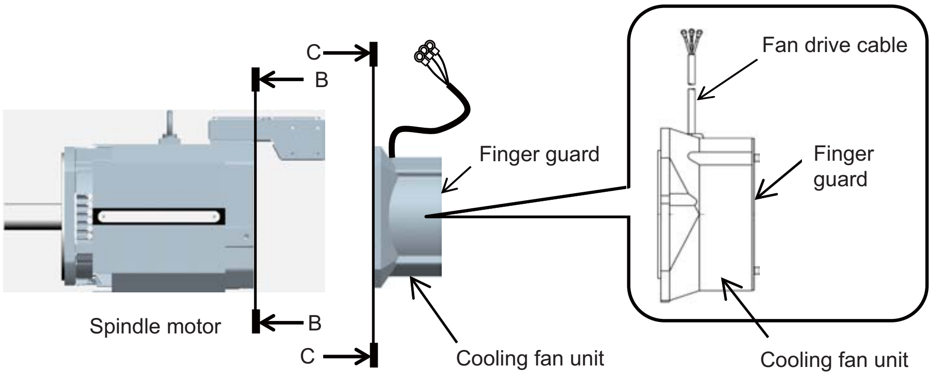
(2) Cleaning

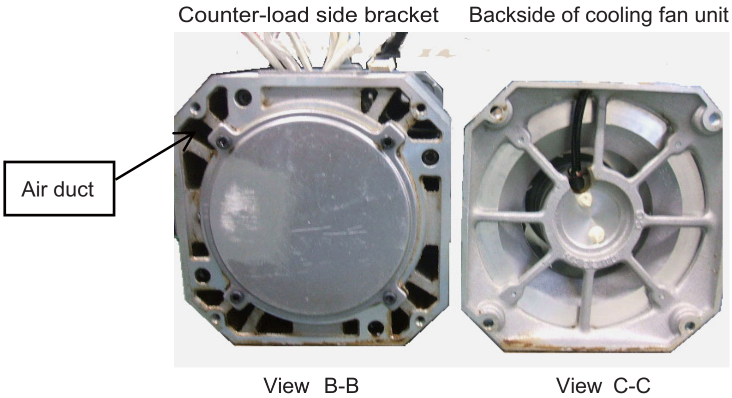
(a) Clean up the backside of the cooling fan unit and the air duct in the counter-load side bracket of the spindle motor.

Wipe dirt off the backside of the cooling fan unit and the air duct of the counter-load side bracket using wastes, etc.

(Note 1) Do not use air blow as this may cause foreign matters to enter the inner part of the cooling fan motor.

(Note 2) Do not wash with liquid detergent as the cooling fan motor is an electrical appliance.

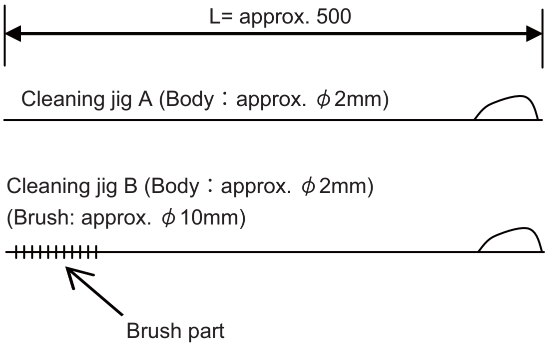




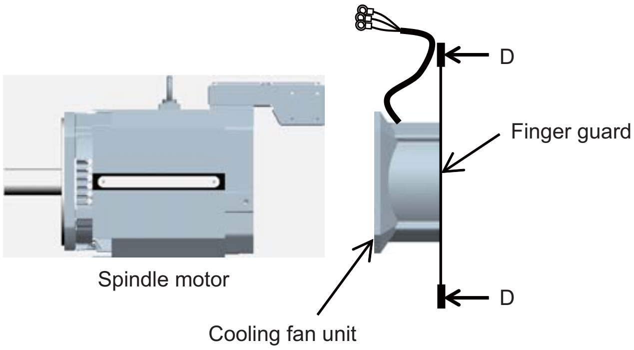
(b) Clean up the inner part of the fan case and the air duct of the spindle motor body

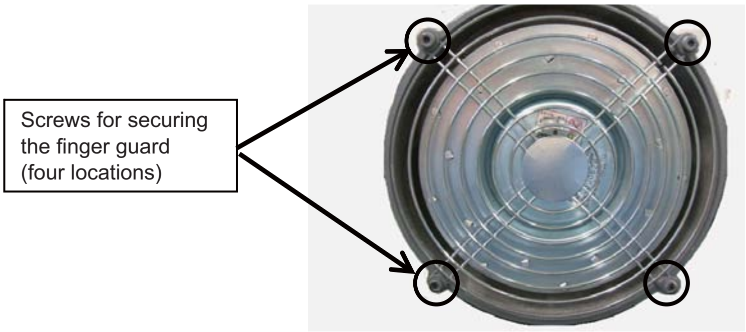
[1] Prepare the cleaning jigs (two types) as illustrated below.

The main body of the jigs A and B is a wire stick (approx. φ2mm) with the length of approx. 500mm. A brush is attached at the top of the cleaning jig B. For the brush on the jig B, do not choose a hard brush such as the one made of wires.



[2] Detach the finger guard from the cooling fan unit.
Remove the four screws used for securing the finger guard.

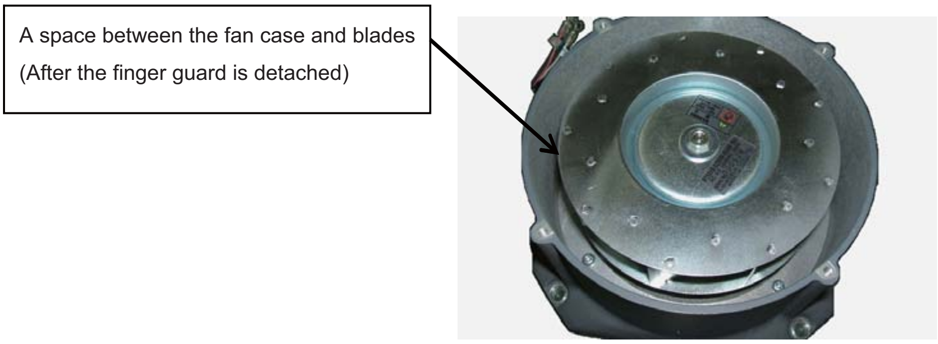




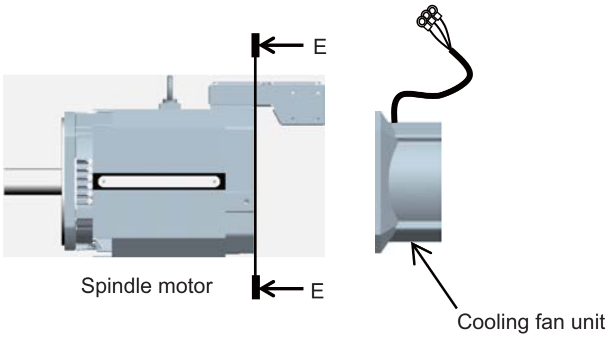
View D-D

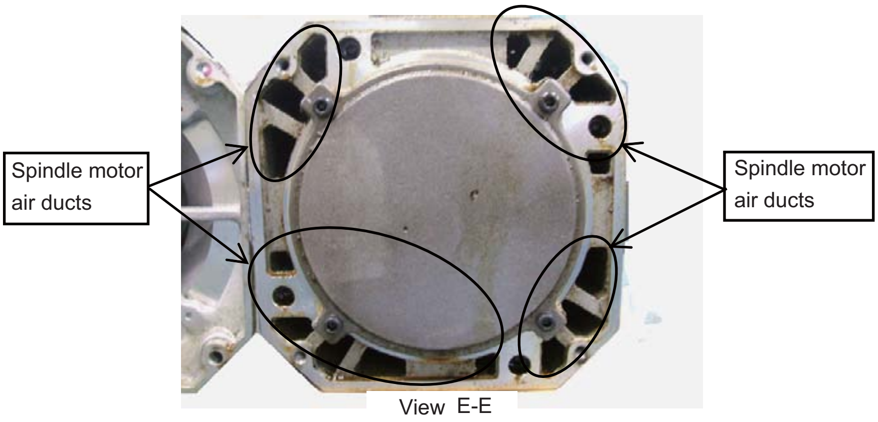
[3] Wipe dirt off the finger guard using wastes, etc.

[4] Use the cleaning jigs to clean the inner part of the cooling fan case.
Use the cleaning jigs A and B to scrape out dirt between the fan case and blades in the cooling fan unit, and wipe it off with wastes, etc.
(Note 1) Do not use air blow as this may cause foreign matters to enter the inner part of the cooling fan motor.
(Note 2) Do not wash with liquid detergent as the cooling fan motor is an electrical appliance.
(Note 3) Take extra care not to damage the cooling fan during cleaning.



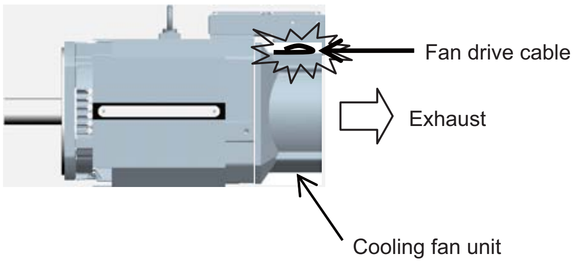
[5] Use the cleaning jigs to clean the air ducts of the spindle motor body.
Insert the cleaning jigs A and B into the motor's air ducts from the counter-load side bracket, scrape out the dirt, and wipe it off with wastes, etc.





(3) Assembling

After all the cleaning processes have been completed, attach the cooling fan unit to the motor in the order opposite to that of the detachment process. After attaching the unit, perform a test run to check the air blow direction of the fan, etc.
Be careful not to pinch the cable between the cooling fan unit and the terminal box.



7-2 Service parts

A guide to the part replacement cycle is shown below. Note that these will differ according to the working conditions or environmental conditions, so replace the parts if any abnormality is found. Contact Mitsubishi branch or your dealer for repairs or part replacements.

Part name		Standard replacement time	Remarks
Servo drive unit	**Smoothing capacitor**	10 years	The standard replacement time is a reference. Even if the standard replacement time is not reached, the part must be replaced if any abnormality is found.
	Cooling fan	10,000 to 30,000 hours (2 to 3 years)	
	Battery	10,000 hours (for MR-J3BAT / MDS-BTBOX-36)	
Servomotor	**Bearings**	20,000 to 30,000 hours	
	Detector	20,000 to 30,000 hours	
	Oil seal, V-ring	5,000 hours	

[1] Power smoothing capacitor:
The characteristics of the power smoothing capacitor will deteriorate due to the effect of ripple currents, etc. The capacitor life is greatly affected by the ambient temperature and working conditions. However, when used continuously in a normal air-conditioned environment, the service life will be ten years.

[2] Relays:
Contact faults will occur due to contact wear caused by the switching current. The service life will be reached after 100,000 cumulative switches (switching life) although this will differ according to the power capacity.

[3] Servomotor bearings:
The motor bearings should be replaced after 20,000 to 30,000 hours of rated load operation at the rated speed. This will be affected by the operation state, but the bearings must be replaced when any abnormal noise or vibration is found in the inspections.

[4] Servomotor oil seal, V-ring:
These parts should be replaced after 5,000 hours of operation at the rated speed. This will be affected by the operation state, but these parts must be replaced if oil leaks, etc., are found in the inspections.

7-3 Adding and replacing units and parts

⚠ **CAUTION**

1. Correctly transport the product according to its weight. Failure to do so could result in injury.
2. Do not stack the product above the indicated limit.
3. Installation directly on or near combustible materials could result in fires.
4. Install the unit as indicated at a place which can withstand the weight.
5. Do not get on or place heavy objects on the unit. Failure to observe this could result in injury.
6. Always use the unit within the designated environment condition range.
7. Do not allow conductive foreign matter such as screws or metal chips, or combustible foreign matter such as oil enter the servo drive or servomotor.
8. Do not block the intake or exhaust ports of the servo drive of servomotor. Failure to observe this could result in faults.
9. The servo drive and servomotor are precision devices. Do not drop them or apply strong impacts.
10. Do not install or operate a servo drive or servomotor which is damaged or missing parts.
11. When the unit has been stored for a long time, contact the Service Center or Service Station.
12. Connect the detector(CN2/CN3) immediately after the installation of the servo drive unit. In addition, when a battery box is used, immediately connect to the BTA/BTB connector. (prevention of absolute position data lost)

7-3-1 Replacing the drive unit

(1) Arrangement of replacing parts

Contact Mitsubishi branch or your dealer for an order or a replacement of the drive unit.
Place an order for the same type of a drive unit as the one to be replaced.

(2) Replacement procedure

Replace the drive unit with the following procedures.

Procedures

[1] Turn the breaker for the input power OFF. Make sure the CHARGE lamp of the power supply unit is turned OFF.
[2] Disconnect all the connecters and the wires connected to the drive unit.
[3] Remove the two (four) screws fixing the drive unit onto the control panel. Remove the drive unit from the control panel.
[4] Make a same setting for the rotary switch and the dip switch of the new drive unit as those of the uninstalled drive unit.
[5] Install a new drive unit by following the removal procedure in reverse.

(3) Restoration

Data backup and restoration is not required before replacing drive units because drive units’ data such as parameters are stored in the controller. However, carry out a backup of the whole system before replacement as a precautionary measure.
The power for keeping the detector’s position data of an absolute position system is supplied from the battery connected to the drive unit. Keep the power ON once for 30 minutes or more if possible, and make sure to complete the replacement within 60 minutes after charging the detector’s capacitor.

7-3-2 Replacing the unit fan

(1) Replacing parts

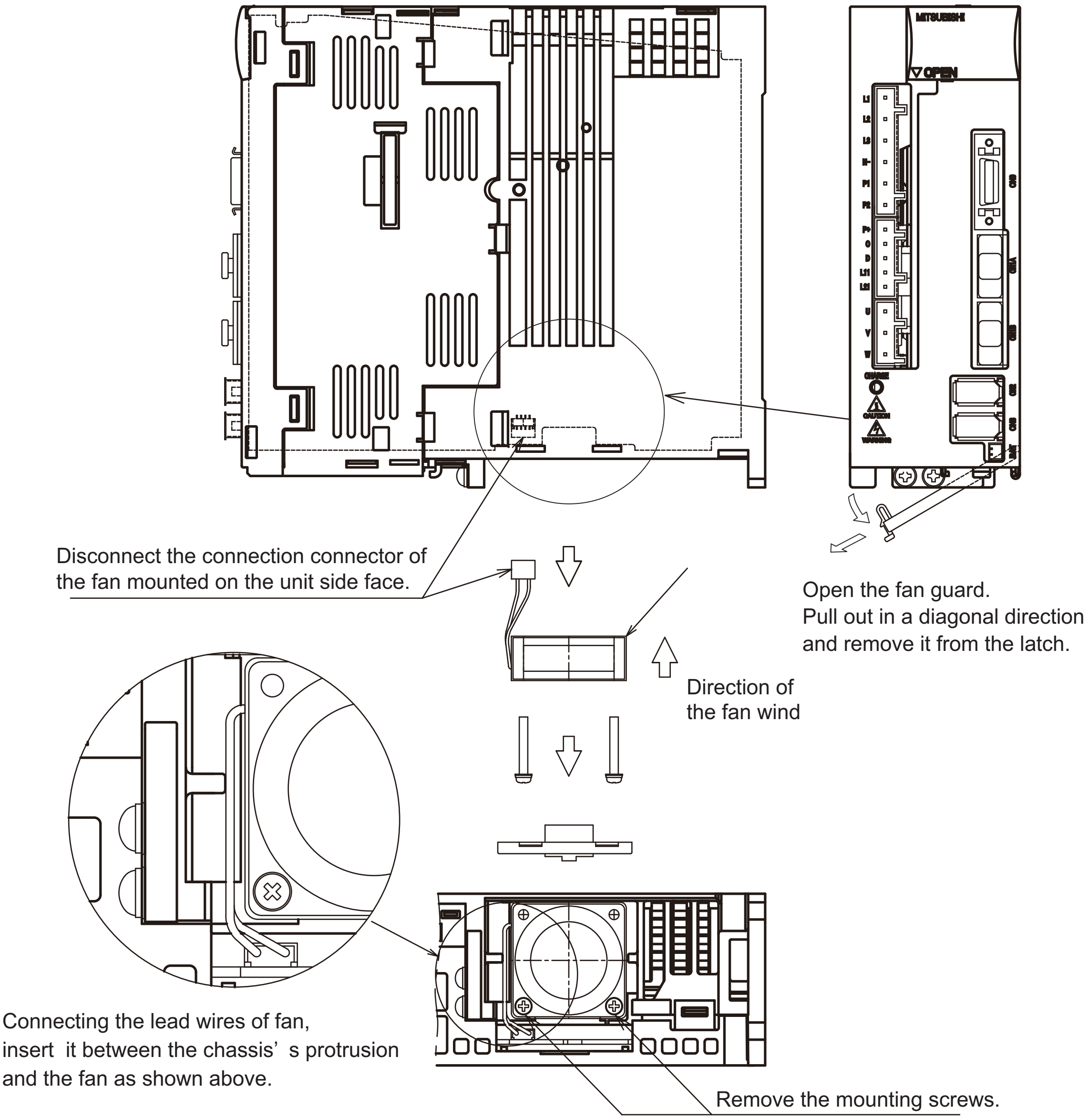
Unit fan type

Drive unit type	Fan type	Size [mm]
MDS-D-SVJ3-07NA, MDS-D-SPJ3-075NA	MMF-04C24DS BKO-CB0479H01	40SQ.
MDS-D-SPJ3-110NA	MMF-06F24ES-RP1 BKO-CA1638H01	60SQ.
MDS-D-SVJ3-10NA/20NA/35NA, MDS-D-SPJ3-22NA/37NA	MMF-06F24ES-RP3 BKO-CB0500H01	
MDS-D-SPJ3-55NA/75NA	MMF-08G24ES-CP1 BKO-CA1941H01	80SQ.

(2) Replacement procedure

Replace the unit fan with the following procedures.

<MDS-D-SVJ3-07NA, MDS-D-SPJ3-075NA>



Disconnect the connection connector of the fan mounted on the unit side face.

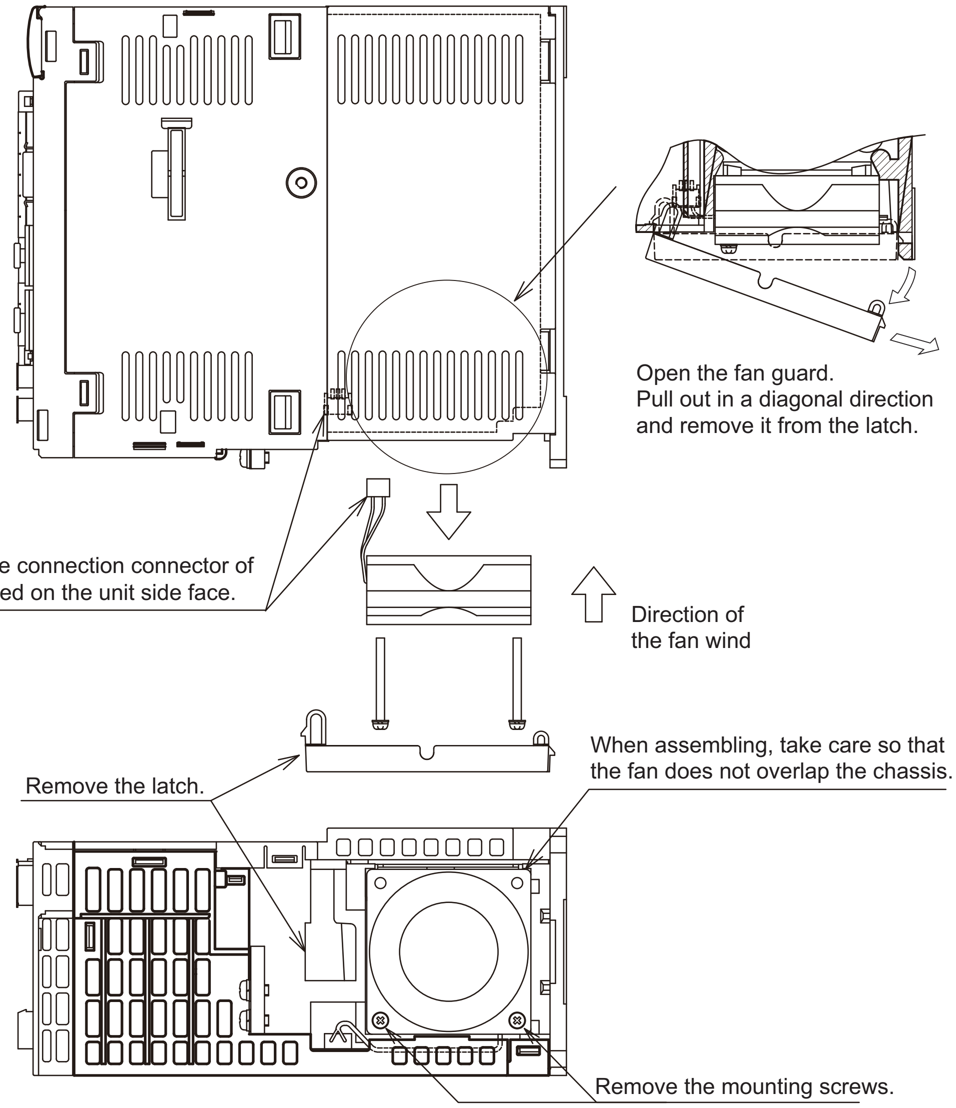
Open the fan guard.
Pull out in a diagonal direction and remove it from the latch.

Direction of the fan wind

Connecting the lead wires of fan, insert it between the chassis’s protrusion and the fan as shown above.

Remove the mounting screws.

<MDS-D-SVJ3-10NA/20NA/35NA, MDS-D-SPJ3-22NA/37NA>



Open the fan guard.
Pull out in a diagonal direction and remove it from the latch.

Disconnect the connection connector of the fan mounted on the unit side face.

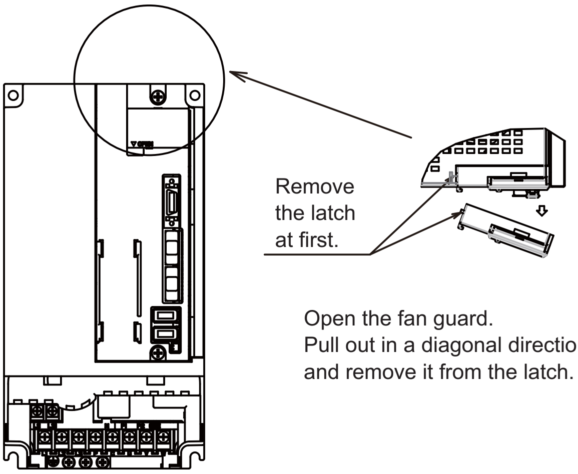
Direction of the fan wind

When assembling, take care so that the fan does not overlap the chassis.

Remove the latch.

Remove the mounting screws.

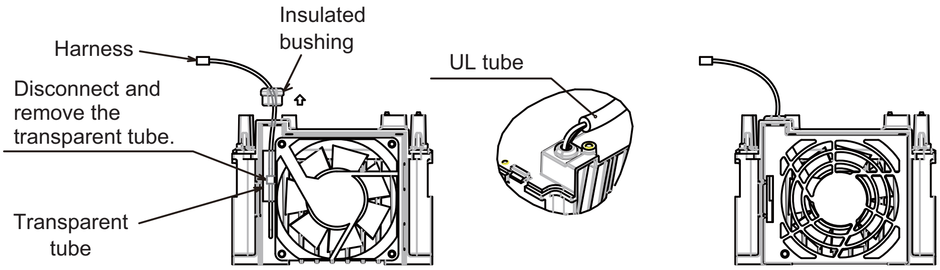
<MDS-D-SPJ3-55NA/75NA>



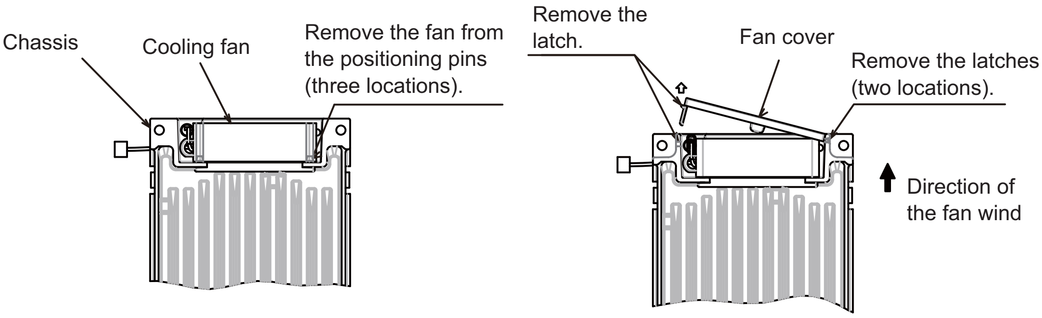
Remove the latch at first.

Open the fan guard.
Pull out in a diagonal direction and remove it from the latch.

(Note) When installing the insulated bushing, take care not to get the cable’ s UL tube caught.



Disconnect and remove the transparent tube.

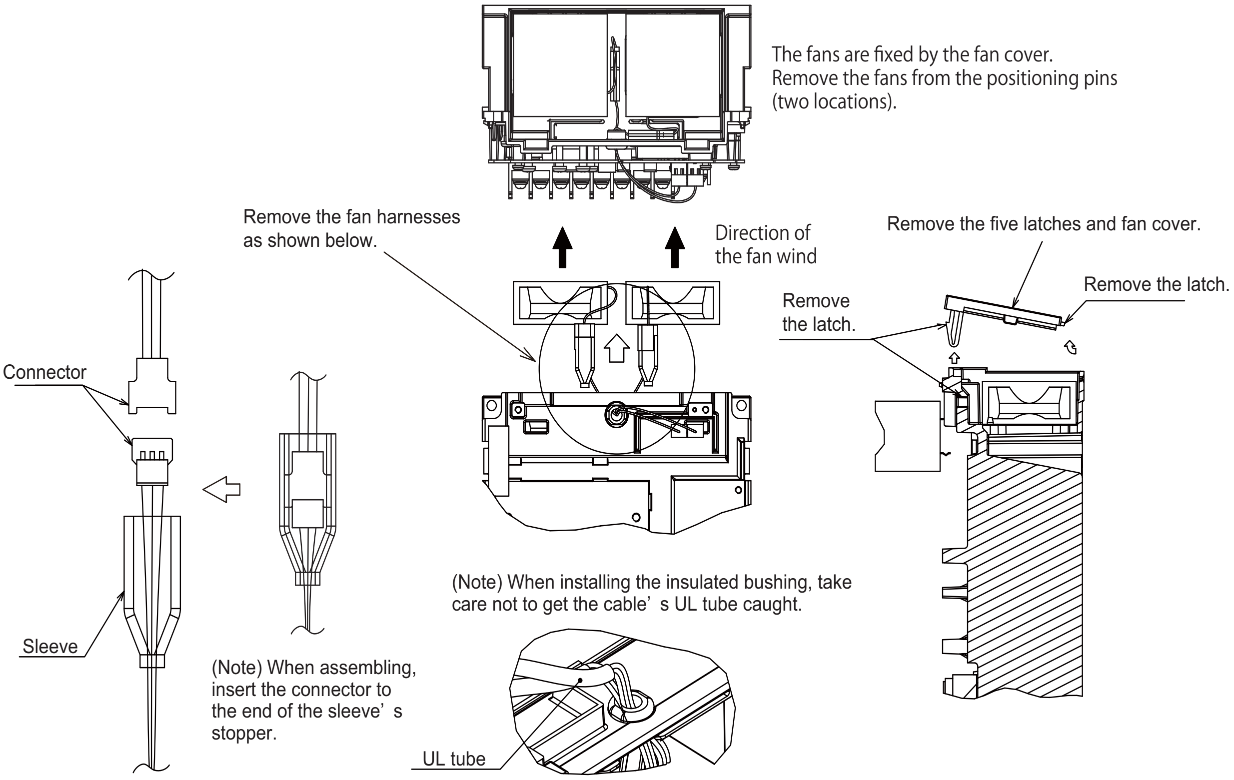


Remove the fan from the positioning pins (three locations).

Remove the latch.

Remove the latches (two locations).

<MDS-D-SPJ3-110NA>



The fans are fixed by the fan cover. Remove the fans from the positioning pins (two locations).

Remove the fan harnesses as shown below.

Remove the five latches and fan cover.

Remove the latch.

Remove the latch.

(Note) When installing the insulated bushing, take care not to get the cable’s UL tube caught.

(Note) When assembling, insert the connector to the end of the sleeve’s stopper.

7-3-3 Replacing the battery

(1) Replacing parts

<Replacing a battery equipped with the servo drive unit or the battery unit, MDS-BTBOX-36>

When the battery voltage is low (warning F9), place an order for the same type of a battery as the one currently equipped with the unit.

Battery type LR20 is commercially available as a size-D alkaline battery. The battery may be purchased and replaced by the user.

Battery type

Type	Battery equipped unit
MR-J3BAT	Servo drive unit
LR20 (size-D alkaline battery)	Battery unit, MDS-BTBOX-36

(Note) Four LR20 size-D alkaline batteries are needed for per battery unit, MDS-BTBOX-36.

<Replacing the battery unit MR-J3BAT>

The battery unit itself must be replaced because the battery is built into the unit.

When the battery voltage is low (warning F9), place an order for the same type of the battery unit as the one to be replaced.

⚠ CAUTION

1. When the battery voltage is low (warning 9F), do not shut OFF the power of the drive unit until replacement of the battery to protect the data
2. Replace the MDS-BTBOX-36 battery with new batteries (LR20) that is within the recommended service period.

(2) Replacement procedure

Replace the battery with the following procedures.

⚠ **CAUTION**

1. The power of the drive unit must be turned ON for 30min. or longer before replacing the battery.
2. Replace the battery within one hour.

<Replacement procedure for the cell battery MR-J3BAT>

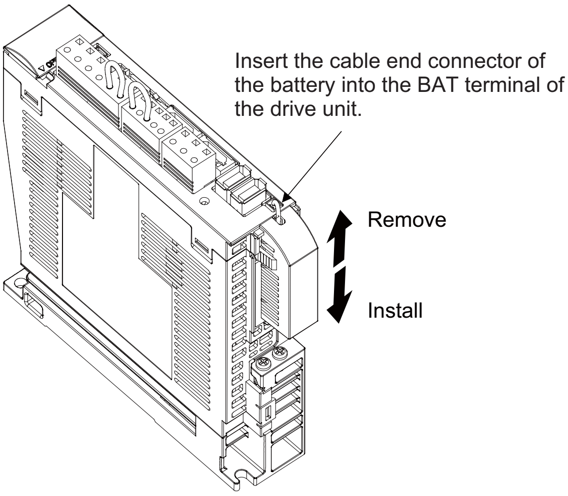
[1] Turn the breaker for the input power OFF. Make sure the power of the replacing drive unit is turned OFF.

[2] Pull out the battery connector connected with the connector BAT of the drive unit.

[3] Slide the battery and remove it while holding the tab on the battery side face.

[4] Connect a new battery connector to the connector BAT of the drive unit.

[5] Install the battery into the drive unit.



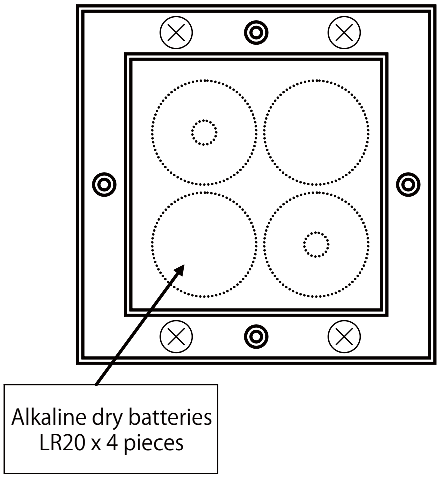
<Replacement procedure for the battery unit MDS-BTBOX-36>

Possible backup period

Possible backup period is at most one year. Thus, make sure to exchange the batteries in the one-year cycle.

How to replace the battery

[1] Remove the battery box cover (four screws).
[2] Replace the batteries with new ones. Be careful not to mistake the polarity.
[3] Attach the cover, and fix it with the four screws.
(Note 1) Replace the batteries while applying control power to the servo drive unit.
(Note 2) If the cover is ill-set, mist enters through the interstices and enter into the panel. Tighten the screws.



⚠ CAUTION

1.Use new batteries that are within the recommended service period. (Check the recommended service period written on the batteries before using them.)

2. Replace the batteries with new ones immediately after the battery voltage drop alarm (9F) has been output.

3. Replace the batteries while applying the servo drive unit’s control power.

4. Wrong connection may cause liquid leakage, heat generation and/or explosion.

5.Do not mix new batteries with used ones or mix different type batteries.

Appendix 1

Cable and Connector Specifications

Contents

Appendix 1 Cable and Connector Specifications

Appendix 1-1 Selection of cable

Appendix 1-1-1 Cable wire and assembly

(1) Cable wire

The specifications of the wire used for each cable, and the machining methods are shown in this section. When manufacturing the detector cable and battery connection cable, use the recommended wires shown below or equivalent products.

(a) Heat resistant specifications cable

Wire type (other manufacturer's product)	Finish outer diameter	Sheath material	No. of pairs	Wire characteristics					
				Configuration	**Conductive resistor**	**Withstand voltage**	**Insulation resistance**	**Heat resistance temperature**	**Flexibility**
BD20288 Compound 6-pair shielded cable Specification No. Bangishi-17145 (Note 1)	8.7mm	Heat resistant PVC	2 (0.5mm^2)	100 strands/ 0.08mm	40.7Ω/km or less	500VAC/ 1min	1000 MΩ/km or more	105°C	70×10^4 times or more at R200
			4 (0.2mm^2)	40 strands/ 0.08mm	103Ω/km or less				

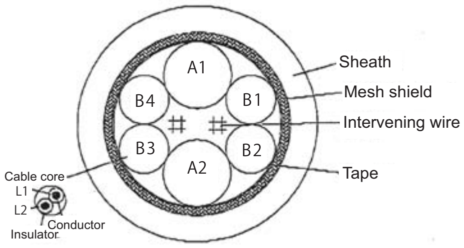
(b) General-purpose heat resistant specifications cable

Wire type (other manufacturer's product)	Finish outer diameter	Sheath material	No. of pairs	Wire characteristics					
				Configuration	**Conductive resistor**	**Withstand voltage**	**Insulation resistance**	**Heat resistance temperature**	**Flexibility**
BD20032 Compound 6-pair shielded cable Specification No. Bangishi-16903 Revision No. 3 (Note 2))	8.7mm	PVC	2 (0.5mm^2)	100strands/ 0.08mm	40.7Ω/km or less	500VAC/ 1min	1000 MΩ/km or more	60°C	100×10^4 times or more at R200
			4 (0.2mm^2)	40strands/ 0.08mm	103Ω/km or less				

(Note 1) Bando Electric Wire (Contact: 81+48-461-0561 http://www.bew.co.jp)

(Note 2) The Mitsubishi standard cable is the (a) Heat resistant specifications cable. For MDS-C1/CH series, (b) or equivalent is used as the standard cable.

Compound 6-pair cable structure drawing

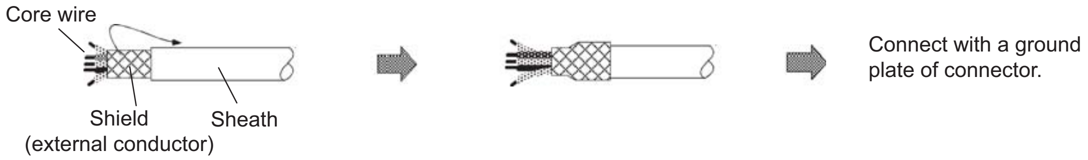


Core identification

Pair No.	Insulator color	
	L1	**L2**
A1 (0.5mm^2)	Red	White
A2 (0.5mm^2)	Black	White
B1 (0.2mm^2)	Brown	Orange
B2 (0.2mm^2)	Blue	Green
B3 (0.2mm^2)	Purple	White
B4 (0.2mm^2)	Yellow	White

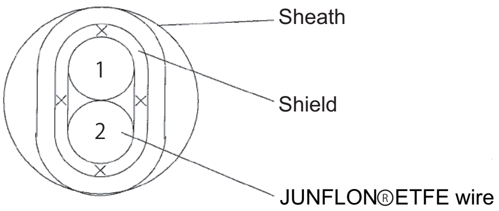
(2) Cable assembly

Assemble the cable with the cable shield wire securely connected to the ground plate of the connector.



(3) Battery connection cable

Wire type (other manufacturer's product)	Finish outer diameter	Sheath material	No. of pairs	Wire characteristics					
				Configuration	Conductive resistor	Withstand voltage	Insulation resistance	Heat resistance temperature	Minimum bend radius
J14B101224-00 Two core shield cable	3.3mm	PVC	1 ($0.2mm^2$)	7strands / 0.2mm	91.2Ω/km or less	AC500V/ 1min	1000MΩ/ km or less	80°C	R33mm



Two core shield cable structure drawing

Core identification

No.	Insulator color
1	Red
2	Black

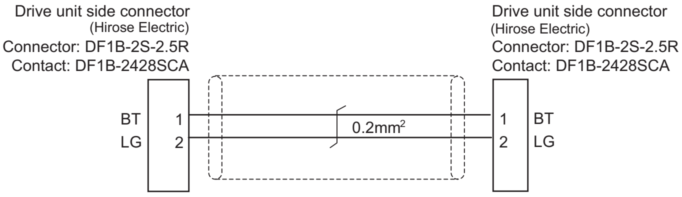
Appendix 1-2 Cable connection diagram

⚠ CAUTION

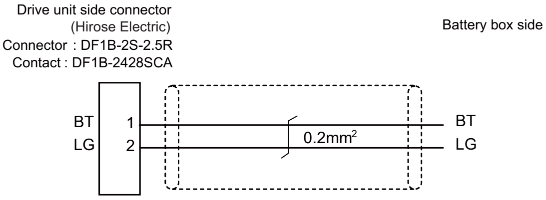
1. Take care not to mistake the connection when manufacturing the detector cable. Failure to observe this could lead to faults, runaway or fire.
2. When manufacturing the cable, do not connect anything to pins which have no description.

Appendix 1-2-1 Battery cable

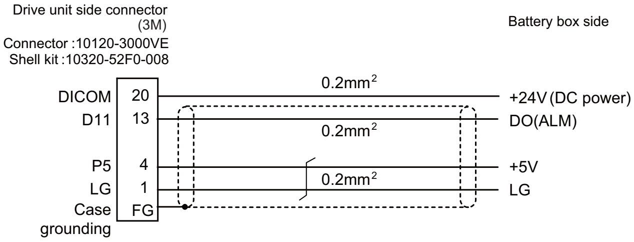
<DG22 cable connection diagram (Connection cable between drive unit and drive unit)>



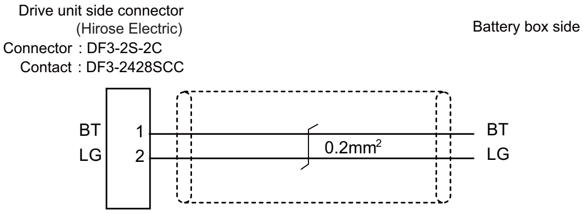
<DG23 cable connection diagram (Connection cable between drive unit and MDS-BTBOX-36)>



<DG24 cable connection diagram (Connection cable for alarm output between drive unit and MDS-BTBOX-36)>



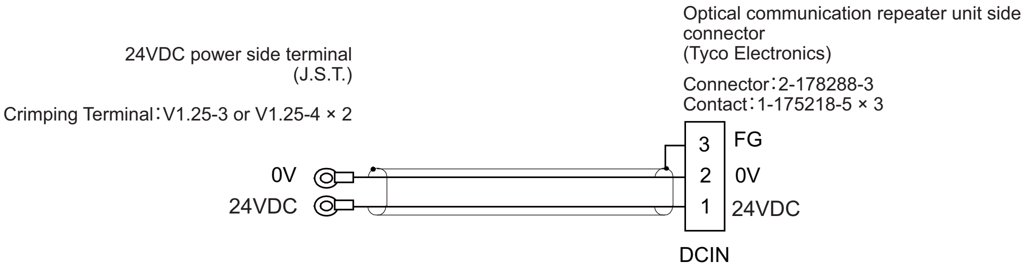
<DG25 cable connection diagram (Connection cable between drive unit and MDS-BTBOX-36)>



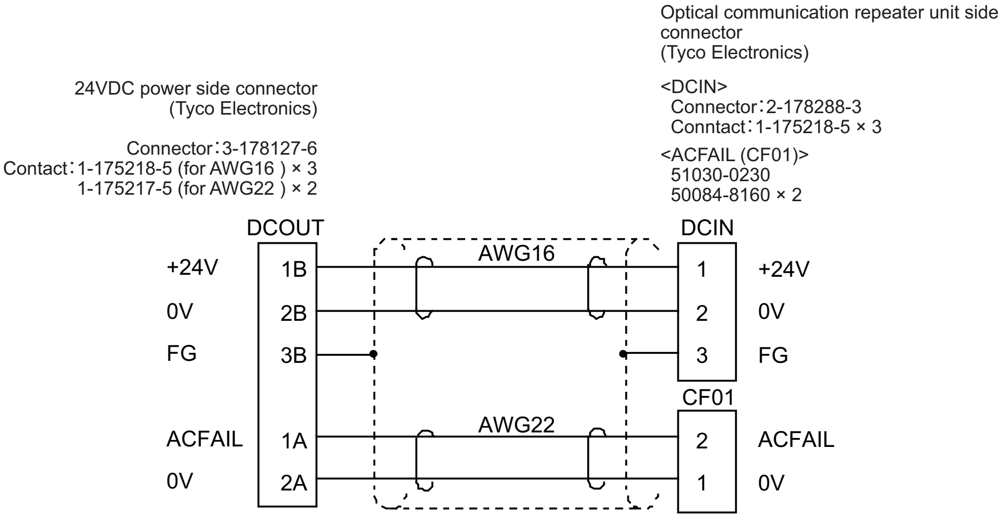
CAUTION ! When DG24 cable is used, proximity switch or external emergency stop cannot be wired, so these functions cannot be used.

Appendix 1-2-2 Optical communication repeater unit cable

< F070 cable connection diagram >



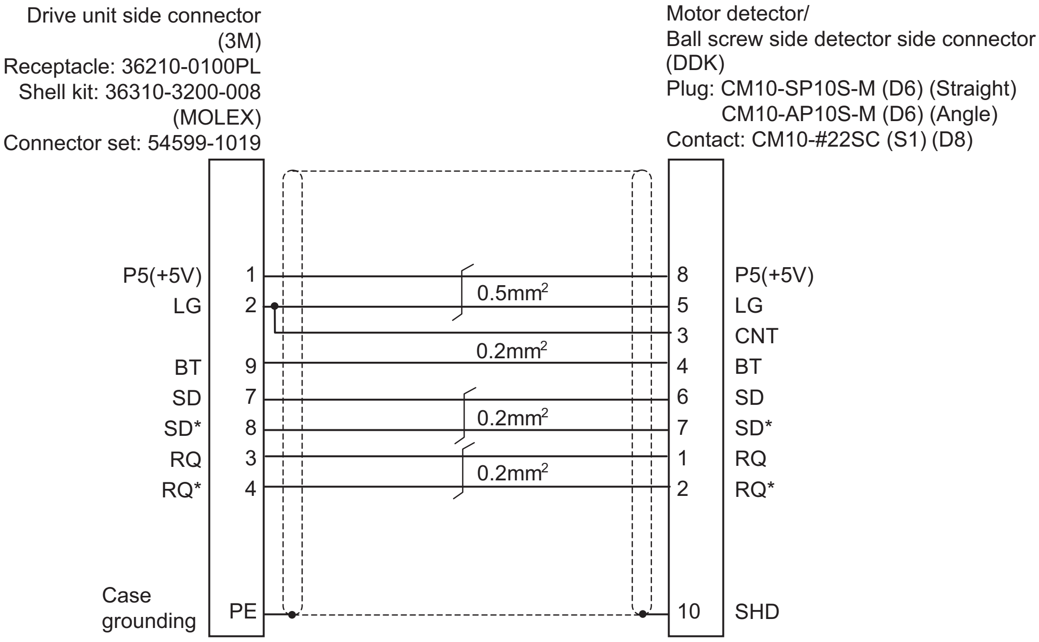
< F110 cable connection diagram >



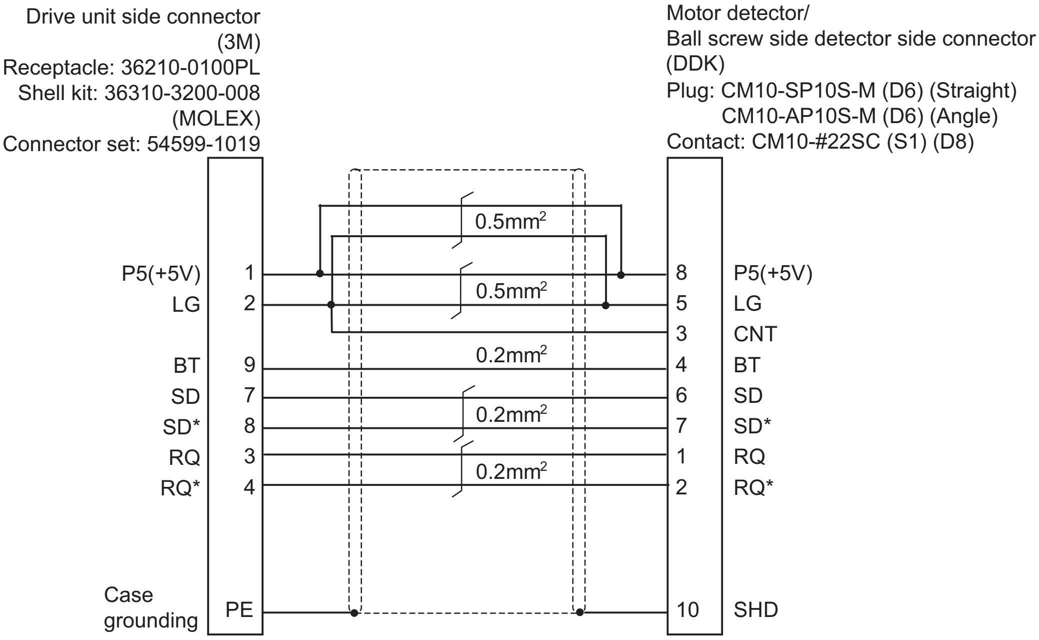
Appendix 1 Cable and Connector Specifications

Appendix 1-2-3 Servo / tool spindle detector cable

<CNV2E-8P, CNV2E-9P cable connection diagram>

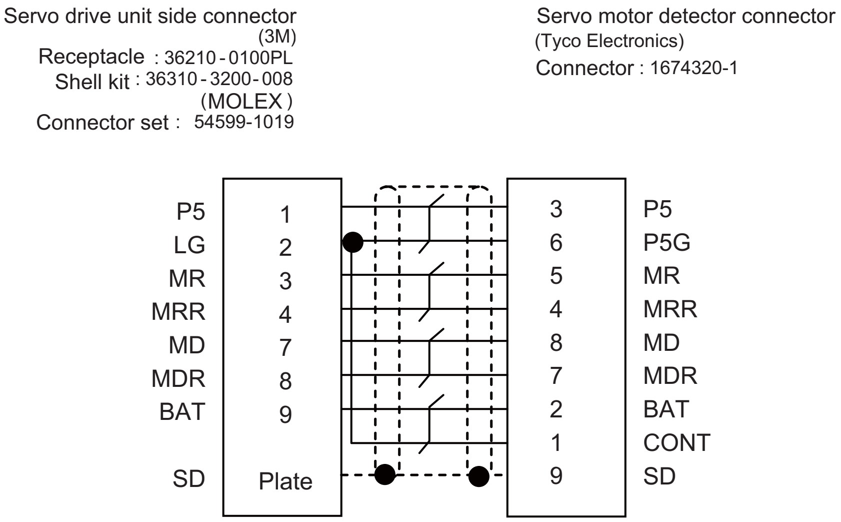


<For 15m or less>

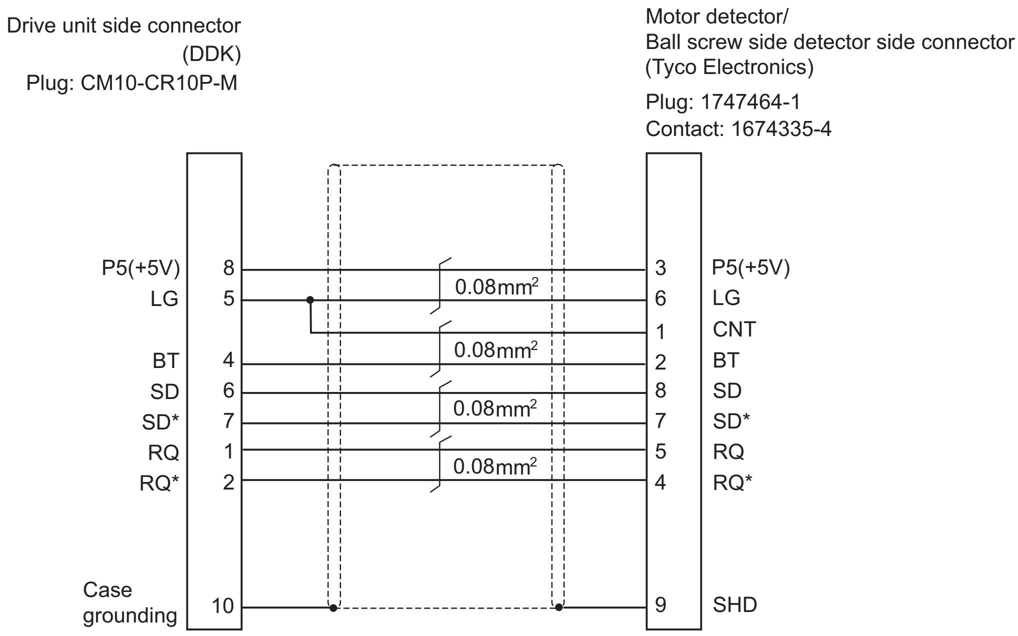


<For 15m to 30m>

< CNV2E-K1P, CNV2E-K2P cable connection diagram (Direct connection type) >

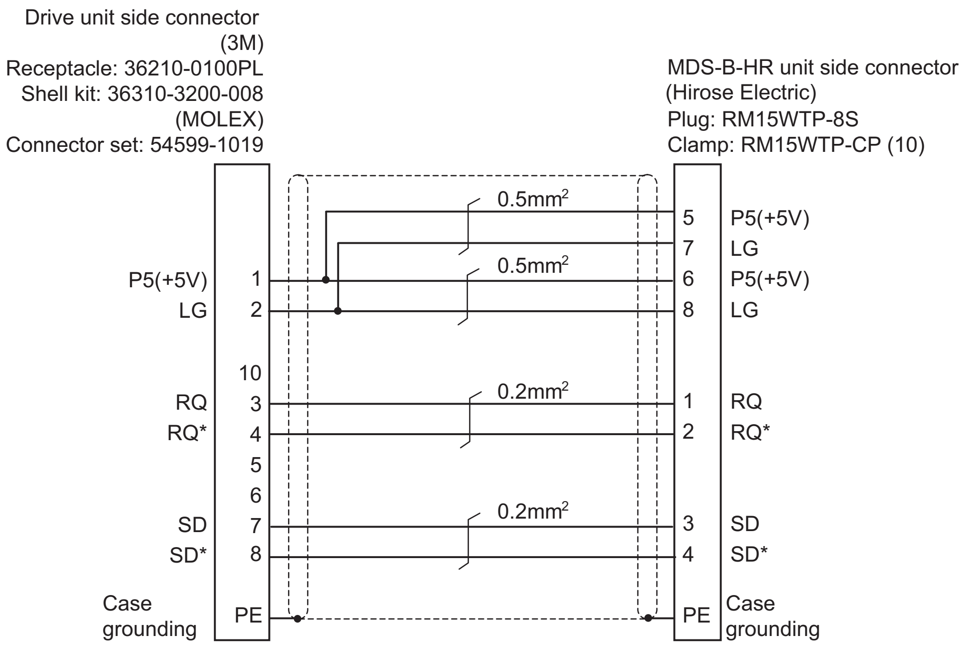


< CNV22J-K1P, CNV22J-K2P cable connection diagram (Relay type) >

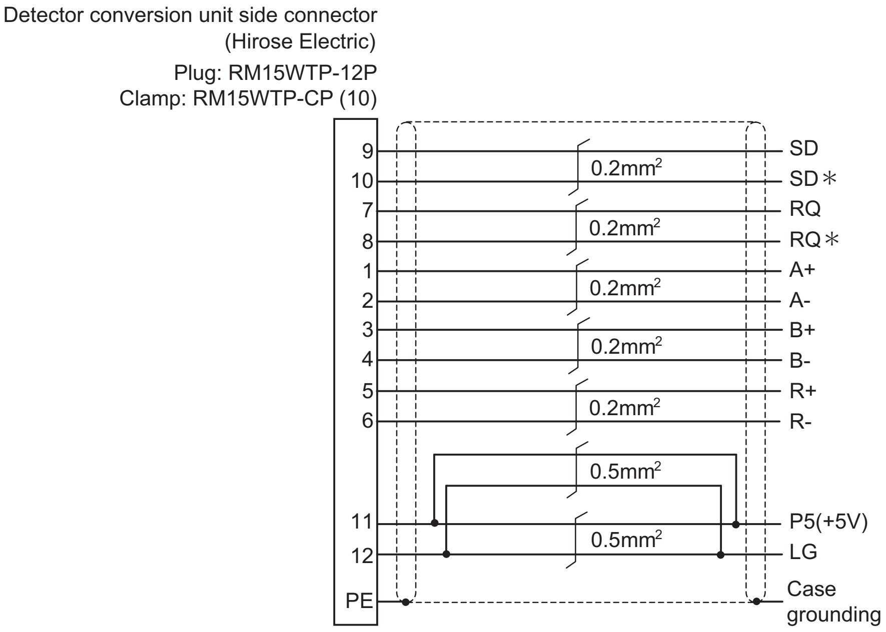


Appendix 1 Cable and Connector Specifications

<CNV2E-HP cable connection diagram>

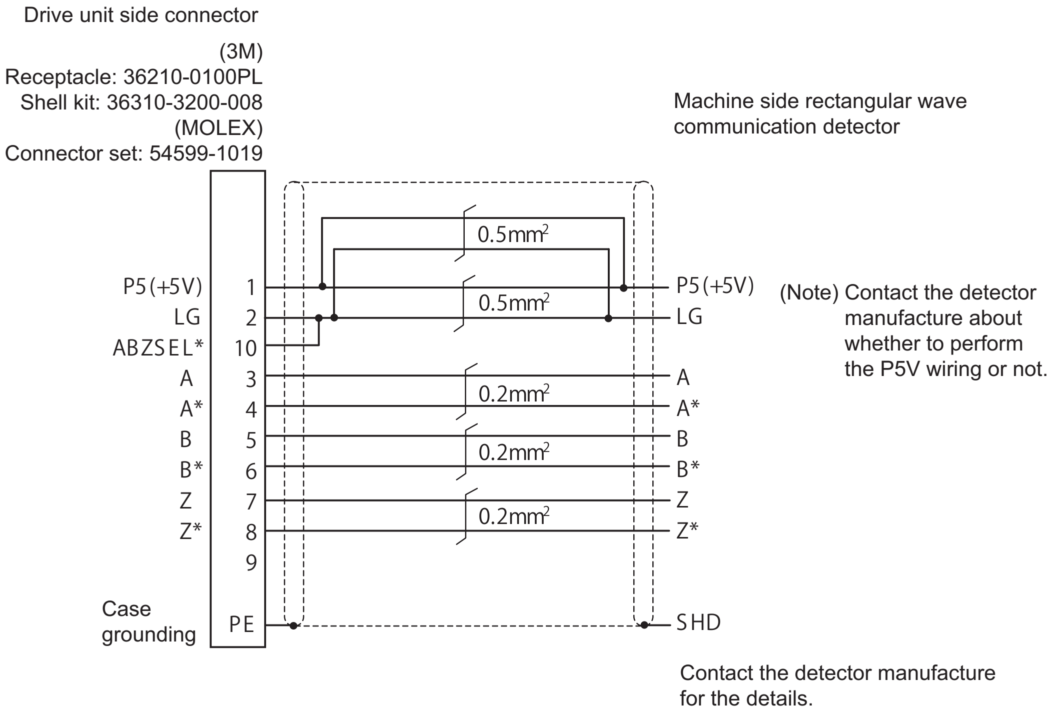


<Cable connection diagram between scale I/F unit and scale (CNLH3 cable, etc.) >



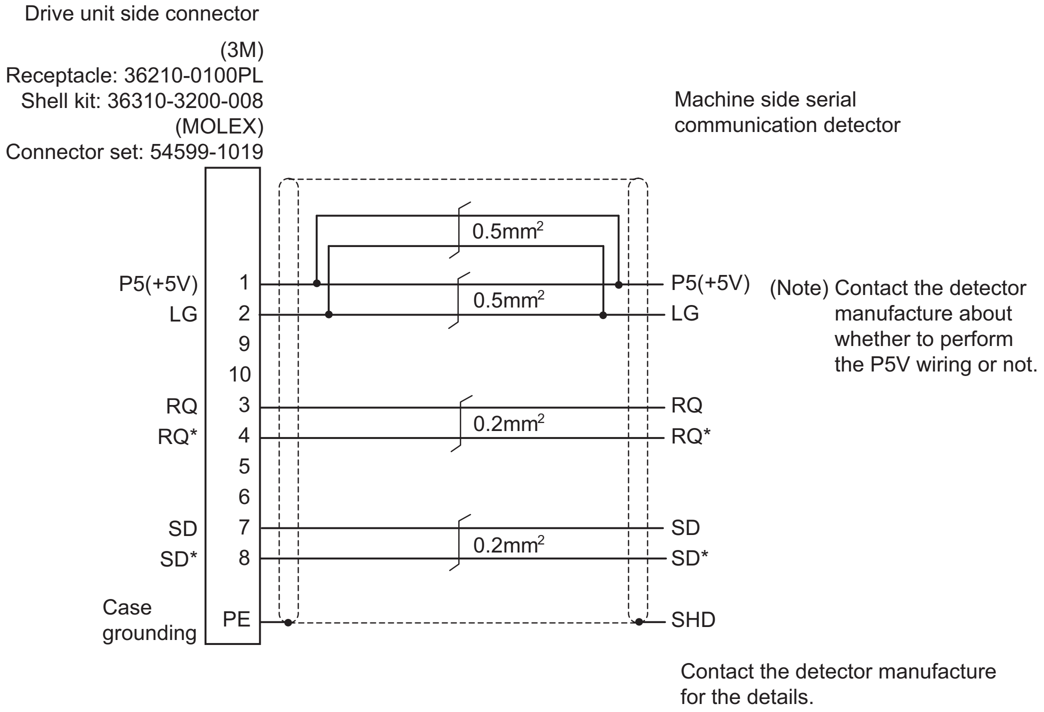
(Note) This cable must be prepared by the user.

<Rectangular wave communication detector (linear scale, etc.) cable connection diagram>



(Note) This cable must be prepared by the user.

<Serial communication detector (linear scale, etc.) cable connection diagram>



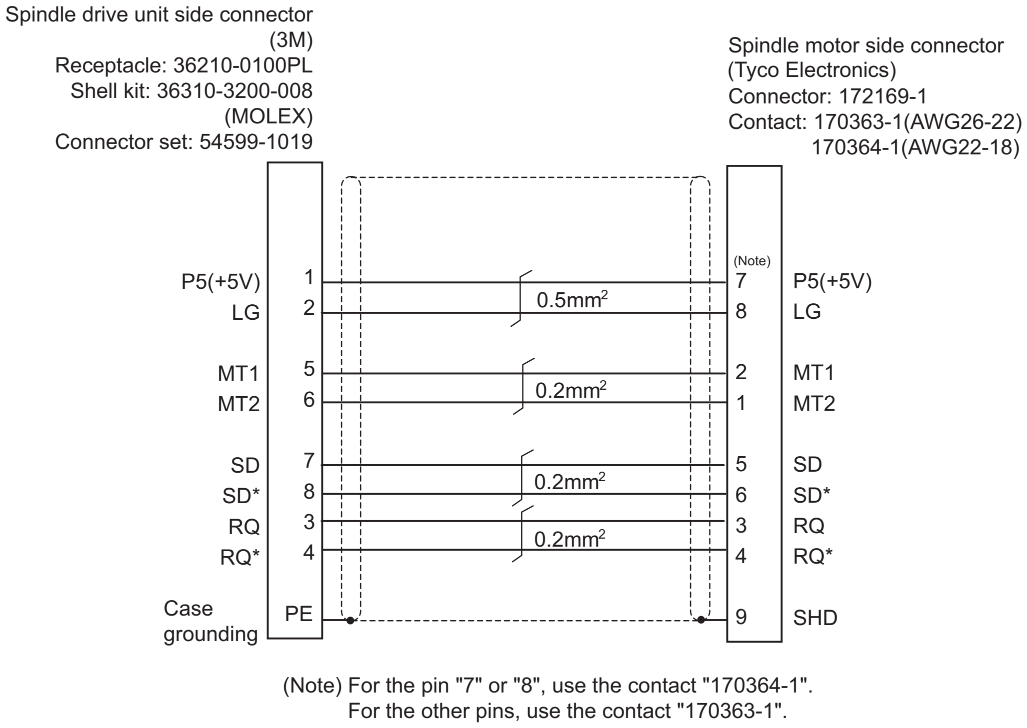
(Note) This cable must be prepared by the user.

POINT For compatible detector, refer to the section "Servo option" in Specifications Manual.

Appendix 1 Cable and Connector Specifications

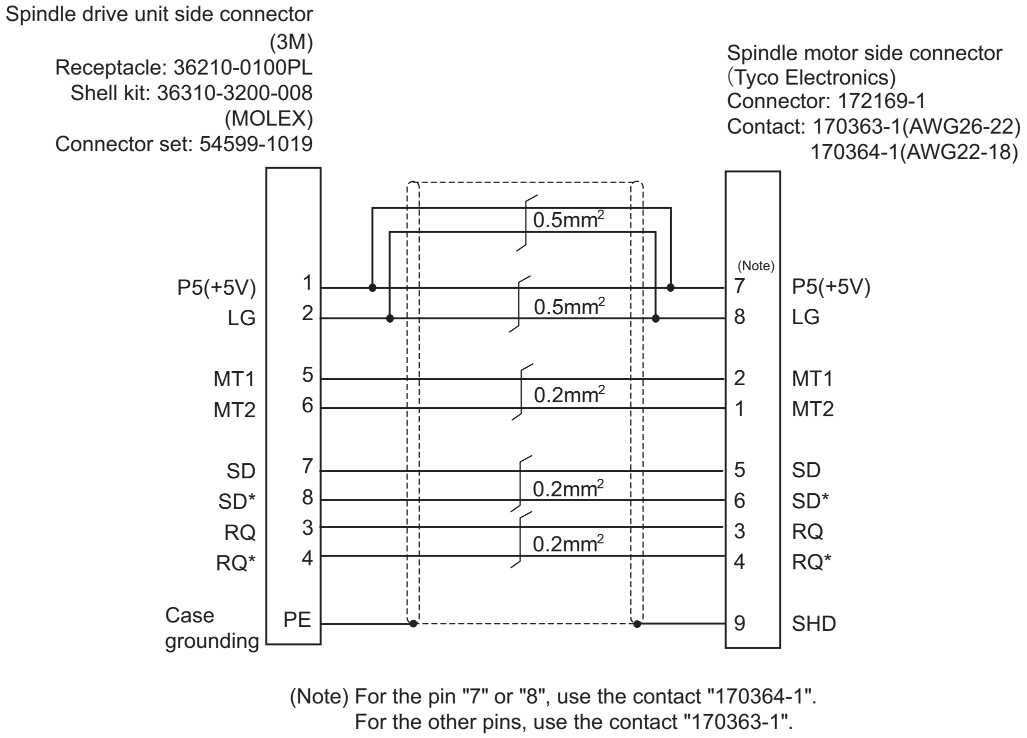
Appendix 1-2-4 Spindle detector cable

<CNP2E-1 cable connection diagram>



(Note) For the pin "7" or "8", use the contact "170364-1".
For the other pins, use the contact "170363-1".

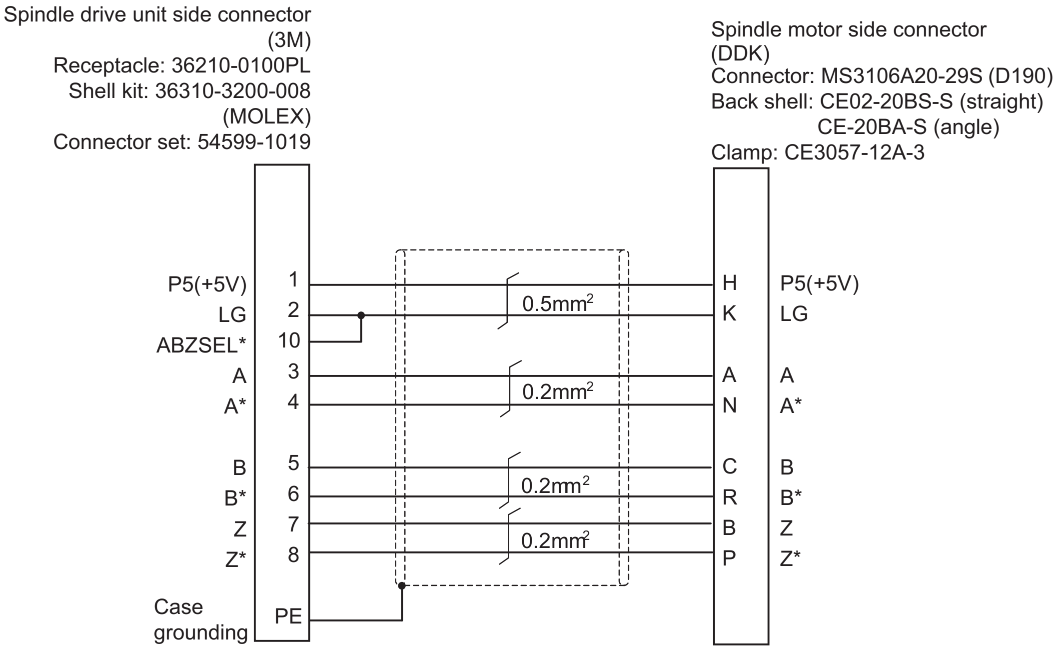
<For 15m or less>



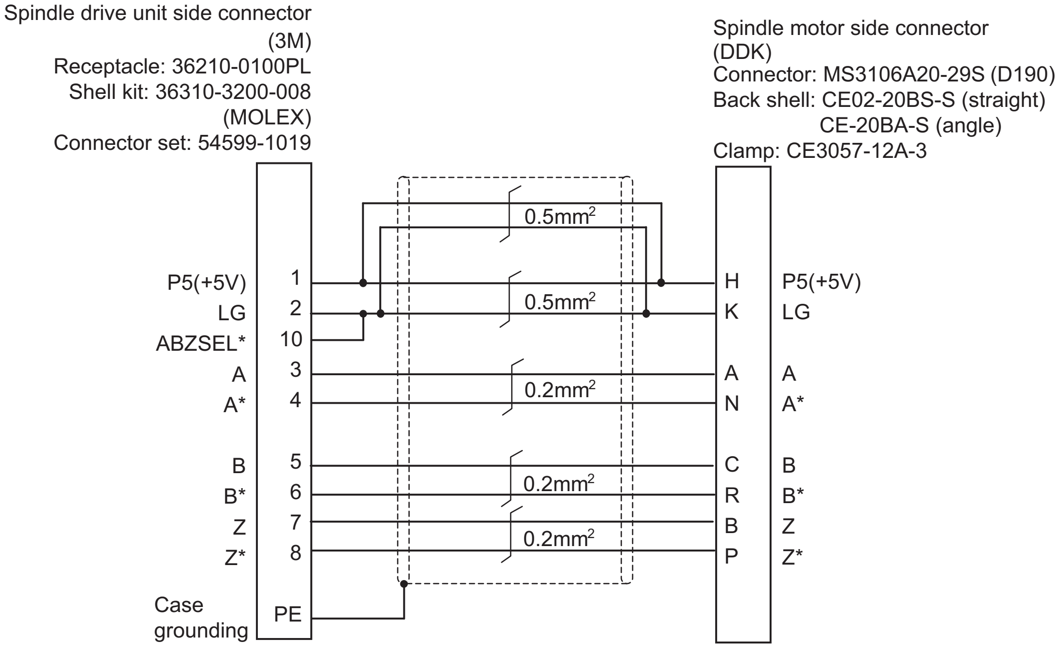
(Note) For the pin "7" or "8", use the contact "170364-1".
For the other pins, use the contact "170363-1".

<For 15m to 30m>

<CNP3EZ-2P, CNP3EZ-3P cable connection diagram>


Spindle drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019
Spindle motor side connector
(DDK)
Connector: MS3106A20-29S (D190)
Back shell: CE02-20BS-S (straight)
CE-20BA-S (angle)
Clamp: CE3057-12A-3
P5(+5V) 1
LG 2
ABZSEL* 10
A 3
A* 4
B 5
B* 6
Z 7
Z* 8
Case grounding PE
0.5mm²
0.2mm²
0.2mm²
0.2mm²
H P5(+5V)
K LG
A A
N A*
C B
R B*
B Z
P Z*

<For 15m or less>


Spindle drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019
Spindle motor side connector
(DDK)
Connector: MS3106A20-29S (D190)
Back shell: CE02-20BS-S (straight)
CE-20BA-S (angle)
Clamp: CE3057-12A-3
0.5mm²
P5(+5V) 1
LG 2
ABZSEL* 10
A 3
A* 4
B 5
B* 6
Z 7
Z* 8
Case grounding PE
0.5mm²
0.2mm²
0.2mm²
0.2mm²
H P5(+5V)
K LG
A A
N A*
C B
R B*
B Z
P Z*

<For 15m to 30m>

Appendix 1-3 Connector outline dimension drawings

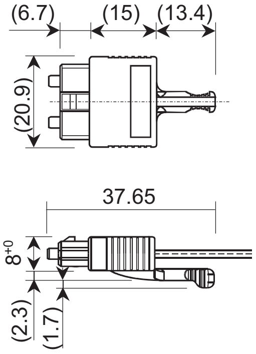
Appendix 1-3-1 Optical communication cable

For wiring between drive units (inside panel)

Optical communication connector

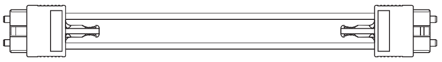
[Unit:mm]

Manufacturer: Japan Aviation Electronics Industry
<Type>
Connector:2F-2D103

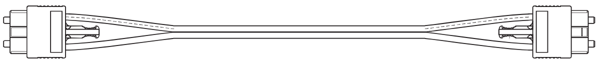


Cable appearance
<Type>
Connector: 2F-2D103 (Japan Aviation Electronics Industry)
Optical fiber: ESKA Premium (MITSUBISHI RAYON)

（L≦0.1m）



（L≧0.2m）



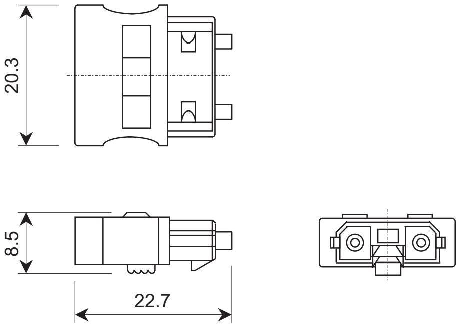
(Note 1) The POF fiber's light amount will drop depending on how the fibers are wound. So, try to avoid wiring the fibers.
(Note 2) Do not wire the optical fiber cable to moving sections.

For wiring between drive units (outside panel)

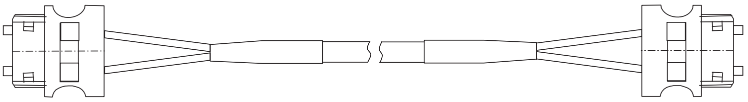
Optical communication connector

[Unit:mm]

Manufacturer: Tyco Electronics
<Type>
Connector: 1123445-1



Cable appearance
<Type>
Connector: 1123445-1
(Tyco Electronics)
Optical fiber: ESKA Premium
(MITSUBISHI RAYON)



(Note 1) The PCF fiber's light amount will drop depending on how the fibers are wound. So, try to avoid wiring the fibers.
(Note 2) Do not wire the optical fiber cable to moving sections.

For wiring between NC and drive unit

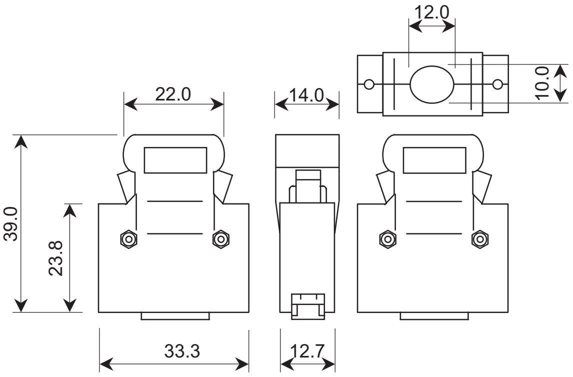
Refer to the instruction manual for CNC.

Appendix 1-3-2 DI/O or maintenance connector

Connector for CN4/9

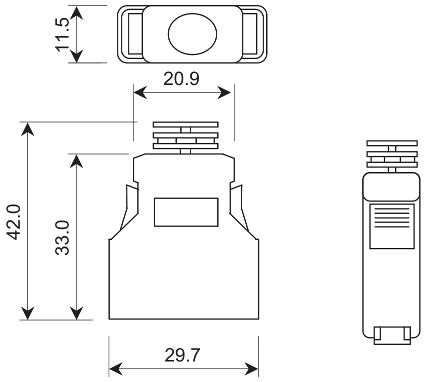
[Unit:mm]

Manufacturer: 3M
<Type>
Connector: 10120-3000VE
Shell kit: 10320-52F0-008



[Unit:mm]

Manufacturer: 3M
<Type>
Connector: 10120-6000EL
Shell kit:10320-3210-000
This connector is integrated with the cable, and is not available as a connector set option.

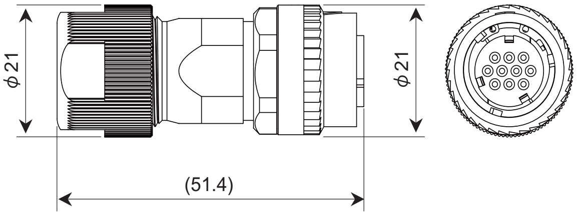


Appendix 1-3-3 Servo detector connector

Motor side detector connector / Ball screw side detector for connector

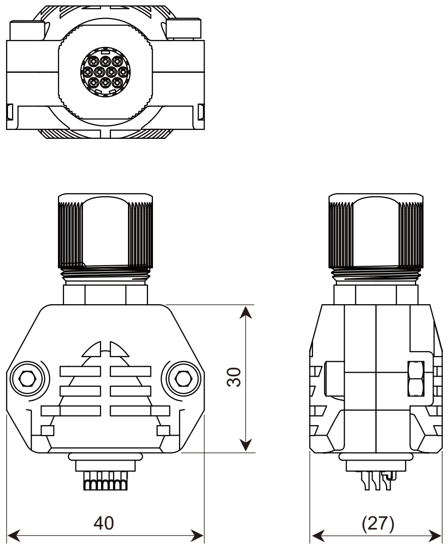
[Unit:mm]

Manufacturer: DDK
<Type>
Plug:CM10-SP10S-M(D6)



[Unit:mm]

Manufacturer: DDK
<Type>
Reinforcing cover for straight plug:
CM10-SP-CV



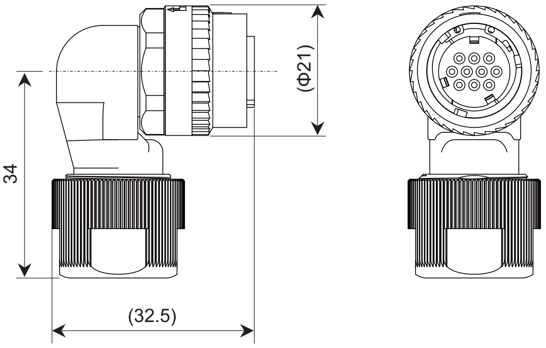
(Note 1) For the manufacturing method of CM10 series connector, refer to the section "Cable and connector assembly" in Instruction Manual.

(Note 2) Use the reinforcing cover if thumping vibration and strong impacts could be applied on the connector.

Motor side detector connector / Ball screw side detector for connector

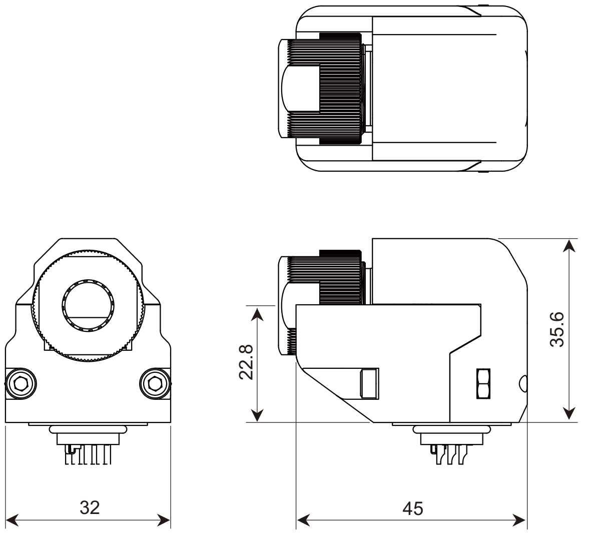
[Unit:mm]

Manufacturer: DDK
<Type>
Plug:CM10-AP10S-M(D6)



[Unit:mm]

Manufacturer: DDK
<Type>
Reinforcing cover for angle plug:
CM10-AP-D-CV



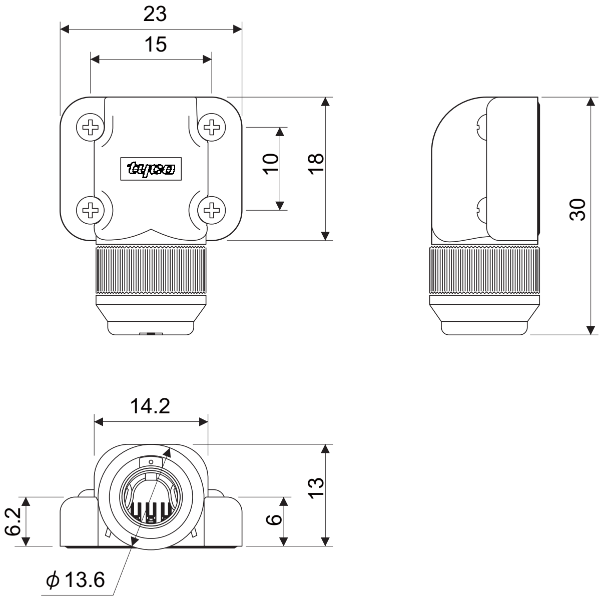
(Note 1) For the manufacturing method of CM10 series connector, refer to the section "Cable and connector assembly" in Instruction Manual.

(Note 2) Use the reinforcing cover if thumping vibration and strong impacts could be applied on the connector.

Motor side detector connector

[Unit:mm]

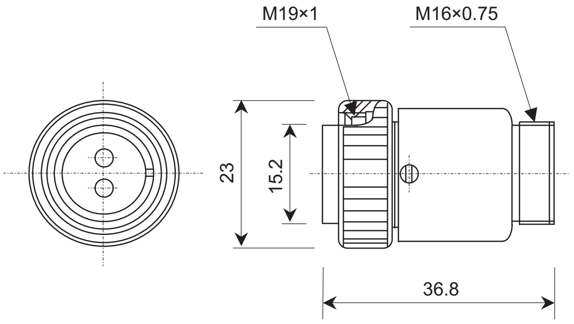
Manufacturer: Tyco Electronics
<Type>
Assembly: 1674320-1



MDS-B-HR connector

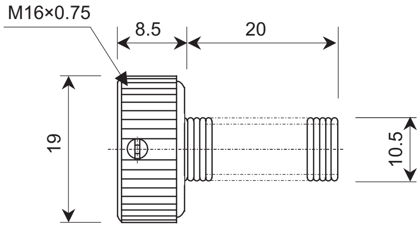
[Unit:mm]

Manufacturer: Hirose Electric
<Type>
Plug:
RM15WTP-8S (for CON1,2)
RM15WTP-12P (for CON3)



[Unit:mm]

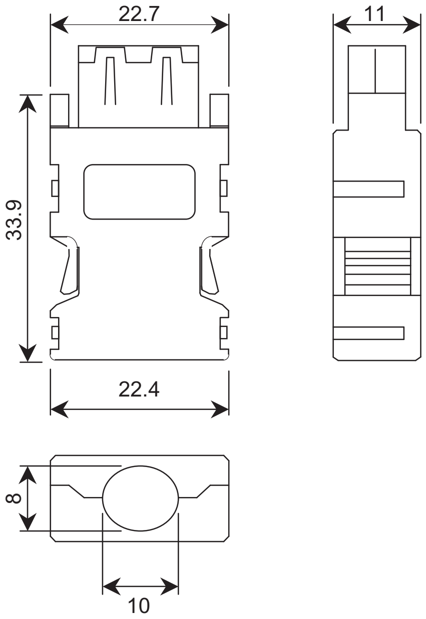
Manufacturer: Hirose Electric
<Type>
Clamp: RM15WTP-CP(10)



Drive unit connector for CN2/3

[Unit:mm]

Manufacturer: 3M
<Type>
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
Manufacturer: MOLEX
<Type>
Connector set:54599-1019

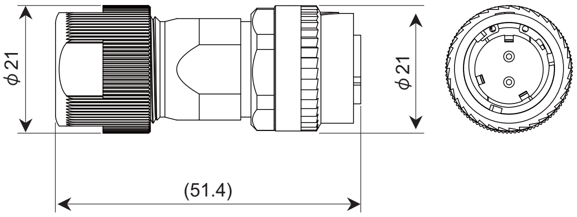


Appendix 1-3-4 Brake connector

Brake connector

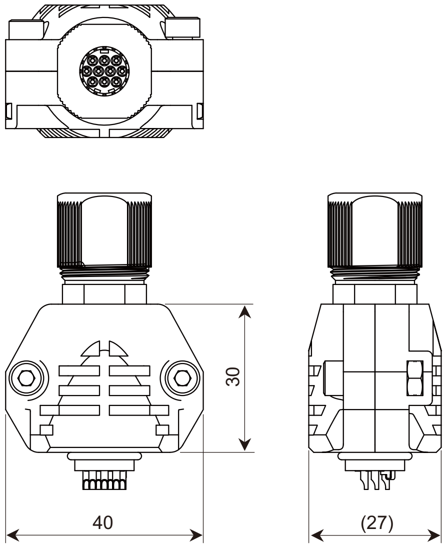
[Unit:mm]

Manufacturer: DDK
<Type>
Plug: CM10-SP2S-S(D6)



[Unit:mm]

Manufacturer: DDK
<Type>
Reinforcing cover for straight plug:
CM10-SP-CV



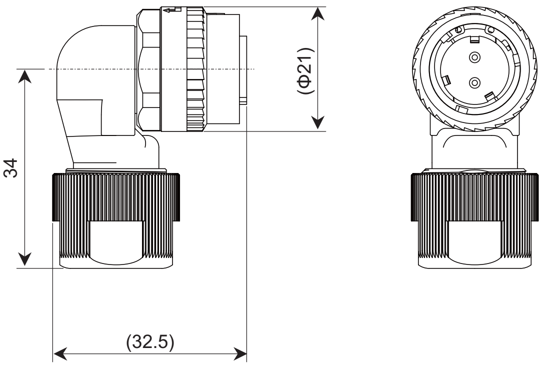
(Note 1) For the manufacturing method of CM10 series connector, refer to the section "Cable and connector assembly" in Instruction Manual.

(Note 2) Use the reinforcing cover if thumping vibration and strong impacts could be applied on the connector.

Brake connector

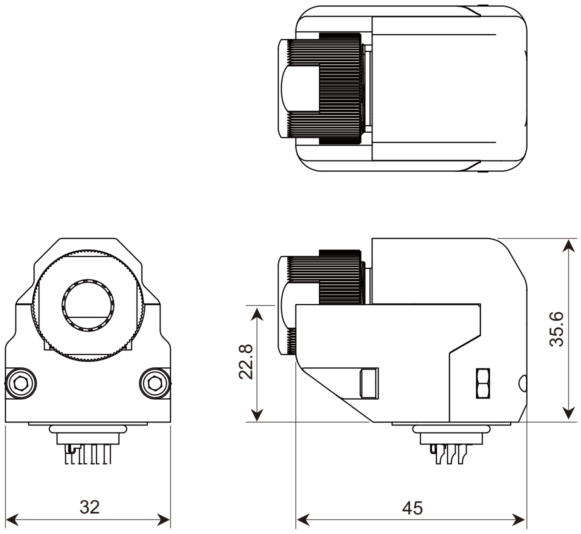
Manufacturer: DDK
<Type>
Plug: CM10-AP2S-S(D6)

[Unit:mm]



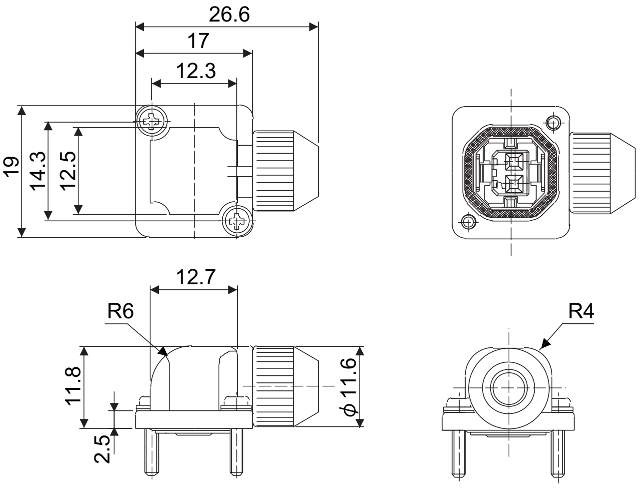
Manufacturer: DDK
<Type>
Reinforcing cover for angle plug:
CM10-AP-D-CV

[Unit:mm]



Manufacturer: Japan Aviation Electronics Industry
<Type>
JN4FT02SJ1-R

[Unit:mm]



(Note 1) For the manufacturing method of CM10 series connector, refer to the section "Cable and connector assembly" in Instruction Manual.

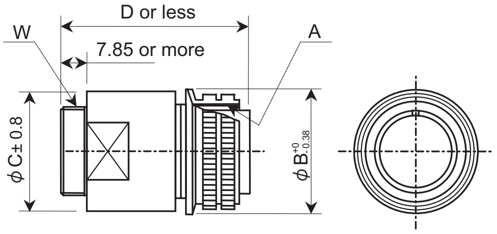
(Note 2) Use the reinforcing cover if thumping vibration and strong impacts could be applied on the connector.

Appendix 1-3-5 Power connector

Motor power connector

[Unit:mm]

Manufacturer: DDK

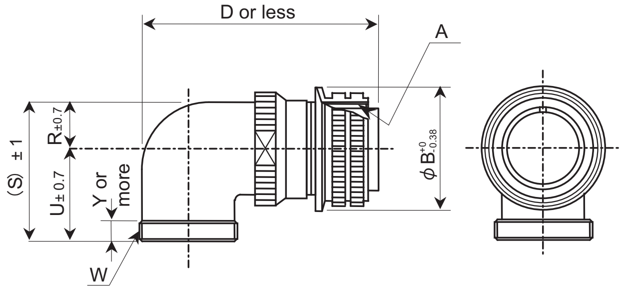


Plug:

Type	A	B	+0	C±0.8	D or less	W
			-0.38			
CE05-6A18-10SD-C-BSS	$1^1/_8$-18UNEF-2B	34.13		32.1	57	1-20UNEF-2A
CE05-6A22-22SD-C-BSS	$1^3/_8$-18UNEF-2B	40.48		38.3	61	$1^3/_{16}$-18UNEF-2A

[Unit:mm]

Manufacturer: DDK

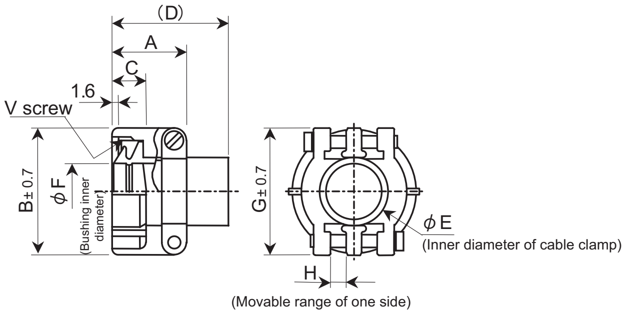


Plug:

Type	A	B	+0	D or less	W	R±0.7	U±0.7	(S)±1	Y or more
			-0.38						
CE05-8A18-10SD-C-BAS	$1^1/_8$-18UNEF-2B	34.13		69.5	1-20UNEF-2A	13.2	30.2	43.4	7.5
CE05-8A22-22SD-C-BAS	$1^3/_8$-18UNEF-2B	40.48		75.5	$1^3/_{16}$-18UNEF-2A	16.3	33.3	49.6	7.5

[Unit:mm]

Manufacturer: DDK



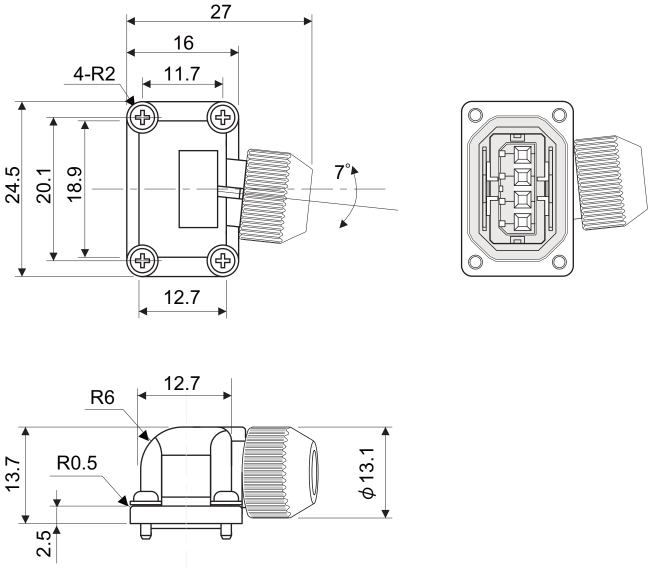
Clamp:

Type	Shell size	Total length A	Outer dia. B	Avail. screw length C	D	E	F	G	H	Fitting screw V	Bushing	Applicable cable
CE3057-10A-1(D240)	18	23.8	30.1	10.3	41.3	15.9	14.1	31.7	3.2	1-20UNEF-2B	CE3420-10-1	φ10.5 to φ14.1
CE3057-12A-1(D240)	20	23.8	35	10.3	41.3	19	16.0	37.3	4	$1^3/_{16}$-18UNEF-2B	CE3420-12-1	φ12.5 to φ16.0

Motor power connector

[Unit:mm]

Manufacturer: Japan Aviation Electronics Industry
<Type>
JN4FT04SJ1-R

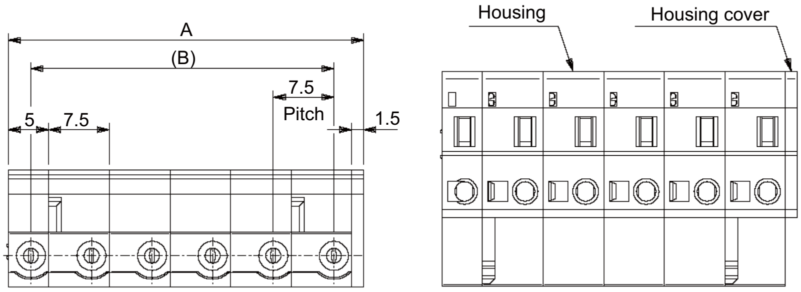


Appendix 1-3-6 Drive unit side main circuit connector

Drive unit CNP1 connector (for power supply), CNP3 connector (for motor power)

[Unit:mm]

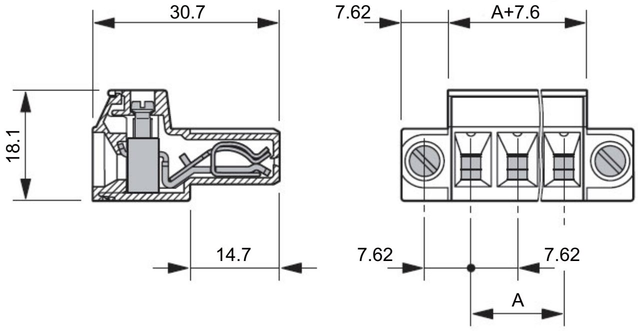
Manufacturer: MOLEX



Type	A	B	No. of poles
54928-0670	44	37.5	6 (for CNP1)
54928-0370	21.5	15	3 (for CNP3)

[Unit:mm]

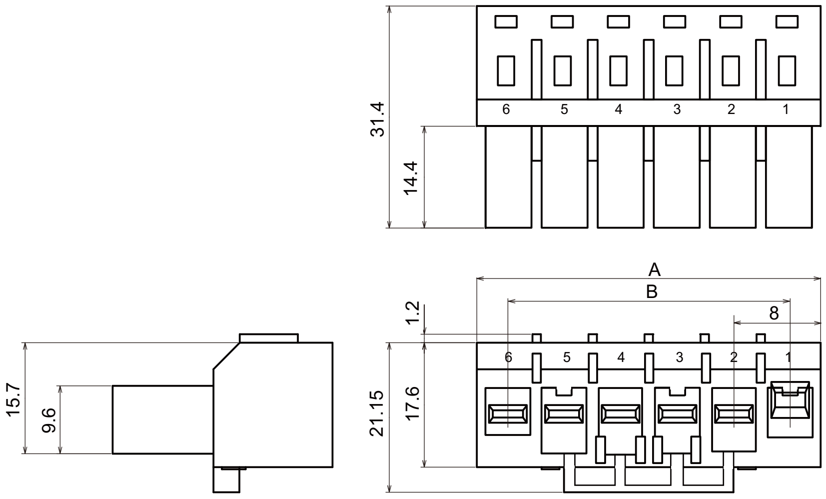
Manufacturer: Phoenix contact



Type	A	No. of poles
PC4/6-STF-7.62-CRWH	38.10	6 (for CNP1)
PC4/3-STF-7.62-CRWH	15.24	3 (for CNP3)

[Unit:mm]

Manufacturer: J.S.T.



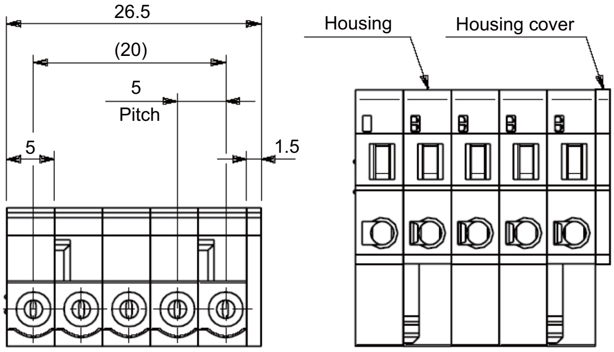
Type	A	B	No. of poles
06JFAT-SAXGFS-XL	49.1	40	6 (for CNP1)
03JFAT-SAXGFS-XL	25.1	16.0	3 (for CNP3)

Appendix 1 Cable and Connector Specifications

Drive unit CNP2 connector (for control power)

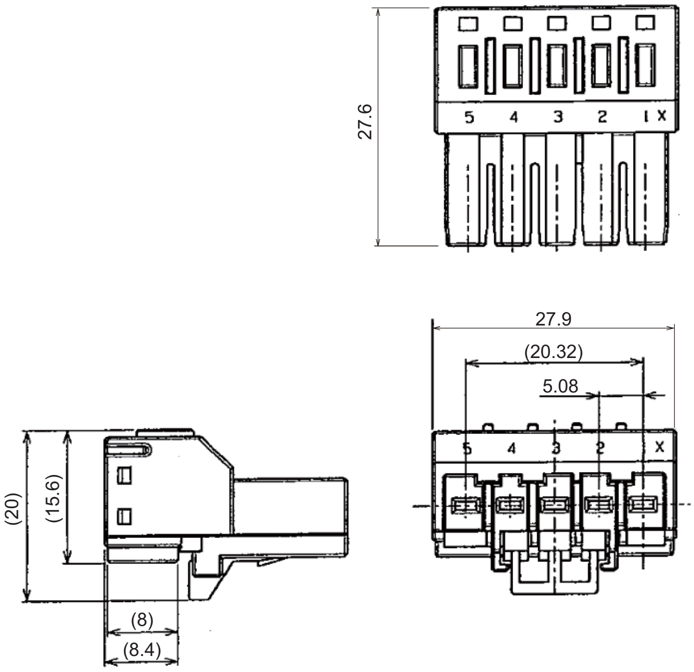
[Unit:mm]

Manufacturer: MOLEX
<Type>
Connector:54927-0520



[Unit:mm]

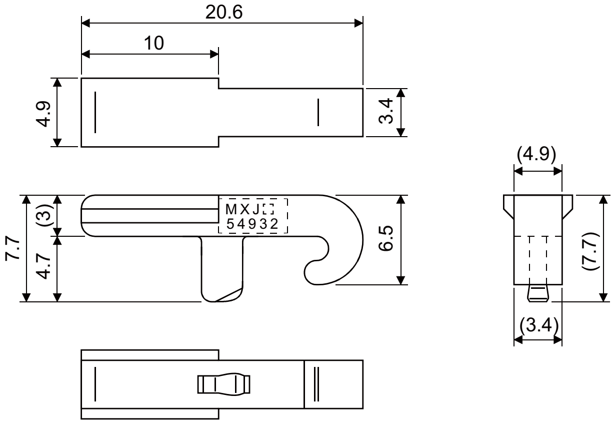
Manufacturer: J.S.T.
<Type>
Connector:05JFAT-SAXGSA-E-SS



Connection lever for drive unit

[Unit:mm]

Manufacturer: MOLEX
<Type>
Connector:54932-0000

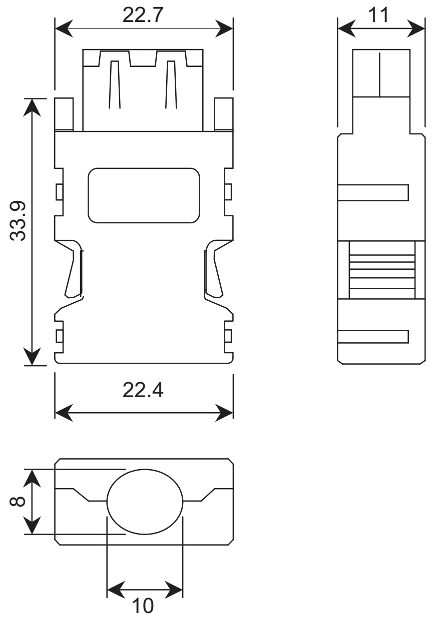


Appendix 1-3-7 Spindle detector connector

Spindle drive unit Connector for CN2/3

[Unit:mm]

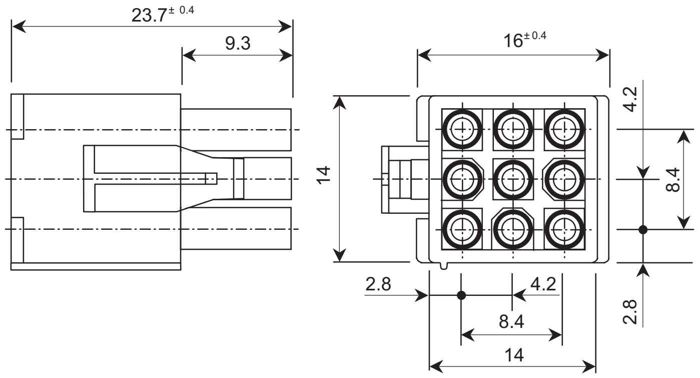
Manufacturer: 3M
<Type>
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
Manufacturer: MOLEX
<Type>
Connector set: 54599-1019



Motor side PLG (TS5690) connector

[Unit:mm]

Manufacturer: Tyco Electronics
<Type>
Plug: 172169-1

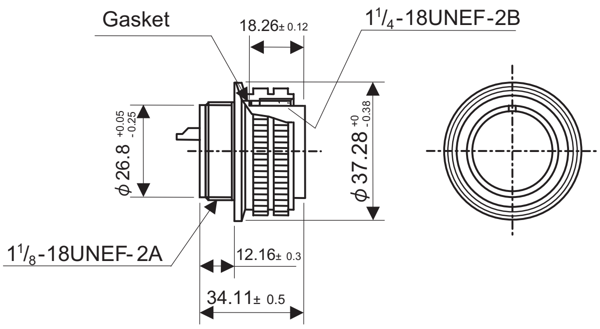


Appendix 1 Cable and Connector Specifications

Spindle side detector connector (for OSE-1024)

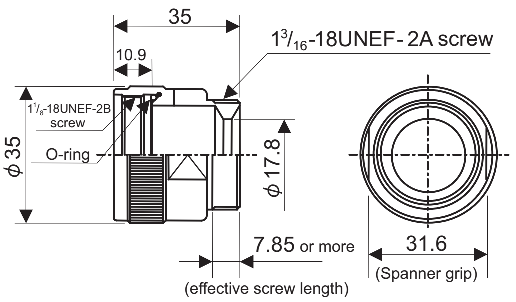
[Unit:mm]

Manufacturer: DDK
<Type>
Connector: MS3106A20-29S(D190)



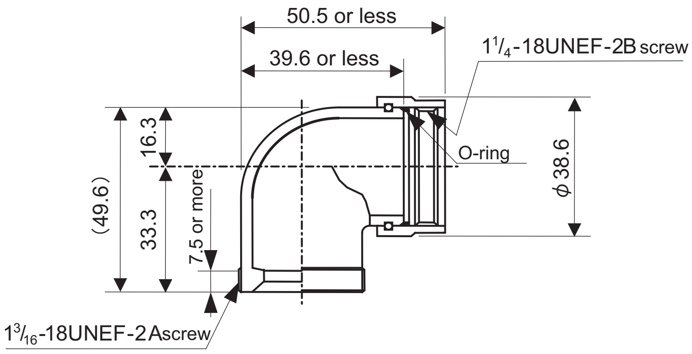
[Unit:mm]

Manufacturer: DDK
<Type>
Straight back shell: CE02-20BS-S



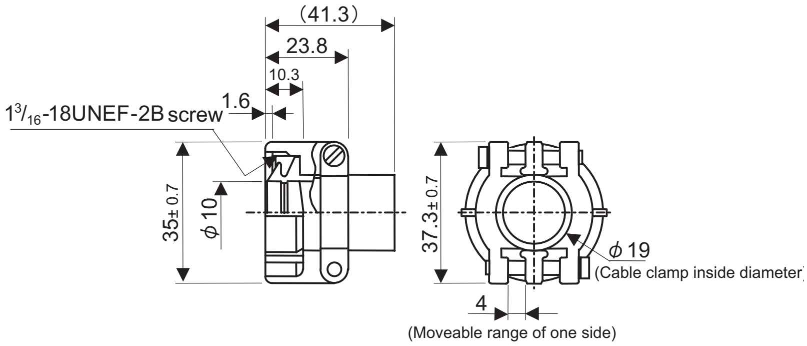
[Unit:mm]

Manufacturer: DDK
<Type>
Angle back shell: CE-20BA-S



[Unit:mm]

Manufacturer: DDK
<Type>
Cable clamp:CE3057-12A-3



Appendix 2

Cable and Connector Assembly

Contents

Appendix 2 Cable and Connector Assembly

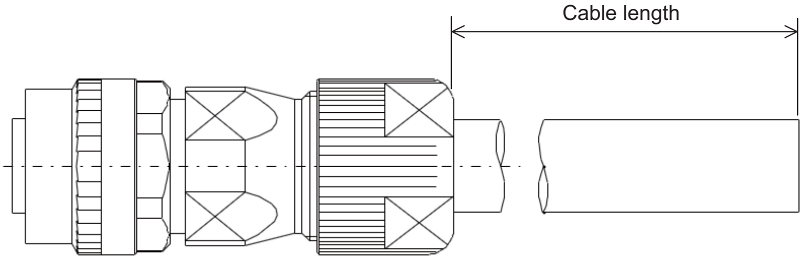
Appendix 2-1 CM10-SPxxS-x(D6) plug connector

This section explains how to assemble the wire to CM10 plug connector.

(1) Cutting a cable

Cut the cable to the following dimensions:

(Note) Not to change cable length.

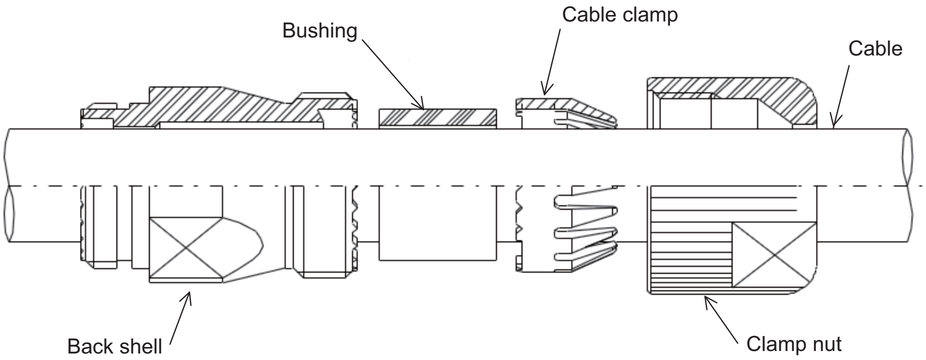


Cable length after cutting = 35±0.5mm for CM10-SPxxS-x(D6) + Cable length
= 35±0.5mm + Cable length

(2) Inserting parts

Insert the clamp nut, the cable clamp, the bushing and the back shell to the cable.

(Note) Pay attention to the direction each part is inserted.
Make sure that every part is inserted.

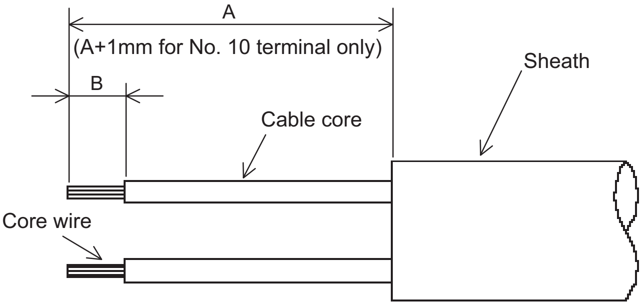


(3) Stripping a cable

Strip the cable's sheath to the A length, cut the wire set at its root and strip the core wire to the B length.

(Note) Make sure to strip the cable to the correct length.
Do not leave cutting or scratch to the cable core.

* When making CM10-SP10S-x(D6), strip the cable for No. 10 terminal in a way that the A length becomes 1mm longer than that of other cables.
(This is to prevent excessive tension of the cable when inserting the contact to the housing in the next process.)



Product name	A [mm]	B [mm]
CM10-SP10S-x(D6)	18.5 to 19.5	4.5 to 5.0
CM10-SP2S-x(D6)	17.5 to 18.5	

(4) Soldering a contact

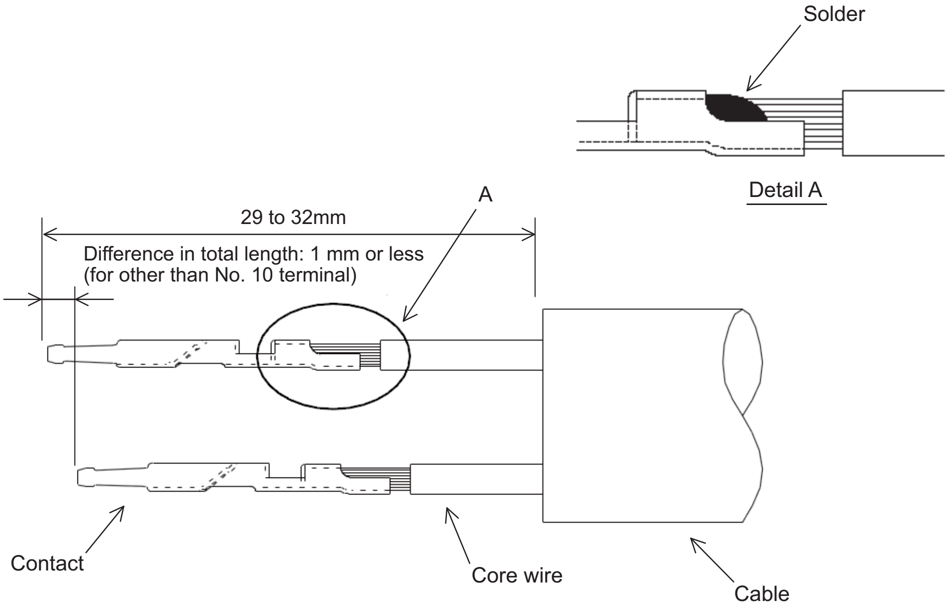
Apply preliminary soldering to each contact and to the cable’s core wire, then solder the core wire to the contacts.

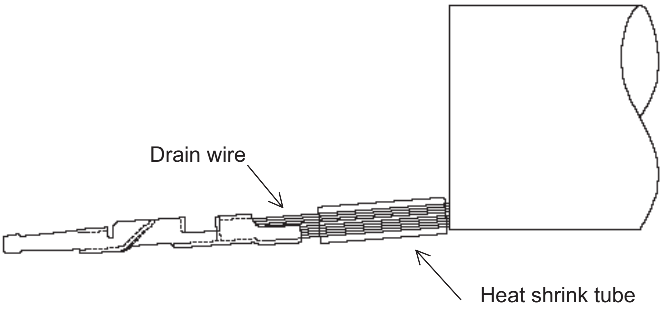
Connector name	Applicable contact	Applicable cable
CM10-SP10S-x(D6)	CM10-#22SC-(S1)(D8)	AWG20 or below
CM10-SP2S-x(D6)	CM10-#22SC-(S2)(D8)	AWG16 or below

(Note) Make sure that the core wire does not come out of the contact.
When soldering, make sure that the solder does not stick to the circumference of the solder cup.
When using a drain wire, attach a heat shrink tube to the drain cable after soldering.

* When making CM10-SP10S-x(D6), the cable for No. 10 terminal is 1mm longer than other cables. (To avoid the cable tension when inserting a contact to the housing in a later process.)

* The difference in the total A length of the cables for other than No. 10 terminal must be 1mm or less.





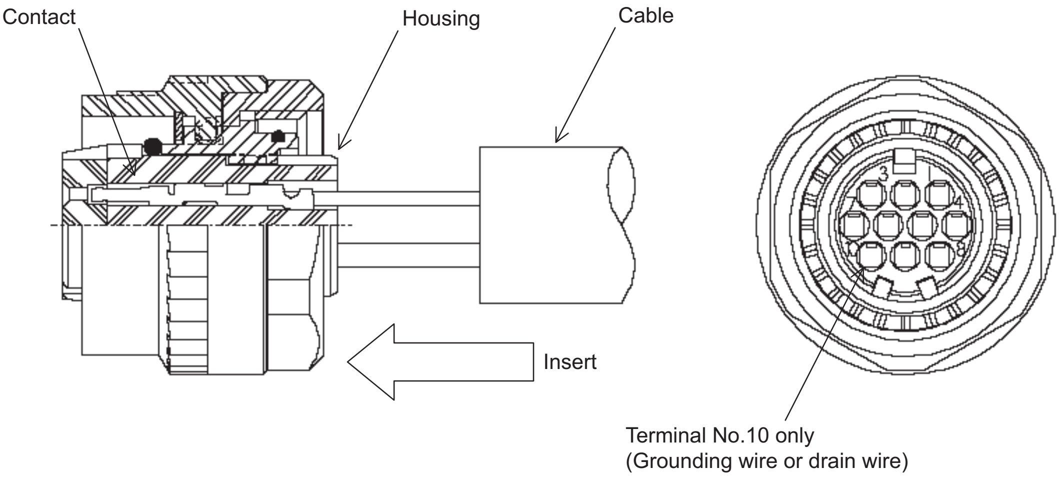
If a drain wire is soldered

(5) Inserting the contact

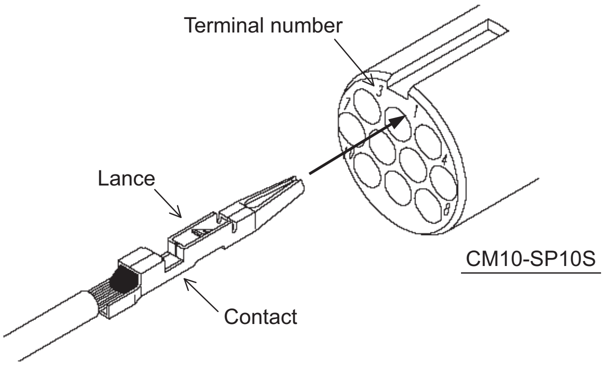
Insert the contact into the specified terminal number point in the housing.
(Insert grounding wire or drain wire into terminal No. 10).

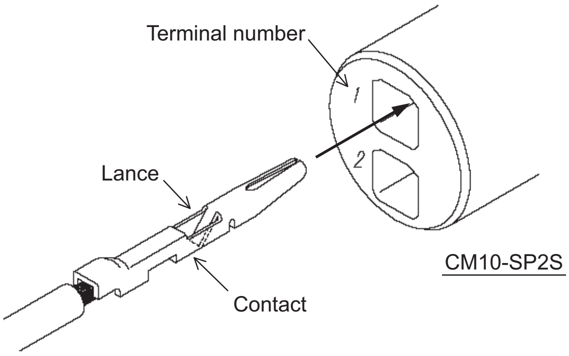
- * When the contact catches the housing, you will hear a snap.
- * Pulling the wire for confirming the correct position.

(Note) Before inserting the contact, check that the clamp nut, cable clamp, bushing and back shell is inserted.
Take care not to insert the contact upside down as shown below.



- * Insert the contact so that the terminal number face the same direction. However, in case of CM10-SP2S-x(D6), insert the contact so that the lance and the terminal number face the opposite direction.
- * Using a pull out tool for pulling up inserted contact.
  Tool No.: 357J-50548T
  Refer to the instruction manual in case of using pull up tool.
- * As Lance falls down easily after pulling up, set up to original position before re-insert.

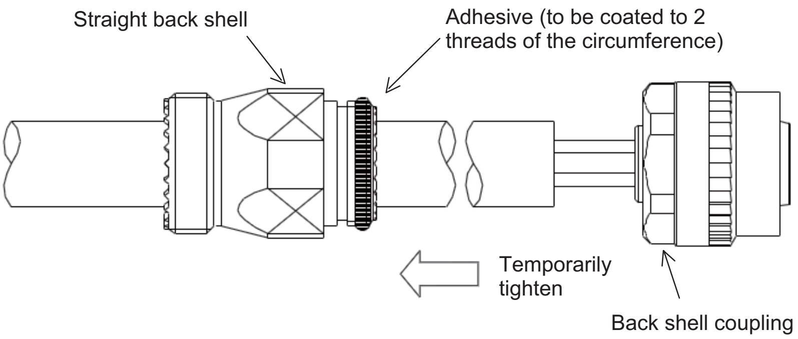


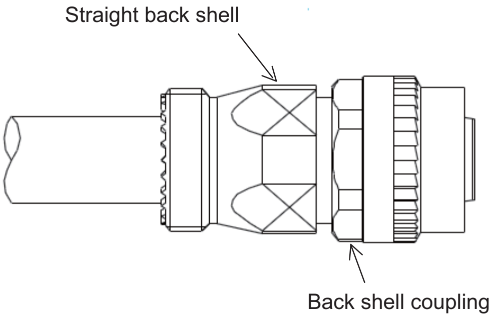


(6) Back clamp nut tightening, shell tightening

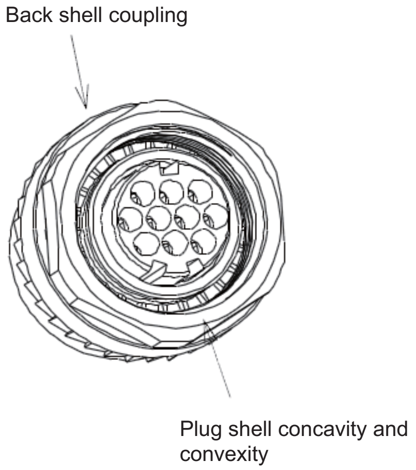
[1] To prevent the straight back shell from loosening, coat 2 threads of the circumference of the straight back shell with adhesive.
Recommended adhesive: 1401B (Three Bond Co., Ltd.)

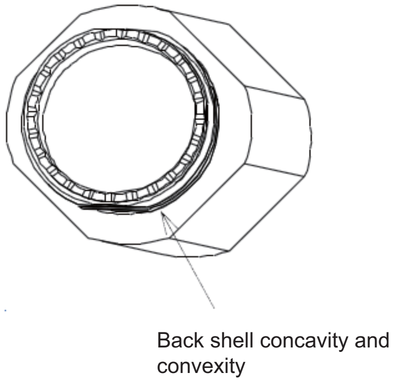
[2] Rotate the back shell coupling of the connector and temporarily tighten the straight back shell.



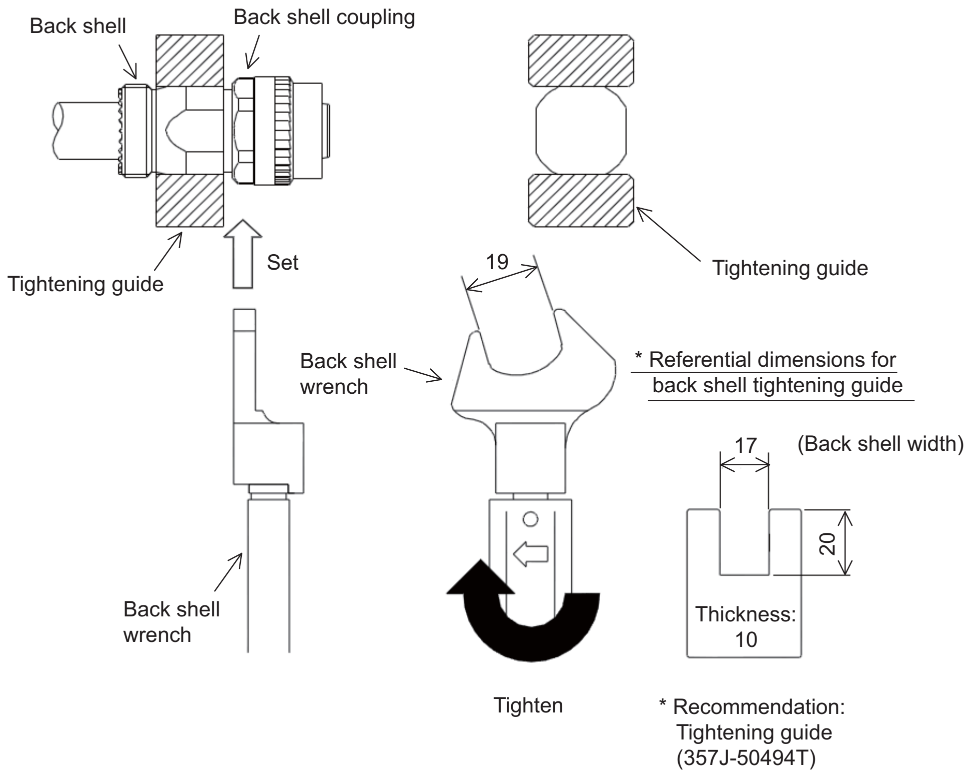


* When tightening temporarily, match the concavity and convexity of the plug shell with those of the angle back shell.
(You can confirm the correct connection of concavity and convexity waving lightly back shell just before inserting to BS coupling.)





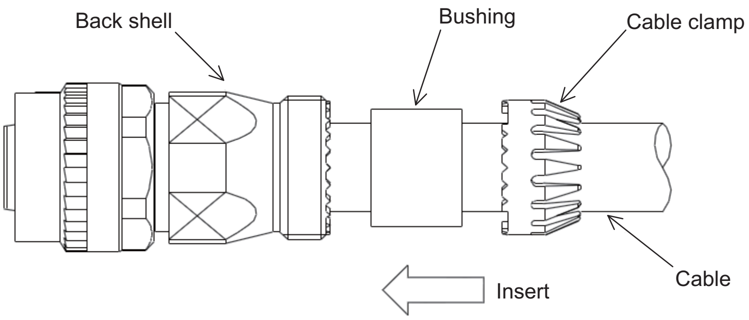
[3] Fix the 2 surface width of the angle back shell on the tightening guide.
[4] Set the tightening wrench adjusting to the back shell coupling.
[5] With the wrench, tighten the back shell coupling to the angle back shell.
Recommended tightening torque: 5N•m
(Note1) When setting the work to the wrench, adjust it to the 2 surface width.
To remove, take the reverse steps.



● Recommended jigs and tools : Back shell wrench (357J-51333T)
(Bit (357J-51344T)
Torque wrench (CL6N x 8D,Tonichi Mfg.))
* Recommended tightening guide: (357J-50494T)

(7) Insert a busing and a cable clamp

Insert the bushing and the cable clamp in the back shell.



(Note) After the Bushing insert, confirm that cable position should be inside of Bushing.

(8) Tightening a clamp nut

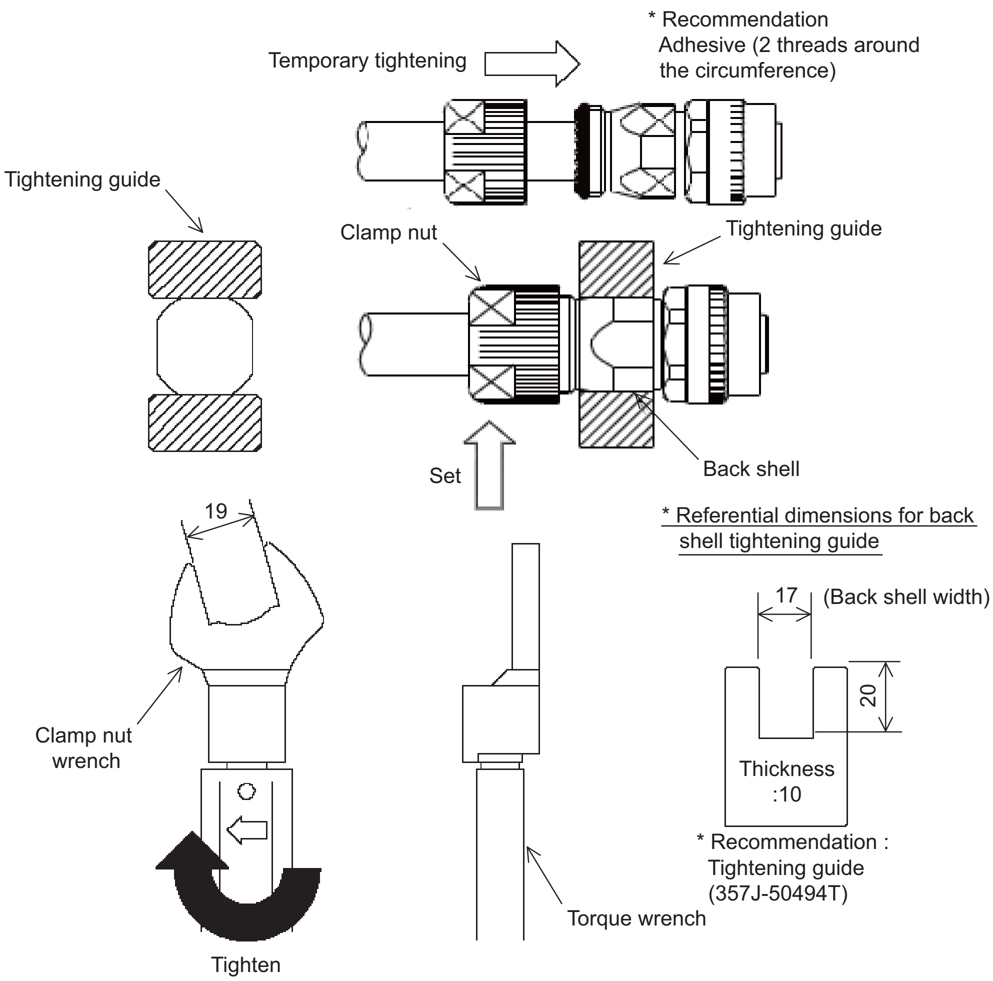
[1] Temporarily tighten the clamp nut on the angle back shell.
*To prevent the loosening, it is recommended to coat the straight back shell with adhesive.
Recommended adhesive: 1401B (Three Bond Co., Ltd.)

[2] Fix the 2 surface width of the angle back shell on the tightening guide.

[3] Set the tightening wrench adjusting the 2 surface width of the clamp nut.

[4] With the wrench, tighten the clamp nut on the angle back shell.
Recommended tightening torque: 5N•m

(Note 1) When setting the work to the wrench, adjust the 2 surface width.
In case of squeezing the clamp nut with excessed torque provided as above, the clamp nut may be broken. Please use the torque wrench.
To remove, take the reverse steps.

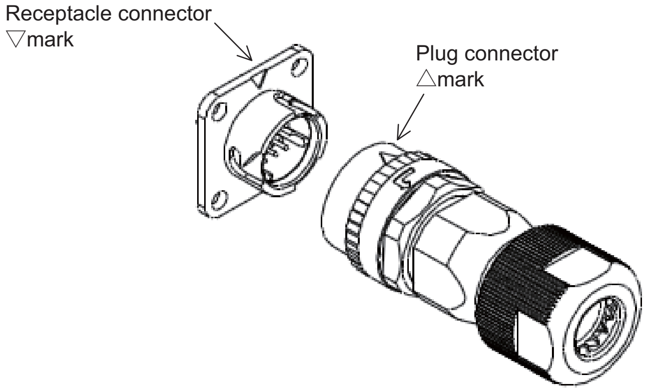


● Recommended jigs and tools : Clamp nut wrench(357J-51334T)
Bit (357J-51345T)
Torque wrench (CL6N x 8D, Tonichi Mfg.)

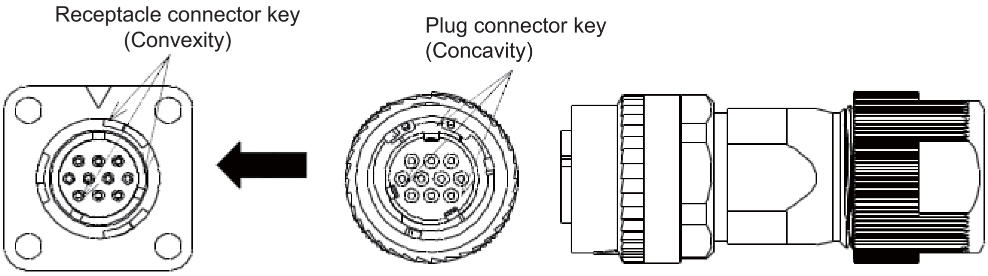
* Recommended tightening jig : (357J-50494T)

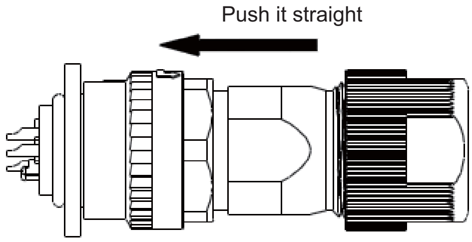
(9) When connecting

[1] Set the △ mark of each other's connectors.

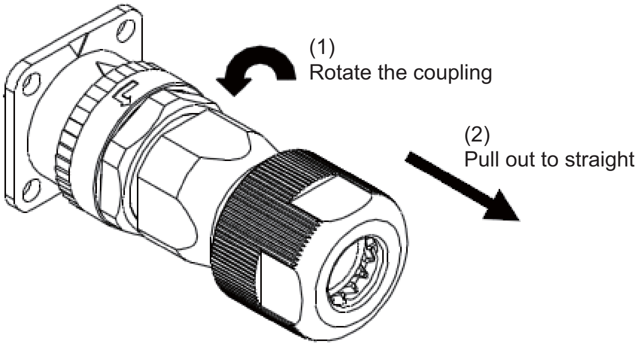


[2] Each other's key (concavity and convexity) are fit in. Push it straight, take care not to tilt.





* To remove, rotate the coupling and pull out to straight.

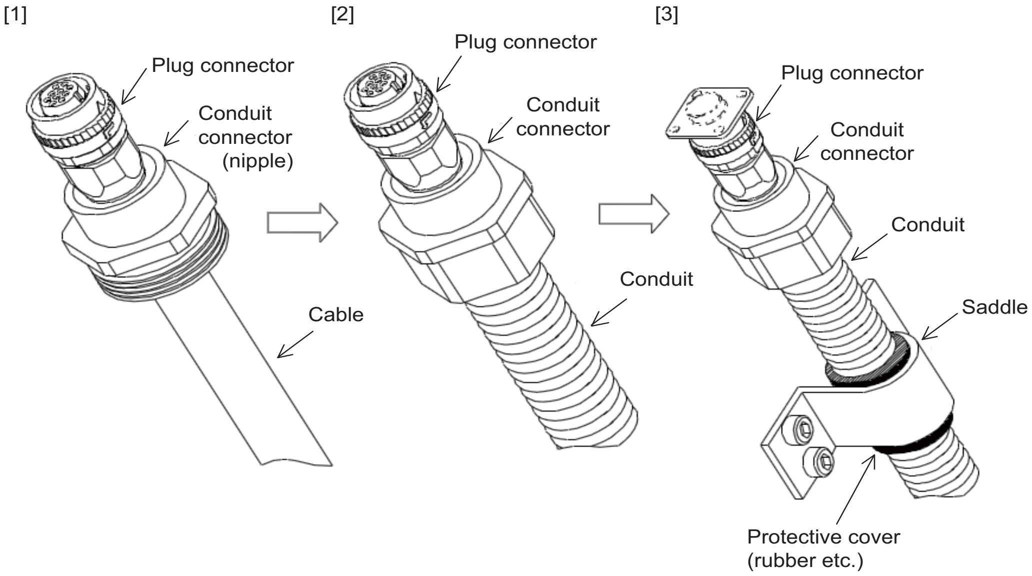


(10) When using a conduit

[1] Tighten the nipple of conduit connector on the plug connector (CM10).

[2] Set the conduit on the nipple of conduit connector.

[3] Fix the conduit to the plug connector (CM10). If the conduit is used in a moving part, fix the conduit with a saddle, etc. so that no load is applied to the plug connector (CM10) and to the conduit connector.
If the conduit is fixed with a saddle, etc., make sure that no load is applied to the fixing area.
Set the protective cover (rubber etc.,) on the conduit to avoid cable damage.



Recommended conduit

Type: VF   Type: SR   Type: FBN   Type: EM   Type: VFS   Type: SRK   etc

Recommended connector

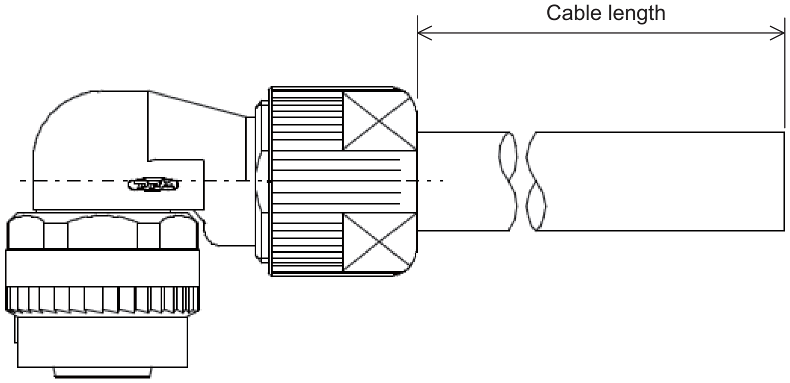
Recommended connector	Applicable connector type	Applicable cable range
RCM103S	CM10-SP10S-S(D6)/CM10-AP10S-S(D6)	φ4.0 to φ6.0mm
RCM103M	CM10-SP10S-M(D6)/CM10-AP10S-M(D6)	φ6.0 to φ9.0mm
RCM104L	CM10-SP10S-L(D6)/CM10-AP10S-L(D6)	φ9.0 to φ12.0mm

Appendix 2-2 CM10-APxxS-x(D6) angle plug connector

This section explains how to assemble the wire to CM10 angle plug connector.

(1) Cutting a cable

Cut the cable to the following dimensions:



Cable length after cutting = measurement A for CM10-APxxS-x(D6)+ Cable length
= A + Cable length

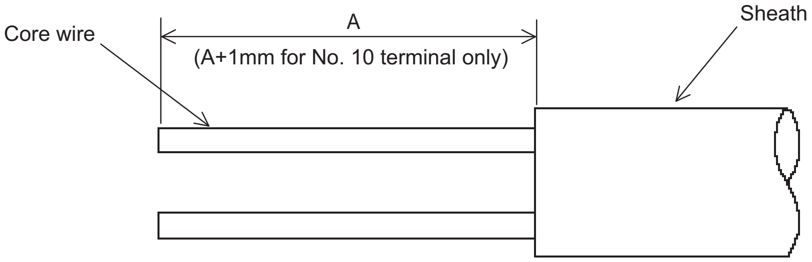
Product name	A [mm]
CM10-APxxS-S(D6)	40±0.5
CM10-APxxS-M(D6)	
CM10-APxxS-L(D6)	55±0.5

(2) Stripping a cable sheath

Strip the cable sheath to the length A as shown below.

(Note) Take care the cable peel length.
Take care not to damage anything.

* When making CM10-AP10S-x(D6), strip the cable for No. 10 terminal in a way that makes the A length 1mm longer than other cables.
(To avoid the cable tension when inserting a contact to the housing in a later process.)

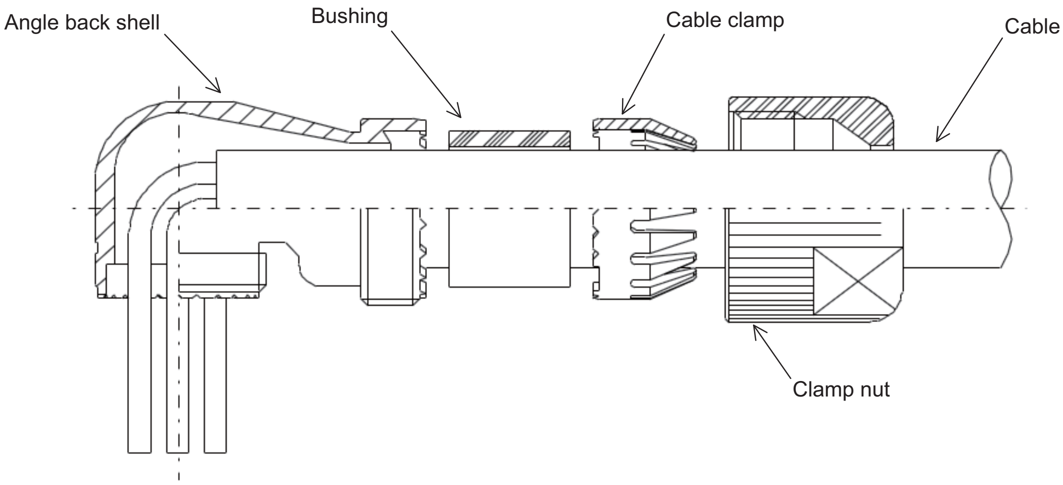


Product name	A [mm]
CM10-APxxS-S(D6)	30±0.5
CM10-APxxS-M(D6)	
CM10-APxxS-L(D6)	45±0.5

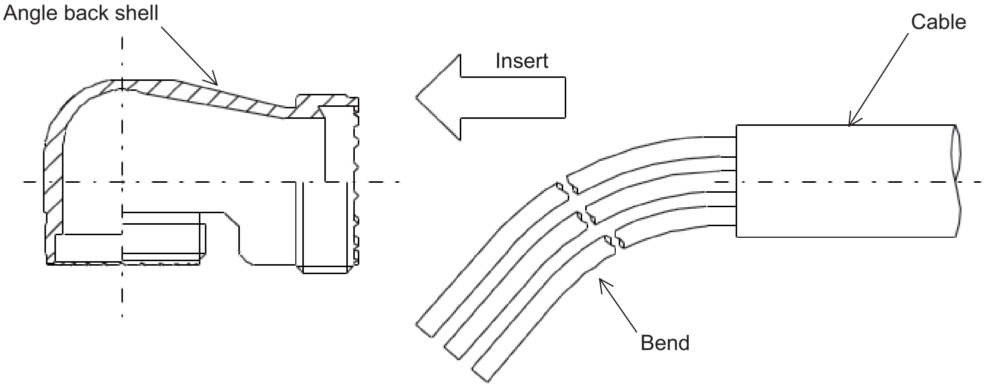
(3) Inserting parts

Insert the clamp nut, the cable clamp, the bushing and the angle back shell to the cable stripped.

(Note) Pay attention to the direction each part is inserted.
Make sure that every part is inserted.



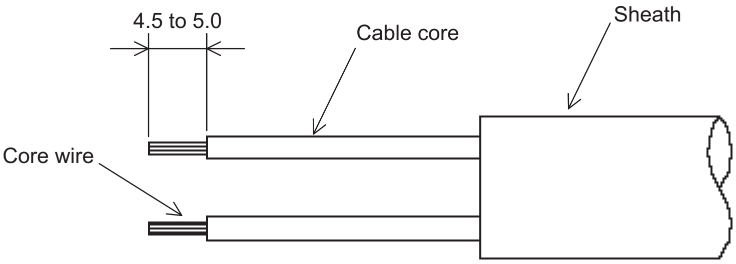
* To insert the angle back shell, bend the cable.



(4) Stripping a core wire

Strip the cable’s core wire to the length 4.5 to 5.0mm.

(Note) Do not mistake the length of the core wire to be stripped.
Do not leave cut or scratch to the cable core.



(5) Soldering a contact

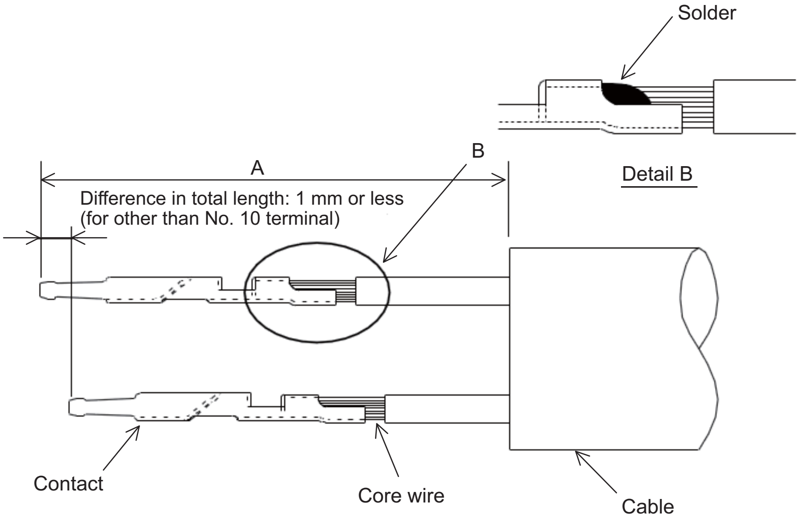
Apply preliminary soldering to each contact and to the cable's core wire, then solder the core wire to the contacts.

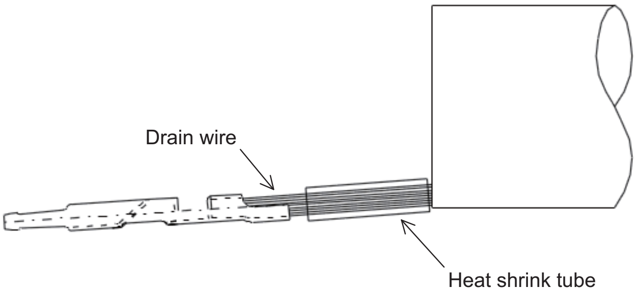
Connector name	Applicable contact	Applicable cable
CM10-AP10S	CM10-#22SC(S1)(D8)	AWG20 or below
CM10-AP2S	CM10-#22SC(S2)(D8)	AWG16 or below

(Note) Make sure that the core wire does not come out of the contact.
When soldering, make sure that the solder does not stick to the circumference of the solder cup.
When using a drain wire, attach a heat shrink tube to the drain cable after soldering.

* When making CM10-AP10S-x(D6), the cable for No. 10 terminal is 1mm longer than other cables.
(To avoid the cable tension when inserting a contact to the housing in a later process.)

* The difference in the total A length of the cables for other than No. 10 terminal must be 1mm or less.





If a drain wire is soldered

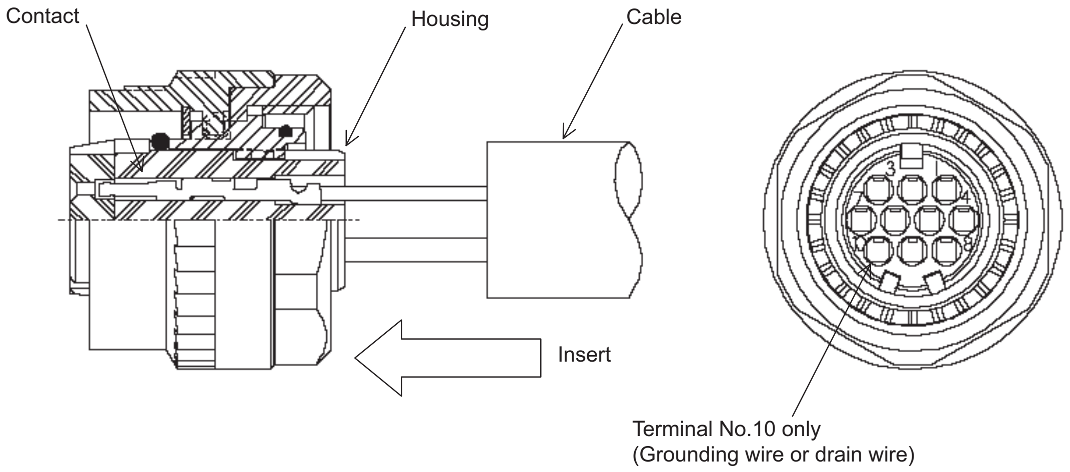
Product name	A [mm]
CM10-APxxS-S(D6)	39 to 42
CM10-APxxS-M(D6)	
CM10-APxxS-L(D6)	54 to 57

(6) Inserting the contact

Insert the contact into the specified terminal number point in the housing.
(Insert grounding wire or drain wire into terminal No. 10)

- * When the contact catches the housing, you will hear a snap.
- * Pulling the wire for confirming the correct position.

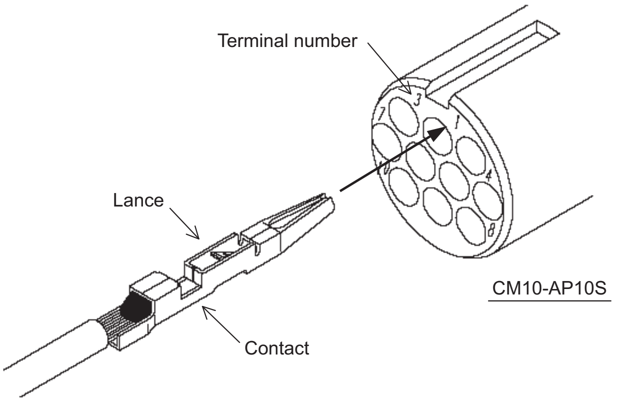
(Note) Before inserting the contact, check that the clamp nut, cable clamp, bushing and angle back shell is inserted.
Take care not to insert the contact upside down as shown below.

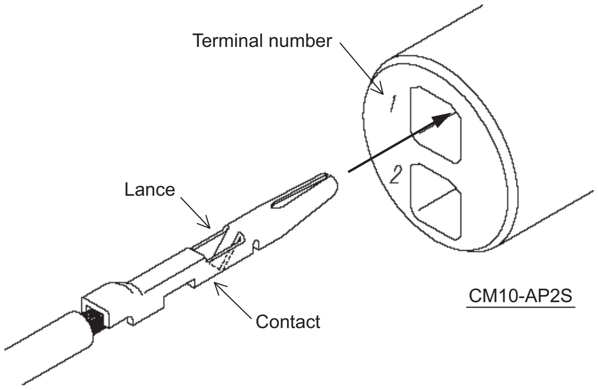


- * Insert the contact so that the terminal number face the same direction.
  However, in case of CM10-AP2S-x(D6), insert the contact so that the lance and the terminal number face the opposite direction.

- * Using a pull out tool for pulling up inserted contact.
  Tool No.: 357J-50548T
  Refer to the instruction manual in case of using pull up tool.

- * As Lance falls down easily after pulling up, set up to original position before re-insert.

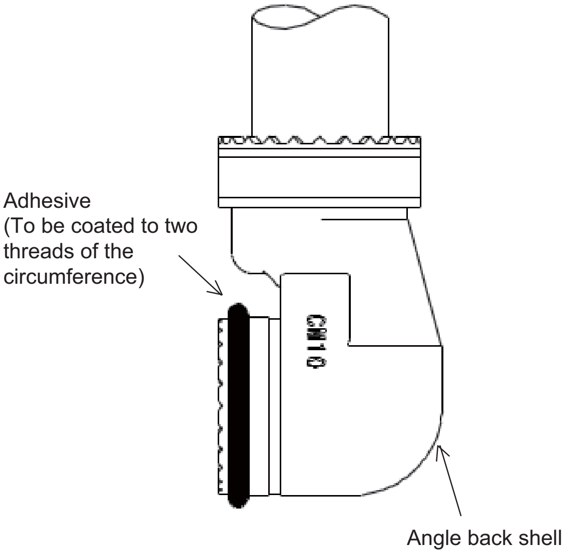


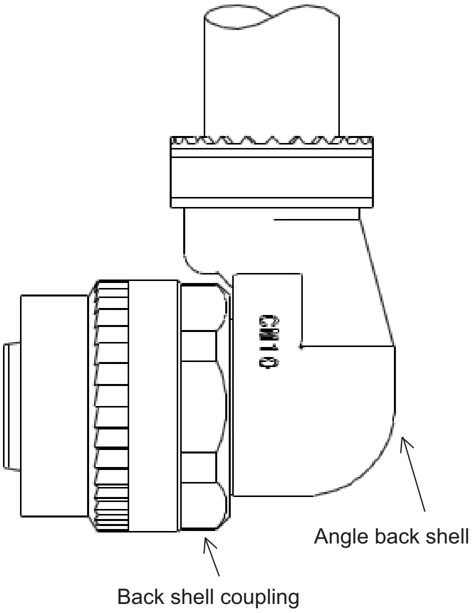


(7) Tightening an angle back shell

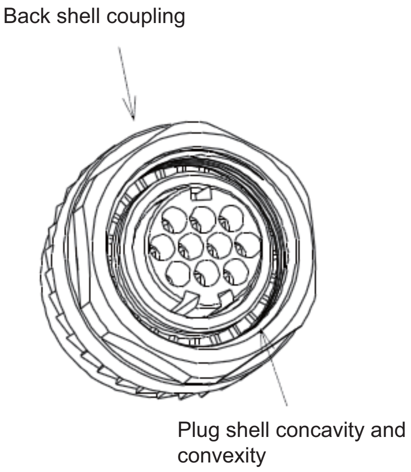
[1] To prevent loosening, the adhesive should be applied to the angle back shell by two threads around the circumference.
Recommended adhesive: 1401B (Three Bond Co., Ltd.)

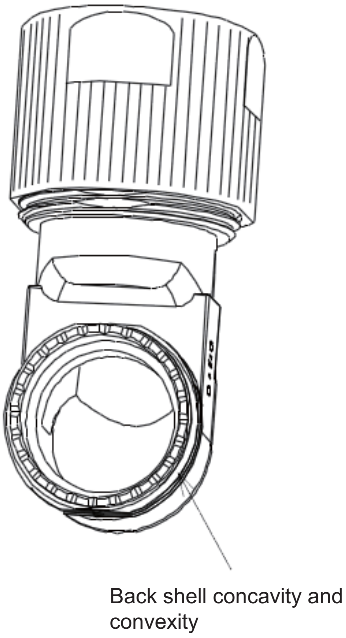
[2] Rotate and temporarily tighten the back shell coupling by setting the connector and the angle back shell to the specified angle.



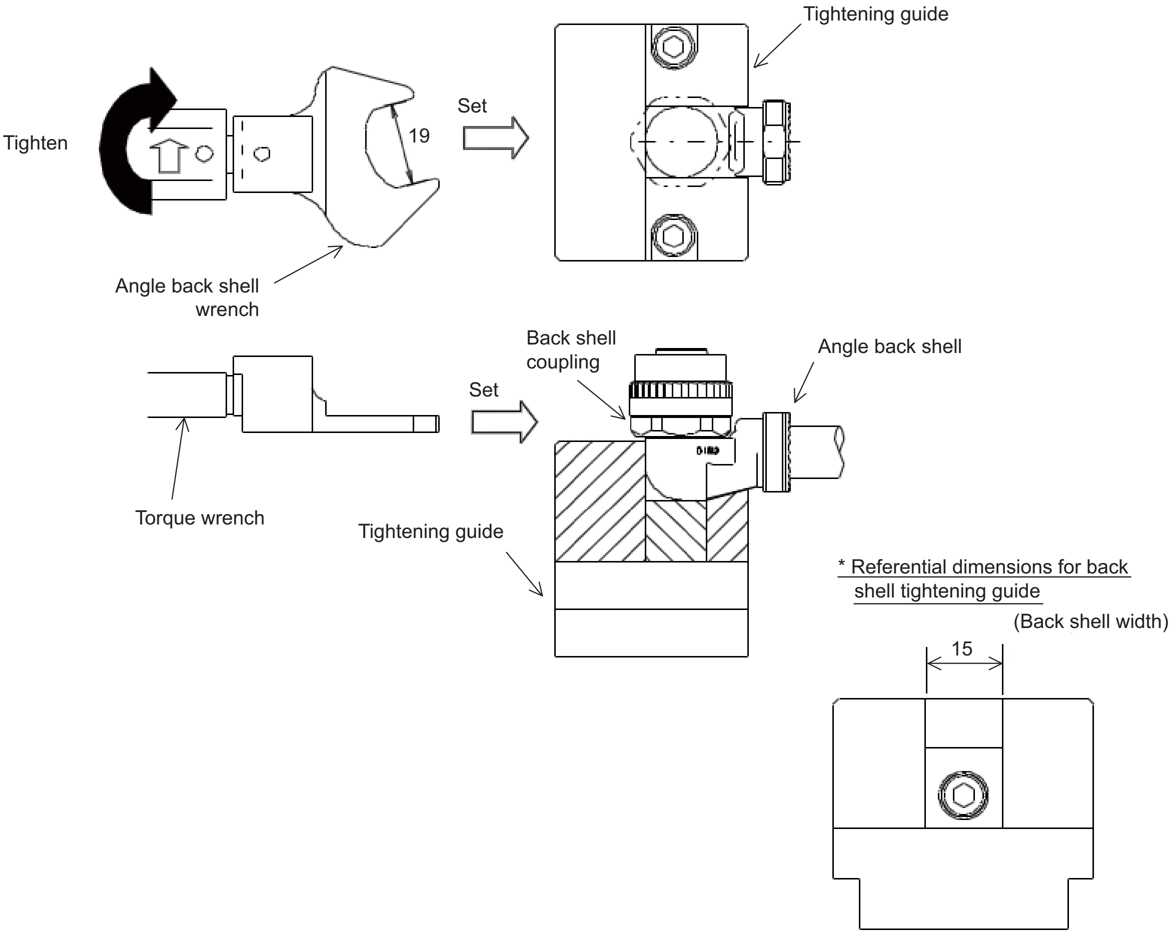


* When tightening temporarily, match the concavity and convexity of the plug shell with those of the angle back shell.
(You can confirm the correct connection of concavity and convexity waving lightly back shell just before inserting to BS coupling.)





[3] Fix the 2 surface width of the angle back shell on the tightening guide.
[4] Set the back shell wrench adjusting to the 2 surface width of the back shell coupling.
[5] With the wrench, tighten the back shell coupling to the angle back shell.
Recommended tightening torque: 5N•m
(Note 1) When setting the work to the wrench, adjust it to the 2 surface width.
To remove, take the reverse steps.



* Recommendation:
Tightening guide
(357J-52658T)

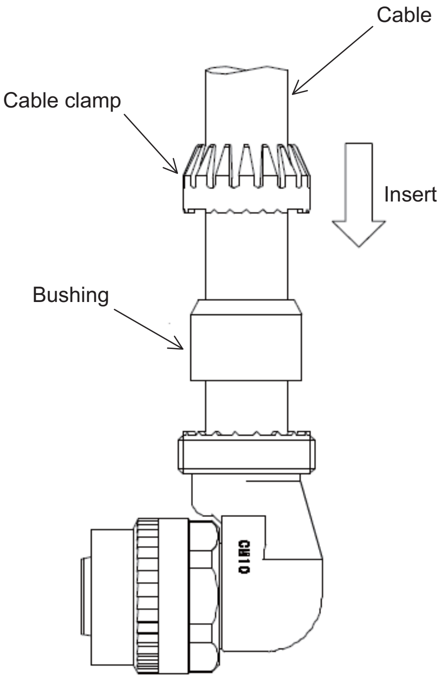
(Note) To change the back shell angle, adjust the toothing position of the plug shell and back shell.

- Recommended jigs and tools : Back shell wrench (357J-51333T)
  - Bit (357J-51344T)
  - Torque wrench (CL6N x 8D,Tonichi Mfg.)

* Recommended tightening guide: (357J-52658T)

(8) Inserting a busing and a cable clamp

Insert the bushing and the cable clamp to the back shell.



(Note) After the Bushing insert, confirm that cable position should be inside of Bushing.

(9) Tightening a clamp nut

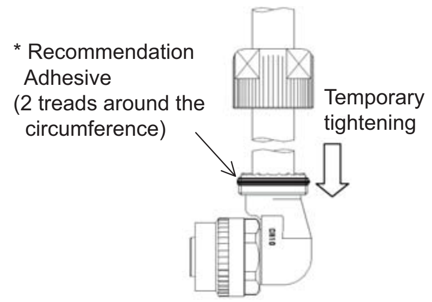
[1] Temporarily tighten the clamp nut on the angle back shell.
 * To prevent loosening, the adhesive should be applied to the angle back shell.
 Recommended adhesive: 1401B (Three Bond Co., Ltd.)

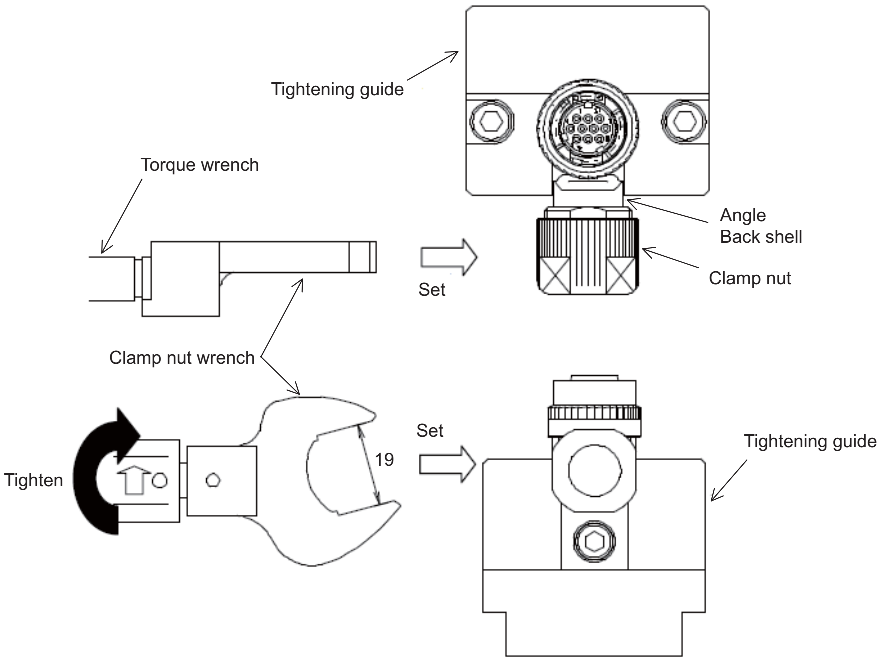
[2] Fix the 2 surface width of the angle back shell on the tightening guide.

[3] Set the tightening wrench adjusting the 2 surface width of the clamp nut.

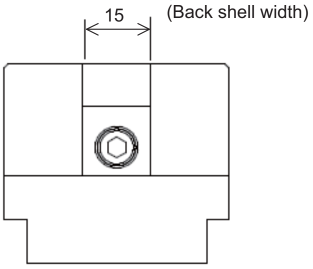
[4] With the wrench, tighten the clamp nut on the angle back shell.
 Recommended tightening torque: 5N•m

(Note1) To set the work to the wrench, adjust the 2 surface width.
In case of squeezing the clamp nut with excessed torque provided as above, the clamp nut may be broken. Please use the torque wrench.
To remove, take the reverse steps.





* Referential dimensions for back shell tightening guide

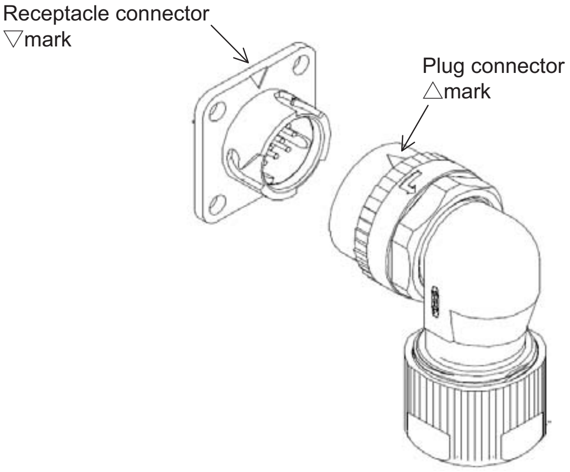


* Recommendation:
Tightening guide
(357J-52658T)

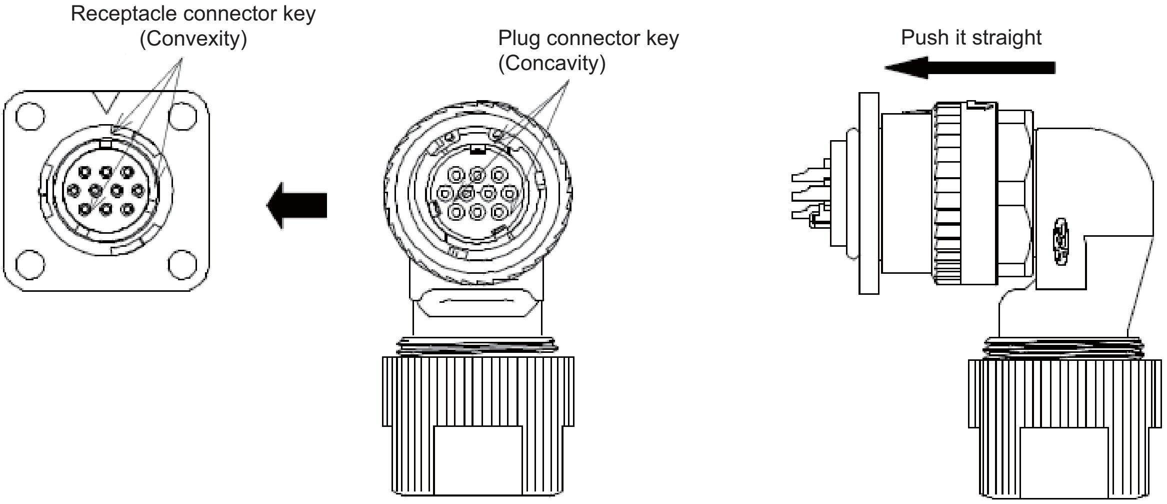
● Recommended jigs and tools : Clamp nut wrench (357J-51334T)
Bit (357J-51345T)
Torque wrench (CL6N x 8D,Tonichi Mfg.)
* Recommended tightening guide: (357J-52658T)

(10) When connecting

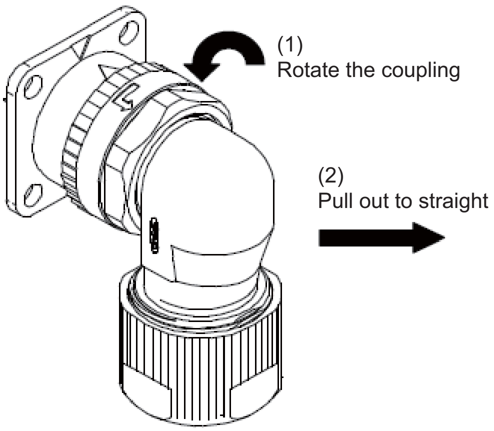
[1] Set the △ mark of each other’s connectors.



[2] Each other’s key (concavity and convexity) are fit in. Push it straight, take care not to tilt.

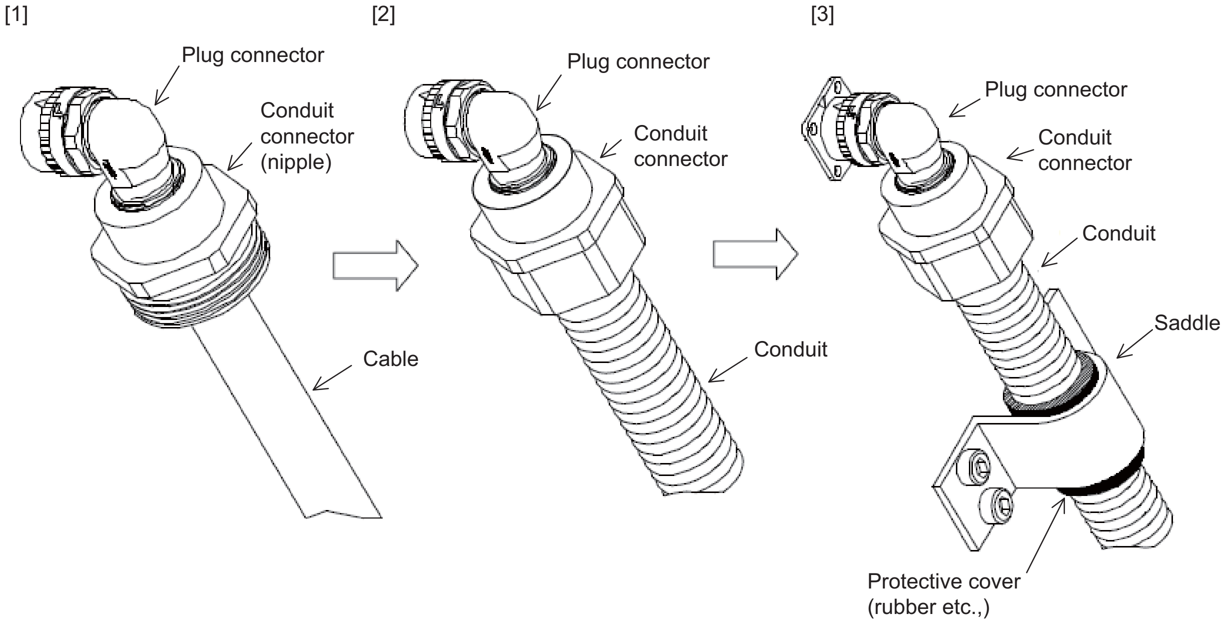


* To remove, rotate the coupling and pull out to straight.



(11) When using a conduit

[1] Tighten the nipple of conduit connector on the plug connector (CM10).
[2] Set the conduit on the nipple of conduit connector.
[3] Fix the conduit to the plug connector (CM10). If the conduit is used in a moving part, fix the conduit with a saddle, etc. so that no load is applied to the plug connector (CM10) and to the conduit connector.
If the conduit is fixed with a saddle, etc., make sure that no load is applied to the fixing area.
Set the protective cover (rubber etc.,) on the conduit to avoid cable damage.



Recommended conduit

Type: VF Type: SR Type: FBN Type: EM Type: VFS Type: SRK etc

Recommended connector

Recommended connector	Applicable connector type	Applicable cable range
RCM103S	CM10-SP10S-S(D6)/CM10-AP10S-S(D6)	φ4.0 to φ6.0mm
RCM103M	CM10-SP10S-M(D6)/CM10-AP10S-M(D6)	φ6.0 to φ9.0mm
RCM104L	CM10-SP10S-L(D6)/CM10-AP10S-L(D6)	φ9.0 to φ12.0mm

Appendix 2-3 CM10-SP-CV reinforcing cover for straight plug

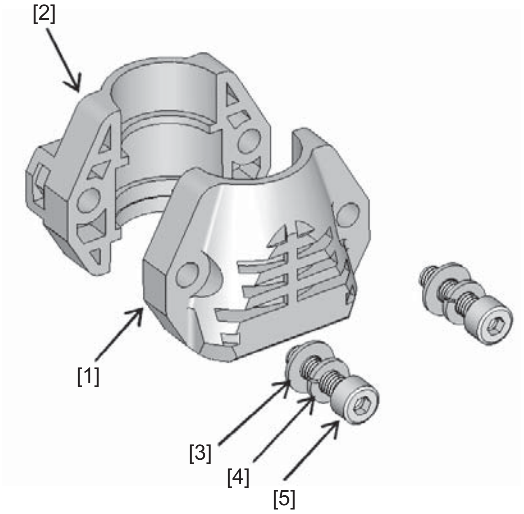
This section explains how to assemble the CM10-SP-CV reinforcing cover for straight plug.

(1) Check the application before assembly parts.

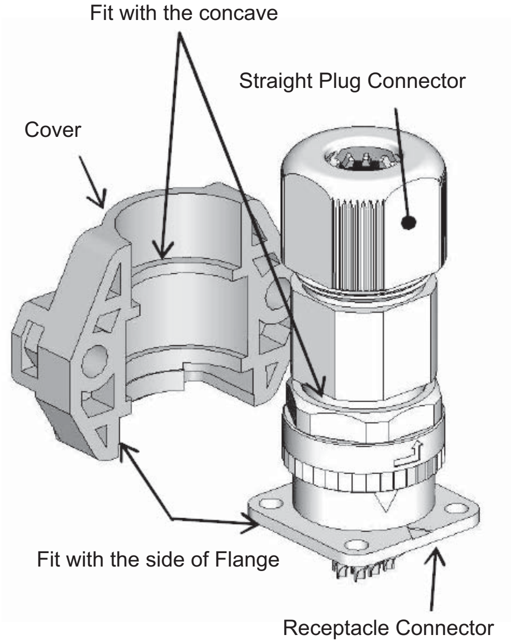
(Note) Take care to the part [1] without hexagon nut, the part [2] comes with hexagon nut.

Application Parts

[1] CM10-SP-CV-A (without hexagon nut):	1 pc.
[2] CM10-SP-CV-B (with hexagon nut):	1 pc.
[3] Hexagon socket head screw (M4 x20):	2 pcs
[4] Spring washer:	2 pcs.
[5] Plain washer:	2 pcs

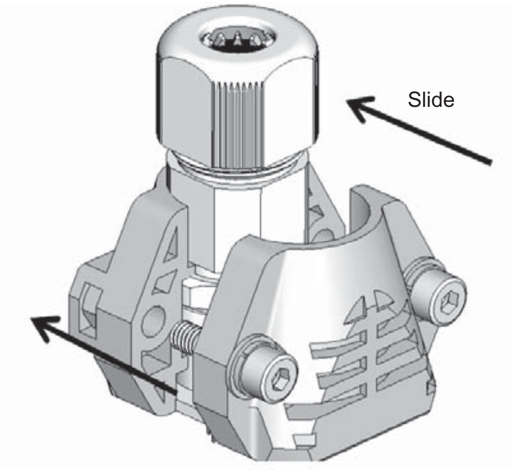


(2) The CM10-SP-CV-B (with hexagon nut) set to the engaged receptacle connector and the straight plug connector. The cover fit in the flange of the receptacle connector and concave of the straight plug connector.



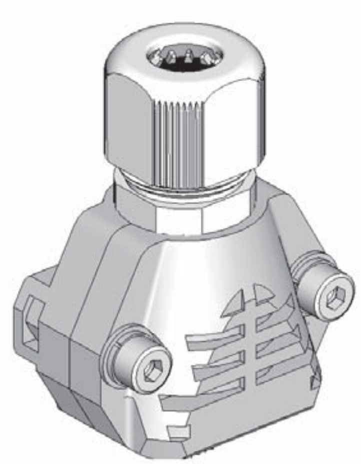
[Cover position]

(3) In the same manner as in step 2, the CM10-SP-CV-A (without hexagon nut) set it.



[Before setting the Cover]

(4) Set the hexagon socket head screw (M4x20), spring washers (for M4) and plain washers (for M4) onto the covers. Using a hexagonal wrench or hexagonal screwdriver, tighten the right and left screw equally. Take care to no gap the cover A and B after tighten the screw. And tighten them additionally with tightening torque of 150cN•m.



[After Assembly]

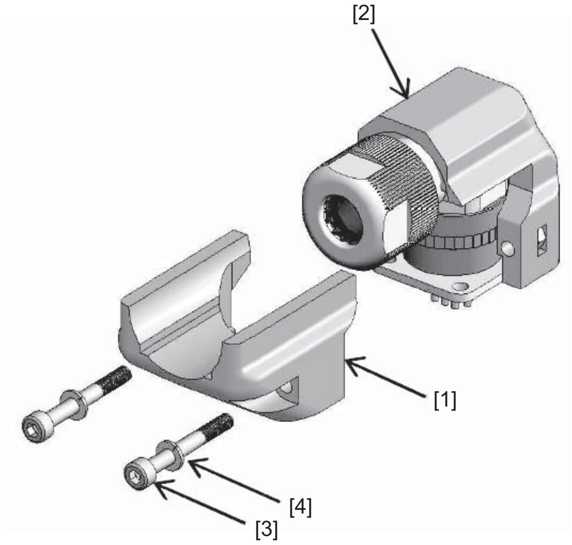
Appendix 2-4 CM10-AP-D-CV reinforcing cover for angle plug

This section explains how to assemble the CM10-AP-D-CV reinforcing cover for angle plug.

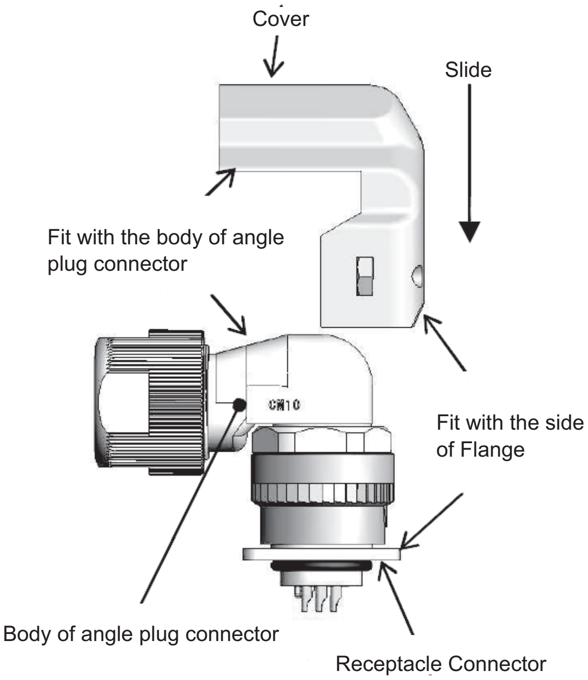
(1) Check the application before assembly parts.
(Note) Take care to the part [1] without hexagon nut, the part [2] comes with hexagon nut.

Application Parts

[1] CM10-AP-CV-A (without hexagon nut):	1 pc.
[2] CM10-AP-D-CV-B (with hexagon nut):	1 pc.
[3] Hexagon socket headscrew (M3x25):	2 pcs.
[4] Spring washer:	2 pcs.

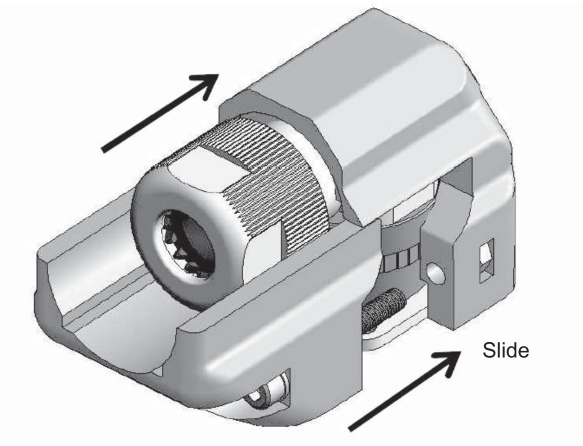


(2) The CM10-AP-CV-B (with hexagon nut) set to the engaged receptacle connector and the angle plug connector. The cover fit in the flange of the receptacle connector and body of the angle plug connector.



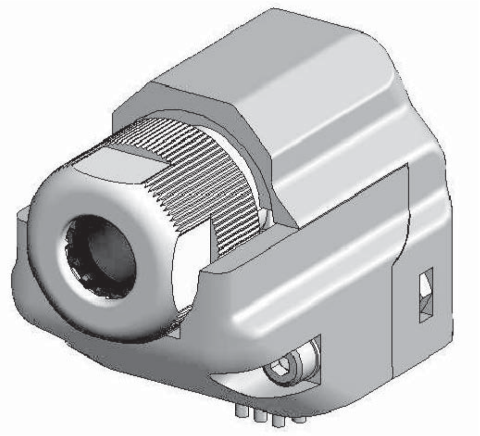
[Cover position]

(3) The CM10-AP-CV-A (without hexagon nut) set to the receptacle connector and the CM10-AP-CV-B (with hexagon nut). The cover fit in the flange of the receptacle connector and the CM10-AP-CV-B (with hexagon nut) with the angle plug connector be set.



[Before setting the Cover]

(4) Set the hexagon socket head screw (M3x 25), spring washers (for M3) and onto the covers. Using a hexagonal wrenchor hexagonal screwdriver, tighten the right and left screw equally. Take care to no gap the cover A and B after tighten the screw. And tighten them additionally with tightening torque of 63cN•m.



[After Assembly]

Appendix 2-5 1747464-1 plug connector

Appendix 2-5-1 Applicable products

Part No.	Descriptions
1674320-1 1674320-2	Encoder cable I/O kit
1674335-4	Receptacle contact

Appendix 2-5-2 Applicable cable

Wire conductor size	Cable jacket outside diameter
#26-22AWG	6.8 - 7.4 mm

Refer to Product Specification and Application Specification for details.

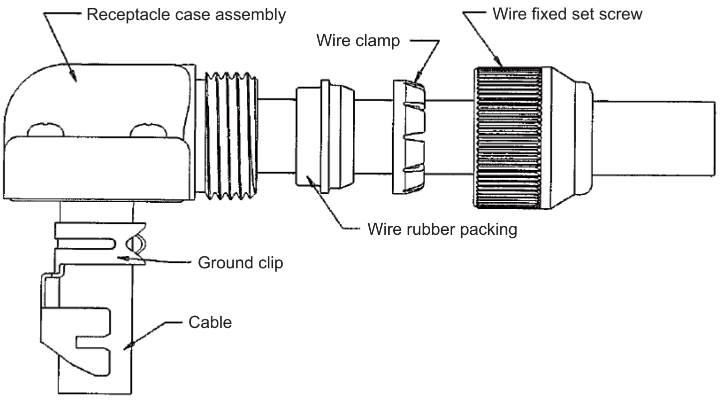
Appendix 2-5-3 Related documents

No.	Details
108-5864	Product Specification
114-5335	Rec, Contact Application Specification
114-5338	Ground Clip Application Specification

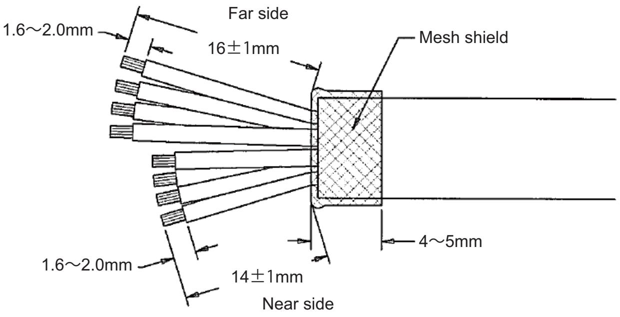
Appendix 2-5-4 Assembly procedure

Assemble the cable in the following procedure:

(1) Insert accessories to the cable.

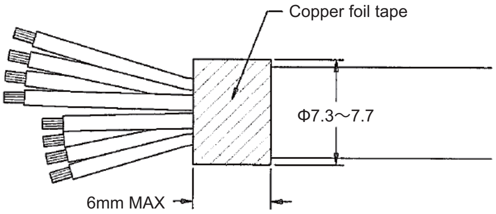


(2) Remove the sheath of the cable jacket and core wires referring to the following typical dimensions.
Do not damage the core wires. Retry it if the core wires are partly cut off or damaged.
The length of mesh shield should be decided referring to the figure below and be turned up on the outside of a jacket.

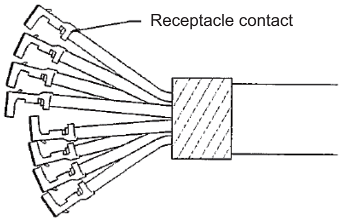


(Note) Even when the dimensions above is applied,
product performance problem can occur depending on the wires which is used.
Be sure to contact with the sales department of the manufacturer below if you consider to adopt this connector.
Tyco Electronics K.K. http://www.tycoelectronics.com

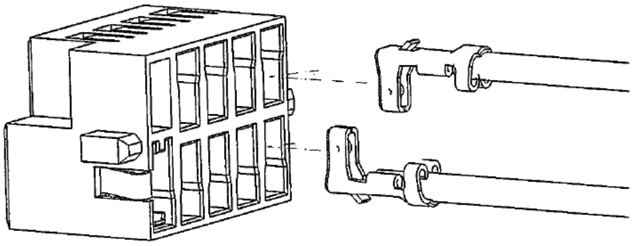
(3) Twist a copper foil tape with conductive adhesive of width 5mm around the mesh shield.
Cable finish outside diameter: Φ7.3 - 7.7



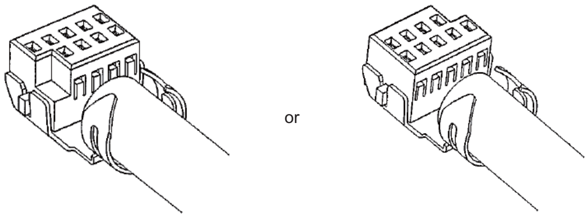
(4) Refer to Application Specification (114-5335) and crimp the contacts. After crimping, check the state in accordance with the Specification.



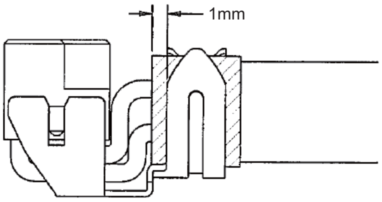
(5) Verifying the direction, insert the crimped contact into the receptacle housing. After the insertion, pull each wire lightly to make sure that the contacts are fully inserted. (Lock feeling and sound can be confirmed when the contact is fully/correctly inserted.)



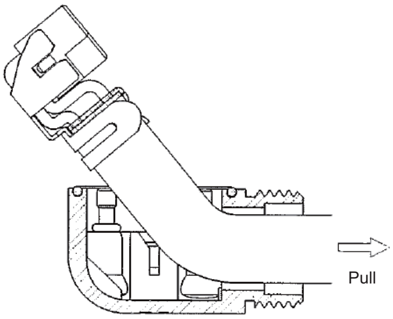
(6) Crimp the ground clip.
As receptacle housing is settled inside a ground clip, it opts for direction according to the purpose, and positions as shown below.
(Note) Direction of receptacle housing is unchangeable after ground slip crimping.



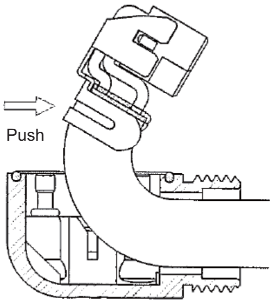
Positioning the cable jacket end as shown below. Refer to the Application Specification (114-5338) and crimp the ground clip.



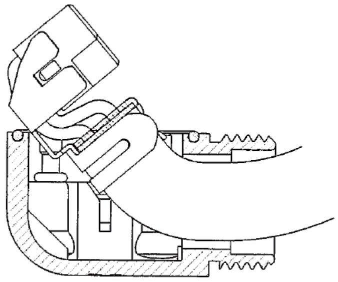
(7) Store the receptacle housing and ground clip in the receptacle case.
Pull the cable side and draw the receptacle housing side as shown below, without pushing in it.



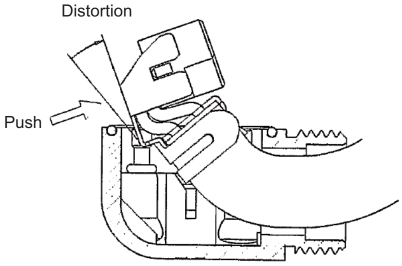
Work will become easy when the crimping part of the ground clip is pushed and the cable is bent as shown below.



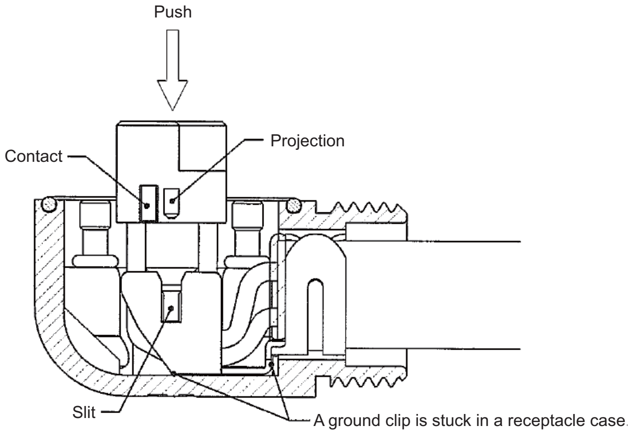
When the ground clip interferes with receptacle case at the position below and cause difficulty in continuing to draw in,



push the ground clip to distort and drawing become easy.
(Note) To prevent a fracture, do not use the ground clip which is bend and unbend 3 times or more.

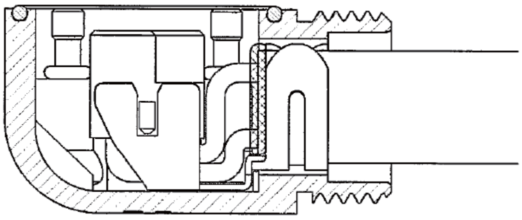


Turn the form of the ground clip back to normal and position it for the receptacle case as shown below.

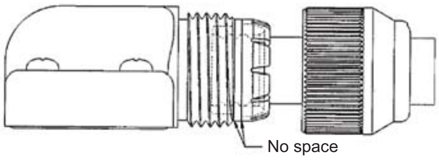


Adjust the projection of receptacle housing to the slit of the receptacle case and push in until it is fixed to the case.

(Note) See that the contact of receptacle housing goes inside a ground clip.

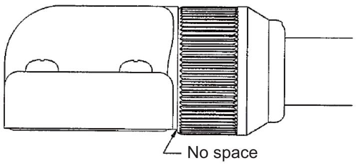


(8) Shift the wire rubber packing and wire clamp to the position below, and tighten the wire fixed set screw to fix the cable to receptacle case.

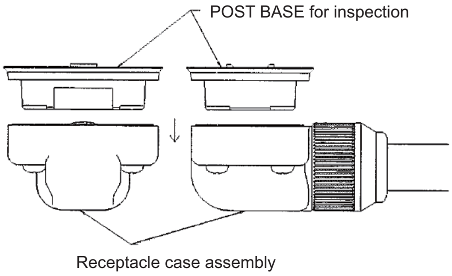


Tighten it not to create the space between the receptacle case and wire fixed set screw.

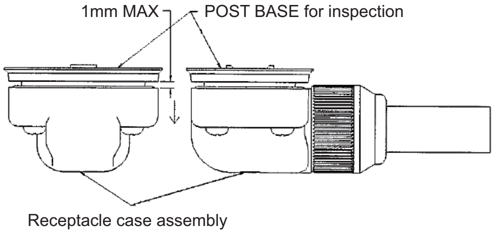
(Note) Confirm that the cable is fixed.



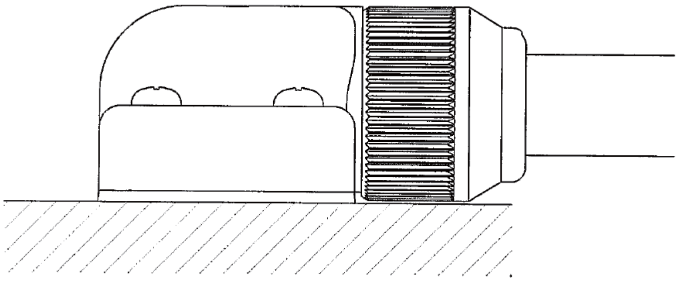
(9) To ensure that there is no leaning on the receptacle housing in the receptacle case assembly, drop the POST BASE for inspection naturally as shown below.



Confirm that the space between the receptacle case assembly and the POST BASE is within 1mm.
Regarding POST BASE for inspection, contact with the sales department of the manufacturer below.
Tyco Electronics K.K. http://www.tycoelectronics.com



(10) Insert the assembled connector until it stick fast to the POST BASE and then, tighten the four bind screws to fix. The tightening torque of the bind screw is 5.0 to 10.0 N-cm.



Appendix 3

Precautions in Installing Spindle Motor

Contents

Appendix 3 Precautions in Installing Spindle Motor

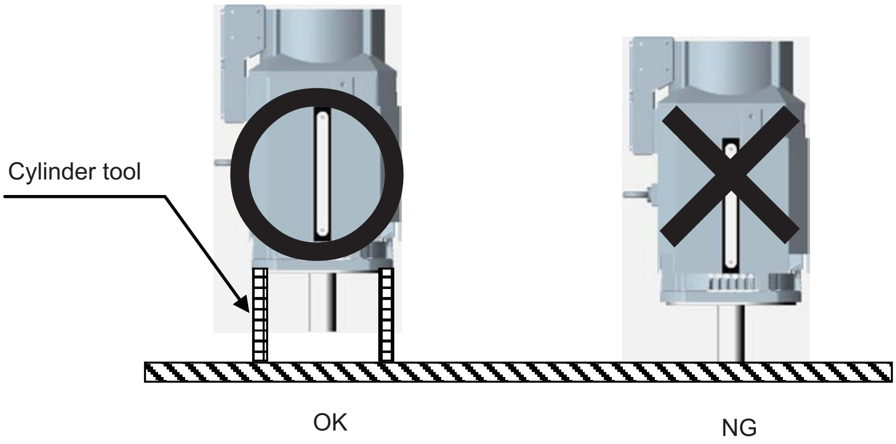
⚠ **CAUTION**

1. When a spindle motor is driven at a high speed, slight unbalance generated on the rotor causes increase of the whirling load on the rotor. Thus rotational vibration occurs, which may result in abnormal sound, shorter bearing life and/or damages (fretting or flaking). Therefore, it is important to minimize the unbalance of rotational objects including the gear, pulley, coupling, rotary joint for coolant, etc. that are attached on the motor shaft.
2. For Mitsubishi frame-type spindle motors, we consider key-less specification as standard in order to simplify balancing procedure of such as gear, pulley, coupling and rotary joint for coolant. We recommend you to choose a gear, pulley and coupling that have a fully symmetric shape, and arrange screw holes on their end faces at short and equal intervals in the circumferential direction. We also recommend you to use a fastener such as a shaft lock element to fix those fittings to the motor shaft.
3. Carry out balancing by suppressing the circumferential vibrations as well as by such as adding screws to the screw holes formed on the gear, pulley and coupling for the purpose of balancing.

Appendix 3-1 Precautions in transporting motor

(1) When you carry the motor, use the eye bolt, and do not grip the motor shaft, power line or fan case, etc. If you grasp the motor shaft in carrying, the shaft may distort and the bearing may be damaged, resulting in abnormal vibration or sound, or shorter bearing life.

(2) When you place the motor vertically, use a cylinder tool so that the motor weight is supported on the load-side bracket flange attachment surface. If the weight is born by the shaft, the bearing may be damaged.



Vertical placement of motor

Appendix 3-2 Precautions in selecting motor fittings

(1) When you select fittings for the motor shaft, such as a gear, pulley, coupling and rotary joint for coolant, choose those that meet the motor specifications (shaft diameter, rotation speed and output torque). If any of the fittings is outside the specifications, the motor failure or accident may result. Apply such fastening method as a shaft lock element so as not to apply impact of a hammer, etc. during installation.

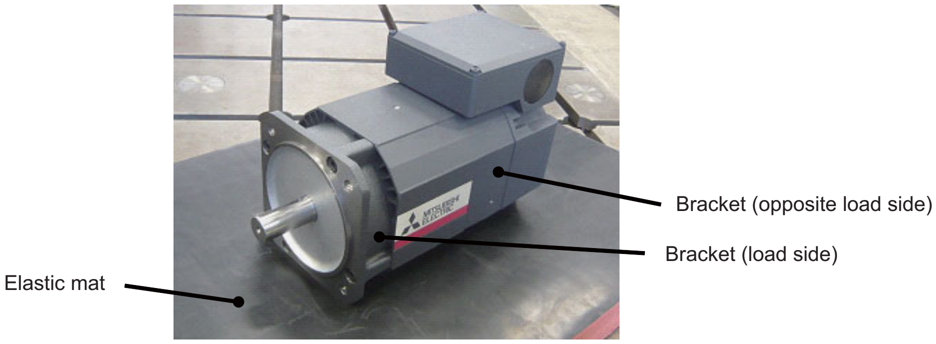
(2) The unbalance of the rotary fittings should be as small as possible. We recommend you to choose such fittings that have a fully symmetric shape, and arrange screw holes on their end faces at short and equal intervals in the circumferential direction. When you do balancing of the fittings before installation to the motor, suppress the circumferential vibrations as well as add screws to the screw holes formed on the fittings for the purpose of balancing. After balancing, apply thread locker on the screws to avoid loosening.

(3) If you use a rotary joint for coolant for a hollow shaft specification motor, prepare a coolant drain route by such as making a draining hole in order to prevent leaked coolant from intruding into the motor. The coolant intruded into the motor may degrade the motor insulation or may cause bearing deterioration.

Appendix 3-3 Precautions in mounting fittings

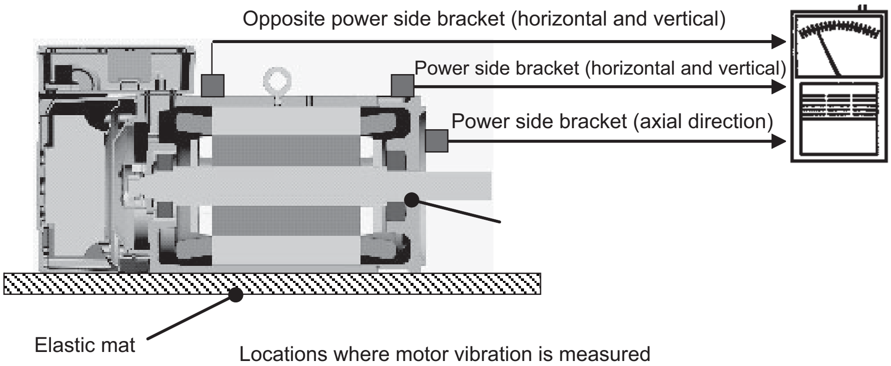
(1) When you attach fittings such as a gear, pulley, coupling and rotary joint for coolant to the motor shaft, be careful not to apply excessive impact by striking with a hammer, etc. This may cause the shaft distortion and bearing damage, resulting in abnormal vibration, sound or shorter bearing life.

(2) After attaching the fittings, carry out no-load operation up to the motor's maximum speed, and use an accelerometer or vibrometer to confirm there is no abnormal vibration. The points to measure are the bracket sections where bearings are stored (on the load and opposite load sides).



How to measure motor vibration

Make sure to place the motor on an elastic mat to avoid resonance with surrounding devices during measurement.



Locations where motor vibration is measured

(3) The vibration acceleration shall be 0.5G (4.9m/s2) or less or the vibration amplitude shall be V5 (peak-to-peak is 5μm) or less in all the speed range. If these values are not met, the unbalance of the attached fittings may be too large. In such case, carry out balancing for the attached fittings or for the motor with the fittings attached.

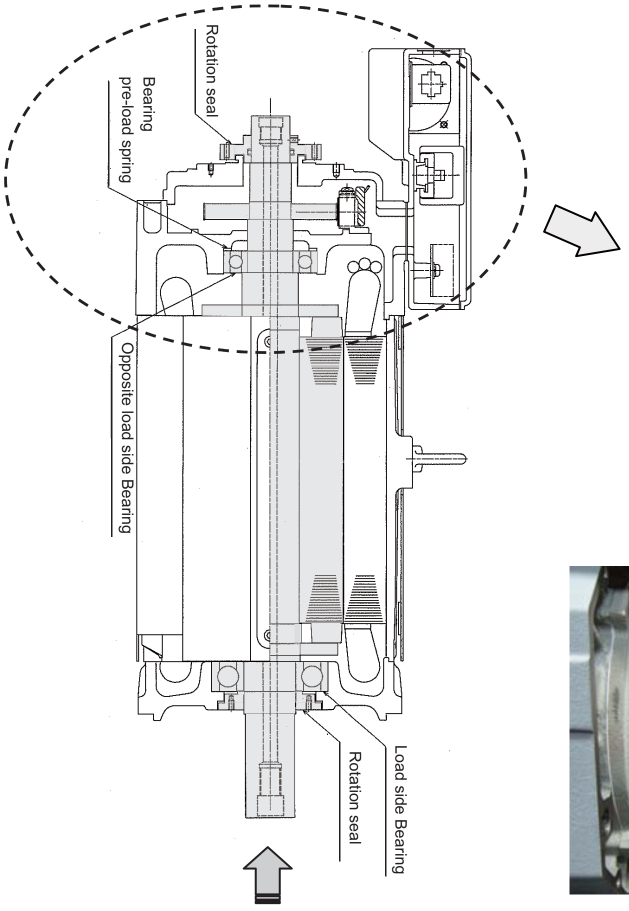
Appendix 3 Precautions in Installing Spindle Motor

Appendix 3-4 Precautions in coupling shafts

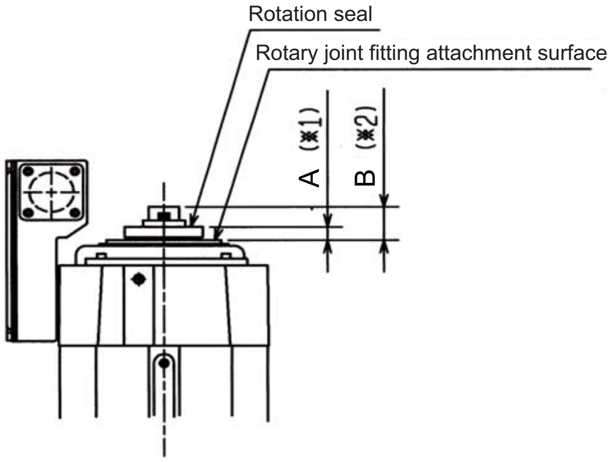
(1) When direct coupling between the motor shaft and spindle shaft is not accurate, abnormal vibration and/or sound may result. Therefore, do not rely too much on the coupling's flexibility but perform centering and parallel correcting carefully during shaft coupling.

(2) According to the motor specifications, the allowable load on the motor shaft in the motor's inward direction (thrust direction) is 0 [kgf]. Thus you have to choose a coupling that causes no thrust load on the motor shaft, and also pay attention to the extension by thermal expansion.

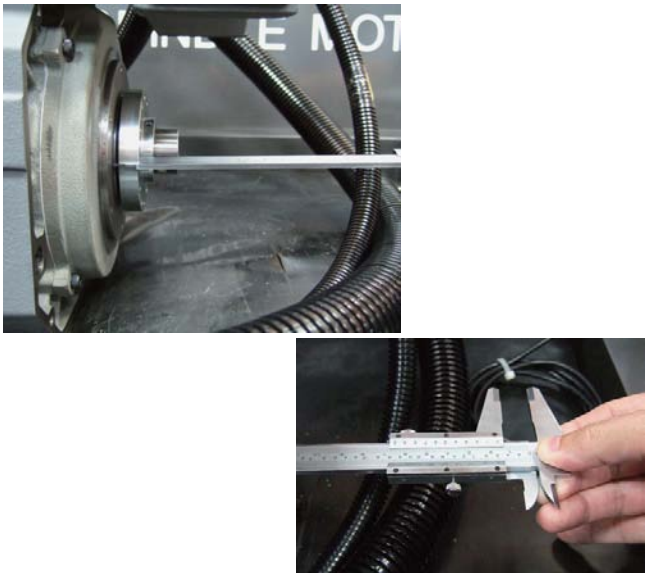
(3) If a gear coupling or Oldham coupling is used, the motor shaft may be kept pushed into the motor's inward when the shaft is inserted into the spindle head. For a hollow-shaft specification, measure the distance A or B before and after insertion to confirm that there is no difference between before and after insertion (the allowance is ±0.1mm)
- Distance A: between the rotary joint fitting attachment surface and the rotation seal's end face (*1)
- Distance B: between the rotary joint fitting attachment surface and the opposite load side shaft end (*2)



Motor structural drawing



Enlarged view of motor rear



How to measure

Appendix 3-5 Precautions in installing motor in machine

(1) After mounting the motor on a machine and engaging the shafts, perform unloaded operation up to the motor's maximum speed to confirm there is no abnormal vibration or sound. If abnormal vibration or sound is generated, shaft coupling failure or unbalance on the spindle side can be the cause. Therefore check again on these two items.

(2) If you apply coolant piping for a hollow shaft specification motor, be careful so that peripheral components such as a tube will not apply tension on the motor rotor or cause unbalance.

(3) If you have punched a hole or cutout on a distance block for coolant pipe, cover the hole or cutout with a metal sheet after piping. If you leave the hole, this may degrade the motor cooling performance or machine rigidity, etc.

Appendix 3-6 Other Precautions

(1) To yield good cooling performance, provide a space of at least 30 [mm] between the cooling fan and wall. If the motor is covered by a structure and the air is not exchanged, its cooling performance degrades and the motor is unable to fully exercise its performance, which may cause the spindle motor overheat alarm. Thus avoid use of the spindle motor in an enclosed space with little ventilation.

(2) Under the standard cooling fan specifications, air is taken in from the load side and exhausted from the counter-load side. To secure the motor's cooling performance, arrange the machine structure so that the exhaust from the counter-load side will not flow to the load side and external air (at a room temperature) can be taken in from the load side.

(3) If you continue to use the spindle motor with dirt such as oil mist and dust adhered, its cooling performance degrades and the motor is unable to fully exercise its performance, which may cause the spindle motor overheat alarm. In some cases this may result in damage to the bearing or cooling fan. Use a filter, etc. to protect the motor from oil mist and dust.

(4) To secure the cooling performance, perform cleaning of spindle motor and cooling fan on a regular basis.

Appendix 3-7 Example of unbalance correction

Unbalance correction is normally performed by rotating a rotor at a constant speed. The unbalance on the rotor appears in the form of vibration that has a frequency of one cycle per revolution.

<How to balance>

Step 1 To grasp the present situation, drive the motor with the gear, pulley and coupling attached, and detect the reflection sticker attached on the rotor using a revolution indicator (this is a rotation signal). And also detect an acceleration signal using an acceleration pickup attached on the bracket. Then input these signals to each balancing machine to measure the present unbalance force.

⇩

Step 2 Add trial weights to the balance correction holes on the gear, pulley and coupling and measure the unbalance in the same way.

⇩

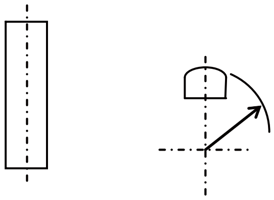
Step 3 When you input the two data in a balancing machine, the machine shows where to correct. Then, follow the instruction to carry out balancing.

⇩

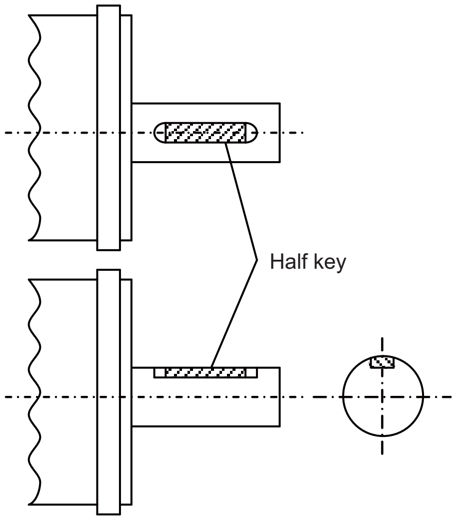
Step 4 For confirmation, check the unbalance again.
* If further balancing is required, repeat from Step 2.

Appendix 3-8 Precautions in balancing of motor with key

For a motor with key, the balancing with a half key attached to the key groove on the shaft is performed before shipment. The balancing is carried out so that the rotor's residual unbalance is reduced to 0.1g or less.

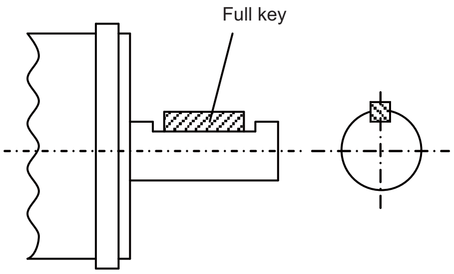


Half key

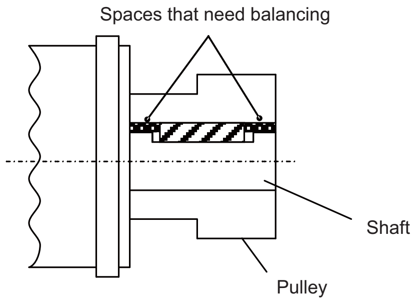


State with a half key
(State during balancing before shipment)

However if a full key is attached instead (See Figure 9 below), spaces that need balancing are generated when a fitting such as a gear, pulley and coupling is installed. Therefore take into consideration these spaces during the balancing of each fitting, or carry out balancing with the fittings attached to the motor.



State with a full key



State with a pulley

Appendix 4

Compliance to EC Directives

Contents

Appendix 4 Compliance to EC Directives

Appendix 4-1 Compliance to EC Directives

Appendix 4-1-1 European EC Directives

In the EU Community, the attachment of a CE mark (CE marking) is mandatory to indicate that the basic safety conditions of the Machine Directives (issued Jan. 1995), EMC Directives (issued Jan. 1996) and the Low-voltage Directives (issued Jan. 1997) are satisfied. The machines and devices in which the servo and spindle drive are assembled are the targets for CE marking.

(1) Compliance to EMC Directives

The servo and spindle drive are components designed to be used in combination with a machine or device. These are not directly targeted by the Directives, but a CE mark must be attached to machines and devices in which these components are assembled. The next section "EMC Installation Guidelines", which explains the unit installation and control panel manufacturing method, etc., has been prepared to make compliance to the EMC Directives easier.

(2) Compliance to Low-voltage Directives

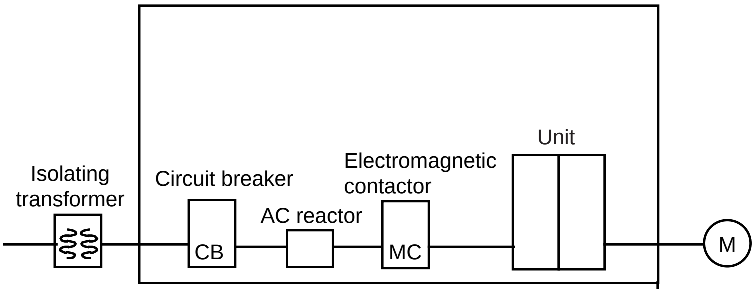
Each unit is targeted for the Low-voltage Directives. An excerpt of the precautions given in this specification is given below. Please read this section thoroughly before starting use.

For the EMC Directives and Low-voltage Directives, Self-Declaration Documents has been prepared. Contact Mitsubishi or your dealer when required.

Appendix 4-1-2 Cautions for EC Directive compliance

Use the Low-voltage Directive compatible parts for the servo/spindle drive and servo/spindle motor. In addition to the items described in this instruction manual, observe the items described below.

(1) Configuration



Insert a type B circuit breaker (RCD) in the power supply side of the unit.

(2) Environment

Use the units under an Overvoltage II (MDS-D, MDS-D-SVJ3/SPJ3) and Pollution Class of 2 or less environment as stipulated in IEC60664.

(a) To adjust the units to the Overvoltage Category II, insert an isolating transformer of the star connection complying with EN or IEC standard in the input of the power supply unit.

(b) To adjust the units to the Pollution Class of 2, install the units in a control panel having a structure (IP54 or higher) in which water, oil, carbon or dust cannot enter.

Unit

	During operation	Storage	During transportation
Ambient temperature	0°Cto 55°C	-15°C to 70°C	-15°C to 70°C
Humidity	90%RH or less	90%RH or less	90%RH or less
Altitude	1000m or less	1000m or less	13000m or less

Motor

	During operation	Storage	During transportation
Ambient temperature	0°C to 40°C	-15°C to 70°C	-15°C to 70°C
Humidity	80%RH or less	90%RH or less	90%RH or less
Altitude	1000m or less	1000m or less	13000m or less

(3) Power supply

[1] Use the power supply and servo/spindle drive unit under an Overvoltage Category II (MDS-D, MDS-D-SVJ3/SPJ3) as stipulated in IEC60664.

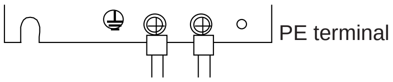
[2] Earth the PE terminal of the units to the neutral point of the star connection.

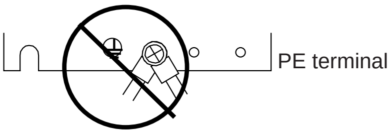
[3] Do not omit the circuit breaker and electromagnetic contactor.

(4) Earthing

[1] To prevent electric shocks, always connect the servo/spindle drive unit protective earth (PE) terminal (terminal with ⏚ mark) to the protective earth (PE) on the control panel.

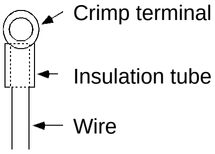
[2] When connecting the earthing wire to the protective earth (PE) terminal, do not tighten the wire terminals together. Always connect one wire to one terminal.



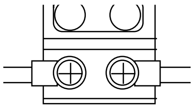


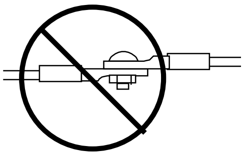
(5) Wiring

[1] Always use crimp terminals with insulation tubes so that the connected wire does not contact the neighboring terminals.



[2] Do not connect the wires directly.





[3] Always install the power supply unit and servo/spindle drive unit on the metal panel.

Appendix 4 Compliance to EC Directives

(6) Peripheral devices

[1] Use EN/IEC Standards compliant parts for the circuit protector and contactor.

[2] Select type B circuit protector manufactured by RCD.
Apply Annex C of EN60204-1 for sizing of the circuit protector.

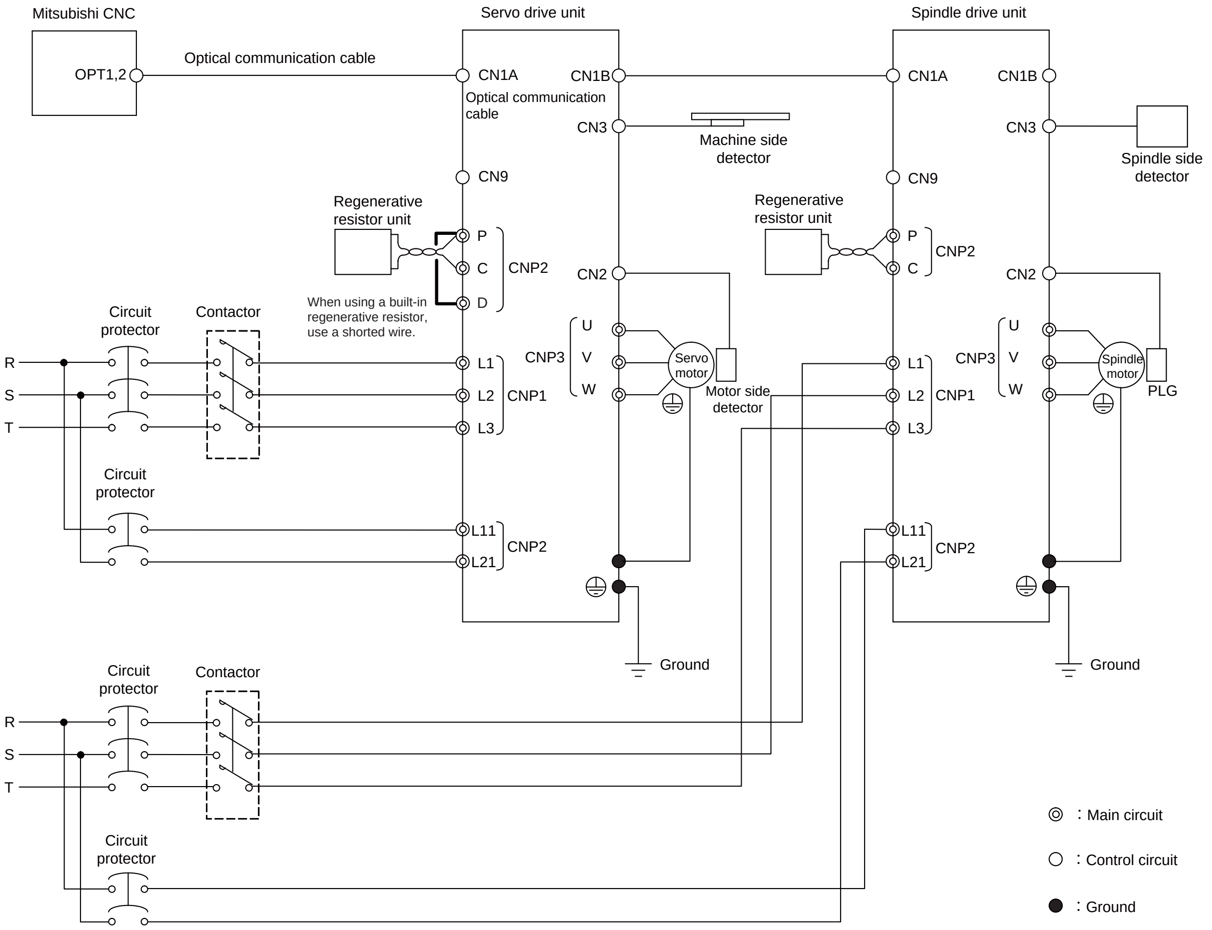
(7) Miscellaneous

[1] Refer to the next section "EMC Installation Guidelines" for methods on complying with the EMC Directives.

[2] Ground the facility according to each country's requirements.

[3] The control circuit connector (○) is safely separated from the main circuit (◎) and ground (●).

[4] Inspect the appearance before installing the unit. Carry out a performance inspection of the final unit, and save the inspection records.



Appendix 5

EMC Installation Guidelines

Contents

Appendix 5 EMC Installation Guidelines

Appendix 5-1 Introduction

EMC Instructions became mandatory as of January 1, 1996. The subject products must have a CE mark attached indicating that the product complies with the Instructions.
As the NC unit is a component designed to control machine tools, it is believed to be out of the direct EMC Instruction subject. However, we would like to introduce the following measure plans to backup EMC Instruction compliance of the machine tool as the NC unit is a major component of the machine tools.

[1] Methods for installation in control/operation panel
[2] Methods of wiring cable outside of panel
[3] Introduction of countermeasure parts

Mitsubishi is carrying out tests to confirm the compliance to the EMC Standards under the environment described in this manual. However, the level of the noise will differ according to the equipment type and layout, control panel structure and wiring lead-in, etc. Thus, we ask that the final noise level be confirmed by the machine manufacturer.
For measures for CNC, refer to "EMC INSTALLATION GUIDELINES" of each NC Connection Manual.

Appendix 5-2 EMC instructions

The EMC Instructions regulate mainly the following two withstand levels.

Emission ..... Capacity to prevent output of obstructive noise that adversely affects external sources.
Immunity ..... Capacity not to malfunction due to obstructive noise from external sources.

The details of each level are classified as Table 1. It is assumed that the Standards and test details required for a machine are about the same as these.

Table 1

Class	Name	Details	Generic Standard	Standards for determining test and measurement
Emission	Radiated noise	Electromagnetic noise radiated through the air	EN61000-6-4 EN61800-3 (Industrial environment)	-----
	Conductive noise	Electromagnetic noise discharged from power line		
Immunity	Static electricity electrical discharge immunity test	(Example) Withstand level of discharge of electricity charged in a human body.	EN61000-6-2 EN61800-3 (Industrial environment)	EN61000-4-2
	Radiated radio-frequency magnetic field immunity test	(Example) Simulation of immunity from digital wireless transmitters		EN61000-4-3
	Electrical fast transient/burst immunity test	(Example) Withstand level of noise from relays or connecting/disconnecting live wires		EN61000-4-4
	Immunity to conducted disturbance induced by radio-frequency magnetic field	(Example) Withstand level of noise entering through power line, etc.		EN61000-4-6
	Power supply frequency field immunity test	(Example) 50/60Hz power frequency noise		EN61000-4-8
	Immunity test for voltage dip, short-time power failure and voltage fluctuation	(Example) Power voltage drop withstand level		EN61000-4-11
	Surge immunity test	(Example) Withstand level of noise caused by lightning		EN61000-4-5

Appendix 5-3 EMC measures

The main items relating to EMC measures include the following.

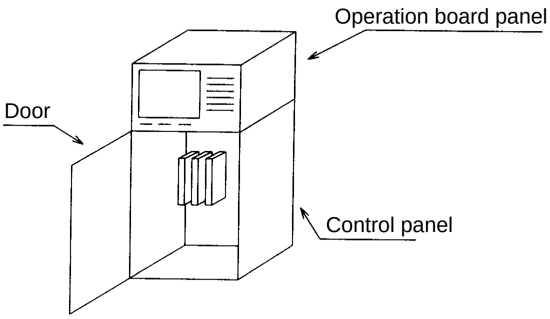
[1] Store the device in an electrically sealed metal panel.
[2] Earth all conductors that are floating electrically. (Lower the impedance.)
[3] Wire the power line away from the signal wire.
[4] Use shielded wires for the cables wired outside of the panel.
[5] Install a noise filter.

Ensure the following items to suppress noise radiated outside of the panel.

[1] Securely install the devices.
[2] Use shielded wires.
[3] Increase the panel's electrical seal. Reduce the gap and hole size.
Note that the electromagnetic noise radiated in the air is greatly affected by the clearance of the panel and the quality of the cable shield.

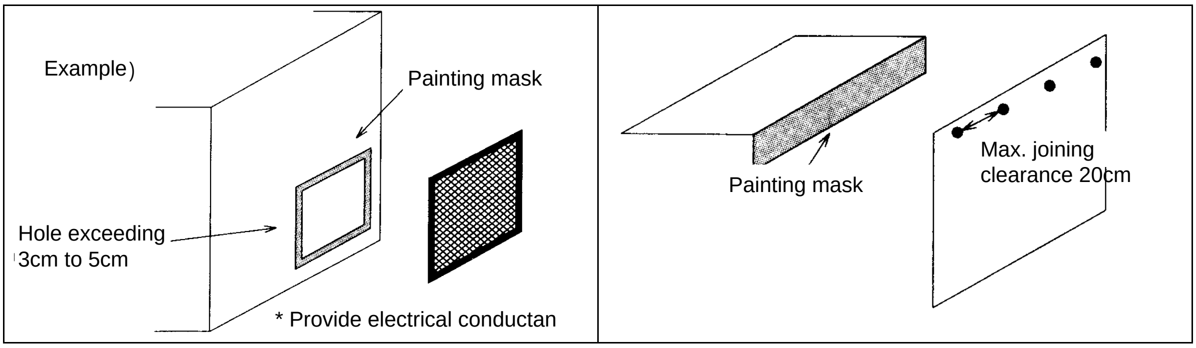
Appendix 5-4 Measures for panel structure

The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.



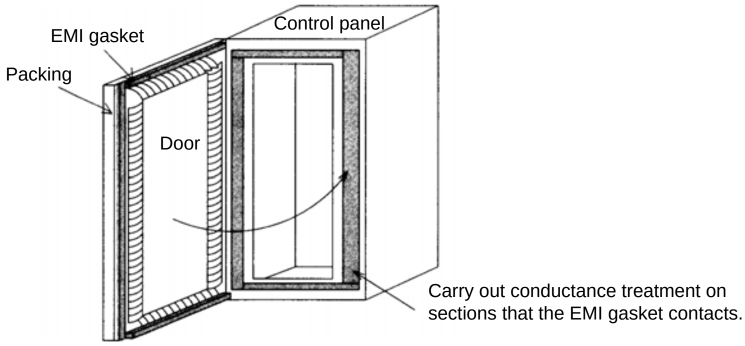
Appendix 5-4-1 Measures for control panel unit

[1] Use metal for all materials configuring the panel.
[2] For the joining of the top plate and side plates, etc., mask the contact surface with paint, and fix with welding or screws.
In either case, keep the joining clearance to a max. of 20cm for a better effect.
[3] Note that if the plate warps due to the screw fixing, etc., creating a clearance, noise could leak from that place.
[4] Plate the metal plate surface (with nickel, tin) at the earthing section, such as the earthing plate.
[5] The max. tolerable hole diameter of the openings on the panel surface, such as the ventilation holes, must be 3cm to 5cm. If the opening exceeds this size, use a measure to cover it. Note that even when the clearance is less than 3cm to 5cm, noise may still leak if the clearance is long.



Appendix 5-4-2 Measures for door

[1] Use metal for all materials configuring the door.
[2] Use an EMI gasket or conductive packing for the contact between the door and control panel unit.
[3] The EMI gasket or conductive packing must contact at a uniform and correct position of the metal surface of the control panel unit.
[4] The surface of the control panel unit contacted with the EMI gasket or conductive packing must have conductance treatment.
(Example) Weld (or screw) a plate that is plated (with nickel, tin).



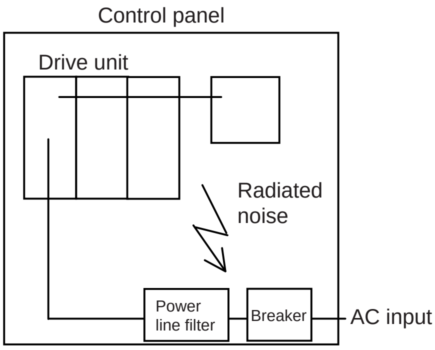
[5] As a method other than the above, the control panel unit and door can be connected with a plain braided wire. In this case, the panel and door should be contacted at as many points as possible.

Appendix 5-4-3 Measures for operation board panel

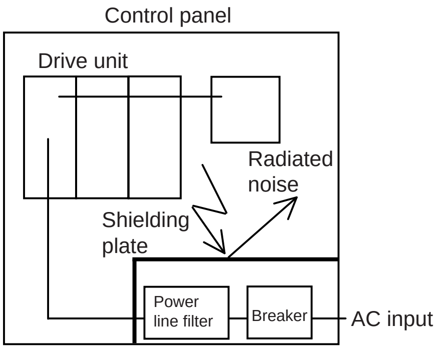
[1] Always connect the operation board and indicator with an earthing wire.
[2] If the operation board panel has a door, use an EMI gasket or conductive packing between the door and panel to provide electrical conductance in the same manner as the control panel.
[3] Connect the operation board panel and control panel with a sufficiently thick and short earthing wire.

Appendix 5-4-4 Shielding of the power supply input section

[1] Separate the input power supply section from other parts in the control panel so that the input power supply cable will not be contaminated by radiated noise.
[2] Do not lead the power line through the panel without passing it through a filter.



The power supply line noise is eliminated by the filter, but cable contains noise again because of the noise radiated in the control panel.



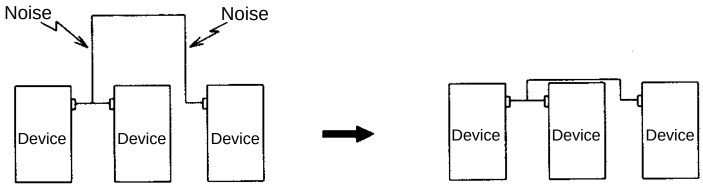
Use a metal plate, etc., for the shielding partition. Make sure not to create a clearance.

Appendix 5-5 Measures for various cables

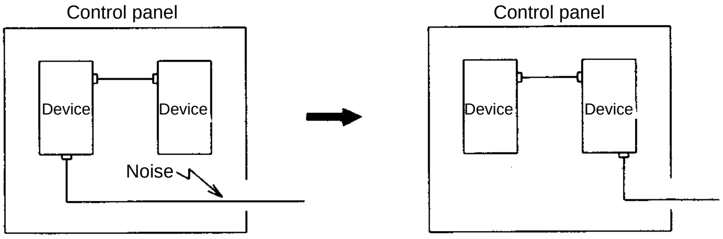
The various cables act as antennas for the noise and discharge the noise externally. Thus appropriate treatment is required to avoid the noise.
The wiring between the drive unit and motor act as an extremely powerful noise source, so apply the following measures.

Appendix 5-5-1 Measures for wiring in panel

[1] If the cables are led unnecessarily in the panel, they will easily pick up the radiated noise. Thus, keep the wiring length as short as possible.



[2] The noise from other devices will enter the cable and be discharged externally, so avoid internal wiring near the openings.



[3] Connect the control device earthing terminal and earthing plate with a thick wire. Take care to the leading of the wire.

Appendix 5-5-2 Measures for shield treatment

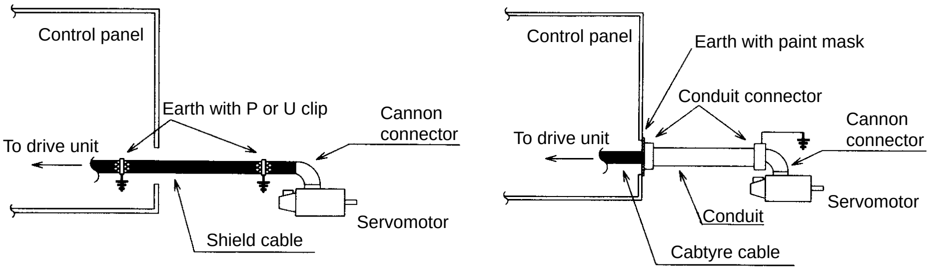
Common items

Use of shield clamp fittings is recommended for treating the shields. The fittings are available as options, so order as required. (Refer to the section "Shield clamp fitting" in this chapter.)
Clamp the shield at a position within 10cm from the panel lead out port.

POINT

1. When leading the cables, including the grounding wire (FG), outside of the panel, clamp the cables near the panel outlet (recommendation: within 10cm).
2. When using a metal duct or conduit, the cables do not need to be clamped near the panel outlet.
3. When leading cables not having shields outside the panel, follow the instructions given for each cable. (Installation of a ferrite core, etc., may be required.)

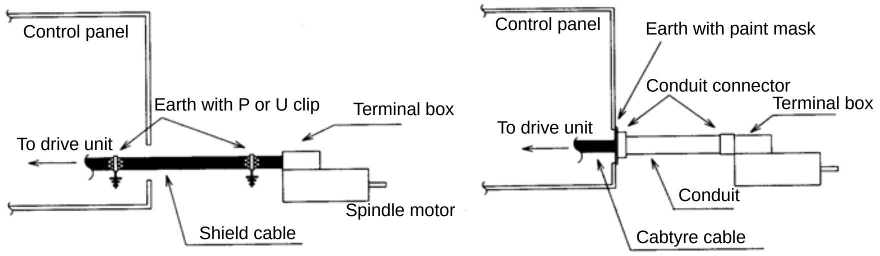
Appendix 5-5-3 Servo/spindle motor power cable



Using shield cable

Using conduit

Power cable for servo motor

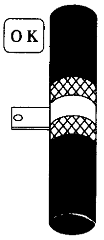


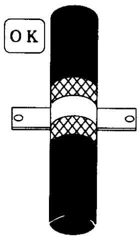
Using shield cable

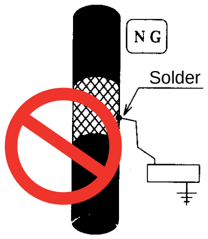
Using conduit

Power cable for spindle motor

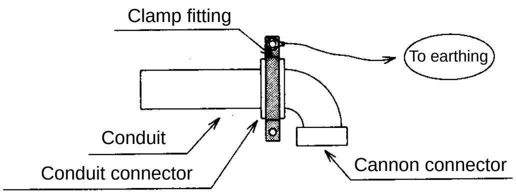
[1] Use four wires (3-phase + earthing) for the power cable that are completely shielded and free from breaks.
[2] Earth the shield on both the control panel side and motor chassis side.
[3] Earth the shield with a metal P clip or U clip.
(A cable clamp fitting can be used depending on the wire size.)
[4] Directly earth the shield. Do not solder the braided shield onto a wire and earth the end of the wire.





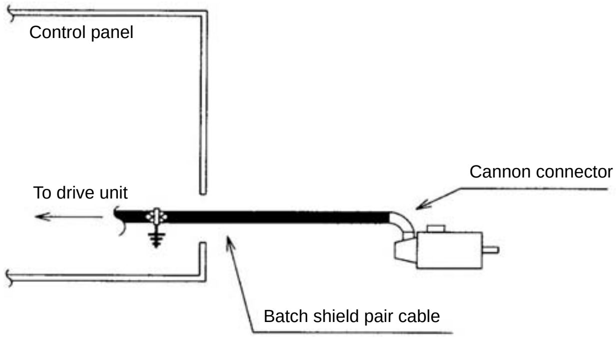


[5] When not using a shield cable for the power cable, use a conventional cabtyre cable. Use a metal conduit outside the cable.
[6] Earth the power cable on the control panel side at the contact surface of the conduit connector and control panel. (Mask the side wall of the control panel with paint.)
[7] Follow the treatment shown in the example for the conduit connector to earth the power cable on the motor side. (Example: Use a clamp fitting, etc.)



Appendix 5-5-4 Servo/spindle motor feedback cable

Use a shield pair cable for feed back cable of the servo motor to earth on NC side (inside the control panel.) Mounting a ferrite core directly behind the unit connector is also effective in suppressing noise.

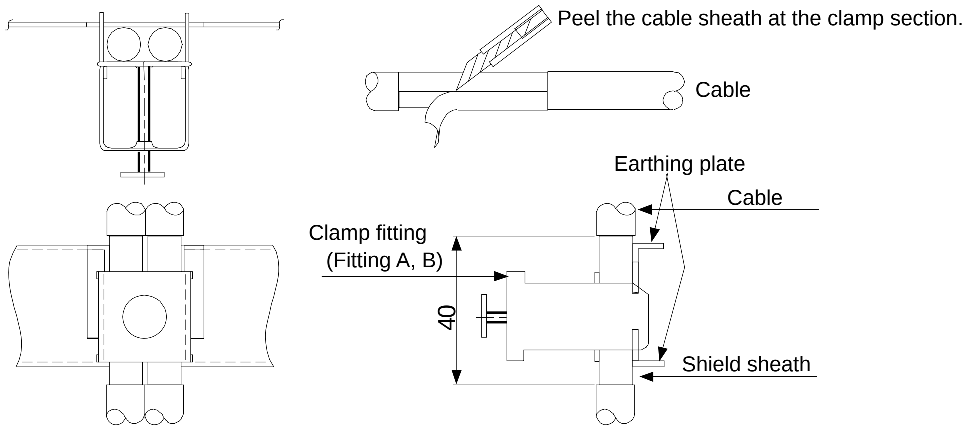


Feed back cable for servomotor

Appendix 5-6 EMC countermeasure parts

Appendix 5-6-1 Shield clamp fitting

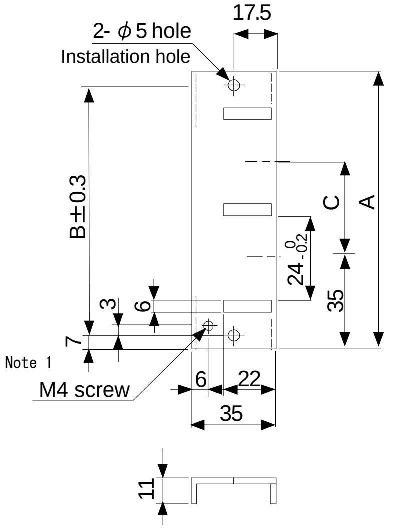
The effect can be enhanced by connecting the cable directly to the earthing plate. Install an earthing plate near each panel's outlet (within 10cm), and press the cable against the earthing plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together. Securely earth the earthing plate with the frame ground. Install directly on the cabinet or connect with an earthing wire.



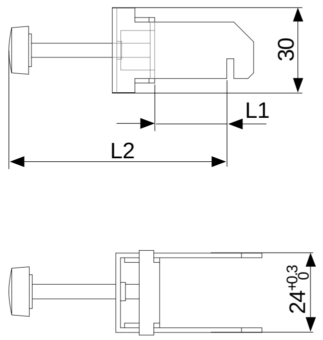
View of clamp section

・Outline drawing

Earthing plate



Clamp fitting



[Unit: mm]

(Note 1) Screw hole for wiring to earthing plate in cabinet.
(Note 2) The earthing plate thickness is 1.6mm.

	A	B	C	Enclosed fittings
Ground Plate #D	100	86	30	Clamp fitting A x 2
Ground Plate #E	70	56	-	Clamp fitting B x 1

	L1 (maximum dimension when it is open)	L2 (reference dimension)
Clamp fitting A	25	(77)
Clamp fitting B	12	(54)

Appendix 5-6-2 Ferrite core

A ferrite core is integrated and mounted on the plastic case. Quick installation is possible without cutting the interface cable or power cable. This ferrite core is effective against common mode noise, allowing measures against noise to be taken without affecting the signal quality.

Recommended ferrite core
TDK ZCAT Series

Shape and dimensions

ZCAT type

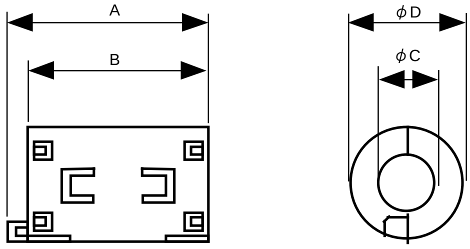


Fig.1

ZCAT-A type

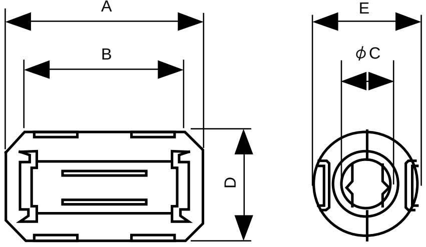


Fig.2

ZCAT-B type

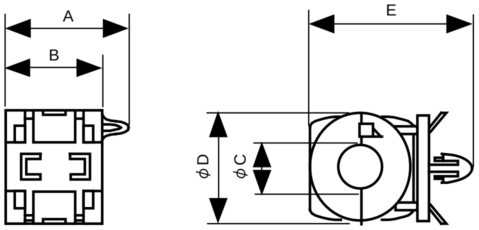


Fig.3

ZCAT-C type

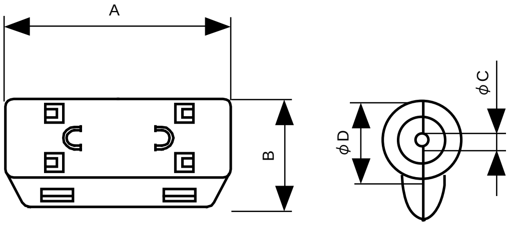


Fig.4

[Unit: mm]

Part name	Fig	A	B	C	D	E	Applicable cable outline	Mass	Recommended ferrite core
ZCAT3035-1330(-BK)[*1]	1	39	34	13	30	-	13	63	◎
ZCAT2035-0930-M(-BK)	2	35	29	13	23.5	22	10 to 13	29	
ZCAT2017-0930-M(-BK)	3	21	17	9	20	28.5	9	12	
ZCAT2749-0430-M(-BK)	4	49	27	4.5	19.5	-	4.5	26	

*1 A fixing band is enclosed when shipped.

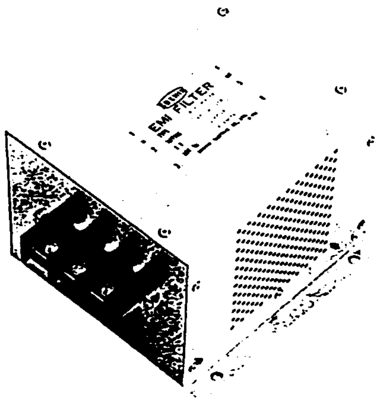
ZCAT-B type: Cabinet fixed type, installation hole ø4.8 to 4.9mm, plate thickness 0.5 to 2mm

ZCAT-C type: Structured so that it cannot be opened easily by hand once closed.

Appendix 5-6-3 Power line filter

< Power line filter for 200V >

HF3000A-TM Series for 200V



■Features

(a) 3-phase 3-wire type (250V series, 500V series)
(b) Compliant with noise standards German Official Notice Vfg243, EU Standards EN55011 (Class B)
(c) Effective for use with IGBT inverter and MOS-FET inverter.
(d) Easy mounting with terminal block structure, and outstanding reliability.

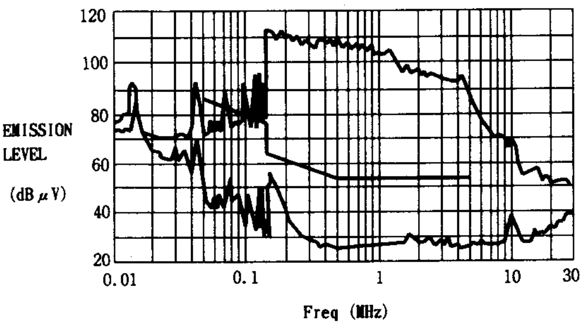
■Application

(a) Products which must clear noise standards German Official Notice Vfg243 and EU Standards EN55011 (Class B).
(b) For input of power converter using advanced high-speed power device such as IGBT MOS-FET.

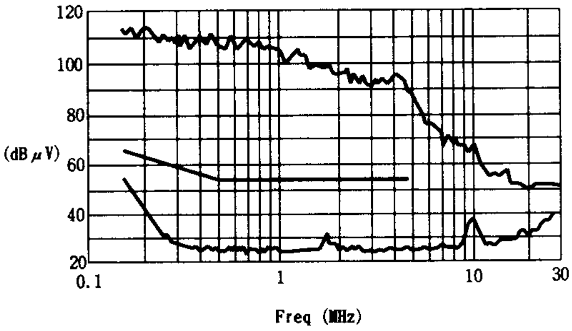
■Specifications (250V series)

Part name	HF3005A -TM	HF3010A -TM	HF3015A -TM	HF3020A -TM	HF3030A -TM	HF3040A -TM	HF3050A -TM	HF3060A -TM	HF3080A -TM	HF3100A -TM	HF3150A -TM
Rated voltage	250V AC										
Rated current	5A	10A	15A	20A	30A	40A	50A	60A	80A	100A	150A
Leakage current	1.5mA MAX 250V AC 60Hz										

<Example of measuring voltage at noise terminal>•••Measured with IGBT inverter

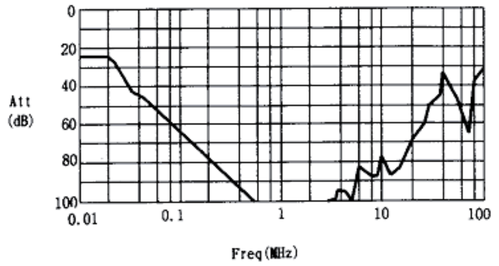


German Official Notice Vfg243 measurement data

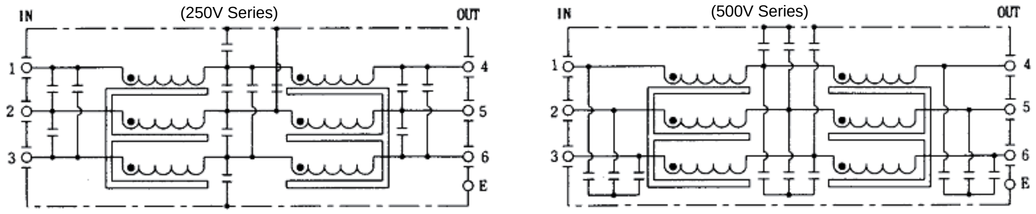


EU Standards EN55011 (Class B) measurement data

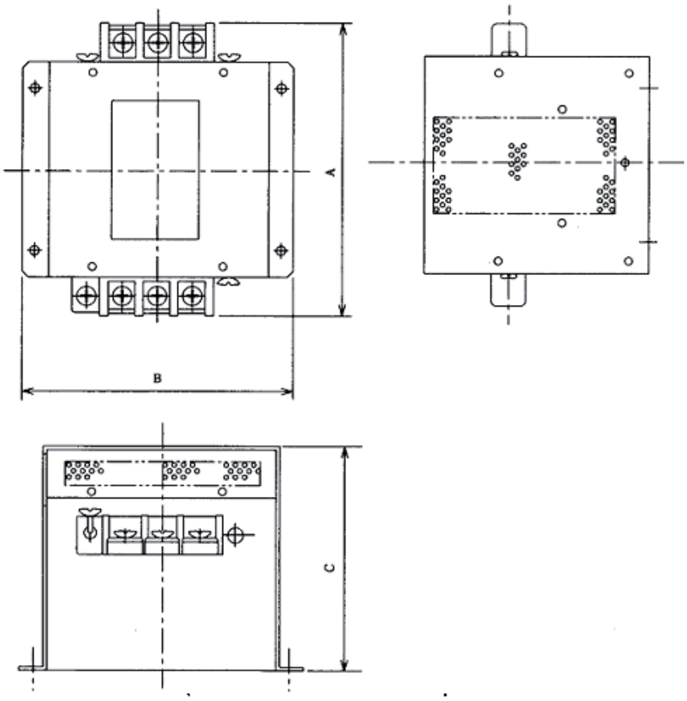
<Typical characteristics>



<Circuit diagram>



■**Outline dimensions**



[Unit: mm]

Model	Dimension		
	A	B	C
HF3005A-TM	180	170	130
HF3010A-TM			
HF3015A-TM			
HF3020A-TM			
HF3030A-TM	260	155	140
HF3040A-TM			
HF3050A-TM	290	190	170
HF3060A-TM			230
HF3080A-TM	405	220	210
HF3100A-TM			
HF3150A-TM	570	230	

Appendix 5 EMC Installation Guidelines

MX13 Series 3-phase high attenuation noise filter for 200V

■Features

(a) Perfect for mounting inside control panel: New shape with uniform height and depth dimensions
(b) Easy mounting and maintenance work: Terminals are centrally located on the front
(c) Complaint with NC servo and AC servo noise: High attenuation of 40dB at 150KHz
(d) Safety Standards:UL1283, CSAC22.2 No.8, EN60939(SEMKO)
(e) Patent and design registration pending

■Specifications

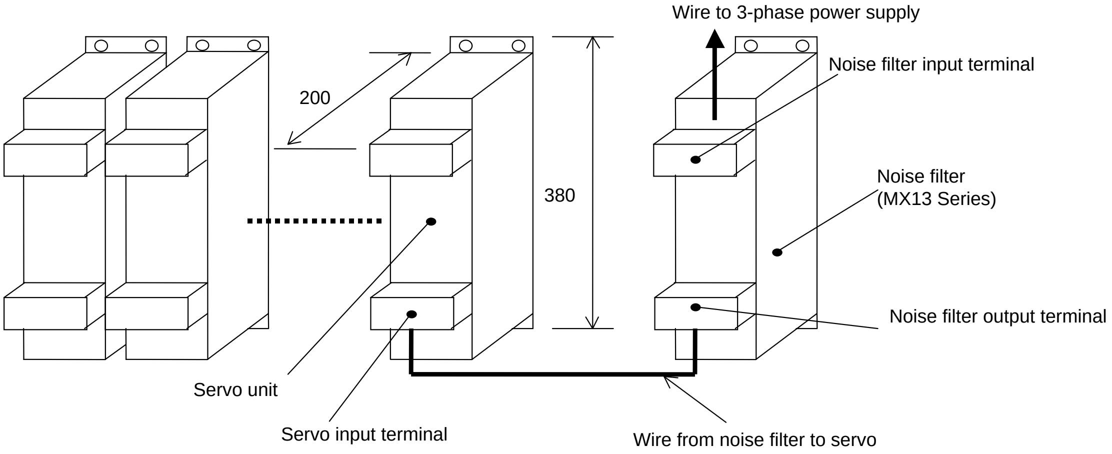
Item		Type			
		MX13030	MX13050	MX13100	MX13150
1	Rated voltage (AC)	3-phase 250VAC (50/60Hz)			
2	Rated current (AC)	30A	50A	100A	150A
3	Test voltage (AC for one minute across terminal and case)	2500VAC (100mA) at 25°C, 70% RH			
4	Insulation resistance (500VDC across terminal and case)	100MΩ min. at 25°C, 70% RH			
5	Leakage current (250V, 60Hz)	3.5mA max		8mA max	
6	DC resistance	30mΩ max	11mΩ max	5.5mΩ max	3.5mΩ max
7	Temperature rise	30°C max			
8	Working ambient temperature	–25°C to +85°C			
9	Working ambient humidity	30% to 95% RH (non condensing)			
10	Storage ambient temperature	–40°C to +85°C			
11	Storage ambient humidity	10% to 95% RH (non condensing)			
12	Mass (typ)	2.8kg	3.9kg	11.5kg	16kg

(Note) This is the value at Ta ≦ 50°C.
Refer to the following output derating for Ta > 50°C.

Contact: Densei-lambda Co., Ltd. Telephone: 03-3447-4411 (+81-3-3447-4411)
Fax: 03-3447-7784 (+81-3-3447-7784) http://www.densei-lambda.com

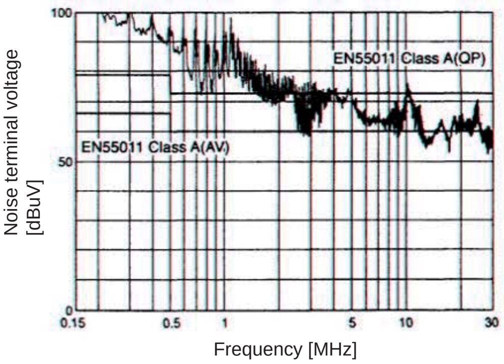
■Example of using MX13 Series

This is a noise filter with the same dimensions as the drive unit depth (200mm) and height (380mm).
This unit can be laid out easily in the device by arraigning it in a row with the servo unit.
As with the servo unit, the terminals are arranged on the front enabling ideal wire lead-out.
Refer to the following figure for details.

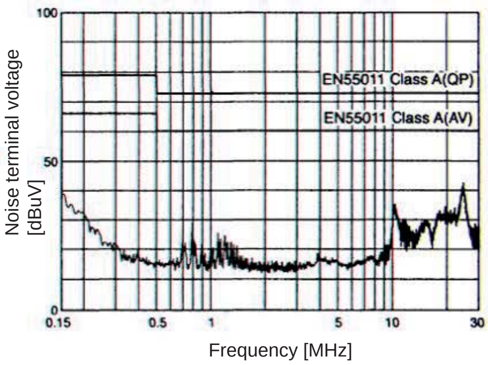


[Unit:mm]

■Example of noise terminal voltage attenuation

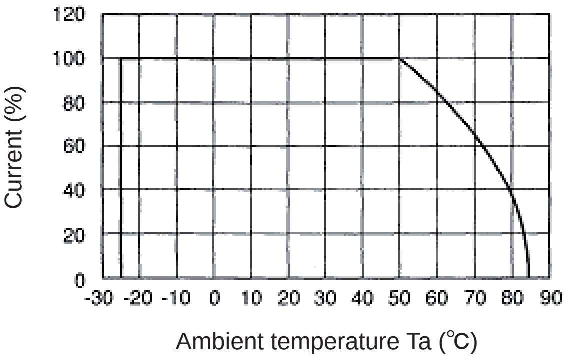


EMI data for independent control panel
(with six-axis servo unit mounted)



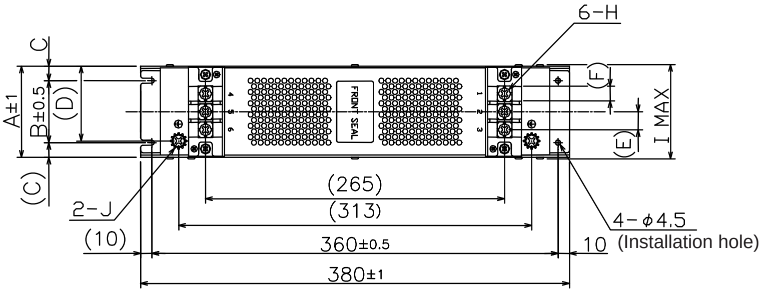
EMI data for control panel + noise filter (MX13030)

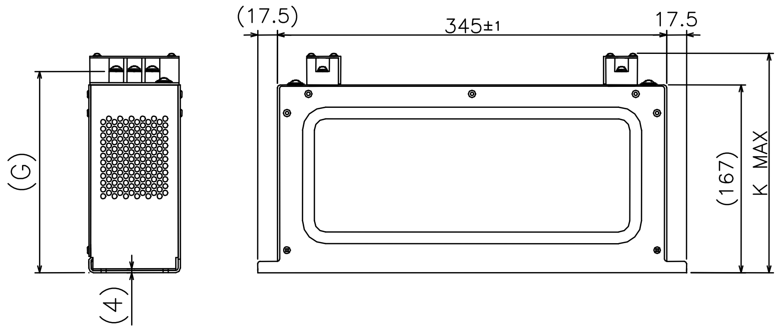
■Output derating



■Outline dimension drawings

MX13030, MX13050

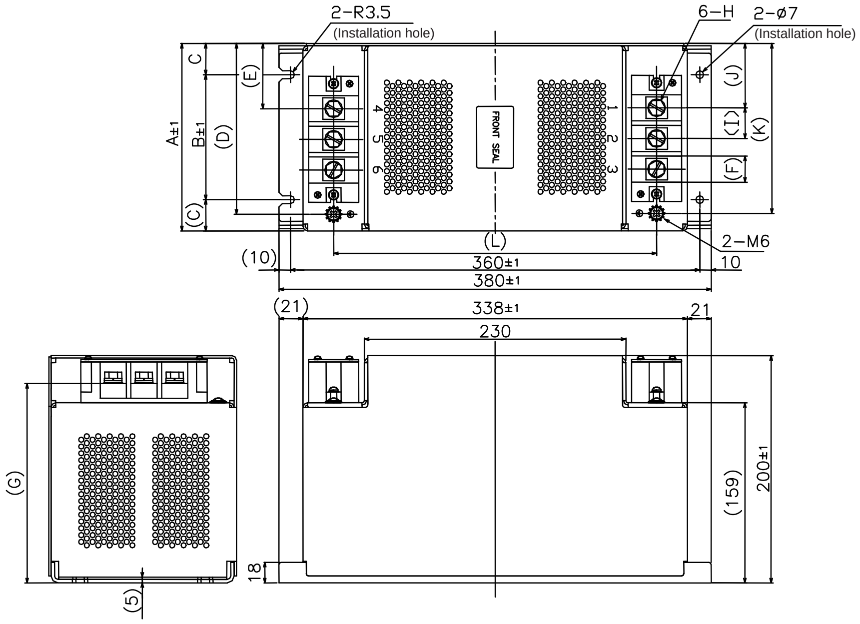




[Unit:mm]

	MX13030	MX13050
A	66	81
B	45	55
C	10.5	13
D	50	67
E	13	16
F	10	13
G	177	179
H	M4 screw	M6 screw
I	70	85
J	M4 screw	M6 screw
K	195	200

MX13100, MX13150



[Unit:mm]

	MX13100	MX13150
A	130	165
B	90	110
C	20	27.5
D	115	150.5
E	37.5	57.5
F	18	23
G	174	176
H	M6 screw	M8 screw
I	21	27
J	37.5	56.5
K	115	149.5
L	276	284

Appendix 5-6-4 Surge protector

Insert a surge protector in the power input section to prevent damage to the control panel or power supply unit, etc. caused by the surge (lightning or sparks, etc.) applied on the AC power line.
Use a surge protector that satisfies the following electrical specifications.

< Surge protector for 200V >

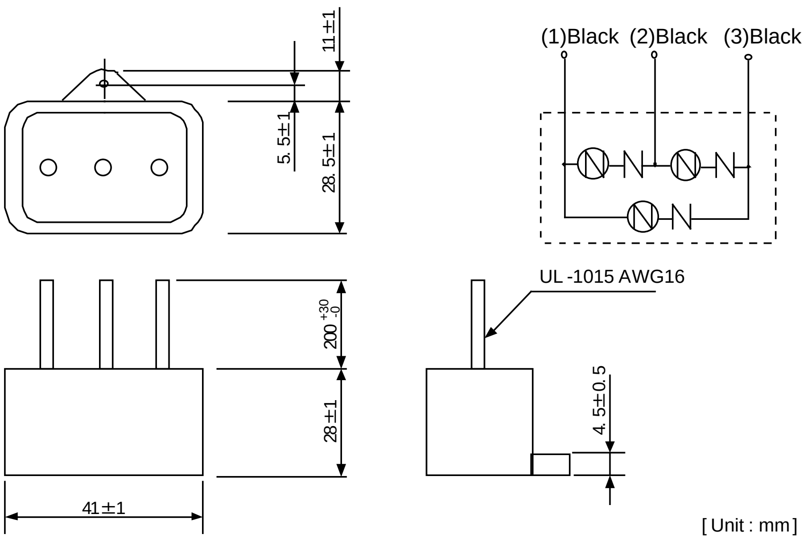
200V R•A•V-BYZ Series (for protection between lines)

Part name	Circuit voltage 50/60Hz	Maximum tolerable circuit voltage	Clamp voltage	Surge withstand level 8/20 µs	Surge withstand voltage 1.2/50 µs	Electrostatic capacity	Service temperature
RAV-781BYZ-2	3AC 250V	300V	783V±10%	2500A	20kV	75pF	-20 to 70°C

(Note) Refer to the manufacturer's catalog for details on the surge protector's characteristics and specifications.

Outline dimension drawings

Circuit diagram



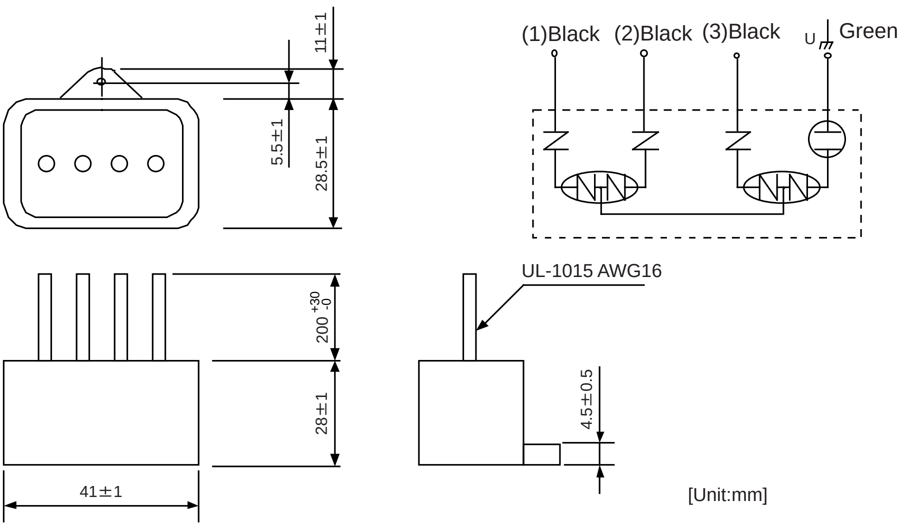
200V R•A•V-BXZ Series (for protection between line and earth)

Part name	Circuit voltage 50/60Hz	Maximum tolerable circuit voltage	Clamp voltage	Surge withstand level 8/20 μs	Surge withstand voltage 1.2/50 μs	Electrostatic capacity	Service temperature
RAV-781BXZ-4	3AC 250V	300V	1700V±10%	2500A	2kV	75pF	-20 to 70°C

(Note) Refer to the manufacturer's catalog for details on the surge protector's characteristics and specifications.

Outline dimension drawings

Circuit diagram



Appendix 5 EMC Installation Guidelines

< Surge protector for both between phases and between phase and earth >

■ Features

This surge protector can protect both between phases and between phase and earth.
This contains a fuse and has windows to check malfunction or device degradation.

■Specifications

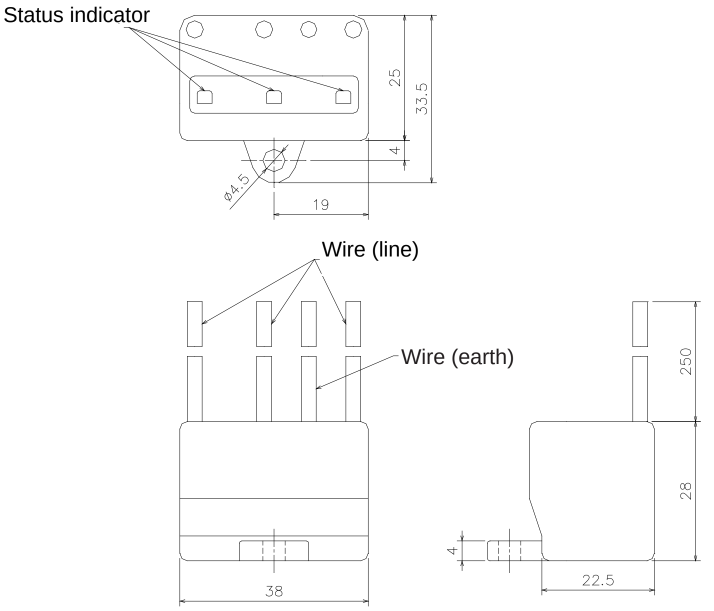
LT-C Series 200V

Part name	Circuit voltage 50/60Hz	Maximum tolerable circuit voltage	AC operation start voltage (between line and earth)	AC operation start voltage (between lines)	Voltage protection level (Up)	Nominal discharge current (8/20μs)	Maximum discharge current (8/20μs)
LT-C32G801WS	3AC 250Vrms	275Vrms	560V±20%	410V±20%	1.5kV	2500A	5000A

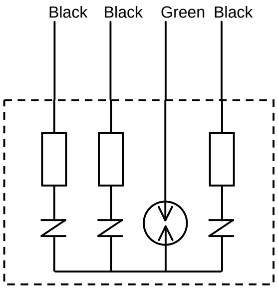
(Note) Refer to the manufacturer's catalog for details on the surge protector's characteristics and specifications, etc.

■Outline dimensions

Outline dimension drawings



Circuit diagram



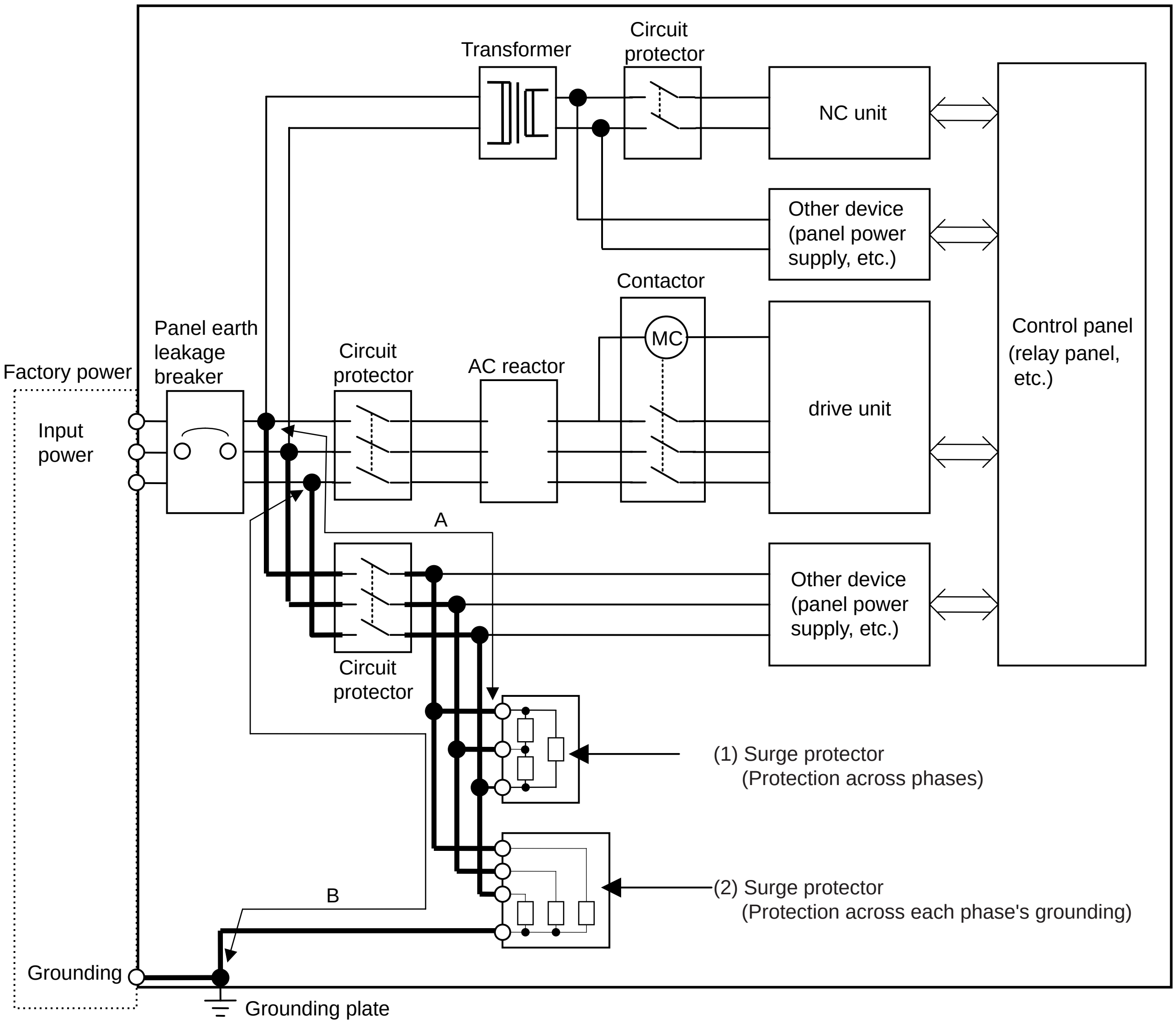
[Unit: mm]

Contact: Soshin Electric Co., Ltd. Telephone: 03-5730-8001 (+81-3-5730-8001)
http://www.soshin.co.jp

< Example of surge protector installation >

An example of installing the surge protector in the machine control panel is shown below.

A short-circuit fault will occur in the surge protector if a surge exceeding the tolerance is applied. Thus, install a circuit protector in the stage before the surge protector. Note that almost no current flows to the surge protector during normal use, so a circuit protector installed as the circuit protection for another device can be used for the surge protector.



Installing the surge absorber

CAUTION !

1. The wires from the surge protector should be connected without extensions.
2. If the surge protector cannot be installed just with the enclosed wires, keep the wiring length of A and B to 2m or less. If the wires are long, the surge protector's performance may drop and inhibit protection of the devices in the panel.
3. Surge protector to be selected varies depending on input power voltage.

Appendix 6

EC Declaration of Conformity

Contents

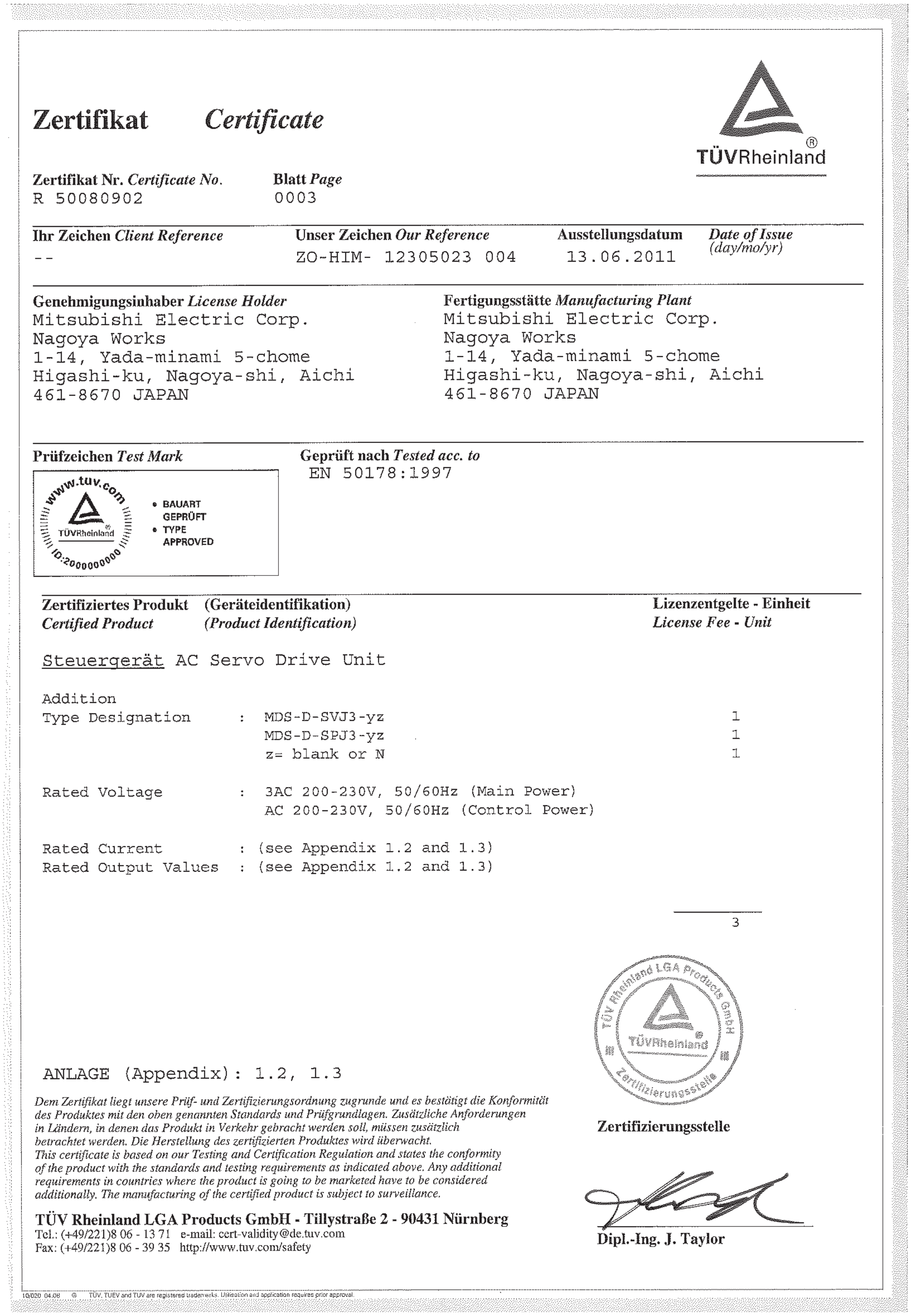
Appendix 6 EC Declaration of Conformity

Appendix 6-1 Compliance to EC Directives

Each series can respond to LVD and EMC directive.
Approval from a third party certification organization has been also acquired for the Low Voltage Directive.
The declaration of conformity of each unit is shown below.

Appendix 6-1-1 Low voltage equipment

MDS-D-SVJ3/SPJ3 Series



Zertifikat ***Certificate***

TÜVRheinland®

Zertifikat Nr. *Certificate No.*
R 50080902

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0003

Ihr Zeichen *Client Reference*	**Unser Zeichen** *Our Reference*	**Ausstellungsdatum** *Date of Issue (day/mo/yr)*
--	ZO-HIM- 12305023 004	13.06.2011

Genehmigungsinhaber *License Holder*
Mitsubishi Electric Corp.
Nagoya Works
1-14, Yada-minami 5-chome
Higashi-ku, Nagoya-shi, Aichi
461-8670 JAPAN

Fertigungsstätte *Manufacturing Plant*
Mitsubishi Electric Corp.
Nagoya Works
1-14, Yada-minami 5-chome
Higashi-ku, Nagoya-shi, Aichi
461-8670 JAPAN

Prüfzeichen *Test Mark*
www.tuv.com
TÜVRheinland®
ID:2000000000
- BAUART GEPRÜFT
- TYPE APPROVED

Geprüft nach *Tested acc. to*
EN 50178:1997

Zertifiziertes Produkt *Certified Product*	**(Geräteidentifikation)** *(Product Identification)*	**Lizenzentgelte - Einheit** *License Fee - Unit*

Steuergerät AC Servo Drive Unit

Addition

Type Designation	: MDS-D-SVJ3-yz	1
	MDS-D-SPJ3-yz	1
	z= blank or N	1
Rated Voltage	: 3AC 200-230V, 50/60Hz (Main Power)	
	AC 200-230V, 50/60Hz (Control Power)	
Rated Current	: (see Appendix 1.2 and 1.3)	
Rated Output Values	: (see Appendix 1.2 and 1.3)	
		3

ANLAGE (Appendix): 1.2, 1.3

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

Zertifizierungsstelle

Dipl.-Ing. J. Taylor

TÜV Rheinland LGA Products GmbH - Tillystraße 2 - 90431 Nürnberg
Tel.: (+49/221)8 06 - 13 71 e-mail: cert-validity@de.tuv.com
Fax: (+49/221)8 06 - 39 35 http://www.tuv.com/safety

Appendix 7

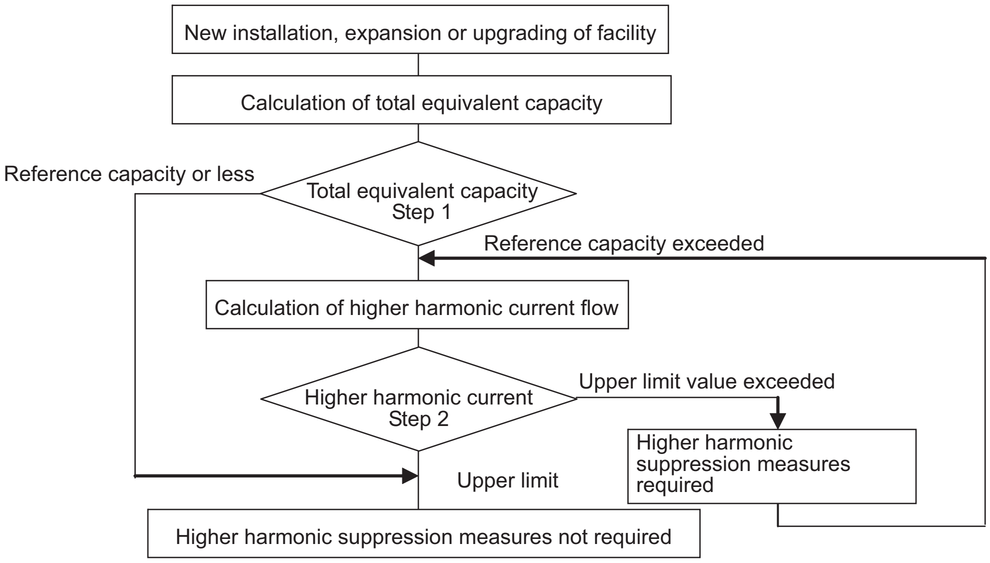
Higher Harmonic Suppression Measure Guidelines

Contents

Appendix 7 Higher Harmonic Suppression Measure Guidelines

Appendix 7-1 Higher harmonic suppression measure guidelines

These guidelines apply to users for which the 6-pulse equivalent capacity total of the installed higher harmonic generator exceeds the reference in the following table. (Note that household appliances and general-purpose products having a rated current of 20A/phase or less connected to a 300V or less commercial power supply are excluded from the generators.)
Use the following flow chart to confirm whether the total exceeds the reference.



Higher Harmonic Suppression Guidelines were set in September 1994 by the Ministry of International Trade and Industry's Agency of Natural Resources and Energy.

- Higher Harmonic Suppression Measure Guidelines for Household Appliances and General-purpose Products
- Higher Harmonic Suppression Measure Guidelines for Consumers Receiving High Voltage or Special High Voltage Power

Appendix 7-1-1 Calculating the equivalent capacity of the higher harmonic generator

As a principle, the higher harmonic suppression measure guidelines must be followed by the customer.

(1) Calculating the total equivalent capacity (Step 1)
Calculate the total equivalent capacity with the following expression.

Total equivalent circuit: Po = Σ • Ki • Pi

Ki :Conversion coefficient (Refer to following table)
Pi :Rated input capacity of each device

(Table 1) Rated capacity of each unit

Unit type MDS-	Rated input capacity pi [kVA]	Unit type MDS-	Rated input capacity pi [kVA]
SPJ3-075NA	0.97	**SVJ3-03NA**	0.6
SPJ3-22NA	2.81	**SVJ3-04NA**	0.8
SPJ3-37NA	4.61	**SVJ3-07NA**	1.2
SPJ3- 55NA	6.77	**SVJ3-10NA**	1.6
SPJ3-75NA	9.07	**SVJ3-20NA**	2.7
SPJ3-110NA	13.1	**SVJ3-35NA**	4.7

(Note) The rated capacity Pi above, is the value used to calculate whether the product corresponds to the higher harmonic guidelines. Thus, the value will differ from the actual power facility's capacity.

(Table 2) Circuit class and conversion coefficient for each unit

Name	Model	Circuit class	Circuit type	Conversion coefficient Ki
Servo drive unit	MDS-D-SVJ3 Series	**3**	3-phase bridge (with smoothing capacitor) With AC reactor	K32=1.8
Spindle drive unit	MDS-D-SPJ3 Series	**3**	3-phase bridge (with smoothing capacitor) With AC reactor	K32=1.8

(Table 3) Limit values for total equivalent capacity

Incoming voltage	Total of 6-pulse equivalent capacity
6.6kV	50kVA
22/33kV	300kVA
66kV or more	2,000kVA

If the total equivalent capacity Po exceeds the limit value given in (Table 3), proceed to "1.2 Calculating the higher harmonic current flow" below.
Measures are not required if the value is not exceeded.

(2) Calculating the higher harmonic current flow (Step 2)

To calculate the higher harmonic current flow, calculate the rated current for the incoming power voltage conversion.

Rated current for incoming power voltage conversion (mA) = a • Pi

(Table 4) Incoming power voltage conversion coefficient a

Incoming power voltage	Coefficient a
6.6kV	87.5
22 kV	26.2
33 kV	17.5
66 kV	8.75
77 kV	7.5

(Table 5) Upper limit of higher harmonic current flow (mA/kW)

Conversion coefficient	5th- order	7th- order	11th- order	13th- order	17th- order	19th- order	23rd- order	25th- order
6.6kV	3.5	2.5	1.6	1.3	1.0	0.9	0.76	0.70
22kV	1.8	1.3	0.82	0.69	0.53	0.47	0.39	0.36
33kV	1.2	0.86	0.55	0.46	0.35	0.32	0.26	0.24
66kV	0.59	0.42	0.27	0.23	0.17	0.16	0.13	0.12
77kV	0.50	0.36	0.23	0.19	0.15	0.13	0.11	0.10

Obtain the upper limit of the higher harmonic current flow (judgment value) for each order.
(The contracted electricity must be known for this.)

Upper limit of higher harmonic current flow (mA) = Contracted electricity, flow upper limit value

Flow upper limit value :

Insert a value from Table 5 according to the higher harmonic order to be calculated.

Obtain the higher harmonic current flow for each order using the following expression.

Higher harmonic current flow (mA) = (a • Pi), Device's maximum operation rate, target order

Device's maximum operation rate : The user must set the operation rate.

Target order : Insert a value from Table 6 according to the higher harmonic order to be calculated.

(Table 6) Higher harmonic current generation rate %

Conversion coefficient	5th- order	7th- order	11th- order	13th- order	17th- order	19th- order	23rd- order	25th- order
K32 = 1.8	38.0	14.5	7.4	3.4	3.2	1.9	1.7	1.3
K31 = 3.4	65.0	41.0	8.5	7.7	4.3	3.1	2.6	1.8

Values when basic wave current is 100%.

Check whether the calculated results exceed the limit value.
If the limit value for the higher harmonic current flow is exceeded, consider the higher harmonic measures shown below.

Examples of higher harmonic measures

Item	Details
Power-factor improving capacitor	Higher harmonics are suppressed by adding a leading capacitor for improving the power factor.
Installation of AC line filter	A reactor and capacitor are combined to reduce the impedance for specific frequencies.

(3) Higher harmonic current flow calculation form

A higher harmonic current flow calculation form is shown below for reference.

<Form 1>

Date of application	
Application No.	
Date of acceptance	

Higher harmonic generating device's higher harmonic current flow calculation form (Part 1)

User name		Industry		Incoming power voltage	kV	Contracted electricity	kW

No.	Step 1: Details of higher harmonic generating device									Step 2: Calculation of higher harmonic current flow rate									
	Higher harmonic generating device			Rated capacity (kVA)	Qty. of devices	Total capacity Pi (kVA)	Circuit type classification No.	6-pulse calculation coefficient Ki	6-pulse equivalent capacity [Ki x Pi] (kVA)	Rated current value for incoming power voltage conversion [a x Pi] (mA)	Device's maximum operation rate (%)	Higher harmonic current flow per order							
	Device name	Maker	Type									5th-order	7th-order	11th-order	13th-order	17th-order	19th-order	23rd-order	25th-order
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
					6-pulse equivalent capacity total Po					Total									
									Necessity of measures										

Higher harmonic current flow upper limit value
(Higher harmonic current flow upper limit per contracted kW x contracted electricity)

Order	5th-order	7th-order	11th-order	13th-order	17th-order	19th-order	23rd-order	25th-order
Current upper limit value (mA)								

<Instructions for completing form>

Step 1

- ☐ Indicate the details of the higher harmonic generating device.
  Refer to the reference and indicate the circuit type classification No., etc.
- ☐ If the device's circuit type classification No. is 10, complete the application shown in <Format 3>.
- ☐ If P, > 50kVA (6kV incoming power), 300kVA (22, 33kV incoming power), 2000kVA (66kV or higher incoming power), proceed to Step 2. (Step 2 does not need to be completed in all other cases.)

Step 2

- ☐ If the current flow > current flow upper limit value at each order, then
  - ○ If there is a facility that lowers the higher harmonics in the factory, or when suppression measures are implemented, proceed to Calculation Form (Part 2)
  - ○ In all other cases, separate measures must be taken

Revision History

Date of revision	Manual No.	Revision details
Sep. 2006	IB(NA)1500193-A	First edition created.
Mar. 2009	IB(NA)1500193-B	- "Coupling with the load" was added. - "Global service network" was revised.
Jan. 2011	IB(NA)1500193-C	- "Outline for MDS-D-SVJ3/SPJ3 Series Specifications Manual (IB-1500158-B)" was added. - "Function specifications list" was added. - The following servomotors were added. HF224, HF123, HF223, HF303, HF142, HF302, HF-KP13, HF-KP23, HF-KP43, HF-KP73 - SJ-D Series and SJ-DJ Series were added. - Descriptions for tool spindle motor was added. - "Machine accuracy", "Installation of servomotor" and "Installation of the spindle detector" were added. - "Main circuit connector (CNP1,CNP2,CNP3) wiring method" was revised. - "Connection of the full-closed loop system" was revised. - "Connecting the spindle side detector" and "Connecting the spindle side accuracy detector" were added to "Connection of the spindle motor". - "External option regenerative resistor" and "Wiring of the motor magnetic brake" were revised. - "Wiring of the Input/output circuit" were revised. - "Contactor connection" was changed to "Wiring of the contactor control" and revised. - "Wiring of an external emergency stop" was revised. - "Wiring of orientation near switch" was changed to "Specifications of proximity switch" and revised. - "Setting DIP switch" was added. - "Setting the initial parameters for the servo drive unit", "Setting the initial parameters for the spindle drive unit" and list of parameters were revised. - "Servo control signal" and "Spindle control signal" were revised. - "Maximum tolerable current command value when adjusting acceleration/ deceleration time constant", "Improvement of protrusion at quadrant changeover", and "Vertical axis drop prevention control" were revised. - "Setting the output magnification" and "Gain adjustment" in "Spindle Adjustment" were revised. - Cautions were added to "Adjusting the acceleration/deceleration operation". - "Orientation adjustment" was revised.

Date of revision	Manual No.	Revision details
Jan. 2011	IB(NA)1500193-C	- "Synchronous tapping adjustment (For machining system)" was changed to "Synchronous tapping adjustment" and revised. - "Spindle C axis adjustment (For lathe system)" was revised. - "High-response acceleration/deceleration function" and "Spindle cutting withstand level improvement" were added. - "List of alarms", "List of warnings" and "Troubleshooting" were revised. - "Cable and Connector Specifications" was revised. - "Compliance to EC Directives" was revised. - "EMC Installation Guidelines" was revised. - "EC Declaration of Conformity" was revised. - "Global service network" was revised. - Miswrite is corrected.
Sep. 2011	IB(NA)1500193-D	- Descriptions related to the unit type followed by "NA" were added. (SVJ3-10NA/20NA, SPJ3-22NA: The connector for CNP1,2 and 3 was changed.) - "Precautions for safety" was revised. - "Handling of our product" was added. - Function specifications list was revised. - A caution was added to "Shaft characteristics" in "Installation of tool spindle motor". - "Spindle side detector" was replaced by "Spindle side ABZ pulse output detector". - "Spindle side accuracy detector" was replaced by "Spindle side PLG serial output detector". - "Installation accuracy diagnosis for PLG detector" was revised. - "Connecting with optical communication repeater unit" was added. - "Motor and detector connection", "Wiring of the peripheral control", "Wiring of the motor magnetic brake (MDS-D-SVJ3)", "Wiring of an external emergency stop", "Safety observation function" were revised. - "Setting of machine side detector" was revised. - List of parameters were revised. - "Position loop gain", "Characteristics improvement" and "Settings for emergency stop" in "Servo Adjustment" were revised. - " Adjustment procedures for each control" was revised. - "Settings for emergency stop" was added to "Spindle Adjustment". - "List of alarms" and "Troubleshooting for each alarm No." were revised. - "Cleaning of spindle motor" was added. - "MDS-BTBOX-36" was added. - "Cable and Connector Specifications" was revised. - "Cable and Connector Assembly" was revised. - "Precautions in Installing Spindle Motor" was revised. - "EC Declaration of Conformity" was revised. - "Global service network" was revised. - Miswrite is corrected.

Global Service Network

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Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible.
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MODEL	MDS-D-SVJ3/SPJ3 Series
MODEL CODE	008-483
Manual No.	IB-1500193

IB(NA)1500193(ENG)-D(1109)MEE
Made in JAPAN