

CNC

**MELDAS AC SPINDLE
MDS-B-SPJ2 Series**

SPECIFICATION MANUAL



Thank you for purchasing the Mitsubishi AC spindle drive unit. This manual describes the handling and precautions for using this unit. Incorrect handling may lead to unforeseen accidents, so always read this manual thoroughly to ensure correct usage.

Make sure that this manual is delivered to the end user. Always store this manual for future reference.

All specifications of the MDS-B-SPJ2 Series are listed in this manual. However, each CNC does not always apply to the specifications, so confirm the CNC specifications before using the unit.

Precautions for reading this Specifications and Maintenance Manual

- (1) This manual gives a general explanation for the spindle system. Refer to the manuals issued by the machine maker for the specifications of each machine tool.
The "restrictions" and "available functions" described in the manuals issued by the machine maker has precedence to those in this manual.
- (2) This manual describes as many special operations as possible, but it should be interpreted that items not mentioned in this manual cannot be performed.

Precautions for Safety

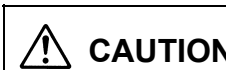
Please read this manual and enclosed documents before starting installation, operation, maintenance or inspection to ensure correct usage. Thoroughly understand the device, safety information and precautions before starting operation. After reading, always store this manual where it can be accessed easily.

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




DANGER

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



CAUTION


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

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


Thank you for purchasing the Mitsubishi AC spindle drive.

The "Prohibited" and "Mandatory" displays are explained as follows.



: This indicates a prohibited action (an action that must not be done). For example, the display for "Fire Prohibited" is .



: This indicates a mandatory action (an action that must be done). For example, the display for grounding is .

After reading, always store this manual where it can be accessed easily.

Precautions that do not reach the level of material damage and precautions for separate functions, etc., are ranked as "Note", "Notice" and "Memo".

Note : This indicates situations in which mishandling will result in failure of this product, but not material damage.







Notice : This indicates situations in which a separate function is entered by parameter change, etc., and other usage methods are required.

Memo : This indicates a point important for correct usage.

For Safe Use




1. Electric shock prevention

DANGER

-  Always turn the power OFF and wait 10 minutes or more until the charge lamp has turned OFF before wiring or carrying out inspections. Using a tester, etc., always confirm that there is no voltage between the P-N terminals before starting wiring or inspections. Failure to observe this could lead to electric shocks.
-  Ground the spindle amplifier and spindle motor with Class 3 grounding or higher.
-  Wiring and inspections must always be carried out by a qualified technician.
-  Always install the spindle amplifier and spindle motor before wiring. Failure to observe this could lead to electric shocks.
-  Do not touch the switches with wet hands. Failure to observe this could lead to electric shocks.
-  Do not damage, apply forcible stress, place heavy items or engage the cable. Failure to observe this could lead to electric shocks.





2. Fire prevention

CAUTION

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

3. Injury prevention

CAUTION












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

4. Various precautions






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

(1) Transportation and installation

CAUTION






-  Correctly transport the product according to its weight.
-  Do not stack the spindle motor or spindle amplifiers above the tolerable number.
-  Do not hold the cables, axis or detector when transporting the spindle motor.
-  Do not hold the front cover when transporting the spindle amplifier. The unit could drop.
-  Follow the Instruction Manual and install the unit in a place where the weight can be borne.
-  Do not get on top of or place heavy objects on the product.
Always observe the installation direction.
-  Secure the specified space between the spindle amplifier and inside wall of the control panel, and between other devices.
-  Do not install or operate a spindle amplifier or spindle motor that is damaged or missing parts.
-  Do not let conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter the spindle amplifier or spindle motor.
-  The spindle amplifier and spindle motor are precision devices, so do not drop them or apply strong impacts to them.
-  Store and use the units under the following environment conditions.

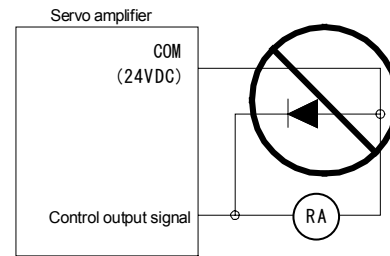
Environment	Conditions	
	Spindle amplifier	Spindle motor
Ambient temperature	0°C to +55°C (with no freezing)	0°C to +40°C (with no freezing)
Ambient humidity	90% RH or less (with no dew condensation)	80%RH or less (with no dew condensation)
Storage temperature	-20°C to +65°C (with no freezing)	-15°C to +70°C (with no freezing)
Storage humidity	90%RH or less (with no dew condensation)	
Atmosphere	Indoors (Where unit is not subject to direct sunlight) With no corrosive gas, combustible gas, oil mist or dust	
Altitude	1000m or less above sea level	
Vibration	5.9 m/s ² (0.6G) or less	SJ-P, SJ-PF 14.7 m/s ² (1.5G) or less

-  Securely fix the spindle motor to the machine. The spindle motor could come off during operation if insecurely fixed.
-  Always install a cover, etc., over the shaft so that the rotary sections of the spindle motor cannot be touched during spindle motor rotation.
-  When using a coupling connection to the spindle motor shaft, do not apply an impact by hammering, etc. The detector could be damaged.
-  Do not apply a load exceeding the tolerable load onto the spindle motor shaft. The shaft could be damaged.
-  Before using this product after a long period of storage, please contact the Mitsubishi Service Station or Service Center.

(2) Wiring



CAUTION

-  Correctly and securely perform the wiring. Failure to do so could lead to runaway of the spindle motor.
-  Do not install a phase advancing capacity, surge absorber or radio noise filter (option FR-BIF) on the output side of the spindle amplifier.
-  Correctly connect the output side (terminals U, V, W). Failure to do so could lead to abnormal operation of the spindle motor.
-  Do not directly connect a commercial power supply to the spindle motor. Doing so could lead to faults.
-  Do not mistake the orientation of the surge absorption diode to be installed on the DC relay for contactor and motor break output signals.










(3) Trial operation and adjustment

CAUTION

-  Check each parameter before starting operation. Failure to do so could lead to unforeseen operation of the machine.
-  Do not make remarkable adjustments and changes as the operation could become unstable.




(4) Usage methods

CAUTION

-  Install an external emergency stop circuit so that the operation can be stopped immediately and the power can be shut off.
-  Never disassemble or repair the unit.
-  The operation will suddenly restart if a reset (RST) is carried out while an operation start signal (ST) is being input. Therefore, always confirm that the operation signal is OFF before resetting (RST). Failure to observe this could result in accidents.
-  Never make modifications.
-  Reduce the influence of electromagnetic interference by using a noise filter, etc. The electronic devices used near the spindle amplifier could be affected by magnetic noise.
-  Use the spindle motor and spindle amplifier with the designated combination.
-  Install a stop device for ensuring safety on the machine side.


(5) Troubleshooting

CAUTION

-  If a dangerous situation is predicted during a stop or product fault, take prevention measures by installing an external brake mechanism to hold the tool.
-  When an alarm occurs, always eliminate the cause of the alarm and ensure safe operation before resetting.
-  Never go near the machine after restoring the power after a failure, as the machine could start suddenly. (Design the machine so that personal safety can be ensured even if the machine starts suddenly.)


(6) Maintenance, inspection and part replacement

CAUTION

-  The capacity of the electrolytic capacitor will drop due to deterioration. To prevent secondary damage due to faults, replace the capacitor every ten years when using under a general environment. Consult the Service Station or Service Center for replacements.

(7) Disposal

CAUTION

-  Treat this unit as general industrial waste.

(8) General precautions

CAUTION

The drawings given in this Specification Manual show the covers, safety partitions, etc., removed to provide a clearer explanation. Always return the covers and safety partitions to their specified locations before operating this product, and operate following the Instruction Manual.

Compliance to European EC Directives

1. European EC Directives

The European EC Directives were issued to unify Standards within the EU Community and to smooth the distribution of products of which the safety is guaranteed. In the EU Community, the attachment of a CE mark (CE marking) to the product being sold 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 are assembled are a target for CE marking.

The spindle is a component designed not to function as a single unit but to be used with a combination of machines and devices. Thus, it is not subject to the EMC Directives, and instead the machines and devices in which the spindle is assembled are targeted.

This spindle complies with the Standards related to the Low-voltage Directives in order to make CE marking of the assembled machines and devices easier. The EMC INSTALLATION GUIDELINES (BNP-B8582-45) which explain the spindle amplifier installation method and control panel manufacturing method, etc., has been prepared to make compliance to the EMC Directives easier. Contact Mitsubishi or your dealer for more information.

2. Cautions of compliance

Use the standard spindle amplifier and EN Standards compliance part for the spindle motor. In addition to the items described in this instruction manual, observe the items described below.


(1) Environment

The spindle amplifier must be used within an environment having a Pollution Class of 2 or more as stipulated in the IEC664. For this, install the spindle amplifier in a control panel having a structure (IP54) into which water, oil, carbon and dust cannot enter.

(2) Power supply

- ① The spindle amplifier must be used with the overvoltage category II conditions stipulated in IEC664. For this, prepare a reinforced insulated transformer that is IEC or EN Standards complying at the power input section.
- ② When supplying the interface power supply from an external source, use a 24 VDC power supply of which the input and output have been reinforced insulated.

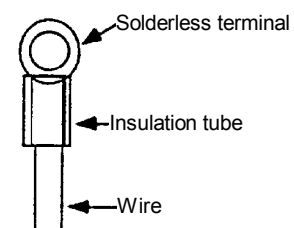
(3) Installation

- ① To prevent electric shocks, always connect the spindle amplifier 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.

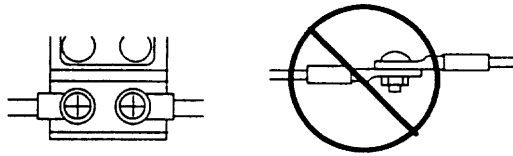


(4) Wiring

- ① Always use solderless terminals with insulation tubes so that the wires connected to the spindle amplifier terminal block do not contact the neighboring terminals.



- ② Connect the SJ-P and SJ-PF Series spindle motor power lead to the spindle amplifier using a fixed terminal block. Do not connect the wires directly.



(5) Peripheral devices and options

- ① Use a no-fuse breaker and magnetic contactor that comply with the EN/IEC Standards described in section 6-2-1.
- ② The wires sizes must follow the conditions below. When using other conditions, follow Table 5 of EN60204 and the Appendix C.
 - Ambient temperature: 40°C
 - Sheath: PVC (polyvinyl chloride)
 - Install on wall or open table tray
- ③ When using the EMC filter, the radio noise filter (FR-BIF) is not required.

(6) Spindle motor

Contact Mitsubishi for the outline dimensions, connector signal array and detector cable.

(7) Others

Refer to the EMC INSTALLATION GUIDELINES (BNP-B8582-45) for other EMC Directive measures related to the spindle amplifier.

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Chapter 1 Outline

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1. Outline

1.1 Features for MDS-B-SPJ2 Series

- (1) The unit has been downsized and reduced in weight with the incorporation of a high speed, high integration LSI, high speed DSP and IGBT
- (2) The speed response has been improved with the high speed DSP, improving the cutting capacity and improving the cutting precision during positioning control.
- (3) A smooth operation and short time orientation time have been realized by incorporating the high speed orientation method that enables direct orientation from high speeds.
- (4) All spindle parameters can be set from the NC side CRT screen making operation easier.

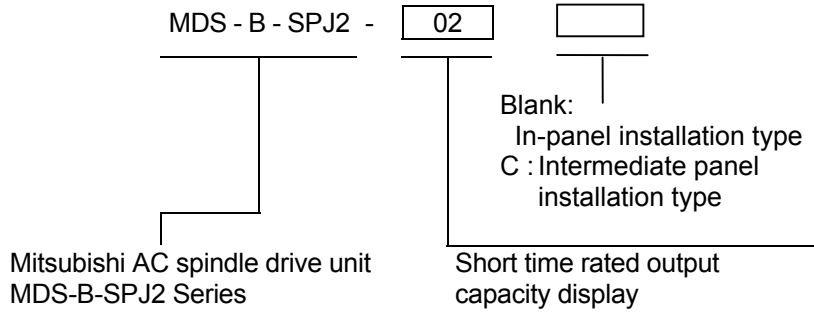
1.2 Precautions for use

- (1) The motor rated output is guaranteed at the drive unit rated input (200/220/230VAC). If the input voltage fluctuates and drops below this, the rated output may not be reached.
- (2) A PWM controlled high harmonics chopper voltage is applied on the motor, so a high harmonic leakage current will flow during motor operation.
If a general purpose leakage breaker is used, it may malfunction due to the high harmonics. Always use a leakage breaker for inverter purposes.
- (3) The above high harmonics leakage current will also flow in the grounding wire between the motor and controller. If this grounding wire is placed near the NC CRT screen, the CRT screen may malfunction due to the magnetic field of the leakage current. Keep the grounding wire and CRT screen as far away as possible.
- (4) Noise could be a problem particularly to AM radio broadcasts due to the magnetic radio wave noise radiated from the motor and controller.
Keep radios as far away from the motor and controller as possible.
A filter for radio noise measures is prepared as an option, so use it as necessary.

1. Outline

1.3 Type configuration

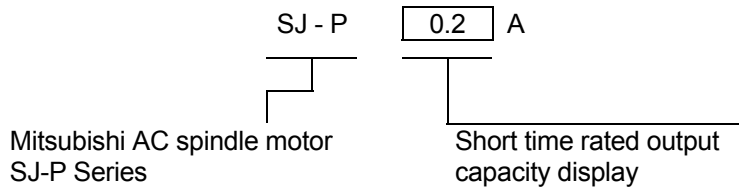
● Spindle drive unit type



Symbol	Output capacity (kW)
02	0.2
04	0.4
075	0.75
15	1.5
22	2.2
37	3.7
55	5.5
75	7.5
110	11.0

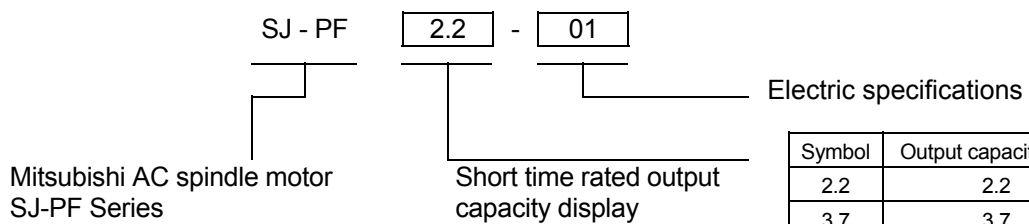
● Spindle motor type

(1) SJ-P Series (self-cooling type)



Symbol	Output capacity (kW)
0.2	0.2
0.4	0.4
0.75	0.75
1.5	1.5
2.2	2.2
3.7	3.7

(2) SJ-PF Series (fan cooling type)



Symbol	Output capacity (kW)
2.2	2.2
3.7	3.7
5.5	5.5
7.5	7.5
11	11.0

1. Outline

1.4 Basic functions and option functions

● Basic functions (High-speed serial communication interface input/output signals)

Function	Details
Emergency stop input	When the emergency stop signal turns OFF, the motor decelerates to a stop with regenerative braking, and after stopping the gate is shut off.
Speed command input	The digital speed command is input from the control unit.
Ready ON input	After ready ON is input, the motor can be run. When the signal is turned OFF, the motor will coast to stop.
Forward run, reverse run command input	While this signal is ON, the motor will rotate in the counterclockwise direction (forward run) or clockwise direction (reverse run) looking from the motor shaft side. The operation will follow the speed command. The motor will decelerate to a stop when this signal turns OFF.
Orientation command input	This is the orientation start signal. When this signal turns ON, orientation will start regardless of the forward run/reverse run commands.
Gear selection 1,2 input	The spindle gear step (4-step) for orientation or position control is selected.
Torque limit 1, 2, 3 input	The motor is rotated with the output torque temporarily reduced. Seven types of torque limit values (parameter set) can be used.
Indexing forward run, reverse run command input	This is the forward run (CCW) or reverse run (CW) indexing command input after multi-point orientation. This is valid when the orientation start signal is ON.
Control mode selection command 1, 2, 3, 4, 5 input	The spindle drive unit operation mode (speed control, position control) can be selected directly with bit correspondence.
Zero speed output	This signal turns ON when the actual motor speed drops to below zero speed (parameter set).
Speed reached output	This signal turns ON when the actual motor speed in respect to the commanded speed reaches $\pm 15\%$.
Speed detection output	This signal turns ON when the motor speed drops to below that set with parameters.
Current detection output	This signal turns ON when the current value reaches 110% or more of the rated current.
In motor forward run/reverse run output	Whether the actual motor is running in forward or reverse is detected and a signal is output.
Orientation output complete	This signal turns ON if the stop position is in the in-position (parameter set) range during orientation. This signal turns OFF when not in the in-position range.
Index positioning complete output	This signal turns ON when indexing is completed.
In alarm output	This signal turns ON if an alarm occurs in the spindle drive unit. The alarm details are displayed with corresponding numbers on the unit and drive unit.
Speed display output	The actual motor speed is displayed on the control unit screen.
Load display output	The actual motor load (motor output) is displayed on the control unit screen with 100% as the short time rated output.
Acceleration/deceleration time constant setting	The time constant of the speed command used during acceleration/deceleration can be set with parameters. Note that this will differ from the actual operation time because of the load GD.

● Option functions

1. When using motor built-in encoder (only gear ratio 1:1)
2. When using installed 1024p/rev encoder

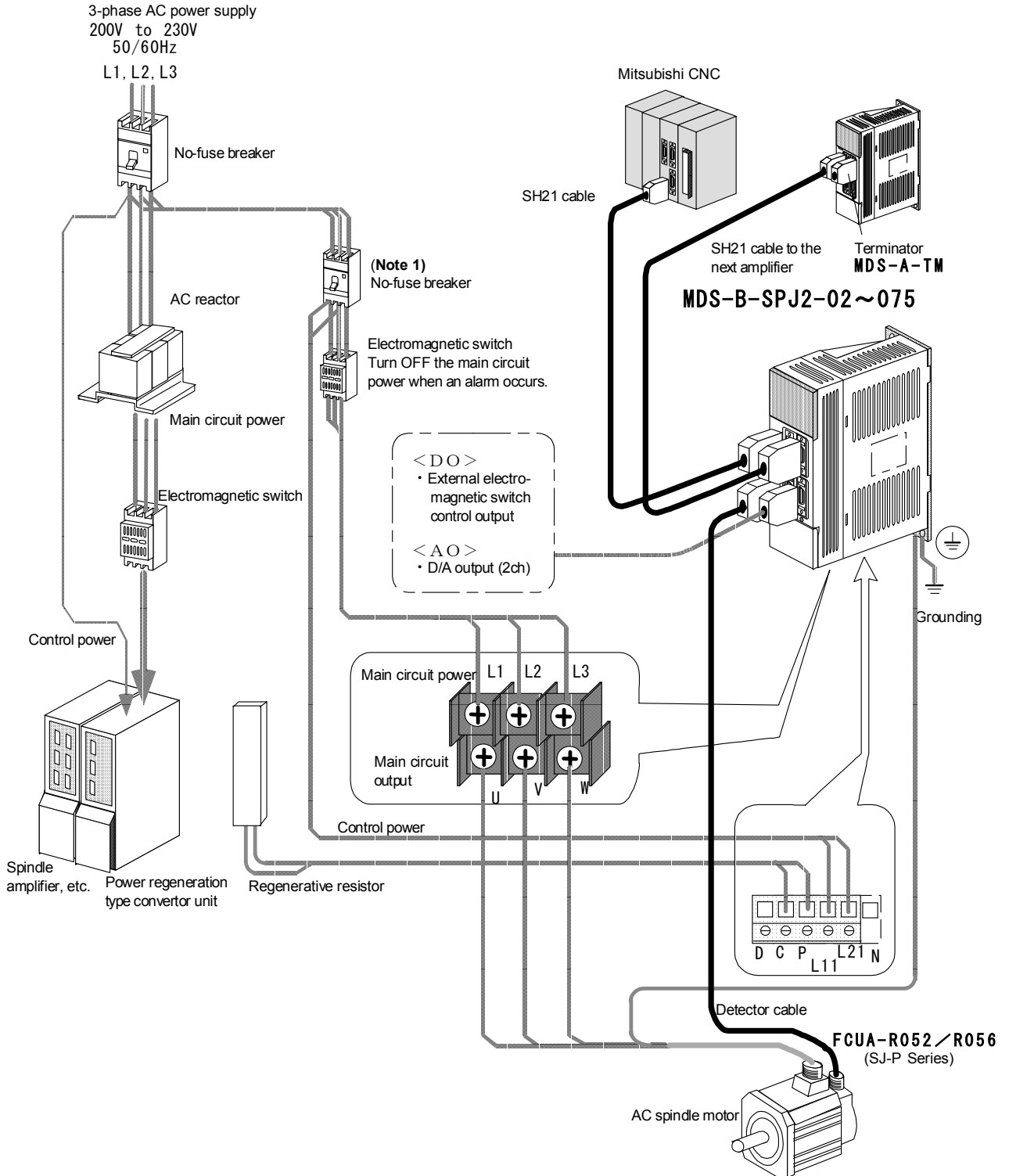
Function	Details
Multi-point (4096 point) orientation	Stopping from the high speed rotation to any of the 4096 points is possible directly.
Indexing function	After orientation stop, the motor can be stopped from either forward run or reverse run at any of the 4096 points.
High-speed synchronous tapping	Direct high-speed, high-precision tapping is possible without using a floating tap chuck.
Spindle speed display, synchronous feed signal	The encoder pulse data is output to the control unit via a high-speed serial cable, so the spindle speed can be displayed and threading can be carried out.

1. Outline

1.5 Configuration

1.5.1 Basic configuration

<MDS-B-SPJ2-02 ~ MDS-B-SPJ2-075>



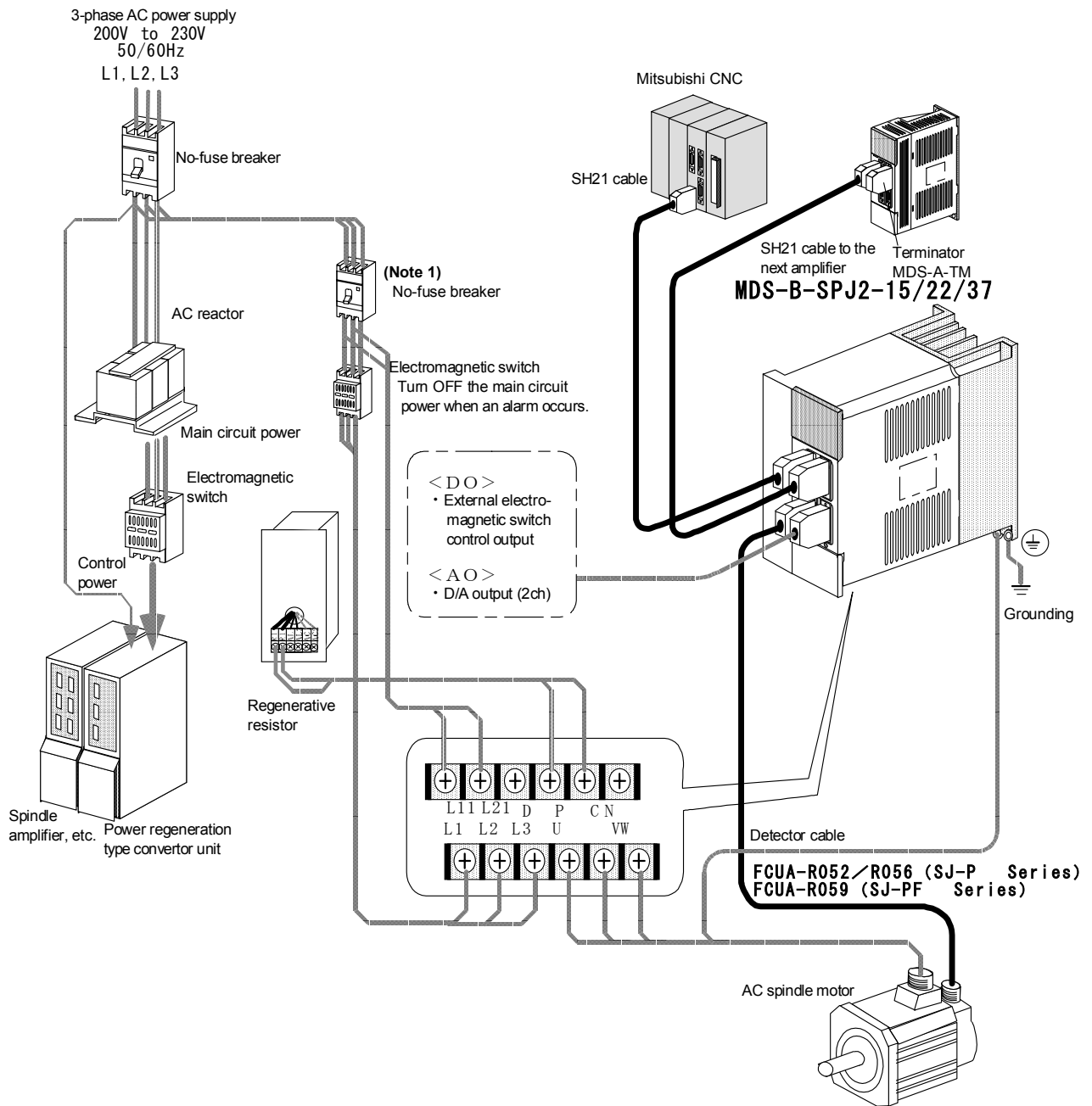
⚠ CAUTION

(Note 1)

Install an independent no-fuse breaker for the MDS-B-SPJ2 main circuit power. This is especially necessary when the circuit is shared with a large capacity converter unit, where the no-fuse breaker may not operate at a main circuit short-circuit in a small capacity spindle amplifier (SPJ2) if the no-fuse breaker is also installed so that it is shared. If this happens a fire may result.

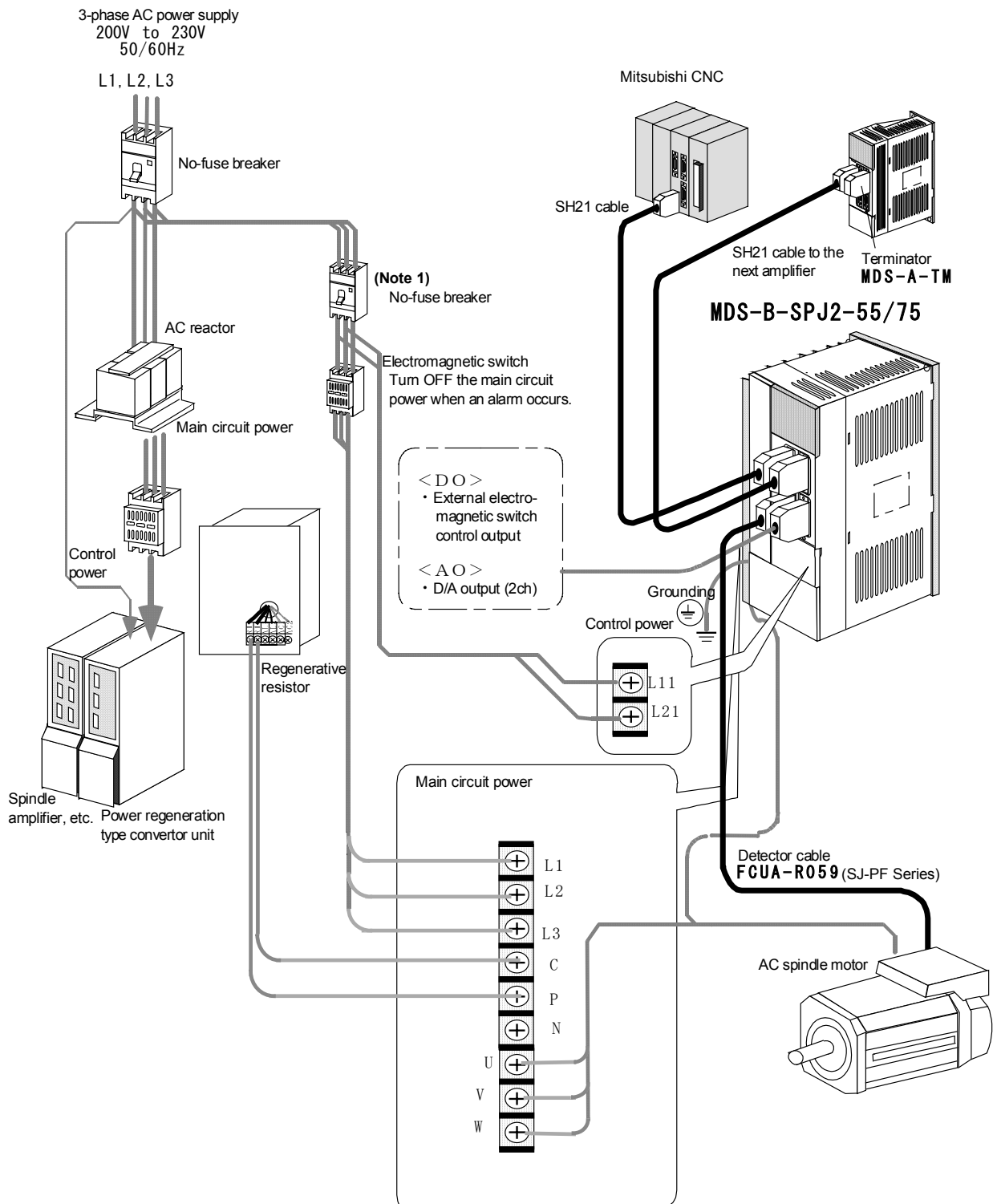
1. Outline

<MDS-B-SPJ2-15/22/37>



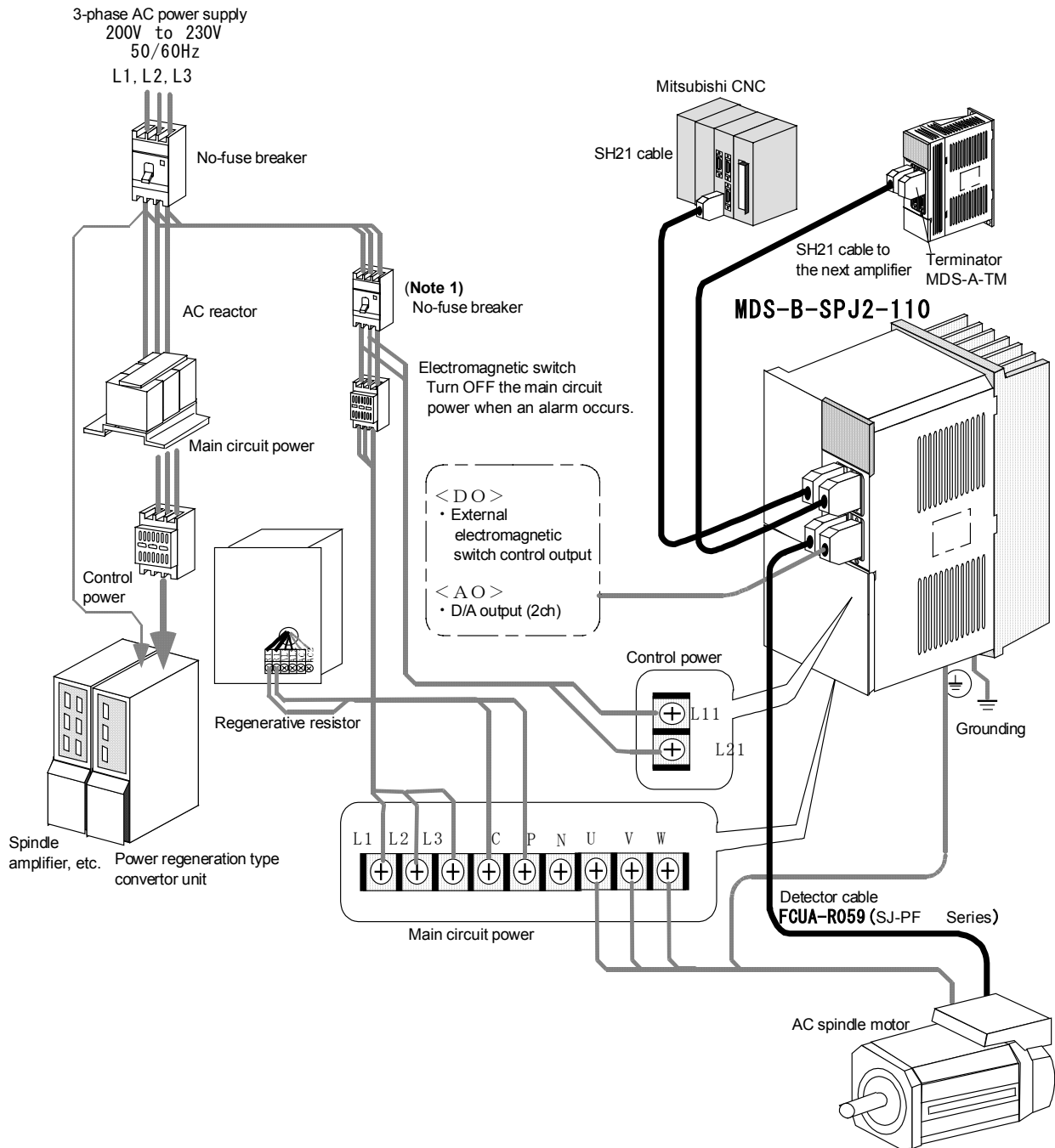
1. Outline

<MDS-B-SPJ2-55/75>



1. Outline

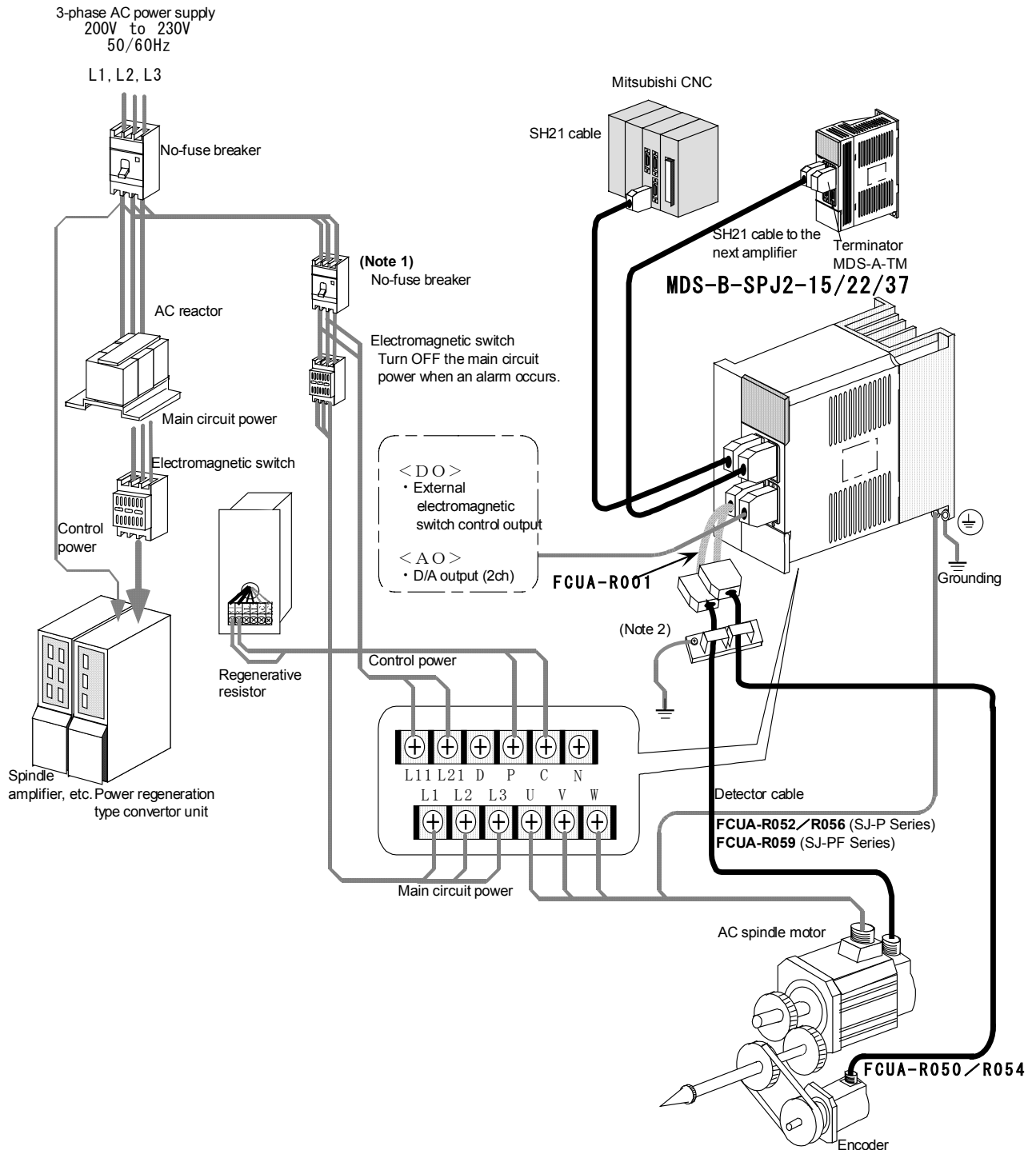
<MDS-B-SPJ2-110/110C>



1. Outline

1.5.2 Encoder orientation (full closed)

<MDS-B-SPJ2-15/22/37>



(Note 2)

When orientation, etc., is carried out using an external encoder, a motor detector cable and encoder cable are connected using a forked cable from the connector (CN2). Note that when the cable shield is not connected to the ground via the connector case, the shield should be securely connected to the ground using a cable clamp jig, etc., as shown in the drawing. If the shield is not connected to the ground, it may cause the motor to produce abnormal noises or the orientation position to deviate.

Chapter 2 Specifications

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2. Specifications

2. Specifications

2.1 AC spindle motor and drive unit specifications

Motor series		SJ-P Series						
Specifications	Spindle motor model	SJ-P0.2A	SJ-P0.4A	SJ-P0.75A	SJ-P1.5A	SJ-P2.2A	SJ-P3.7A	
	Spindle drive unit model	MDS-B-SPJ2-02	MDS-B-SPJ2-04	MDS-B-SPJ2-075	MDS-B-SPJ2-15	MDS-B-SPJ2-22	MDS-B-SPJ2-37	
Spindle motor	Continuous characteristics (Note 1)	Rated output (kW)	0.1	0.15	0.3	0.55	1.1	1.5
		Rated torque (Nm)	0.64	0.96	1.91	3.5	7.0	9.55
		(kgcm)	6.5	9.8	19.5	35.7	71.4	97.4
	Short-time characteristics (10min) (Note 1)	Rated output (kW)	0.2	0.4	0.75	1.5	2.2	3.7
		Rated torque (Nm)	1.27	2.55	4.77	9.55	14.0	23.5
		(kgcm)	13	26	48.7	97.4	143	240
	Rated speed (r/min)	1500						
	Max. speed (r/min)	10000			8000			
	Frame No.	A46F	B46F	A71F	B71F	A112F	B112F	
	Max. torque (Nm)	1.54	3.07	5.73	11.4	16.8	28.2	
		(kgcm)	15.6	31.4	58.5	117	288	
	Max. current (A)	2.5	5.0	6.5	11	14	23	
	Power rate (kW/sec)	2.8	3.0	4.0	5.8	7.5	9.1	
	Moment of inertia	J (kgcm ²)	1.5	3.0	9.0	21	65	100
		GD ² (kgcm ²)	6.0	12	36	84	260	400
	Speed position encoder	Incremental encoder resolution 4096p/rev						
Accessories	Thermal protector and oil seal provided							
Structure	Fully enclosed self-cooling (IP54) Flange installation							
Ambient temperature	0°C to 40°C							
Weight (kg)	4.5	6.5	10	20	25	35		
Spindle drive unit	Power supply (Note 2)	Voltage, frequency	3-phase 200V to 230VAC 50/60Hz					
		Tolerable voltage fluctuation	170V to 253V 50/60Hz					
		Tolerable frequency fluctuation	Within ± 5%					
		Power facility capacity	0.5	1.0	2.0	3.0	4.0	7.0
	Control method	Sinusoidal PWM control, current control type vector control method						
	Braking method	Regenerative control (resistance electrical-discharge)						
	Speed control range	35 to 10000 (r/min)						
	Tolerable load moment of inertia	10-times or less of motor moment of inertia						
	Controller connection specifications	HDLC high-speed serial bus connection						
	Protective functions	Overcurrent shut off, overvoltage shut off, overload shut off (thermal relay), undervoltage protection, main circuit element overheat protection, regenerative resistor overheat protection, overspeed protection, excessive error protection, detector error protection						
	Environment	Ambient temperature	0°C to 55°C (with no freezing) Storage -20°C to 65°C					
		Ambient humidity	90%RH (with no dew condensation)					
		Atmosphere	No corrosive gases or dust					
		Altitude	1000m or less					
		Vibration	5.9m/S ² (0.6G) or less					
	Outline dimensions H×W×D (mm)	168×54×135	168 × 70 × 135		168 × 90 × 195			
Weight (kg)	0.8	1.0		2.3				

Note 1) The rated output is guaranteed at the rated input voltage (200 to 230VAC). If the input voltage fluctuates and drops below this value, the rated output may not be achieved.

Note 2) When using a voltage not within the above specifications, prepare a power supply transformer.

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Motor series			SJ-PF Series				
Specifications	Spindle motor model		SJ-PF2.2-01	SJ-PF3.7-01	SJ-PF5.5-01	SJ-PF7.5-01	SJ-PF11-01
	Spindle drive unit model	In-panel installation type	MDS-B-SPJ2-22	MDS-B-SPJ2-37	MDS-B-SPJ2-55	MDS-B-SPJ2-75	MDS-B-SPJ2-110
		Intermediate panel installation type					MDS-B-SPJ2-110C
Spindle motor	Continuous characteristics (Note 1)	Rated output (kW)	1.5	2.2	3.7	5.5	7.5
		Rated torque (Nm)	9.55	14.0	23.5	35.0	47.8
			(kgcm)	97.5	143	240	357
	Short-time characteristics (10min) (Note 1)	Rated output (kW)	2.2 (15 min.)	3.7 (15 min.)	5.5 (30 min.)	7.5 (30 min.)	11.0 (30 min.)
		Rated torque (Nm)	14.0	23.5	35.0	47.8	70.0
			(kgcm)	143	240	357	487
	Rated speed (r/min)		1500				
	Max. speed (r/min)		10000		8000		6000
	Frame No.		A90	B90	D90	A112	B112
	Max. torque (Nm)	16.8	28.2	42.0	57.4	84.1	
		(kgcm)	171	283	428	584	858
	Max. current (A)		17	28	37	53	64
	Power rate (kW/sec)		14	23	40	52	76
	Moment of inertia	J (kgcm ²)	65	85	137	235	298
		GD ² (kgcm ²)	260	340	550	940	1190
	Speed position encoder		Incremental encoder resolution 4096p/rev				
	Accessories		Thermal protector provided				
Structure		Fully enclosed self-cooling (IP54) flange installation					
Ambient temperature		0°C to 40°C					
Weight (kg)		25	30	49	60	70	
Spindle drive unit	Power supply (Note 2)	Voltage, frequency	3-phase 200V to 230VAC 50/60Hz				
		Tolerable voltage fluctuation	170V to 253V 50/60Hz				
		Tolerable frequency fluctuation	Within ± 5%				
		Power facility capacity	4.0	7.0	9.0	12.0	17.0
	Control method		Sinusoidal PWM control, current control type vector control method				
	Braking method		Regenerative control (resistance electrical-discharge)				
	Speed control range		35 to 8000 (r/min)				
	Tolerable load moment of inertia		10-times or less of motor moment of inertia				
	Controller connection specifications		HDLC high-speed serial bus connection				
	Protective functions		Overcurrent shut off, overvoltage shut off, overload shut off (thermal relay), undervoltage protection, main circuit element overheat protection, regenerative resistor overheat protection, overspeed protection, excessive error protection, detector error protection				
	Environment	Ambient temperature		0°C to 55°C (with no freezing) Storage -20°C to 65°C			
		Ambient humidity		90%RH (with no dew condensation)			
		Atmosphere		No corrosive gases or dust			
		Altitude		1000m or less			
		Vibration		5.9m/S ² (0.6G) or less			
	Outline dimensions	In-panel installation type		168 × 90 × 195	250 × 130 × 200		380×180×200
		Intermediate panel installation type				350×180×200	
H×W×D (mm)							
Weight (kg)		2.3		4.5		6.5	

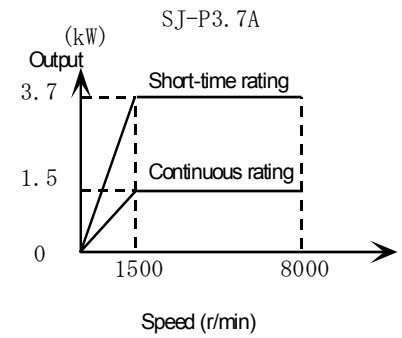
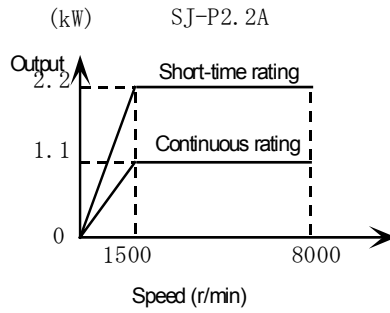
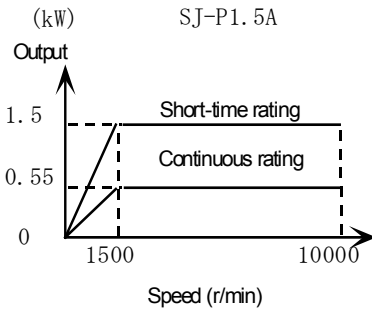
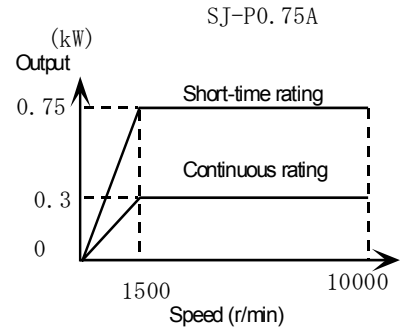
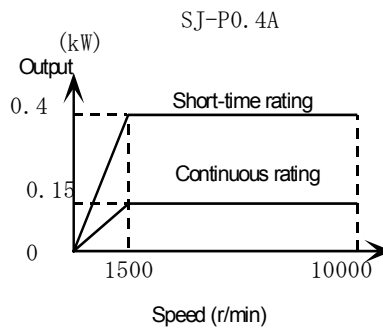
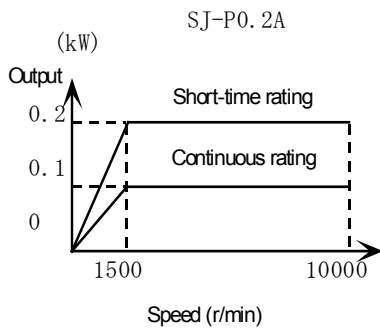
Note 1) The rated output is guaranteed at the rated input voltage (200 to 230VAC). If the input voltage fluctuates and drops below this value, the rated output may not be achieved.

Note 2) When using a voltage not within the above specifications, prepare a power supply transformer.

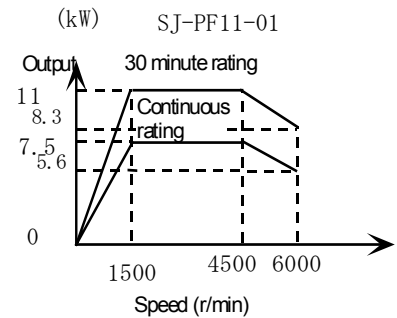
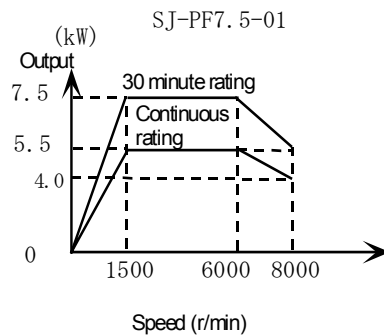
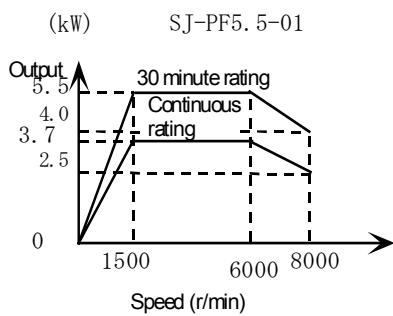
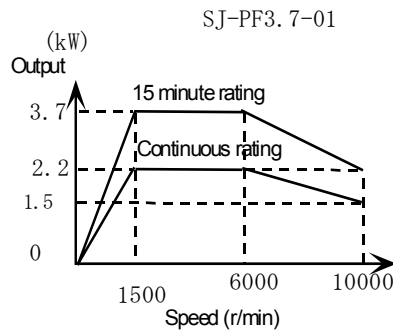
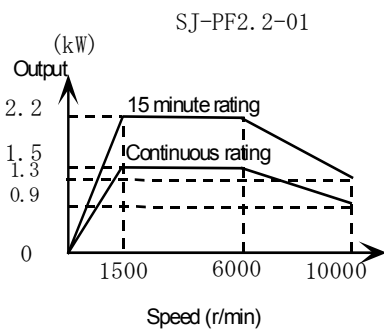
2. Specifications

2.2 Output characteristics

● SJ-P Series



● SJ-PF Series



2.3 Tolerable acceleration/deceleration frequency characteristics

The tolerable acceleration/deceleration frequency characteristics of the controller fluctuate according to the motor speed and motor shaft conversion GD^2 , so calculate the tolerable frequency with the following items. The smaller of the frequency determined by the acceleration/deceleration time according to the controller output (refer to appendix) and the frequency determined by the regenerative resistor becomes the operable frequency (tolerable duty cycle).

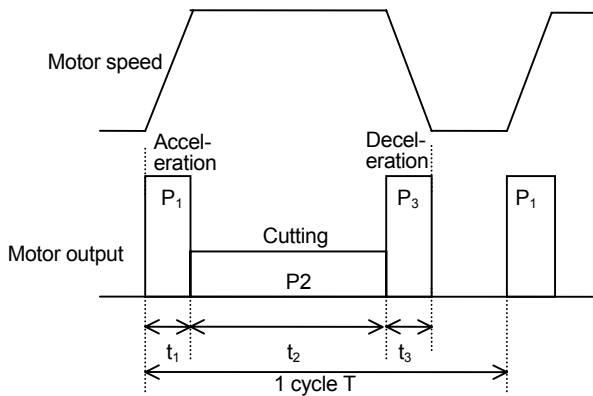
2.3.1 Frequency according to acceleration/deceleration time (tolerable duty cycle)

When machining with a frequent spindle acceleration/deceleration, the average output value per cycle must not exceed the continuous rated output.

$$\text{Continuous rated output} \geq 1 \text{ cycle average output value}$$

(1) How to obtain the average output

$$\text{Average output } P_{AV} = \sqrt{\frac{P_1^2 \cdot t_1 + P_2^2 \cdot t_2 + P_3^2 \cdot t_3}{T}}$$



P_1, P_3 : Output (kW) during acceleration/
deceleration
30 minute rated output \times 1.2
 P_2 : Output (kW) during cutting
 t_1, t_3 : Acceleration/deceleration time

2.3.2 Frequency according to regenerative resistor (tolerable duty cycle)

The energy during motor deceleration (during regeneration) is consumed by the regenerative resistor. This heating value of this regenerative resistor changes according to the motor type, speed being used, load inertia and continuous repetition cycle (duty cycle).

Use a regenerative resistor with an adequate capacity according to the load and continuous cycle time.

(1) How to obtain the regenerative resistor capacity

Obtain the rotation energy with the following equation, and select so that the value does not exceed the capacity of the regenerative resistor.

$$\text{Regenerative resistor capacity} \geq \text{Motor rotation energy}$$

Refer to section 2.3.3 for the regenerative resistor capacity.

2. Specifications

The spindle motor rotation energy W is :

$$W = \frac{n}{120} \times \frac{(GD_M^2 + GD_L^2)}{4} \times \left[\frac{2\pi \cdot N}{60} \right]^2$$

GD_M^2 : Motor rotor inertia (kg•m²)
 GD_L^2 : Motor shaft conversion load inertia (kg•m²)
 N : Motor speed (r/min)
 n : Acceleration/deceleration frequency (times/min.)

$$n = \frac{60}{T} \quad T : \text{Tolerable duty cycle (sec)}$$

2.3.3 Combination of regenerative resistor capacity and unit

The combinations of the regenerative resistor capacity (tolerable heating value) and the unit are shown below.

Model	Tolerable heating value	Resistance value (ohm)	Combination with spindle drive unit (MDS-B-SPJ2-**)								
			-02	-04	-075	-15	-22	-37	-55	-75	-110
No regenerative resistor	—	—									
FCUA-RB04	60W	200	○	○							
FCUA-RB075	80W	100	○	○	○						
FCUA-RB15	120W	60		○	○	○					
FCUA-RB22	155W	40			○	○	○				
FCUA-RB37	185W	25				○	○	○			
FCUA-RB75/2 1 unit used	340W	30					○	○			
FCUA-RB55	340W	20						○	○		
FCUA-RB75/2 Two units in series	680W	15							○	○	
R-UNIT1	700W	15					○	○			
R-UNIT2	700W	15							○	○	
R-UNIT3	2100W	15							○	○	
R-UNIT4	2100W	10									○
R-UNIT5	3100W	10									○



If repeated frequency operation exceeding the regenerative resistor capacity is carried out, and over-regeneration alarm will occur and the spindle drive unit will stop.

The over-regeneration alarm detects the cumulative value of the current that flows within a set time to the regenerative resistor. The alarm can be released just by turning the power ON again, but do not resume operation immediately.

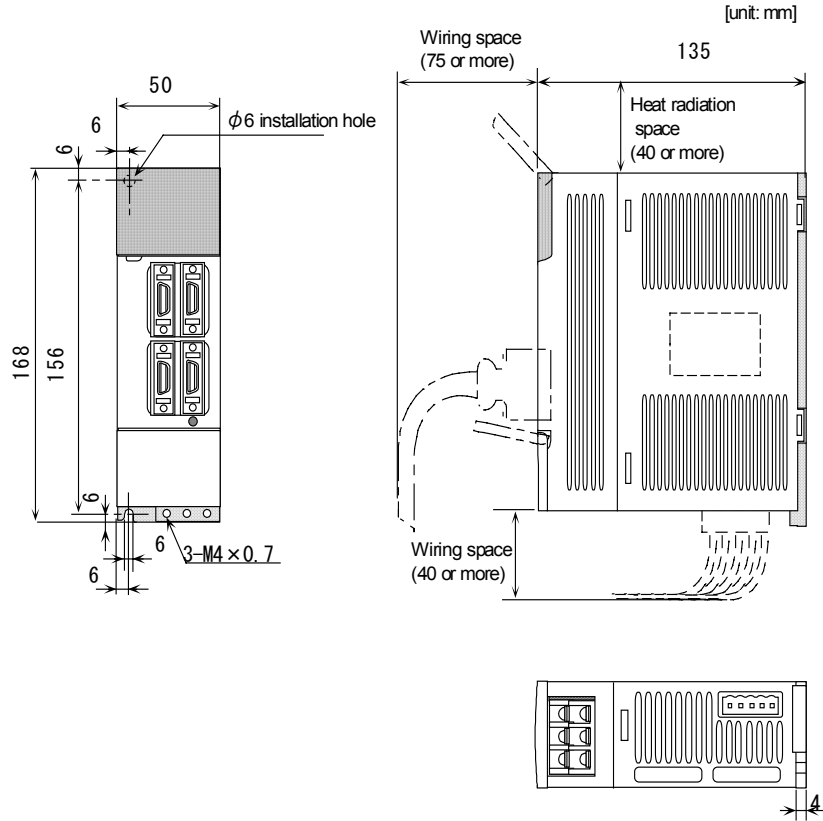
If operation is resumed before the regenerative resistor cools, the regenerative resistor could burn out and fires could occur. Always resume operation after the regenerative resistor cools.

2. Specifications

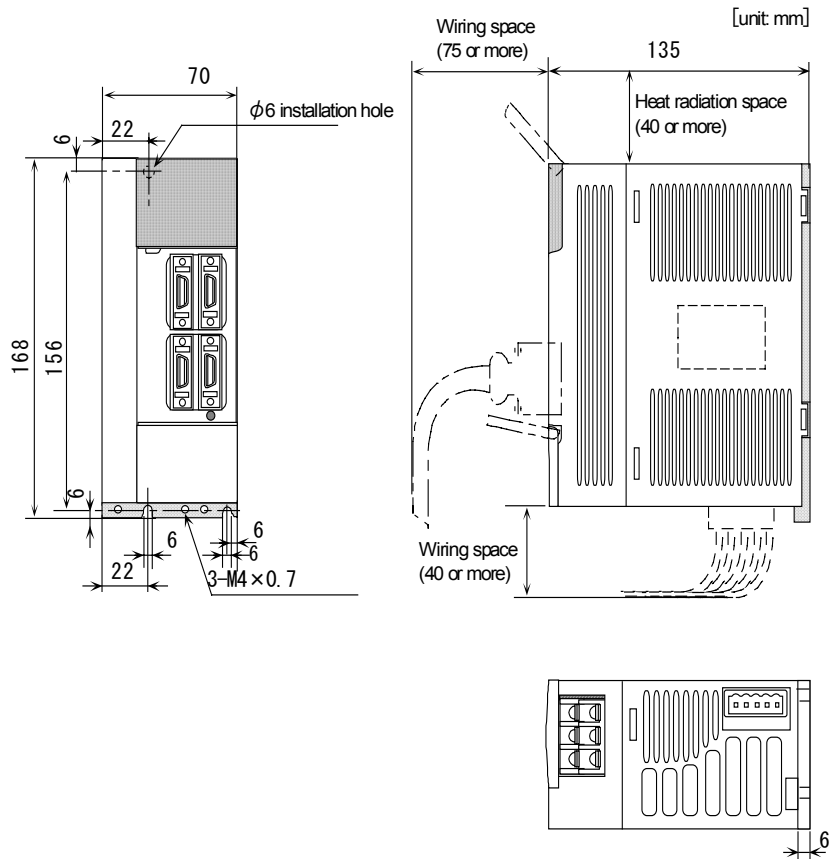
2.4 Outline dimension

2.4.1 Spindle drive unit

- MDS-B-SPJ2-02

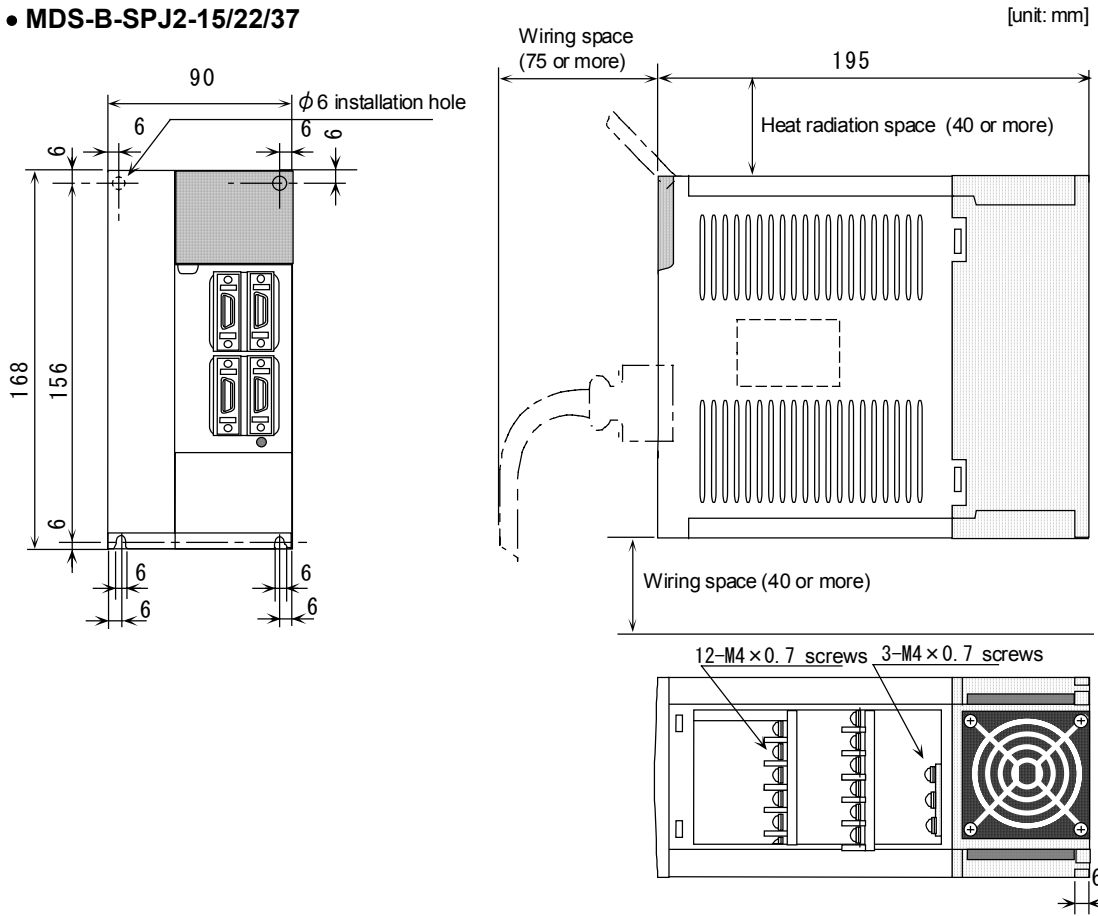


- MDS-B-SPJ2-04/075

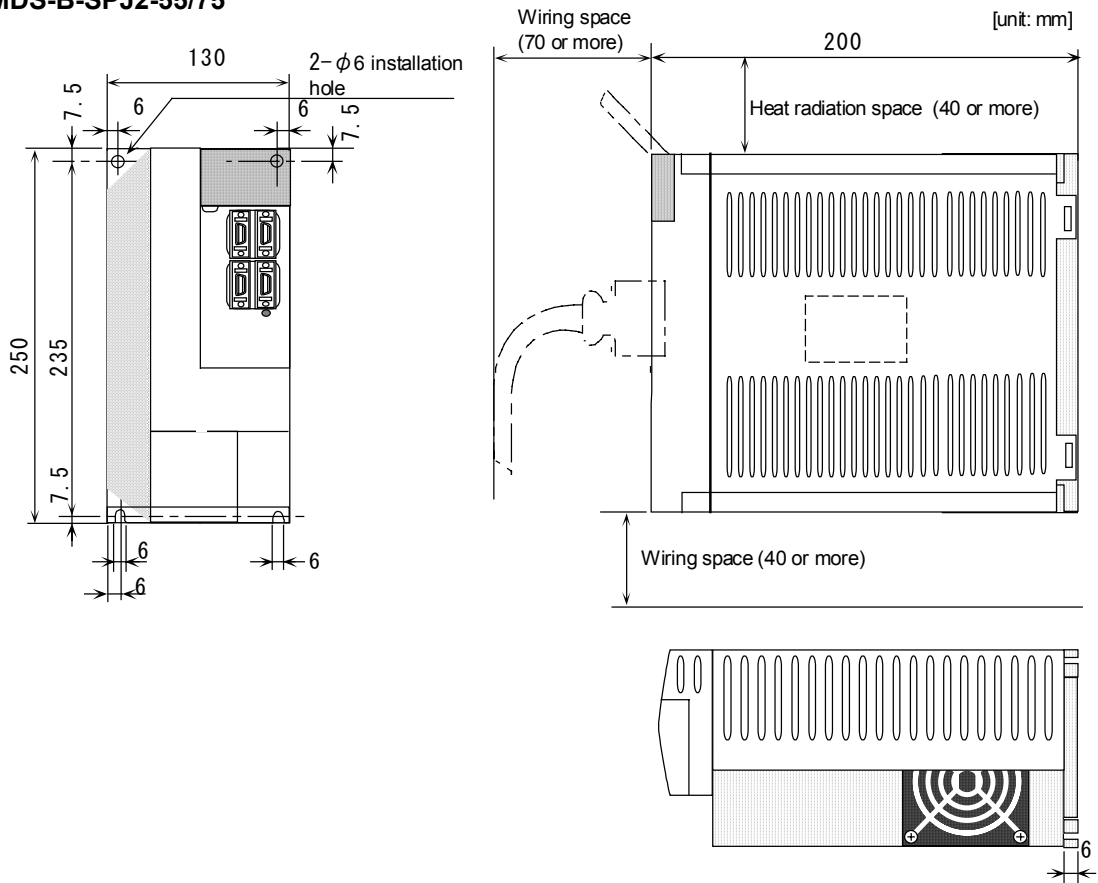


2. Specifications

• MDS-B-SPJ2-15/22/37

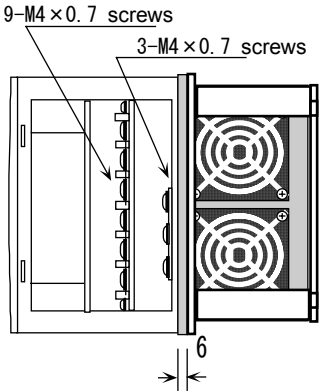
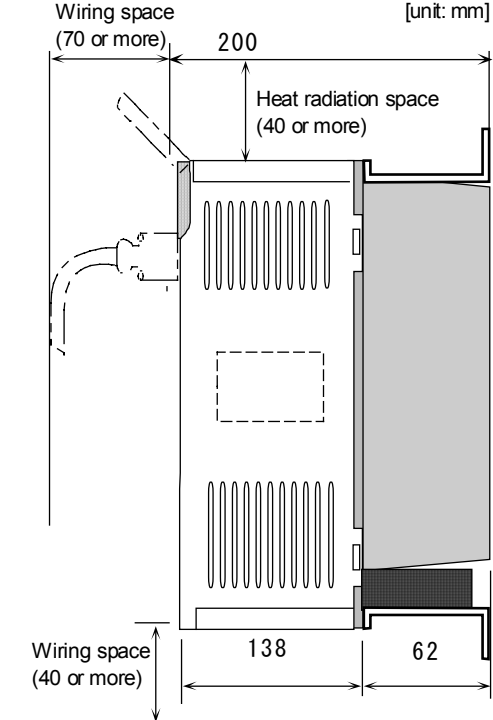
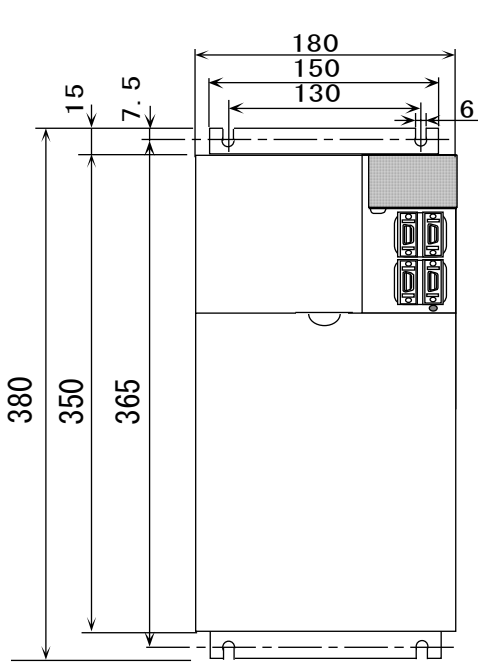


• MDS-B-SPJ2-55/75



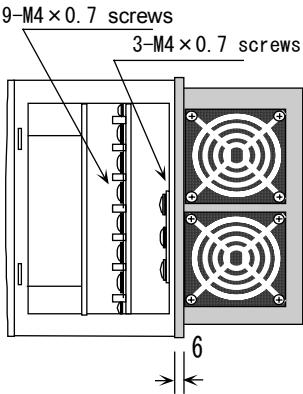
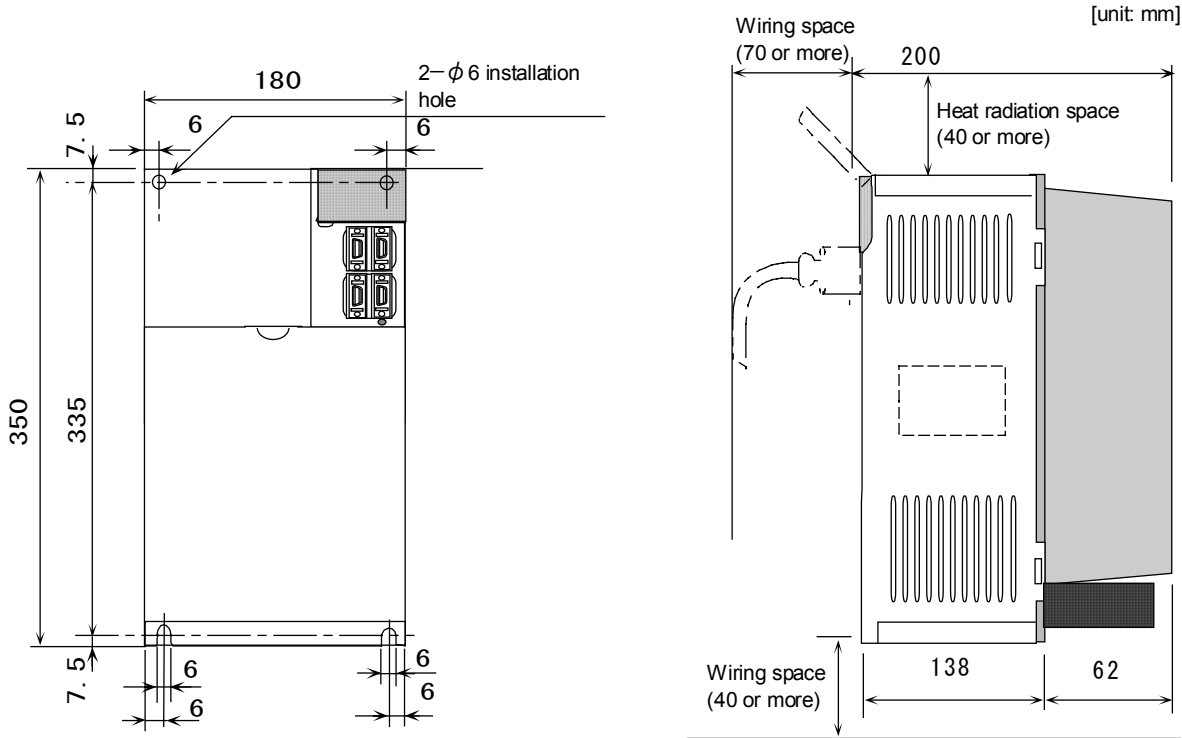
2. Specifications

• MDS-B-SPJ2-110

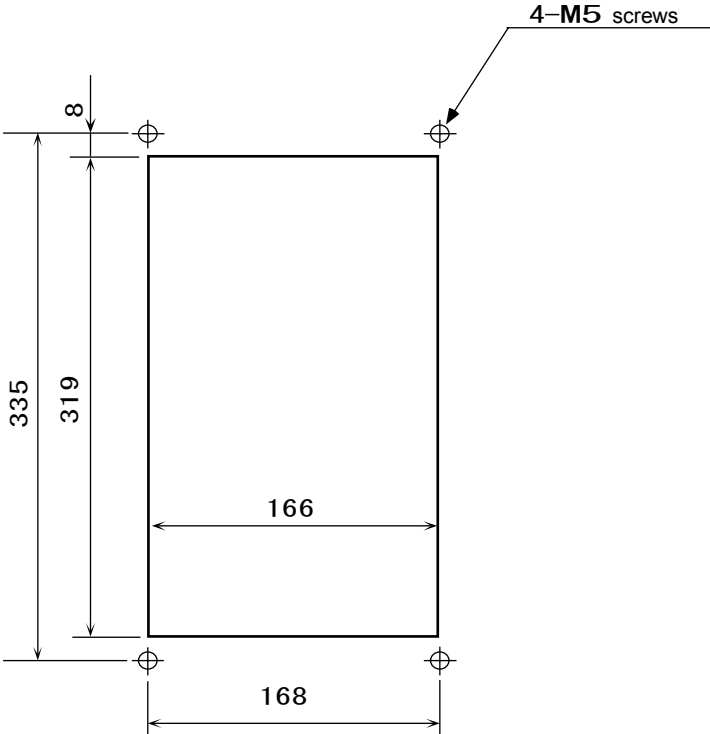


2. Specifications

• MDS-B-SPJ2-110C



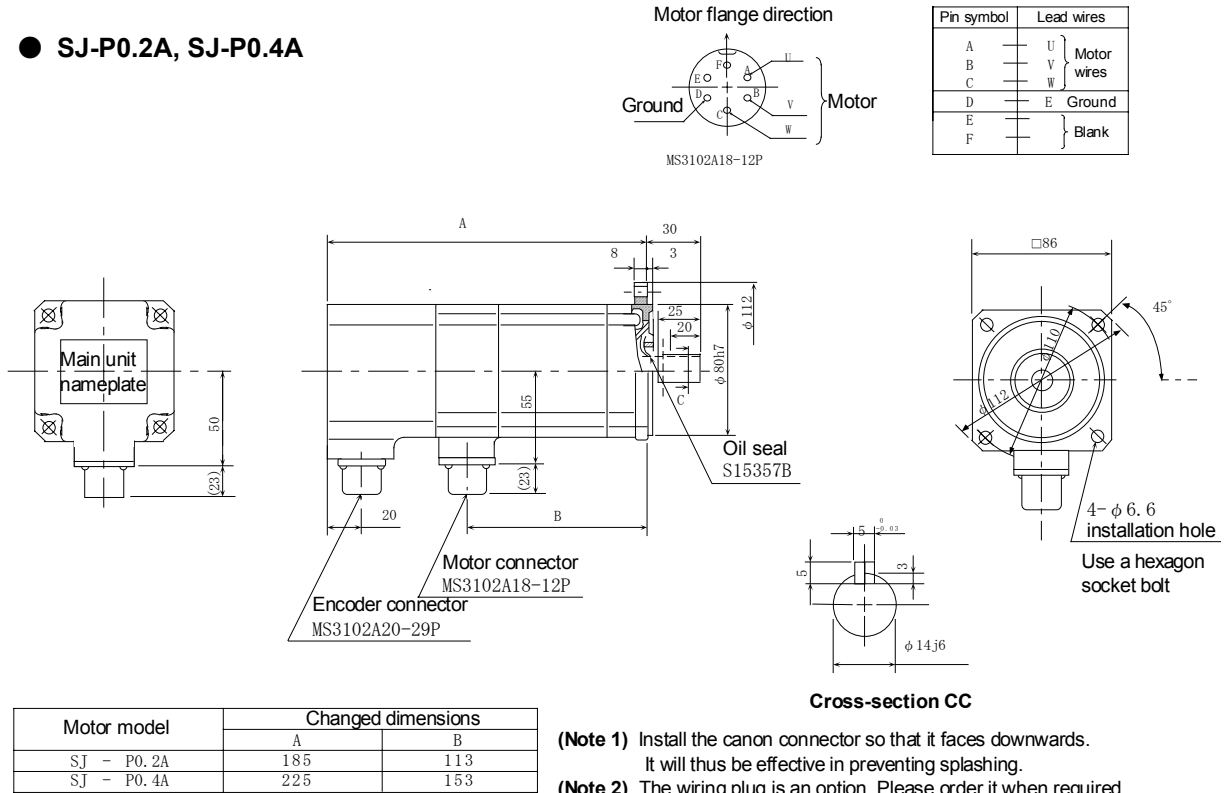
< Embedded installation Installation hole dimensions >



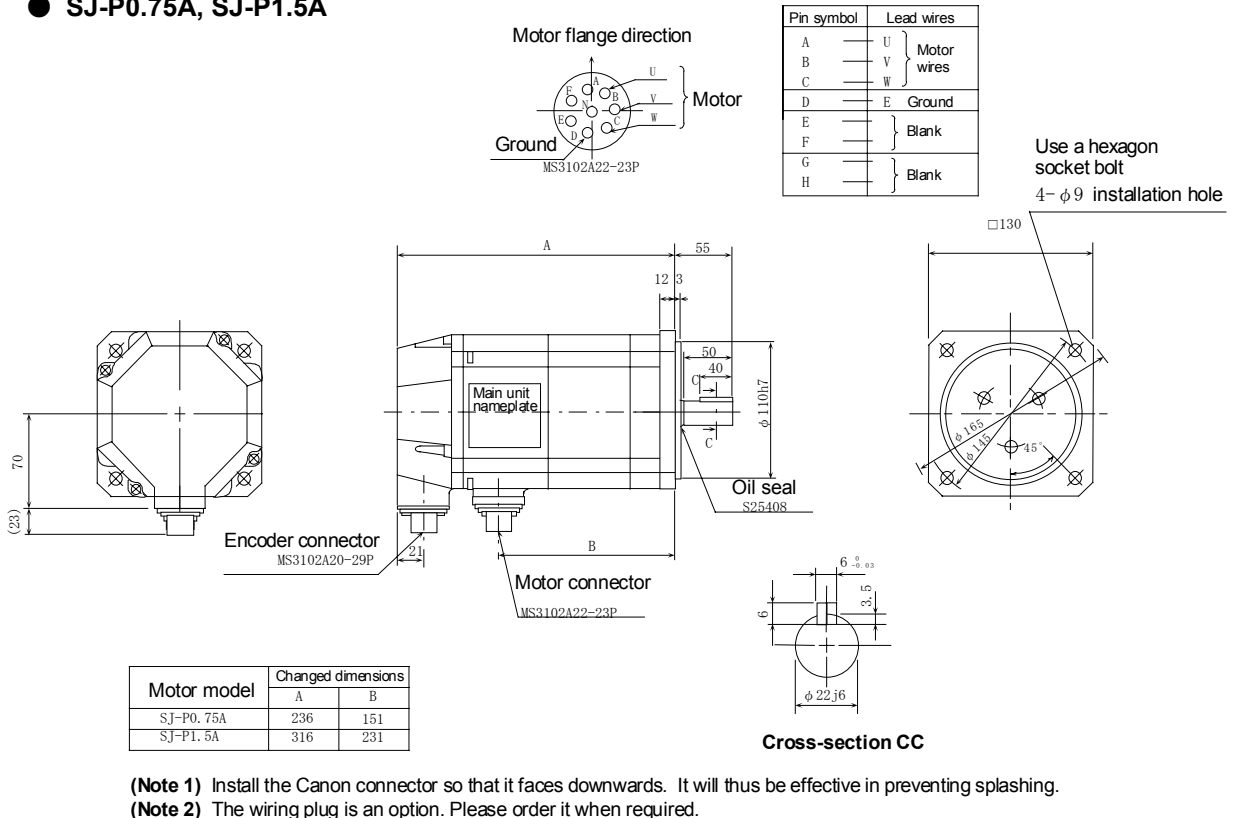
2. Specifications

2.4.2 Spindle motor

● SJ-P0.2A, SJ-P0.4A

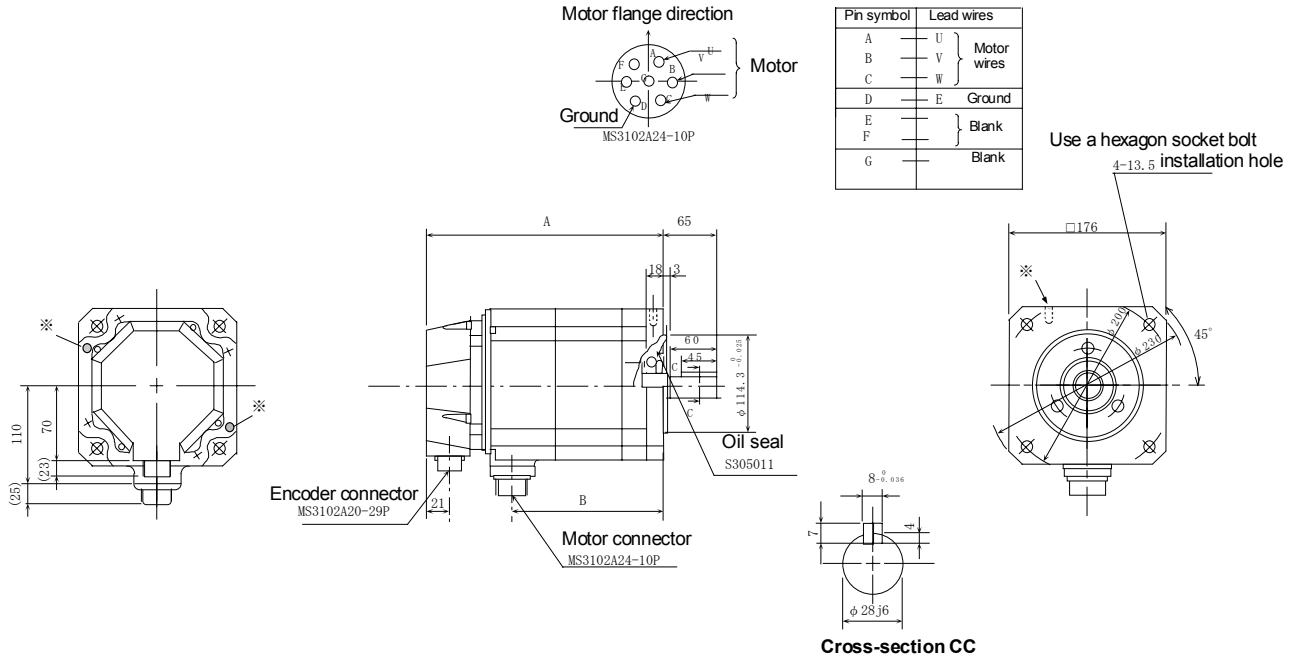


● SJ-P0.75A, SJ-P1.5A



2. Specifications

● SJ-P2.2A, SJ-P3.7A

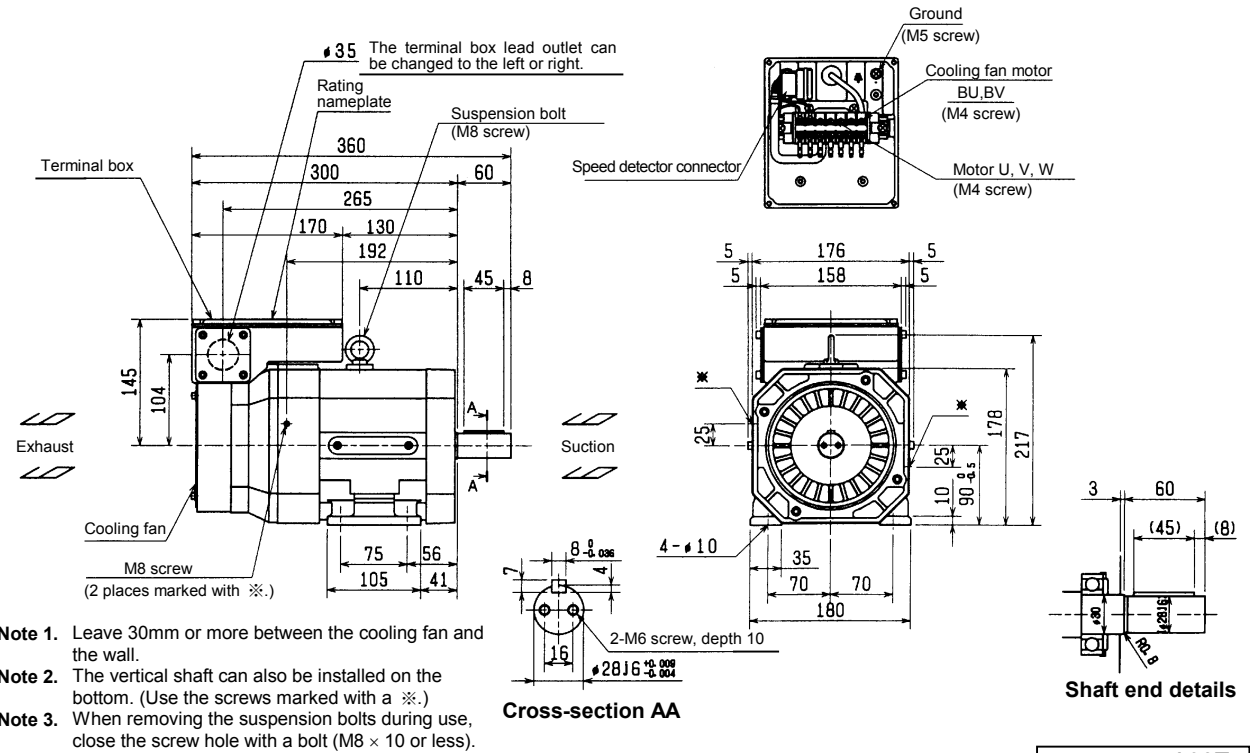
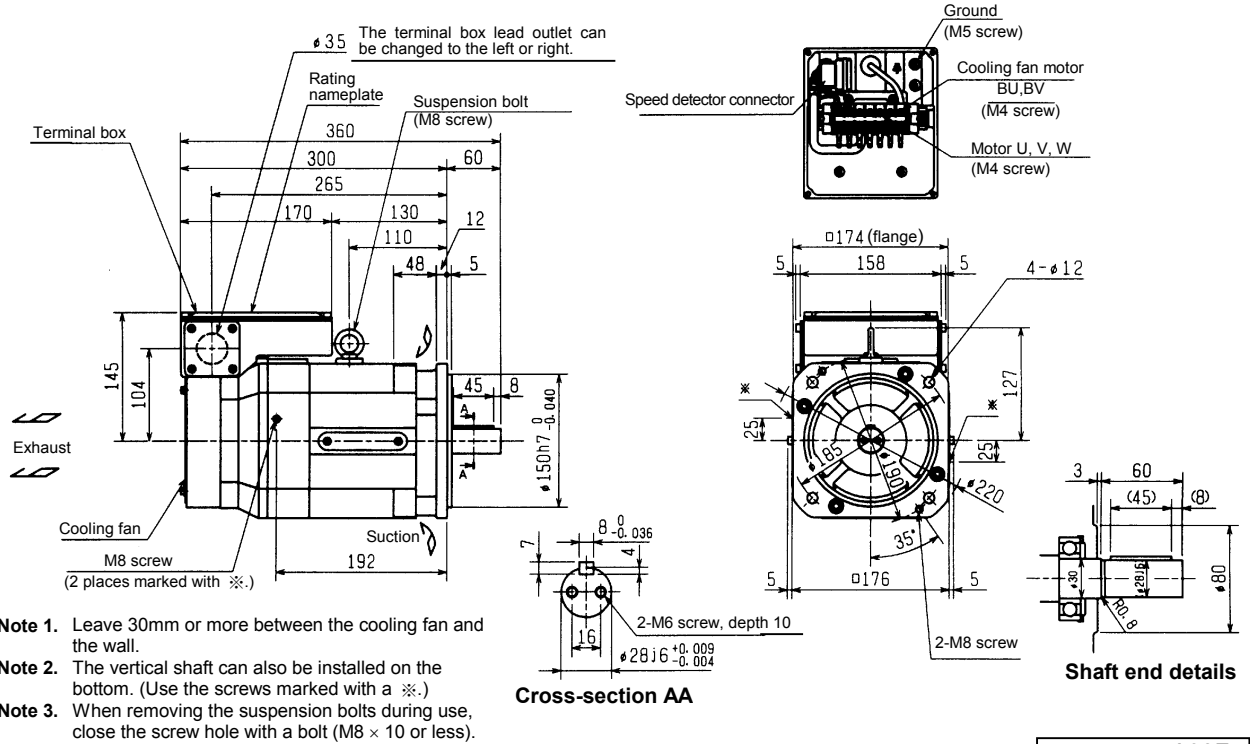


Motor model	Changed dimensions	
	A	B
SJ-P2.2A	293	211
SJ-P3.7A	353	271

- Note 1)** Install the canon connector so that it faces downwards.
- Note 2)** The wiring plug is option. Please order it when required.
- Note 3)** The hole marked with a ※ is the M8 installation screw hole for the eye-bolt.

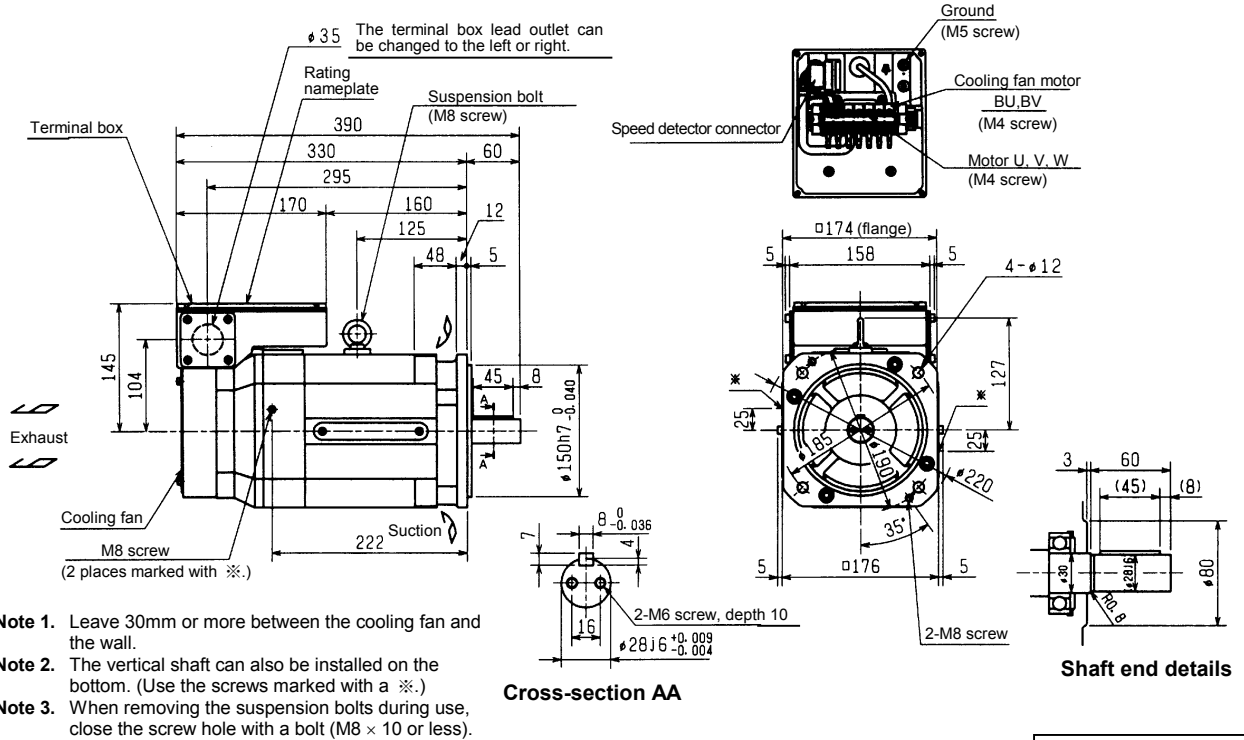
2. Specifications

● SJ-PF2.2-01

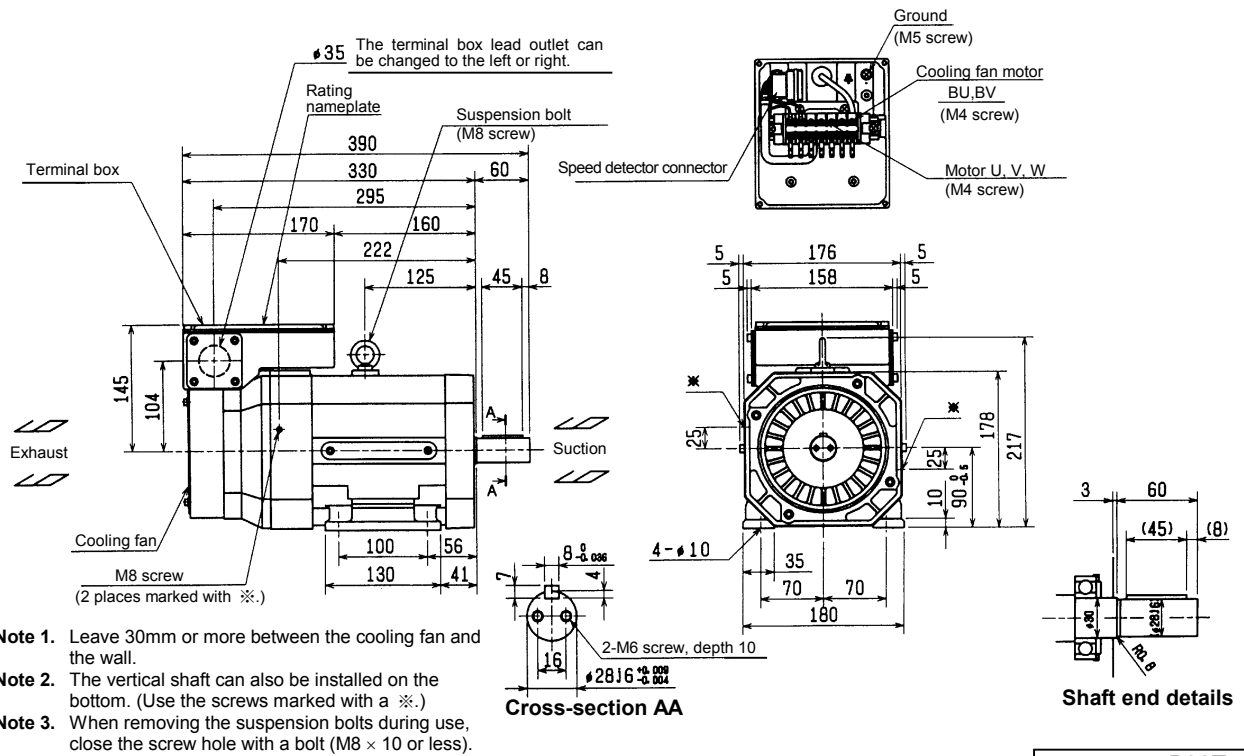


2. Specifications

● SJ-PF3.7-01



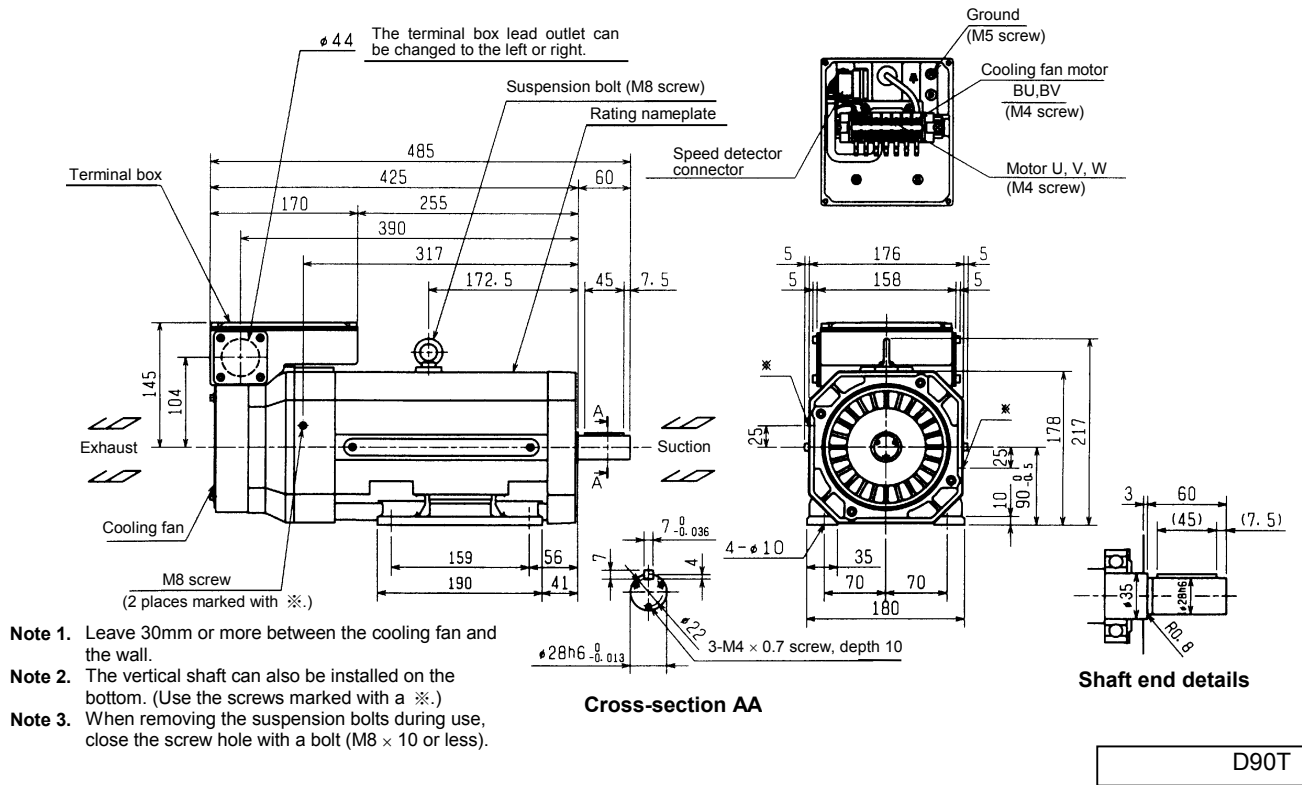
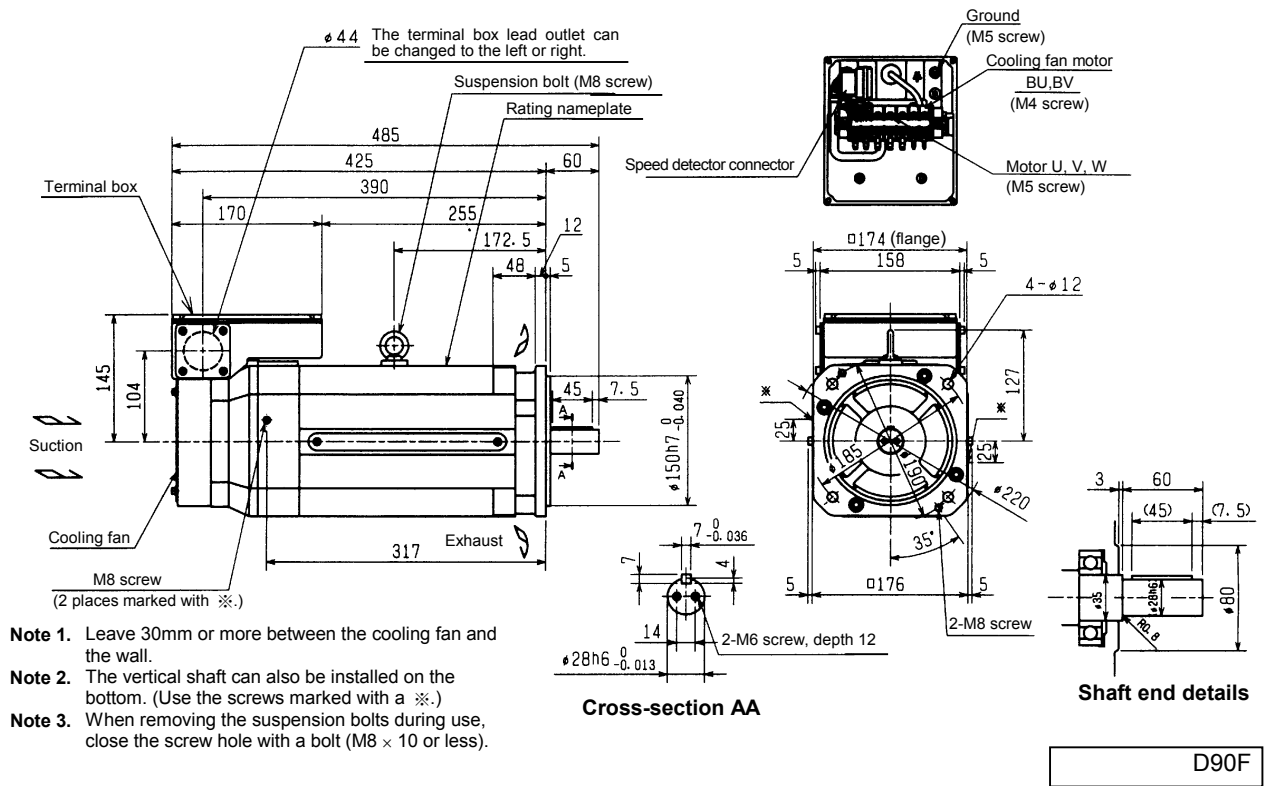
B90F



B90T

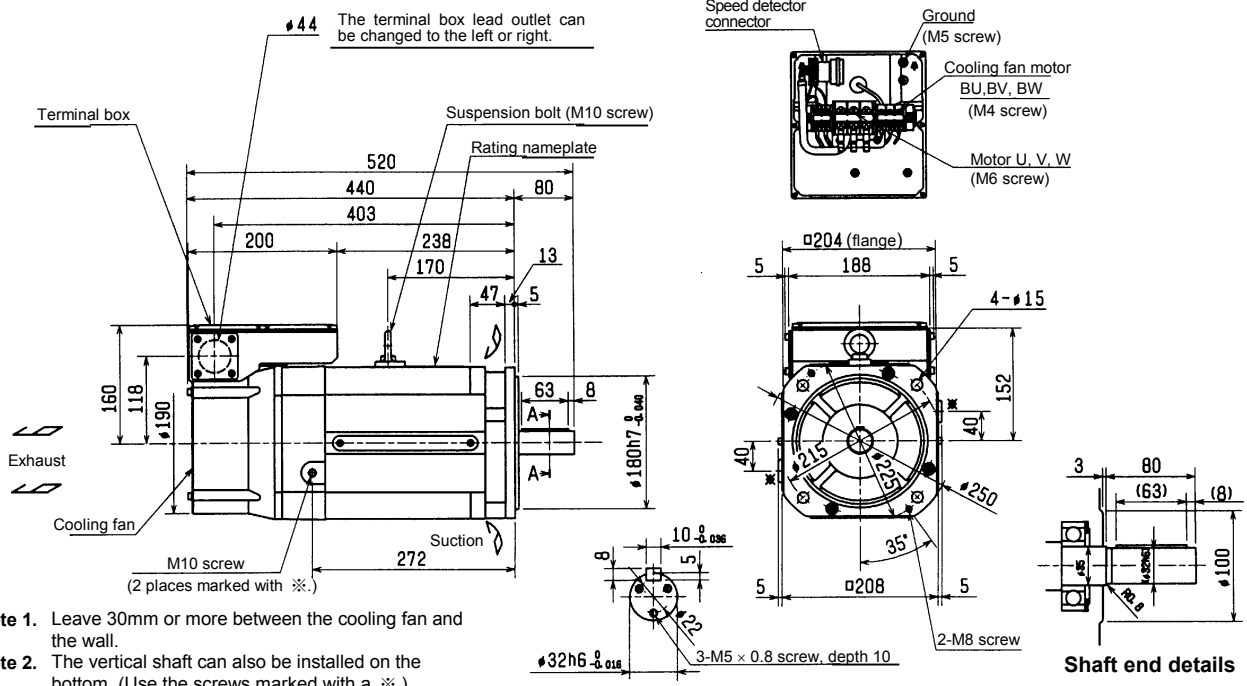
2. Specifications

● SJ-PF5.5-01



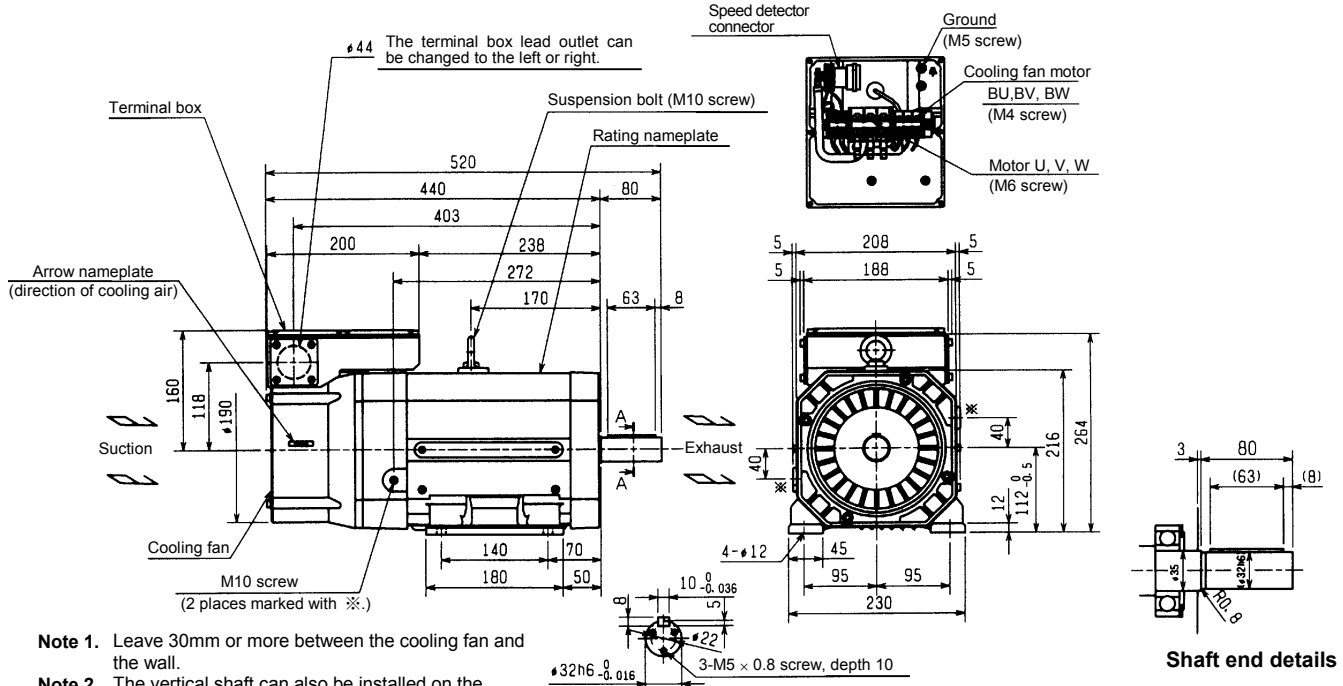
2. Specifications

● SJ-PF7.5-01



- Note 1.** Leave 30mm or more between the cooling fan and the wall.
- Note 2.** The vertical shaft can also be installed on the bottom. (Use the screws marked with a ※.)
- Note 3.** When removing the suspension bolts during use, close the screw hole with a bolt (M10 × 15 or less).

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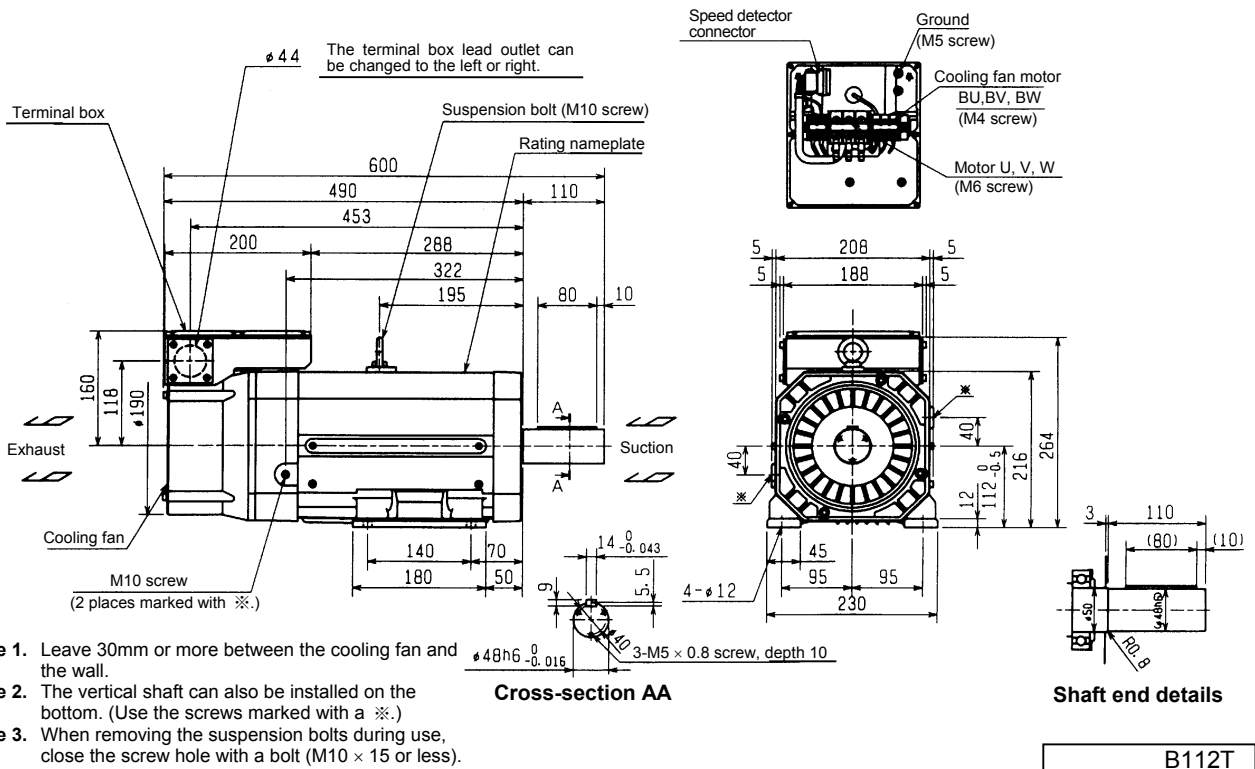
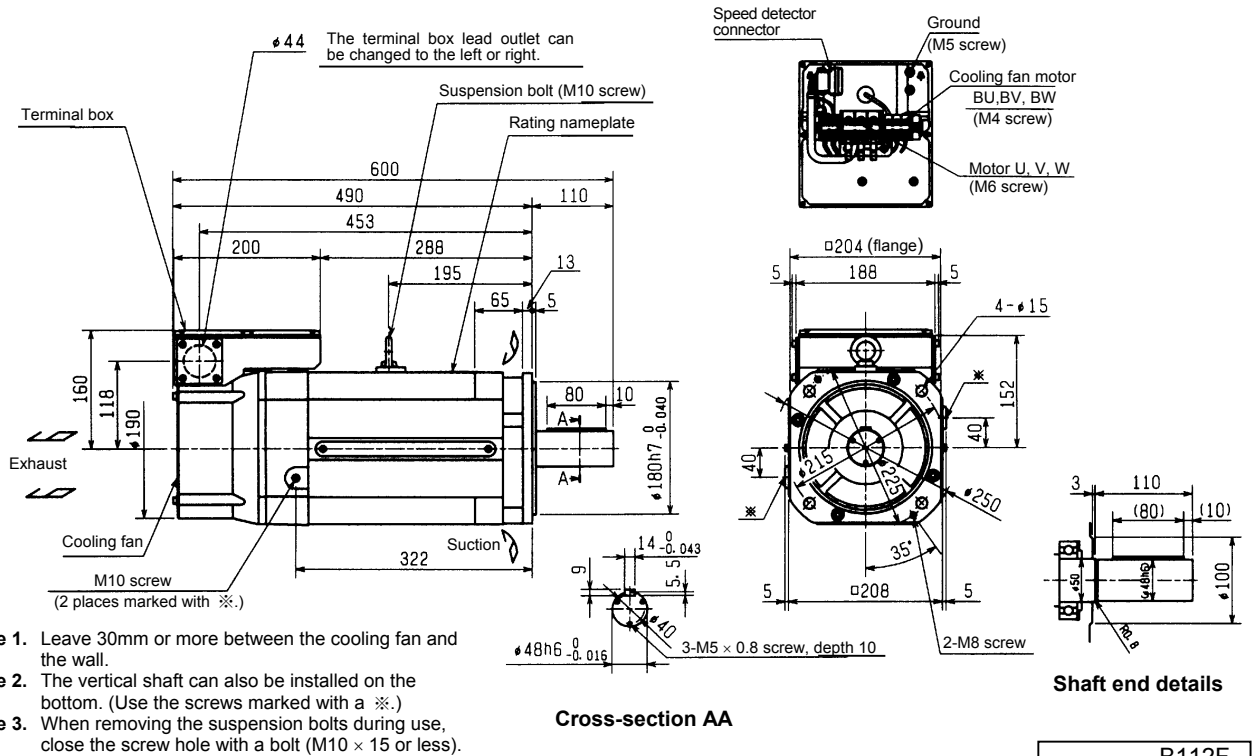


- Note 1.** Leave 30mm or more between the cooling fan and the wall.
- Note 2.** The vertical shaft can also be installed on the bottom. (Use the screws marked with a ※.)
- Note 3.** When removing the suspension bolts during use, close the screw hole with a bolt (M10 × 15 or less).

A112T

2. Specifications

● SJ-PF11-01

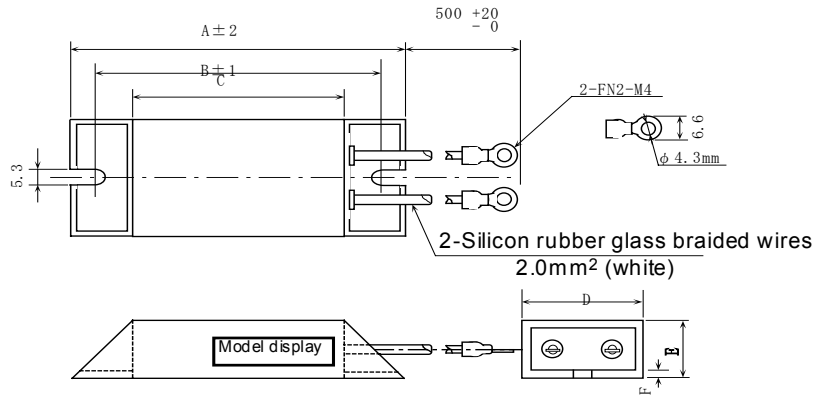


2. Specifications

2.4.3 Regenerative resistor

(1) "FCUA-RB Series" Regenerative Resistor

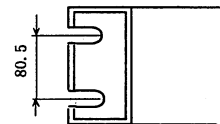
The regenerative resistor is not built into the spindle unit.
The following regenerative resistor must be installed.



Regenerative resistor model	Tolerance (W)	Outline dimensions (mm)						Installation	Remarks
		A	B	C	D	E	F		
FCUA-RB04	60	140	125	100	40	20	2.5	2 points	Note 1
FCUA-RB075	80	215	200	175	40	20	2.5	2 points	
FCUA-RB15	120	240	225	200	50	25	2.0	2 points	
FCUA-RB22	155	215	200	175	60	30	2.5	2 points	
FCUA-RB37	185	335	320	295	60	30	2.5	2 points	
FCUA-RB55	380	400	385	360	80	40	2.5	4 points	Note 2
FCUA-RB75/2	380	400	385	360	80	40	2.5	4 points	

(Note 1) The FCUA-RB04/075 has ribs (grooves) 1.5mm deep and 1.5mm wide on the top and bottom.

(Note 2) The FCUA-RB55/75/2 is installed with two installation points of each side (total four points).
The installation pitch is 80.5mm.



Precautions for installation

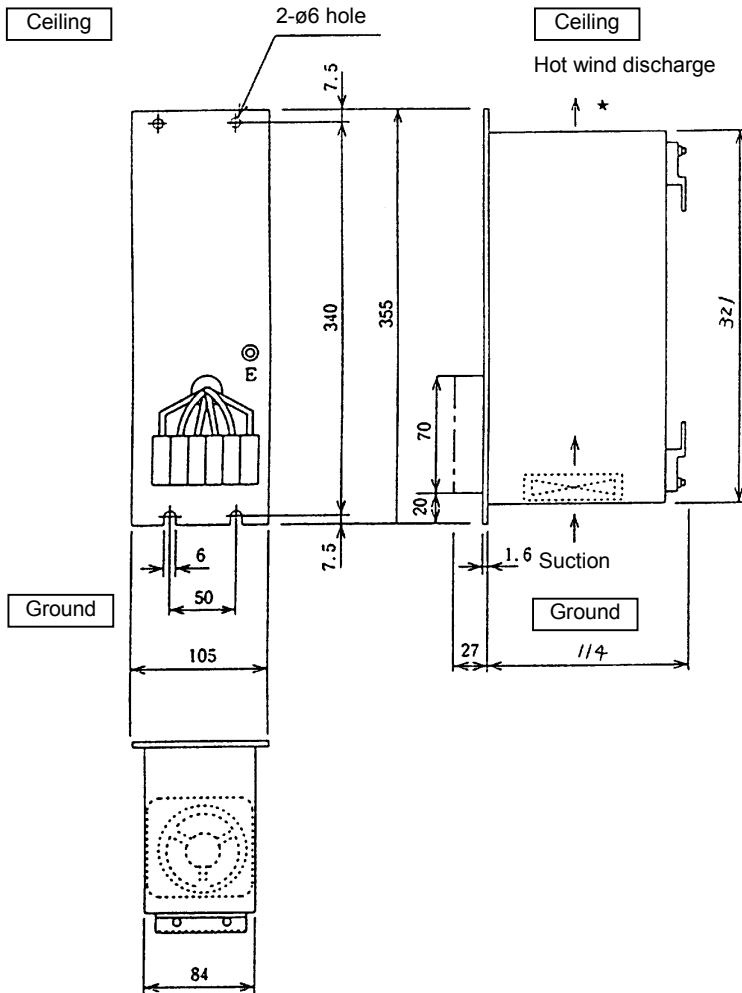
- (1) When using an operation pattern in which the regenerative resistor is used at a high frequency, the surface of the resistor may exceed 300°C, so take care to the installation and the heat radiation. Do not install the resistor where it can be easily touched by hand or body parts as touching could lead to burns. Install a well-ventilated protective cover (punched metal, etc.) if body parts might come in contact.
- (2) Installation of the regenerative resistor on a metallic surface outside the panel is recommended to improve the heat radiating effect.
- (3) Install the regenerative resistor so that the section where the lead wires are led out is not at the top of the resistor.

2. Specifications

(2) "R-UNIT Series" Regenerative Resistor Unit

● R-UNIT-1, R-UNIT-2

Capacity	Model
1.5K to 3.7K	R-UNIT-1
5.5K, 7.5K	R-UNIT-2

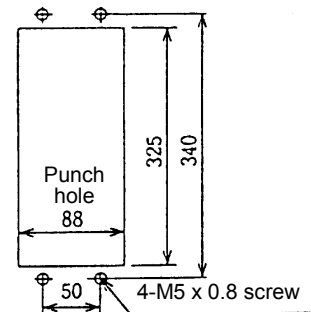


Terminal layout

R1	R2	AL1	AL2	AC1	AC2
----	----	-----	-----	-----	-----

Terminal screw size:
M4 x 0.7 screw

Applicable crimp terminal:
Bare round terminal up to 5.5-4



**Embedded installation
(outer heat radiating section)**

**Installation hole dimensions
for embedded installation**

Note 1: Do not wire or arrange other devices in front of the section marked with a * as extremely hot wind will be blown out.

Note 2: For the installation direction of this resistor, the "Ceiling" is the top and "Ground" is the bottom.

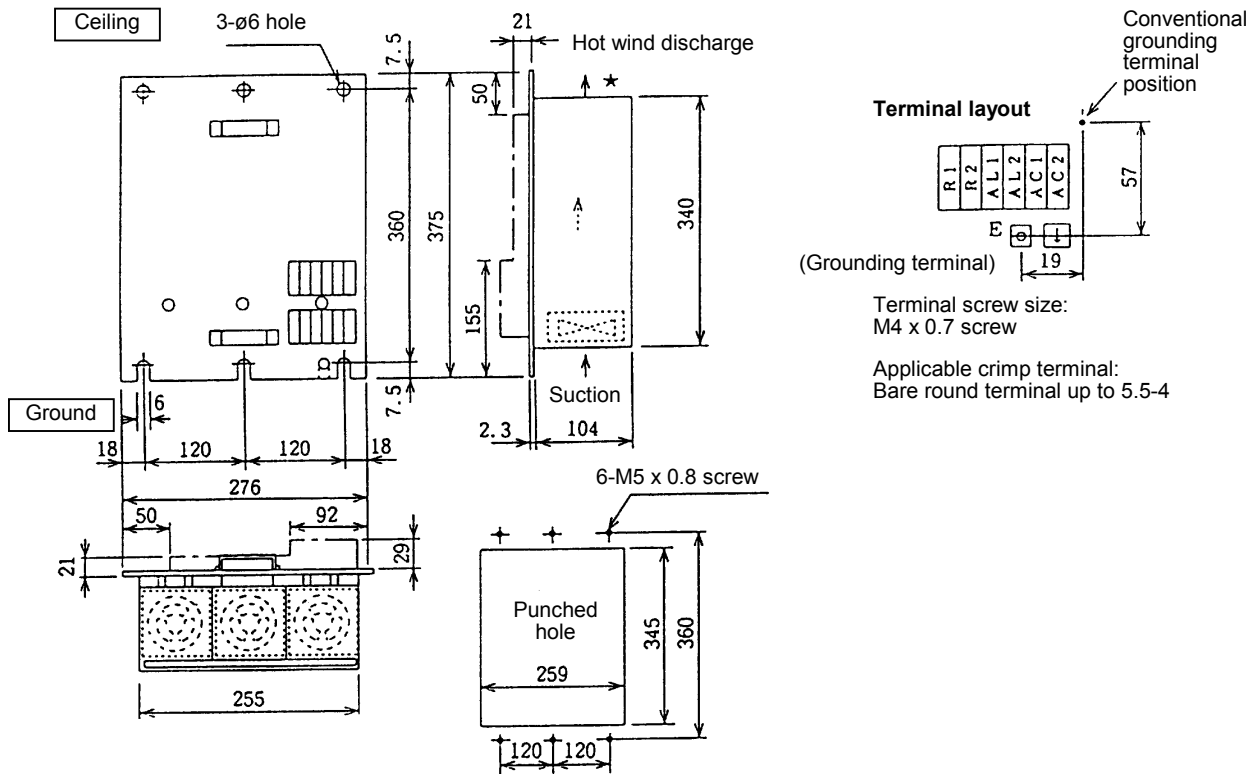
Note 3: Touching the resistor when it is hot could lead to burns. Always install a protective cover or consider the installation site so that workers will not touch the unit.

Note 4: The resistor's heating value will differ according to the acceleration/deceleration frequency, speed being used and the load GD^2 conditions, etc. However, install the resistor so that the hot wind is always exhausted to outside the panel.

2. Specifications

- R-UNIT-3 (For 5.5kW, 7.5kW high frequency)
- R-UNIT-4 (For 11kW)

Embedded installation (outer heat radiating section)



Installation hole dimensions for embedded installation

Note 1: The ventilation area is approx. 100 × 120.

Note 2: Attach packing to the flange section.

Note 3: Do not wire or arrange other devices in front of the section marked with a * as extremely hot wind will be blown out.

Note 4: For the installation direction of this resistor, the "Ceiling" is the top and "Ground" is the bottom.

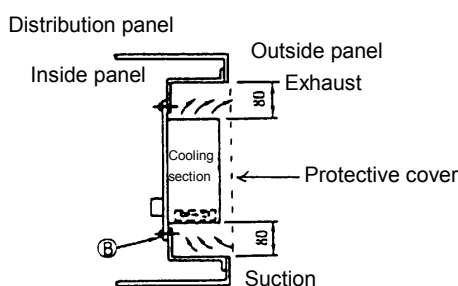
Note 5: Touching the resistor when it is hot could lead to burns. Always install a protective cover or consider the installation site so that workers will not touch the unit.

Note 6: The resistor's heating value will differ according to the acceleration/deceleration frequency, speed being used and the load GD^2 conditions, etc. However, install the resistor so that the hot wind is always exhausted to outside the panel.

● Example of resistor installation

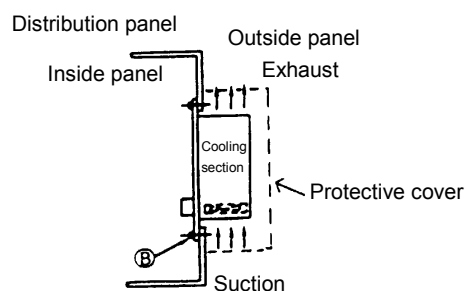
Example 1.

To place cooling section on inner side of distribution panel.



Example 2.

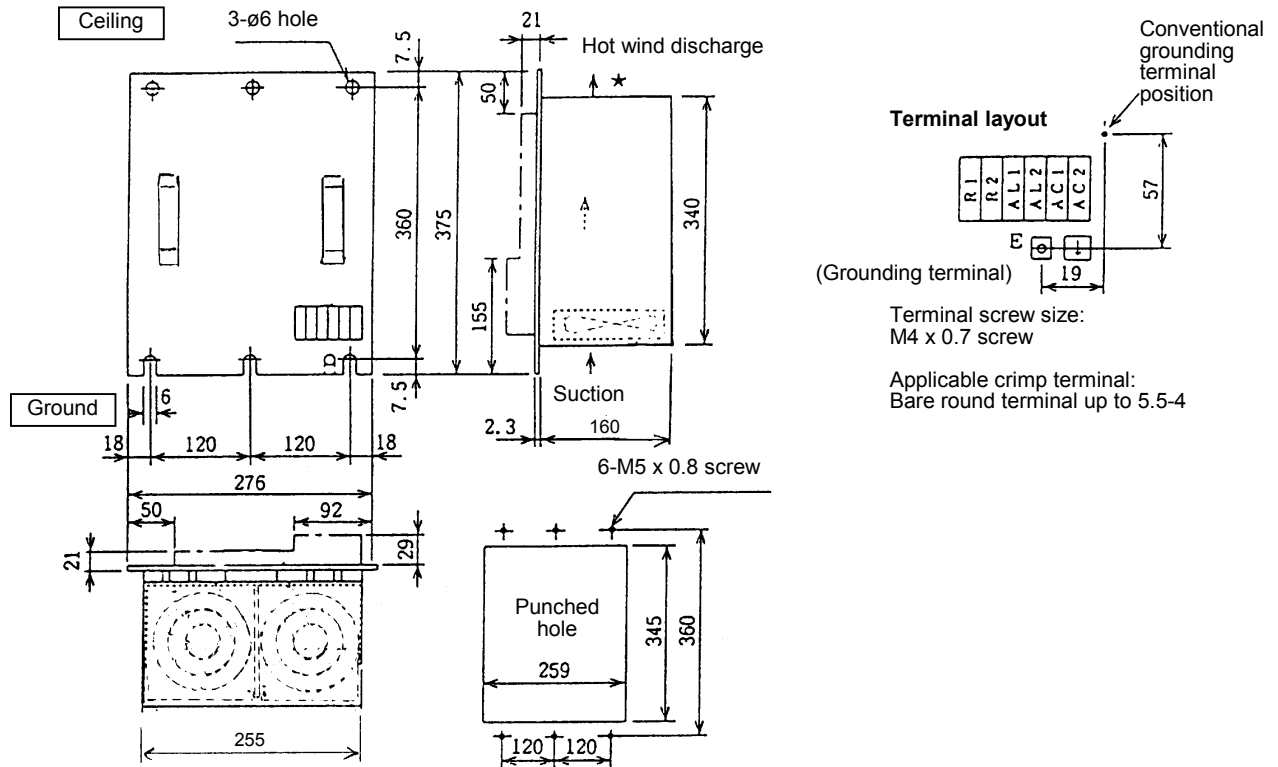
To place cooling section on outer side of distribution panel.



2. Specifications

● R-UNIT-5 (For 11kW high frequency)

Embedded installation (outer heat radiating section)



Installation hole dimensions for embedded installation

Note 1: The ventilation area is approx. 100 × 120.

Note 2: Attach packing to the flange section.

Note 3: Do not wire or arrange other devices in front of the section marked with a * as extremely hot wind will be blown out.

Note 4: For the installation direction of this resistor, the "Ceiling" is the top and "Ground" is the bottom.

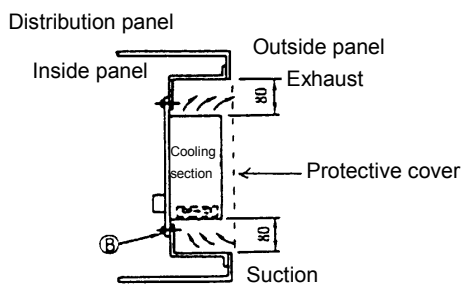
Note 5: Touching the resistor when it is hot could lead to burns. Always install a protective cover or consider the installation site so that workers will not touch the unit.

Note 6: The resistor's heating value will differ according to the acceleration/deceleration frequency, speed being used and the load GD^2 conditions, etc. However, install the resistor so that the hot wind is always exhausted to outside the panel.

● Example of resistor installation

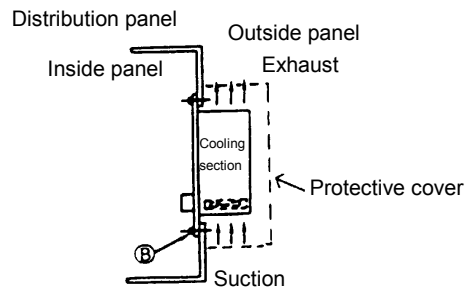
Example 1.

To place cooling section on inner side of distribution panel.



Example 2.

To place cooling section on outer side of distribution panel.



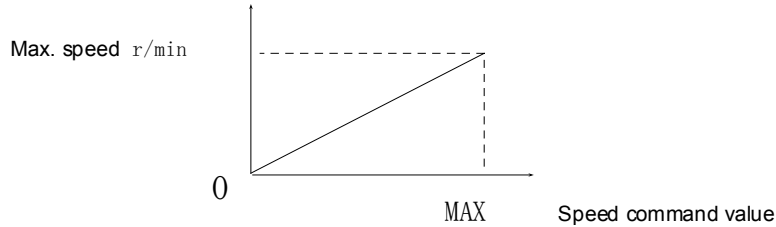
Chapter 3 Functions

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3.1 Control input signals	3 - 1
3.2 Control output signals	3 - 3
3.3 Meter output specifications	3 - 6

3. Functions

3.1 Control input signals



(1) Speed command input

- 1) When the speed command value is 0, the motor speed becomes 0. When the speed command value is the maximum value, the motor will rotate at the maximum motor speed set with parameter SP017 (TSP).
- 2) The motor will run in forward or reverse according to the forward run and reverse run signals. (The motor will not rotate with just the speed command value.)

(2) Forward run command input (SRN) 1)

- 1) When SRN is ON, the motor will rotate in the counterclockwise direction (CCW) looking from the motor shaft according to the commanded speed.
- 2) When SRN is OFF, the motor will decelerate to a stop, and the transistor base will be shut off.
- 3) When an orientation command is input, the orientation will have the priority.

(3) Reverse run command input (SRI) 1)

- 1) When SRI is ON, the motor will rotate in the clockwise direction (CW) looking from the motor shaft according to the commanded speed.
- 2) When SRI is OFF, the motor will decelerate to a stop, and the transistor base will be shut off.
- 3) When an orientation command is input, the orientation will have the priority.

(4) Torque limit 1, 2 and 3 input (TL1, TL2 and TL3)

- 1) The torque limit temporarily reduces the motor's output torque during mechanical spindle orientation or gear shifting, and rotates the motor.
- 2) The following seven torque limit values can be used according to the combination of TL1, TL2 and TL3 bit inputs.

TL3	TL2	TL1	Torque limit value
0	0	1	Torque limit value (%) set with parameter SP021
0	1	0	Torque limit value (%) set with parameter SP049
0	1	1	Torque limit value (%) set with parameter SP050
1	0	0	Torque limit value (%) set with parameter SP051
1	0	1	Torque limit value (%) set with parameter SP052
1	1	0	Torque limit value (%) set with parameter SP053
1	1	1	Torque limit value (%) set with parameter SP054

Note) % indicates the percentage to the motor short time rated torque.

3. Functions

(5) Orientation start command input (ORC)

- 1) This is the orientation start signal. Orientation will start regardless of the run command (SRN, SRI) when ORC is ON.
- 2) If either a forward run (SRN) or reverse run (SRI) command is input when ORC is OFF, the motor will start rotating at the commanded speed again.
- 3) When an orientation command is input, the orientation will have the priority.

(6) Gear selection command 1, 2 input (GR1, GR2)

- 1) The spindle gear step for carrying out orientation or various position control operations is selected.
- 2) Four types of gears shown below can be selected according to the combination of the GR1 and GR2 2-bit input.
- 3) Do not change the signal when an orientation command or servo ON command is input.

GR 2	GR 1	Parameter used to set the gear ratio
0	0	SP025 (GRA1), SP029 (GRB1)
0	1	SP026 (GRA2), SP030 (GRB2)
1	0	SP027 (GRA3), SP031 (GRB3)
1	1	SP028 (GRA4), SP032 (GRB4)

(7) Indexing forward run command input (WRN), reverse run command input (WRI)

- 1) This is the command input for forward run indexing or reverse run indexing during multi-point orientation. This signal is valid only when the orientation start signal is ON.
- 2) Forward run indexing takes place in the CCW direction looking from the motor shaft, and reverse run indexing takes place in the CW direction.

(8) Control mode selection command 1, 2, 3, 4, 5 input (SC1, SC2, SC3, SC4, SC5)

The operation mode for position control of the spindle drive unit is selected with bit correspondence. The selections are as follow.

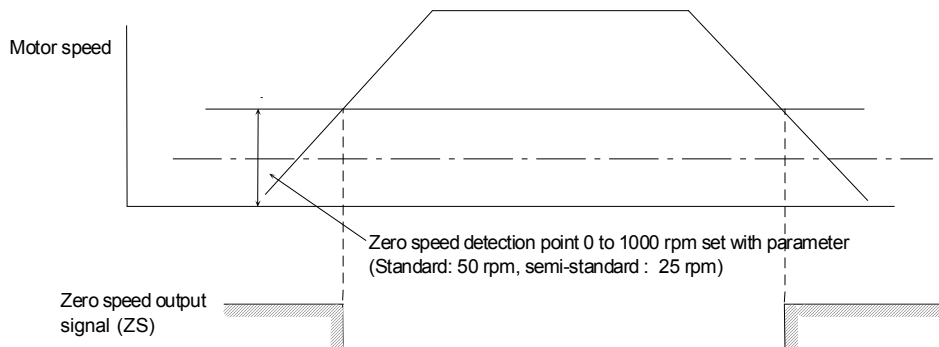
SC5	SC4	SC3	SC2	SC1	Operation mode
0	1	0 ~ 0	0	0	Synchronous tapping operation mode
0	1		1	1	
0	1	1 ~ 1	0	0	Mode not used
0	1		1	1	
1	0	0 ~ 0	0	0	Spindle synchronization operation mode
1	0		1	1	

(Note) Bit selections other than the above will validate the normal speed operation mode.

3.2 Control output signals

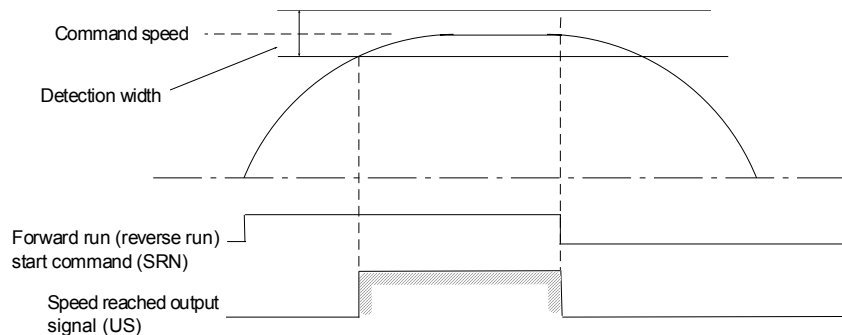
(1) Zero speed output (ZS)

- 1) ZS turns ON when the actual motor speed drops below the zero detection point in respect to the stop command.
- 2) The ZS signal is output when the above conditions are satisfied regardless of the speed command (SRN, SRI).
- 3) The minimum output width for this signal is approx. 200 ms.
- 4) The zero speed detection speed can be set in the range of 0 to 1000 rpm using parameter SP018 (ZSP).



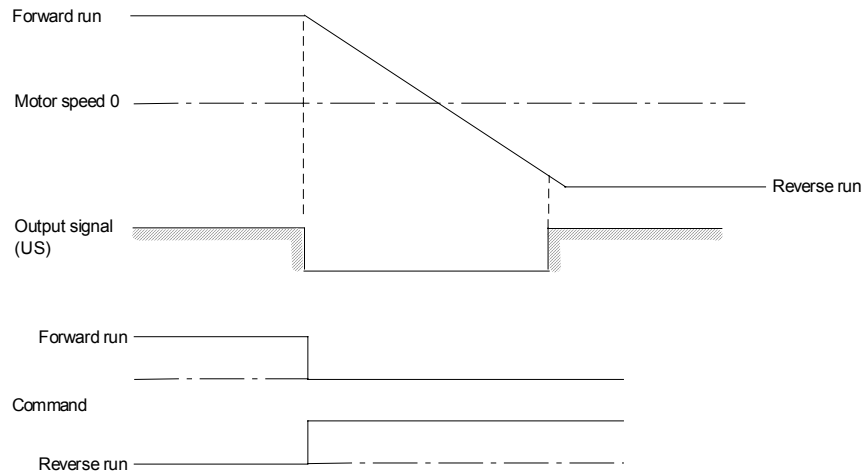
(2) Speed reached output (US)

- 1) USO turns ON when the actual motor speed in respect to the commanded speed reaches $\pm 15\%$.



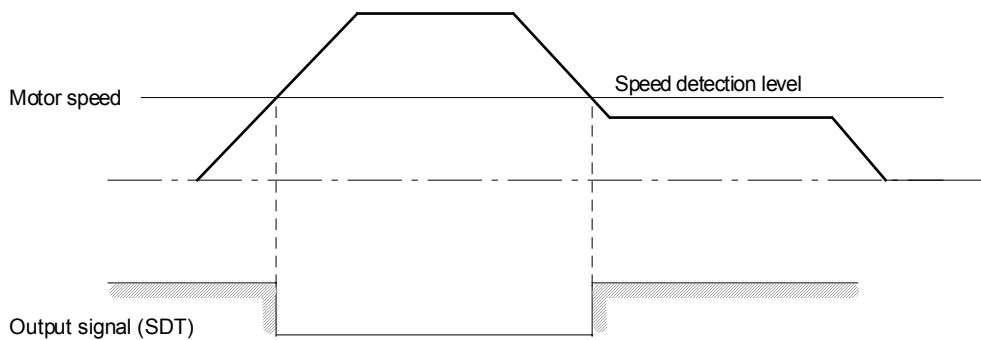
- 2) The USO signal will not be output unless the SRN or SRI signal is ON.
- 3) The USO signal can be used as a confirmation signal in respect to the forward run (M03) and reverse run (M04) command. This signal turns OFF when the start command signal is turned OFF.
- 4) When the reverse run command turns ON, the motor will start to decelerate and the USO signal will turn OFF. When it is confirmed that the speed reached signal has turned ON again, the reverse run command will be completed.

3. Functions



(3) Speed detection output (SD)

- 1) SDT turns ON when the motor speed drops to below that set with parameter SP020 (SDTS).
- 2) The SDT signal turns ON when the motor speed's absolute value drops to below a set detection level regardless of the speed command (SRN, SRI).



(4) Orientation complete output (ORCF)

If the current position of the spindle is within the in-position range set with parameter SP004 (OINP) during orientation, ORCF will turn ON.

(5) Current detection output (CD)

CD turns ON when the current value is 110% or more of the rated current.

(6) In motor forward run output (SRNA)

SRNA turns ON when the motor is rotating in the counterclockwise direction looking from the shaft side.

(7) In motor reverse run output (SRIA)

SRIA turns ON when the motor is rotating in the clockwise direction looking from the shaft side.

(8) In torque limit 1, 2, 3 input (TL1A, TL2A, TL3A)

This is the answer output in respect to the torque limit 1, 2, 3 input (TL1, TL2, TL3).

(9) In orientation start command output (ORCA)

This is the answer output in respect to the orientation start command input (ORC).

3. Functions

(10) In gear selection command 1, 2 output (GR1A, GR2A)

This is the answer output in respect to the gear selection command 1, 2 input (GR1, GR2).

(11) In indexing forward run command output (WRNA), reverse run command output (WRIA)

This is the answer output in respect to the indexing forward run command input (WRN), reverse run command input (WRI).

(12) Synchronous speed match output (SYSA)

SYSA turns ON when transition from the speed operation mode to the spindle synchronization operation mode is possible during spindle synchronization operation.

(13) Index positioning complete output (WRCF)

WRCF turns ON when indexing is completed.

(14) Drive unit in warning output (WRN)

WRN turns ON if a warning state occurs in the spindle drive unit.

(15) In alarm output (ALM)

ALM turns ON if an alarm state occurs in the spindle drive unit.

(16) Z-phase passed output (ZFIN)

ZFIN turns ON when the Z phase is passed first after servo ON during position control.

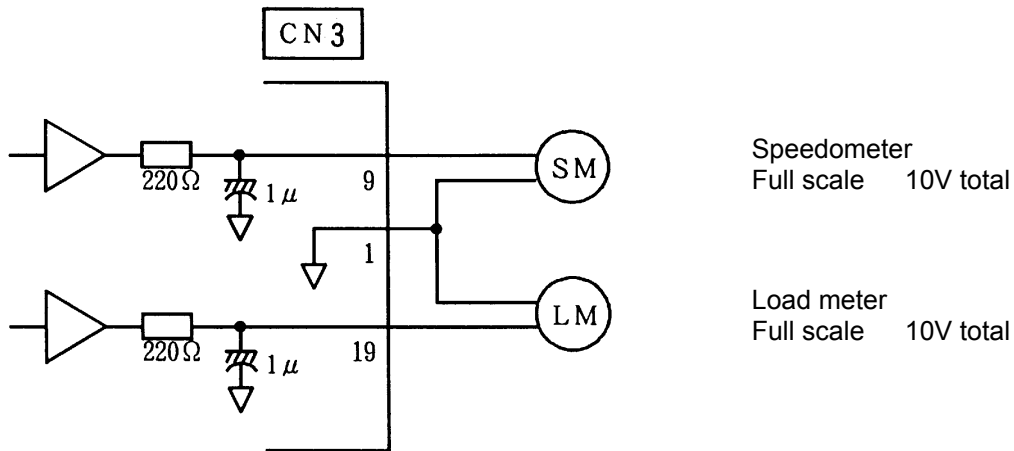
(17) Position loop in-position output (INP)

INP turns ON when the current position is within the in-position range set with the parameters during position control other than orientation. When the servo is turned OFF, INP turns OFF.

(18) Control mode selection command 1, 2, 3, 4, 5 output (SC1A, SC2A, SC3A, SC4A, SC5A)

This is the answer output to the control mode selection output 1, 2, 3, 4, 5 input (SC1, SC2, SC3, SC4, SC5).

3.3 Meter output specifications

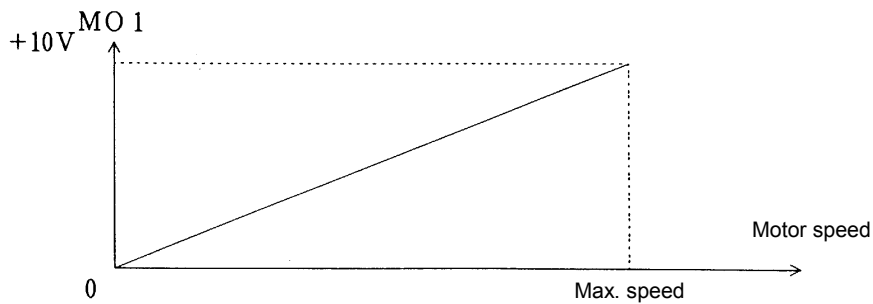


(1) Speedometer output

(a) A speedometer having the following specifications is recommended for measuring the speedometer output.

- (i) Model : YM-8G type DC voltmeter (Mitsubishi)
- (ii) Rating : 10VDC full scale
- (iii) Internal impedance : Approx. 10kΩ

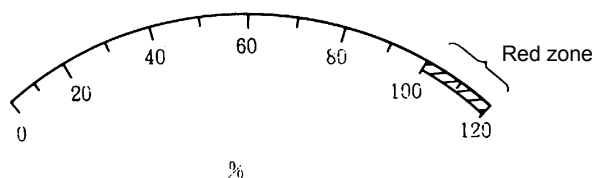
(b) The +10VDC is output at the max. motor speed, regardless of the motor rotation direction.



(2) Load meter output

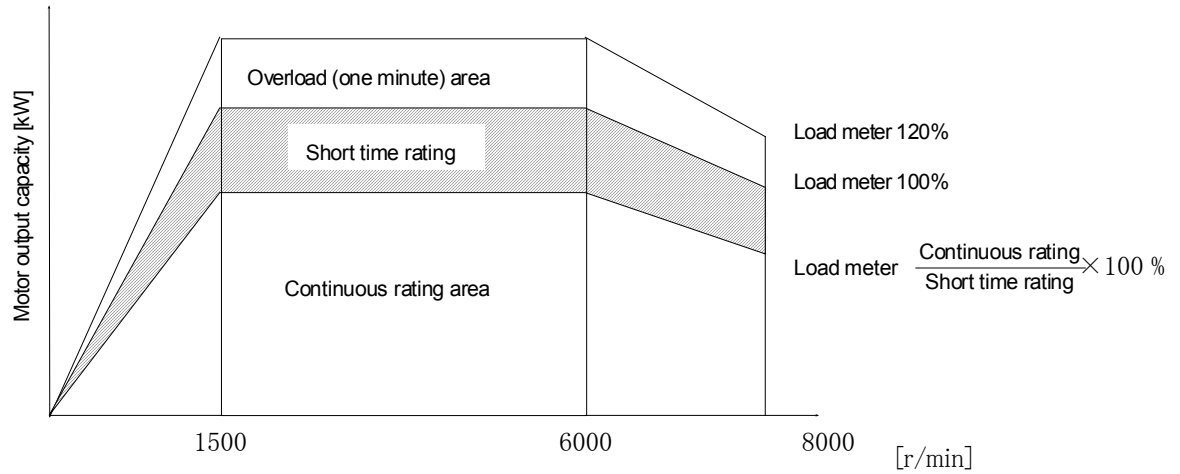
(a) A load meter having the following specifications is recommended for measuring the load meter output.

- (i) Model : YM-8G type DC voltmeter (Mitsubishi)
- (ii) Rating : 10VDC full scale
- (iii) Internal impedance : Approx. 10kΩ
- (iv) Scale



3. Functions

- (b) The load meter indication displays the percent of the load in respect to the motor's rated output as a percent (%). The relation of the motor output capacity (kW) and load meter display is as follows.



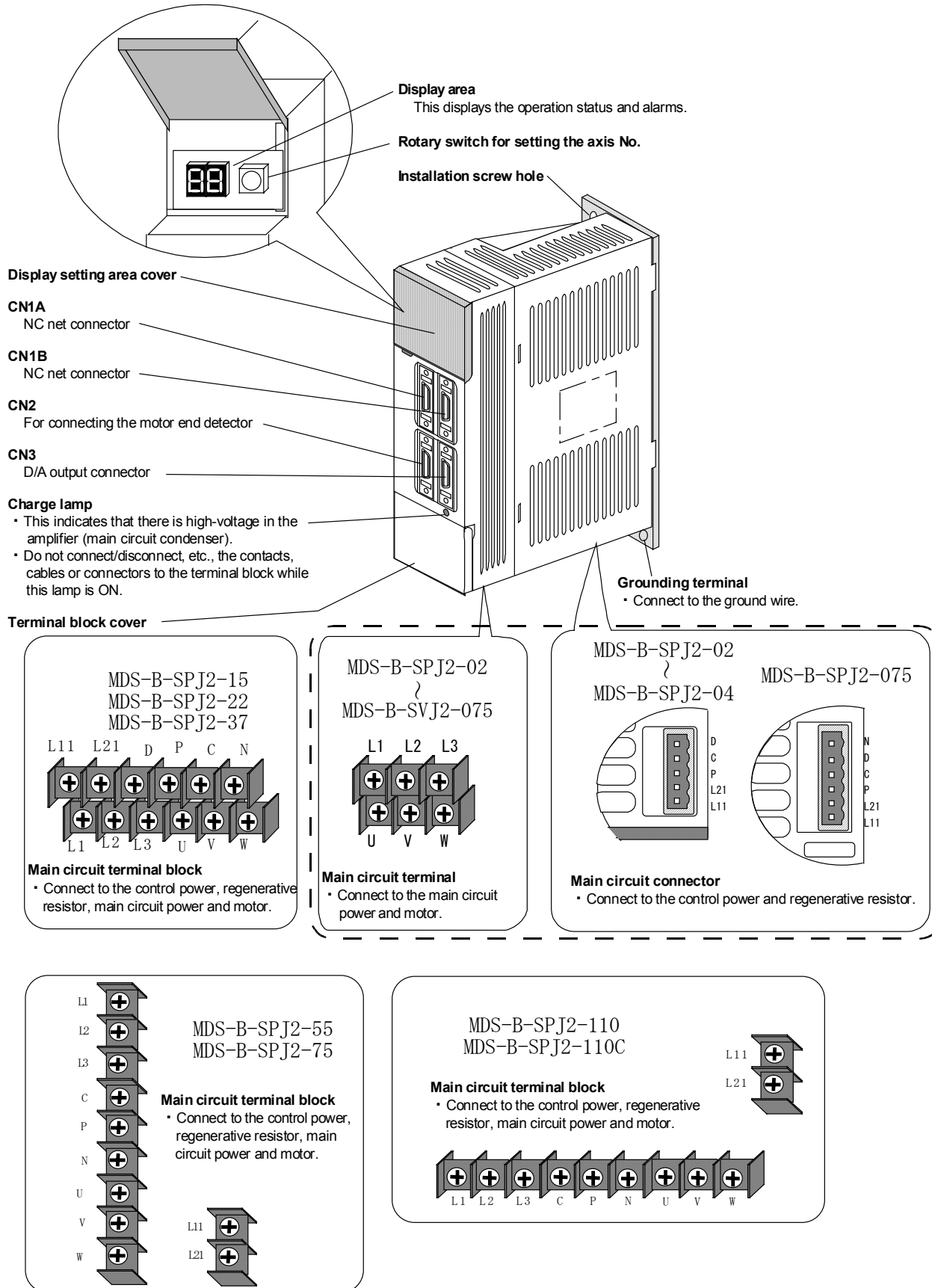
Chapter 4 Handling

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4.2 Installation	4 - 2
4.2.1 Spindle amplifier installation.....	4 - 2
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4. Handling

4.1 Explanation of unit parts



4. Handling

4.2 Installation

CAUTION

1. Install the unit on noncombustible material. Direct installation on combustible material or near combustible materials could lead to fires.
2. Follow this manual and install the unit in a place where the weight can be borne.
3. Do not get on top of or place heavy objects on the product.
4. Use the unit under the designated range of environment conditions.
5. Do not let conductive objects such as screws or metal chips, etc., or combustible materials such as oil enter the spindle amplifier.
6. Do not block the suction and ventilation ports of the spindle amplifier. Unit failure may occur if these are blocked.
7. The spindle amplifier and spindle motor are precision devices, so do not drop them or apply strong impacts to them.
8. Do not operate a spindle amplifier or spindle motor that is damaged or missing parts.
9. Before using this product after a long period of storage, please contact the Mitsubishi Service Station or Service Center.

4.2.1 Spindle amplifier installation

CAUTION

1. Always observe the installation direction. Failure to observe this will result in unit failure.
2. Secure the specified space between the spindle amplifier and inside wall of the control panel, and between the other devices. Failure to observe this will result in unit failure.

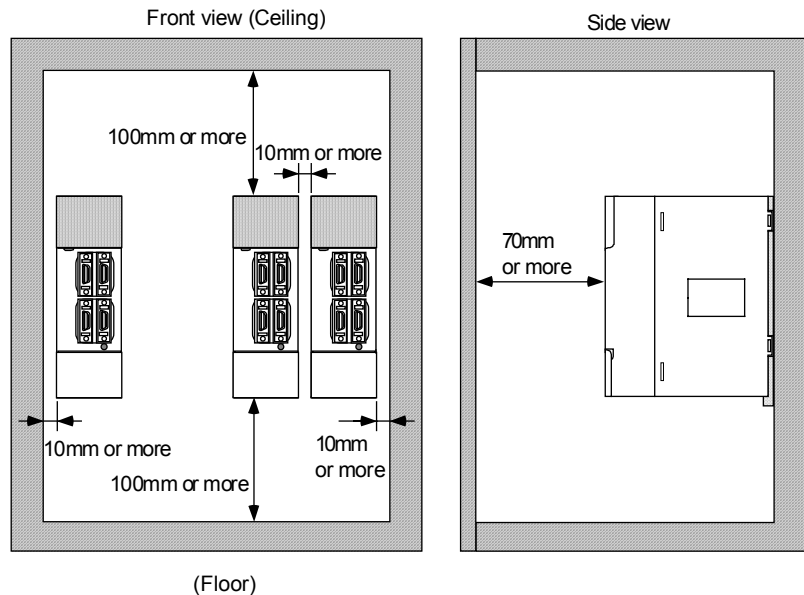
(1) Environment conditions

Environment	Condition
Ambient temperature	0°C to +55°C (with no freezing)
Ambient humidity	90%RH or less (with no freezing)
Storage temperature	-20°C to +65°C (with no freezing)
Storage humidity	90%RH or less (with no freezing)
Atmosphere	Indoors (where the unit is not subject to direct sunlight) With no corrosive gas, combustible gas, oil mist or dust
Altitude	1000m or less above sea level
Vibration	5.9m/s ² (0.6G) or less

4. Handling

(2) Installation direction and spacing

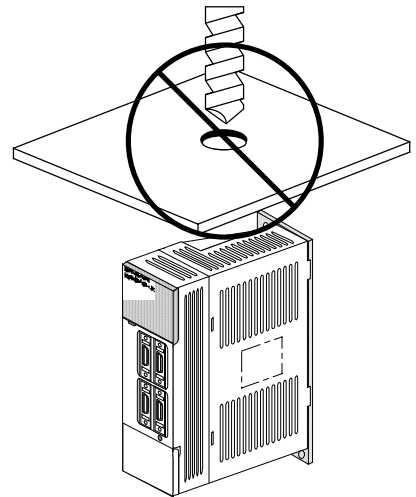
Install so the spindle amplifier can be seen from the front, with consideration for the heat dissipation and wiring of each unit. Secure space for ventilation, using the following drawings as a reference.



(3) Prevention of foreign matter entry

Carry out the following measures on the cabinet.

- Treat the cable inlets for dust prevention and oil prevention by plugging the inlet with packing, etc.
- Make sure that the external air does not enter inside the cabinet from the heat radiating holes, etc.
- Plug all clearances.
- Securely install the door packing.
- If a rear cover is provided, always install packing.
- Take special measures such as oil proof packing, etc., as oil will easily accumulate on the top plate and enter the cabinet from the screw holes.
- Avoid machining parts in the area after installing each unit. The cutting chips, etc., could adhere on the electronic parts and cause faults.



4. Handling

4.3 Spindle drive unit heat radiation

The loss generated during continuous rated load operation of the spindle drive unit is shown below. Use the values in table considering the most adverse conditions when designing the thermal aspects of the sealed control panel. In the actual machine, the heating value will be the middle value of the load and no-load according to the cutting load and acceleration/deceleration duty. However, use the loss generated during continuous rated load operation as a guideline.

Heating value during rated output

Drive unit model	Spindle drive unit heating value	
	During continuous rating output (W)	During no-load (W)
MDS-B-SPJ2-02	30	15
MDS-B-SPJ2-04	35	15
MDS-B-SPJ2-075	45	15
MDS-B-SPJ2-15	55	20
MDS-B-SPJ2-22	85	20
MDS-B-SPJ2-37	110	20
MDS-B-SPJ2-55	150	20
MDS-B-SPJ2-75	200	20
MDS-B-SPJ2-110	300 (Note 1)	25

Note 1) For intermediate panel installation type (MDS-B-SPJ2-110C) units, the amount of heat generated outside the panel is approx. (total amount of heat generated - 30) × 0.5 [W].

Note 2) The heat generated during regeneration is not included in the spindle drive unit's heating value. If the acceleration/deceleration frequency is high and the regenerative resistor's heating value is required, calculated it with the following outline equation.

$$W_R = \frac{n}{120} \times \frac{(GD_M^2 + GD_L^2)}{4} \times \left[\frac{2\pi \cdot N}{60} \right]^2 \text{ [W]}$$

GD_M^2 : Motor rotor inertia	[kg•m ²]
GD_L^2 : Motor shaft conversion load inertia	[kg•m ²]
N : Motor speed	[r/min]
n : Acceleration/deceleration frequency	[times/min.]

Chapter 5 Connections

Contents

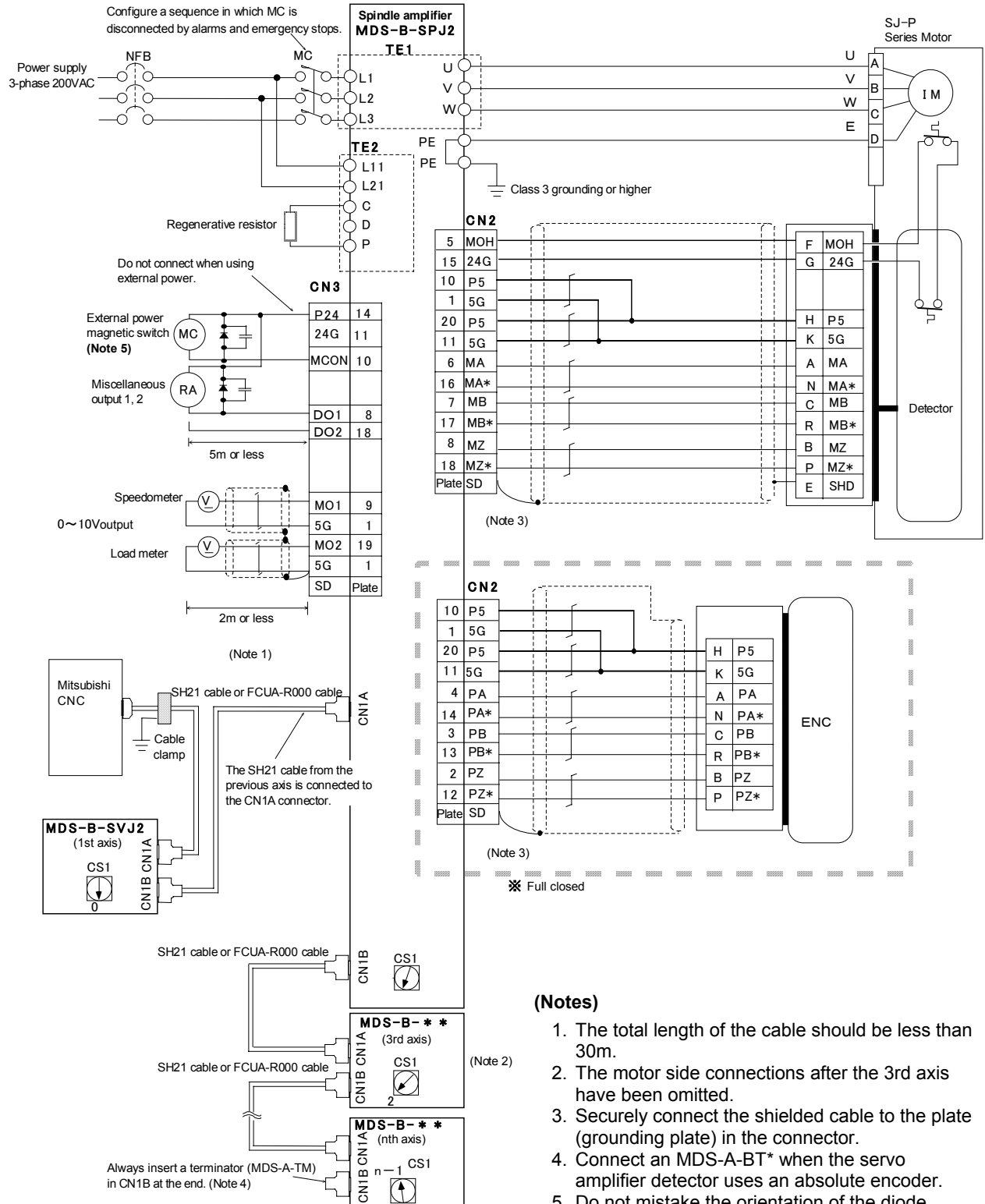
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5. Connections

5. Connections

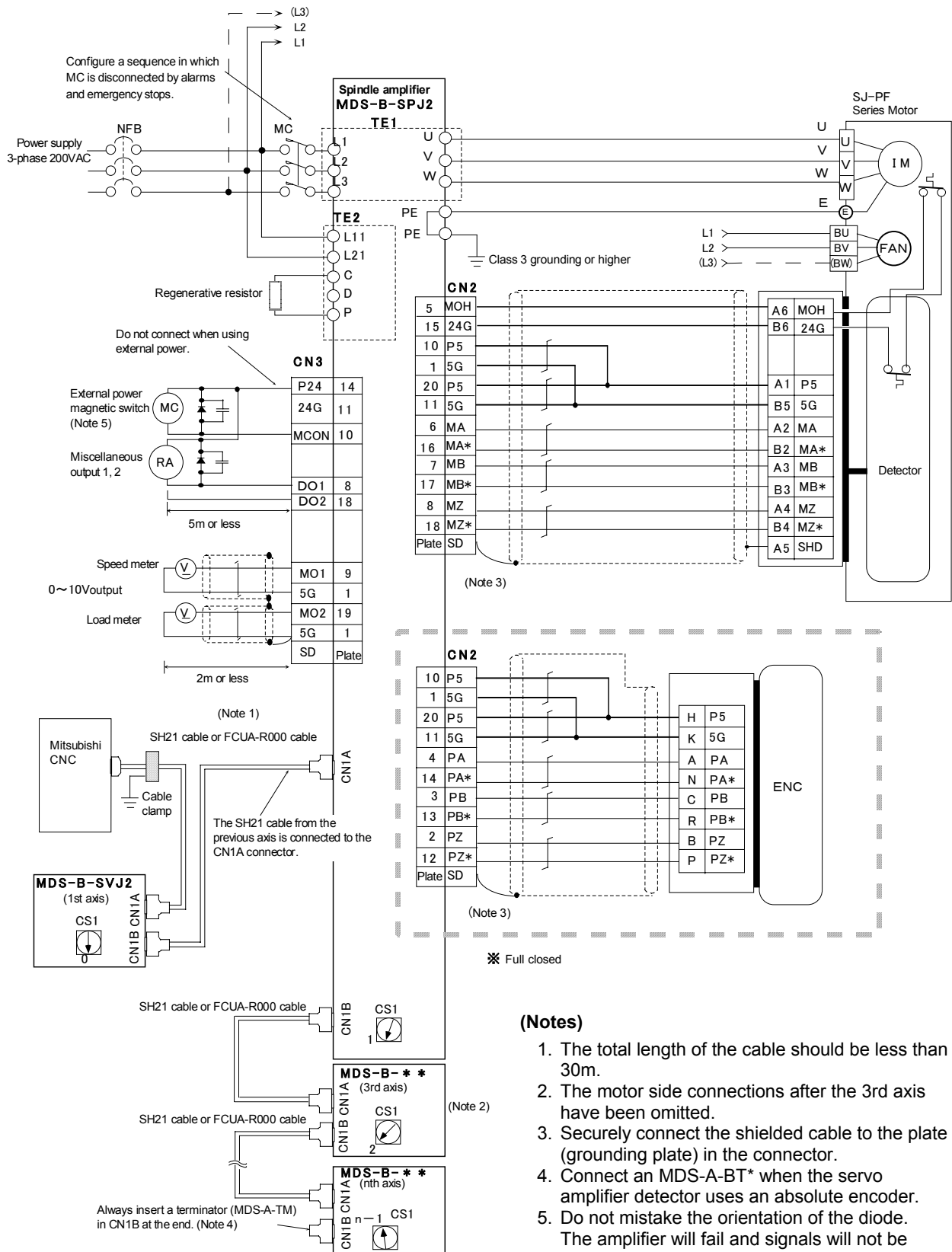
5.1 Machine-to-machine connection diagram

● SJ-P Series Motor




5. Connections

● SJ-PF Series Motor



5. Connections

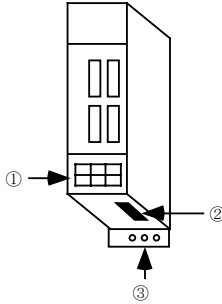
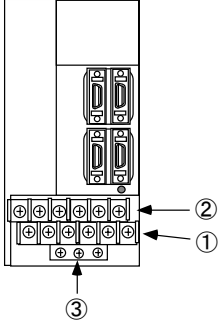
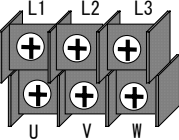
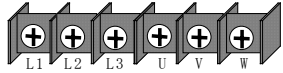
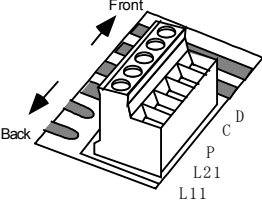
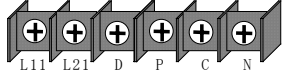
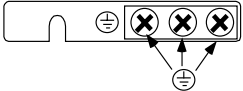
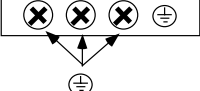
5.2 Spindle amplifier connections


CAUTION

Do not apply a voltage other than that specified to any terminal.
Failure to observe this may cause damage and/or failure, etc.

5.2.1 Main circuit terminal block and control circuit terminal block

The signal array of each terminal block is shown in the following table.


Spindle amplifier		MDS-B-SPJ2-02 MDS-B-SPJ2-04 MDS-B-SPJ2-075	MDS-B-SPJ2-15 MDS-B-SPJ2-22 MDS-B-SPJ2-37
Terminal			
Terminal position			
Terminal signal	①	 <p style="text-align: center;">Terminal screws : M4</p>	 <p style="text-align: center;">Terminal screws : M4</p>
	②		 <p style="text-align: center;">Terminal screws : M4</p>
	③		

5. Connections

Spindle amplifier		MDS-B-SPJ2-55 MDS-B-SPJ2-75	MDS-B-SPJ2-110
Terminal			
Terminal position			
Terminal signal	① Main circuit terminal block (TE1)		
	② Control circuit terminal block (TE2)		
	③ Protective grounding terminal block (PE)		

5. Connections

5.2.2 Signal names and applications of the main circuit terminal block and control circuit terminal block

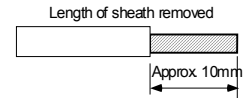
Terminal name	Signal name	Details
L1•L2•L3	Main circuit power	Main circuit power input terminal Connect to a 3-phase 200 to 230VAC, 50/60Hz power supply.
L11•L12	Control circuit power	Control circuit power input terminal Connect to a single-phase 200 to 230VAC, 50/60Hz power supply. Connect so the power phase of L11 is the same as L1, and that of L12 is the same as L2. Failure to observe this will may result in failure.
P•C	Regenerative resistor connection	Regenerative resistor connection terminal Wire the regenerative resistor between P and C.
(N)	Main circuit standard potential	This is normally not used. (This is the standard potential of the main circuit DC voltage.)  Caution Do not connect anything to this terminal unless specifically instructed by Mitsubishi. Failure to observe this could result in electric shocks or spindle amplifier damage.
U•V•W	Spindle motor output	Spindle motor power output terminal Connect to the spindle motor power terminal (U, V, W).
PE	Ground	Grounding terminal Ground by connecting to the spindle motor grounding terminal.

5. Connections

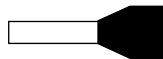
5.2.3 Usage method of the control circuit terminal block (MDS-B-SPJ2-02 to 075)

(1) Wire terminal treatment

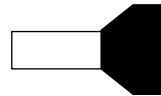
Single wire : Can be used as is with the sheath removed.
(Wire size: 0.2 to 2.5mm²)



Twisted wire : Remove the sheath and twist the core before using. Be careful that the strands of wire from the core do not short circuit with the next terminal. Do not apply solder to the core area, as it will cause a faulty contact. (Wire size: 0.2 to 2.5mm²)
The twisted wire can also be gathered together using a terminal bar.



Single-wire terminal bar
(Terminal bar phenol with insulation sleeve)

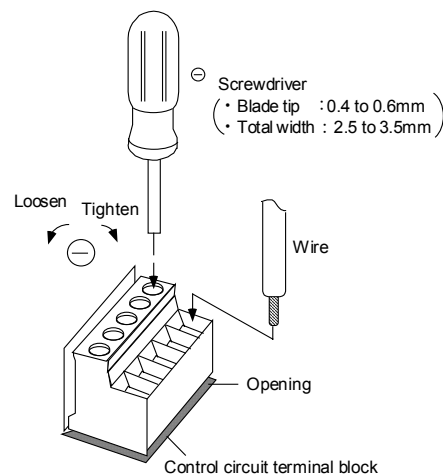


Double-wire terminal bar
(TWIN phenol with insulation sleeve)

Wire size		Terminal bar model		Crimp tool
[mm ²]	AWG	Single-wire	Double-wire	
0.25	24	AI0.25-6YE AI0.25-8YE	-	CRIMPFOX-UD6
0.5	20	AI0.5-6WH AI0.5-8WH	-	
0.75	18	AI0.75-6GY AI0.75-8GY	AI-TWIN2 × 0.75-8GY AI-TWIN2 × 0.75-10GY	
1	18	AI1-6RD AI1-8RD	AI-TWIN2 × 1-8RD AI-TWIN2 × 1-10RD	
1.5	16	AI1.5-6BK AI1.5-8BK	AI-TWIN2 × 1.5-8BK AI-TWIN2 × 1.5-12BK	
2.5	14	AI2.5-8BU AI2.5-8BU-1000	AI-TWIN2 × 2.5-10BU AI-TWIN2 × 2.5-13BU	

(2) Connection method

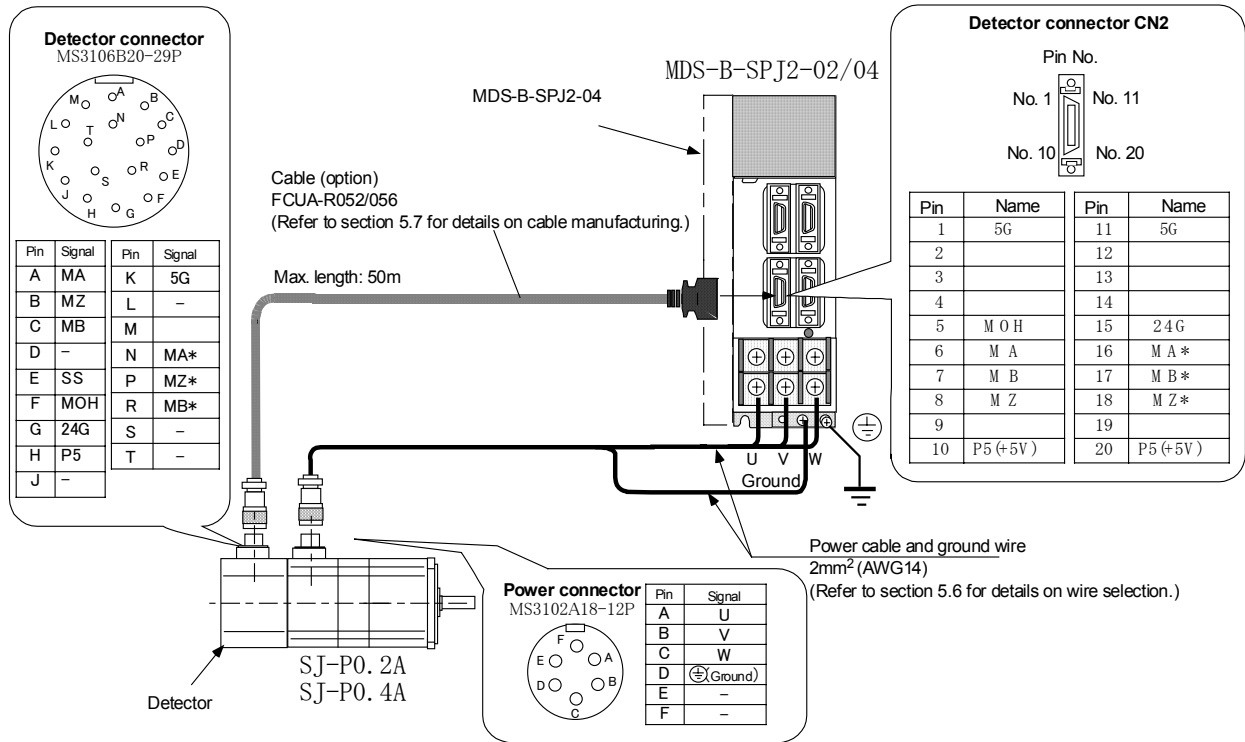
Insert the wire core into the terminal opening, and tighten with a screwdriver so the wire cannot be pulled out. (Tightening torque: 0.5 to 0.6N•m). Be sure that the terminal screw is sufficiently loosened when inserting the wire in the terminal opening. Two wires of 1.5mm² or less can be inserted into one opening.



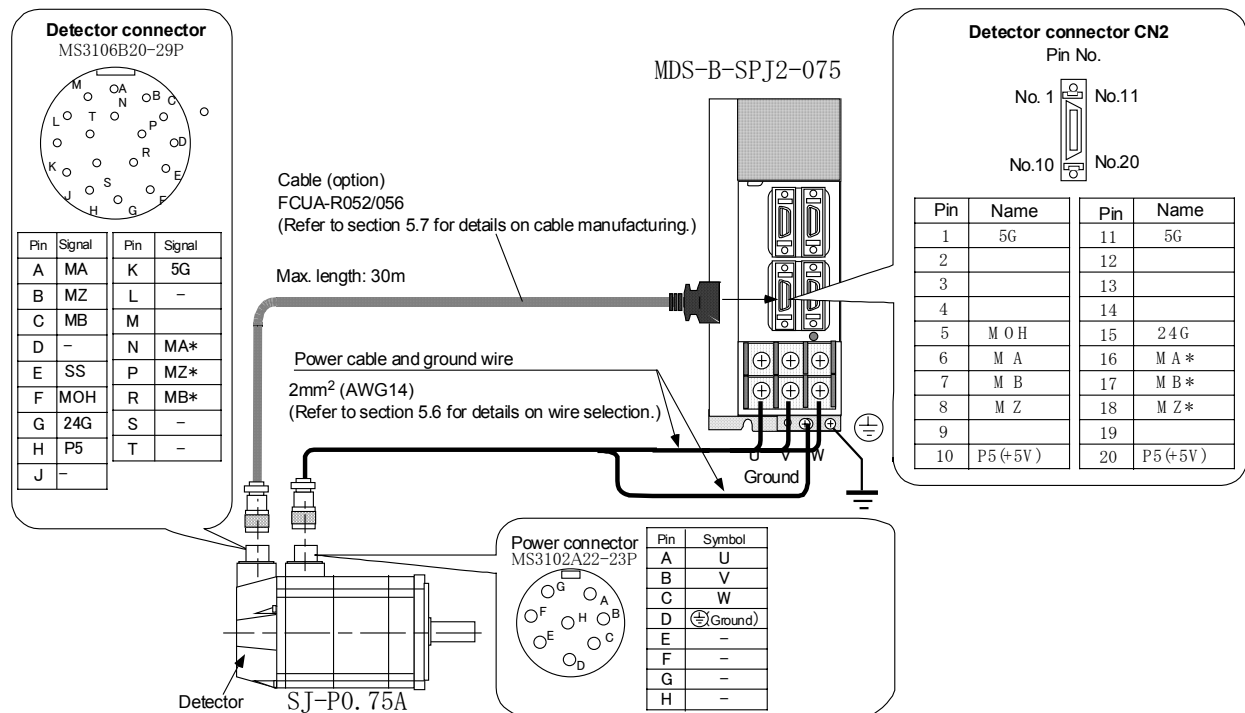
5. Connections

5.3 Spindle motor and detector connection

5.3.1 SJ-P0.2A/0.4A motor connection

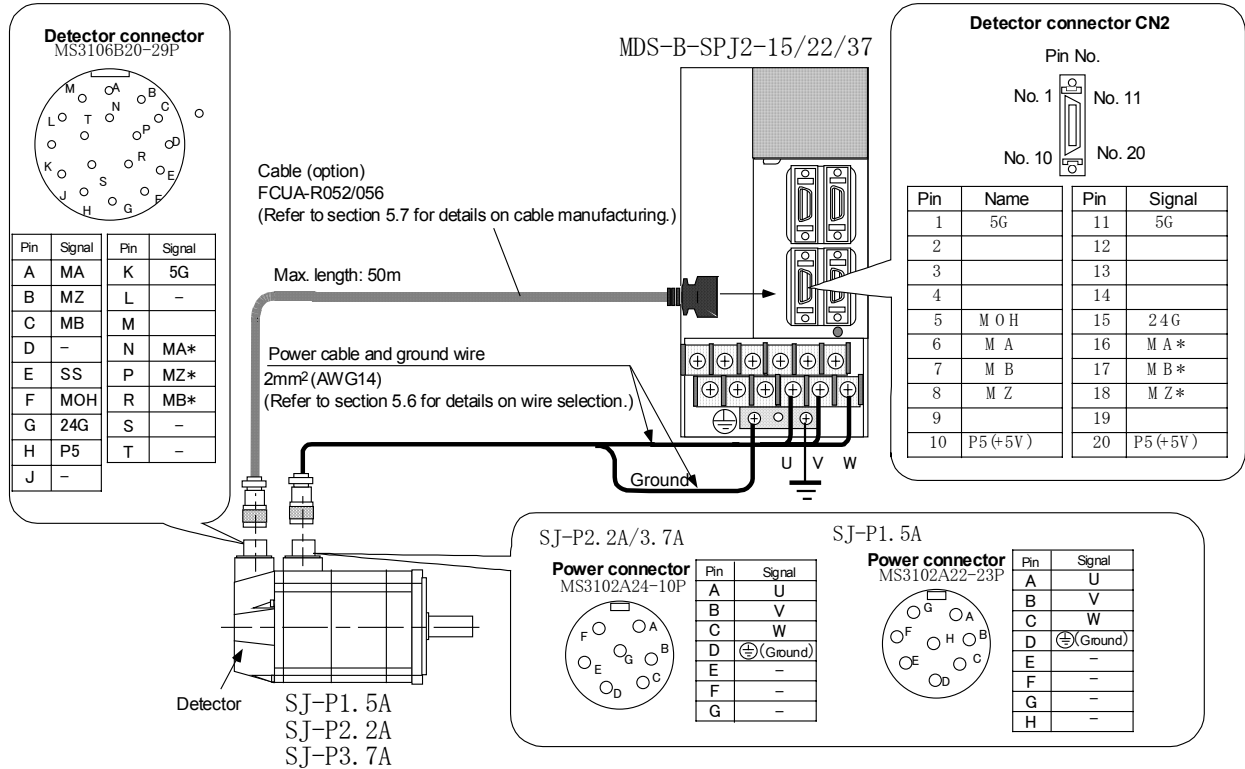


5.3.2 SJ-P0.75A motor connection

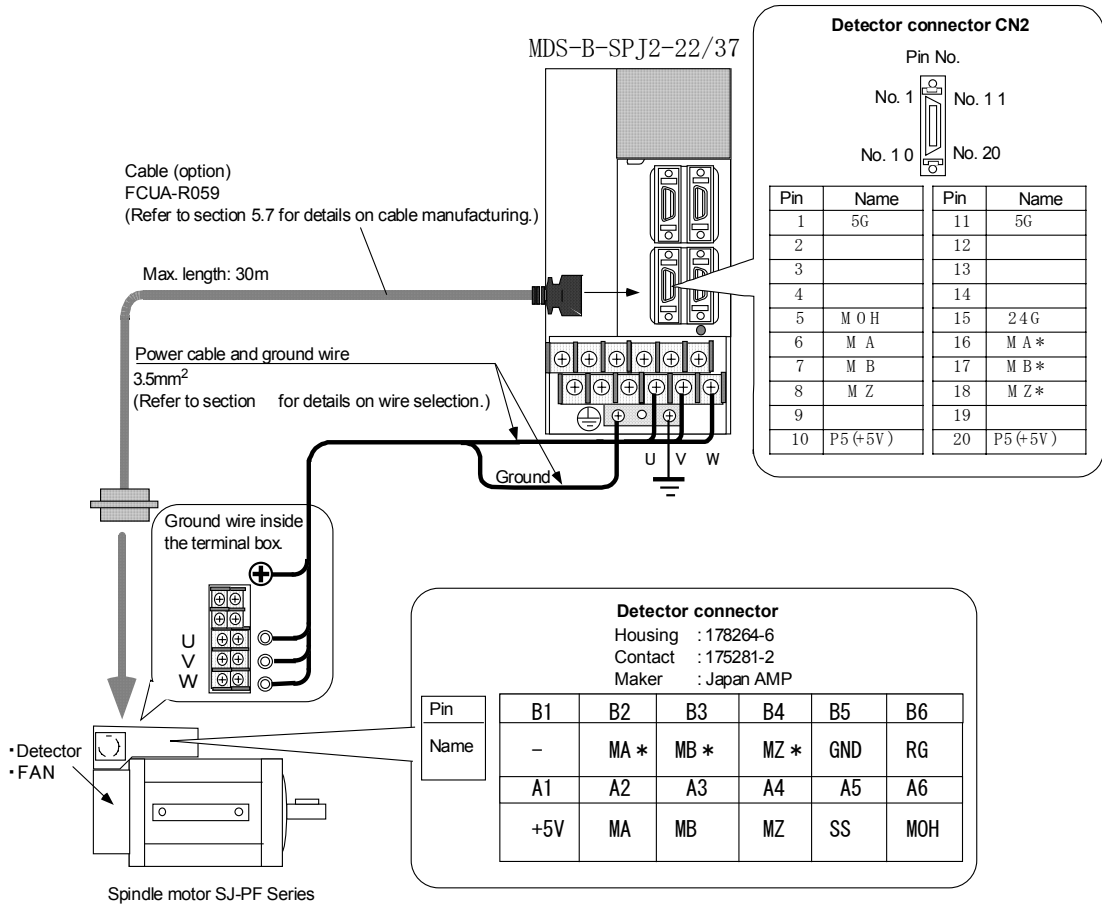


5. Connections

5.3.3 SJ-P1.5A/2.2A/3.7A motor connection

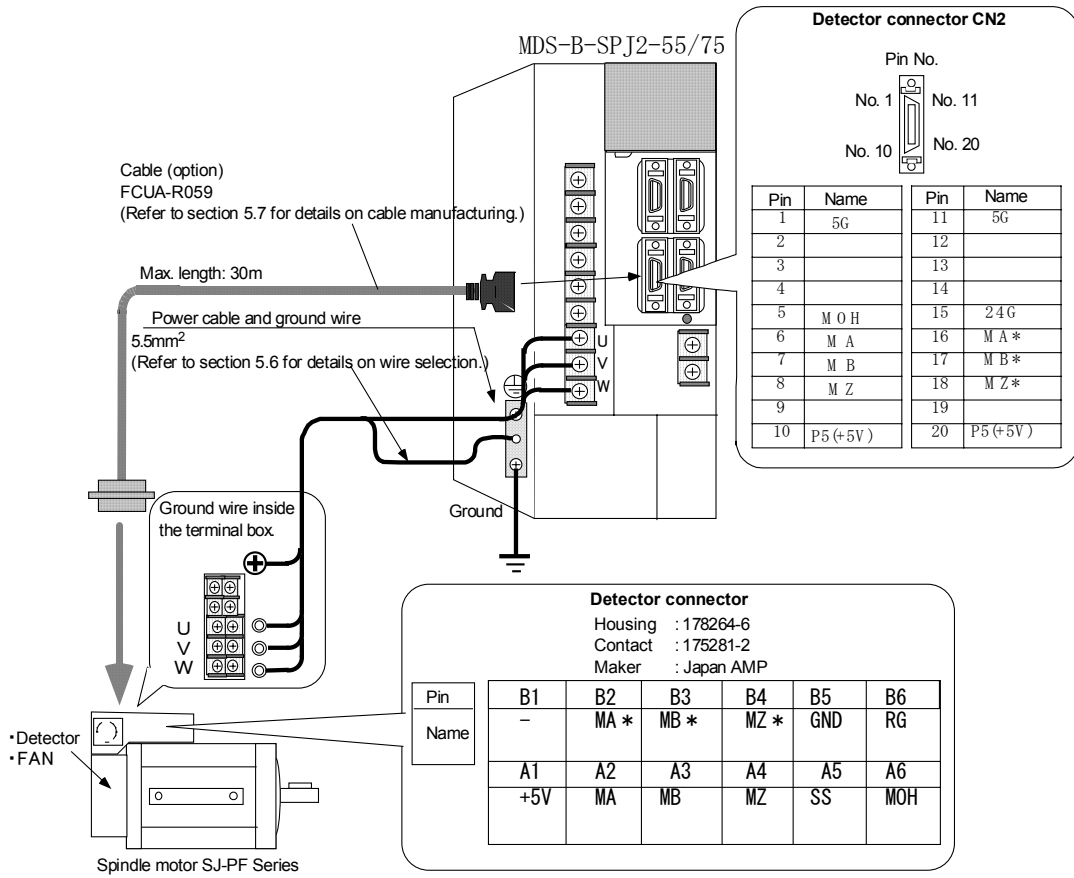


5.3.4 SJ-PF Series motor connection (1.5/2.2/3.7kW)



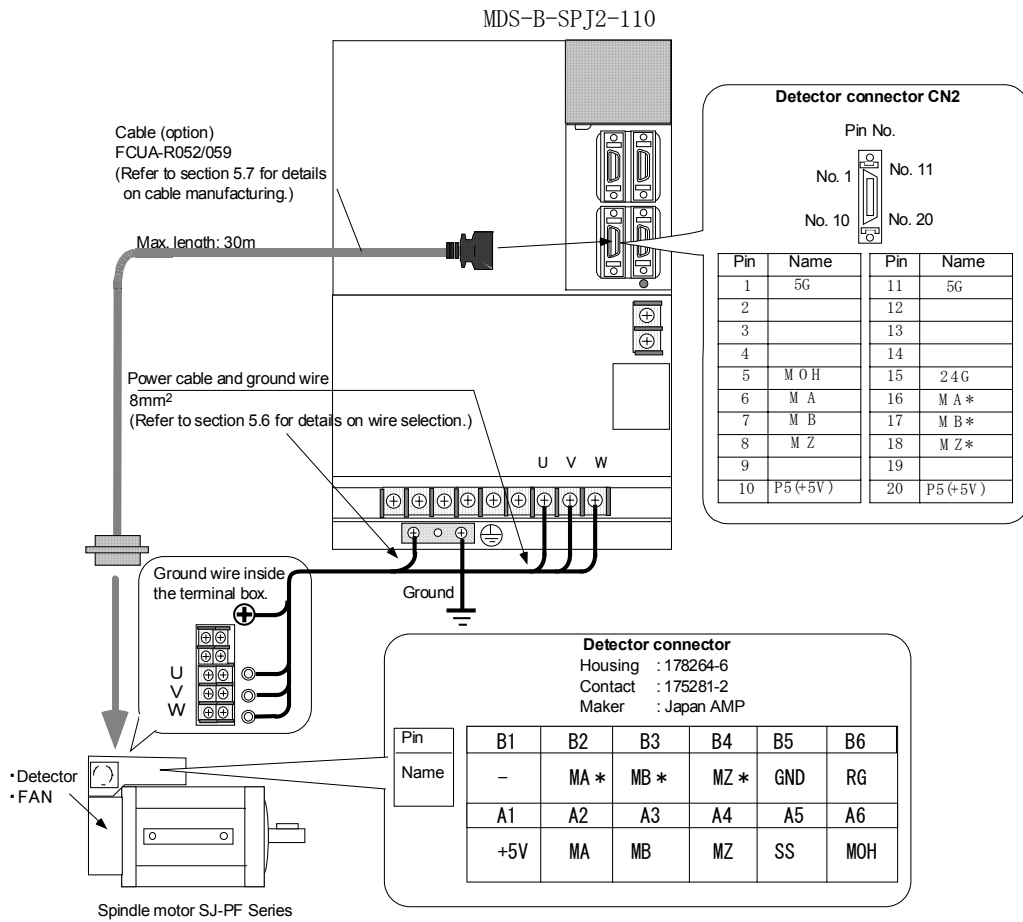
5. Connections

5.3.5 SJ-PF Series motor connection (5.5/7.5kW)



5. Connections

5.3.6 SJ-PF Series motor connection (11kW)

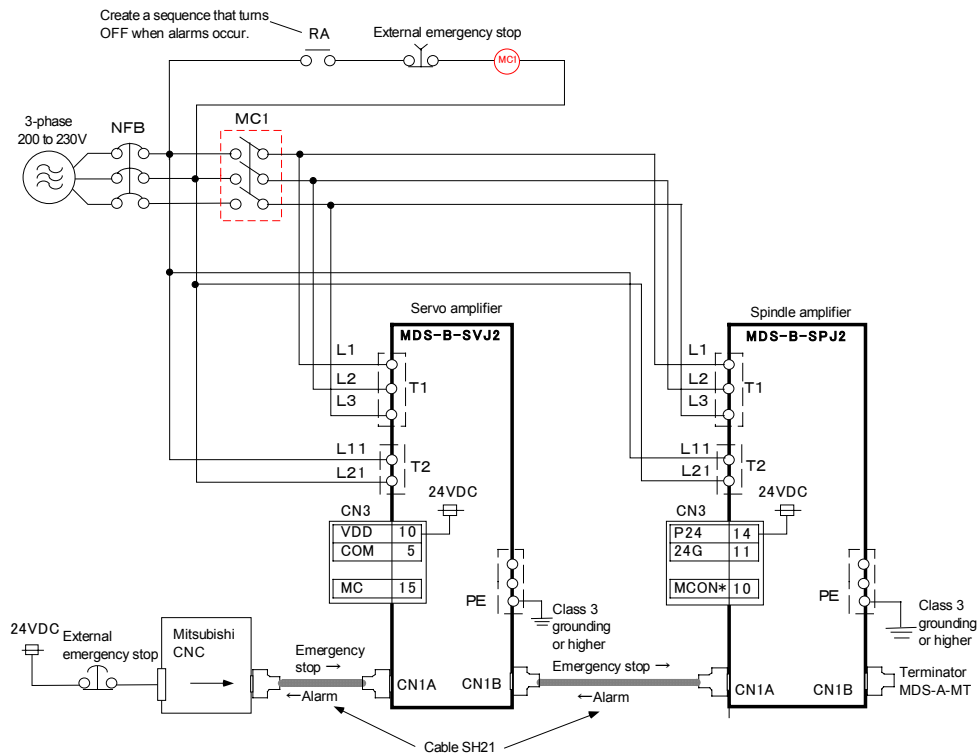


5.4 Power supply connection

⚠ CAUTION

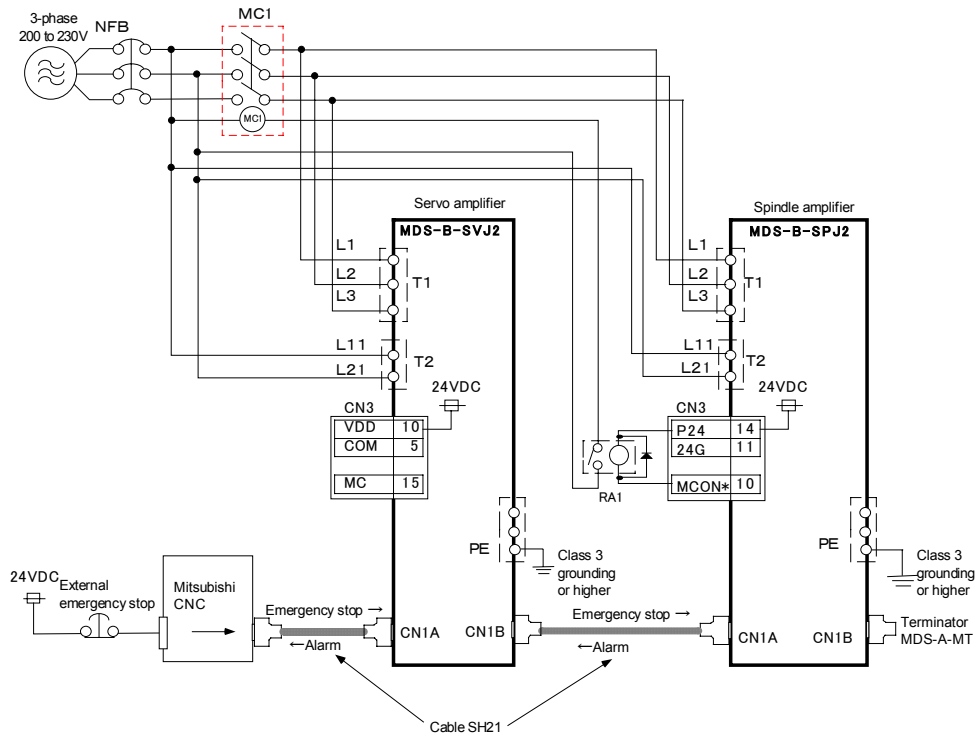
1. Do not exceed the power supply voltage, capacity, etc., specified in the controller specifications. Failure to observe this could result in damage or failure.
2. Always install a no-fuse breaker or earth leakage breaker for safety, and be sure the power is turned OFF at the breakers during abnormalities or inspections. A large rush current is flowed when the power is turned ON. Refer to section 5.6, and select an appropriate no-fuse breaker or earth leakage breaker.
3. The wire size will differ according to the amplifier capacity. Refer to the table in section 5.6, and select the appropriate wire size.
4. Always install an electromagnetic switch for safety, and be sure that the power turns OFF when abnormalities occur. There is an electromagnetic switch control function in the MDS-B-SPJ2. An external relay is required for this function. When there is a convertor unit MDS-B-CV in the system, the electromagnetic switch control function of the convertor can be used. The MDS-B-CV can directly drive the electromagnetic switch.

5.4.1 Connection example when controlling the electromagnetic switch with an external sequence circuit



5. Connections

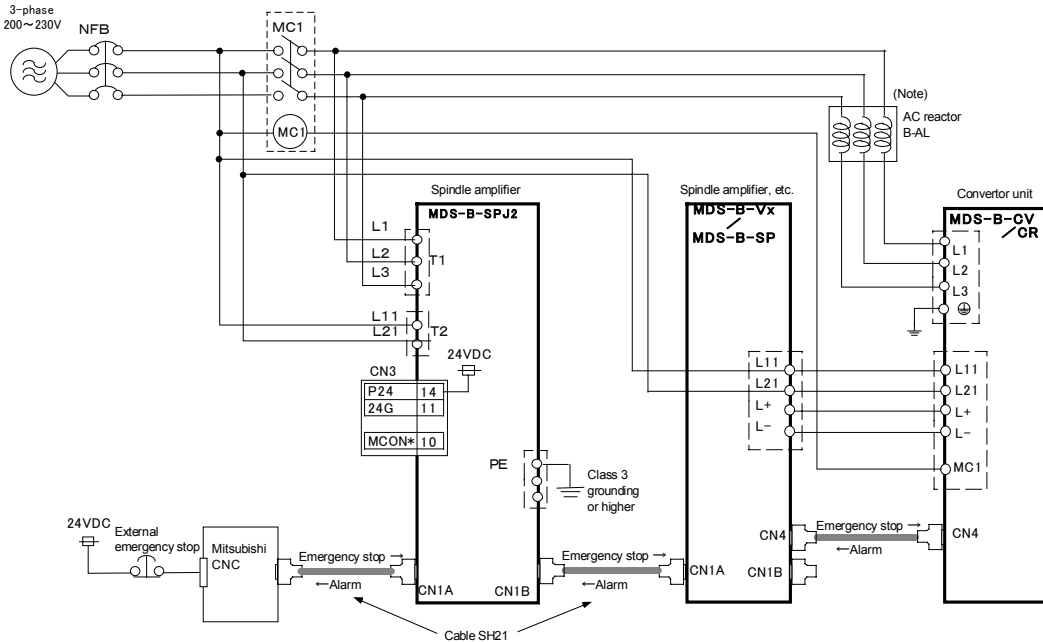
5.4.2 Connection example when controlling the electromagnetic switch with the MDS-B-SPJ2



5. Connections

5.4.3 Connection example when controlling the electromagnetic switch with the MDS-B-CV/CR

The following is a connection example when there is a converter unit MDS-B-CV/CR in the system. The electromagnetic switch control signal (MC1) of the MDS-B-CV/CR can directly drive the electromagnetic switch.



- Refer to the "MDS-B Series Specification Manual BNP-B3759" for details about the converter unit MDS-B-CV/CR.

⚠ CAUTION

Always install a converter unit AC reactor MDS-B-AL. Always wire the MDS-B-SPJ2 main circuit (L1, L2, L3), control power (L11, L21) and spindle amplifier, etc., control power (L11, L21) to the primary side of the MDS-B-AL.

5.4.4 Output circuit of the electromagnetic switch control signal (MCON*)

A relay or photocoupler can be driven. Install a diode for inductive loads.

	When using an internal power supply	When using an external power supply
Inductive load	<p>Spindle amplifier 24VDC P24 MCON*output 24G Load The spindle amplifier will fail if the diode is installed with reverse polarity.</p> <p>Allowable current : 40mA or less Rush current : 100mA or less</p>	<p>Spindle amplifier 24VDC P24 MCON*output 24G Load The spindle amplifier will fail if the diode is installed with reverse polarity.</p> <p>Allowable current : 40mA or less Rush current : 100mA or less</p> <p>27VDC or less</p>

5. Connections

5.5 Regenerative resistor connection

⚠ CAUTION

The regeneration option and servo amplifier cannot be set except as the designated combination. Failure to observe this could result in fires, so always use the correct combination.

A regenerative resistor must be connected to the spindle drive unit.
Connect the regenerative resistor between the C and P terminals of the spindle drive unit.

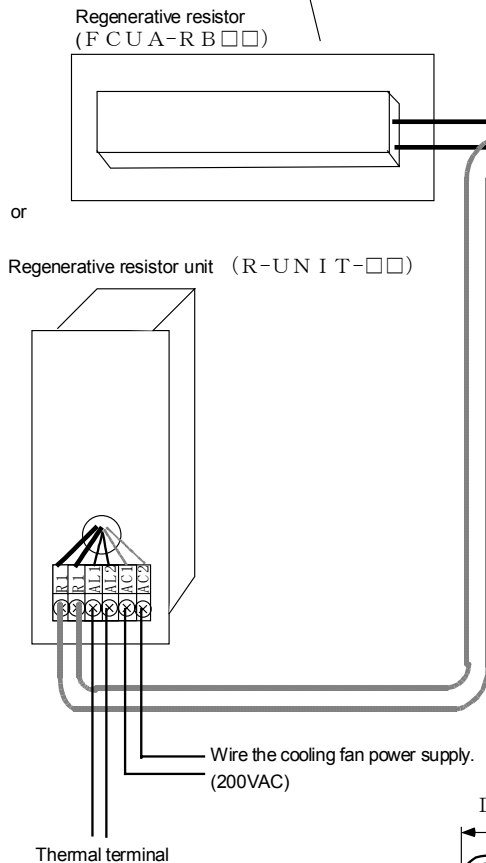
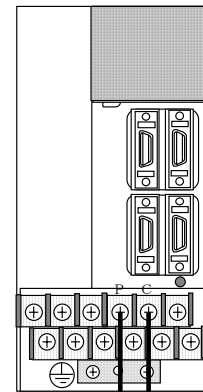
⚠ CAUTION

The regenerative resistor type differs according to the motor capacity, load GD2, and frequency of regeneration. Always confirm that the regenerative resistor is the selected type before connecting. The unit could be damaged if it is operated with the incorrect resistor connected.

⚠ DANGER

Depending on the frequency of use, the regenerative resistor main unit may generate heat of 300deg or more. Never install the regenerative resistor directly on any surface susceptible to heat.

Spindle drive unit
MDS-B-SPJ2



⚠ CAUTION

Always wire the regenerative resistor using twisted wire. When using a relay wire, keep the length as short as possible (5m or less).

⚠ DANGER

Use a noncombustible wire for the relay wire, and wire so that the regenerative resistor is not contacted.

Wire size selection table

Model	Wire (mm ²)	Spindle amplifier terminal block screw sized
	P, C	
MDS-B-SPJ2-02	2	Refer to section 5.2.3.
MDS-B-SPJ2-04	2	
MDS-B-SPJ2-075	2	
MDS-B-SPJ2-15	3.5	M4 D ≤ 8mm ²
MDS-B-SPJ2-22	3.5	
MDS-B-SPJ2-37	3.5	M4 D ≤ 9.6mm ²
MDS-B-SPJ2-55	3.5	
MDS-B-SPJ2-75	3.5	M4 D ≤ 9.6mm ²
MDS-B-SPJ2-110 /110C	3.5	

(Note) Make sure that the input power is shut OFF when the thermal relay functions (when a fault occurs) to protect the regenerative resistor from overheating.
* The contact turns OFF when abnormal overheating occurs.

5. Connections

5.6 Relation to the main circuit

5.6.1 Selection of the main circuit wire, no-fuse breaker and electromagnetic contactor

Select and prepare the main circuit wire, breaker and electromagnetic contactor for the power/motor from the following table according to the spindle amplifier capacity.

Amplifier model	Power supply equipment (kVA)	No-fuse breaker	Electro-magnetic contactor	Wire (mm ²) (Note 1)			
				L1,L2,L3 ⊕	L11,L21	U,V,W	P,C (Note 2)
MDS-B-SPJ2-02	0.5	NF30-type 5A	S-N10 (S-K10)	2	1.25	2	2
MDS-B-SPJ2-04	1.0	NF30-type 10A	S-N11 (S-K11)				
MDS-B-SPJ2-075	2.0						
MDS-B-SPJ2-15	3.0	NF30-type 15A	S-N18 (S-K18)	3.5	1.25	3.5	3.5
MDS-B-SPJ2-22	4.0	NF30-type 20A	S-N25 (S-K25)				
MDS-B-SPJ2-37	7.0	NF30-type 30A		5.5	1.25	3.5	3.5
MDS-B-SPJ2-55	9.0	NF50-type 40A					
MDS-B-SPJ2-75	12.0	NF50-type 40A	14	1.25	3.5	3.5	3.5
MDS-B-SPJ2-110 MDS-B-SPJ2-110C	17.0	NF50-type 50A	14				

(Note 1) The standard wire is a 600V vinyl wire. The wires (U, V, W) in the table are for a distance of 30m or less between spindle motor and spindle amplifier.
The recommended wire sizes are those selected under conditions corresponding to the power capacity (short-time rating), when all three wires have the same sensitivity and the ambient temperature is 30°C. Determine the wire size matching the actual ambient temperature, ambient humidity, wire and wiring status by conversion, using the table above as a reference.

(Note 2) Wire with a twisted regenerative resistor (P, C) connection wire.

5.6.2 Input/output DIO relay

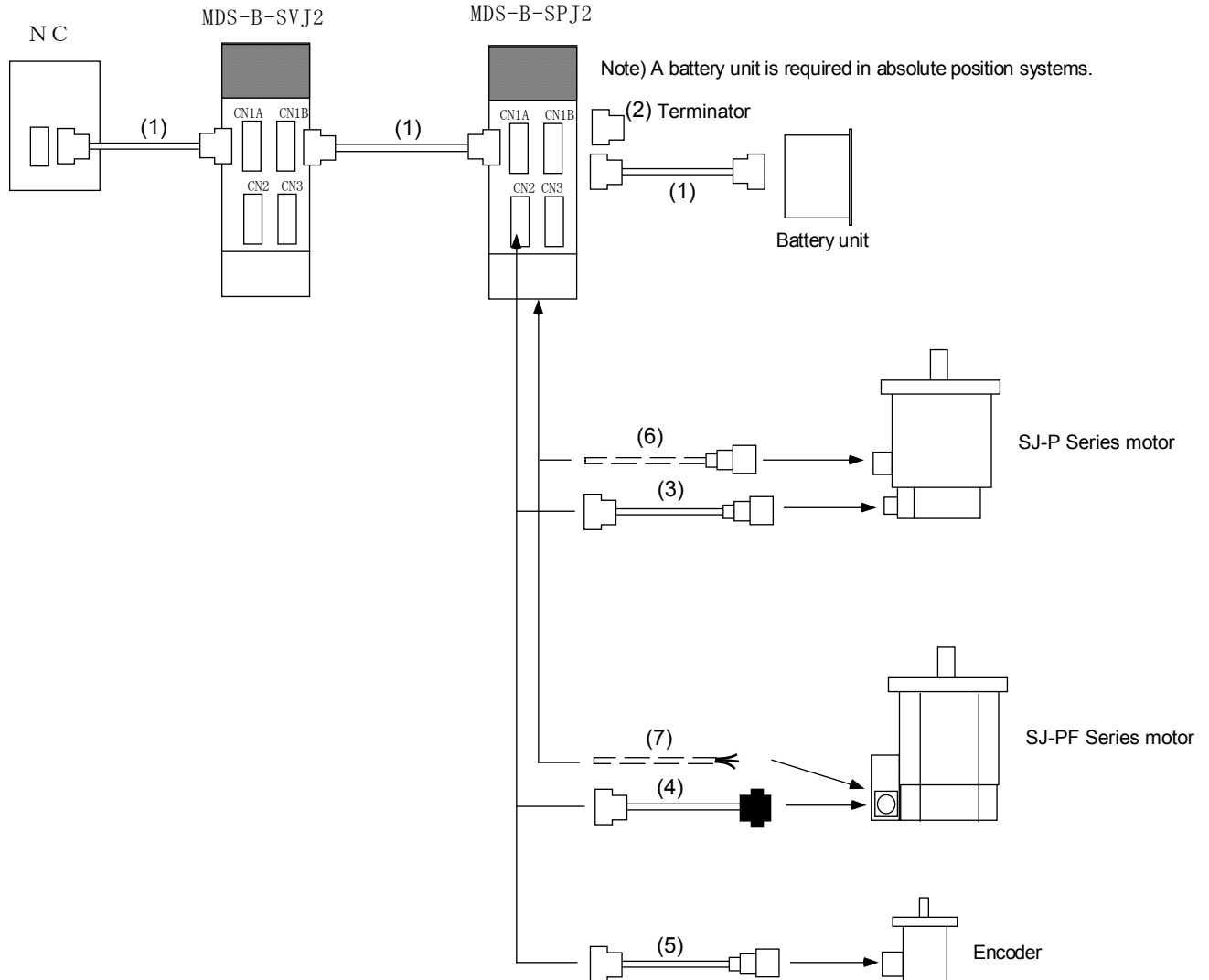
Use the following relays for the input/output interface (contactor output: MC, etc.)

Interface name	Selection example
Relay used to turn the digital input signal ON/OFF	Use for minute signals to prevent faulty contacts (twin contacts). < Example > OMRON: G2A, MY
Relay used for digital output signals (MBR, MC)	Compact relay of 40mA or less for 12 VDC or 24VDC. < Example > OMRON: MY

5. Connections

5.7 Control circuit cables and connectors

- Use cables (3) and (4) for the detector cables, after confirming the spindle motor series and necessary wiring length. Also use cable (5) when an encoder is installed externally.
- Use the detector connector sets (4) and (5) to manufacture a detector cable, referring to "5. Connections" for details.
- Connect the terminator (2) to CN1B of the last spindle amplifier.



Optional cables (1/2)

Product name		Model	Details	
CN1A and CN1B	(1)	NC-Amplifier Amplifier-Amplifier Bus cable	SH21 or FCUA-R000	Amplifier side connector (3M or equivalent product) 10120-3000VE (connector) 10320-52F0-008 (shell kit)
	(2)	Terminator	A-TM FCUA-A-TM	Amplifier side connector (3M or equivalent product) 10120-3000VE (connector) 10320-52F0-008 (shell kit)

5. Connections

Optional cables (2/2)









Product name		Model	Details		
CN2	(3)	Detector cable for an SJ-P*A motor	FCUA-R052 (straight plug) FCUA-R056 (angle plug)	Amplifier side connector (3M or equivalent product) 10120-3000VE (connector) 10320-52F0-008 (shell kit)	Spindle motor detector side connector (Japan Aviation Electronics) MS3106B20-29S (straight plug) or MS3108B20-29S (angle plug) MS3057-12A (clamp)
	(4)	Detector cable for an SJ-PF* motor	FCUA-R059	Amplifier side connector (3M or equivalent product) 10120-3000VE (connector) 10320-52F0-008 (shell kit)	Spindle motor detector side connector (Japan AMP) 178289-6 (housing) 1-175217-2 (contact)
	(5)	Detector cable for an external encoder	FCUA-R050 (straight plug) FCUA-R054 (angle plug)	Amplifier side connector (3M or equivalent product) 10120-3000VE (connector) 10320-52F0-008 (shell kit)	Spindle motor detector side connector (Japan Aviation Electronics) MS3106B20-29S (straight plug) or MS3108B20-29S (angle plug) MS3057-12A (clamp)

Optional connector sets (1/2)

Product name		Model	Details		
CN1A and CA1B and CN3	(1)	Connector set (2 sets included)	FCUA-CS000	Spindle amplifier side connector (3M or equivalent product) Connector: 10120-3000VE × 2 pcs. Shell kit: 10320-52F0-008 × 2 pcs.	
CN2	(3) (5)	Detector connector set for an SJ-P*A motor and external encoder	FCUA-CS050 (straight plug)	Spindle amplifier side connector (3M or equivalent product) Connector: 10120-3000VE Shell kit : 10320-52F0-008	Spindle motor/encoder detector side connector (DDK) Straight plug: MS3106B20-29S Clamp : MS3057-12A
			FCUA-CS054 (angle plug)	Spindle amplifier side connector (3M or equivalent product) Connector: 10120-3000VE Shell kit : 10320-52F0-008	Spindle motor detector side connector (Japan AMP) Angle plug : MS3108B20-29S Clamp : MS3057-12A

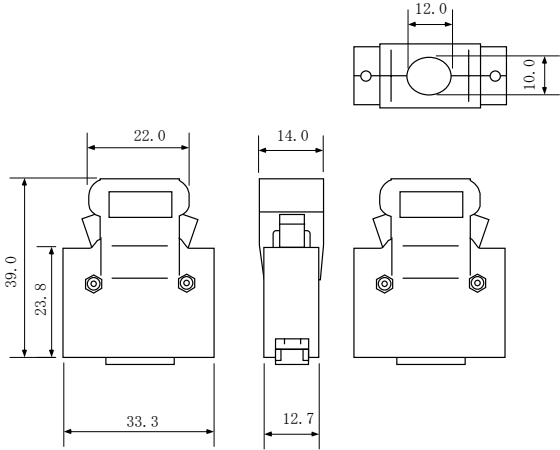
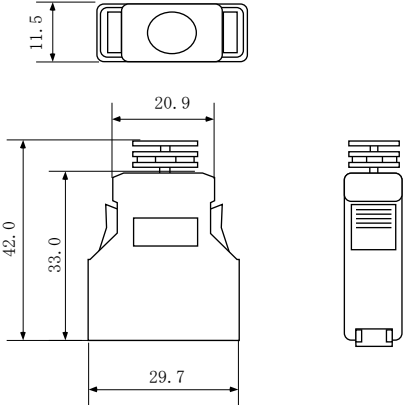
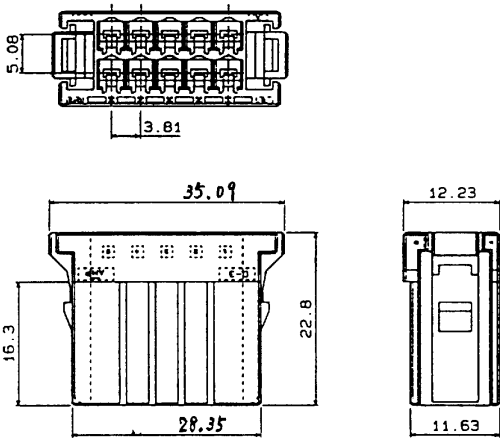
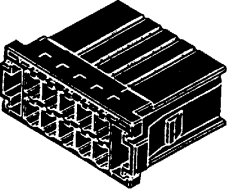
5. Connections

Optional connector sets (2/2)

Product name		Model	Details		
CN2	(4)	Detector connector set for an SJ-PF* motor	FCUA-CS059	Spindle amplifier side connector (3M or equivalent product) Connector: 10120-3000VE Shell kit : 10320-52F0-008 	Spindle motor detector side connector (Japan AMP) Housing : 178289-6 Contact : 1-175217-2 
Motor	(6)	Power supply connector for SJ-P0.2A/0.4A (straight canon)	FCUA-CN801		Spindle motor side power supply connector (DDK) Connector: MS3106B18-12S Clamp : MS3057-10A 
		Power supply connector for SJ-P0.75A/1.5A (straight canon)	FCUA-CN802		Spindle motor side power supply connector (DDK) Connector: MS3106B22-23S Clamp : MS3057-12A 
		Power supply connector for SJ-P2.2A/3.7A (straight canon)	FCUA-CN803		Spindle motor side power supply connector (DDK) Connector: MS3106B24-10S Clamp : MS3057-16A 
		Power supply connector for SJ-P0.2A/0.4A (angle canon)	FCUA-CN805		Spindle motor side power supply connector (DDK) Connector: MS3108B18-12S Clamp : MS3057-10A 
		Power supply connector for SJ-P0.75A/1.5A (angle canon)	FCUA-CN806		Spindle motor side power supply connector (DDK) Connector: MS3108B22-23S Clamp : MS3057-12A 
		Power supply connector for SJ-P2.2A/3.7A (angle canon)	FCUA-CN807		Spindle motor side power supply connector (DDK) Connector: MS3108B24-10S Clamp : MS3057-16A 

5. Connections

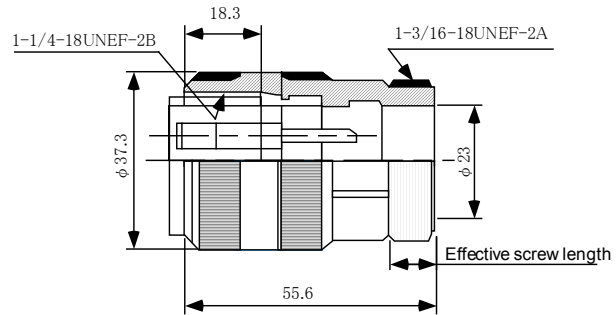
(1) Connector outline

Connectors for a spindle amplifier CN2	
<p>Maker : Sumitomo 3M [Unit: mm] < Model > Connector: 10120-3000VE Shell Kit : 10320-52F0-008</p>	
<p>Maker : Sumitomo 3M [Unit: mm] < Model > Connector: 10120-6000EL Shell Kit : 10320-3210-000</p> <p>There is no setting for this connector option. It is an integral part of the cable.</p>	
Connector for an SJ-PF* motor detector (motor accessory)	
<p>Maker : Japan AMP [Unit: mm] < Model > Housing : 178289-6 Contact : 1-175217-2</p> <p>A crimp tool is required to wire this connector. Contact Japan AMP for information on crimp tools.</p> <p>< Reference > Crimp tool : 919601-1</p>	
	

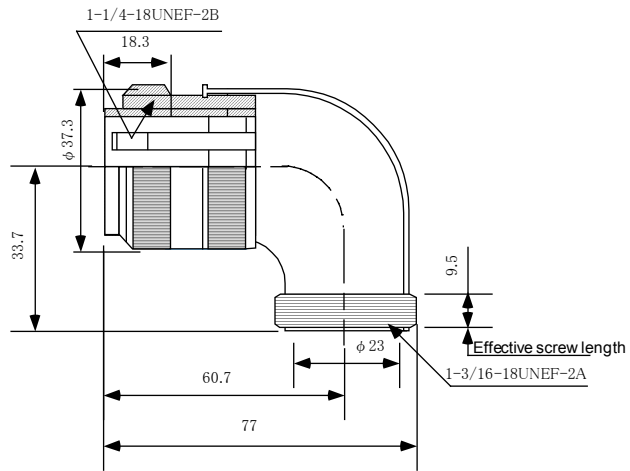
5. Connections

Connectors for an SJ-P*A motor/external encoder detector

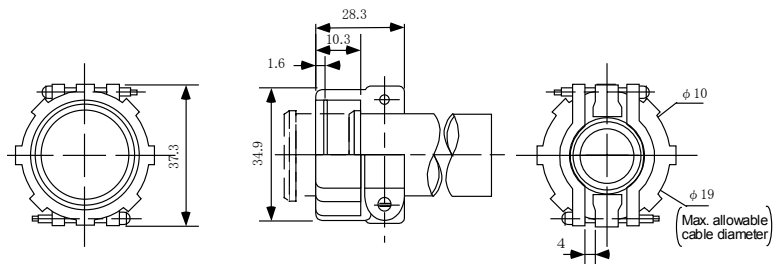
Straight plug [Unit: mm]
 Maker : Japan Aviation
 Electronics
 Model : MS3106B20-29S



Angle plug [Unit: mm]
 Maker : Japan Aviation
 Electronics
 Model : MS-3108B20-29S



Cable clamp [Unit: mm]
 Maker : Japan Aviation
 Electronics
 Model : MS3057-12A



5. Connections

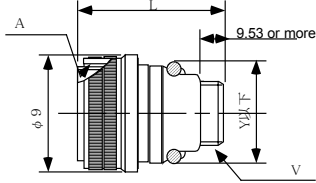
Connector for an SJ-P*A motor power supply

Straight plug

[Unit: mm]

Maker : Japan Aviation
Electronics

Model : MS-3106B22-23S
MS-3106B24-10S



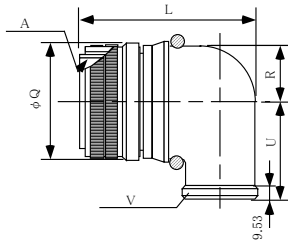
Compatible motor	Model	A	L	Q	V	Y
SJ-P0.75A	MS3106B-22-23S	1-3/8-18UNEF	55.57	40.48	1-3/16-18UNEF	50
SJ-P1.5A	MS3106B-24-10S	1-1/2-18UNEF	58.72	43.63	1-7/16-18UNEF	53

Angle plug

[Unit: mm]

Maker : Japan Aviation
Electronics

Model : MS-3108B22-23S
MS-3108B24-10S



Compatible motor	Model	A	L	Q	R	U	V
SJ-P0.75A	MS3108B-22-23S	1-3/8-18UNEF	76.98	40.48	24.1	33.3	1-3/16-18UNEF
SJ-P1.5A	MS3108B-24-10S	1-1/2-18UNEF	86.51	43.63	25.6	36.5	1-7/16-18UNEF

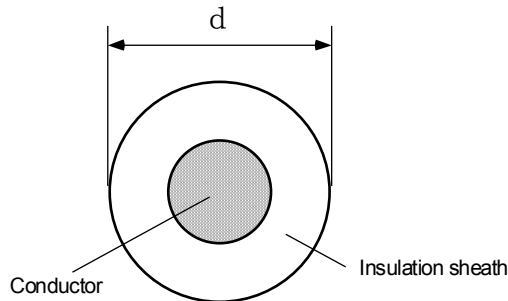
5. Connections

(2) Wire and assembly of detector cables and communication cables

The wire specifications and manufacturing methods for each cable are shown below. Use the recommended wire or equivalent parts in the following table when manufacturing the cable, and be sure to connect all parts correctly.

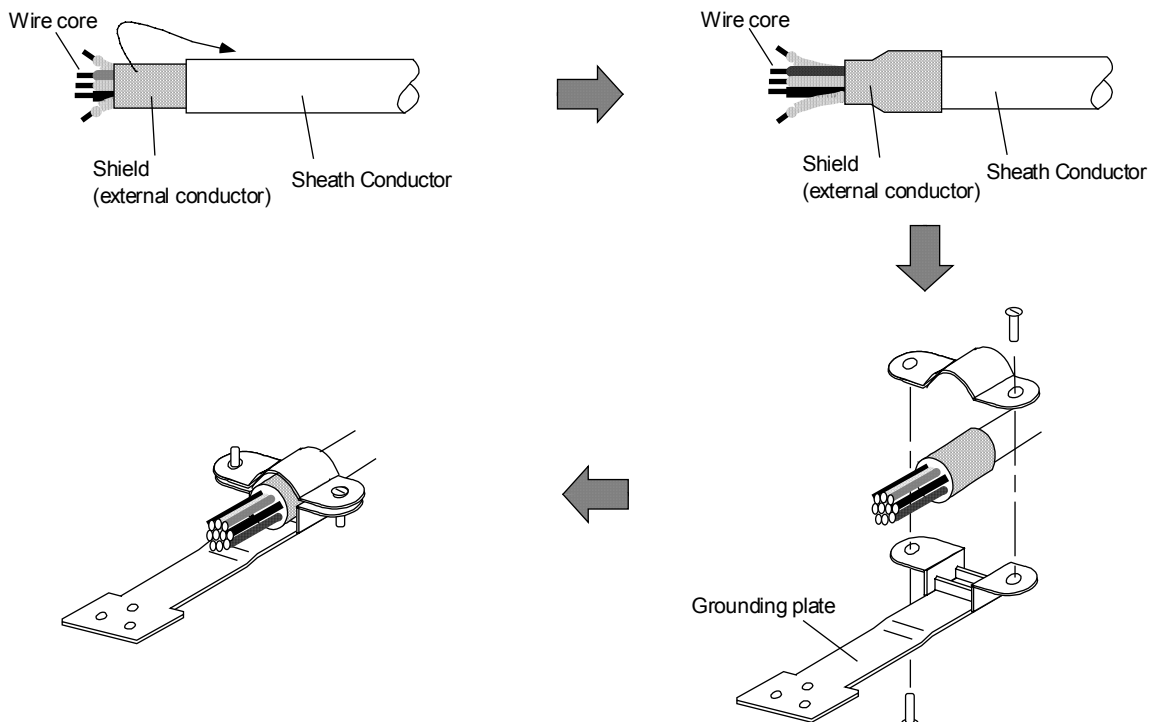
Core size [mm ²] × one pair	Outline of the core insulation sheath (Note) d [mm]	Recommended wire model	Cable type
0.08 × 10	0.9 ~ 1.27	UL20276 AWG28 10 pair (Black)	Serial bus cable (CN1A/CN1B)
0.3 × 12		UL1061-2464 AWG22 12 pair (Black)	Standard detector cable

Note : d is as shown in the following drawing.



Cross-section of the wire core

Securely connect the cable shield wire to the connector grounding plate as shown in the following drawings.



5. Connections

(3) Detector cable connection drawings

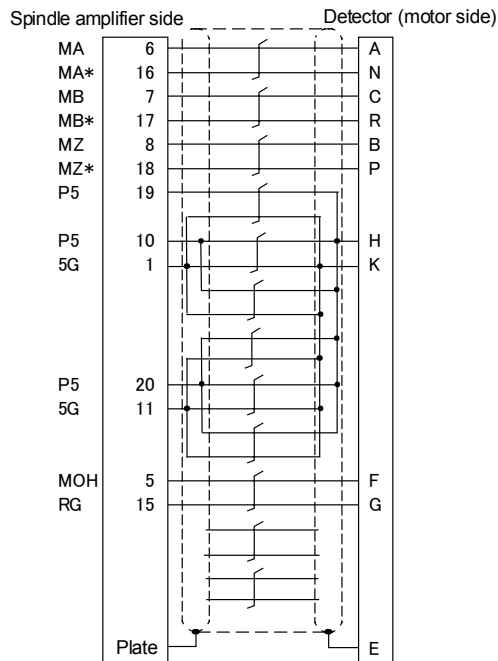


When manufacturing the cable, be sure to connect all parts correctly. Failure to observe this could result in failure, runaway or fires.

< SJ-P*A motor detector >

Optional cable connection drawing

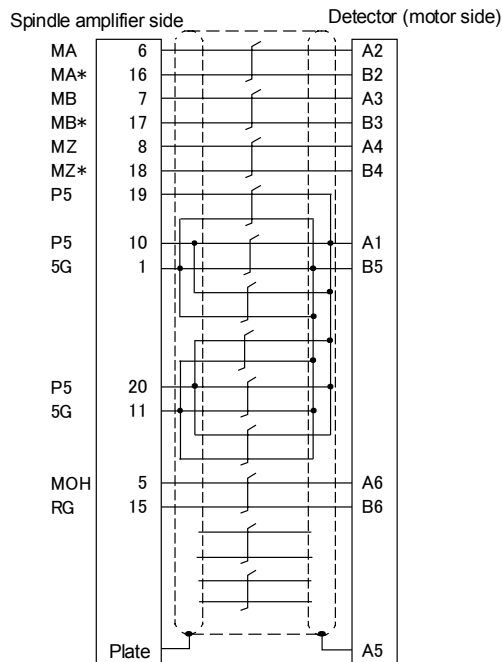
FCUA-R052/R056



< SJ-PF* motor detector >

Optional cable connection drawing

FCUA-R059

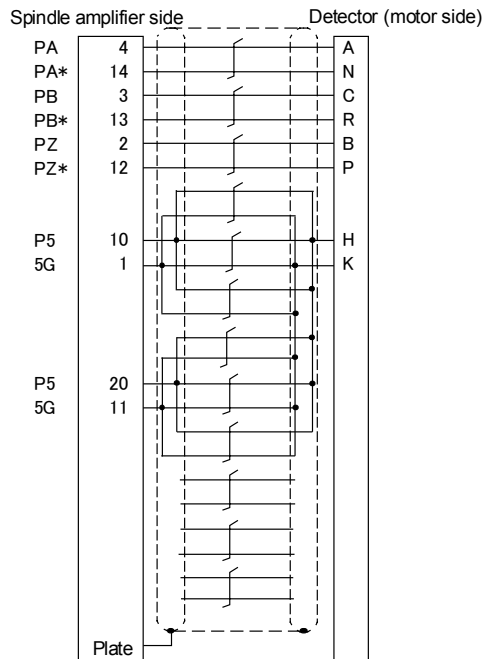


5. Connections

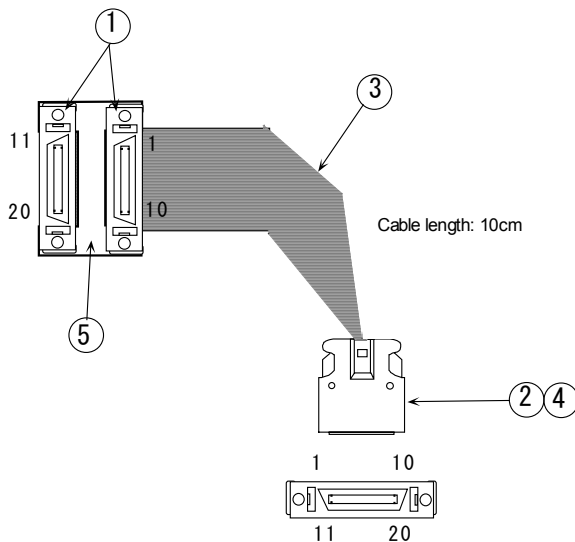
< External encoder detector >

Optional cable connection drawing

FCUA-R050/R054



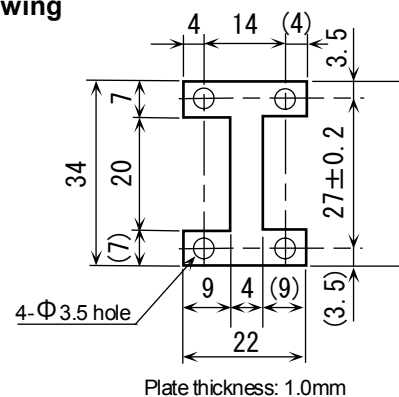
FCUA-R001



List of parts used

No.	Part name/model	Maker	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 dimensions drawing



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

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

Chapter 6 Status Display and Parameter Setting

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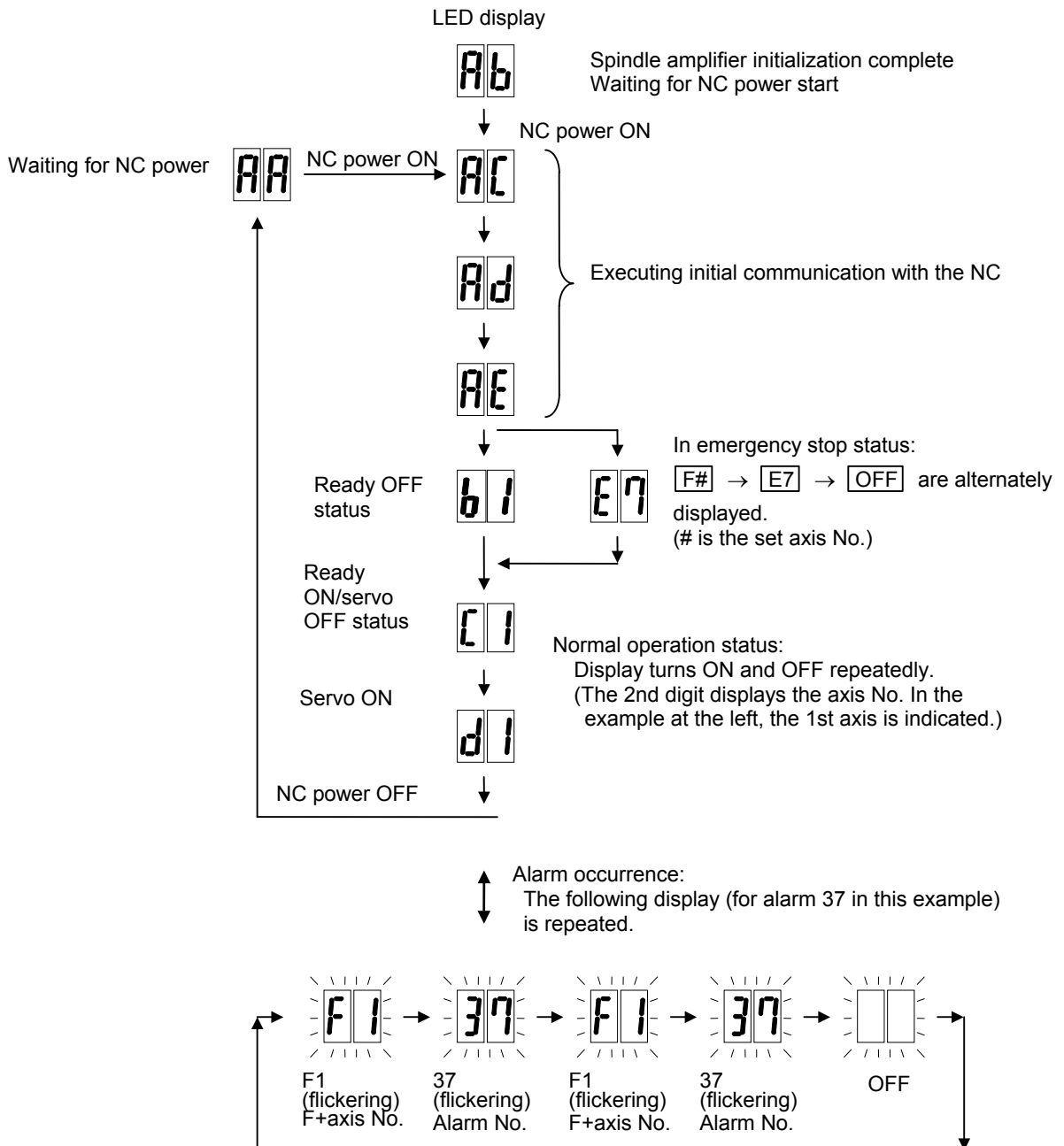
6. Status Display and Parameter Setting

6.1 Status display with 7-segment LED

< LED display transition after the power is turned ON >

When the axis No. is set and the spindle amplifier power or NC power is turned ON, the spindle amplifier is automatically initialized, etc., for self-diagnosis and operation. The 7-segment LED display on the front of the spindle amplifier main unit changes as shown below, together with the progression of these processes.

The 7-segment LED also displays the alarm No. when an alarm occurs.



6. Status Display and Parameter Setting

6.2 Spindle parameters

CAUTION

Never drastically adjust or change the parameters. Extreme adjustments and changes of the parameters will cause the operation to become unstable.

(1) Parameter list

(Note 1) With the MDS-B-SPJ2, all of the spindle parameters (total 384) can be set from the M500 CNC screen.

(Note 2) Parameters marked with a . in the CNG column can be set and changed when setting the parameters with a personal computer without turning OFF the spindle drive unit power.

< Class: Spindle specifications >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP001	PGM	Motor built-in encoder orient position loop gain	The orientation time will be reduced when the value is increased and the servo rigidity will increase. On the other hand, the vibration will increase and machine sway will occur easily.	DEC	*	100	1/10 s ⁻¹	0 ~ 360
SP002	PGE	Encoder orient position loop gain	Same as above	DEC	*	100	1/10 s ⁻¹	0 ~ 360
SP003	PGC		Not used. Set to 0.	DEC		0		
SP004	OINP	Orient in-position width	The position error range where the orient complete signal is output is set.	DEC	*	16	1/16 deg.	1 ~ 2880
SP005	OSP	Orient changeover speed limit value	The motor speed limit value for when changing from the speed loop to position loop during orientation is set. When the setting value is 0, the limit speed will be SP017 (TSP).	DEC		0	r/min	0 ~ 32767
SP006	CSP	Deceleration rate during orientation	The orientation time will be reduced when the value is increased. On the other hand, the vibration will increase.	DEC	*	20		1 ~ 1000
SP007	OPST	Orientation position shift amount	The orientation stop position is set. Set a value that is 360° divided by 4096.	DEC	*	0		0 ~ 4095
SP008			Not used. Set to 0.	DEC		0		
SP009	PGT	Synchronous tapping position loop gain	The position loop gain for the spindle during synchronous tapping is set.	DEC	*	15	S ⁻¹	1 ~ 100
SP010	PGS	Spindle synchronization position loop gain	The position loop gain for the spindle during spindle synchronization is set.	DEC	*	15	S ⁻¹	1 ~ 100
SP011 ~ SP016			Not used. Set to 0.	DEC		0		
SP017	TSP	Motor max. speed	The motor's maximum speed is set.	DEC		6000	r/min	1 ~ 32767
SP018	ZSP	Motor zero speed	The motor speed where zero speed is output is set.	DEC		50	r/min	1 ~ 1000
SP019	CSN1	Speed command Acceleration/deceleration time constant	The time constant for the speed command from 0 to the maximum speed is set. (This is invalid during position loop.)	DEC		30	10 ms	1 ~ 32767
SP020	SDTS	Speed detection set value	The motor speed where the speed detection output is performed is set. Normally, 10% of the SP017 (TSP) value is set.	DEC		600	r/min	0 ~ 32767
SP021	TLM1	Torque limit 1	The torque limit ratio for when torque limit signal 001 is set.	DEC		10	%	1 ~ 120
SP022	VGNP1	Speed loop gain proportion item during speed control	The speed loop proportional gain during speed control is set. The response will improve when increased, but vibration and sound will increase.	DEC		63	rad/s	0 ~ 1000

6. Status Display and Parameter Setting

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP023	VGNI1	Speed loop gain integral item during speed control	The speed loop integral gain during speed control is set. Normally, this is set so that the percentage to SP022 (VGNP1) is approximately constant.	DEC		60	1/10 rad/s	0 ~ 1000
SP024			Not used. Set to 0.	DEC		0		
SP025	GRA1	Spindle side No. of gear teeth 1	The No. of teeth on the spindle side is set for gear 000.	DEC		1		1 ~ 32767
SP026	GRA2	Spindle side No. of gear teeth 2	The No. of teeth on the spindle side is set for gear 001.	DEC		1		1 ~ 32767
SP027	GRA3	Spindle side No. of gear teeth 3	The No. of teeth on the spindle side is set for gear 010.	DEC		1		1 ~ 32767
SP028	GRA4	Spindle side No. of gear teeth 4	The No. of teeth on the spindle side is set for gear 011.	DEC		1		1 ~ 32767
SP029	GRB1	Motor shaft side No. of gear teeth 1	The No. of teeth on the motor shaft side is set for gear 000.	DEC		1		1 ~ 32767
SP030	GRB2	Motor shaft side No. of gear teeth 2	The No. of teeth on the motor shaft side is set for gear 001.	DEC		1		1 ~ 32767
SP031	GRB3	Motor shaft side No. of gear teeth 3	The No. of teeth on the motor shaft side is set for gear 010.	DEC		1		1 ~ 32767
SP032	GRB4	Motor shaft side No. of gear teeth 4	The No. of teeth on the motor shaft side is set for gear 011.	DEC		1		1 ~ 32767

< Class: Spindle/machine specifications >

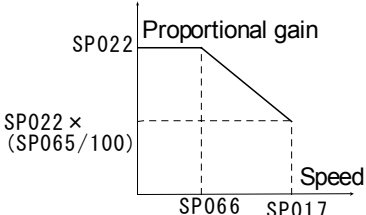
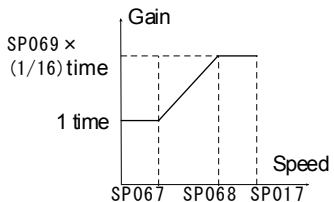
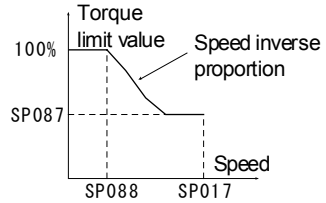
No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP033	SFNC1	Spindle function 1	This corresponds to bits, and sets the spindle function 1 selection. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP034	SFNC2	Spindle function 2	This corresponds to bits, and sets the spindle function 2 selection. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP035	SFNC3	Spindle function 3	This corresponds to bits, and sets the spindle function 3 selection. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP036	SFNC4	Spindle function 4	This corresponds to bits, and sets the spindle function 4 selection. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP037	SFNC5	Spindle function 5	This corresponds to bits, and sets the spindle function 5 selection. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP038	SFNC6	Spindle function 6	This corresponds to bits, and sets the spindle function 6 selection. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP039	ATYP	Amplifier type	The amplifier type is set. Set a compliant motor No. from the standard motors indicated in section 6.2.(3).	HEX		0000		0000 ~ FFFF
SP040	MTYP	Motor type	This is valid when SP034 (SFNC2) bit -0 is set to 0. Set the applicable motor No. from the standard shown in section 6.2(3).	HEX		0000		0000 ~ FFFF
SP041	PTYP	Regenerative resistor type	The regenerative resistor type is set. Set a compliant resistor No. from the regenerative resistors indicated in section 6.2.(4).	HEX		0000		0000 ~ FFFF
SP042	CRNG		Not used. Set to 0.	DEC		0		~
SP043	TRNG		Not used. Set to 0.	DEC		0		~
SP044	TRANS	NC communication cycle	The communication cycle with the NC is set.	DEC		Standard = 0 Special = 1028		0 ~ 32727

6. Status Display and Parameter Setting

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP045			Not used. Set to 0.	DEC		0		
SP046	CSN2	Speed command dual cushion	The speed command is smoothed only during the acceleration/deceleration start according to the acceleration/deceleration time constant set in SP019 (CSN1). The smoothness of the operation will increase when this setting value is small, but the acceleration/deceleration time will increase. This is invalidated when 0 is set.	DEC		0		0 ~ 1000
SP047	SDTR	Speed detection reset value	The hysteresis width for the reset of the speed detection set value set in SP020 (SDTS) is set.	DEC		30	r/min	0 ~ 1000
SP048	SUT	Speed reached range	The percentage of the speed deflection in respect to the commanded speed for outputting the speed reached signal is set.	DEC		15	%	0 ~ 100
SP049	TLM2	Torque limit 2	The torque limit ratio for torque limit signal 010 is set.	DEC		20	%	1 ~ 120
SP050	TLM3	Torque limit 3	The torque limit ratio for torque limit signal 011 is set.	DEC		30	%	1 ~ 120
SP051	TLM4	Torque limit 4	The torque limit ratio for torque limit signal 100 is set.	DEC		40	%	1 ~ 120
SP052	TLM5	Torque limit 5	The torque limit ratio for torque limit signal 101 is set.	DEC		50	%	1 ~ 120
SP053	TLM6	Torque limit 6	The torque limit ratio for torque limit signal 110 is set.	DEC		60	%	1 ~ 120
SP054	TLM7	Torque limit 7	The torque limit ratio for torque limit signal 111 is set.	DEC		70	%	1 ~ 120
SP055	SETM	Speed deflection excessive timer	The time until the speed deflection excessive alarm is output is set. A time longer than the acceleration/deceleration time is set.	DEC		12	sec	0 ~ 60
SP056	PYVR	Variable excitation	The minimum value of the variable excitation ratio is set. If the gear noise is large, select a small value. Note that a larger value is effective for impact response.	DEC	*	50	%	0 ~ 100
SP057 ~ SP062			Not used. Set to 0.	DEC		0		~
SP063	OLT	Overload alarm detection time	The detection time constant for the motor overload alarm detection is set.	DEC		60	sec	0 ~ 1000
SP064		Overload alarm detection level.	The detection level of the motor overload alarm detection is set.	DEC		110	%	0 ~ 200

6. Status Display and Parameter Setting

< Class: Speed control >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP065	VCGN1	Variable speed loop proportional gain target value	The speed loop proportional gain magnification for SP022 (VGNP1) in the motor max. speed set in SP017 (TSP) is set.	DEC		100	%	0 ~ 1000
SP066	VCSN1	Variable speed loop proportional gain change start speed	The speed to start the speed loop proportional gain change is set. 	DEC		0	r/min	0 ~ 32767
SP067	VIGWA	Variable current loop gain change start speed	The speed to start current loop gain change is set.	DEC		5000	r/min	0 ~ 32767
SP068	VIGWB	Variable current loop gain change complete speed	The speed to complete current loop gain change is set.	DEC		10000	r/min	0 ~ 32767
SP069	VIGN	Variable current loop gain target value	The current loop gain (torque amount and excitation amount) magnification in the change complete speed set in SP068 (VIGWB) is set. The magnification will be 1 when set to 0.  <p>(Note) Refer to section 8. "Adjustment Procedures" for guidelines on setting SP067 to SP069.</p>	DEC		64		0 ~ 32767
SP070	FHz		Not used. Set to 0.			0		~
SP071 ~ SP082		Fixed control constant	This parameter is determined by Mitsubishi. Set to "0" unless designated otherwise.	DEC		0		~
SP083 ~ SP086		Fixed control constant	Not used. Set to 0.	DEC		0		~
SP087	DIQM	Variable torque limit magnification target value during deceleration	The minimum value of the torque limit value fluctuated during deceleration is set.	DEC		75	%	0 ~ 150
SP088	DIQN	Torque limit magnification change start speed during deceleration	The speed to start changing the torque limit value during deceleration is set. 	DEC		3000	r/min	0 ~ 32767
SP089 ~ SP093			Not used. Set to 0.	DEC		0		~

6. Status Display and Parameter Setting

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP094	LMAV	Load meter output filter	The load meter output filter time constant is set. When the standard value is set to 0, this time constant becomes 100ms.	DEC		0	2ms	0 ~ 32767
SP095			Not used. Set to 0.	DEC		0		~
SP096	EGAR	Encoder gear ratio	The gear ratio of the spindle end and encoder end (excluding the motor built-in encoder) is set as shown below. (1) 1 : 1 Setting value = 0 (2) 1 : 2 Setting value = 1 (3) 1 : 4 Setting value = 2 (4) 1 : 8 Setting value = 3 (5) 1 : 16 Setting value = 4	DEC		0		0 ~ 7

< Class: Orientation control >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP097	SPECO	Orientation specification	The orientation specifications are selected with bit correspondence. Refer to section 6.2 (2) for details.	HEX		0000		0000 ~ FFFF
SP098	VGOP	Speed loop gain proportional item during orientation	The speed loop proportional gain during orientation is set. The response will improve when increased but the vibration and sound will increase.	DEC		63	rad/s	0 ~ 1000
SP099	VGOI	Speed loop gain integral item during orientation	The speed loop integral gain during orientation is set.	DEC		60	1/10 rad/s	0 ~ 1000
SP100	VGOD	Speed loop gain delay advance item during orientation	The speed loop delay advance gain during orientation is set. PI control will be applied when 0 is set.	DEC		15	1/10 rad/s	0 ~ 1000
SP101	DINP	Orientation dummy in-position width	When using the orientation in-position early indexing function, set an in-position width larger than the specified in-position width: SP004 (OINP).	DEC		16	1/16 deg.	1 ~ 2880
SP102	OODR	Excessive error value during orientation	Set the excessive error value to be used during orientation.	DEC		32767	1/4 pulse (1 pulse = 0.088 deg.)	1 ~ 32767
SP103	FTM	Positioning complete off time timer	The time to forcibly turn off an index positioning complete signal separately from the orientation complete signal during indexing after the rising of the indexing function signal is set.	DEC		200	ms	1 ~ 10000
SP104	TLOR	Torque limit value during orientation servo lock	The torque limit value for orientation in-position output is set. Note that if the external torque limit signal is input, the torque limit value set with this parameter will be invalid.	DEC		100	%	1 ~ 120
SP105	IQGO	Current loop gain magnification 1 during orientation	The current loop gain (torque amount) magnification during orientation is set.	DEC		100	%	0 ~ 1000
SP106	IDGO	Current loop gain magnification 2 during orientation	The current loop gain (excitation amount) magnification during orientation is set.	DEC		100	%	0 ~ 1000
SP107	CSP2	Deceleration ratio during orientation 2	The deceleration ratio during orientation for gear 001 is set. When the setting value is 0, the value will be the same as SP006 (CSP).	DEC	*	0		0 ~ 1000

6. Status Display and Parameter Setting

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP108	CSP3	Deceleration ratio during orientation 3	The deceleration ratio during orientation for gear 10 is set. When the setting value is 0, the value will be the same as SP006 (CSP).	DEC	*	0		1 ~ 1000
SP109	CSP4	Deceleration ratio during orientation 4	The deceleration ratio during orientation for gear 11 is set. When the setting value is 0, the value will be the same as SP006 (CSP).	DEC	*	0		1 ~ 1000
SP110	WCML	Turret index command magnification	The integer magnification (gear ratio 1: N) for the index position command (0 to 359) is set.	DEC	*	0	-fold	0 ~ 32767
SP111	WDEL	Turret index deceleration magnification	The magnification for the orientation deceleration rate is set using 256 as 1.	DEC		0	1/256-fold	0 ~ 32767
SP112	WCLP	Turret index clamp speed	The max. speed during indexing is set. This becomes the max. speed of the motor when set to 0.	DEC		0	r/min	0 ~ 32767
SP113	WINP	Turret index in-position width	The position error range is set in which an orientation (indexing) completed signal is output during turret indexing. This becomes the same as SP004 when set to 0.	DEC	*	0	1/16 degree	0 ~ 32767
SP114 ~ SP128			Not used. Set to 0.	DEC		0		~

< Class: C axis control >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP129 ~ SP176		C axis specification	Not used. Set to 0.			0		~

< Class: Spindle synchronization control >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP177	SPECS	Spindle synchronization specifications	The spindle synchronization specification selection is set with bit correspondence. Refer to section 6.2. (2) for details.	HEX		0000		0000 ~ FFFF
SP178	VGSP	Speed loop gain proportional item during spindle synchronization	The speed loop proportional gain during spindle synchronization is set.	DEC		63	rad/s	1 ~ 1000
SP179	VGSI	Speed loop gain integral item during spindle synchronization	The speed loop integral gain during spindle synchronization is set.	DEC		60	1/10 rad/s	1 ~ 1000
SP180	VGSD	Speed loop gain delay advance item during spindle synchronization	The speed loop delay advance gain during spindle synchronization is set. If 0 is set, PI control will be applied.	DEC		15	1/10 rad/s	1 ~ 1000
SP181	VCGS	Variable speed loop proportional gain target value during spindle synchronization	The speed loop proportional gain magnification for SP178 (VGSP) in the motor max. speed set in SP017 (TSP) during spindle synchronization is set.	DEC		100	%	0 ~ 1000

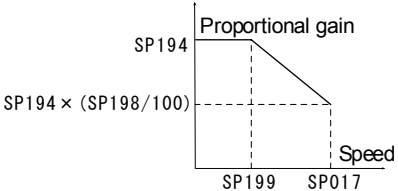
6. Status Display and Parameter Setting

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP182	VCSS	Variable speed loop proportional gain change start speed during spindle synchronization	<p>The speed is set at which the speed loop proportional gain starts to change during spindle synchronization.</p> <p style="text-align: center;"> $SP178$ $SP178 \times (SP181/100)$ $SP182$ $SP017$ </p>	DEC		0	rpm	0 ~ 32767
SP183	SYNY	Synchronization match speed during spindle synchronization	The speed command error range is set in which a synchronous speed match signal is output when changing from the speed loop to position loop during spindle synchronization.	DEC	*	20	rpm	0 ~ 1000
SP184			Not used. Set to 0.	DEC		0		
SP185	SINP	Spindle synchronization inposition width	The position error range for outputting the in-position signal during spindle synchronization is set.	DEC	*	16	1/16 deg.	1 ~ 2880
SP186	SODR	Excessive error width during spindle synchronization	The excessive error width for spindle synchronization is set.	DEC		32767	Pulse (1 pulse = 0.088 deg.)	1 ~ 32767
SP187	IQGS	Spindle synchronization current loop gain magnification 1	The current loop gain (torque amount) magnification for spindle synchronization is set.	DEC		100	%	0 ~ 1000
SP188	IDGS	Spindle synchronization current loop gain magnification 2	The current loop gain (exciting amount) magnification for spindle synchronization is set.	DEC		100	%	0 ~ 1000
SP189 ~ SP192			Not used. Set to 0.			0		

< Class: Synchronous tapping control >

SP193	SPECT	Synchronous tapping specifications	The synchronous tapping specification selection is set with bit correspondence. Refer to section 6.2. (2) for details.	HEX		0000		0000 ~ FFFF
SP194	VGTP	Speed loop gain proportional item during synchronous tapping	The speed loop proportional gain during synchronous tapping is set.	DEC		63	rad/s	0 ~ 1000
SP195	VGTI	Speed loop gain integral item during synchronous tapping	The speed loop integral gain during synchronous tapping is set.	DEC		60	1/10 rad/s	0 ~ 1000
SP196	VGTD	Speed loop gain delay advance item during synchronous tapping	The speed loop delay advance gain during synchronous tapping is set. If 0 is set, PI control will be applied.	DEC		15	1/10 rad/s	0 ~ 1000
SP197			Not used. Set to 0.	DEC		0		
SP198	VCGT	Variable speed loop proportional gain target value during synchronous tapping	The speed loop proportional gain magnification for SP194 (VGSP) in the motor max. speed set in SP017 (TSP) during synchronous tapping is set.	DEC		100	%	0 ~ 1000

6. Status Display and Parameter Setting

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP199	VCST	Variable speed loop proportional gain change start speed during synchronous tapping	<p>The speed to start speed loop change during synchronous tapping is set.</p>  <p style="text-align: center;"> $SP194$ Proportional gain $SP194 \times (SP198/100)$ Speed $SP199$ $SP017$ </p>	DEC		0	r/min	0 ~ 32767
SP200	FFC1	Synchronous tapping acceleration feed forward gain (gear 1)	<p>The acceleration feed forward gain for when gear 000 is selected during synchronous tapping is set.</p> <p>Set this when the relative position error with the Z phase servo is large.</p>	DEC		0	%	0 ~ 32767
SP201	FFC2	Synchronous tapping acceleration feed forward gain (gear 2)	<p>The acceleration feed forward gain for when gear 001 is selected during synchronous tapping is set.</p>	DEC		0	%	0 ~ 32767
SP202	FFC3	Synchronous tapping acceleration feed forward gain (gear 3)	<p>The acceleration feed forward gain for when gear 010 is selected during synchronous tapping is set.</p>	DEC		0	%	0 ~ 32767
SP203	FFC4	Synchronous tapping acceleration feed forward gain (gear 4)	<p>The acceleration feed forward gain for when gear 011 is selected during synchronous tapping is set.</p>	DEC		0	%	0 ~ 32767
SP204 ~ SP213			Not used. Set to 0.	DEC		0		~
SP214	TZRN	Synchronous tapping zero point return speed	<p>This is valid when SP193(SPECT)-bitE is set to 0.</p> <p>The zero point return speed for when changing from a speed loop to a position loop is set.</p>	DEC	*	50	r/min	1 ~ 1000
SP215	TPDT	Synchronous tapping zero point return deceleration point	<p>This is valid when SP193(SPECT)-bitE is set to 0.</p> <p>The deceleration point for decelerating to the target stop point from the synchronous tapping zero point return speed is set.</p> <p>Set a large value if the stopping point is overrun.</p>	DEC	*	1		1 ~ 10000
SP216	TPST	Synchronous tapping zero point return shift amount	<p>This is valid when SP193(SPECT)-bitE is set to 0.</p> <p>The synchronous tapping zero point position is set.</p>	DEC	*	0		0 ~ 4095
SP217	TINP	Synchronous tapping in-position width	<p>The position error range for outputting the in-position signal during synchronous tapping is set.</p>	DEC	*	16	1/16 deg.	1 ~ 2880
SP218	TODR	Excessive error width during synchronous tapping	<p>The excessive error width for synchronous tapping is set.</p>	DEC		32767	Pulse	1 ~ 32767 (1 pulse = 0.088 deg.)
SP219	IQGT	Synchronous tapping current loop gain magnification 1	<p>The loop gain (torque amount) magnification for synchronous tapping is set.</p>	DEC		100	%	1 _ 1000
SP220	IDGT	Synchronous tapping current loop gain magnification 2	<p>The loop gain (exciting amount) magnification for synchronous tapping is set.</p>	DEC		100	%	1 _ 1000
SP221 ~ SP224			Not used. Set to 0.	DEC		0		

6. Status Display and Parameter Setting

< Class: Others >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP225 ~ SP252			Not used. Set to 0.	DEC		0		~
SP253	DA1NO	DA output channel 1 data No.	The output data No. for the 1st channel of the D/A output function is set. The speedometer is output when this is set to 0. Refer to the output specifications in section 6.5 for details.	DEC	*	0		0 ~ 32767
SP254	DA2NO	DA output channel 2 data No.	The output data No. for the 2nd channel of the D/A output function is set. The load meter is output when this is set to 0. Refer to the output specifications in section 6.5 for details.	DEC	*	0		0 ~ 32767
SP255	DA1MP Y	D/A output channel 1 magnification	The output data magnification for the 1st channel of the D/A output function is set. The magnification is 1 when this is set to 0. Refer to the output specifications in section 6.5 for details.	DEC	*	0	1/256-fold	0 ~ 32767
SP256	DA2MP Y	D/A output channel 2 magnification	The output data magnification for the 2nd channel of the D/A output function is set. The magnification is 1 when this is set to 0. Refer to the output specifications in section 6.5 for details.	DEC	*	0	1/256-fold	0 ~ 32767

< Class: Motor constants >

No.	Abbr.	Name	Description	TYP	CNG	Standard setting	Unit	Tolerable setting range
SP257 ~ SP320	RPM ~ BSD	Motor constant (H-coil)	This is valid only in the following two conditions. (1) When SP034 (SFNC2) - bit 0 is 1 and bit 2 is 0. The constants for the motor that is a special motor not described in 6.2.(2), and is not a winding changeover motor. (2) When SP034 (SFNC2) - bit 0 is 1 and bit 2 is 1. The constants for the winding changeover motor H winding side motor are set. (Note) This parameter must not be changed by the user.	HEX		0000		0000 ~ FFFF
SP321 ~ SP384			Not used. Set to 0.	HEX		0000		~

6. Status Display and Parameter Setting

(2) Details of parameters corresponding to bits

Name	Abbr.	Description	TYP																																
SP033	SFNC1	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td> </tr> </table>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
SP034	SFNC2	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: right;">mtsl</td> </tr> </table> <p>[mtsl] Motor constant (0: standard/1: special)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																mtsl	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
															mtsl																				
SP035	SFNC3	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: right;">hbsd</td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: right;">hwid</td> </tr> </table> <p>[hwid] Wide constant output (0: invalid/1: valid)</p> <p>[hbsd] Base slide (0: invalid/1: valid)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0														hbsd		hwid	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
													hbsd		hwid																				

6. Status Display and Parameter Setting

Name	Abbr.	Description	TYP																																
SP036	SFNC4	<table style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td> </tr> </table>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
SP037	SFNC5	<table style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">nstv</td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">plgo</td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">enco</td> </tr> </table> <p>[enco] Encoder orientation</p> <p>[plgo] PLG orientation</p> <p>[nstv] No signal detection type (0: constant monitor/ 1: only during position loop or orientation)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0								nstv						plgo		enco	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
							nstv						plgo		enco																				
SP038	SFNC6	<table style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">open</td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">pftm</td><td style="border: 1px solid black; width: 20px; height: 15px;"></td><td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">alty</td> </tr> </table> <p>[alty] Deceleration stop during alarm (0: invalid/1: valid) .. Note, only during specific alarms</p> <p>[pftm] Positioning data for thread cutting (0: invalid/1: valid)</p> <p>[open] Open loop operation (0: invalid/1: valid)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	open													pftm		alty	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
open													pftm		alty																				

6. Status Display and Parameter Setting

Name	Abbr.	Description	TYP																																
SP097	SPECO	<table style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">tlet</td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">fdir</td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">pyfx</td> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">dmin</td> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">odi2</td> <td style="border: 1px solid black; width: 20px; height: 15px; text-align: center;">odi1</td> </tr> </table> <p>Orientation control</p> <p>[odi2, odi1] Orientation rotation direction</p> <p style="padding-left: 20px;">0 0 Pre (orientation from rotation rotated in during speed control)</p> <p style="padding-left: 20px;">0 1 Motor forward run</p> <p style="padding-left: 20px;">1 0 Motor reverse run</p> <p style="padding-left: 20px;">1 1 (Prohibited)</p> <p>[dmin] Dummy in-position (0: Invalid/1: Valid)</p> <p>[pyfx] Fixed excitation during orientation servo lock (0: Invalid/1: Valid)</p> <p>[fdir] Encoder detector polarity (0: (+)/1: (-))</p> <p>[tlet] Turret indexing (0: invalid/1: valid)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0								tlet			fdir		pyfx	dmin	odi2	odi1	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
							tlet			fdir		pyfx	dmin	odi2	odi1																				
SP129	SPECC	<table style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> <td style="border: 1px solid black; width: 20px; height: 15px;"></td> </tr> </table> <p>C axis control</p> <p style="padding-left: 20px;">Not used.</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				

6. Status Display and Parameter Setting

Name	Abbr.	Description	TYP																																
SP177	SPECS	<table style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px; text-align: center;">odl</td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px; text-align: center;">fdir</td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px; text-align: center;">pyfx</td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px; text-align: center;">fclx</td> </tr> </table> <p>Spindle synchronization control [fclx] Semi-closed loop control (0: Invalid/1: Valid)</p> <p>[pyfx] Fixed excitation during position loop (0: Invalid/1: Valid)</p> <p>[fdir] Position detector polarity (0: (+)/1: (-))</p> <p>[odl] Excessive error width scale (0: 1-fold/1: 8-fold)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0			odl								fdir		pyfx			fclx	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
		odl								fdir		pyfx			fclx																				
SP193	SPECT	<table style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="text-align: center;">F</td><td style="text-align: center;">E</td><td style="text-align: center;">D</td><td style="text-align: center;">C</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">9</td><td style="text-align: center;">8</td><td style="text-align: center;">7</td><td style="text-align: center;">6</td><td style="text-align: center;">5</td><td style="text-align: center;">4</td><td style="text-align: center;">3</td><td style="text-align: center;">2</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">zrth</td><td style="border: 1px solid black; width: 20px; text-align: center;">ptyp</td><td style="border: 1px solid black; width: 20px; text-align: center;">odl</td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px; text-align: center;">fdir</td><td style="border: 1px solid black; width: 20px; text-align: center;">cdir</td><td style="border: 1px solid black; width: 20px; text-align: center;">pyfx</td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px;"></td><td style="border: 1px solid black; width: 20px; text-align: center;">fclx</td> </tr> </table> <p>Synchronous tapping control [fclx] Semi-closed loop control (0: Invalid/1: Valid)</p> <p>[pyfx] Fixed excitation during position loop (0: Invalid/1: Valid)</p> <p>[cdir] Command polarity (0: CCW/1: CW)</p> <p>[fdir] Position detector polarity (0: (+)/1: (-))</p> <p>[odl] Excessive error width scale (0: 1-fold/1: 8-fold)</p> <p>[ptyp] Position control changeover type (0: After zero point return/1: After deceleration stop)</p> <p>[ztrn] Zero point return direction (0: CCW/1: CW)</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	zrth	ptyp	odl								fdir	cdir	pyfx			fclx	HEX setting
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																				
zrth	ptyp	odl								fdir	cdir	pyfx			fclx																				

6. Status Display and Parameter Setting

(3) Drive unit capacity, motor type and regenerative resistor type selection details

Name	Abbr.	Description	TYP																																																												
SP039	ATYP	<p>Select the capacity of the drive unit to be used.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Setting value</th> <th style="text-align: left;">Drive unit model</th> </tr> </thead> <tbody> <tr><td>0000</td><td>—</td></tr> <tr><td>0001</td><td>MDS-B-SPJ2-02</td></tr> <tr><td>0002</td><td>MDS-B-SPJ2-04</td></tr> <tr><td>0003</td><td>MDS-B-SPJ2-075</td></tr> <tr><td>0004</td><td>MDS-B-SPJ2-15</td></tr> <tr><td>0005</td><td>MDS-B-SPJ2-22</td></tr> <tr><td>0006</td><td>MDS-B-SPJ2-37</td></tr> <tr><td>0007</td><td>MDS-B-SPJ2-55</td></tr> <tr><td>0008</td><td>MDS-B-SPJ2-75</td></tr> <tr><td>0009</td><td>MDS-B-SPJ2-110/110C</td></tr> </tbody> </table>	Setting value	Drive unit model	0000	—	0001	MDS-B-SPJ2-02	0002	MDS-B-SPJ2-04	0003	MDS-B-SPJ2-075	0004	MDS-B-SPJ2-15	0005	MDS-B-SPJ2-22	0006	MDS-B-SPJ2-37	0007	MDS-B-SPJ2-55	0008	MDS-B-SPJ2-75	0009	MDS-B-SPJ2-110/110C	HEX setting																																						
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SP040	MTYP	<p>Set the motor to be used. This parameter is valid only when SP034 (SFNC2) - bit 0 is set to 0.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Setting value</th> <th style="text-align: left;">Motor model</th> <th style="text-align: left;">Max. speed (rpm)</th> <th style="text-align: left;">Corresponding drive unit model name</th> </tr> </thead> <tbody> <tr><td>1000</td><td>—</td><td>—</td><td>—</td></tr> <tr><td>1001</td><td>SJ-P0.2A</td><td>10000</td><td>MDS-B-SPJ2-02</td></tr> <tr><td>1002</td><td>SJ-P0.4A</td><td>10000</td><td>MDS-B-SPJ2-04</td></tr> <tr><td>1003</td><td>SJ-P0.75A</td><td>10000</td><td>MDS-B-SPJ2-075</td></tr> <tr><td>1004</td><td>SJ-P1.5A</td><td>10000</td><td>MDS-B-SPJ2-15</td></tr> <tr><td>1005</td><td>SJ-P2.2A</td><td>8000</td><td>MDS-B-SPJ2-22</td></tr> <tr><td>1006</td><td>SJ-P3.7A</td><td>8000</td><td>MDS-B-SPJ2-37</td></tr> <tr><td>1007</td><td>SJ-PF5.5-01</td><td>8000</td><td>MDS-B-SPJ2-55</td></tr> <tr><td>1008</td><td>SJ-PF7.5-01</td><td>8000</td><td>MDS-B-SPJ2-75</td></tr> <tr><td>1009</td><td>SJ-PF11-01</td><td>6000</td><td>MDS-B-SPJ2-110/110C</td></tr> </tbody> </table>	Setting value	Motor model	Max. speed (rpm)	Corresponding drive unit model name	1000	—	—	—	1001	SJ-P0.2A	10000	MDS-B-SPJ2-02	1002	SJ-P0.4A	10000	MDS-B-SPJ2-04	1003	SJ-P0.75A	10000	MDS-B-SPJ2-075	1004	SJ-P1.5A	10000	MDS-B-SPJ2-15	1005	SJ-P2.2A	8000	MDS-B-SPJ2-22	1006	SJ-P3.7A	8000	MDS-B-SPJ2-37	1007	SJ-PF5.5-01	8000	MDS-B-SPJ2-55	1008	SJ-PF7.5-01	8000	MDS-B-SPJ2-75	1009	SJ-PF11-01	6000	MDS-B-SPJ2-110/110C	HEX setting																
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1007	SJ-PF5.5-01	8000	MDS-B-SPJ2-55																																																												
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SP041	PTYP	<p>Select a value from the following table according to the regenerative resistor being used.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Setting value</th> <th style="text-align: left;">Regenerative resistor model</th> <th style="text-align: left;">Capacity [W]</th> <th style="text-align: left;">Resistance value [Ω]</th> </tr> </thead> <tbody> <tr><td>0000</td><td>—</td><td>—</td><td>—</td></tr> <tr><td>2000</td><td>No connection</td><td>—</td><td>—</td></tr> <tr><td>2100</td><td>FCUA-RB04</td><td>60</td><td>200</td></tr> <tr><td>2200</td><td>FCUA-RB075</td><td>80</td><td>100</td></tr> <tr><td>2300</td><td>FCUA-RB15</td><td>120</td><td>60</td></tr> <tr><td>2400</td><td>FCUA-RB22</td><td>155</td><td>40</td></tr> <tr><td>2500</td><td>FCUA-RB37</td><td>185</td><td>25</td></tr> <tr><td>2600</td><td>FCUA-RB55</td><td>340</td><td>20</td></tr> <tr><td>2700</td><td>FCUA-RB75/2</td><td>340/680</td><td>30/15</td></tr> <tr><td>2800</td><td>R-UNIT1</td><td>700</td><td>30</td></tr> <tr><td>2900</td><td>R-UNIT2</td><td>700</td><td>15</td></tr> <tr><td>2A00</td><td>R-UNIT3</td><td>2100</td><td>15</td></tr> <tr><td>2B00</td><td>R-UNIT4</td><td>2100</td><td>10</td></tr> <tr><td>2C00</td><td>R-UNIT5</td><td>3100</td><td>10</td></tr> </tbody> </table> <p style="text-align: right; margin-right: 20px;">(Note 1)</p> <p>Note 1) This setting for the FCUA-RB75/2 is used when only one unit is used, or when two units connected with a parallel connection are used.</p>	Setting value	Regenerative resistor model	Capacity [W]	Resistance value [Ω]	0000	—	—	—	2000	No connection	—	—	2100	FCUA-RB04	60	200	2200	FCUA-RB075	80	100	2300	FCUA-RB15	120	60	2400	FCUA-RB22	155	40	2500	FCUA-RB37	185	25	2600	FCUA-RB55	340	20	2700	FCUA-RB75/2	340/680	30/15	2800	R-UNIT1	700	30	2900	R-UNIT2	700	15	2A00	R-UNIT3	2100	15	2B00	R-UNIT4	2100	10	2C00	R-UNIT5	3100	10	HEX setting
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2400	FCUA-RB22	155	40																																																												
2500	FCUA-RB37	185	25																																																												
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2A00	R-UNIT3	2100	15																																																												
2B00	R-UNIT4	2100	10																																																												
2C00	R-UNIT5	3100	10																																																												

6.3 SPINDLE SPECIFICATION PARAMETERS screen

The spindle parameters are divided into those transferred from the NC to the spindle drive unit and those used on the NC side.

(1) Parameters transferred from the NC to the spindle drive unit

The parameters (384 total) indicated on page (6-2/N) to (6-8/N) are transferred from the NC to the spindle drive unit.

(2) Parameters used on the NC side

The spindle specification parameters indicated on this page are used on the NC side.

[SPINDLE SPEC.]					
#					
1	slimt	1	8000	17	stapt1 200
2		2	8000	18	2 400
3		3	8000	19	3 1000
4		4	8000	20	4 2000
5	smax	1	6000	21	sori 0
6		2	6000	22	sgear 0
7		3	6000	23	smini 10
8		4	6000	24	serr 0
9	ssift	1	0	25	sname 0
10		2	0	26	
11		3	0	27	senc_pno 0
12		4	0	28	sana_pno 0
13	stap	1	1500	29	spfig 0
14		2	3000	30	senc_no 0
15		3	4000	31	sana_no 0
16		4	5000	32	smcp-no 0
#() DATA()					

#	Item	Details	Setting range (unit)
1 2 3 4	slimt 1 2 3 4 Speed limit	Gear 00 01 The spindle speed corresponding to 10 the max. motor speed in each gear is 11 set.	0 ~ 99999 (rpm)
5 6 7 8	smax 1 2 3 4 Max. speed	Gear 00 01 The spindle speed in each gear is 10 set. 11 Set so that slimt ≥ smax.	0 ~ 99999 (rpm)
9 10 11 12	ssift 1 2 3 4 Shift speed	Gear 00 01 The spindle speed for shifting gears 10 in each gear is set. 11	0 ~ 32767 (rpm)
13 14 15 16	stap 1 2 3 4 Max. tap speed	Gear 00 01 The max. spindle speed during the 10 tap cycle in each gear is set. 11	0 ~ 99999 (rpm)
17 18 19 20	stapt 1 2 3 4 Tap time constant	Gear 00 01 The time constant to the max. tap 10 speed during the constant 11 inclination tap cycle is set.	0 ~ 5000 (msec)
22	sgear Encoder gear ratio	The gear ratio between the spindle and the encoder is set.	0 : 1/1 1 : 1/2 2 : 1/4 3 : 1/8
23	smini Min. speed	The min. spindle speed is set. The spindle rotates at this speed even if an S command is input that is less than this value.	0 ~ 32767 (rpm)

6. Status Display and Parameter Setting

6.4 SPINDLE MONITOR screen

The current status of the spindle can be confirmed on the NC screen. That monitor screen is shown on this page.

[SPINDLE MONITOR]									
					76543210				
GAIN (1/sec)	33	D/I	1L	00000011	UNIT TYP		B-SPJ2-37		
DROOP (I)	3103		H	00000001	UNIT NO		75220100		
SPEED (rpm)	1500		2L	00000000	S/W VER		527000A1		
LOAD (%)	15		H	00000000	1WORK TIME		72		
AMP DISP	D4		3L	00001000	2ALM HIST	1	[46]	10	
ALARM			H	00000001		2	[23]	5	
CYC CNT (P)	10240		4L	00000000		3	[52]	4	
			H	00000000		4	[53]	4	
						5	[37]	0	
		D/O	1L	00000011		6	[37]	0	
			H	00100001		7	[00]	0	
			2L	00000000		8	[00]	0	
			H	00000000					
			3L	00001000	MNT			00000000	
			H	00000001	/SYS			00000000	
			4L	00000110					
			H	00000000					

Data	Unit	Display details
GAIN	1/sec	The position loop gain during operation of the spindle with the position command is displayed.
DROOP	Pulse	The position error amount during operation of the spindle with the position command is displayed.
SPEED	r/min	The motor speed is displayed.
LOAD	%	The motor load (load rate) is displayed. The motor's 30 min. rated output is 100%.
AMP DISP (Amplifier display)		The 7-segment LED display of the spindle drive unit is displayed.
ALARM		If an alarm other than that displayed on the 7-segment LED display of the spindle drive unit occurs, that alarm No. is displayed.
CYC CNT (Cycle counter)		The current position from the reference position (Z phase) of the position detector is displayed when operating the spindle with the position command.
D/I (Control input)	1L H	The control input signal 1 input from the NC to the spindle drive unit is displayed with bit correspondence. (Refer to the subsequent pages for details.)
D/I (Control input)	2L H	Same as above (Control input signal 2)
D/I (Control input)	3L H	Same as above (Control input signal 3)
D/I (Control input)	4L H	Same as above (Control input signal 4)
D/O (Control output)	1L H	The control output signal 1 output from the spindle drive unit to the NC is displayed with bit correspondence. (Refer to the subsequent pages for details.)
D/O (Control output)	2L H	Same as above (Control output signal 2)
D/O (Control output)	3L H	Same as above (Control output signal 3)
D/O (Control output)	4L H	Same as above (Control output signal 4)
UNIT TYP (Amplifier type)		The spindle drive unit type is displayed.
UNIT NO (Amplifier manufacturing No.)		The manufacturing No. of the spindle drive unit is displayed.
S/W VER (Software version)		The main software version in the spindle drive unit is displayed.
1 WORK TIME		The cumulative work time of the spindle drive unit is displayed.
2 ALM HIST 1 to 8 (2 Alarm history 1 to 8)		The alarm occurrence history is displayed. 1 is the latest alarm.

6. Status Display and Parameter Setting

(1) Control input

1) Control input 1 L,
H

L	0	Ready ON command	H	8	Torque limit 1
	1	Servo ON command		9	Torque limit 2
	2			A	Torque limit 3
	3			B	
	4			C	
	5			D	
	6	Parameter conversion command		E	
	7	Servo alarm reset command		F	Cutting

2) Control input 2 L,
H

L	0	* Not used.	H	8	* Not used.
	1			9	
	2			A	
	3			B	
	4			C	
	5			D	
	6			E	
	7			F	

3) Control input 3 L,
H

L	0	Spindle control mode selection command 1	H	8	Forward run start command
	1	Spindle control mode selection command 2		9	Reverse run start command
	2	Spindle control mode selection command 3		A	Index forward run command
	3	Spindle control mode selection command 4		B	Index reverse run command
	4	Spindle control mode selection command 5		C	Orientation start command
	5	Gear selection command 1		D	
	6	Gear selection command 2		E	Sub-motor selection command (during 1-amplifier 2-motor changeover)
	7	Gear selection command 3		F	

6. Status Display and Parameter Setting

4) Control input 4 L,
H

L	0	* Not used.	H	8	* Not used.
	1			9	
	2			A	
	3			B	
	4			C	
	5			D	
	6			E	
	7			F	

(2) Control output

1) Control output 1 L,
H

L	0	Ready ON	H	8	In torque limit 1
	1	Servo ON		9	In torque limit 2
	2			A	In torque limit 3
	3			B	
	4	Drive unit warning		C	
	5			D	Z phase passed
	6	Converting parameter		E	Position loop in-position
	7	Alarm		F	In current limit

2) Control output 2 L,
H

L	0	* Not used.	H	8	* Not used.
	1			9	
	2			A	
	3			B	
	4			C	
	5			D	
	6			E	
	7			F	

6. Status Display and Parameter Setting

3) Control output 3 L,
H

L	0	In spindle control mode selection command 1	H	8	In forward run
	1	In spindle control mode selection command 2		9	In reverse run
	2	In spindle control mode selection command 3		A	In index forward run command
	3	In spindle control mode selection command 4		B	In index reverse run command
	4	In spindle control mode selection command 5		C	In orientation start command
	5	In gear selection command 1		D	
	6	In gear selection command 2		E	In sub-motor selection command (during 1-amplifier 2-motor changeover)
	7	In gear selection command 3		F	

4) Control output 4 L,
H

L	0	Current detection	H	8	
	1	Speed detection		9	
	2	Speed reached		A	
	3	Zero speed		B	
	4	Orientation completed		C	
	5	Synchronization speed match		D	
	6	Changing coil		E	
	7	Index positioning completed		F	

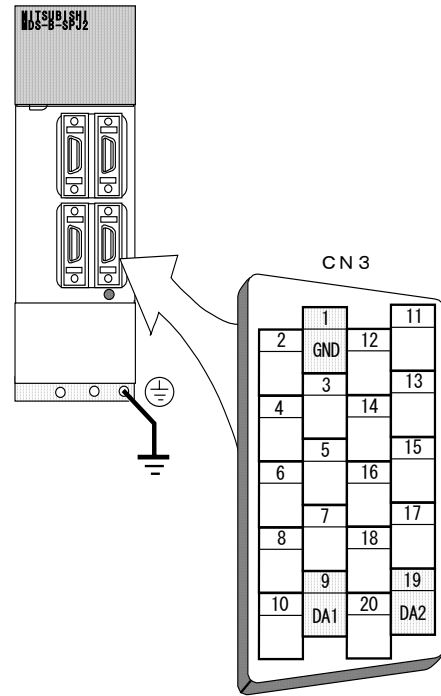
6.5 D/A output specifications

(1) Outline

A function for D/A output of various control data is mounted on the MDS-B-SPJ2 spindle amplifier. The drive unit status and data can be confirmed using this D/A output function.

(2) Output specifications

- No. of channels : 2ch.
- Output cycle : 0.4ms (min. value)
- Output accuracy : 8bit
- Output voltage : 0 to +10V
- Output pin : CN3 connector
 - DA1 = 9-pin
 - DA2 = 19-pin
 - GND = 1-pin
- Magnification setting : $\pm 1/256$ to ± 128 -fold



(3) Parameters

The data Nos. and output magnifications for each channel are set using the following parameters.

No.	Abbreviation	Name	Details
SP253	DA1N0	DA output channel 1 data No.	The output data No. for the 1st channel of the D/A output function is set. * The speedometer is output when this is set to 0. Refer to section (4) "Output data Nos." when this parameter is set to a value other than 0.
SP254	DA2N0	DA output channel 2 data No.	The output data No. for the 2nd channel of the D/A output function is set. * The load meter is output when this is set to 0. Refer to section (4) "Output data Nos." when this parameter is set to a value other than 0.
SP255	DA1MPY	DA output channel 1 magnification	The output data magnification for the 1st channel of the D/A output function is set. * Magnification = Setting value/256 -fold The magnification is 1 when this is set to 0.
SP256	DA2MPY	DA output channel 2 magnification	The output data magnification for the 2nd channel of the D/A output function is set. * Magnification = Setting value/256 -fold The magnification is 1 when this is set to 0.

6. Status Display and Parameter Setting

(4) Output data Nos.

The No. of the data to be D/A output is set in SP253 and SP254.

The correlation between the output data and the data No. is shown in the following table.

* Brackets [] indicate the conversion value when the output voltage is changed to 1V.
(Note that this is for a magnification of 1)

No. (= parameter setting value)	CH1		CH2	
	Output data	Unit	Output data	Unit
0 (normal)	Speedometer output	Max. speed at 10V (Note 2)	Load meter output	120% load at 10V
2	Current command	Actual data (value is equivalent to 100% when it equals 4096) [0.625%/V] (Note 1)	Same as for CH1	
3	Current feedback	Actual data (value is equivalent to 100% when it equals 4096) [0.625%/V] (Note 1)		
4	Speed feedback	Actual data (= r/min unit) [25.6r/min/v]		
6	Position droop (low-order)	Interpolation unit (value is equivalent to 360° when it equals 23040000) [Low-order: 0.0004°/v, high-order: 26.2°/v]		
8	(high-order)			
8	Position FΔt (high-order)	Interpolation unit/NC communication cycle [Low-order: 0.0004°/v, high-order: 26.2°/v]		
9	(low-order)			
10	Position command (high-order)	Interpolation unit (value is equivalent to 360° when it equals 23040000) [Low-order: 0.0004°/v, high-order: 26.2°/v]		
11	(low-order)			
12	Feedback position (high-order)	Interpolation unit (value is equivalent to 360° when it equals 23040000) [Low-order: 0.0004°/v, high-order: 26.2°/v]		
13	(low-order)			
80	Control input 1	Bit correspondence		
81	2			
82	3			
83	4			
84	Control output 1	Bit correspondence		
85	2			
86	3			
87	4			
125	Test output sawtooth wave	0 ~ +10V		
126	Test output rectangular wave			
127	Test output OV			

(Note 1) The "%" of current commands and current feedback indicates 100% at the motor 30 min. rated output.

(Note 2) The motor speed during speedometer 10V output can be changed with parameter "SP249". Set the required speed (r/min). A 10V output at the setting speed will result.
(Note that when SP249 is set to 0, the speed follows parameter SP017 "Max. speed".)

6. Status Display and Parameter Setting

(5) Output magnification setting

The output magnification of the data to be D/A output is set in SP255 and SP256. The output data (DATA) is calculated using equation 1.

$\text{DATA} = \text{Actual data} \times \frac{\text{SP255 (or SP256)}}{256}$	Equation (1)
---	--------------

The D/A output specifications of the output data are shown in Fig. 1 below.

- * When the data = 0, the output is 5V. (0 offset: 5V)
- When the max. data = 127, the output is 10V.
- When the min. data = -128, the output is 0V.

(Note) The D/A output specifications for speedometer output and load meter output data are shown in Fig. 2 below. * When the data = 0, the output is 0V.

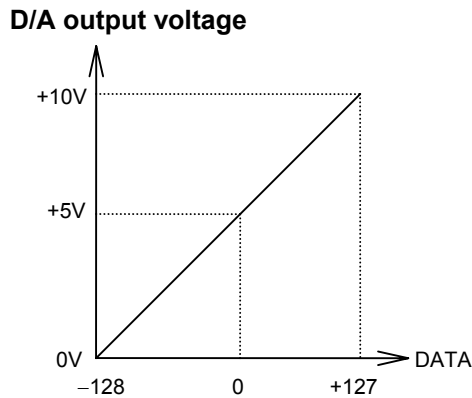


Fig. 1

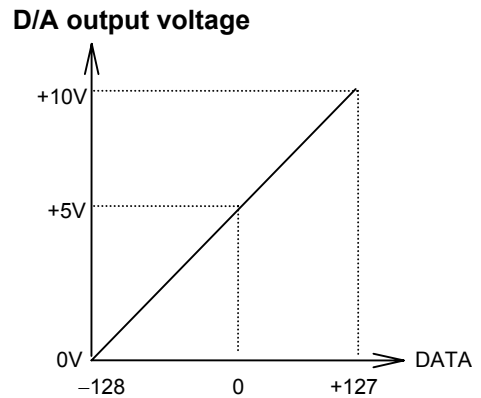


Fig. 2

(Example 1) Current command and current feedback

The data unit is a value equivalent to 100% when the actual data = 4096. Thus, for a +120% current feedback, 4915 is output (actual data = 4096 x 1.2 = 4915). When parameter: SP255 (SP256) is 256 (magnification =1), the D/A output voltage is determined by equation 1,

$$\text{DATA} = 4915 > +128$$

and the D/A output voltage max. value is exceeded.

Thus, the setting value of parameter: SP255 (SP256) in this case is as follows:

$$\text{DATA} = 4915 * \{\text{setting value}\} / 256 < 128$$

From this,

$$\{\text{setting value}\} < 6.666 \dots (= 128 * 256 / 4915)$$

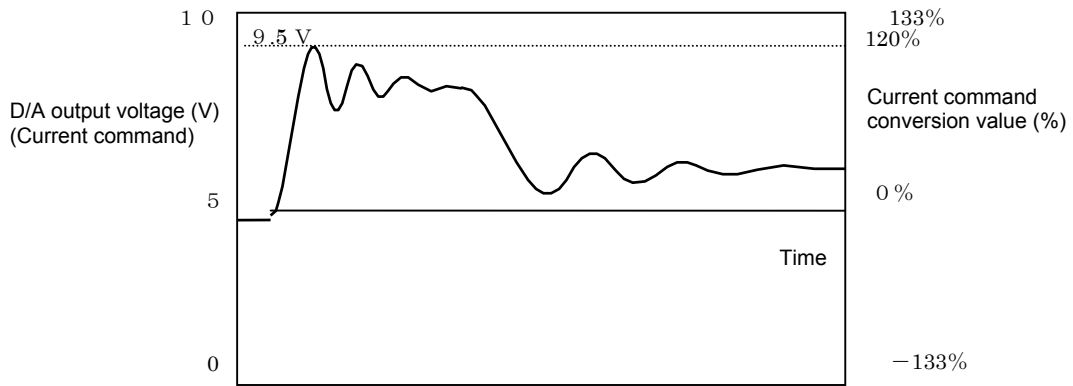
The data can be confirmed by setting SP255 (SP254) to 6.

The D/A output voltage value at this time is as follows:

$$\text{D/A output voltage} = 5V + \{4915 \times 6 / 256 \times (5V / 128)\} = 9.5V$$

The waveform examples are shown on the following page.

6. Status Display and Parameter Setting



Example of current command waveform

(Example 2) Speed feedback

The data unit is r/min.

Thus, when the motor rotates at +2000rpm, 2000 is output as the actual data.

When parameter: SP255 (SP256) is 256 (magnification =1), the D/A output voltage at this time exceeds the max. value. (DATA = 2000 > +128)

Thus, the setting value of parameter: SP255 (SP256) in this case is as follows:

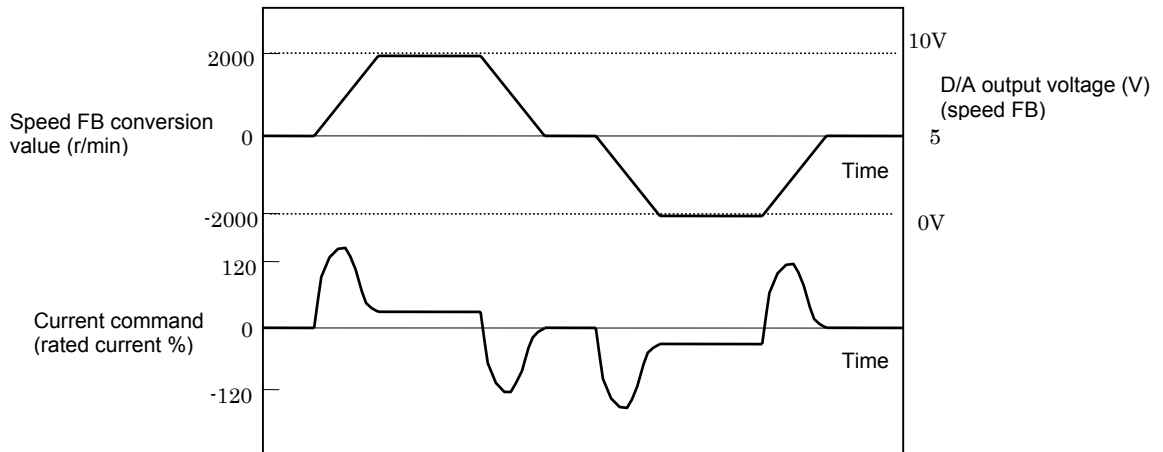
$$\text{DATA} = 2000 * \{\text{setting value}\} / 256 < 128$$

From this,

$$\{\text{setting value}\} < 16.384 (= 128 * 256/2000)$$

The data can be confirmed by setting SP255 (SP254) to 16.

The D/A output voltage value at this time is 9.88V (= 5V + {2000 x 16/256 x (5V/128)}).



Example of speed/current command waveforms during acceleration/deceleration.

6. Status Display and Parameter Setting

(Example 3) Position droop

The data unit is a value equivalent to 360° when the actual data = 23040000.
 Thus, for a +0.1° position droop, 6400 is output (actual data = $0.1 \times 23040000/360 = 6400$).
 When parameter: SP255 (SP256) is 256 (magnification =1), the D/A output voltage at this time exceeds the max. value. (DATA = 6400 > +128)
 Thus, the setting value of parameter SP255 (SP256) in this case is as follows:

$$\text{DATA} = 6400 * \{\text{setting value}\} / 256 < 128$$

 From this,

$$\{\text{setting value}\} < 5.12 \quad (=128 * 256/6400)$$

 The data can be confirmed by setting SP255 (SP254) to 5.
 The D/A output voltage value at this time is 9.88V (= 5V + {6400 × 5/256 × (5V/128)}).

(Example 4) Confirmation of the orientation completed signal with control output 4L

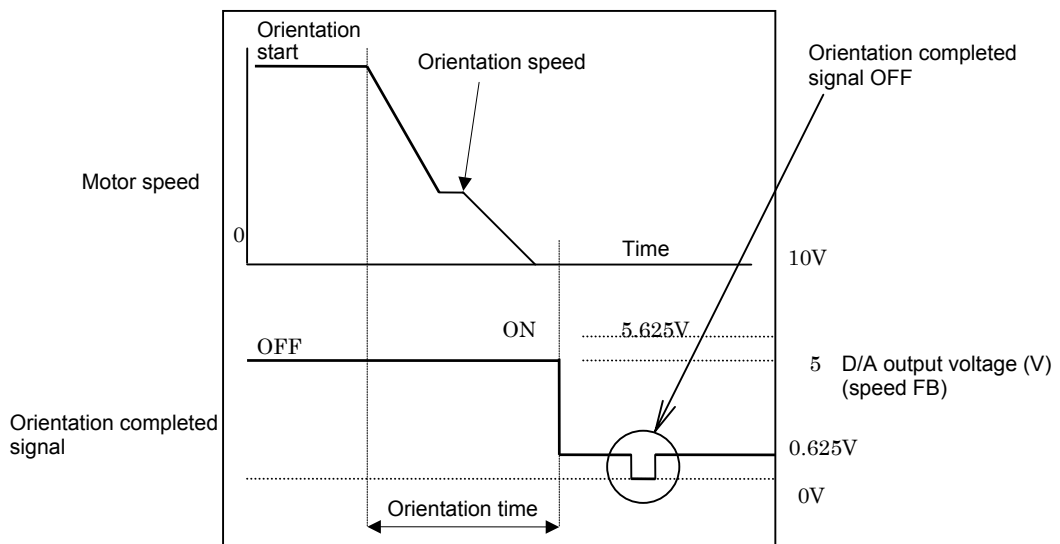
The data unit is bit correspondence data.
 Refer to section 1.1 "Spindle monitor" for the meanings of bit correspondence signals of control output 4L.
 The orientation completed signal corresponds to bit4 of the control output 4L.
 Thus, bit4 = 1 when the orientation completed signal is ON, and the following is output:
 Actual data = 16 (= 2⁴)

When parameter: SP255 (SP256) is 256 (magnification =1), the data can be confirmed because the D/A output voltage is smaller than the max. value (DATA = 16 < +128)
 The D/A output voltage value at this time is 5.625V (= 5V + {16 × 256/256 × (5V/128)}).
 Note that when a bit other than bit4 is ON, the voltage of that bit will be added to the 6.25V above. Therefore, confirm the data with the changed voltage of 0.625V (= 5.625V – 5V) during measurement of the actual orientation completed signal.
 (Note) When the orientation is completed, the index positioning completed signal (bit7) turns ON simultaneously, so the actual data = 128 (2⁷) is added.
 * D/A output voltage = 5V + { (16 + 128) × 256/256 × (5V/128)} = 10.625V

[Reference] When 10V is exceeded as in the above, the data will overflow. Thus, the actual voltage V becomes (= calculated D/A voltage – 10n : n being the largest positive integer when the right equation is positive.)

(Example) When the index positioning completed signal above is added.

$$V = 10.625 - 10 * 1 = 0.625 \text{ (V)}$$



6. Status Display and Parameter Setting

6.6 List of spindle protection functions and warning functions

Alarm No.	Abbr.	Name	Details	Operation	Reset method
10	UV	Undervoltage	The main circuit DC bus (PN) voltage became 200V or less.	a	PR
12	ME1	Memory error	An error occurred in the ROM check sum or RAM check of the spindle drive control card.	a	AR
13	SWE	Software process error	The software data process did not end within the set time.	a	PR
17	ADE	AD error	The current detection AD converter did not function correctly during initialization.	a	PR
21	NS	No signal (spindle encoder)	A signal (for orientation) was not input from the spindle encoder, or the input signal is not the correct level.	a	PR
23	OSE	Excessive speed deflection	The error of the speed command and the actual motor speed became higher than the specified value, and continued in that state for longer than the specified time.	a	PR
24	PG	Ground fault detection	A motor cable ground fault was detected. (Detected only at the ready ON instant.)	a	
30	ORG	Over-regeneration	Overheating of the regenerative resistor was detected due to frequent regeneration.	a	PR
31	OS	Overspeed	The actual motor speed exceeded 115% of the set max. speed.	a	PR
32	PME	Power module abnormality	A current exceeding the specified value flowed to the IPM or metal PCB used in the spindle drive main circuit section.	a	PR
33	OV	Overvoltage	The main circuit condenser voltage abnormally rose above the specified value due to the regeneration energy during data deceleration.	a	PR
34	DP	CRC error	A CRC error occurred in the communication data from the NC.	a	PR
35	DE	Data error	The movement command from the NC is abnormally large during position control.	a	PR
36	TE	Transmission error	The cyclic transmission from the NC was cut off.	a	PR
37	PE	Parameter error	There was an error in the spindle parameters transferred from the NC during initialization.	a	PR
38	TP1	Protocol error 1	A protocol error occurred during the communication with the NC.	a	PR
39	TP2	Protocol error 1	A protocol error occurred during the communication with the NC. (Information error)	a	PR
3B	PMOH	Power module overheat	The power components being used in the spindle drive main circuit section overheated.	a	PR
42	PLE	Feedback error (PLG)	The motor PLG rotation counter value error pulse exceeded the setting value (SP90: PLE).	a	PR
46	OHM	Motor overheat	Overload, or the motor cooling blower stop and the motor overheated causing the built-in thermal protector to function.	a	NR
50	OL	Overload	The motor current flowed for a time exceeding the overload time constant of the overload detection level.	a	NR
52	OD	Excessive error	The position tracking error was over the specified value in the position loop operation.	a	NR
5C	ORF	Orientation feedback error	After the orientation in-position is completed, the error of the command and feedback exceeded the setting value (SP114: OPER).	a	NR
88	WD	Watchdog	The software process did not finish within the specified time.	a	AR
E0	WOR	Over-regeneration alarm	The regenerative resistor load reached 80% of the alarm level.	b	–
E1	WOL	Overload warning	The motor current flowed at 80% or more of the detection time constant for a time exceeding the overload detection level.	b	–
E4	WPE	Parameter error warning	A value exceeding the tolerable value was set during ready ON.	b	–
E7	NCE	NC emergency stop warning	The emergency stop command was input from an external source.	c	–

Note 1) If the above protective functions activate, the alarm No. will be displayed on the 7-segment LED built into the spindle drive, and the following will occur.

[Operation]
a : The base of the spindle drive unit is shut off and the spindle motor coasts to a stop.
b : The spindle motor decelerates to a stop with regenerative braking, the base is shut off.
c : This is only a warning, and the operation is continued.

[Reset method]
AR : This alarm is reset when the spindle driver power is turned ON again.
PR : This alarm is reset when the NC power is turned ON again.
NR : This alarm is reset when the NC reset key is pressed.
– : This alarm is automatically reset after the warning is reset. Note that the start command must be turned OFF once for emergency stop warnings. (Except during orientation.)

Chapter 7 Optional Specifications and Parts

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7. Optional Specifications and Parts

7.1 Orient specifications (optional)

The following two types of orient specifications are available:

- (1) 4096 point orientation using encoder
- (2) 4096 point orientation using motor built-in encoder

7.1.1 4096 point orientation using encoder

(1) Connection

Refer to page "1.5 Configuration" for the connection of the encoder and spindle drive unit.

(2) Installation conditions

Mechanical characteristics for rotation

- a. Inertia : 100g-cm² or less
- b. Shaft friction torque : 1kg-cm or less
- c. Shaft angle acceleration : 10⁴rad/sec² or less
- d. Tolerable speed : 7,030rpm

Mechanical configuration

- a. Bearings : Non-lubricated for 100,000 or more rotations (at 2,000rpm)
Non-lubricated for 20,000 hours or more at 6,000rpm
- b. Shaft amplitude : 0.02mm or less at 15mm from end
- c. Tolerable load : Thrust direction 10kg (5kg during operation)
Radial direction 20kg (10kg during operation)
- d. Weight : 1.5kg max
- e. Squareness of flange to shaft : 0.05mm or less
- f. Flange matching eccentricity : 0.05mm or less

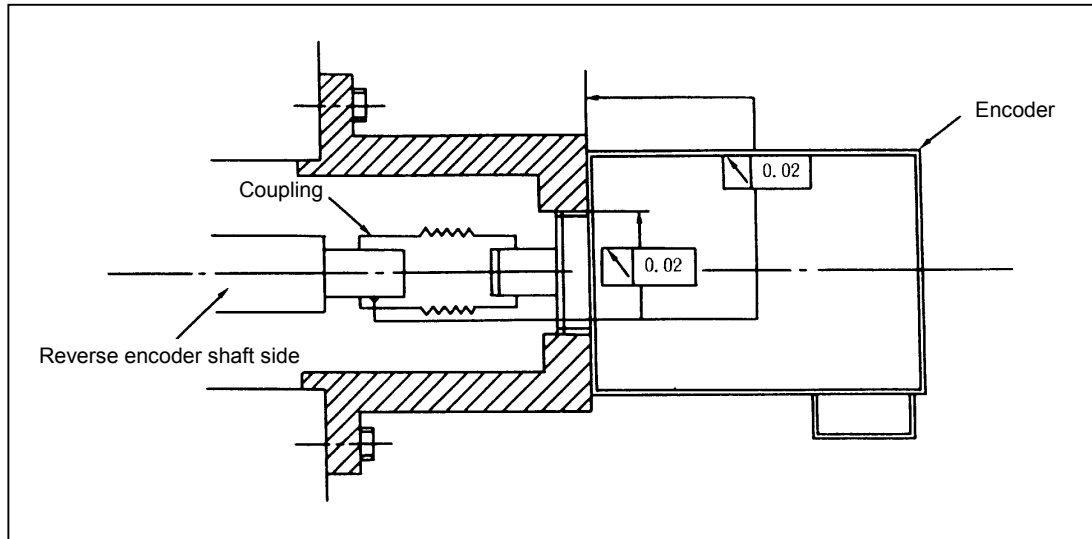
Working conditions

- a. Working temperature range : -5°C ~ +55°C
- b. Storage temperature range : -20°C ~ +85°C
- c. Humidity range : 95% PH (at 40°C) for 8 hours
- d. Vibration resistance : 5 to 50Hz, total vibration width 1.5mm, each axis for 30 min.
- e. Impact resistance : 30G 11msec, each axis 6 times

7. Optional Specifications and Parts

(3) Handling

- a. Use of a flexible coupling is recommended for the connection of the encoder and spindle shaft in terms of improving the encoder life and performance.
- b. Installation precision
The precision shown below should be secured for the encoder installation section engaging section and installation surface sway in order to maximize the coupling life.



c. Recommended coupling

		Recommendation 1	Recommendation 2
Maker		Tokushu Seiko	Eagle
Model		Model M1	FCS38A
Resonance frequency		1,374 Hz	3,515 Hz
Position detection error		0.8×10^{-3} deg	1.2×10^{-3} deg
Tolerable speed		20,000 rpm	10,000 rpm
Mis-alignment	Core deviation	0.7 mm	0.16 mm
	Angle displacement	1.5 deg	1.5 deg
Dimensions	Max. length	74.5 mm	33 mm
	Max. diameter	ø57 mm	ø38 mm

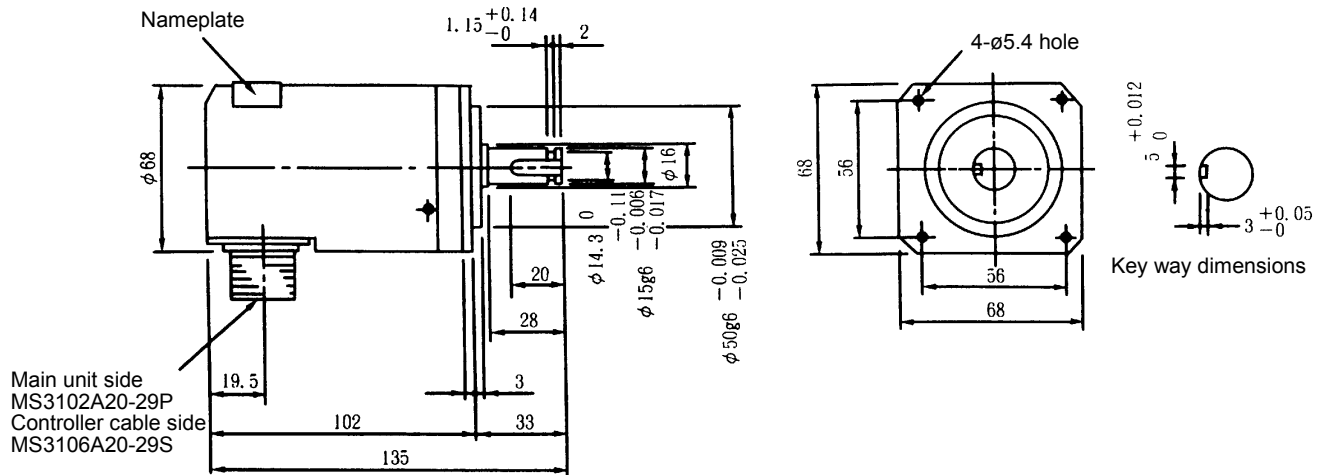
Refer to the coupling catalogue for details on the coupling.

7. Optional Specifications and Parts

(4) Encoder orientation parts (Optionally supplied parts)

Encoder (1024P/rev)

Encoder model	Tolerable speed
RFH-1024-22-1M-68	6000rpm
RFH-1024-22-1M-68-8	8000rpm



A	1chA	K	OV
B	2chZ	L	
C	1chB	M	
D		N	1ch \bar{A}
E	Case earth	P	2ch \bar{Z}
F		R	1ch \bar{B}
G		S	
H	+5V	T	
J			

7.1.2 4096 point orientation using motor built-in encoder

This can be used only when the motor and spindle connection is the direction connection or when the timing belt with a reduction ratio of 1 is used.

(1) Connection

Refer to page "1.5 Configuration" for the connection of the signals.

(2) Installation conditions

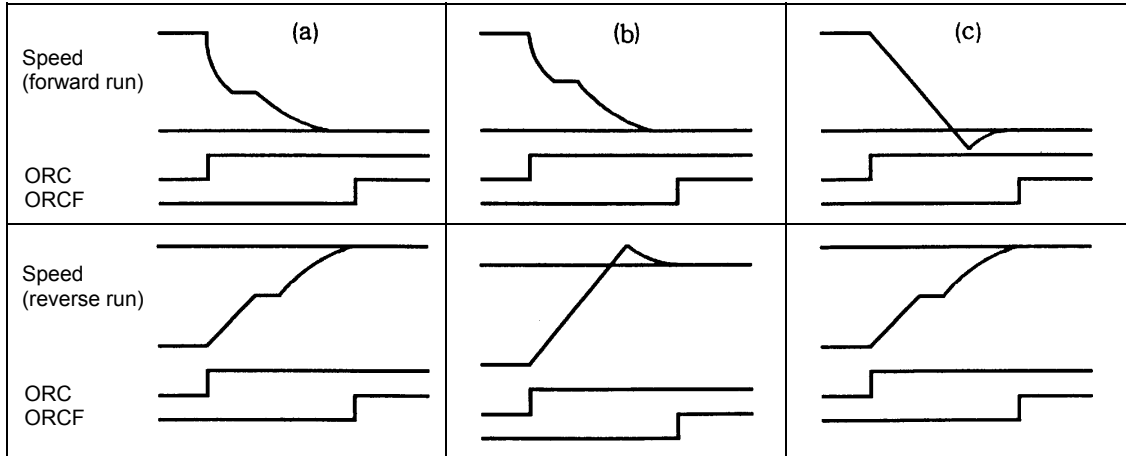
The encoder is built into the motor so no special detector needs to be installed.

7.1.3 Orientation operation

(1) Operation

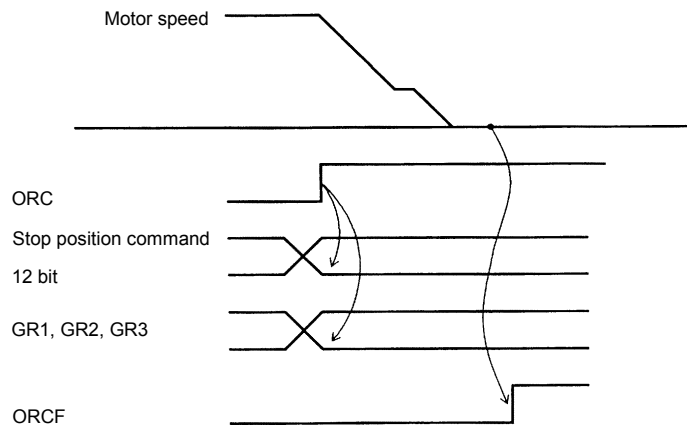
The three types of orientation stop methods are shown in the following drawings. The method is set in the parameter SPECO.

1. PRE (a) Orientation is carried out in the rotation direction.
2. Forward run orientation (b) Orientation is always carried out in the forward run direction.
3. Reverse run orientation (c) Orientation is always carried out in the reverse run direction.



(2) Operation sequence

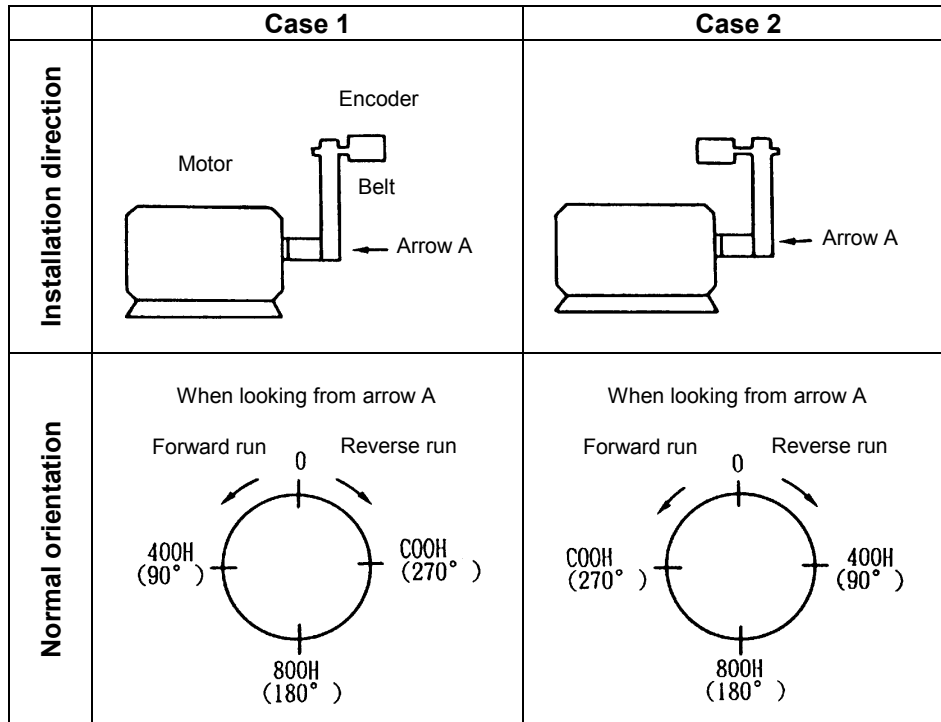
- 1) The motor speed changes from the operation speed to the position loop changeover speed when the orientation command ORC is ON. The multi-point orientation stop position command is read simultaneously.
- 2) The operation changes from speed control to position control (position loop gain parameter **(Note 1)**).
(The position loop changeover speed is automatically set by the position loop gain.)
- 3) At changeover, the distance to the orientation stop point is calculated, a deceleration stop is carried out with the constant deceleration pattern (parameter CSP), and the orientation status is entered.
- 4) The orientation completed signal ORCF turns ON when the in-position range (parameter OINP) is entered.
- 5) The stop position zero point movement is carried out according to parameter OPST.
- 6) When the orientation command (ORC) is canceled, the motor returns to the speed of the speed command issued at that time.



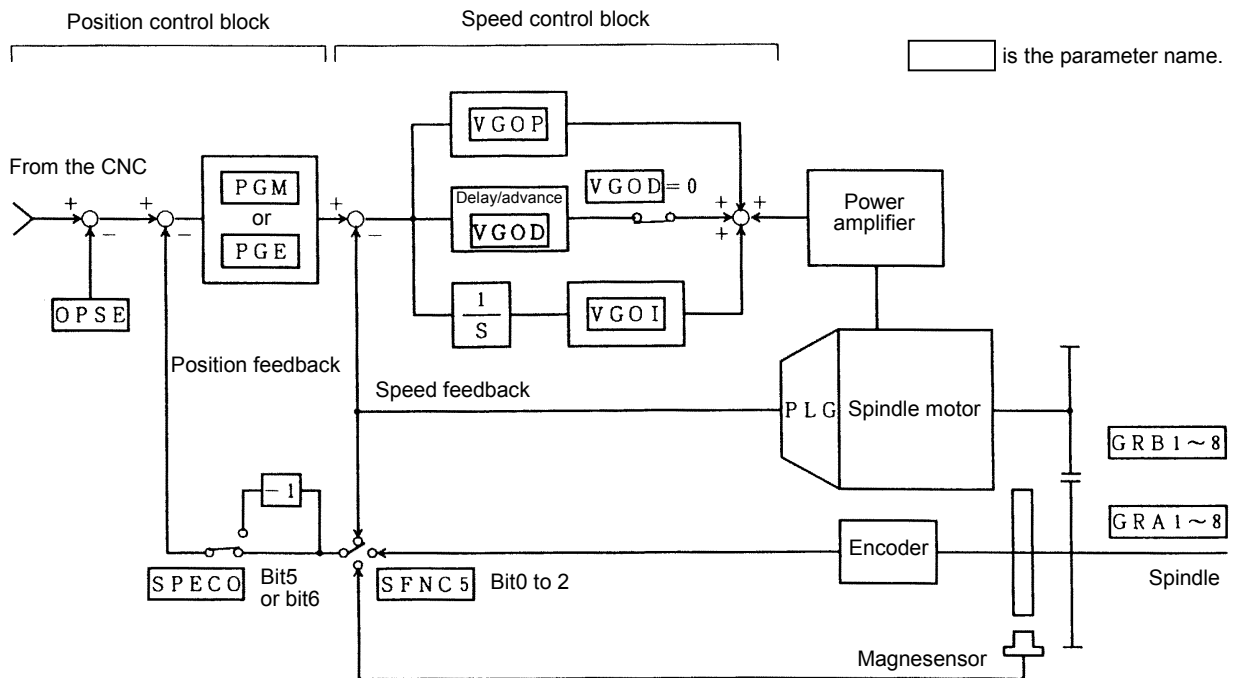
(Note 1) PGM is used for the motor built-in encoder orientation, and PGE is used for encoder orientation.

7. Optional Specifications and Parts

The stop position changes by the encoder installation direction as follows.



(3) Relation drawing of orientation parameters



7.2 Synchronous tap specifications (option)

The two types of synchronous taps are as follows:

1. Closed method synchronous tap
2. Semi-closed method synchronous tap

7.2.1 Closed method synchronous tap

In this method, the position loop is configured by the position signal of the encoder installed on the spindle.

(1) Connection

Refer to page "1.5 Configuration" for information on connecting the encoder and spindle drive unit.

(2) Encoder installation

Refer to the page on encoder orientation for information.

7.2.2 Semi-closed method synchronous tap

In this method, the position loop is configured by the position signal of the motor built-in encoder.

Thus, a special detector for synchronous tapping is not required.

Note that this only applies when the connection between the spindle and motor uses gears or is a direct connection.

(Closed method synchronous tapping is possible if the connection is with a belt or timing belt.)

This method is also possible for standard motors without a Z phase signal.

(1) Connection

There are no connections to be added for the synchronous tap function.

7.2.3 Synchronous tap operation

When the synchronous tap operation is entered, one of the following types of operations can be selected with the parameter.

- (1) Synchronous tap operation after the zero point return (0 is designated in parameter SPECT-bit E)
- (2) Synchronous tap operation after the deceleration stop (1 is designated in parameter SPECT-bit E)

The possibility of the operations above is restricted in the following manner.

○..... Possible ×..... Impossible

	No orientation		Encoder orientation	Motor built-in encoder orientation
Synchronous tap after zero point return	×		○	○
Synchronous tap after deceleration stop	○		○	○

7. Optional Specifications and Parts

7.3 Single parts (optionally supplied parts)

7.3.1 Power step-down transformer

When available power supply is at 400V, use this optional step-down transformer.

(1) 12-23KVA (ITEM1 ~ 3)

Item	Capacity (kVA)	Dimensions		Weight (kg)	Remarks
		A			
1	12	230		90	7.5K
2	17	175		115	11K
3	23	215		130	15K

DIA-TRANS

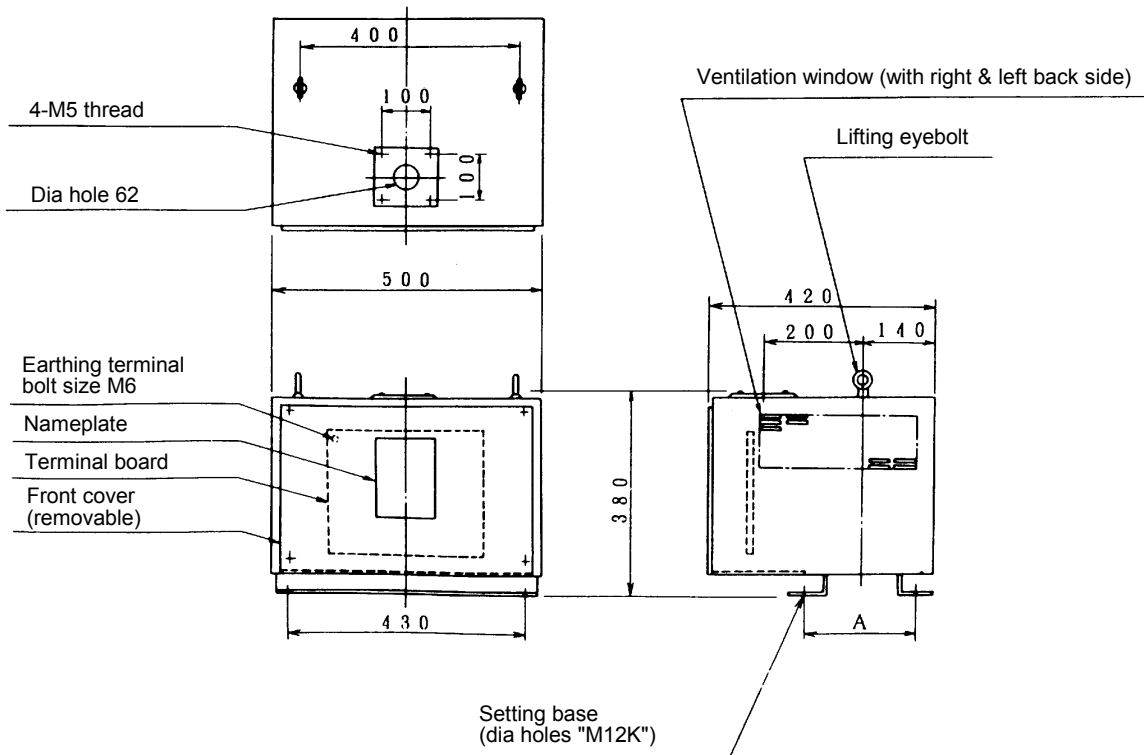
TRANSFORMER AV-DN

DRY SELF-COOLED IN-DOOR USE		INSULATION CLASS		H
KVA 50/60 Hz		THREE PHASE		
HIGH VOLTAGE		LOW VOLTAGE		
415/208V		A		210V
AC TEST VOLTAGE		4 KV		AC TEST VOLTAGE
IMPEDANCE VOLTAGE		%AT115C		TEMP RISE
TOTAL WEIGHT		kg		AMBIENT TEMP
SERIAL NO		DATE		40 °C
JEM 1310 (1969) JEC-204 (1974)		WITH GROUND SCREEN		

HV & LV terminal bolt size M8

HIGH VOLTAGE	
VOLTAGE	CONNECT
F 480V	5-6
F 460V	4-7
F 440V	3-7
F 415V	3-8
F 380V	2-8
F 240V	1-6, 5-8
F 230V	1-7, 4-8
F 208V	8-10, 3-11

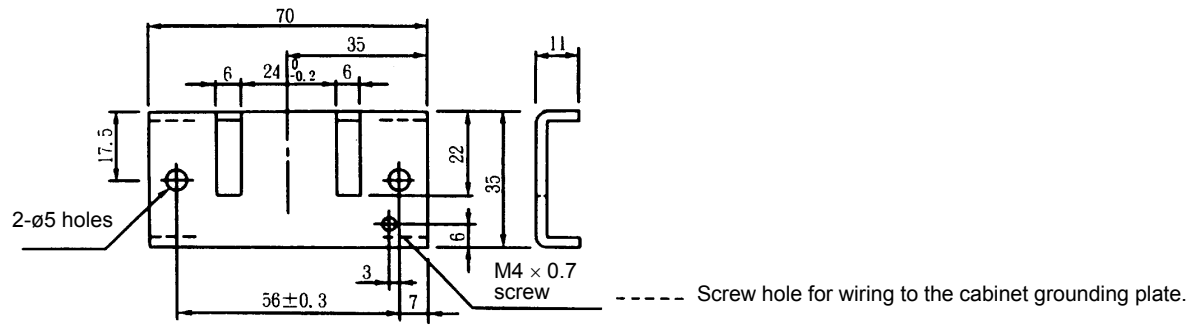
Nameplate



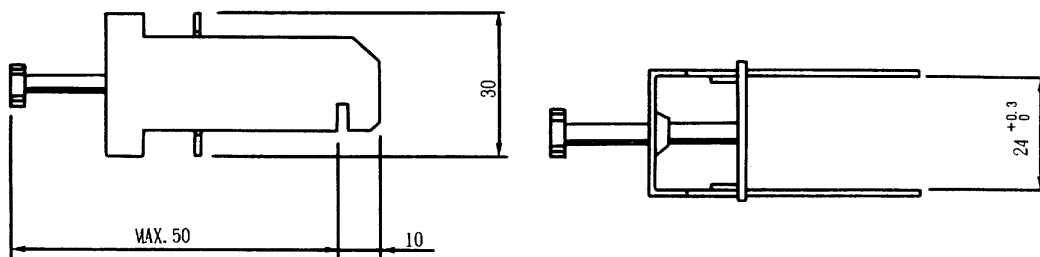
7. Optional Specifications and Parts

7.3.2 Grounding plate and cable clamp metal fittings

Grounding plate E



Metal fitting B (cable clamp)



7.3.3 Noise filter

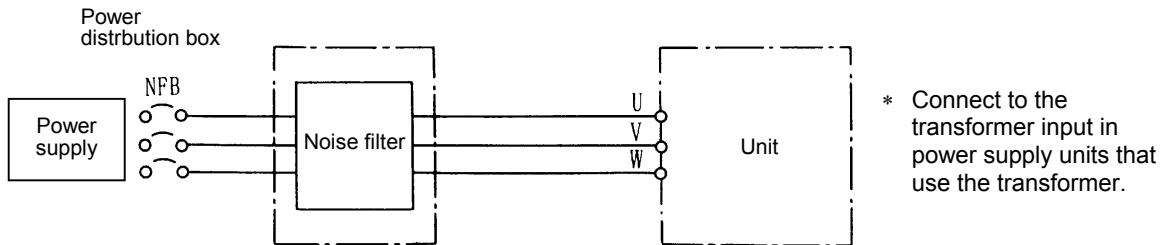
(1) Selection

If radio noise must be reduced, select a noise filter from the following table according to the power supply unit model:

MDS-B-SPJ2	Noise filter name (Tohoku Kinzoku)
02, 04, 075	LF-310
15	LF-315
22	LF-320
37	LF-330
55	LF-340
75	LF-350
110/110C	LF-360

(2) Noise filter installation position

Insert the noise filter in the unit input.

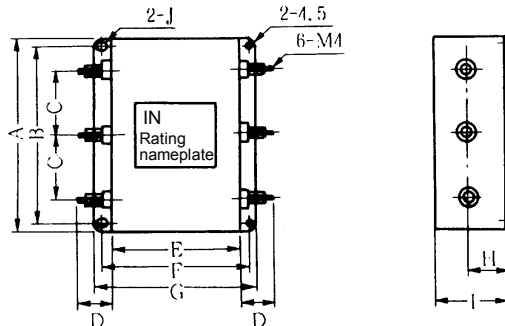


(3) Specifications

Name	Rated voltage AC DC (V)	Rated current AC DC (A)	Tested voltage AC 1 min. (V) Between case terminals	Insulation resistance (MW) 500VDC	Leakage current (mA) 250V 60Hz	Working tem- perature range (°C)
LF-310	250	10	1500	> 300	< 1	-20 ~ +55
LF-315	250	15	1500	> 300	< 1	-20 ~ +55
LF-320	250	20	1500	> 300	< 1	-20 ~ +55
LF-330	250	30	1500	> 300	< 1	-20 ~ +55
LF-340	250	40	1500	> 300	< 1	-20 ~ +45
LF-350	250	50	1500	> 300	< 1	-20 ~ +45
LF-360	250	60	1500	> 300	< 1	-20 ~ +45

(4) Shape and dimensions

• LF-300 Series



Unit: mm

Part name	A	B	C	D	E	F	G	H	I	J
LF-310	180	170	60	25	120	135	150	35	65	4.5 × 7
LF-315	180	170	60	25	120	135	150	35	65	4.5 × 7
LF-320	180	170	60	29	120	135	150	35	65	6.5 × 9
LF-330	180	170	60	29	120	135	150	35	65	6.5 × 9
LF-340	180	160	50	30	200	220	240	40	80	6.5 × 9
LF-350	180	160	50	30	200	220	240	40	80	6.5 × 9
LF-360	200	180	60	30	300	320	340	50	100	6.5 × 9

7.4 Other optional specifications

Refer to the optional specifications for each function for information on optional specifications not described in this specification manual.

Chapter 8 Adjustment Procedure

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8. Adjustment Procedure

8. Adjustment Procedure

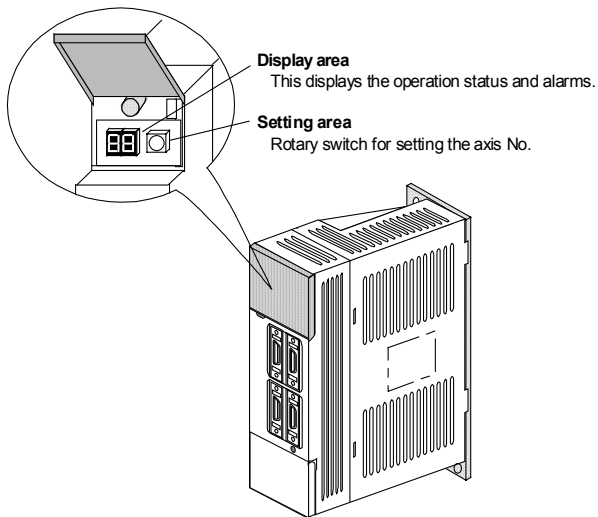
CAUTION

Never drastically adjust or change the parameters. Extreme adjustments and changes of the parameters will cause the operation to become unstable.

8.1 Spindle amplifier initial setup

8.1.1 Rotary switch setting

The axis No. must be set with the rotary switch before turning the power ON. The rotary switch setting is validated when the power is turned ON.



Rotary switch setting	Setting axis No.
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis
4	5th axis
5	6th axis
6	7th axis
7	Not used
8	
9	
A	
B	
C	
D	Unused axis
E	
F	

CAUTION

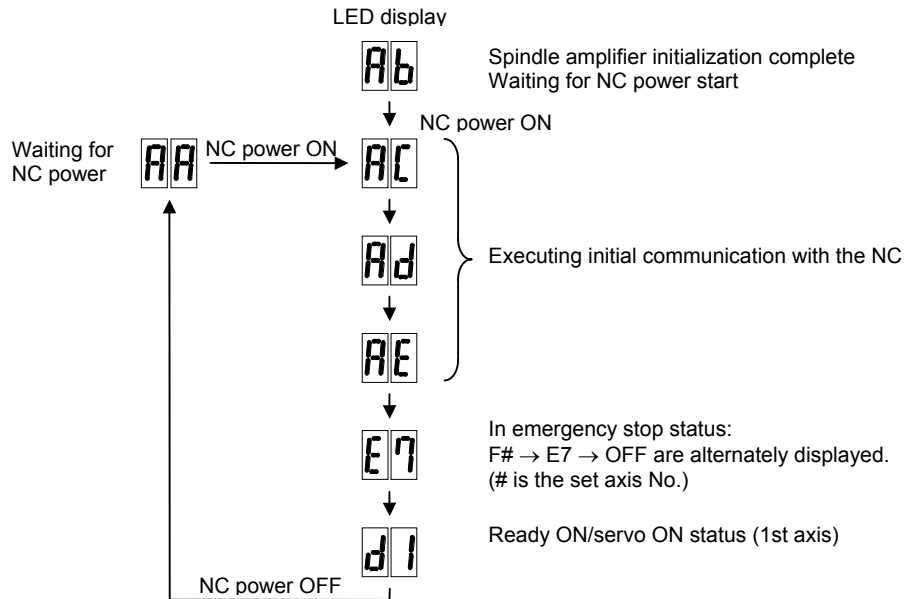
When an unused axis is selected, "Ab" will remain displayed on the LED, and that axis will not be controlled after the power is turned ON.
The system emergency stop cannot be canceled once the power of an unused axis is turned OFF.

8. Adjustment Procedure

8.1.2 LED display transition after the power is turned ON

When the axis No. is set and the spindle amplifier power or NC power is turned ON, the spindle amplifier is automatically initialized, etc., for self-diagnosis and operation. The 7-segment LED display on the front of the spindle amplifier main unit changes as shown below, together with the progression of these processes.

The 7-segment LED also displays the alarm No. when an alarm occurs. Refer to section "11. Troubleshooting" for details on alarm displays.



8.2 Initial adjustment

8.2.1 Parameter confirmation

After installation is finished and the wiring, etc., has been checked, confirm the spindle parameters again.

- * Confirm that the spindle NC, spindle specifications and spindle adjustment parameters match the machine specifications and spindle system specifications.

The SPINDLE PARAMETER screen appears when the NC menu key SPINDLE is pressed.

The spindle parameters are divided into those controlled on the NC side and those controlled on the spindle controller side.

(Note 1) Refer to the instruction manual for each CNC for details on operation methods and NC side parameters.

(Note 2) Each parameter screen is shown as a 14-inch CRT screen.

(1) SPINDLE NC PARAMETER

[SP-NC PARAM]		M-PARAM 9. 1/30	
#			
1	slimt1	4500 17	stapt1 0 33 Sana_ofs 49
2	2	4500 18	2 0 34 Sana_gin 50
3	3	4500 19	3 0 35 51
4	4	4500 20	4 0 36 52
5	smax1	4500 21	sori 0 37 53
6	2	4500 22	sgear 0 38 54
7	3	4500 23	smini 35 39 55
8	4	4500 24	serr 0 40 56
9	ssift1	5 25	sname 1 41 57
10	2	15 26	42 58
11	3	0 27	senc_pno 00 43 59
12	4	0 28	sana_pno 00 44 60
13	stap1	623 29	spflg 00 45 61
14	2	3500 30	senc_no 11 46 62
15	3	0 31	sana_no 00 47 63
16	4	0 32	smcp_no 15 48 64
# () DATA ()			
SPINDLE	CONSTANT	TIMER	COUNTER
BIT-SELECT	PLC-AX	PSW	MENU

8. Adjustment Procedure

(2) SPINDLE SPECIFICATION PARAMETER

The SPINDLE NC PARAMETER screen appears when the menu key SPINDLE is pressed, and page 1 of the SPINDLE SPECIFICATION PARAMETER screen appears when the NEXT PAGE key is pressed. When the NEXT PAGE key is pressed again, page 2 of the SPINDLE SPECIFICATION PARAMETER screen appears.

[SPINDLE SPEC.]
M-PARAM 9 . 3/30

#	<1>
17 SPECO (HEX)	0000
18 SPECC (HEX)	0000
19 SPECS (HEX)	0000
20 SPECT (HEX)	0000
21 CRNG (pulse)	0
22 TRNG (pulse)	15
23	
24	
25 GRA1 (teeth)	17152
26 GRA2 (teeth)	22048
27 GRA3 (teeth)	1024
28 GRA4 (teeth)	0
29 GRB1 (teeth)	33
30 GRB2 (teeth)	50
31 GRB3 (teeth)	20
32 GRB4 (teeth)	150

() NO.< > DATA()

SPINDLE
CONSTANT
TIMER
COUNTER
BIT-SELEC

[SPINDLE SPEC.]
M-PARAM 9 . 2/30

#	<1>
1 SFNC1 (HEX)	0096
2 SFNC2 (HEX)	0014
3 SFNC3 (HEX)	0014
4 SFNC4 (HEX)	0000
5 SFNC5 (HEX)	0096
6 SFNC6 (HEX)	0000
7 ATYP (HEX)	0014
8 MTYP (HEX)	0000
9 PTYP (HEX)	0000
10 TSP (rpm)	0
11 ZSP (rpm)	0
12 CNS1 (sec)	0
13 SDTS (%)	0
14 TLM1 (%)	0
15	
16	

() NO.< > DATA()

SPINDLE
CONSTANT
TIMER
COUNTER
BIT-SELECT
PLC-AX
PSW
MENU

(3) SPINDLE ADJUSTMENT PARAMETER

The SPINDLE NC PARAMETER screen appears when the menu key SPINDLE is pressed, and the SPINDLE ADJUSTMENT parameter screen appears when the NEXT PAGE key is pressed three times.

[SPINDLE ADJUST. PARAM.]
M-PARAM 9 . 6/30

#	<1>
33 PGS (1/sec)	0000
34 VGSP (rad/s)	0
35 VGSI (rad/s)	0
36 VGSD (rad/s)	0
37	
38	
39	
40	
41 PGT (1/sec)	0
42 VGTP (rad/s)	0
43 VGTI (rad/s)	625
44 VGTD (rad/s)	0
45 TZRN (rpm)	0
46 TPDT (pulse)	0
47 TPST (deg)	0
48 TINP (deg)	0

() NO.< > DATA()

SPINDLE
CONSTANT
TIMER
CO

[SPINDLE ADJUST. PARAM.]
M-PARAM 9 .5/30

#	<1>
17 PGCO (1/sec)	257
18 VGCP0 (rad/s)	0
19 VGCI0 (rad/s)	0
20 VGCD0 (rad/s)	0
21 CZRN (rpm)	0
22 CPDT (pulse)	0
23 CPSTL (HEX)	0000
24 CPSTH (HEX)	0000
25 CIMP (HEX)	0015
26 CPYX (%)	0
27	
28	
29	
30	
31	
32	

() NO.< > DATA()

SPINDLE
CONSTANT
TIMER
CO

[SPINDLE ADJUST. PARAM.]
M-PARAM 9 .4/30

#	<1>
1 VGNP1 (rad/s)	2000
2 VGNI 1 (rad/s)	0
3 PYVR (%)	1364
4	
5	
6	
7	
8 PGM (1/sec)	0
9 PGE (1/sec)	2570
10 VGOP (rad/s)	0
11 VGOI (rad/s)	0
12 VGOD (rad/s)	0
13 OSP (rpm)	0
14 CSP (rpm)	20000
15 OPST (deg)	0
16 OINP (deg)	0

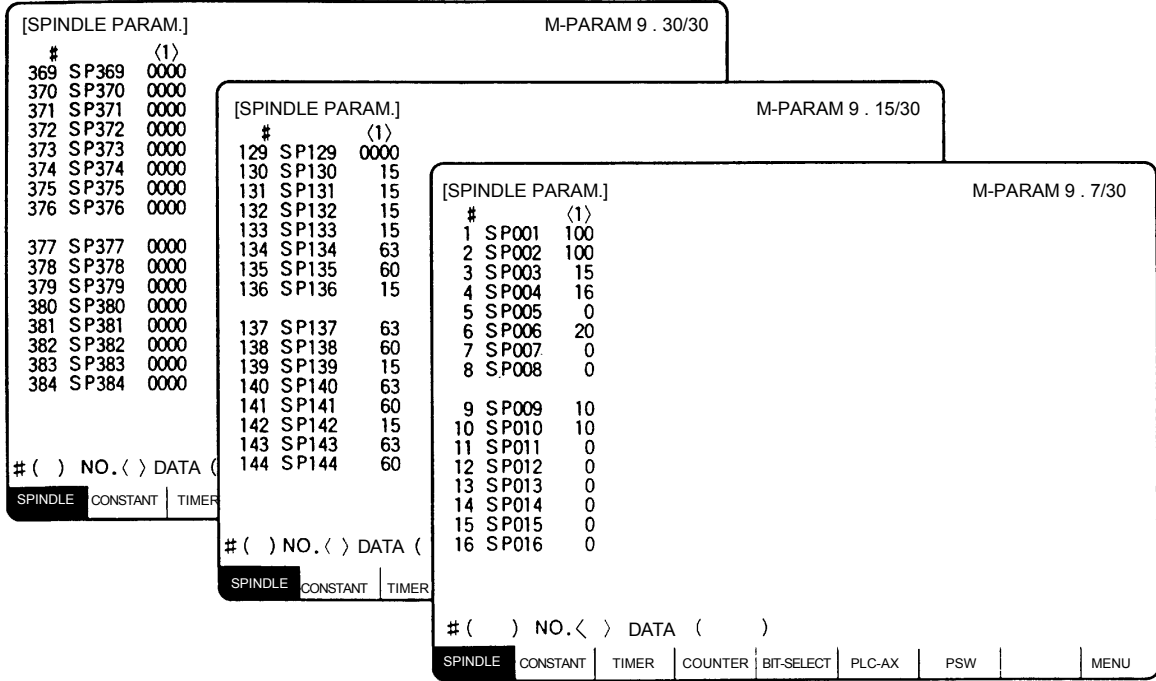
() NO.< > DATA()

SPINDLE
CONSTANT
TIMER
COUNTER
BIT-SELECT
PLC-AX
PSW
MENU

8. Adjustment Procedure

(4) SPINDLE PARAMETER

The SPINDLE NC PARAMETER screen appears when the menu key SPINDLE is pressed, and the SPINDLE PARAMETER screen appears when the NEXT PAGE key is pressed six times.



8.3 Test operation

The motor and machine are directly connected, and the machine break-in and control statuses are checked.

- (1) Do the command speed and actual speed match?

→ If they do not match:

- 1) Check whether the spindle parameters (SP000 to SP384) are set correctly.
Especially check whether the following parameters are set correctly:

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

- 2) Check whether the following spindle NC parameters are set correctly:

- ① slimit1 ~ 4
- ② Smax1 ~ 4
- ③ Smini

- (2) Is the rotation smooth?
(3) Is there any abnormal noise?
(4) Is there any abnormal smell?
(5) Is the bearing temperature abnormally high?

If the operation is normal, next operate the motor with an actual load and check for abnormalities.

< Reference >

Speed adjustment

Because the speed command is a digital signal via a bus line connection, there is no drift, offset, etc.

Thus, the speed does not need adjusting. However, when the spindle speed must be adjusted to allow for deviation such as pulley diameter, adjust using the following method.

- (1) Setting Slimit
Slimit

= (Max. motor speed (rpm) set in $\boxed{\text{TSP}}$) × (deceleration ratio between the motor and spindle)

(Example) When $\boxed{\text{TSP}}$ is 6000rpm, and the speed change ratio is 1/2:

$$\text{Slimit} = 6000 \times 1/2 = 3000.$$

So 3000 is set as the Slimit.

- (2) Set the speed command to 1/2 the max. spindle speed, and measure the spindle speed.
If the speed does not match the specified speed, adjust the speed to match the specified speed by raising/lowering the parameter $\boxed{\text{Slimit}}$. (Compensate for accuracy errors such as pulleys, etc.)
- (3) Set the S command to the max. spindle speed, and check that the spindle speed matches the commanded speed.

If the max. spindle speed is not reached (the motor stays at the max. speed set in #31 $\boxed{\text{TSP}}$), readjust from step (2) after changing #31 $\boxed{\text{TSP}}$.

- (4) For gear changeover machines, adjust the speed with steps (1) and (2) above after changing gears.

Set the optimum value for $\boxed{\text{Slimit}}$ and $\boxed{\text{Smax}}$ of each gear stage.

8. Adjustment Procedure

8.4 Acceleration/deceleration adjustment

Using the speedometer output (CN3) described in section "6.5 D/A Output Function", measure the acceleration/deceleration waveform, and check whether it is within $\pm 15\%$ of the theoretical acceleration/deceleration time.

(Note: Refer to Appendix 3 for the calculation method of the theoretical acceleration/deceleration time.)

(1) If the acceleration/deceleration time does not match the theoretical value

- The acceleration/deceleration time will not necessarily match the theoretical value when there is an error in the GD^2 of the motor shaft conversion. Check the load GD^2 again.
 - The friction torque is probably large if the acceleration time is long and the deceleration time is short. Check the load meter value (SPINDLE MONITOR screen) at the max. speed. If it is 10% or more, the friction torque is probably comparatively large. It can be surmised that mechanical friction is present in the bearing, timing belt, etc. Measure the acceleration/deceleration time again after executing a test operation once.
- * Regardless of whether a problem exists in the details above, the spindle motor and amplifier are probably not the specified type, or there is probably a mistake in the parameters if the acceleration/deceleration time does not match the theoretical value. Check the spindle motor and amplifier type again, and also check the parameters.

(2) If the deceleration time is longer than the acceleration time (note that this is when the acceleration time is within $\pm 15\%$ of the theoretical value)

- The time can be adjusted with the following procedure.

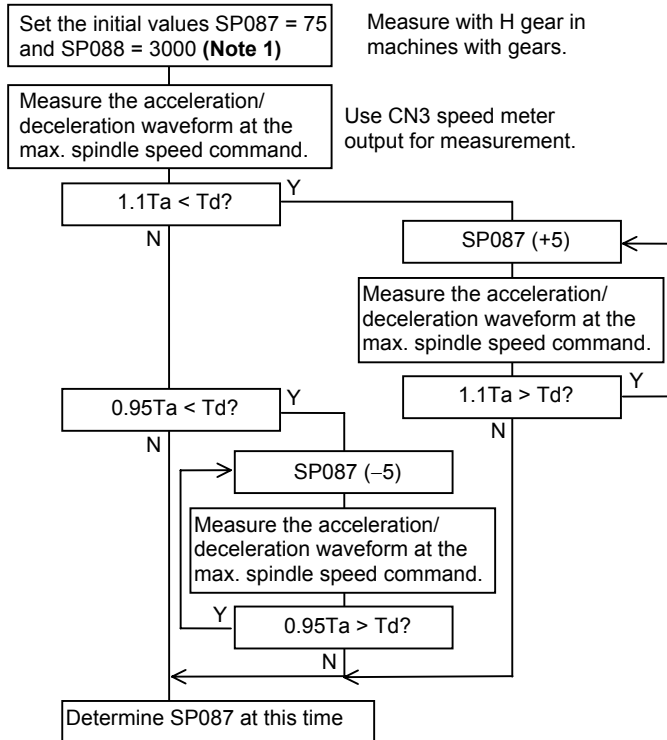
1) Spindle parameters

No.	Abbreviation	Name	Details	TYP	CNG	Standard setting	Unit	Allowable setting range
SP087	DIQM	Variable torque limit magnification during deceleration Target value	Set the minimum variable torque limit value during deceleration.	DEC		75	%	0 ~ 150
SP088	DIQN	Variable torque limit magnification during deceleration Change start speed	Set the speed at which the torque limit value starts to change during deceleration. <div style="text-align: center;"> <p>The graph plots Torque limit (%) on the y-axis against Speed on the x-axis. A horizontal line at 100% represents the constant torque limit. At speed SP088, the torque limit begins to decrease, following an inverse proportion curve. At speed SP017, the torque limit reaches a constant value of SP087%.</p> </div>	DEC		3000	r/min	0 ~ 32767
			<p>(Note) Refer to the flow chart on the next page for the procedure to change the SP087 and SP088 settings. (SP088 does not require changing.) Adjust the deceleration time to the same time as the acceleration time using SP087.</p>					

8. Adjustment Procedure

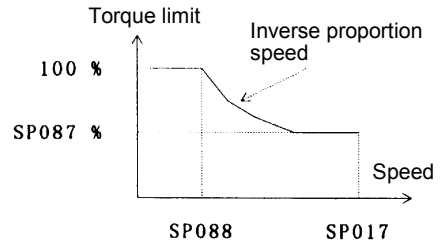
2) Adjustment procedure

(Note) Refer to the following flow chart for the procedure to change the SP087 and SP088 settings. (SP088 does not require changing.)
Adjust the deceleration time to the same time as the acceleration time using SP087.



Measure with H gear in machines with gears.

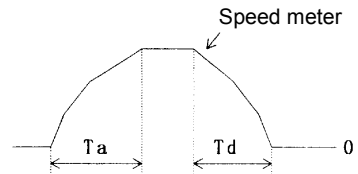
Use CN3 speed meter output for measurement.



(Note 1) Set the standard SP087 and SP088 settings for the SJ-PF Series Motor as follows:

- SP088 = "Fixed output max. speed/1.2"
- $SP087 \leq SP088 \times 75 / \text{max. speed}$

Example)
 SJ-PF2.2-01 → SP087=35, SP088=5000
 SJ-PF7.5-01 → SP087=45, SP088=5000
 SJ-PF11-01 → SP087=45, SP088=3750

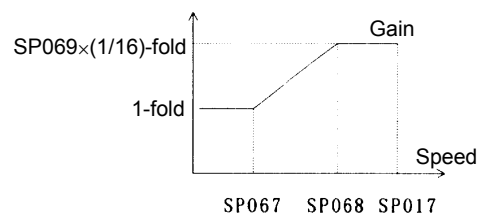


< Reference > Variable current loop gain adjustment

- SP067 (VIGWA) : Change start speed (r/min)
- SP068 (VIGWB) : Change finish speed (r/min)
- SP068 (VIGWB) : Set the magnification of the current loop gain (torque amount or excitation amount). The magnification is 1-fold when this is set to 0. (The magnification becomes 1 when this setting value is 16.)

(Note) Refer to the following as a guideline for setting SP067 to SP069.

Max. motor speed SP017 (TSP)	SP067 (VIGWA)	SP068 (VIGWB)	SP069 (VIGN)
0 ~ 6000	0	0	0
6001 ~ 8000	5000	8000	45
8001 or more	5000	10000	64



Observe the following when carrying out the settings above:

- 1) If there is a slight hunting (high frequency vibration) during operation at the max. speed, lower SP068 in -8 increments to a setting where no problem occurs.
- 2) If there is a slight swelling (low frequency vibration) during operation at the max. speed, raise SP068 in +8 increments to a setting where no problem occurs.
- 3) If "OVERCURRENT ALARM 32" or "OVERVOLTAGE ALARM 33" occurs when decelerating from the max. speed, the current loop gain in the high-speed region is probably insufficient. Raise SP068 in +16 increments to a setting where no problem occurs.

8.5 Orientation adjustment

8.5.1 Motor built-in encoder orientation adjustment preparation

< Parameters >

Parameter name	No.	Initial value
PGM	SP001	100
OINP	SP004	16
OSP	SP005	0
CSP	SP006	20
OPST	SP007	0
GRA1	SP025	1
GRA2	SP026	1
GRA3	SP027	1
GRA4	SP028	1
GRB1	SP029	1
GRB2	SP030	1
GRB3	SP031	1
GRB4	SP032	1
VGOP	SP098	63
VGOI	SP099	60
VGOD	SP100	15
CSP2	SP107	0
CSP3	SP108	0
CSP4	SP109	0

< Preparation >

- a) Check that the parameters are set to the values in the table above.

8. Adjustment Procedure

8.5.2 Encoder orientation adjustment preparation

< Parameters >

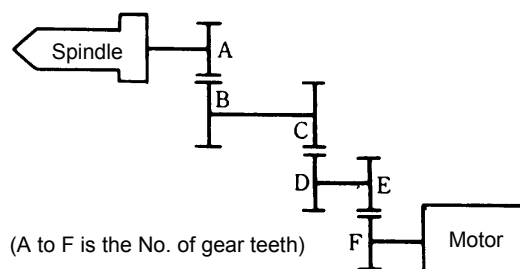
Parameter name	No.	Initial value
PGE	SP002	100
OINP	SP004	16
OSP	SP005	0
CSP	SP006	20
OPST	SP007	0
GRA1	SP025	1 ~ 32767
GRA2	SP026	1 ~ 32767
GRA3	SP027	1 ~ 32767
GRA4	SP028	1 ~ 32767
GRB1	SP029	1 ~ 32767
GRB2	SP030	1 ~ 32767
GRB3	SP031	1 ~ 32767
GRB4	SP032	1 ~ 32767
VGOP	SP098	63
VGOI	SP099	60
VGOD	SP100	15
CSP2	SP107	0
CSP3	SP108	0
CSP4	SP109	0

< Preparation >

- a) The gear ratios (or pulley ratios) from the motor shaft to the magnesensor rotation axis must be accurate. Check that the correct No. of gear teeth is set in parameters GRA1 to GRB4.

$$\boxed{\text{GRA}} = A \times C \times E$$

$$\boxed{\text{GRB}} = B \times D \times F$$



(Note) The No. of gear teeth parameters $\boxed{\text{GRA1}}$ to $\boxed{\text{GRB4}}$ may be set by the user. If so, always set the accurate values corresponding to the machine used.

- b) Check that the parameters are set to the values in the table above.

8. Adjustment Procedure

8.5.3 Orientation adjustment method

< Adjustment > (Encoder orientation is shown in brackets [].)

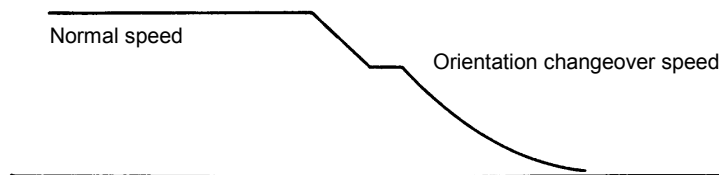
(1) Orientation position adjustment

There is no position shift volume or rotary switch.

The position shift is set with the parameter OPST.

Execute an orientation after changing the setting of OPST, and adjust so that it matches the target stop point.

(2) Orientation time and vibration adjustment



Using the procedures in the table below, adjust each phenomenon according to the orientation status.

Phenomenon	Adjustment procedure	
	[PGM PGE]	CSP
Sways at stop	↘	↘
Orientation time is long	↗	↗
Hunting at stop	↘	→

(Note 1) ↗ : Increase the parameter value
 → : Do not change the parameter value.
 ↘ : Decrease the parameter value.

First adjust PGM and PGE, then adjust CSP

Adjust CSP2, CSP3, CSP4 in the same manner to execute the shortest orientation time adjustment in each gear stage.

Adjust OSP if the gear ratio is large (i.e. 1:10) or an EXCESSIVE ERROR alarm occurs. When hunting widely occurs at the orientation stop, the orientation detector installation direction must be adjusted. Readjust following the orientation position adjustment procedure on this page.

8. Adjustment Procedure

8.5.4 Servo rigidity adjustment

Increase the servo rigidity during orientation stop by adjusting with the following procedure.

- i) Increase the **PGM** (motor built-in encoder orientation, magnesensor orientation) and **PGE** (encoder orientation) values to a level where swaying does not occur at the orientation stop.
- ii) Raise the values of parameters **VGOP** and **VGOI** by the same percentage.

For example, if **VGOP** is set to 80, also set **VGOI** to 80.

Note that the magnification cannot be raised further if vibration occurs during orientation stop at this setting.

- iii) Parameter **VGOD** is the delay/advance compensation gain.

The servo rigidity can be momentarily raised by increasing this value, but the torque for the position error will drop.

PI control is validated at orientation stop when **VGOD** = 0.

8.5.5 Delay/advance control and PI control

Delay advance control is normally selected. Use PI control in the following case.

- When the spindle static friction torque is large, and machine PI control is required for stop position accuracy, the servo rigidity will drop somewhat compared with delay/advance control, so select this control matching the machine specifications.

8. Adjustment Procedure

8.5.6 Troubleshooting for orientation errors

(1) Orientation is not carried out.

(a) The spindle rotates without stopping.

Cause	Investigation items	Remedy	Remarks
The parameters are not appropriate	The orientation detector and parameters do not match. Parameter [SFNC5] Motor built-in encoder orientation.....4 Encoder orientation1 Magnesensor.....2	Correctly set parameter [SFNC5] .	
The specifications do not match	Orientation was attempted with a standard motor that is not a motor built-in encoder with a Z phase.	Change to a motor having a motor built-in encoder with Z phase.	For motor built-in encoder orientation
Wiring error	The connector pin No. is incorrect, or the connector No. to be inserted was incorrect.	Change the wiring.	

(2) The spindle stops after passing the orientation stop. (The spindle stops after swaying.)

Cause	Investigation items	Remedy	Remarks
The parameters are not appropriate	The gear ratio parameters GRA1 to 4 and GRB1 to 4 are incorrect.	Correctly set the gear ratio parameters.	
	The problem will improve if the parameter [CSP] is halved.	Readjust the parameter [CSP] , and select the optimum value.	CSP2, CSP3 and CSP4 are remedied in the same manner.
	The problem will improve if the parameters [PGM] and [PGE] are halved.	Readjust the parameters [PGM] and [PGE] , and select the optimum value.	
	The orientation stops in one direction (CCW or CW). Bit 0.1 of parameter [SPEC0] is not set to 0.	Set the orientation stop to PRE. (Change [SPEC0] to PRE.)	

8. Adjustment Procedure

(3) The stop position deviates.

Cause	Investigation items	Remedy	Remarks
Machine factor	The stop position does not deviate on the encoder axis.	There is backlash, slippage, etc., between the spindle and encoder.	
	<ul style="list-style-type: none"> The deceleration ratio between the spindle and encoder is not 1:1 or 1:2. 	Set the deceleration ratio to 1:1 or 1:2.	
	The position shift changed to 2048 at a 1:2 deceleration ratio between the spindle and encoder. (Deviation on the encoder axis.)	The position does not change because the spindle rotates once at 2048 in this case. (However, the position changes on the encoder axis.)	
Noise	There is a break in the encoder cable.	Use one encoder cable.	

(4) The spindle vibrates when stopped.

Cause	Investigation items	Remedy	Remarks
The parameter setting is incorrect.	The gear ratio parameters GRA1 to 4 and GRB1 to 4 are incorrect.	Correctly set the gear ratio parameters.	
Orientation adjustment	The vibration frequency is several Hz.	Lower the position loop gain [PGM] and [PGE].	
	The vibration frequency is 10Hz or more.	Lower the speed loop gain [VGOP] and [VGOI] during orientation.	

(5) An orientation completed signal is not output.

Cause	Investigation items	Remedy	Remarks
Refer to item (1) "Orientation is not carried out".			
The machine load is heavy	The in-position (parameter [OINP]) value is too small.	Reconsider the in-position range. (Parameter x [OINP])	
	An orientation completed signal is output by changing the control during orientation to PI control.	Reconsider the speed loop gain during orientation (parameters [VGOP] and [VGOI]).	This may also apply if hunting occurs at the stop point.

8. Adjustment Procedure

8.6 Synchronous tap adjustment

8.6.1 Synchronous tap operation adjustment

< Preparation >

Operate the spindle by a speed command or adjust the orientation before adjusting the synchronous tap adjustment.

< Parameter >

(1) Spindle controller setting

Parameter		Details						
SP037	SFNC5	Spindle function 5	Possibility and setting values of orientation type and synchronous tap method combinations					
			Synchronous tap method		Closed method	Semi-closed method	Setting value	
		Orientation method						
		No orientation	×	×	×	○	○	
		Orientation method	Motor built-in encoder	×	×	○	○	4
			Encoder orientation	○	○	×	×	1
		○ : Possible, × : Impossible						

(2) NC screen settings

Screen selection	Parameter	Details	Setting value
< USER PARAMETER >			
CONTROL PARAMETER	Synchronous tap	This validates the synchronous tap. When not validated, the conventional tap cycle is validated.	Valid
< MACHINE PARAMETER >			
BASIC SPECIFICATION PARAMETER	bit3 of mpar1	This selects whether the synchronous tap is carried out with the constant time constant method or constant inclination method.	0: Constant time constant 1: Constant inclination
	tap-tl	This sets the time constant of the position command during constant time constant synchronous tap. Set as follows when the start time during operation by S command to the possible tap max. speed is set to t. When the tap accuracy is given priority tap-tl = t × 2 (ms) When the tap cycle time is given priority tap-tl = t × 2 (ms)	1 ~ 1500 (msec) Standard: 1000
SERVO PARAMETER (Z AXIS)	PGN1SP (SV049)	This sets the position loop gain during synchronous tap. This must be set to the same value as the spindle parameter PGT.	1 ~ 200 Standard: 10

8. Adjustment Procedure

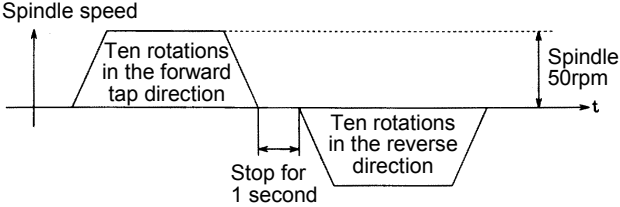
Screen selection	Parameter	Details	Setting value
SPINDLE NC PARAMETER	sgear	This sets the gear ratio between the spindle and spindle encoder. Always set this to 0 (1:1) when there is no spindle encoder (semi-closed method).	0 Standard: 0
	stap 1 stap 2 stap 3 stap 4	Gear00, Gear 01, Gear 10, Gear11 Set the max. spindle speed during the constant inclination tap cycle in each gear.	0 ~ 99999 (rpm)
	stapt 1 stapt 2 stapt 3 stapt 4	Gear00, Gear01, Gear10, Gear11 Set the time constant to the max. tap speed during the constant inclination tap cycle in each gear. The setting method is the same as that in tap-tl above.	0 ~ 5000 (msec)
SPINDLE PARAMETER	PGT	This sets the position loop gain during synchronous tap. This must be set to the same value as parameter PGN1SP of the (Z axis).	1 ~ 100 Standard: 10
	SPECT	bit5 This sets the rotation direction of the detector (spindle encoder) during synchronous tap. Set to 0 for semi-closed method. bit3 Set to 1 for stronger excitation during synchronous tap. The response to the impact load increases. Normally set to 0. bit0 0: Closed (spindle with encoder) 1: Semi-closed (spindle without encoder) bit4 This determines the motor command direction (spindle rotation direction in G84) during synchronous tap. bitE=0. A zero point return is carried out at the first of the synchronous tap mode. bitE=1. The position loop is entered after the deceleration stop without carrying out a zero point return.	—
	GRA1 ~ GRA4, GRB1 ~ GRB4	The gear ratio (No. of gear teeth) of each gear stage must be accurately set. $\text{Motor speed} \times \frac{\text{Motor shaft side No. of gear teeth (GRB1 to GRB4)}}{\text{Spindle side No. of gear teeth (GRA1 to GRA4)}} = \text{Spindle speed}$	—
	EGEAR	This sets the gear ratio between the spindle and spindle encoder. Always set this to 0 (1:1) when there is no spindle encoder (semi-closed method).	0 Standard: 0

< Precautions >

- 1) Accurate synchronous tapping is difficult when the spindle is driven with a belt or timing belt in the semi-closed method (when there is no spindle encoder), due to the stretching, slipping, etc. of the belt.
Use an encoder when driving the spindle with a belt, and carry out synchronous tap with the closed method. Use the encoder method orientation in this case.
- 2) Set the spindle parameter EGAR to 1 when the spindle and encoder are connected by a 2:1 speed ratio in the closed method (when there is a spindle encoder).
Also set the spindle NC parameter sgear to 1.

8. Adjustment Procedure

< Operation confirmation and adjustment >

	Normal operation	Check items during abnormal operation
1	<p style="text-align: center;">Without a workpiece installed : G84 Z-10 F.1.0 P1000 S50</p> 	<p>When the rotation direction is the reverse tap direction: Reverse bit4 of the parameter SPECT.</p> <p>When the speed differs: Reconfirm that the parameter and machine specifications match.</p> <p>Others: Refer to the section "Troubleshooting for abnormal synchronous tap".</p>
2	<p>Execute a cutting test with a floating tap chuck attached.</p> <ol style="list-style-type: none"> 1) There must be no lengthening or shortening of the taper. 2) Accurate tapping must be carried out. 	<p>Refer to the section "Troubleshooting for abnormal synchronous tap".</p>
3	<p>Execute a cutting test without a floating tap chuck attached.</p> <ol style="list-style-type: none"> 1) Accurate tapping must be carried out. 	<p>Refer to the section "Troubleshooting for abnormal synchronous tap".</p>

8. Adjustment Procedure

8.6.2 Troubleshooting for abnormal synchronous tap

No.	Phenomenon	Factors/remedy
1	An EXCESSIVE ERROR ALARM (alarm 52) occurs.	1) The synchronous tap detector direction of spindle parameter [SPECT] bit5 is set backwards. 2) The spindle motor does not follow commands because the tap time constant is too short. Multiply the start time for S commands $\times 1.2$ or more and set that value.
2	An OVERCURRENT (alarm 32) occurs.	1) The spindle motor does not follow commands because the tap time constant is too short. Multiply the start time for S commands $\times 1.2$ or more and set that value.
3	The spindle rotation movement amount does not match the command value.	1) The closed/semi-closed setting is incorrect in spindle parameter [SPECT] bit0. 2) The spindle parameter gear settings [GRA1] to [GRA4] and [GRB1] to [GRB4] do not match the machine gear ratios.
4	1) The tap breaks. 2) The tap accuracy is poor.	1) The (Z axis) parameter [PGNISP] and spindle parameter [PGM] values are different. 2) The tap time constant is short. 3) The program thread pitch F and actual tap pitch are different. 4) The tap is slipping at the chuck. → Substitute with a chuck having a large tightening torque. 5) The prepared hole is shallow, and the cutting chips are not being discharged properly. 6) A tap with poor cutting chip discharge is being used. (A spiral tap is preferred.) 7) The tap depth is too deep for the tap diameter. (Normally 2 to 3 fold) 8) Noise is superimposed on the position feedback signal, causing poor synchronization accuracy. Check the shielding on the spindle encoder cable for a closed method, and the speed feedback cable from the motor for a semi-closed method. → Check whether the correct shielded cable is being used. Also check for cable breaks. 9) Replace with a new tap.
5	1) The load is heavy. The spindle stops during tapping and the accuracy is becoming worse.	1) Select stronger excitation by setting bit 3 of the spindle parameter [SPECT] to 1. 2) Raise the speed loop gain during tapping. 3) Use tapping paste.
6	There is no problem at low speeds (1000rpm or less), but the following occur at high speeds: 1) The tap breaks. 2) The tap accuracy is poor.	1) The position loop gain deviates slightly. (Example) With the closed method, the pulley ratio does not match the theoretical gear ratio when the motor and spindle are connected with a V-belt.

Chapter 9 Unit Replacement

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9. Unit Replacement

9.1 Preparation for unit replacement

Be sure to observe the following precautions when replacing the unit.

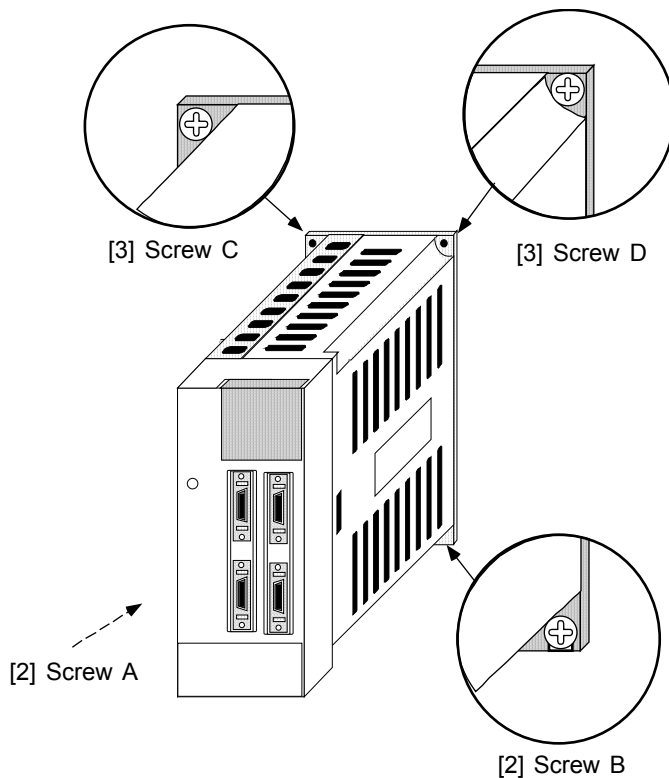
- (1) Turn OFF the power to the entire system, including peripheral devices.
- (2) High-voltage remains in the spindle drive unit even after the power is turned OFF. Do not touch the unit terminal block or regenerative resistor for 3 to 4 minutes after turning the power OFF.
- (3) When 3-4 minutes have passed after turning the power OFF, disconnect all cables connected to the unit.

Never carry out work on the unit while the power is ON. Doing so could damage the normal unit and peripheral devices, and is also dangerous.

9.2 Unit replacement method

The following shows the replacement method for the spindle drive unit.

- [1] Disconnect all cables from the front of the unit.
- [2] Loosen screws A and B. (They do not need to be removed.)
- [3] While supporting the unit with one hand, remove screws C and D.
- [4] Lift the unit upward.



Chapter 10 Daily Maintenance

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10. Daily Maintenance

 **CAUTION**

1. Wait 10 minutes or more after turning the power OFF before carrying out maintenance or inspections. Failure to do so may result in electric shocks.
2. Maintenance and inspections must always be carried out by a qualified technician. There is a danger of electric shocks if they are carried out by unqualified persons. Contact the nearest Mitsubishi Service Center or Service Station for repair and parts replacement.

Proper maintenance and inspections are essential for realization of the device's performance, for preventing accidents, and for continued reliable operation over long periods.

**Caution : Electric shocks can lead to serious accidents. Be sure to check that all power is turned OFF before carrying out inspections in which the power does not need to be turned ON.
Always check that the charge lamp is not lit.**

10.1 Maintenance equipment

(1) Measuring devices

The following measuring devices are required to check whether the correct power is being supplied to the amplifier, whether the amplifier wiring is correct, etc.

Device	Conditions	Application
Tester		Check that the wiring to the amplifier is correctly carried out before turning the power ON.
Oscilloscope		For general measurement and troubleshooting.
AC voltmeter	Measures AC power voltage. Tolerance of $\pm 2\%$ or less.	For measuring the AC power voltage supplied to the amplifier.
DC voltmeter	Max. graduation 10V, 30V Tolerance of $\pm 2\%$ or less.	For measuring the DC power voltage.
AC current ammeter		For measuring the AC supplied to the motor.

(2) Tools

Driver (⊕ : Large and medium size, ⊖ : small size)

10. Daily Maintenance

10.2 Periodic inspections

10.2.1 Control unit inspections

NOTE	
Do not carry out a megger test (insulation resistance measurement) on the drive unit control circuit.	

	Inspection item	Inspection cycle	Essential points	Remedy
1	Cooling fan	Once a month	(1) Does the fan turn smoothly when rotated by hand? (2) Is the fan sufficiently powerful when turned ON? (3) Is there any abnormal noise from the bearings?	Replace the unit
2	Dirt and screw loosening	When needed	Periodically clean the outside of the amplifier, especially the cooling fan. Also, periodically tighten the input/output terminals and all connections.	
3	Wiring	When needed	The wires must not contact any conductive parts or be pinched.	

10. Daily Maintenance

10.2.2 Motor inspections

	Inspection item	Inspection cycle	Essential points	Remedy
1	Noise and vibration	Once a month	<ul style="list-style-type: none"> • There must not be any noise or abnormal vibration occurring that has not been noticed before. Check the following when an abnormality occurs. (1) Check the base and installation. (2) Check the core alignment accuracy of the direct coupling. (3) Is any vibration being transmitted from the coupler? (4) Is the bearing damaged or does it emit any abnormal noise? (5) Is there any abnormal vibration or noise in the reduction gears or belt? (6) Is there any abnormality in the control unit? (7) Is there any abnormality in the cooling fan? (8) Is the belt tension correct? 	Clean
2	Temperature rise	Once a month	<ul style="list-style-type: none"> • Is the bearing temperature normal? (Normal is an ambient temperature of +10 to 40°C.) • Is the motor frame temperature the same as normal? Check the following when an abnormality occurs. (1) Is the cooling fan rotating normally? (2) Is any foreign matter caught and clogging the cooling duct (between the frame and the cover)? (3) Is the load abnormally increased? 	Refer to the section "Troubleshooting".
			<ul style="list-style-type: none"> (4) Is there any abnormality in the control unit? 	
3	Insulation resistance value	Once six months	<ul style="list-style-type: none"> • Is the insulation resistance value abnormally low? Disconnect the wiring to the spindle drive unit and carry out a megger test between the circuit batch and the ground. (If the value is 1MΩ or more at 500V megger, there is no problem.) If the insulation resistance is 1MΩ or less, the inside of the motor must be cleaned and dried. Disassemble the motor and dry the motor in a drying furnace at 90°C or less. 	
4	Cooling fan	Once a week, once a month	<ul style="list-style-type: none"> • Is the fan circulating air and rotating normally? Is there any abnormal noise or vibration? 	

10.2.3 Regenerative resistor unit inspection

	Inspection item	Inspection cycle	Essential points	Remedy
1	Cooling fan	Once a week, once a month	<ul style="list-style-type: none"> (1) Does the fan turn smoothly when rotated by hand? (2) Is the fan sufficiently powerful when turned ON? (3) Is there any abnormal noise from the bearings? 	Replace the fan.

Chapter 11 Troubleshooting

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11. Troubleshooting

WARNING

1. Wait 10 minutes or more after turning the power OFF before carrying out maintenance or inspections. Failure to do so may result in electric shocks.
2. Maintenance and inspections must always be carried out by a qualified technician. There is a danger of electric shocks if they are carried out by unqualified persons. Contact the nearest Mitsubishi Service Center or Service Station for repair and parts replacement.

11.1 Introduction

If trouble occurs with the control unit, first check the following items as much as possible. After that, carry out inspection and repair following the details described in this section. The following items are also extremely useful for describing the trouble to the maker's service department.

Checklist when trouble occurs.

NOTE

Do not carry out a megger test (insulation resistance measurement) on the amplifier control circuit.

1. Which alarm is displayed on the unit alarm display? Check the past alarms with the unit 7-segment LED display or NC DIAGNOSIS SCREEN. (Refer to the List of Alarms and Warnings on page __.)
2. Can the fault/abnormality be repeated?
3. Are the ambient temperature and temperature inside the panel normal?
4. Does the trouble occur during acceleration, deceleration or constant speed operation? At what speed?
5. Is there any difference between forward and reverse run operation?
6. Is there any momentary power failure?
7. Does the trouble occur during any specific operation or command?
8. How frequently does the trouble occur?
9. Does the trouble occur when the load is increased or decreased?
10. Where emergency measures taken?
11. How many years has the unit been in operation?
12. Is the power voltage normal? Does it change greatly according to the time of day?

11.2 First step

Check the following items as the first step of troubleshooting.

- (1) The power voltage must not drop below the following, even for short periods:
200V (+10% – 15%) 50 Hz, 200 to 230V (+10% – 15%) 60Hz, and especially 200V – 15%
(Example) • The voltage drops at a set time every day.
• The voltage drops when a specific machine starts.
- (2) Are the control functions around the unit normal?
(Example) • Are the NC and sequence circuits, etc., normal?
• Are any wiring abnormalities noticed during a visual check?
- (3) Is the temperature around the control unit (temperature in the panel) 55°C or less?
- (4) Are there any abnormalities in the unit appearance?
(Example) Loose connection connectors, damage, foreign matter intrusion, etc.

11. Troubleshooting

Class II trouble	Investigation items	Remedy
The unit operated normally before, but now suddenly will not operate.	(1) Check the input power voltage 200VAC +10%–15% 50Hz 200~230VAC +10%–15% 60Hz	(1) Return the voltage to normal if abnormal. Or, ensure a voltage capacity to maintain the voltage at the left in excessive states (during acceleration/deceleration or cutting).
	(2) An alarm is displayed on the unit 7-segment LED.	(2) Refer to section 11.4.1.
	(3) Is the input signal from the NC normal?	(3) Check using the NC SPINDLE MONITOR SCREEN.
	(4) Is the output waveform from each detector normal? • Built-in speed detector • 1024P/rev encoder	(4) Check the waveform using a synchroscope and readjust or replace the detector.

Class III trouble	Investigation items	Remedy
The unit does not operate normally sometimes. The orientation stop position deviates. An alarm is displayed, but the operation returns to normal when the power is turned OFF then ON again, or when reset.	In this state it is necessary to fully grasp the condition in which the trouble is occurring. (Load conditions, operation modes, etc.) The trouble is probably cause by one of the following three causes:	
	(1) The input voltage momentarily stops or drops, and a MOMENTARY POWER FAILURE ERROR is displayed.	(1) Carry out a detailed investigation of the input voltage fluctuation, etc.
	(2) The control circuit mis-operated due to an abnormally large amount of noise, etc. The unit can withstand 1600V/1us of power line noise.	(2) Find the source of the noise, and install a surge killer, etc., there. Reconsider the unit grounding and detector shield, grounding, etc.
	(3) The orientation is incorrect. The orientation stop position deviates. The orientation takes a long time.	(3) Readjust the parameters for orientation. (Change the setting values of SP001, 002 and 006.) Or, investigate for backlash between the spindle and encoder if using a 1024P/rev encoder.

11. Troubleshooting

The faulty area can usually be roughly determined when the above conditions are confirmed. MDS-B-SPJ2 errors are largely divided as follows:

Class A trouble

- The controller was turned ON for the first time but did not operate correctly. (I)
- The unit operated normally before, but now suddenly will not operate. (II)
- The unit does not operate normally sometimes. The orientation stop position deviates. An alarm is displayed. (III)

Class B trouble

- Unit error
 - Power supply unit error
 - Spindle drive unit error
- Detector error
 - Speed detection encoder error
 - 1024P/rev encoder error
 - 90000P/rev encoder error
 - Magnesensor error
- Parameter and transfer data from the NC error
- Power error
- Motor error
- Other errors (incomplete input signal conditions, cable break, etc.)

11.3 Second step

Class I trouble	Investigation items	Remedy
The unit was turned ON for the first time but did not operate correctly.	The unit was thoroughly tested before shipping, so the unit should operate correctly. If not, the following causes are possible:	
	(1) The unit was damaged somewhere by a strong blow during operation or installation.	(1) Carry out a thorough visual check of the unit appearance to see if there are any abnormalities.
	(2) The external wiring or sequence is incorrect, or there is a broken wire. Has the unit been properly grounded? Note that the power phase sequence is unrelated.	(2) Check that the 7-segment LED in the unit is ON. Check that the external wiring and sequences are complete. (Note 1) The input/output signals to the unit can be checked on the NC SPINDLE MONITOR SCREEN.
	(3) Is the parameter setting correct?	(3) Check the spindle parameters.
	(4) The motor speed does not increase.	(4) Check that the motor wiring UVW is correctly connected. Or, check that the speed detector output waveform is correct, especially for built-in motors.
	(5) The motor unit operation itself is normal.	(5) Check that the load conditions are the same as the design values.
	(6) The unit operates normally except during orientation. (Swaying, etc.)	(6) Carry out orientation adjustment.
	(7) The C axis, synchronous tap and spindle synchronization do not operate normally.	(7) Adjust, and check the waveform of each detector.
(8) An alarm is displayed on the unit 7-segment LED.	(8) Refer to section 2.5.	

(Note 1) Be sure to turn ON the start signal CW and CCW input after inputting the READY signal and speed command.

11.4 Approach by each phenomenon

11.4.1 Details when alarms and warnings are displayed in the 7-segment LED

(1) Alarm No. **10** : UNDERVOLTAGE

[Details] The main circuit DC bus (PN) voltage of the spindle drive unit became 200V or less.

	Investigation items	Investigation results	Remedy
1	Is there a contactor (MC) to externally shut off the main circuit?	Externally installed.	Investigate item 2, and carry out the appropriate measures.
		Not externally installed.	Investigate item 3, and carry out the appropriate measures.
2	Contactor operation and continuity check	Contactor continuity error.	Inspect the contactor and replace if required.
		Contactor operation error. 1) The contactor does not turn ON. <ul style="list-style-type: none"> • Contactor signal (output voltage) error from the unit. • Connector (CN3) is coming loose. • The cable is broken. 2) The timing is delayed. <ul style="list-style-type: none"> • The contactor ON signal was executed with a separate sequence. 	Inspect the unit and replace if required. Correctly connect the unit. Replace the cable. Reconsider the sequence. (Or, change the signal from this unit.)
		No problem.	Investigate item 3, and carry out the appropriate measures.
3	Observe the charge lamp turning ON when an alarm occurs.	Charge lamp stays ON for a while.	Investigate item 4, and carry out the appropriate measures.
		Charge lamp momentarily turns ON, but turns OFF immediately when the alarm is issued and the contactor turns OFF. Or, the lamp turns OFF immediately when the power is turned OFF.	Inspect the unit and replace if required.
		Lamp does not light at all.	Inspect the unit and replace if required.
4	Input voltage and PN voltage check 1) Is there an open phase? 2) Is the power capacity small? 3) Does a momentary power failure occur?	There was an open phase.	Input the correct 3-phase 200V.
		The input voltage drops during acceleration.	Reconsider the power.
		A momentary power failure occurred.	Reconsider the power.
		No error.	Replace the unit.

11. Troubleshooting

(2) Alarm No. 12 : MEMORY ERROR 1

[Details] A ROM check sum error or RAM check error occurred in the spindle drive unit.

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm occurs each time the power is turned ON.	Replace the spindle drive unit.
		The alarm occurs sometimes.	Investigate item 2, and carry out the appropriate measures.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded? 2) Is there any device that produces noise around the unit?	1) The grounding is incomplete.	Correctly ground the unit.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the unit.

(3) Alarm No. 13 : SOFTWARE PROCESS ERROR

[Details] The spindle drive unit data processing did not finish within the normal time.

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm occurs each time the power is turned ON.	Replace the spindle drive unit.
		The alarm occurs sometimes.	Investigate item 2, and carry out the appropriate measures.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded? 2) Is there any device that produces noise around the unit?	1) The grounding is incomplete.	Correctly ground the unit.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the unit.

(4) Alarm No. 17 : A/D CONVERTOR ERROR

[Meaning] The current detection A/D conversion circuit in the spindle drive unit did not operate normally during initialization.

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm occurs each time the power is turned ON.	Replace the spindle drive unit.
		The alarm occurs sometimes.	Investigate item 2, and carry out the appropriate measures.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded? 2) Is there any device that produces noise around the unit?	1) The grounding is incomplete.	Correctly ground the unit.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the unit.

11. Troubleshooting

(5) Alarm No. 21 : NO SIGNAL DETECTION (ENC)

[Details] There was an A, B or Z phase signal error for the orientation 1024P/rev encoder.

	Investigation items	Investigation results	Remedy
1	Check the spindle parameter (SP037: SFNC5) setting.	Bit0 is set to "1" even though encoder orientation is not executed.	Set the correct value.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Jiggle the connector (spindle drive unit side and detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connector did not come (was not coming) loose.	Investigate item 3, and carry out the appropriate measures.
3	Turn the power OFF, and check the detector cable connection with a tester.	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Replace the spindle drive unit or detector.

11. Troubleshooting

(6) Alarm No. 23 : EXCESSIVE SPEED ERROR

[Details] The error between the speed command and the current speed exceeded 50rpm for 12 seconds.

	Investigation items	Investigation results	Remedy
1	Check the U, V, W wiring between the spindle drive unit and motor.	The wiring is not connected correctly.	Wire correctly.
		The wiring is connected correctly.	Investigate item 2, and carry out the appropriate measures.
2	Check the spindle parameter (SP034, SP040, SP055, SP257 and after) setting values.	The correct value is not set.	Set the correct value.
		The correct value is set.	Investigate item 3, and carry out the appropriate measures.
3	Measure the acceleration/deceleration time to the max. spindle speed. If the alarm occurs when changing from forward run to reverse run or vice versa, measure the acceleration/deceleration time from the max. forward run speed to the max. reverse run speed (or vice versa).	Acceleration/deceleration takes 12 sec. or more.	Increase the spindle parameter (SP055) setting value.
		Acceleration/deceleration takes 12 sec. or less.	Investigate item 4, and carry out the appropriate measures.
4	If the alarm occurs during cutting, check the load amount.	The load amount is 120% or more.	Decrease the load amount.
		The load amount is 119% or less.	Investigate item 5, and carry out the appropriate measures.
5	Jiggle the speed detector connector (spindle drive unit side and speed detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connector did not come (was not coming) loose.	Investigate item 6, and carry out the appropriate measures.
6	Turn the power OFF, and check the speed detector cable connection with a tester.	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Replace the spindle drive unit.

11. Troubleshooting

(7) Alarm No. 24 : GROUND FAULT

[Details] A motor cable ground fault was detected. (Detected only at the ready ON instant.)

	Investigation items	Investigation results	Remedy
1	Check whether the motor power line (U, V, W phase) is grounded. (Check the continuity between the cables.)	The motor cable sheath is pulled back and the power line is grounded.	Replace the cable.
		The power line is coming loose.	Correct the connection.
2	Is the motor insulation faulty?	The motor insulation is faulty.	Replace the motor.
		The correct value is set.	Investigate item 3, and carry out the appropriate measures.
3	Check the spindle load amount.	Frequent starting and stopping.	Decrease the starting/stopping frequency. Or, increase the capacity of the regenerative resistor.
		No particular problem.	Replace the spindle drive unit.

(8) Alarm No. 30 : EXCESSIVE REGENERATION

[Details] Regeneration reached the regeneration capacity limit.

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm occurs each time the power is turned ON.	Replace the spindle drive unit.
		The alarm occurs sometimes.	Investigate item 2, and carry out the appropriate measures.
2	Check the regenerative resistor capacity.	A small capacity regenerative resistor is installed.	Change to a regenerative resistor with the correct capacity.
		The correct regenerative resistor is installed.	Investigate item 3, and carry out the appropriate measures.
3	Check the spindle parameter (SP041) setting value.	The correct value is not set.	Set the correct value.
		The correct value is set.	Investigate item 4, and carry out the appropriate measures.
4	Check the spindle load amount.	Frequent starting and stopping.	Decrease the starting/stopping frequency. Or, increase the capacity of the regenerative resistor.
		No particular problem.	Replace the spindle drive unit.

11. Troubleshooting

(9) Alarm No. 31 : OVERSPEED

[Details] The motor speed exceeded 115% of the value set in the spindle parameter (SP017: TSP).

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm only occurs during the speed loop operation.	Investigate item 2, and carry out the appropriate measures.
		The alarm only occurs during the position loop.	Investigate item 3, and carry out the appropriate measures.
		The alarm occurs constantly.	Investigate item 4, and carry out the appropriate measures.
2	Check the spindle parameter (SP017: TSP) setting value.	The setting value is 2000 or less.	Increase the setting value.
		The setting value is 2001 or more.	Investigate item 4, and carry out the appropriate measures.
3	If the alarm occurs during synchronous tap, check the spindle parameter (SP193: SPECT) setting value and tap time constant.	The SP193 bit5 (position detection polarity) setting is incorrect. Or, the tap time constant setting value is small.	Set the correct value.
		The setting value is correct.	Investigate item 4, and carry out the appropriate measures.
4	Investigate the wiring and installation environment. grounded?		
	1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground the unit.
	2) Is there any device that produces noise around the unit?	2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
	3) Are the speed and position detector cables correctly shielded?	3) The cables are not correctly shielded.	Correctly shield the cables.
		No particular problem.	Replace the spindle drive unit.

11. Troubleshooting

(10) Alarm No. 32 : POWER MODULE ERROR

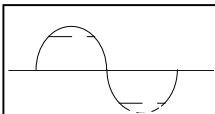
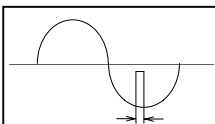
[Details] An excessive current flowed to the power component used in the spindle drive unit.

	Investigation items	Investigation results	Remedy
1	Investigate the location where the phenomenon occurred.	The phenomenon occurred before ready ON.	Replace the spindle drive unit.
		The phenomenon occurred after servo ON.	Investigate item 2, and carry out the appropriate measures.
2	Check the spindle parameter (SP034, SP040, SP055, SP257 and after) setting values.	The correct value is not set.	Set the correct value.
		The correct value is set.	Investigate item 3, and carry out the appropriate measures.
3	If the alarm occurs during cutting, check the load amount.	The load amount is 120% or more.	Decrease the load amount.
		The load amount is 119% or less.	Investigate item 4, and carry out the appropriate measures.
4	Check the U, V, W wiring between the spindle drive unit and motor. 1) Are the terminal screws loose? 2) Is there a short-circuit in the wiring between phases? 3) Is there a ground fault in one of the phases? When checking items 2) and 3), leave both ends of the cable open.		
		1) The terminal screws were loose.	Correctly tighten the screws.
		2) There was a short-circuit.	Replace the cable.
		3) There was a ground fault.	Replace the cable.
		No particular problem.	Investigate item 5, and carry out the appropriate measures.
5	Check the motor insulation. Carry out a megger test between each motor wire and ground.	The resistance value is 1MΩ or less.	Replace the motor.
		The resistance value is larger than 1MΩ.	Investigate item 6, and carry out the appropriate measures.
6	Check the power voltage.	The voltage sometimes becomes 170V or less during acceleration/ deceleration and during cutting.	Reconsider the power voltage.
		The voltage is constantly 171V or more.	Investigate item 7, and carry out the appropriate measures.
7	Investigate the wiring and installation environment. 1) Is the unit correctly grounded? 2) Is there any device that produces noise around the unit?		
		1) The grounding is incomplete.	Correctly ground the unit.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the spindle drive unit.

11. Troubleshooting

(11) Alarm No. 33 : OVERVOLTAGE

[Details] The main circuit DC bus (PN) voltage exceeded 400V.

	Investigation items	Investigation results	Remedy
1	Check the P and C wiring between the spindle drive unit and the regenerative resistor.	There was a broken or loose wire.	Replace the cable. Or, carry out correct wiring.
		The wiring is normal.	Investigate item 2, and carry out the appropriate measures.
2	Is the specified power capacity secured?	The power capacity is insufficient.	Increase the power capacity.
		No particular problem.	Investigate item 3, and carry out the appropriate measures.
3	Using a tester, check whether the PN bus voltage is also 170V or more during motor acceleration/deceleration.	The voltage became 170V or less.	Increase the power capacity.
		The voltage is 170V or more.	Investigate item 4, and carry out the appropriate measures.
4	Observe the power voltage waveform with a synchroscope. (During acceleration/deceleration also.)	1. Waveform distortion. 	Eliminate the waveform distortion. 1. Increase the power capacity, or use a larger power cable. 2. Improve other semiconductor devices that produce waveform distortion. (Additionally install an AC reactor.)
		2. When there is a partial voltage drop. 	
		3. Other waveform and frequency error.	
		No particular problem.	Investigate item 5, and carry out the appropriate measures.
5	Using a tester, measure the voltage between wires R-S, S-T and T-R.	The voltage difference between each wire is 10V or more.	Improve the power phase balance.
		No particular problem.	Investigate item 6, and carry out the appropriate measures.
6	Observe the power voltage waveform with a synchroscope.	Momentary power failures or voltage drops sometimes occur.	Reconsider the power equipment.
		No particular problem.	Investigate item 7, and carry out the appropriate measures.
7	Investigate the wiring and installation environment.		
	1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground the unit.
	2) Is there any device that produces noise around the unit?	2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the unit.

11. Troubleshooting

(12) Alarm No. 34 : NC COMMUNICATION AND CRC ERROR

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

	Investigation items	Investigation results	Remedy
1	Jiggle the connectors between the NC ↔ spindle drive unit, battery unit ↔ spindle drive unit, and spindle drive unit ↔ servo drive unit to see whether any are coming loose. Also check if the terminators are coming loose. Check if there is any excessive force being applied to the connectors.	Connector came (was coming) loose. Excessive force was applied.	Install correctly.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Disconnect each cable in item 1, and check the connection with a tester.	There was a connection fault.	Replace the cable.
		There was no connection fault.	Investigate item 3, and carry out the appropriate measures.
3	Investigate the wiring and installation environment. 1) Are the units correctly grounded? 2) Are there any devices that produce noise around the units?		
		1) The grounding is incomplete.	Correctly ground the units.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		3) No particular problem.	Replace the spindle drive unit. Or, replace the MCP card on the NC side.

(13) Alarm No. 35 : NC COMMUNICATION AND DATA ERROR

[Details] The movement command data from the NC was excessive

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 34 , and carry out the appropriate measures.		

(14) Alarm No. 36 : NC COMMUNICATION AND TRANSMISSION ERROR

[Details] The cyclic data transmission from the NC was interrupted.

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 34 , and carry out the appropriate measures.		

11. Troubleshooting

(15) Alarm No. 37 : PARAMETER ERROR

[Details] There were errors in the spindle parameters transmitted from the NC during initialization.

	Investigation items	Investigation results	Remedy
1	Check the spindle parameter setting values. The No. of the incorrectly set parameter is displayed on the NC DIAGNOSIS SCREEN.	There was an incorrectly set value.	Set the correct value.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Investigate as in alarm No. 34 , and carry out the appropriate measures.		

(16) Alarm No. 38 : NC COMMUNICATION AND PROTOCOL ERROR 1

[Details] The protocol error "FRAME ERROR" occurred in the communication with the NC.

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 34 , and carry out the appropriate measures.		

(17) Alarm No. 39 : NC COMMUNICATION AND PROTOCOL ERROR 2

[Details] The protocol error "INFORMATION ERROR" occurred in the communication with the NC.

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 34 , and carry out the appropriate measures.		

11. Troubleshooting

(18) Alarm No. **3B** : POWER MODULE OVERHEATING

[Details] Overheating was detected in the IPM used in the spindle drive main circuit. (Capacity: 5.5kW or more only)

	Investigation items	Investigation results	Remedy	
1	Investigate the heat dissipation environment.			
	1) Check the rotation of the fan on the bottom of unit.	The fan does not rotate normally.	Replace the fan.	Take measures so cutting oil, dust, etc., do not get on the fan.
			Clean the fan.	
	2) Check for oil, dust, etc., on the heat radiating fins on the side of the unit.	The heat radiating fins have a lot of cutting oil, dust, etc., adhered to them.	Clean the fins.	
	3) Measure the unit ambient temperature.	The temperature exceeds 55°C.	Give consideration to the panel ventilation cooling.	
	None of the items is relevant.	Investigate item 2, and carry out the appropriate measures.		
2	Investigate the wiring and installation environment.			
	1) Is the unit correctly grounded?	1) The grounding is incomplete.	Correctly ground the unit.	
	2) Are there any devices that produce noise around the unit?	2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.	
		No particular problem.	Replace the spindle drive unit.	

(19) Alarm No. **42** : FEEDBACK ERROR (MOTOR PLG)

[Details] The one rotation counter value error pulse of the motor PLG exceeded the setting value (SP90: PLE).

	Investigation items	Investigation results	Remedy
1	Is the speed detector cable correctly shielded?	The cable is not correctly shielded.	Correctly shield the cable.
		The cable is correctly shielded.	Investigate item 2, and carry out the appropriate measures.
2	Is the encoder cable broken?	The cable is broken.	Use one encoder cable.
		The cable is not broken.	Investigate item 3, and carry out the appropriate measures.
3	Push and pull on the encoder or speed detector cable, and use a tester to check if a wire is almost broken.	A wire is almost broken.	Replace the cable.
		The wires are normal.	Investigate item 4, and carry out the appropriate measures.
4	Are the A, B and Z phase waveforms of the speed detector adjusted correctly?	The waveforms deviate.	Correctly adjust the waveforms.
		The waveforms are normal.	Replace the unit, or readjust/replace the position detector.

11. Troubleshooting

(20) Alarm No. 46 : MOTOR OVERHEATING

[Details] The motor overheated and the motor's built-in thermal protector activated.

When this alarm occurs, the motor cooling fan must be allowed to operate for 10 to 20 min. after the motor stops before the alarm can be canceled.

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm repeats immediately after the power is turned ON. Or, the alarm occurs a few minutes after the operation.	Investigate item 2, and carry out the appropriate measures.
		The alarm occurs after operating for a while.	Investigate item 5, and carry out the appropriate measures.
2	Jiggle the speed detector spindle drive unit side connector to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		No particular problem.	Investigate item 3, and carry out the appropriate measures.
3	Check the speed detector cable connection.	The connection is faulty.	Correctly connect the cable.
		The connection is normal.	Investigate item 4, and carry out the appropriate measures.
4	Check between MOH and RG of the motor thermal protector with a tester.	The resistance value is 100Ω or more.	Replace the motor.
		The resistance value is 10Ω or less.	Replace the spindle drive unit.
5	Check the spindle load amount.	Frequent starting and stopping. Or, the cutting load amount is large.	Decrease the starting/stopping frequency. Or, decrease the load.
		No particular problem.	Investigate item 6, and carry out the appropriate measures.
6	Check the wiring and rotation of the motor cooling fan.	The motor cooling fan wiring is incorrect.	Correctly wire the fan.
		The wiring is correct, but the fan does not rotate.	Replace the motor.
		No particular problem.	Investigate item 7, and carry out the appropriate measures.
7	Check the finger guard of the motor cooling fan.	The holes on the finger guard are blocked.	Clean the finger guard.
		No particular problem.	Replace the spindle drive unit.

11. Troubleshooting

(21) Alarm No. 50 : OVERLOAD

[Details] The value of the current flowing to the spindle motor exceeded the overload detection level (spindle parameter SP064: OLL), and continued longer than the overload detection time (spindle parameter SP063: OLT, Standard: 60 sec.).

	Investigation items	Investigation results	Remedy
1	Check the spindle parameter (SP034, SP040, SP055, SP257 and following) setting values.	The correct value is not set.	Set the correct value.
		The correct value is set.	Investigate item 2, and carry out the appropriate measures.
2	Check the spindle parameter (SP063 and SP064) setting values.	The standard value is not set.	Set the standard value.
		The standard value is set.	Investigate item 3, and carry out the appropriate measures.
3	Check the U, V, W wiring between the spindle drive unit and motor. 1) Are the terminal screws loose? 2) Is there a short-circuit in the wiring between phases? 3) Is there a ground fault in one of the phases? When checking items 2) and 3), leave both ends of the cable open.		
		1) The terminal screws were loose.	Correctly tighten the screws.
		2) There was a short-circuit.	Replace the cable.
		3) There was a ground fault.	Replace the cable.
		No particular problem.	Investigate item 4, and carry out the appropriate measures.
4	Jiggle the speed detector connector (spindle drive unit side and speed detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connectors are normal.	Investigate item 5, and carry out the appropriate measures.
5	Turn the power OFF, and check the speed detector cable connection with a tester.	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Investigate item 6, and carry out the appropriate measures.
6	Check the speed detector waveform.	The waveform is incorrect.	Adjust the waveform so it is correct.
		The waveform is correct.	Investigate item 7, and carry out the appropriate measures.
7	Check the motor load amount.	The load amount exceeds the motor rating.	Set the load amount to within the motor rating.
		No particular problem.	Investigate item 8, and carry out the appropriate measures.
8	Check the motor rotation.	The motor is locked.	Reconsider the machine side.
		No particular problem.	Replace the unit.

11. Troubleshooting

(22) Alarm No. 52 : EXCESSIVE ERROR

[Details] The position tracking error during orientation exceeded the specified value (excessive error width setting value).

- Excessive error width setting value
 During orientation (SP102: OODR): Standard value 32767 (32767 pulses)
 During spindle synchronization (SP186: SODR): Standard value 32767 (32767 pulses)
 During synchronous tap (SP218: TODR): Standard value 32767 (32767 pulses)

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm occurs during orientation.	Investigate item 2, and carry out the appropriate measures.
		The alarm occurs during spindle synchronization.	Investigate item 7, and carry out the appropriate measures.
		The alarm occurs during synchronous tap.	Investigate item 11, and carry out the appropriate measures.
2	If the alarm occurs during encoder orientation, check the spindle parameter (SP097: SPEC0) bit5 setting value.	The trouble is eliminated by changing the bit5 setting value.	Change the bit5 setting value.
		The trouble is not eliminated by changing the bit5 setting value.	Return bit5 to the original setting value. Investigate item 3, and carry out the appropriate measures.
3	Check the spindle parameter (SP001: PGM, SP002: PGE, P006: CSP) setting values.	The trouble is eliminated by raising the PGM and PGE values 2-fold, or by halving the CSP value.	Change the setting value.
		The trouble is not eliminated by changing the values as shown above.	Investigate item 4, and carry out the appropriate measures.
4	Jiggle the position and speed detector connectors (spindle drive unit side and position and speed detector side) to see whether they are coming loose.	Connector came (was coming) loose.	Install correctly.
		Connectors are normal.	Investigate item 5, and carry out the appropriate measures.
5	Turn the power OFF, and check the position and speed detector cable connection with a tester.	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Investigate item 6, and carry out the appropriate measures.
6	Check the speed detector waveform.	The waveform is incorrect.	Adjust the waveform so it is correct. Or, replace the detector.
		The waveform is correct.	Replace the unit or detector.
7	If the alarm occurs during spindle synchronization, check the spindle parameter (SP177: SPECS) bit 5 setting value.	The trouble is eliminated by changing the bit5 setting value.	Change the bit5 setting value.
		The trouble is not eliminated by changing the bit5 setting value.	Return bit5 to the original setting value. Investigate item 8, and carry out the appropriate measures.

11. Troubleshooting

	Investigation items	Investigation results	Remedy
8	Check the spindle synchronization time constant of the spindle parameter.	The trouble is eliminated by increasing the setting value.	Reconsider and change the setting value.
		The trouble is not eliminated by increasing the setting value.	Return the setting to the original value. Investigate item 9, and carry out the appropriate measures.
9	Check the spindle parameter (SP010: PGS) setting value.	The trouble is eliminated by increasing the setting value.	Change the setting value.
		The trouble is not eliminated by increasing the setting value.	Return the setting to the original value. Investigate item 10, and carry out the appropriate measures.
10	Check the spindle parameter (SP177 to SP190, SP257 and following) setting values.	The correct values are not set.	Set the correct values.
		No particular problem.	Replace the unit, or readjust/replace the position detector.
11	If the alarm occurs during synchronous tap, check the spindle parameter (SP193: SPECT) bit5 setting value.	The trouble is eliminated by changing the bit5 setting value.	Change the bit5 setting value.
		The trouble is not eliminated by changing the bit5 setting value.	Return bit5 to the original setting value. Investigate item 12, and carry out the appropriate measures.
12	Check the spindle parameter synchronous tap time constant.	The trouble is eliminated by increasing the setting value.	Reconsider and change the setting value.
		The trouble is not eliminated by increasing the setting value.	Return the setting to the original value. Investigate item 13, and carry out the appropriate measures.
13	Check the spindle parameter (SP009: PGT) setting value.	The trouble is eliminated by increasing the setting value.	Change the setting value.
		The trouble is not eliminated by increasing the setting value.	Return the setting to the original value. Investigate item 14, and carry out the appropriate measures.
14	Check the spindle parameter (SP193 to SP222, SP257 and following) setting values.	The correct values are not set.	Set the correct values.
		No particular problem.	Replace the unit, or readjust/replace the position detector.

The tracking error amount (droop amount) can be calculated using the following equation. This alarm will occur if this value exceeds the setting value of each excessive error width.

$$\text{Droop amount (No. of pulses)} = \frac{\{\text{Spindle speed (rpm)}/60\} \times \text{No. of pulses per rotation (*1)}}{\text{Position loop gain (sec}^{-1}\text{)}}$$

(*1) The No. of pulses per rotation is 4096.

11. Troubleshooting

(23) Alarm No. **5C** : ORIENTATION FEEDBACK ERROR

[Details] After completion of the orientation in-position, the error between the command and feedback exceeded the setting value (SP114: 0PER).

	Investigation items	Investigation results	Remedy
1	Is the speed detector cable correctly shielded?	The cable is not correctly shielded.	Correctly shield the cable.
		The cable is correctly shielded.	Investigate item 2, and carry out the appropriate measures.
2	Is the encoder cable broken?	The cable is broken.	Use one encoder cable.
		The cable is not broken.	Investigate item 3, and carry out the appropriate measures.
3	Push and pull on the encoder or speed detector cable, and use a tester to check if a wire is almost broken.	A wire is almost broken.	Replace the cable.
		The wires are normal.	Investigate item 4, and carry out the appropriate measures.
4	Are the A, B and Z phase waveforms of the speed detector adjusted correctly?	The waveforms deviate.	Correctly adjust the waveforms.
		The waveforms are normal.	Replace the unit, or readjust/replace the position detector.

(24) Alarm No. **88** : WATCHDOG

[Details] The system did not operate correctly, and the software processing did not finish within the specified time.

	Investigation items	Investigation results	Remedy
1	Investigate repeatability.	The alarm occurs every time ready ON occurs.	Replace the unit.
		The alarm sometimes occurs.	Investigate item 2, and carry out the appropriate measures.
2	Investigate the wiring and installation environment. 1) Is the unit correctly grounded? 2) Are there any devices that produce noise around the unit?		
		1) The grounding is incomplete.	Correctly ground the unit.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the unit.

(25) Warning No. **EO** : OVER REGENERATION WARNING

[Details] This warning occurs when the regenerative resistor load reaches 80% of the alarm.

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 30 , and carry out the appropriate measures.		

11. Troubleshooting

(26) Warning No. **E1** : OVERLOAD WARNING

[Details] The value of the current flowing to the spindle motor exceeded the overload detection level (spindle parameter SP064: OLL), and continued longer than 80% of the overload detection time (spindle parameter SP063: OLT).

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 50 , and carry out the appropriate measures.		

(27) Warning No. **E4** : PARAMETER ERROR WARNING

[Details] A value was set during ready ON that exceeded the allowable range.

	Investigation items	Investigation results	Remedy
1	Investigate as in alarm No. 37 , and carry out the appropriate measures.		

(28) Warning No. **E7** : NC EMERGENCY STOP

[Details] This warning occurs when an emergency stop signal is input from the NC, or when an alarm occurs in another servo axis or spindle.

	Investigation items	Investigation results	Remedy
1	Check whether the emergency stop switch is ON.	The switch is ON.	Turn the emergency stop button OFF.
		The switch is OFF.	Investigate item 2, and carry out the appropriate measures.
2	Jiggle the connector between the NC and spindle drive unit to see whether it is coming loose. Also check if there is any excessive force being applied to the connectors.	Connector came (was coming) loose. Excessive force was applied.	Install correctly.
		No particular problem.	Investigate item 3, and carry out the appropriate measures.
3	Disconnect the cable between the NC and spindle drive unit, and check the connection with a tester.	There was a connection fault.	Replace the cable.
		There was no connection fault.	Investigate item 4, and carry out the appropriate measures.
4	Investigate the wiring and installation environment. 1) Are the units correctly grounded? 2) Are there any devices that produce noise around the units?		
		1) The grounding is incomplete.	Correctly ground the units.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the spindle drive unit.

11. Troubleshooting

11.4.2 When alarms and warnings appear in the display

(1) There is no error display, but the motor will not rotate at all.

	Investigation items	Investigation results	Remedy
1	Check the wiring around spindle drive unit. Also check for loose terminal screws, broken wires, etc.	The wiring is incorrect, or there is a loose screw or broken wire, etc.	Wire the unit correctly. Tighten the screws. Replace the cable.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Check the input voltage.	The voltage exceeds the specification value.	Return the voltage to the correct value.
		The voltage is within the specification value.	Investigate item 3, and carry out the appropriate measures.
3	Confirm all spindle parameters.	The correct value is not set.	Set the correct value.
		The correct value is set.	Investigate item 4, and carry out the appropriate measures.
4	Check the input signals. <ul style="list-style-type: none"> • Are the ready ON, forward run and reverse run signals input? • Particularly, the forward run and reverse run signals must be input 1 sec. or more after the ready on signal. • Also check if the forward run and reverse run signals are ON simultaneously. 	The signals are not input, or the sequence is incorrect. The orientation command is input.	Correct the input signals.
		No particular problem.	Investigate item 5, and carry out the appropriate measures.
5	Check the speed command.	The speed command is not input correctly.	Correctly input the speed command.
		The speed command is correctly input.	Replace the unit.

11. Troubleshooting

(2) No error is displayed, but the motor will only rotate slowly. Or, there is a noise coming from the motor.

	Investigation items	Investigation results	Remedy
1	Check the U, V, W wiring between the spindle drive unit and motor.	The wiring is not connected correctly.	Wire correctly.
		The wiring is connected correctly.	Investigate item 2, and carry out the appropriate measures.
2	Check the input voltage.	One of the values in the three phases is outside the specification values. No particular problem.	Return the voltage to the correct value. Investigate item 3, and carry out the appropriate measures.
3	Check the speed command	The speed command is not input correctly.	
		The speed command is input correctly.	Investigate item 4, and carry out the appropriate measures.
4	Jiggle the speed detector connector (spindle drive unit side and speed detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connectors are normal.	Investigate item 5, and carry out the appropriate measures.
5	Turn the power OFF, and check the speed detector cable connection with a tester.	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Replace the unit.

(3) The speed command and actual speed do not match.

	Investigation items	Investigation results	Remedy
1	Check the speed command.	The speed command is not input correctly.	Correctly input the speed command.
		The speed command is correct.	Investigate item 2, and carry out the appropriate measures.
2	Check for slippage between the motor and spindle (when connected with a belt or clutch).	There is slippage.	Correct the machine side.
		No particular problem.	Investigate item 3, and carry out the appropriate measures.
3	Check the spindle parameters (SP034, SP040, SP017, SP257 and following).	The correct value is not set.	Set the correct value.
		The correct value is set.	Replace the spindle drive unit.

11. Troubleshooting

(4) The start time was long, or became longer than before.

	Investigation items	Investigation results	Remedy
1	Check whether the friction torque has increased.	The friction torque has increased.	Correct the machine side.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Rotate the motor by hand and check whether the bearing is normal.	The motor does not rotate smoothly.	Replace the spindle motor.
		The motor rotates smoothly.	Investigate item 3, and carry out the appropriate measures.
3	Check whether a torque limit signal is being input.	The signal is being input.	Set so it is not input.
		The signal is not being input.	Replace the unit.

(5) The motor stops during cutting.

	Investigation items	Investigation results	Remedy
1	Check the load amount during cutting.	The load meter jumps above 120% during cutting.	Decrease the load.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Investigate as in item (4) above, and carry out the appropriate measures.		

11. Troubleshooting

(6) There is a lot of vibration and noise (gear sound).

	Investigation items	Investigation results	Remedy
1	Check the machine dynamic balance. (Try coasting from max. speed.)	The sound is the same during coasting.	Correct the machine side.
		No particular problem.	Investigate item 2, and carry out the appropriate measures.
2	Check whether there is a resonance point on the machine side. (Try coasting from max. speed.)	The vibration and noise increase at a certain speed during coasting.	Correct the machine side.
		No particular problem.	Investigate item 3, and carry out the appropriate measures.
3	Check for machine backlash.	There is a large backlash.	Correct the machine side.
		No particular problem.	Investigate item 4, and carry out the appropriate measures.
4	Check the spindle parameter (SP022: VGNP1, SP023: VGNI1, and SP056: PYVR) settings.	The noise and vibration decrease if the values are halved.	Change the setting values. Note that the impact response will decrease, so caution is required.
		The vibration and noise do not change when the setting values are changed as above.	Return the setting to the original value. Investigate item 5, and carry out the appropriate measures.
5	Jiggle the speed detector connector (spindle drive unit side and speed detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connectors are normal.	Investigate item 6, and carry out the appropriate measures.
6	Turn the power OFF, and check the speed detector cable connection with a tester.	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Replace the unit.

(7) The spindle coasts during deceleration.

	Investigation items	Investigation results	Remedy
1	Check for slippage between the motor and spindle (when connected by a belt or clutch).	There is slippage.	Correct the machine side.
		No particular problem.	Replace the unit.

11. Troubleshooting

(8) The rotation does not stabilize.

	Investigation items	Investigation results	Remedy
1	Check the spindle parameter (SP022: VGNP1, SP023: VGNI1) setting values.	The rotation stabilizes when both setting values are raised 2-fold.	Change the setting values. Note that the gear sound may become louder.
		The rotation does not stabilize when the values are changed as shown above.	Return the settings to the original values. Investigate item 2, and carry out the appropriate measures.
2	Jiggle the speed detector connector (spindle drive unit side and speed detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connectors are normal.	Investigate item 3, and carry out the appropriate measures.
3	Turn the power OFF, and check the speed detector cable connection with a tester. (Especially check the shield wiring.)	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The connection is normal.	Investigate item 4, and carry out the appropriate measures.
4	Investigate the wiring and installation environment. 1) Are the units correctly grounded? 2) Are there any devices that produce noise around the units?		
		1) The grounding is incomplete.	Correctly ground the units.
		2) The alarm occurs easily when a specific device is operated.	Execute noise countermeasures for the device at the left.
		No particular problem.	Replace the spindle drive unit.

11. Troubleshooting

(9) The motor does not rotate above a certain speed.

	Investigation items	Investigation results	Remedy
1	Check the speed command. Also check whether the machine operation panel override input is input.	The speed command is not input correctly.	Correctly input the speed command.
		The speed command is input correctly.	Investigate item 2, and carry out the appropriate measures.
2	Check whether the load has suddenly become heavy.	The load has become heavy.	Correct the machine side.
		No particular problem.	Investigate item 3, and carry out the appropriate measures.
3	Rotate the motor by hand and check whether the bearing is normal.	The motor does not rotate smoothly.	Replace the spindle motor.
		The motor rotates smoothly.	Investigate item 4, and carry out the appropriate measures.
4	Jiggle the speed detector connector (spindle drive unit side and speed detector side) to see whether it is coming loose.	Connector came (was coming) loose.	Install correctly.
		Connectors are normal.	Investigate item 5, and carry out the appropriate measures.
5	Turn the power OFF, and check the speed detector cable connection with a tester. (Especially check the shield wiring.)	The connection is faulty, or there is a broken wire.	Replace the detector cable. Correctly connect the cable.
		The waveform is normal.	Replace the spindle drive unit.

Appendix

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Appendix 1 MDS-A/B-SP/SPJ2 Parameter Setting List (1/3)

Customer :
 Machine name :
 [Setting 1] Amplifier : MDS-B-SP-J2- [Setting 2] Amplifier : MDS-B-SP-
 Motor : SJ- Motor : SJ-
 Regenerative resistor : R-UNIT- Converter : MDS-B-CV-
 Delivery specification No.: SS0-
 Remarks :

Created by	Approved by

No.	Abbre.	Setting 1	Setting 2
SP001	PGM	100	
SP002	PGE	100	
SP003	PGCO	15	
SP004	OINP	16	
SP005	OSP	0	
SP006	CSP	20	
SP007	OPST	0	
SP008		0	
SP009	PGT	15	
SP010	PGS	15	
SP011		0	
SP012		0	
SP013		0	
SP014		0	
SP015		0	
SP016		0	
SP017	TSP	6000	
SP018	ZSP	50	
SP019	CSN1	30	
SP020	SDTS	600	
SP021	TLM1	10	
SP022	VGNP1	63	
SP023	VGNI1	60	
SP024		0	
SP025	GRA1	1	
SP026	GRA2	1	
SP027	GRA3	1	
SP028	GRA4	1	
SP029	GRB1	1	
SP030	GRB2	1	
SP031	GRB3	1	
SP032	GRB4	1	

No.	Abbre.	Setting 1	Setting 2
SP033	SFNC1	0000	
SP034	SFNC2	0000	
SP035	SFNC3	0000	
SP036	SFNC4	0000	
SP037	SFNC5	0000	
SP038	SFNC6	0000	
SP039	ATYP	1000	
SP040	MTYP	2000	
SP041	PTYP	0	
SP042	CRNG	0	
SP043	TRNG	0	
SP044	TRANS	0	
SP045		0	
SP046	CSN2	0	
SP047	SDTR	30	
SP048	SUT	15	
SP048	TLM2	20	
SP050	TLM3	30	
SP051	TLM4	40	
SP052	TLM5	50	
SP053	TLM6	60	
SP054	TLM7	70	
SP055	SEIM	12	
SP056	PYYVR	50	
SP057		0	
SP058	HSPT	0	
SP059	MKT	0	
SP060	MKT2	0	
SP061	MKIL	0	
SP062		0	
SP063	OLT	60	
SP064	OLL	110	

No.	Abbre.	Setting 1	Setting 2
SP065	VCGN1	100	
SP066	VCSN1	0	
SP067	VIGWA	5000	
SP068	VIGWB	10000	
SP069	VOGN	64	
SP070	FHz	0	
SP071	VR2WA	0	
SP072	VR2WB	0	
SP073	VR2GN	0	
SP074		0	
SP075		0	
SP076		0	
SP077	TDSL	0	
SP078	FPWM	0	
SP079	ILMT	0	
SP080	ILMA	0	
SP081		0	
SP082		0	
SP083		0	
SP084		0	
SP085		0	
SP086		0	
SP087	DIQM	75	
SP088	DIQN	3000	
SP089	VGHP	0	
SP090	VGHI	0	
SP091	OFSN	0	
SP092	OFSI	0	
SP093	ORE	0	
SP094	LMAV	0	
SP095	VFAV	0	
SP096	EGAR	0	

No.	Abbre.	Setting 1	Setting 2
SP097	SPECO	0000	
SP098	VGOP	63	
SP099	VGOI	60	
SP100	VGOD	15	
SP101	DINP	16	
SP102	OODR	32767	
SP103	FTM	200	
SP104	TLMR	100	
SP105	IQG0	100	
SP106	IDG0	100	
SP107	CSP2	0	
SP108	CSP3	0	
SP109	CSP4	0	
SP110	WCML	0	
SP111	WDEL	0	
SP112	WCLP	0	
SP113	WINP	0	
SP114	OPER	0	
SP115		0	
SP116		0	
SP117		0	
SP118		0	
SP119	MPGH	0	
SP120	MPGL	0	
SP121	MPCSH	0	
SP122	MPCSL	0	
SP123	MGD0	542	
SP124	MGD1	768	
SP125	MGD2	384	
SP126		0	
SP127		0	
SP128		0	

Appendix

MDS-A/B-SP/SPJ2 Parameter Setting List (2/3)

No.	Abbre.	Setting 1	Setting 2
SP129	SPECC	0000	
SP130	PGC1	15	
SP131	PGC2	15	
SP132	PGC3	15	
SP133	PGC4	15	
SP134	VGCP0	63	
SP135	VGC10	60	
SP136	VGCD0	15	
SP137	VGCP1	63	
SP138	VGC11	60	
SP139	VGCD1	15	
SP140	VGCP2	63	
SP141	VGC12	60	
SP142	VGCD2	15	
SP143	VGCP3	63	
SP144	VGC13	60	
SP145	VGCD3	15	
SP146	CGCP4	63	
SP147	VGC14	60	
SP148	VGCD4	15	
SP149	CZRN	50	
SP150	CPDT	1	
SP151	CPSTL	0000	
SP152	CPSTH	0000	
SP153	CINP	03E8	
SP154	CODRL	D4C0	
SP155	CODRH	0001	
SP156		0	
SP157		0	
SP158		0	
SP159	CPY0	50	
SP160	CPY1	100	

No.	Abbre.	Setting 1	Setting 2
SP161	IQGC0	100	
SP162	IDGC0	100	
SP163	IQGC1	100	
SP164	IDGC1	100	
SP165	PG2C	0	
SP166	PG3C	0	
SP167		0	
SP168		0	
SP169		0	
SP170		0	
SP171		0	
SP172		0	
SP173		0	
SP174		0	
SP175		0	
SP176		0	
SP177	SPECS	0000	
SP178	VGSP	63	
SP179	VGSI	60	
SP180	VGSD	15	
SP181	VCGS	100	
SP182	VCSS	0	
SP183	SYNV	20	
SP184		0	
SP185	SINP	16	
SP186	SODR	32767	
SP187	IQGS	100	
SP188	IDGS	100	
SP189	PG2S	0	
SP190	PG3S	0	
SP191		0	
SP192		0	

No.	Abbre.	Setting 1	Setting 2
SP193	SPECT	0000	
SP194	VGTP	63	
SP195	VGTI	60	
SP196	VGTD	15	
SP197		0	
SP198	VCGT	100	
SP199	VCST	0	
SP200	FFC1	0	
SP201	FFC2	0	
SP202	FFC3	0	
SP203	FFC4	0	
SP204		0	
SP205		0	
SP206		0	
SP207		0	
SP208		0	
SP209		0	
SP210		0	
SP211		0	
SP212		0	
SP213		0	
SP214	TZRN	50	
SP215	TPDT	1	
SP216	TPST	0	
SP217	TINP	16	
SP218	TODR	32767	
SP219	IQGT	100	
SP220	IDGT	100	
SP221	PG2T	0	
SP222	PG3T	0	
SP223		0	
SP224		0	

No.	Abbre.	Setting 1	Setting 2
SP225		0	
SP226		0	
SP227		0	
SP228		0	
SP229		0	
SP230		0	
SP231		0	
SP232		0	
SP233		0	
SP234		0	
SP235		0	
SP236		0	
SP237		0	
SP238		0	
SP239		0	
SP240		0	
SP241		0	
SP242		0	
SP243		0	
SP244		0	
SP245		0	
SP246		0	
SP247		0	
SP248		0	
SP249	SMO	0	
SP250	LMO	0	
SP251	SMP1NO	0	
SP252	SMP2NO	0	
SP253	DA1NO	0	
SP254	DA2NO	0	
SP255	DA1EMPTY	0	
SP256	DA2EMPTY	0	

MDS-A/B-SP/SPJ2 Parameter Setting List (3/3)

No.	Abbre.	Setting 1	Setting 2
SP353	ICTL	0000	
SP354	K11L	0000	
SP355	TIL	0000	
SP356	VPWML	0000	
SP357	IDLML	0000	
SP358		0000	
SP359		0000	
SP360		0000	
SP361		0000	
SP362		0000	
SP363		0000	
SP364		0000	
SP365		0000	
SP366		0000	
SP367		0000	
SP368		0000	
SP369		0000	
SP370		0000	
SP371		0000	
SP372		0000	
SP373		0000	
SP374		0000	
SP375		0000	
SP376		0000	
SP377	EDOL	0000	
SP378	SPOL	0000	
SP379	SBSL	0000	
SP380	SIQL	0000	
SP381	DPOL	0000	
SP382	DBSL	0000	
SP383	DIQL	0000	
SP384	BSDL	0000	

No.	Abbre.	Setting 1	Setting 2
SP321	RPML	0000	
SP322	NRL	0000	
SP323	NPL	0000	
SP324	NBL	0000	
SP325	NFL	0000	
SP326	PML	0000	
SP327	PLGL	0000	
SP328	KVPL	0000	
SP329	KVIL	0000	
SP330	KVFL	0000	
SP331	KFPL	0000	
SP332	KFIL	0000	
SP333	PYLT	0000	
SP334	KDPL	0000	
SP335	KDIL	0000	
SP336	KQPL	0000	
SP337	KQIL	0000	
SP338	IDSML	0000	
SP339	IQSML	0000	
SP340	KVDSL	0000	
SP341	KVQSL	0000	
SP342	TMLRL	0000	
SP343	TMLDL	0000	
SP344	TMLSL	0000	
SP345	KWSL	0000	
SP346	KWSRL	0000	
SP347	IQ1L	0000	
SP348	M0L	0000	
SP349	M2L	0000	
SP350	FLUXL	0000	
SP351	KR2L	0000	
SP352	LR2L	0000	

No.	Abbre.	Setting 1	Setting 2
SP289	ICT	0000	
SP290	K11	0000	
SP291	TI	0000	
SP292	VPWM	0000	
SP293	IDLML	0000	
SP294		0000	
SP295		0000	
SP296		0000	
SP297		0000	
SP298		0000	
SP299		0000	
SP300		0000	
SP301	NPM	0000	
SP302	NICNT	0000	
SP303	NICT	0000	
SP304	NCSN	0000	
SP305	NWR1	0000	
SP306	NWR2	0000	
SP307	NWR3	0000	
SP308	NEV0	0000	
SP309	NEV1	0000	
SP310	NEV2	0000	
SP311	NEV3	0000	
SP312		0000	
SP313	EDO	0000	
SP314	SPO	0000	
SP315	SBS	0000	
SP316	SIQ	0000	
SP317	DPO	0000	
SP318	DBS	0000	
SP319	DIQ	0000	
SP320	BSD	0000	

No.	Abbre.	Setting 1	Setting 2
SP257	RPM	0000	
SP258	NR	0000	
SP259	NP	0000	
SP260	NB	0000	
SP261	NF	0000	
SP262	PM	0000	
SP263	PLG	0000	
SP264	KVP	0000	
SP265	KVI	0000	
SP266	KVF	0000	
SP267	KFP	0000	
SP268	KFI	0000	
SP269	PYLT	0000	
SP270	KDP	0000	
SP271	KDI	0000	
SP272	KQP	0000	
SP273	KQI	0000	
SP274	IDSML	0000	
SP275	IQSML	0000	
SP276	KVDS	0000	
SP277	KVQS	0000	
SP278	TMLR	0000	
SP279	TMLD	0000	
SP280	TMLS	0000	
SP281	KWS	0000	
SP282	KWSR	0000	
SP283	IQ1	0000	
SP284	M0	0000	
SP285	M2	0000	
SP286	FLUX	0000	
SP287	KR2	0000	
SP288	LR2	0000	

	Revisions
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Appendix

Appendix 2 Delivery specifications

Mitsubishi AC Spindle Drive MDS-A/B-SP/SPJ2/CSP Delivery Specifications

1. Motor specifications						
Motor model (Rating table No.)		SJ-P (RSJ)		Output characteristics of each coil for coil changeover motor		
No. of motor speed detector pulses		1024 pulse/rev		Changeover speed RPM		
Installation method		Installation direction				
Flange installation	Circle one item	Output shaft horizontal	Circle one item			
Leg installation		Output shaft perpendicular downward				
Built-in		Output shaft perpendicular upward				
Cooling wind direction		P → O		Circle one item		
		O → P	Load side: P O : Reverse load side			
Output characteristics of usage state (Write in the right column for the coil changeover motor)						
Output	30 min. (15 min.) or 50% ED rating	Constant output P1 (P10)	() kW	Fill in numerical value (Note in the () when necessary)	Output during constant run	
		Abated output P3 (P20)	() kW			
Speed	Continuous rating	Constant output P2				
		Abated output P4				
	Base speed	N1 (N10)	() RPM			Output during acceleration/deceleration
	Max. speed	Constant output N2 (N20)	() RPM			
		Abated output N3 (N30)	() RPM			
Output characteristics during constant run		Output characteristics during acceleration/deceleration				

2. Mechanical specifications					
Drive method	Gear		Belt	Direct	Circle one item
			V-belt		
Max. speed of final axis at each gear	H : High-speed			RPM	Fill in numerical value
	MH : Middle-high			RPM	
	ML : Middle-low			RPM	
	L : Low-speed			RPM	
Motor shaft conversion load GD²	H : High-speed			kg-m ²	
	MH : Middle-high			kg-m ²	
	ML : Middle-low			kg-m ²	
	L : Low-speed			kg-m ²	
No. of gear teeth or pulley diameter up to final shaft from motor shaft (diameter) Denominator: spindle side Numerator : motor shaft side	H : High-speed		-- x -- x --		
	MH : Middle-high		-- x -- x --		
	ML : Middle-low		-- x -- x --		
	L : Low-speed		-- x -- x --		

Appendix

3. System specifications/model		
Spindle drive unit model	MDS-A/B-SPJ2 -	
Power supply unit model	MDS-A-C -	
Drive unit model connected to same converter	MDS-A-SP -	MDS-A-V -
	MDS-A-V -	MDS-A-V -
	MDS-A-V -	MDS-A-V -
Magnesensor model	BKO-	
Encoder model (Including C axis)		
Resistor model	FCUA-RB	R-UNIT -
ACL model for power supply unit	A-AL BKO-NC6851H	
ACL model for motor	BKO-	

Circle an item or fill in numerical value




4. Electrical specifications						
Max. motor speed RPM [Speed during max. command (10V)]		3450		4500		4600
		6000		8000		10000
	Special	RPM (per 10RPM)				
Zero speed detection		50RPM			25RPM	
	Special	RPM		1 to 1000 (per 1RPM)		
Load meter output		10V (at 120%)			3V (at 120%)	
Acceleration/deceleration time constant		0.3S		3S		5S
	Special	S	20 to 32760ms (per 10ms)			
Torque limit		10%		30%		50%
	Special	%	0 to 120% (per 1%)			
Speed detection range (% to max. speed)		10%		30%		50%
	Special	%	0 to 100% (per 1%)			

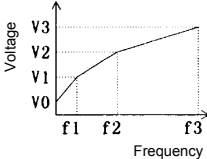
Circle an item or fill in numerical value

5. Additional specifications			
No additional specifications		Circle the all relevant items	
Magnesensor orientation (1-point orientation)			
Encoder (1024 pulse) multi-point orientation			
Encoder (1024 pulse) multi-point indexing orientation			
Motor built-in encoder multi-point orientation			
Motor built-in encoder multi-point indexing orientation			
Motor built-in encoder pulse output			1-fold
Drive unit pulse output in regard to No. of motor built-in encoder pulses			2-fold
1-amplifier 2-motor changeover	Spindle motor + spindle motor (fill sub-side specifications on following pages)		
	Spindle motor + general purpose motor (fill sub-side specifications in Section 8.)		
High-speed synchronous tapping	According to encoder (1024 pulses)		
	According to motor built-in encoder		
Spindle synchronization	According to encoder (1024 pulses)		
	According to motor built-in encoder		
Contour control (C axis control)			

Appendix

6. Additional specifications (When orientation function is provided)				
Motor shaft rotation direction during orientation		PRE	Circle one item	
		Forward run		
		Reverse run		
In-position range	For magnesensor orientation			Circle an item of fill in numerical value
		$\pm 1^\circ$	$\pm 5^\circ$	
	Special	$\pm \quad^\circ$	$0 \sim \pm 20^\circ$ (per $1/16^\circ$)	
	For encoder orientation			
		$\pm 0.88^\circ$	$\pm 5.02^\circ$	
Special	$\pm \quad^\circ$	per $\pm 0.088^\circ$		

7. Usage conditions of encoder for orientation and contour control (C axis control)				
Encoder rotation direction	Motor rotates in direction shown below looking from shaft			Circle one item
				
Transmission ratio of final axis and encoder		1 : 1		
		1 : 2 (When encoder shaft is decelerating)		
		1 : 4 (When encoder shaft is decelerating)		

8. Sub-motor ratings (When 1-amplifier 2-motor changeover function with general purpose motor is provided)						
	Rated output		kW		Fill in all items	
	Rated current		A			
	No. of motor poles		Poles			
	Maker/model		/			
	Cushion time to max. frequency (f3)		s			
V/F pattern	Frequency	f1 = Hz	f3 = Hz	Voltage	V0 = V	V2 = V
		f2 = Hz			V1 = V	V3 = V

9. Special notes

10. Sales information	
Customer	Messrs.
Machine maker	Messrs.
Final delivery destination	Messrs.
Machine name	
Machine model	
No. of units	units
Work No.	

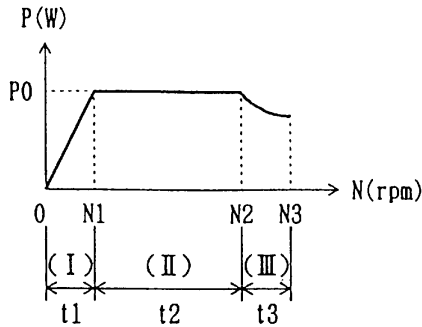
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MITSUBISHI ELECTRIC CORPORATION			
Created by	Checked by	Approved by	
Delivery specifications No. BN 43 U		Pages S	/
		Sub No.	

Appendix 3 Theoretical acceleration and deceleration times

In the calculation described below, load torque is assumed to be zero. Therefore, acceleration and deceleration times determined here somewhat differ from actual acceleration and deceleration times.

(1) Definition



- (Notes) 1) "Po" is (Rated power × 1.2).
Example : For spindle of 2.2/3.7kW,
 $P_o = 3700 \times 1.2 = 4440 \text{ (W)}$
 2) $GD^2 = (\text{Motor } GD^2) +$
 (GD^2 converted into load to motor shaft) ($\text{kg}\cdot\text{m}^2$)

(2) Acceleration/deceleration time "t"

1) Constant torque zone

$$t_1 = \frac{1.03 \times GD^2 \times N_1^2}{375 \times P_o} \quad (\text{sec})$$

2) Constant output (power) zone

$$t_2 = \frac{1.03 \times GD^2 \times (N_2^2 - N_1^2)}{2 \times 375 \times P_o} \quad (\text{sec})$$

3) Reduced output zone

$$t_3 = \frac{1.03 \times GD^2 \times (N_3^2 - N_2^2)}{2 \times 375 \times P_o \times N_2} \quad (\text{sec})$$

Therefore, accel/decel. Time t ($0 \rightarrow N_3$) is,
 $t = t_1 + t_2 + t_3$ (sec)

Example : $GD_L^2 = 0.11 \text{ kgfm}^2$ For motor SJ-PF3.7-01

From specification 2, $GD_M^2 = 0.034 \text{ kgm}^2$

thus, $GD^2 = 0.034 + 0.11 = 0.144 \text{ kgfm}^2$

$$t_1 = \frac{1.03 \times 0.144 \times 1500^2}{375 \times 3700 \times 1.2} = 0.200 \quad (\text{sec})$$

$$t_2 = \frac{1.03 \times 0.144 \times (6000^2 - 1500^2)}{2 \times 375 \times 3700 \times 1.2} = 1.503 \quad (\text{sec})$$

$$t_3 = \frac{1.03 \times 0.144 \times (8000^2 - 6000^2)}{3 \times 375 \times 3700 \times 1.2 \times 6000} = 1.465 \quad (\text{sec})$$

Unit conversion :

Forth : $1 \text{ kgf} = 9.8 \text{ N}$

Speed : $1 \text{ rpm} = \frac{2\pi}{60} \text{ rad/s}$

Torque : $1 \text{ kgfm} = 9.8 \text{ Nm} = 10^2 \text{ kgm}$

Output (power) : $1 \text{ kW} = 1/1.3596 \text{ HP}$

$$P = \omega T_o = \left(2\pi \frac{N}{60}\right) \times 9.8 T$$

P : Output [w]
 ω : Angular velocity [rad/s]
 T_o : Torque [N-m]
 N : Speed [rpm]
 T : Torque [kgm]

Appendix 4 Unit conversion table

The correspondence of the conventional unit symbols used in this manual and the international unit system (SI) is as follows.

Name of weight	Conventional unit symbol	SI unit and symbols of units used commonly	Conversion value
Weight/load (To express mass)	kgf	—	The values are the same
Mass	—	kg	
Weight/load (The concept for force)	kgf	N	1 kgf = 9.80665N
Force	kgf	N	1 kgf = 9.80665N
Torque	kgf · cm	N · m	1 kgf · cm = 9.80665×10^{-2} N·m
Inertia (J)	kgf · cm · S ²	kg · m ²	1 kgf·cm·S ² = 9.80665×10^{-2} kg·m ²
GD ²	kgf · cm ²	—	$J = \frac{GD^2}{4g}$ (g : Gravitational acceleration 980cm/S ²)

Appendix 5 Test operation

(1) Method for rotating the motor in an open loop

< Purpose >

When the below phenomena occur during motor rotation, this operation is used to investigate the causes.

1. There is a lot of motor noise and vibration.
2. Alarm 23 (EXCESSIVE SPEED ERROR)
3. The motor rotates between 10 to 100 rpm, and will not rotate faster.
4. Rotation is irregular. Hunting occurs.
5. The motor does not rotate as commanded.



< Method >

1. Set parameter SP038: bitF from 0 to 1, and enter an open loop status by turning the power OFF/ON.
2. After canceling the emergency stop signal, turn the forward run command (SRN) ON, and gradually raise the S commands from zero to rotate the motor.
3. Set parameter SP038: bitF from 1 back to 0, and return to the normal operation mode by turning the power OFF/ON.

< Note > The normal operation mode cannot be returned to by only turning the power OFF/ON. The parameter must be returned to 0.

< Phenomena and fault causes >

Judge the fault cause from the phenomenon that occurs when the motor is rotated using the method above.

Motor rotation direction	Controller speed display	Rotation status	Fault cause
	Normal display	Smooth rotation	The motor U, V and W phase sequence is incorrect.
	Stays at zero, or changes greatly.	Smooth rotation	The CN2 cable wiring is incorrect. There is a motor built-in encoder error.
Same as above.	Normal display	The speed does not change, even when the speed command is raised.	The speed command signal is not being correctly transmitted.
Same as above.	Same as above.	The motor stays stopped, hunting occurs.	There is a controller error.

(2) Method for coasting the motor

< Purpose >

When a lot of vibration and noise occur during motor rotation, the motor can be put into a coasting state to determine whether mechanical factors (balance, resonance) or electrical factors (motor rotation irregularity, etc.) are responsible.

If the vibration and noise stop when the motor is put into a coasting state, then electrical factors can be judged as the cause. If the vibration and noise continue in the coasting state at the same level as during motor-driven operation, then mechanical factors can be judged as the cause.

< Method >

1. Rotate the motor at the max. speed.
2. Turn the NC power OFF while the motor is rotating at max. speed, and put the motor in a coasting state.

< Note > The method for turning the NC power OFF differs according to the manufacturing specifications of each maker. Before carrying out this method, please check the specifications of the NC being used to make sure of the method to turn the NC OFF, and that there is no problem with suddenly turning the NC power OFF.

MELDAS AC Spindle Drive
MDS-B-SPJ2 Series
Specification Manual (BNP-B2164)

Specification revision history

Sub-number	Date of revision	Revision details
*	July 30, 1997	First edition created.
A	February 6, 1998	Maintenance section added and widely revised.



MODEL	MDS-B-SPJ2 Series
MODEL CODE	007-062
Manual No.	BNP-B2164A(ENG)