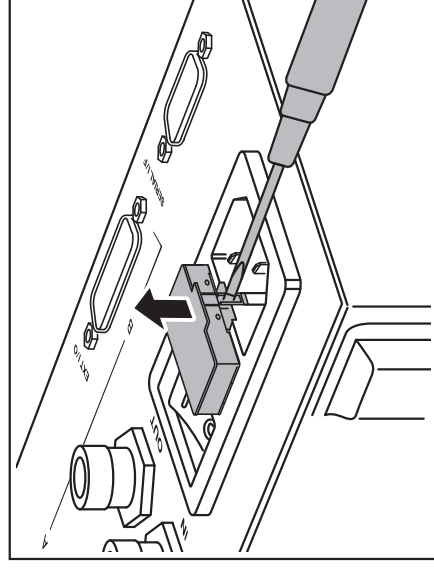


NOTICE

The shape of the fuse holder in the Main Power Inlet with Power Supply Fuses may differ from the description in the operation manual. Follow the instructions below to remove the fuse holder and replace the fuse.

REPLACING FUSES

- 1** Remove the fuse holder in the Main Power Inlet with Power Supply Fuses using a flat-blade screwdriver or similar tool.
- 2** Remove the bad fuse or fuses and replace with the proper type and rating of fuse by the input voltage being used.
- 3** Push the fuse holder firmly into the Main Power Inlet with Power Supply Fuses.



E3000 CONTROLLER

取扱説明書 / OPERATION MANUAL

日本語 : P1 - P45 / English : P47 - P96



Thank you for purchasing the E3000 Ultra-Precision, High-Speed spindle system. The E3000 system was designed for use on CNC lathes, robots, NC lathes and special purpose machines. The motor, spindle and E3000 CONTROLLER are designed to work as an integrated system capable of 80,000 min⁻¹ (rpm). This system utilizes air to cool the motor and protect the spindle. Always use an Air Line Kit to ensure clean, dry, properly regulated air is supplied to the motor and spindle. The E3000 system is capable of being used with coolants and cutting lubricants. Read this and all the associated component Operation Manuals carefully before use. Always keep this Operation Manual in a place where a user can referred to for reference at any time.

CONTENTS

IMPORTANT INSTRUCTIONS AND WARNING - Electric Devices	P48
1 . CAUTIONS FOR HANDLING AND OPERATION	P49
2 . BASIC PACKAGE	P52
3 . WARRANTY	P53
4 . CONTACT US	P53
5 . FEATURES	P53
6 . SPECIFICATIONS AND DIMENSIONS	P54
7 . SYSTEM CHART	P56
8 . TORQUE CHARACTERISTICS	P57
9 . CONTROL PANEL FEATURES	P58
10. REPLACING FUSES	P61
11. BRACKET AND RUBBER PAD INSTALLATION	P62
12. POWER CORD CONNECTION	P64
13. MOTOR CORD CONNECTION	P64
14. AIR HOSE CONNECTION	P65
15. OPERATION PROCEDURES	P66
16. EXTERNAL INPUT / OUTPUT CONNECTOR	P69
17. PROTECT FUNCTION	P80
18. SETTING OF OPERATING PARAMETERS	P82
19. BREAK IN PROCEDURE	P94
20. TROUBLESHOOTING	P94
21. DISPOSAL OF THE CONTROLLER	P96

⚠ IMPORTANT INSTRUCTIONS AND WARNING - Electric Devices

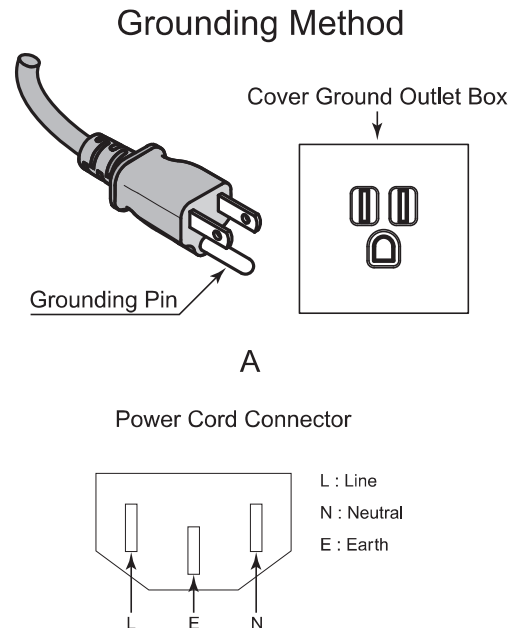
WARNING!

When using electric tools, basic safety precautions should always be followed to reduce the risk of fire, electrical shock and personal injury.

Read all these instructions before operating this product and save these instructions.

A. GROUNDING INSTRUCTIONS

1. In the event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This tool is equipped with an electric cord with a grounding conductor and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.
2. Do not modify the plug provided if it does not fit the outlet. A qualified electrician must install the proper outlet.
3. Improper connection of the grounding conductor can result in electric shock. The grounding conductor has an outer insulation that is green with or without yellow stripes. If repair or replacement of the electric cord or plug is necessary, do not connect the grounding conductor to a live terminal.
4. Check with a qualified electrician or service person if the grounding instructions are not completely understood, or if in doubt as to whether the tool is properly grounded.
5. Use only 3-wire extension cords that have 3-prong grounding plugs and 3-pole receptacles that accept the power cord's plug.
6. Repair or replace a damaged or worn cord immediately.
7. This tool must be used on a circuit that has an outlet that looks like the one illustrated in Sketch A in figure (See below) (115V). The tool has a grounding plug that looks like the plug illustrated in Sketch A in Figure (below).
8. FOR Installation in Machine Electrical Cabinet or when wiring directly to machine internal power terminal strip:
 - 1) Please refer to the pin diagram below for the proper wiring configuration. The plug shown is the female plug that attaches to the E3000 CONTROLLER main power inlet.
 - 2) Make sure you test each individual wire to verify proper circuit prior to attaching any wire to the terminal block. Do not assume wire colors are the same for all power cords.
9. Install an over current protective device of maximum 10 Amps on the E3000 CONTROLLER main power circuit.
10. USE PROPER EXTENSION CORD. Make sure your extension cord is in good condition. When using an extension cord, be sure to use one heavy enough to carry the current your product will draw. An undersized cord will cause a drop the line voltage resulting in loss of power and overheating. Table (below) shows the correct size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gage. The smaller the gage number, the heavier the cord.



Minimum gage for cord

Ampere Rating		Volts	Total length of cord			
		120V	7.5m (25ft.)	15m (50ft.)	30m (100ft.)	45m (150ft.)
		240V	15m (50ft.)	30m (100ft.)	60m (200ft.)	90m (300ft.)
More Than	Not More Than					
0	6	18	16	16	14	
6	10	18	16	14	12	
10	12	16	16	14	12	
12	16	14	12	Not Recommended		
Only the applicable parts of the Table need to be included. For instance, a 120-volt product need include the 240-volt heading.						

B. OTHER WARNING INSTRUCTIONS

1. For your own safety read instruction manual before operating this tool.
2. Replace cracked collet or collet nut immediately.
3. Do not over tighten the collet nut.
4. Use only NAKANISHI manufactured collets and arbors for grinding and sawing applications.
5. REMOVE ADJUSTING KEYS AND WRENCHES. Always check to see that keys and adjusting wrenches are removed from tool before turning the units Main Power Switch on.
6. KEEP WORK AREA CLEAN. Cluttered areas and benches invite accidents.
7. DO NOT USE IN DANGEROUS ENVIRONMENTS. Don't use power tools in damp or wet locations, or expose them to rain.
8. Keep work area well lighted.
9. There is a risk of injury due to accidental starting. Do not use in an area where children may be present.
10. DO NOT FORCE THE TOOL. Never use a tool for an application it was not designed for.
11. USE THE CORRECT TOOL. Do not force tools or attachments to do a job for which it was not designed.
12. WEAR PROPER APPAREL. Do not wear loose clothing, gloves, neck ties, rings, bracelets, or other jewelry that might get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.
13. ALWAYS USE SAFETY GLASSES. Everyday eyeglasses only have impact resistant lenses, they are NOT safety glasses. Also use face or dust mask if cutting operation is dusty.
14. SECURE YOUR WORK. Use clamps or a vise to hold work securely at all times.
15. MAINTAIN TOOLS WITH CARE. Keep tools sharp and clean for best performance and to reduce the risk of injury. Follow instructions for changing accessories.
16. DISCONNECT TOOLS before servicing or when changing accessories, such as blades, cutters etc.
17. REDUCE THE RISK OF UNINTENTIONAL STARTING. Make sure Main Power Switch is in OFF position before plugging in.
18. NEVER LEAVE TOOLS RUNNING UNATTENDED. TURN POWER OFF. Don't leave the tool until it comes to a complete stop.
19. For recommended operating speeds for various applications, please follow recommendations of the cutting tool manufacturer.

1. CAUTIONS FOR HANDLING AND OPERATION

- Read these warnings and cautions carefully and only use in the manner intended.
- These warnings and cautions are intended to avoid potential hazards that could result in personal injury or damage to the device. These instructions are classified as follows in accordance with the seriousness of the risk.

Class	Degree of Risk
 DANGER	Existence of a hazard that.
 WARNING	A hazard that could result in bodily injury or damage to the device if the safety instructions are not properly followed.
 CAUTION	A hazard that could result in light or moderate bodily injury or damage to the device if the safety instructions are not followed.

DANGER

Do not rotate the machining center's main spindle with the HES installed.
Rotating the machining center's main spindle with the HES installed can cause the motor cord to become tangled and pull the CONTROLLER off its mounting.



WARNING

- ① The **CONTROLLER** is not a hand tool. It is designed to be used on a CNC lathe or special purpose machines.
- ② Do not touch the cutting tool while the spindle and tool are rotating. It is very dangerous.
- ③ Wear safety glasses, dust mask, and use a protective cover around the motor spindle whenever the motor spindle is rotating.
- ④ Never connect, disconnect or touch the Power Cord Plug or Motor Cord Plug with wet hands. This may cause an electric shock.
- ⑤ Never operate or handle the **CONTROLLER** and motor or spindle until you have thoroughly read the Operation Manuals and safe operation has been confirmed.
 - 1) To prevent injuries / damages, check the **CONTROLLER**, motor spindle and cutting tool for proper installation, then operate the **CONTROLLER**, motor and spindle.
 - 2) Before disconnecting the **CONTROLLER** or motor spindle, always turn the control power OFF and turn the compressed air supply to the **CONTROLLER** OFF. Then it is safe to remove the **CONTROLLER** and motor spindle.
- ⑥ Do not use in dangerous environments. Protect the **CONTROLLER** from moisture and other contaminants. Failure to protect **CONTROLLER** can result in damage to internal components and injury to the operator.
- ⑦ Reduce the risk of unintentional starting. Make sure the Main Power Switch is in the OFF position before connecting the **CONTROLLER** or plugging the system in.
- ⑧ The plug must plugged matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.
- ⑨ Check to ensure that the supply voltage is the same as the **CONTROLLER** rated voltage.
- ⑩ When installing a tool, tighten the collet correctly and check again the collet and collet nut before use. Do not over tighten the collet. This may cause damage to the spindle.
- ⑪ Do not use bent, broken, chipped, out of round or sub-standard tools, as this may cause them to shatter or explode. Tools with fractures or a bent shank will cause injury to the operator. When using a new tool, rotate it in a low speed and increase speed gradually for safety.
- ⑫ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.
- ⑬ Do not apply excessive force. This may cause tool slippage, tool damage, and injury to the operator, loss of concentricity and precision.
- ⑭ When installing the motor and the spindle, make sure the Main Power Switch of the **CONTROLLER** turned OFF before installing.
- ⑮ When installing a motor spindle to a fixed base, make sure the fixed base is grounded in order to avoid the risk of an electric shock.

CAUTION

- ① A motor cooling and spindle purge air is required to operate the system correctly. The input air line must be connected to the air inlet joint on the front of the **CONTROLLER**. Air pressure between 0.25 - 0.3MPa (36.3 - 43.5psi) must be supplied.
- ② The brushless motor spindle requires air for cooling and purging. Ensure that this air supply is clean and dry. Introduction of dust, moisture and other contaminants into the **CONTROLLER** and motor spindle will cause damage to the internal components.
- ③ If water or oil is allowed to enter the **CONTROLLER**, failure of the **CONTROLLER** may result.
- ④ Do not hit, drop or subject the motor spindle or **CONTROLLER** to any type of shock. This will cause damage to internal components and result in a malfunction.
- ⑤ Do not disassemble, modify or attempt to repair the **CONTROLLER** or motor spindle as it will damage internal components. There are no user serviceable parts available.
- ⑥ Never place the air vents upward or block the air vents of the **CONTROLLER** when installing.
- ⑦ Motor will make a sudden stop when Error LED lights or error output signal is generated. Check and correct the cause of the malfunction before continuing use. Failure to correct the problem will result in damage to the **CONTROLLER** and motor spindle.

CAUTION

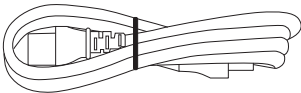
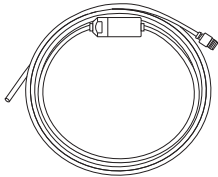
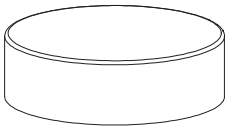
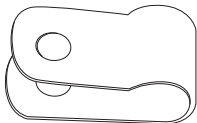
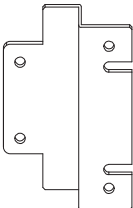
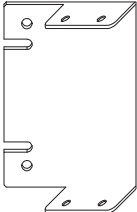
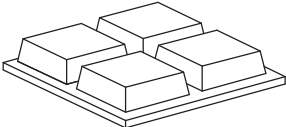
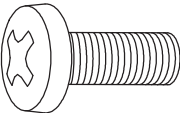
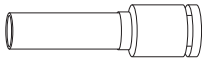
- ⑧ When the warning LED on the CONTROLLER blinks, conditions exist that could result in dangerous operation. Check operating conditions and continue to use only after correcting the problem.
- ⑨ When using CONTROLLER continuously, refer to continuous area on torque Characteristics Graph and check LOAD Monitor LED for a maximum output (3 Green Lamps).
- ⑩ Do not install the system next to RF noise sources, as malfunctions can occur.
- ⑪ If smoke, noise or strange odors emanate from the CONTROLLER or motor spindle, immediately turn OFF the Main Power Switch.
- ⑫ Do not place anything on top of the CONTROLLER.
- ⑬ When installing the CONTROLLER, never place them in areas where vibration and shock are present or possible. This may cause a malfunction to occur.
- ⑭ When using in a place where the power conditions are poor, take measures to enable a supplied input power within the specified voltage fluctuation.
- ⑮ Do not place the CONTROLLER near any source of heat. The temperature inside the CONTROLLER will rise, resulting in a CONTROLLER failure.
- ⑯ Attach the provided Connector Cover for safety and dust proofing when not using Input / Output Connector A/B or Serial I/F Connector.
- ⑰ Do not press the switches on the operation panel of the CONTROLLER with a sharp-pointed tool.
- ⑱ Note that a  symbol is shown near the heat sink of the CONTROLLER. Do not touch this part. It becomes very hot and causes burns to your skin.
- ⑲ When using SELECTOR with CONTROLLER, please use E3000 SELECTOR.
- ⑳ When disposal of a CONTROLLER is necessary, follow the instructions from your local government agency and dispose as an industrial waste.
- ㉑ When using the Air Bearing Spindle, please supply the recommended regulated air pressure to the Air Bearing. When rotating the spindle with less the regulated air pressure, this may make you damage to the spindle or the CONTROLLER.
- ㉒ Be sure to clean the collet and collet nut, the inside of the spindle before replacing the tool. If ground particles or metal chips stick to the inside of spindle or the collet, damage to the collet or spindle can occur due to the loss of precision.
- ㉓ Always clean the tool shank and the machine spindle taper before installing the tool in the machine.
- ㉔ When sizing the correct collet size to the tool shank diameter, a tolerance of +0 ~ -0.01mm is strongly recommended. A tool shank within the +0 ~ -0.1mm range is mountable, however, this may cause poor concentricity and or insufficient tool shank gripping force.
- ㉕ Select suitable products or tools for all applications. Do not exceed the capabilities of the spindle or tools.
- ㉖ Do not stop the supplied cooling air to the motor, spindle, motor spindle, during operation of the machine.
Removing the air pressure from the motor, spindle, motor spindle, causes a loss of purging, allowing the motor, spindle, motor spindle, to ingest coolant and debris. This will cause damage to the motor, spindle, motor spindle.
- ㉗ Carefully direct coolant spray to the tool. Do not spray directly on the spindle body. If large amount spray directly on the spindle, it may cause excess load of the motor rotation with loss of durability to the motor / spindle.
- ㉘ Stop working immediately when abnormal rotation or unusual vibration are observed. Afterwards, please check the content of Section " 20. TROUBLESHOOTING ".
- ㉙ Always check if the tool, collet or collet nut are damaged before and after operating.
- ㉚ After installation, repair, initial operation, or long periods of non operation, please refer to Operation Manual on the spindle / motor spindle detailed in " BREAK-IN PROCEDURE ". When checking the spindle, no vibration or unusual sound should be observed during rotation.
- ㉛ If the power cord is damaged, replace it with a certified power cord with grounding of sufficient voltage and current rating.

2. BASIC PACKAGE

When opening the package, check if it includes all items listed in " Table.1 Packing List Contents ".

In the event of any shortage, please contact either NAKANISHI (see the " 4. CONTACT US " section) or your local dealer.

Table. 1 Packing List Contents

E3000 CONTROLLER Main Body • • 1pc. 	Power Cord • • 1pc. 	φ6mm Air Hose with Filter • • 1pc. 
Connector Cap • • 1pc. 	Connector Cover A Connector Cover B Serial I / F Connector Cover • • 1pc. Each.* 	Nylon Tension Relief • • 1pc. 
Bracket (for bottom) • • 1set 	Bracket (for rear) • • 1set 	Rubber Pad (4pcs.) • • 1set 
Fuse • • 2pcs. 	Mounting Screw • • 9pcs. 	Reducer (φ6 - φ4 Conversion Adapter) • • 1pc. 
Operation Manual • • 1set 	WARNING / Error Code Label • • 1set 	

* The Connector Cap, Connector Cover A / B, and Serial I / F Connector Cover are attached to the CONTROLLER.

3. WARRANTY

We provide a limited warranty for our products. We will repair or replace the products if the cause of failure is due to the following manufactures defects. Please contact us or your local distributor for details.

- (1) Defect in manufacturing.
- (2) Any shortage of components in the package.
- (3) Where damaged components are found when initially opening the package.
(This shall not apply if the damage was caused by the negligence of a customer.)

4. CONTACT US

For your safety and convenience when purchasing our products, we welcome your questions.
If you have any questions about operation, maintenance and repair of the product, please contact us.

Contact Us

● For U.S. Market

Company Name	: NSK America Corp. Industrial Div.
Business Hours	: 8:00 to 17:00 (CST) (closed Saturday, Sunday and Public Holidays)
U.S. Toll Free No.	: +1 800 585 4675
Telephone No.	: +1 847 843 7664
Fax No.	: +1 847 843 7622
Website	: www.nskamericacorp.com

● For Other Markets

Company Name	: NAKANISHI INC. 
Business Hours	: 8:00 to 17:00 (JST) (closed Saturday, Sunday and Public Holidays)
Telephone No.	: +81 289 64 3520
e-mail	: webmaster-ie@nsk-nakanishi.co.jp

5. FEATURES

- ① A high-speed brushless motor is used to achieve a maximum speed of 80,000 min⁻¹ (rpm) (when using EM-3080J) and eliminate the need for motor brush maintenance.
- ② Speed control and protection functions utilize a high performance microprocessor.
- ③ Automatic control and monitoring of spindle functions are possible.
- ④ Wide speed range, 1,000 - 80,000 min⁻¹ (rpm) makes high precision machining possible.
- ⑤ Compact CONTROLLER design allows easy installation in space restricted machines. Connectors and control panel are front mounted for easy access.
- ⑥ The CONTROLLER is capable of being connected to AC100V or AC240V power sources. The Auto Sensing feature reduces installation time and eliminates the possibility of connecting the wrong voltage.
- ⑦ Gear Mode Select Button is included. Set Gear Mode to display the rotating speed of the cutting tool when using an angle spindle or speed reducer.
- ⑧ By setting the parameter **(P9)**, Emergency Operating Function can be utilized. Using the open detection signal of the motor power line and the disconnect of the motor power line by safety relay, allows the E3000 CONTROLLER to establish a safe spindle system.
- ⑨ By setting parameter **(PR)**, the CONTROLLER is capable of storing the last 5 Error Codes that were displayed. This allows Error Codes to be reviewed if no one is present when the error occurs. Error History will be stored to the CONTROLLER, even if the Main Power Switch is turned OFF.
- ⑩ Since CONTROL will automatically recognize the motor attached and detect the maximum rotation speed, there is no need to set maximum rotation speed based on types of motor.

6. SPECIFICATIONS AND DIMENSIONS

6 - 1 Specification of the CONTROLLER

Product Name		E3000 CONTROLLER
Model		NE211
Input Voltage		AC100 - 240V, 50 / 60Hz, 1PHASE, 1.8A
Input Voltage fluctuation		MAX. +/- 10%
Output		AC33V, 0-1KHz, 3 PHASE, 2.4A
Speed Range		1,000 - 80,000min ⁻¹ (rpm) *Note 1
Over Voltage Category		II
Short Circuit Current Rating		63A
Pollution Degree		Class 2
External Control Signal	Input Signal	Input : Digital 9 (Photo Coupler) Analog 1
	Output Signal	Output : Photo Coupler 1, MOS Relay 9 Relay Contact 2, Analog 3
Protection Function		Excess Current, Over Voltage, Motor Sensor Malfunction, CONTROLLER Overheat, Brake Circuit Trouble, Rotor Lock, Low Air Pressure, Torque Over Load, Communication Interception, External Control Signal Error, Incompatible Motor, Over Speed, Emergency Stop Error, Internal Memory Error
Weight		2.8kg
Dimensions		W 88 x D138 x H 238 mm
Operation Environment	Temperature	0 - 40°C
	Humidity	MAX.75% (No condensation)
	Atmospheric Pressure	800 - 1,060hPa
Installation Area		Indoor use
Transportation and Storage Environment	Temperature	-10 - 50°C
	Humidity	10 - 85 %
	Atmospheric Pressure	500 - 1,060hPa
Height above Sea Level		Less than 2000m

* Note 1 : Motor Speed Limited Area

Motor Speed limits depend on the Motor Model. Before using it, check the specifications of the motor and the motor spindle. Since CONTROLLER will automatically recognize the motor types, there is no need to adjust the maximum rotation speed based on the motor model.

• FOR EM-3080J MOTOR AND HES810 SYSTEM USERS

This motor / spindle is designed to machine at min⁻¹ (rpm) 's between 20,000 and 80,000min⁻¹ (rpm) only.

The 1,000 to 19,000min are for warm-up purpose only.

Do not machine at a Speed of less than 20,000min⁻¹ (rpm).

• Control limits motor speed from 1,000 to 60,000 min⁻¹ (rpm) for EM-3060, EM-3060J, EM30-S6000, EM25-S6000 and EM20-S6000.

• Control limits motor speed from 1,000 to 50,000 min⁻¹ (rpm) for EM25N-5000 and HES510.

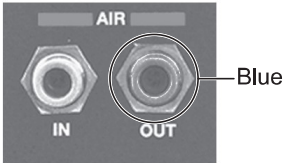
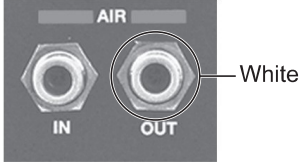
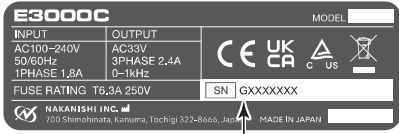
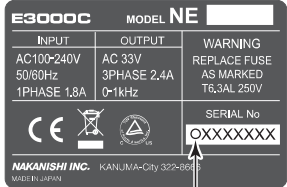
• Control limits motor speed from 1,000 to 32,000 min⁻¹ (rpm) for EMA-3020K and EMA-3020S.

• Control limits motor speed from 1,000 to 30,000 min⁻¹ (rpm) for EM-3030T-J, EM-3030T-J-2M, EM-3030T.

CAUTION

- The brushless motor " EM-3030T-J / EM-3030T-J-2M / EM-3030T " should be connected to the Applicable CONTROLLER (Refer to " Table. 2 Identifying the Applicable CONTROLLER ").
If the brushless motor " EM-3030T-J / EM-3030T-J-2M " connected to non applicable CONTROLLER, brushless motor " EM-3030T-J / EM-3030T-J-2M " will not rotate and Error " EL " (Incompatible Motor) will be displayed on the Digital Speed Indicator, indicating a " Detection of unsafe operating conditions " of the CONTROLLER.

Table. 2 Identifying the Applicable CONTROLLER (EM-3030T-J / EM-3030T-J-2M / EM-3030T)

Identifying Point	Applicable CONTROLLER	Non applicable CONTROLLER
Color of Air Output Joint		
First letter of the Serial No. on the Rating Plate	 First letter : D, E, F, G, . . .	 First letter : O, A, B, C

6 - 2 Compatibility

(1) The E3000 CONTROLLER is compatible with the following overseas safety standard.

- | | |
|---|---|
| • Safety standard in North America (UL,CSA) |  |
| UL61010-1 | CSA C22.2 No.61010-1 |
| • EC Directive |  |
| Low Voltage Directive | IEC/EN 61010-1 |
| EMC Directive | EMS : EN61000-6-2 |
| | EMI : EN61000-6-4 |
| RoHS Directive | 2011/65EU, (EU) 2015/863 |
| • United Kingdom Conformity Assessed (UKCA) marking |  |

6 - 3 Outside View

*Below is an outside view with Brackets (Standard Accessory) attached.

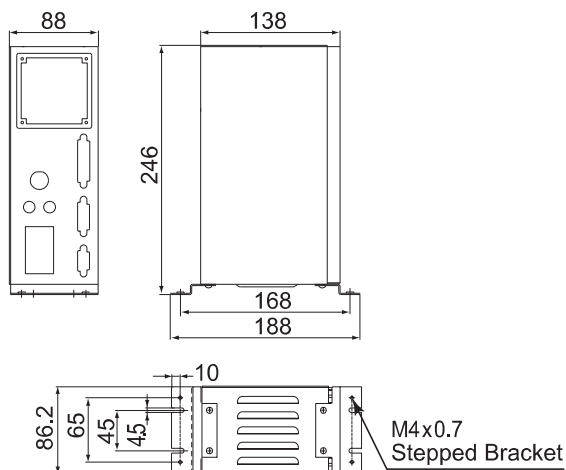


Fig. 1 Bottom Mounting

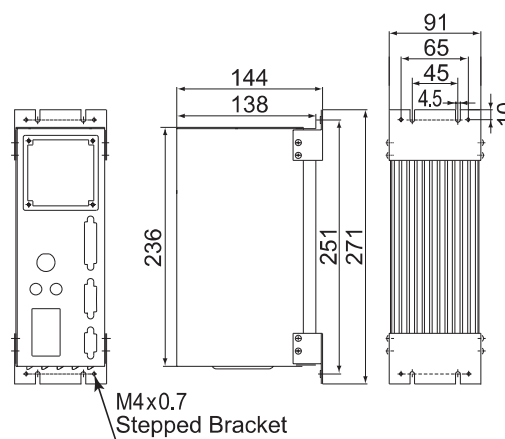


Fig. 2 Rear Mounting

7. SYSTEM CHART

⚠ DANGER

Do not rotate the machining centers' main spindle with the HES installed.
Rotating the machining centers' main spindle with the HES installed can cause the motor cord to become tangled and pull the CONTROLLER off its mounting.

7 - 1 Motor Speed 80,000min⁻¹ (rpm)

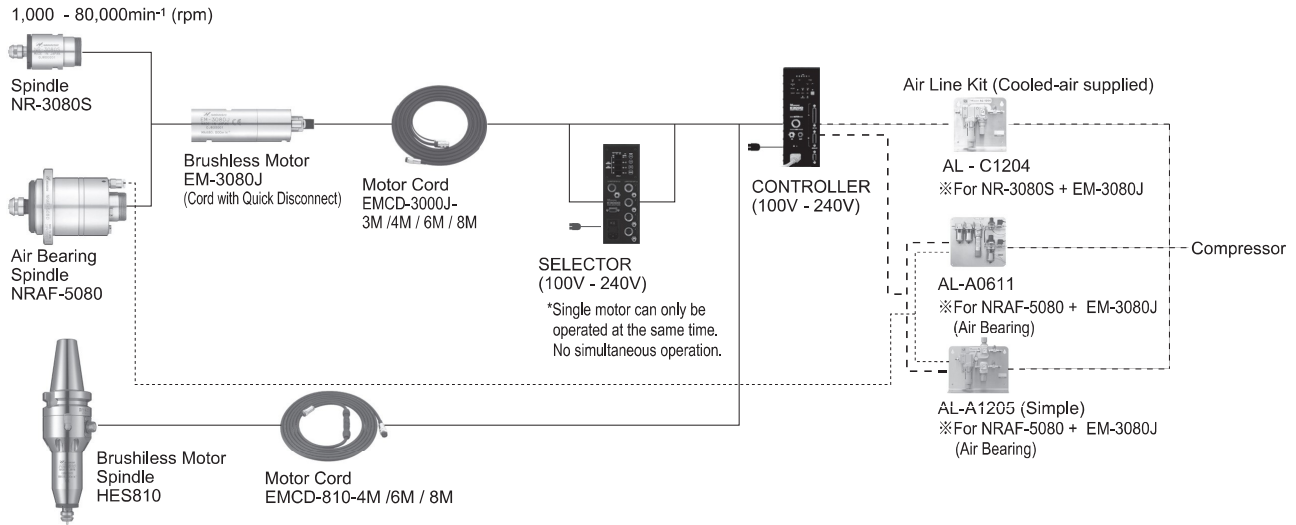


Fig. 3

7 - 2 Motor Speed 60,000min⁻¹ (rpm) / 50,000min⁻¹ (rpm) / 32,000min⁻¹ (rpm)

(1) One piece Type

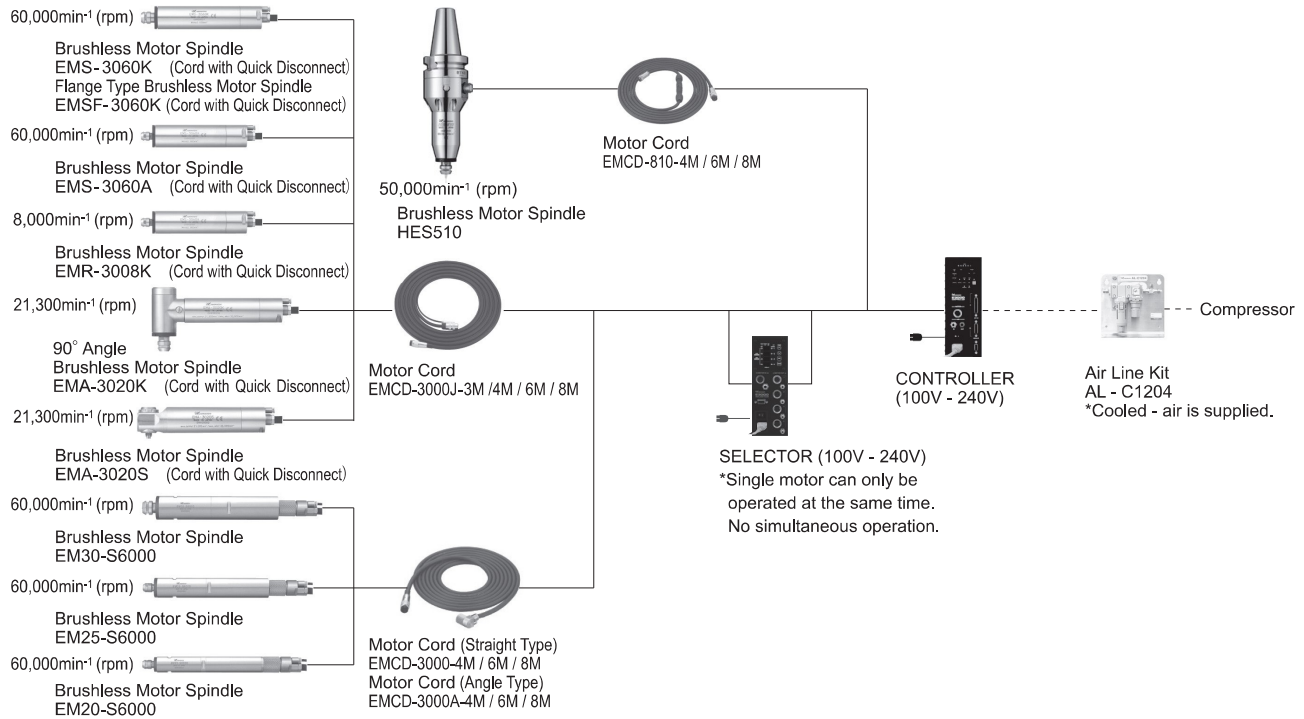


Fig. 4

(2) Separate Type

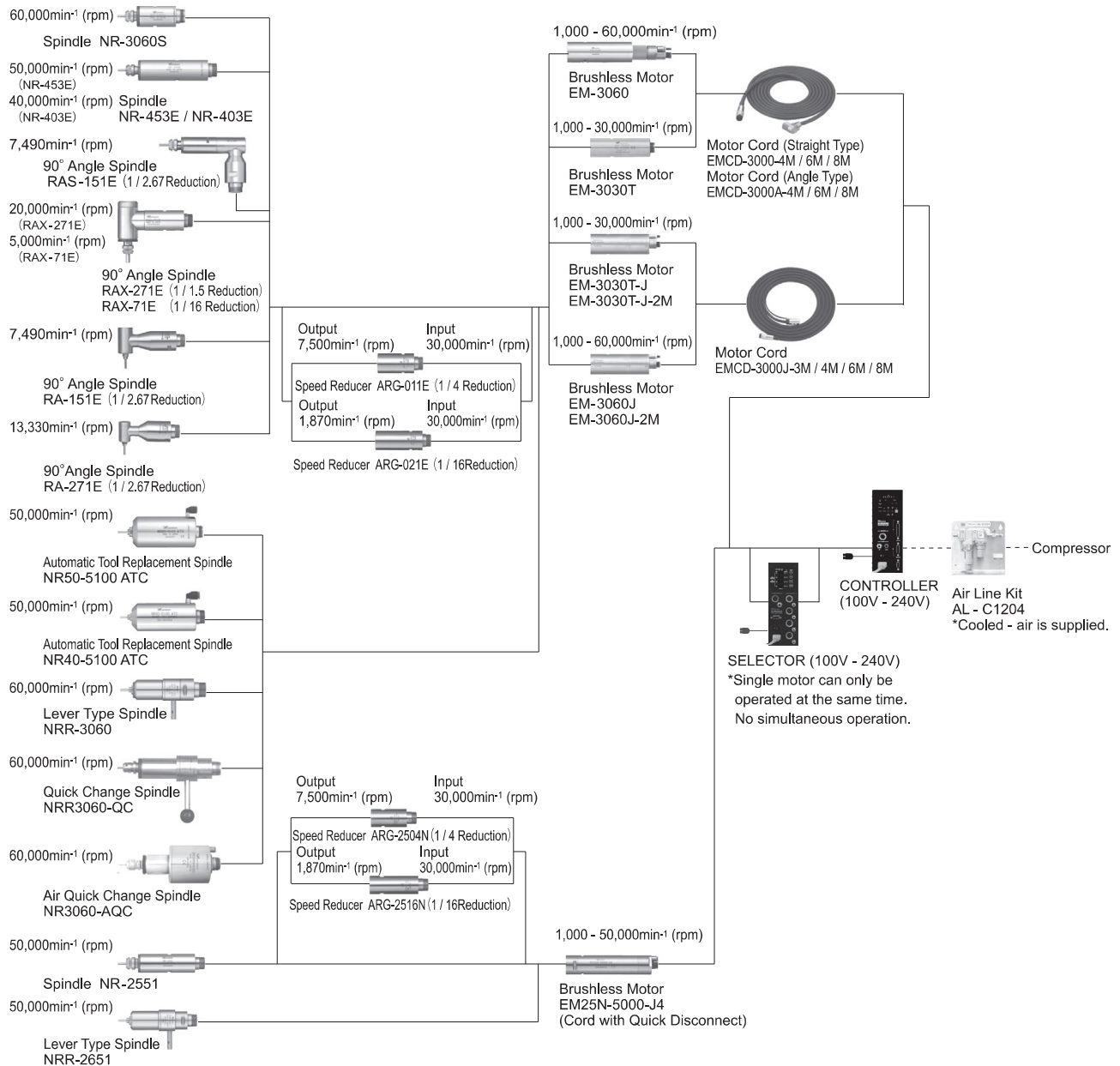


Fig. 5

8. TORQUE CHARACTERISTICS

(1) 80,000min⁻¹ (rpm)

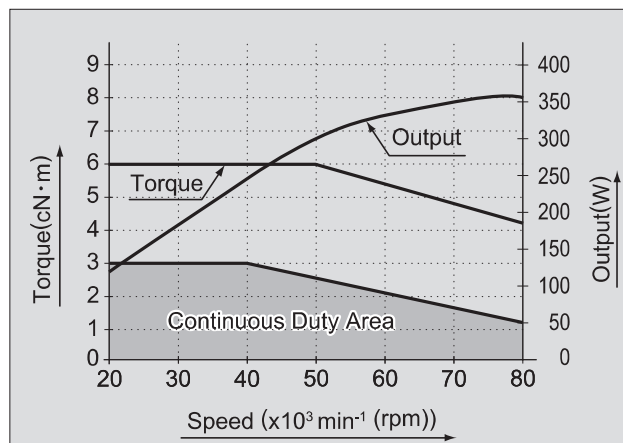


Fig. 6

(2) 60,000min⁻¹ (rpm)

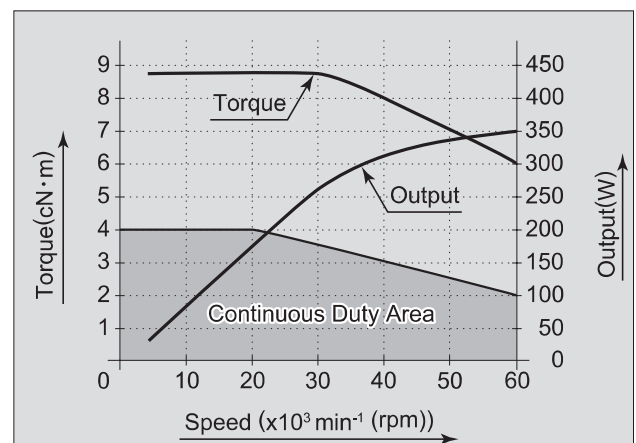


Fig. 7

(3) 50,000min⁻¹ (rpm)

① EM25N-5000

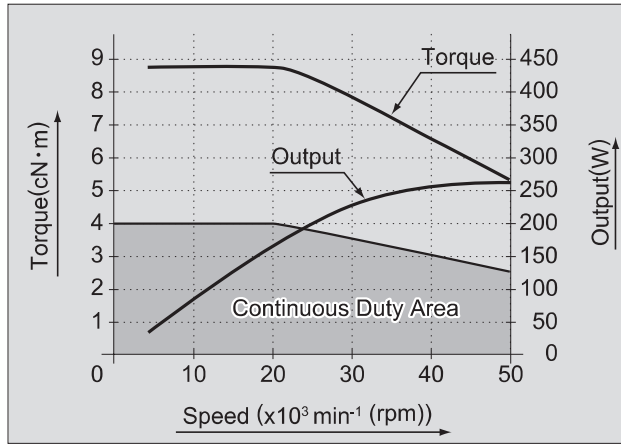


Fig. 8

② HES510

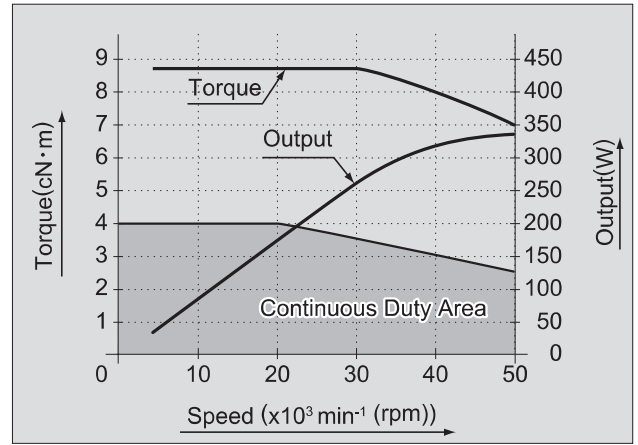


Fig. 9

(4) 32,000min⁻¹ (rpm)

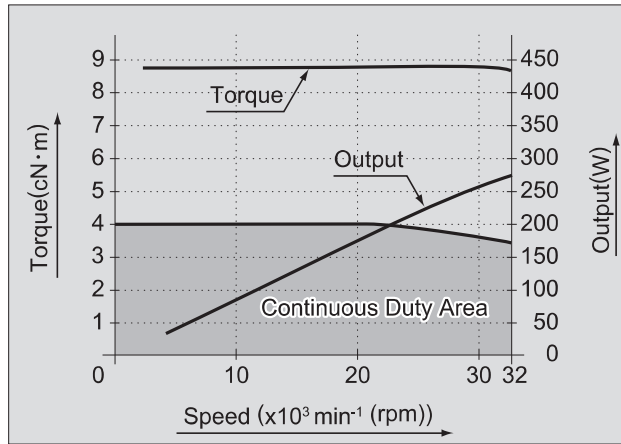


Fig. 10

(5) 30,000min⁻¹ (rpm)

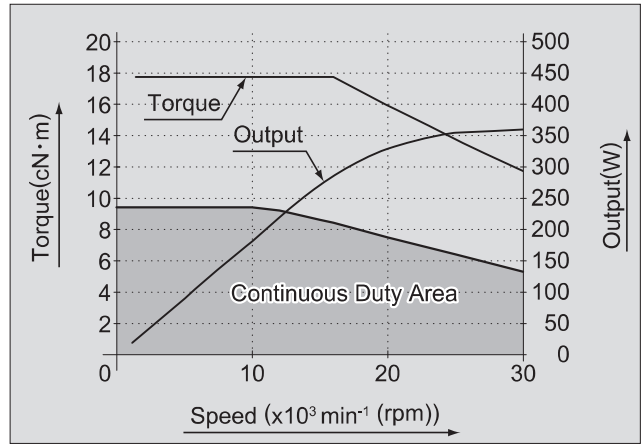


Fig. 11

9. CONTROL PANEL FEATURES

9 - 1 System

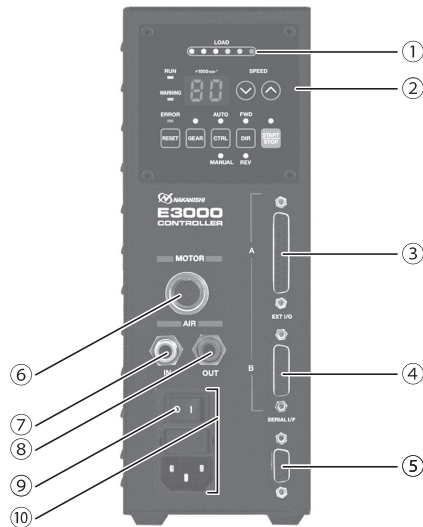


Fig. 12

① E3000 CONTROLLER

② Control Panel

Refer to " 9 - 2 Control Panel Details " section.

③ Input / Output Connector A

Input / Output Connector A is for automatic control and monitoring of motor / spindle system. Refer to " 16 – 1 (1) Details of External Input / Output Connector A Signal " section.

Attach the provided Connector Cover A for safety and dust proofing, when not using Input / Output connector A.

④ Input / Output Connector B

Connector for automatic monitoring of emergency conditions.

Refer to " 16 – 2 (1) Details of External Input / Output Connector B Signal " section.

Attach the provided Connector Cover B for safety and dust proofing, when not using Input / Output connector B.

⑤ Serial I/F Connector

Serial I/F Connector is for the SELECTOR for Communication Cable. Refer to " 12 - 2 Connection of Communication Cable " section of the E3000 SELECTOR Operation Manual.

Attach the provided Serial I/F Connector Cover for safety and dust proofing when not using Serial I/F Connector.

⚠ CAUTION

Do not connect any device other than E3000 CONTROLLER to the Serial I/F Connector of the CONTROLLER, as this will cause damage to the CONTROLLER.

⑥ Motor Connector

Connect the Motor Cord Plug of the motor spindle. Refer to "13. MOTOR CORD CONNECTION " section.

⑦ Air Input Joint

Supply clean, dry, regulated air for motor cooling. Regulate air to between 0.25 - 0.3MPa (36.3 - 43.5 psi).

Max. Air Consumption is 30Nℓ/min. Air must be supplied to operate the system at maximum rpm. Refer to " 14. AIR HOSE CONNECTION " section.

⚠ CAUTION

If the air pressure is too low the E3000 CONTROLLER will not operate.

⑧ Air Output Joint

Connect Air Hose to supply clean, dry, regulated air for motor and spindle cooling and purging. Refer to " 14. AIR HOSE CONNECTION " section.

⑨ Main Power Switch

ON / OFF main power source. The designation " I " Indicates ON. The designation " O " Indicates OFF.

⑩ Main Power Inlet with Power Supply Fuses

Insert the Power Cord. Refer to " 12. POWER CORD CONNECTION " section.

Two fuses (T1.6AL (250V)) have been installed. Make sure the properly rated and type of fuses are used when replacements are necessary. When replacing fuse, refer to " 10. REPLACING FUSES " section.

9 - 2 Control Panel Details

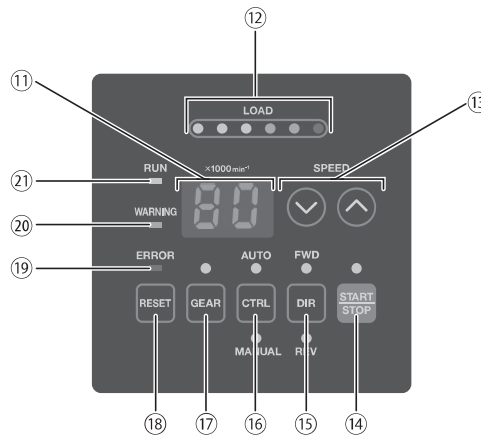


Fig. 13

⑪ Digital Speed Indicator

Preset Speed, Actual Speed, Warning and Error Codes are displayed in 2 digit format. When the motor is stopped the Preset Speed is displayed, when the motor is rotating the actual speed is displayed.

The display also displays the error codes when an error has occurred. If Gear Ratio is on, the gear ratio will be displayed.

⑫ Load Monitor LED (LOAD)

The motor spindle load is displayed by 6 LED's (3 Green, 2 Yellow and 1 Red). Continuous operation is possible with up to all 3 green LED's lit. If one of the yellow LED's is lit the motor spindle can only be run for a short time. Please refer to " 17. PROTECT FUNCTION " section of this manual for allowable duration of high load operation. When any of the yellow or red LED's are lit the Warning LED (WARNING) will blink, if this condition is continued beyond the allowable interval the Error LED (ERROR) will light and the motor spindle will be shut down.

⑬ Motor Speed Adjustment Button (SPEED ▲, ▼)

(Manual adjustable speed control is possible. (▲ (UP) or ▼ (DOWN).) (1 digit is 1,000min⁻¹ (rpm).)

Sets the Gear Ratio when in Gear Ratio Mode.

Speed is adjustable from 1,000 - 80,000 min⁻¹ (rpm). Maximum motor speed depends on the type of motor.

⑭ START / STOP Button (START / STOP)

Starts and stops motor rotation.

⑮ Rotation Direction Button (DIR)

Right hand rotation (FWD.) and left hand rotation (REV.) are as viewed with the cutting tool facing the operator. With the cutting tool facing the operator right hand rotation (FWD.) will be clockwise rotation.

⑯ Control Button (CTRL)

This button will change the control mode to either MANUAL or AUTO.

MANUAL Mode : Controlled by Control Panel ② .

AUTO Mode : Controlled by Input / Output Connector A ③ from External Signal Source.

⑰ Gear Mode Select Button (GEAR)

Set Gear Mode to display the rotating speed at the cutting tool when using an angle spindle or speed reducer. Select the gear ratio by Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬ . When setting Gear ratio mode, the gear ratio will be displayed in Digital Speed Indicator ⑪ .

⑱ Error Reset Button (RESET)

This switch resets the alarm or error and allows restarting of the motor spindle after an error has been corrected. Some error codes will not allow the unit to be reset until after the Main Power Switch ⑨ has been turned OFF.

⑲ Error LED (ERROR)

When a serious problem with the system, alarms are detected this LED illuminates. The motor may shut down and the Digital Speed Indicator ⑪ will displays an error code.

⑩ Warning LED (WARNING)

The operating and working conditions of the system are constantly monitored and the Warning LED (WARNING) flashes when a hazardous condition has been detected. When a hazardous condition is detected the Warning LED (WARNING) flashes and the Digital Speed Indicator ⑪ alternates between the Warning Code and the actual or preset speed, depending on whether or not the motor/spindle is rotating or not.

⑪ Rotating LED (RUN)

When the motor is rotating this LED will illuminate.

10. REPLACING FUSES

⚠ WARNING

- Before removing the fuse holder and fuses, be sure that the Main Power Switch ⑨ is turned OFF and the Power Cord has been removed from the CONTROLLER.
- Verify type and use only following the properly rated and type of fuse.
Specified fuses : T1.6AL (250V)
- * Failure to use the proper type and rated fuse will result in fire, injury, electric shock and / or product damage.

- (1) Push on the clips on the right and left of the fuse holder and remove the fuse holder block.
- (2) Remove the bad fuse or fuses and replace with the proper type and rating of fuse by the input voltage being used.
- (3) Replace the fuse holder containing the fuses into the Main Power Inlet with Power Supply Fuses ⑩ and make sure it snaps in place.

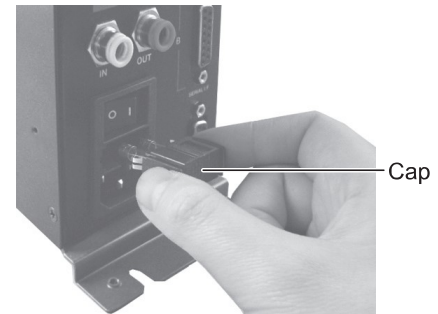


Fig. 14

11. BRACKET AND RUBBER PAD INSTALLATION

11 - 1 Installation of the Bracket

CAUTION

- If there is a possibility for the CONTROLLER to move from its mounting location, for safety, be sure to secure it with the brackets provided.
- When installing the CONTROLLER, be sure to place air vents downward, away from debris. Protect the CONTROLLER (air vents and other connector) from cutting oil, mist oil, powder dust, other contaminants that can buildup heat and damage the internal components of the CONTROLLER.

- 2 types of Mounting Brackets are provided for both Bottom mounting and Rear mounting.
- The Bracket can be installed on the " Bottom Mounting (Fig. 15) " and " Rear Mounting (Fig. 16) " of the CONTROLLER.

(1) Attach the Installation Brackets (2pcs.) using the provided mounting screws. (4pcs.)

(2) Attach the CONTROLLER (Bracket's Slotted Area) to the machine using the provided mounting screws.

Bottom Mounting

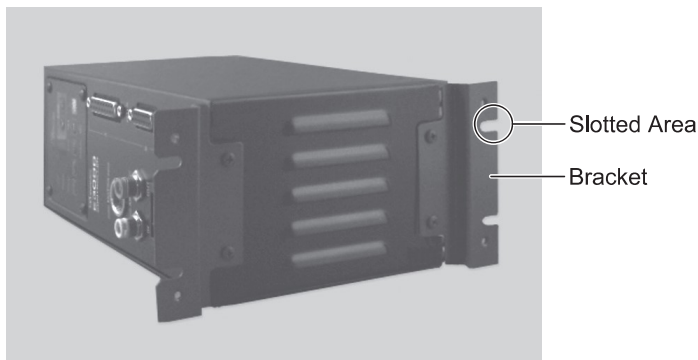


Fig. 15

Rear Mounting

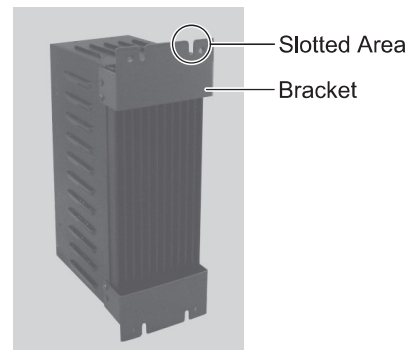


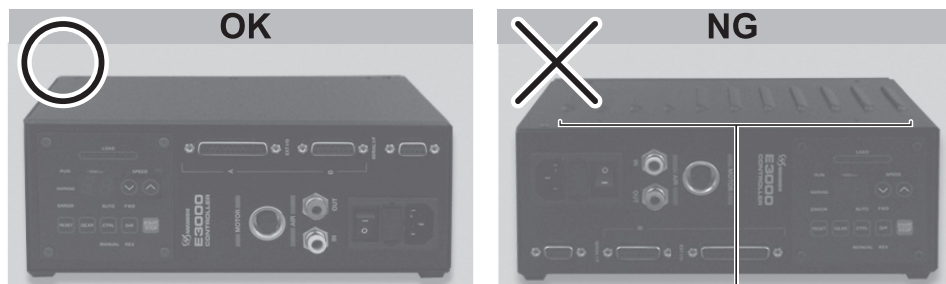
Fig. 16

11 - 2 Installation of the Rubber Pad

Caution for when installing the CONTROLLER horizontally

- When installing the CONTROLLER, be sure to place the air vents downward, away from debris. Protect the CONTROLLER (air vents and other connector) from cutting oil, mist oil, powder dust, other contaminants that can buildup heat and damage the internal components.
- When rotating the direction of setting Control Panel ②, ensure that the Main Power Switch ⑨ is turned OFF and the Power Cord has been removed from the CONTROLLER.

*Be sure to install the air vents of the CONTROLLER downward.



*The air vents of the CONTROLLER is installed upward.

Fig. 17

When placing the CONTROLLER horizontally, the Rubber Pads (Provided) must be installed on the side of the air vents. The Control Panel ② can be rotated 90° from the original position. To rotate, remove the 4 Control Panel Mounting Screw attached to Control Panel ② . Change position of the Control panel ② and re-install the 4 Control Panel Mounting Screws.

Rubber Pad



Fig. 18

Control Panel Mounting Screw

Control Panel ②



Fig. 19

11 - 3 Proper Clearance

⚠ CAUTION

When installing 2 or more CONTROLLERS in the machine cabinet, make sure to check that each unit has the proper clearance on all sides for sufficient air flow. Insufficient clearance will cause heat damage to the CONTROLLER and SELECTORS.

When installing the CONTROLLER and SELECTOR, refer to Fig. 20 and Fig. 21.

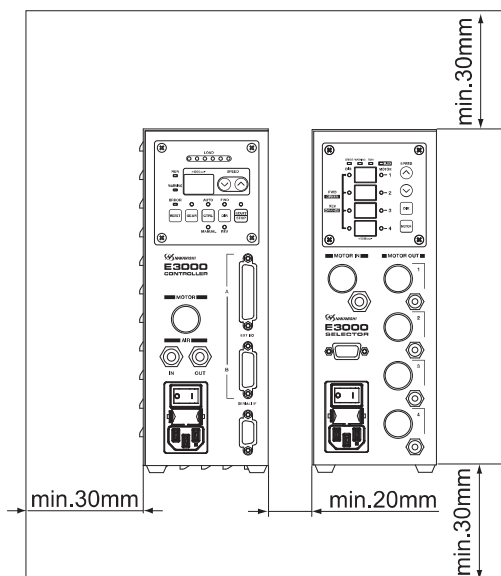


Fig. 20 Vertical Mounting

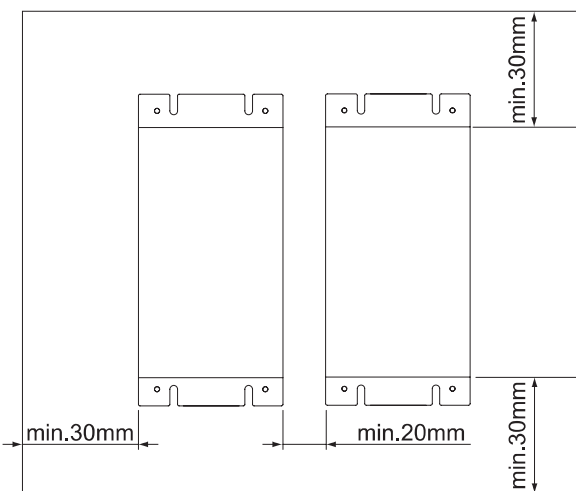


Fig. 21 Horizontal Mounting

12. POWER CORD CONNECTION

⚠ WARNING

Only use grounded power sources. Using a non-specified Power Cord, the risk of fire by overheating of the cord is possible.

⚠ CAUTION

- Reduce the risk of unintentional starting. Make sure the Main Power Switch ⑨ is in the OFF position before connecting the CONTROLLER or plugging the system in.
- When installing the CONTROLLER, provide space of approximately 10cm around the CONTROLLER for easy access to the air inlet and the Power Cord Plug.

(1) Insert the female Power Cord Plug into the Main Power Inlet with Power Supply Fuses ⑩ on the front of the CONTROLLER.

(2) A tapped hole is provided on the lower, right side of the CONTROLLER for attaching the tension relief. Use the provided nylon tension relief to attach the Power Cord to the side of the CONTROLLER when mounting vertically.

* When placing the CONTROLLER horizontally (Fig. 19), do not use the provided nylon tension relief to attach the Power Cord to the side of the CONTROLLER.

Main Power Inlet with
Power Supply Fuses ⑩
Nylon Tension Relief

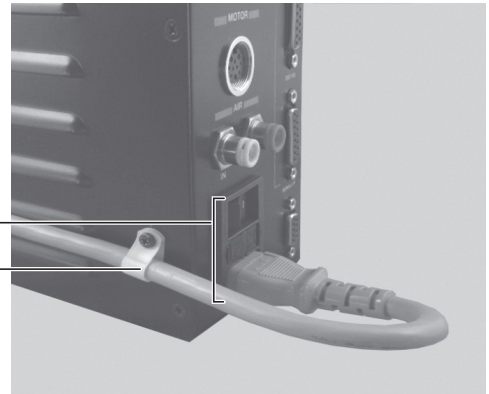


Fig. 22

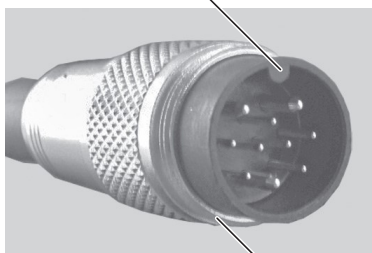
13. MOTOR CORD CONNECTION

⚠ CAUTION

Before connecting to the Motor Cord Plug, make sure the Main Power Switch ⑨ is turned OFF. If the Main Power Switch ⑨ is turned ON while connecting the Motor Cord Plug, damage may occur to the CONTROLLER.

- (1) Ensure the Alignment Pin is located upward (12 o'clock position).
- (2) Carefully insert the Alignment Pin into the Alignment Hole and push straight into the Motor Connector ⑥ on the front of the CONTROLLER.
- (3) Tighten the Connector Nut.

Alignment Pin



Connector Nut

Fig. 23

Alignment Hole

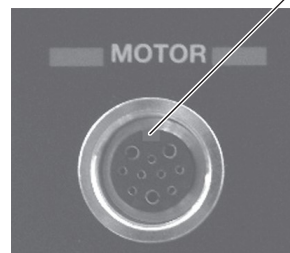


Fig. 24

14. AIR HOSE CONNECTION

CAUTION

When not using NAKANISHI Air Line Kit, make sure that the incoming air supply is dry, clean and properly regulated.

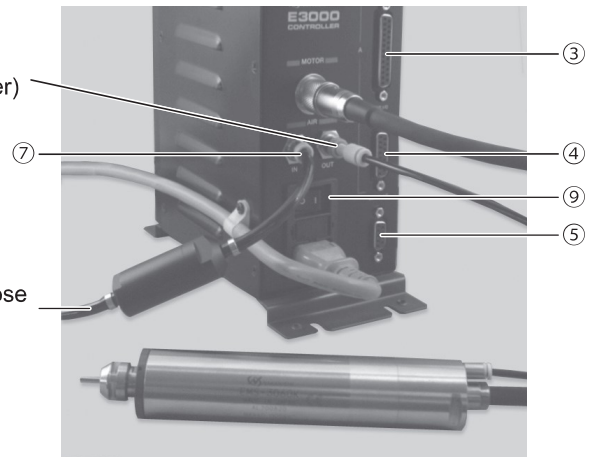
- (1) Insert the provided $\phi 6$ mm Air Hose with Filter from the Air Line Kit AL - C1204 into the Air Input Joint ⑦ on the front of the CONTROLLER.
- (2) Insert one end of the provided $\phi 4$ mm cooling Air Hose into the back of the motor.
- (3) Insert the other end of the $\phi 4$ mm cooling Air Hose into the Air Output Joint ⑧ on the front of the CONTROLLER using the provided Reducer ($\phi 6$ mm - $\phi 4$ mm Conversion Adaptor).
- (4) Regulate air pressure between 0.25 - 0.3MPa (36.3 - 43.5psi).

Setting parameter **[P 7]** (refer to "18 - 4 ⑦ **[P 7]** Selection of Air Input Monitoring Override" section), allows the motor to run at 30,000min⁻¹ (rpm) without motor cooling.

Running the motor and spindle without cooling can cause premature failure due to high temperatures.

Limit the usage of parameter to "**[P 7]** Selection of Air Input Monitoring Override" (startup motor without supplying cooling air) to only when supply cooling air is not suitable or available.

Reducer ($\phi 6$ - $\phi 4$
Conversion Adapter)



$\phi 6$ mm Air Hose
with Filter

Fig. 25

CAUTION

- The Air input joint ⑦, is designed to accept cooling air between 0.25 - 0.3MPa (36.3 - 43.5psi). If the air pressure is too low, the CONTROLLER will not operate and an Error code will be generated.
- The cooling air also provides air purge protection to the motor spindle. If the Main Power Switch ⑨ is turned OFF, the cooling air will continue to flow. When using the CONTROLLER and SELECTOR without supplying cooling air, change setting parameter "**[P 7]** Setting Air Input Monitoring Override" to ON. Never spray coolant directly on the spindle body without an air purge.
- When using the SELECTOR, do not use Air input Joint ⑦ nor Air Output Joint ⑧ of the CONTROLLER. Install the provided Air Plug (($\phi 6$) for air stop) for safety and dust proofing to Air Input Joint ⑦ and Air Output Joint ⑧. The Air Input can be directly connected to the SELECTOR.
- Do not make any sharp bends in the air hose, or pull on the hose as this can cause the hose to break, cut off the air supply or weaken the hose over time resulting in deterioration of the motor and spindle.
- Attach the provided Connector Cover for safety and dust proofing when not using the External Input / Output Connector A ③, B ④, or Serial I/F Connector ⑤ of the CONTROLLER.
- Never supply over regulated air pressure. There is a possibility to damage to the air detection sensor inside the CONTROLLER.
- The air detect function within the CONTROLLER detects air input supply only. If the Air Out hose is damaged from the CONTROLLER, it will not be able to detect the lack of cooling and purging air to the motor spindle.

15. OPERATION PROCEDURES

15 - 1 Select Control Mode (MANUAL / AUTO). (Select the Control Button (CTRL) ⑯ of the Fig. 26.)

- (1) Using the Control Button (CTRL) ⑯ you can select between Manual (Front panel control) or Auto (External Signal Source) modes. External Signal Source can be used to control Motor Start / Stop, Rotation Direction, Motor Speed etc. From an external control source (CNC).
- (2) When operating from an External Signal Source, push the Control Button (CTRL) ⑯ of Fig .26 and select AUTO. The AUTO RED will illuminate.

MANUAL Mode : Controlled by Control Panel ② .

AUTO Mode : Controlled by Input / Output Connector A ③ and from an External Signal Source.

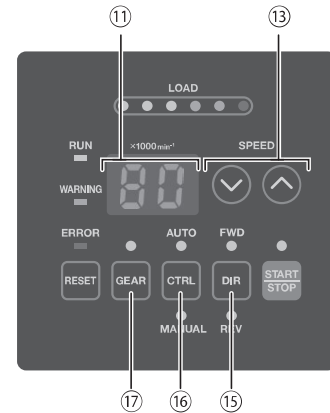


Fig. 26

15 - 2 Setting Motor Rotating Direction, Gear Ratio (GEAR), Motor Start / Stop, Motor Speed

15 - 2 - 1 Manual Mode Operation

- (1) Set Motor Rotating Direction (Set the Rotation Direction Button (DIR) ⑮ of the Fig. 26.)
Push the Rotation Direction Button (DIR) ⑮ .
Select FWD. : Right hand rotation.
Select REV. : Left hand rotation.
With the cutting tool facing the operator right hand rotation (FWD.) will be clockwise rotation.
- (2) Set 500 min⁻¹ (rpm) Centering Rotation (Set the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬ of the Fig. 26.)

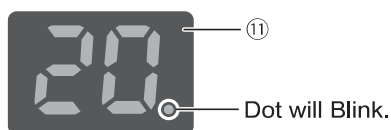
⚠ CAUTION

Never attempt to cut while rotating in Centering Mode.

To select 0.5 (500 min⁻¹ (rpm)), push the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬ . When controlling motor speed from 1,000 min⁻¹ (rpm) to 500 min⁻¹ (rpm) or from 500 min⁻¹ (rpm) to 1,000 min⁻¹ (rpm), stop the motor spindle prior to changing speed.

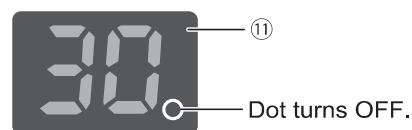
- (3) Setting Gear Ratio (Set the Gear Mode Select Button (GEAR) ⑰ of the Fig. 26.)
Push the Gear Mode Select Button (GEAR) ⑰ . (GEAR LED will light.) Check the gear ratio of the spindle or reducer combination being used. Select the appropriate gear ratio, by pushing the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬ . Display Speed Indicator ⑪ , will show the 6 possible gear ratios: 1.0, 1.5, 2.7, 4.0, 6.0, 16. If a GEAR ratio is set other than " 1.0 ", the dot displayed on Digital Speed Indicator ⑪ will blink. (Refer to Fig.27.)
If you are not using a speed reducer, or an angle type spindle, you do not need to set Gear Ratio Mode. (Set Gear Ratio to 1.0)

When rotation speed is set 30,000min⁻¹ (rpm)
and Gear Ratio is set 1.5



When Gear Ratio "1.5 / 2.7 / 4.0 / 6.0 / 16" is set, the dot displayed on Digital Speed Indicator ⑪ will blink.

When rotation speed is set 30,000min⁻¹ (rpm)
and Gear Ratio is set 1.0



When Gear Ratio is set, the dot displayed on Digital Speed Indicator ⑪ will turn OFF.

Fig. 27

- (4) Motor Start / Stop (Motor Start / Stop by pushing the START / STOP Button (START / STOP) ⑭ of the Fig. 28.)
The motor spindle will start and the LED will illuminate.
Push START / STOP Button (START / STOP) ⑭ again and the motor will stop and the LED will go out.
- (5) Setting Motor Speed (Set the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬ of the Fig. 28.)
Set the speed by pushing the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬ .
- Motor Speed Range is 1,000 - 80,000 min⁻¹ (rpm).
 - The motor speed is displayed in 1,000 min⁻¹ (rpm) increments. 80 equals 80,000 min⁻¹ (rpm).
 - When using Gear Mode the Digital Speed Indicator ⑪ will show Motor Speed changes at a slower rate than during operation at ratio 1.0.
- * Motor Speed limits depend on the Motor Model. Before using it, refer to the " 6 - 1 Specification of the CONTROLLER Note : 1 " section.

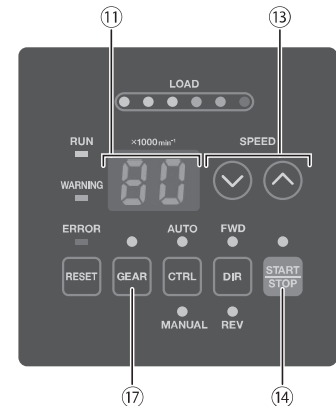


Fig. 28

15 - 2 - 2 Setting Auto Mode

Use the Input / Output Connector A ③ to input control signals to the CONTROLLER (Except setting gear ratio).

(1) Set motor Rotating Direction

Input the " Rotating Direction Setting (Pin No. 2 : DIR_IN) "

Right hand rotation is ' OFF (Open) ' (" FWD ", LED will illuminate)

Left hand rotation is ' ON (Closed) ' (" REV ", LED will illuminate)

With the cutting tool facing the operator right hand rotation (FWD.) will be clockwise rotation.

(2) Set 500 min⁻¹ (rpm) Centering Rotation

⚠ CAUTION

Never attempt to cut while rotating in centering mode.

Input the " Rotates Motor at " Centering " speed (Pin No.16 : 500 min⁻¹ (rpm)) "

When using the Centering Mode : ' ON (Closed) '

(3) Setting Gear Ratio (Set the Gear Mode Select Button (GEAR) ⑰ of the Fig. 28.)

Push the Gear Mode Select Button ⑰ . (GEAR LED will be illuminated.) Check the gear ratio of the spindle or reducer combination being used, select the appropriate gear ratio, by pushing the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬. Display Speed Indicator ⑪, will show the 6 possible gear ratios:1.0, 1.5, 2.7, 4.0, 6.0, 16. If GEAR ratio is set other than " 1.0 ", the dot displayed on Display Speed Indicator ⑪ will blink. (Refer to Fig. 29.)

If you are not using a speed reducer, or an angle type spindle, you do not need to set Gear Ratio Mode. (Set Gear Ratio 1.0)

When rotation speed is set 30,000min⁻¹ (rpm)
and Gear Ratio is set 1.5



When Gear Ratio "1.5 / 2.7 / 4.0 / 6.0 / 16" is set, the dot displayed on Digital Speed Indicator ⑪ will blink.

When rotation speed is set 30,000min⁻¹ (rpm)
and Gear Ratio is set 1.0



When Gear Ratio is set, the dot displayed on Digital Speed Indicator ⑪ will turn OFF.

Fig. 29

(4) Motor Start / Stop

Input the " Rotate Command (Pin No. 14 : START) ".

Motor rotating is ' ON (Closed) '. When startup, RUN LED (RUN) ②① of the CONTROLLER will light and motor will rotate.

(5) Setting the Motor Speed

• Motor Speed Range is 1,000 - 80,000 min⁻¹ (rpm). Maximum motor speed depends on motor and spindle model.

Setting parameter **P2** to ON allows the motor speed to be adjusted in Auto Mode using the Motor Speed Adjustment Button (SPEED , ) ⑬ of the Fig. 28.

(Refer to " 18 - 4 ② **P2** Setting AUTO Mode for Motor Speed Control " section.)

Rotational speed can be set by the using one of the following 3 methods.

① Setting by Analog signal

Input the " Motor Speed Control Voltage (Pin No. 23 : VR) ". Refer to " 16 - 1 (3) ④ Motor Speed Control Signal " section.

When using the motor with specification of 80,000min⁻¹ (rpm), set parameter **P8** of the CONTROLLER. This will change the Motor Speed Characteristics of the motor speed and Speed Control Voltage Signal characteristics. (Refer to " 18 - 4 **P8** Selection of Motor Speed Control Voltage / DC+10V Signal Method " section.)

② Setting by Pulse Signal

(Set parameter **P5** of the CONTROLLER. (Refer to " 18 - 4 ⑤ **P5** Selection of External Speed Control Mode " section.)

Input the " Count Pulse Signal for Setting Motor Speed (Pin No. 3 : CNT_IN) " and " UP / DOWN Signal for Setting Motor Speed (Pin No. 15 : UD_IN) ".

One pulse will increase or decrease 1,000min⁻¹ (rpm) in Spindle Speed. Counted on the leading edge of the signal.

" UP / DOWN Signal for Setting Motor Speed (Pin No. 15 : UD_IN) " is ' ON (Close) ' : increases speed, ' OFF (Open) ' : decreases speed.

③ Set by the Speed Point Signal

(Set parameter **P5** . (Refer to " 18 - 3 ⑤ **P5** Selection of External Speed Control Mode " section.)

! CAUTION

When connecting the CONTROLLER to the SELECTOR, setting the Speed Point Signal is not possible.

Select the Speed Point (U1 - U4) by combination of " Speed Point Select 0 (Pin No. 17 : SEL0) " and " Speed Point Select 1 (Pin No. 5 : SEL1) ".

Set the Motor Rotation Speed.

Select the Speed Point (U1 - U4) by the signal combination in Table. 3

Table. 3

Speed Point	SEL1 (Pin No. 5)	SEL0 (Pin No. 17)
U1	OFF (Open)	OFF (Open)
U2	OFF (Open)	ON (Closed)
U3	ON (Closed)	OFF (Open)
U4	ON (Closed)	ON (Closed)

(6) Resetting System after Error Codes

Releasing Error Code by The " Error Release (Pin No. 4 : RESET) ". Switch the signal on " Error Release (Pin No. 4 : RESET) " of Input / Output Connector A ③ ' OFF (Open) ' → ' ON (Closed) ' → ' OFF (Open) '.

Error Signal will not be released until cause of the error has been removed.

Refer to " 17 - 3 Resetting System after Error Code " section.

(7) Set Motor Selection (When connecting the SELECTOR to the CONTROLLER.)

After connecting a CONTROLLER to a SELECTOR, 4 motors can be selected by SEL0 and SEL1 combination. (Refer to Table. 4.)

Table. 4

Select Motor	SEL1 (Pin No.5)	SEL0 (Pin No.17)
Motor 1	OFF (Open)	OFF (Open)
Motor 2	OFF (Open)	ON (Closed)
Motor 3	ON (Closed)	OFF (Open)
Motor 4	ON (Closed)	ON (Closed)

16. EXTERNAL INPUT / OUTPUT CONNECTOR

16 - 1 External Input / Output Connector A ③

(1) Details of External Input / Output Connector A ③ Signals

⚠ WARNING

- **DO NOT** connect any circuit other than SELV (DC+24V) (Safety Extra Low Voltage) to the External Input / Output Connector A ③ of the CONTROLLER. This will cause I / O board damage in the CONTROLLER.
- Do not supply over voltage or over current into the input / output circuit. Always install a LOAD (resistor) to the output circuit to eliminate the chance of damage to the CONTROLLER.

⚠ CAUTION

Input / Output Connector A ③ do not use Pins No. 9 and No. 22. If pin No. 9 and No. 22 are connected, the CONTROLLER will be damage.

Table. 5

Pin No.	Code	Function	Input / Output	Description
1	COM_1	External Power source for External input	Input	DC0V or DC+24V Power source to be used for External Inputs Signals.
2	DIR_IN	Rotating Direction Setting	Input	Controls the rotational direction of the motor spindle. Setting parameter P6 , can start with reverse rotation. (Refer to " 18 - 4 ⑥ P6 Selection of External Motor Start Signal Control Mode " section.)
3	CNT_IN	Count Pulse Signal for Setting Motor Speed	Input	' OFF (Open) ' → ' ON (Closed) ' One pulse will increase or decrease 1,000min ⁻¹ (rpm) in Spindle Speed depending on parameter P5 setting. (Refer to " 18 - 4 ⑤ P5 Selection of External Speed Control Mode" section.)

Pin No.	Code	Function	Input / Output	Description	
4	RESET	Error Release	Input	' ON (Closed) ' → ' OFF (Open) '	Error Code can be released and the system restarted by toggling this signal OFF and ON. Error will not be released until cause of the error has been removed.
5	SEL1	Motor Select 1	Input	—	Use when selecting motor, after connecting CONTROLLER to the SELECTOR. 4 motors can be selected by SEL0 and SEL1 combination. Refer to " 15 - 2 - 2 (7) Motor Selection Table. 4.")
		Speed Point Select 1			When only using CONTROLLER, Speed Point Signal can be selected. Speed Point (U1 - U4) can be selected by SEL0 and SEL1 signal combination. Refer to " 15 - 2 - 2 (5) ③ Set by the Speed Point Signal " section. Need to set parameter $\overline{P5}$. (Refer to " 18 - 4 ⑤ $\overline{P5}$ Selection of External Speed Control Mode " section.)
6	RUN	Rotating	Output	' OFF (Open) ' : Stop ' ON (Closed) ' : Rotating	Output shows that the motor is rotating.
7	DIR_OUT	Rotating Direction	Output	' OFF (Open) ' : FWD. ' ON (Closed) ' : REV.	Output shows the direction of the Motor is rotating.
8	ERR	Error	Output	' OFF (Open) ' : Error ' ON (Closed) ' : Normal	Output shows that error has occurred. Error code will be displayed on Digital Speed Indicator ⑪ . The error Code Logic can be reversed by setting Parameter $\overline{P1}$. The Error Code Logic can be either Normally Open or Normally Closed depending on the $\overline{P1}$ Setting. In addition, the error code can be output as a patterned signal. For details, refer to "18. SETTING OF OPERATING PARAMETERS".
9	Not used	—	—	—	*Note : Never use pin labeled not used.
10	GND	Internal GND for Motor Speed Control Voltage	Output	Internal CONTROLLER GND	This GND will be used for " Motor Speed Control Voltage (VR) ".
11	Vcc	Internal Power Source for Motor Speed Control Voltage	Output	Internal Power Source : DC+10V	Internal Power Source for " Motor Speed Control Voltage (VR) ".
12	MOTOR_I	Motor Current Monitor	Output	2Amp / V, $0V \leq \text{MOTOR_I} \leq 10V$	Output Motor Current Monitor with Analog Monitor Voltage. 2Amp / 1V. Max. 20Amp.
13	GND	Internal GND for Analog Monitor	Output	Internal CONTROLLER GND	This GND will be used for analog monitor (MOTOR_I, SPEED_V, and LOAD).

Pin No.	Code	Function	Input / Output	Description	
14	START	Rotate Command	Input	' OFF (Open) ' : Stop ' ON (Closed) ' : Start	Motor Start and Motor Stop Signal Setting parameter $P6$, can start with forward rotation. (Refer to " 18 - 4 ⑥ $P6$ Selection of External Motor Start Signal Control Mode" section.)
15	UD_IN	UP / DOWN Signal for Setting Motor Speed	Input	' OFF (Open) ' : Speed Down ' ON (Closed) ' : Speed Up	Determines speed up or speed down. Need to set parameter $P5$. (Refer to " 18 - 4 ⑤ $P5$ Selection of External Speed Control Mode " section.)
16	500min ⁻¹ (rpm)	Rotates Motor at " Centering " speed	Input	' ON (Closed) ' : 500min ⁻¹ (rpm) ' OFF (Open) ' : Normal Operation	Set motor rotation speed is 500min ⁻¹ (rpm). Use the Centering Mode.
17	SEL0	Motor Select 0	Input	—	Use when selecting motor, after connecting CONTROLLER to the SELECTOR. 4 motors can be selected by SEL0 and SEL1 combination. (Refer to " 15 - 2 - 2 (7) Motor Selection Table. 4.")
		Speed Point Select 0			When using CONTROLLER only, Speed Point Signal can be selected. Speed Point (U1 - U4) can be selected by SEL0 and SEL1 signal combination. Refer to " 15 - 2 - 2 (5) ③ Set by the Speed Point Signal " section. Need to set parameter $P5$. (Refer to "18 - 4 ⑤ $P5$ Selection of External Speed Control Mode " section.)
18	COM_2	External Power Source for External Output	Input	DC0V or DC+24V	Power source to be used for External outputs Signals.
19	PULSE	Rotating Pulse	Output	1 pulse / rotation	1 revolution of the motor generates one pulse. Duty 50%.
20	WARNING	WARNING	Output	' OFF (Open) ' : Normal Operation ' ON (Closed) ' : Warning	Output shows that warning has occurred. Warning code will be displayed on Digital Speed Indicator ⑪ . By setting Parameter $P1$, the Warning Code can be output as a patterned signal. For details, refer to "18. SETTING OF OPERATING PARAMETERS".
21	COIN	Speed Achievement	Output	' OFF (Open) ' : Set speed not achieved ' ON (Closed) ' : Set speed achieved	Shows that the Motor has achieved more than 90% of the set speed.
22	Not used	—	—	—	*Note : Never use a pin labeled not used.
23	VR	Motor Speed Control Voltage	Input	Speed (min ⁻¹ (rpm)) = Motor Speed Control Voltage (VR) x 10000 / 1.5 0V ≤ VR ≤ 10V	Sets rotating speed of the motor. (For motors except 80,000min ⁻¹ (rpm) of motor) When using 80,000min ⁻¹ (rpm) of motor speed, setting parameter $P8$. (Refer to " 18 - 4 ⑧ $P8$ Selection of Motor Speed Control Voltage / DC+10V Signal Method " section.) Refer to Fig.36, 37 about relationship between Motor Speed and Motor Speed Control Voltage (VR). * Unit of rotational speed : 1,000min ⁻¹ (rpm)

Pin No.	Code	Function	Input / Output	Description
24	LOAD	Torque Load Monitor	Output	Torque Load Monitor (%) = Torque Load Monitor Voltage x 20 Shows that the torque being applied to the analog motor. 20% / V 100% (rating) / DC+5V Torque Load Monitor : 0 - 200% (0V ≤ LOAD ≤ 10V)
25	SPEED_V	Rotating Speed Analog Monitor Voltage	Output	Output the rotation speed of rotating motor with Analog Monitor Voltage. 10,000min ⁻¹ (rpm) / V 0V ≤ SPEED_V ≤ 10V

(2) Input / Output Diagram

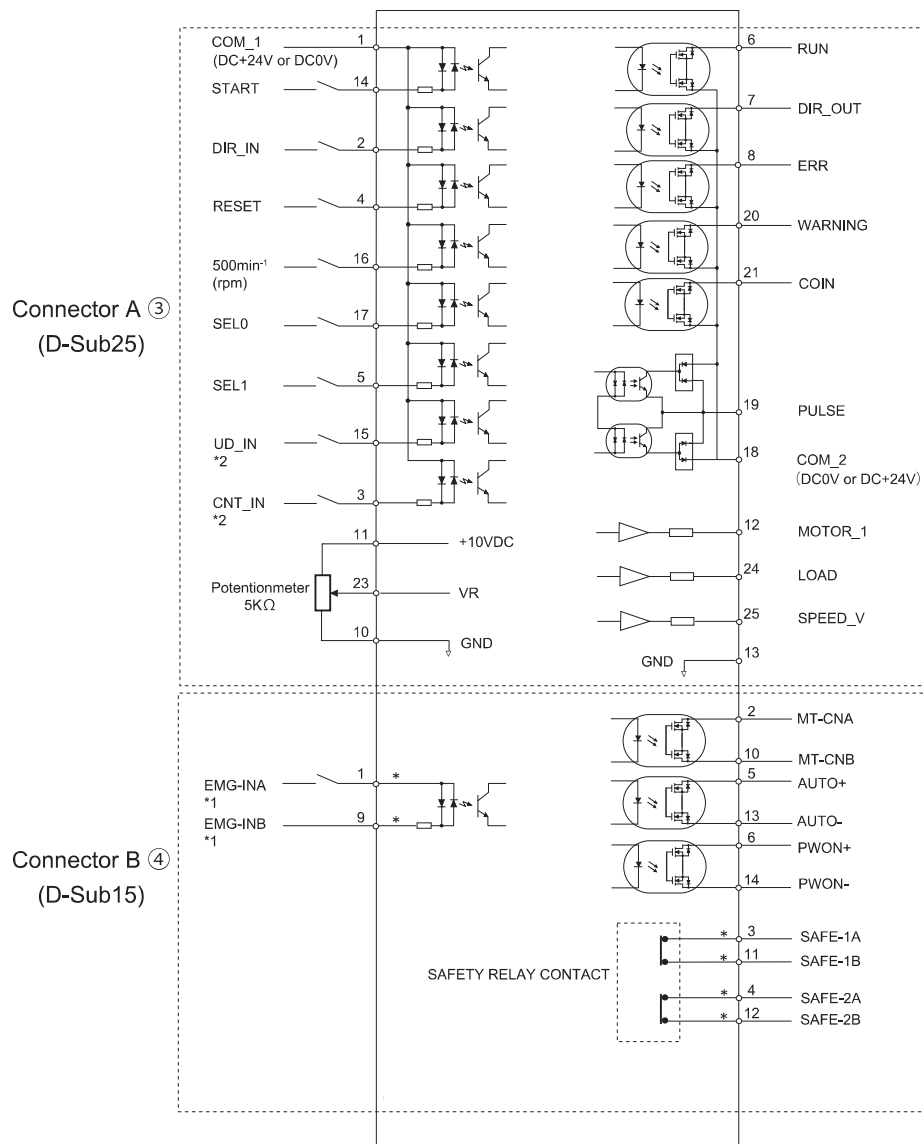


Fig. 30

- *1 When using the " EMG - IN " Signal, set parameter **P9**. (Refer to " 18 - 4 ⑨ **P9** Selection of Emergency Stop Function " sectional.)
- *2 When using the " UD_IN and CNT_IN " Signal, set parameter **P5**. (Refer to " 18 - 4 ⑤ **P5** Selection of External Speed Control Mode " section of the E3000 CONTROLLER Operation Manual.)

(3) Input / Output Signal

① Input Signal

There are 8 different input signals : " Rotate Command (START) ", " Rotating Direction Setting (DIR_IN) ", " Rotates Motor at " Centering " speed (500min^{-1} (rpm)) ", " Error Release (RESET) ", " UP / DOWN Signal for Setting Motor Speed (UD_IN) ", " Count Pulse Signal for Setting Motor Speed (CNT_IN) ", " Motor Select 0 (SEL0) ", and " Motor Select 1 (SEL1) ". These signals are DC+24V signals from an external signal source. Please use a separate power source that is capable of supplying DC+24V $\pm$ 10%, 100mA. Refer to Fig. 31 for connections.

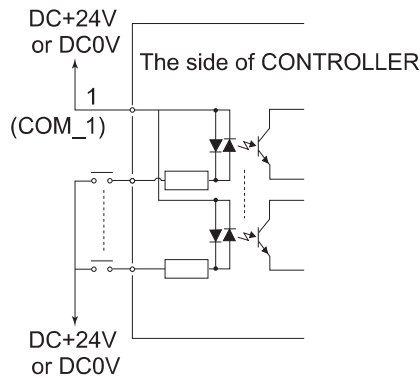


Fig. 31

② Output Signal I

There are 5 separate output signals : " Rotating (RUN) ", " Rotating Direction (DIR_OUT) ", " Error (ERR) ", " WARNING (WARNING) " and " Speed Achievement (COIN) ". These signals are MOSS Relay Contact Connections. The output current can be connected to either sinking or sourcing.

Voltage and Current Specifications

- Applied Voltage (V) $\leq$ DC+30V
- Working Current (Ip) $\leq$ 100mA

Use an external power source for output circuits. It is recommended to use the same DC+24V power source used for input signals. Please refer to Fig. 32 for connections.

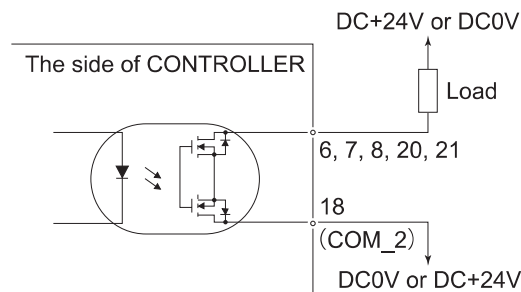


Fig. 32

③ Output Signal II

Refer to Fig. 33 regarding the Output Signal of the " Rotating Pulse (PULSE) ". The output signal can be connected for either sinking or sourcing.

Voltage and Current Specifications

- Applied Voltage (V) $\leq$ DC+30V
- Working Current (Ip) $\leq$ 50mA

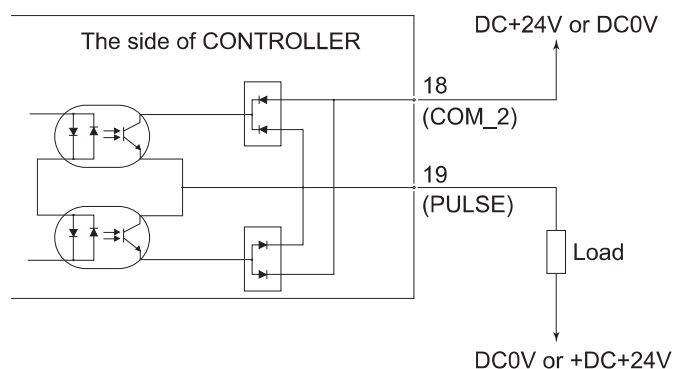


Fig. 33

④ Motor Speed Control Signal

Rotation Speed can be selected by, applying analog voltage to the " Motor Speed Control Voltage (VR) " Refer to Fig. 34, 35 for connections. Refer to Fig. 36, 37 for the relationship between Motor Speed and " Motor Speed Control Voltage (VR) ".

⚠ CAUTION

When applying the VR, never input more than DC+10V to the CONTROLLER (Fig. 35). This will cause serious damage to the I/O Board in the CONTROLLER.

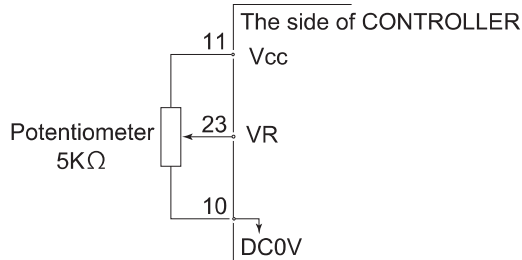


Fig. 34

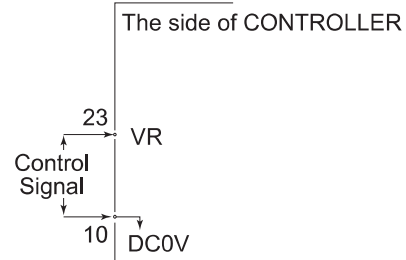


Fig. 35

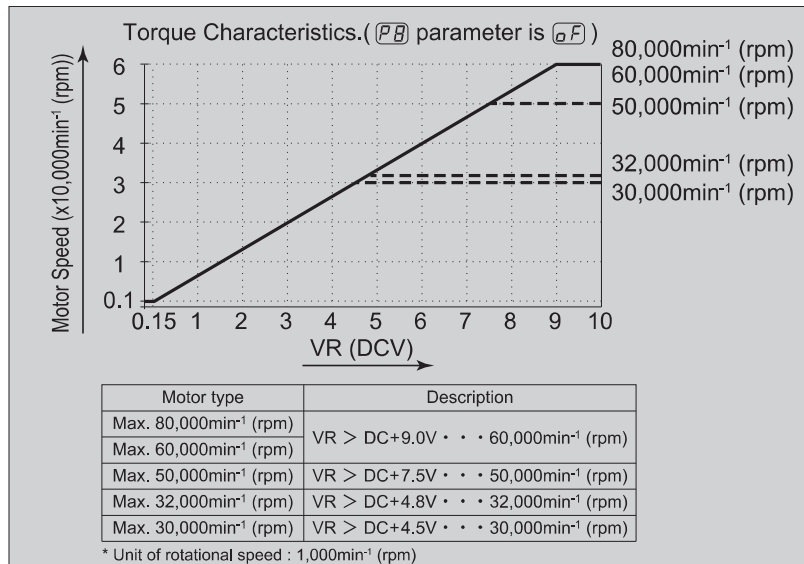


Fig. 36

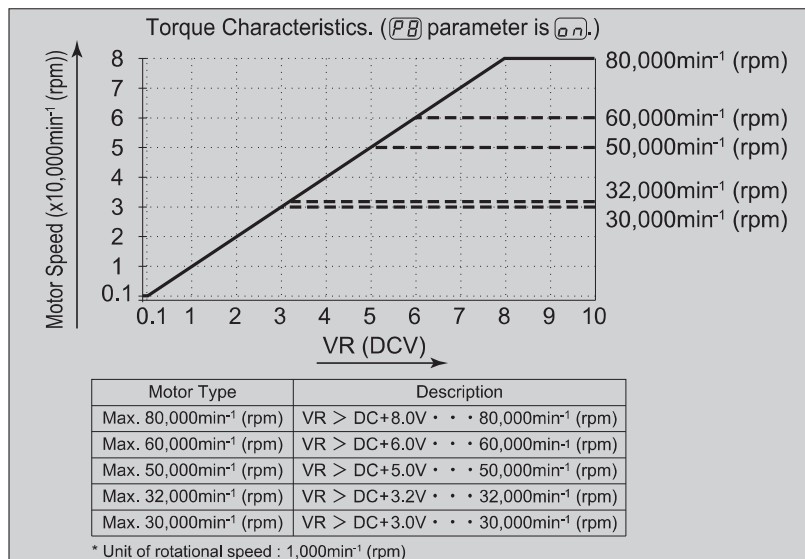


Fig. 37

⑤ Analog Monitor Signals

There are 3 types of monitoring signals : " Motor Current Monitor (MOTOR_I) ", " Torque Load Monitor (LOAD) ", and " Rotating Speed Analog Monitor Voltage (SPEED_V) ". Please refer to Fig. 38 for connections.

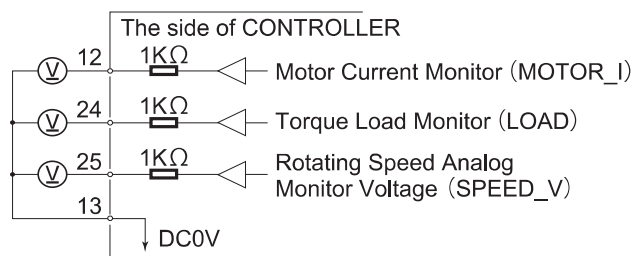


Fig. 38

16 - 2 External Input / Output Connector B ④

(1) Details of External Input / Output Connector B ④ Signals

⚠ WARNING

- **DO NOT** connect any circuit other than SELV (DC+24V) (Safety Extra Low Voltage) to the External Input / Output Connector B ④ of the CONTROLLER. This will cause I / O board damage in the CONTROLLER.
- Do not supply over voltage or over current into the input / output circuit. Always install a LOAD (resistor) to the output circuit to eliminate the chance of damage to the CONTROLLER.

⚠ CAUTION

Input / Output Connector B ④ **DOES NOT** use Pin No. 7, No. 8, and No. 15. If pin No. 7, No. 8, and No. 15 are connected, the CONTROLLER will be damage.

Table. 6

Pin No.	Code	Function	Input / Output	Description
1	EMG-INA	Emergency Stop A	Input	External Power Source input for Emergency Stop Signal or Emergency Stop Signal. Normal Operation ' ON (Closed) ', Emergency ' OFF (Open) '. When using the Emergency Stop Signal, set parameter P9 . (Refer to " 18 - 4 P9 Selection of Emergency Stop Function " section.)
2	MT-CNA	Motor Connect Contact A	Output	Continuity, ' OFF (Open) ', between Pin No. 2 and Pin No. 10 and the selected motor is connected, if no continuity is present, the motor is disconnected or the motor cord is broken.
3	SAFE-1A	Safety Relay Contact 1A	Output	Pin No. 3 and Pin No. 11 continuity ' ON (Closed) ' Safety Relay is OFF When there is continuity between Pin No. 3 and Pin No. 1 are ' ON (Closed) ' Safety Relay is OFF (System Stopped), no continuity Safety Relay is ' OFF (Open) ' Normal Operation.

Pin No.	Code	Function	Input / Output	Description	
4	SAFE-2A	Safety Relay Contact 2A	Output	Pin No. 4 and Pin No. 12 continuity ' ON (Closed) ' Safety Relay is OFF	When there is continuity between Pin No. 4 and Pin No. 12 are ' ON (Closed) ' Safety Relay is OFF (System Stopped), no continuity Safety Relay is ' OFF (Open) ' Normal Operation.
5	AUTO +	Control Mode AUTO Signal (+)	Output	Control Mode AUTO Pin No. 5 and Pin No. 13 are ' ON (Closed) '	When Control Mode AUTO is being used, this Pin No. 5 and Pin No. 13 are ' ON (Closed) '.
6	PWON +	CONTROLLER Power Source Monitor (+)	Output	' ON (Closed) ' : Main Power Supply is connected ' OFF (Open) ' : Main Power Supply is disconnected	If the Main Power Switch ⑨ is ON, Pin No. 6 and Pin No. 14 are ' ON (Closed) '.
7	Not Used	—	—	—	*Note : Never use pin labeled not used.
8	Not Used	—	—	—	*Note : Never use pin labeled not used.
9	EMG-INB	Emergency Stop B	Input	External Power Source input for Emergency Stop Signal or Emergency Stop Signal ' OFF (Open) '	External Power Source input for Emergency Stop Signal or Emergency Stop Signal. Normal Operation ' ON (Closed) ', Emergency ' OFF (Open) '. When using the Emergency Stop Signal, set parameter P9 . (Refer to " 18 - 4 P9 Selection of Emergency Stop Function" section.)
10	MT-CNB	Motor Connect Contact B	Output	Continuity, ' OFF (Open) ', between Pin No. 2 and Pin No. 10 the motor is connected.	When there is continuity, OFF, between Pin No. 2 and Pin 10 are ' OFF (Open) ', the selected motor is connected, if no continuity the motor is disconnected or the motor cord is broken.
11	SAFE-1B	Safety Relay Contact 1B	Output	Pin No. 3 and Pin No. 11 continuity ' ON (Closed) ' Safety Relay is OFF	When there is continuity between Pin No. 3 and Pin No. 11 are ' ON (Closed) ' Safety Relay is OFF (System Stopped), no continuity Safety Relay is ' OFF (Open) ' Normal Operation.
12	SAFE-2B	Safety Relay Contact 2B	Output	Pin No. 4 and Pin No. 12 continuity ' ON (Closed) ' Safety Relay is OFF	When there is continuity between Pin No. 4 and Pin No. 12 are ' ON (Closed) ' the Safety Relay is OFF (System Stopped). If there is no continuity Safety Relay is ' OFF (Open) ' Normal Operation.
13	AUTO -	Control Mode AUTO Signal (-)	Output	Control Mode AUTO Pin No. 5 and Pin No. 13 are ' ON (Closed) '	When Control Mode AUTO is being used, this Pin No. 5 and Pin No. 13 are ' ON (Closed) '.

Pin No.	Code	Function	Input / Output	Description	
14	PWON -	CONTROLLER Power Source Monitor (-)	Output	' ON (Closed) ' : Main Power Supply is connected ' OFF (Open) ' : Main Power Supply is disconnected	If the Main Power Switch ⑨ is ON, Pin No. 6 and Pin No. 14 are ' ON (Closed) '.
15	Not Used	—	—	—	*Note : Never use pin labeled not used.

(2) Input / Output Signals

① Output Signal

Pin No. 2 - 10, 5 - 13, 6 - 14

There are 3 different output signals : " Motor Connect Contact (MT-CN) ", " Control Mode AUTO Signal (AUTO) ", and " CONTROLLER Power Source Monitor (PWON) ".

These signals are MOSS Relay Contact Connections. The output current can be connected for either sinking or sourcing.

Voltage and Current Specifications

- Applied Voltage (V) $\leq$ DC+30V
- Working Current (Ip) $\leq$ 100mA

Use an external power source for output circuits. It is recommended to use a separate power supply Input / Output Connector B ④ . Please refer to Fig. 39 for connections.

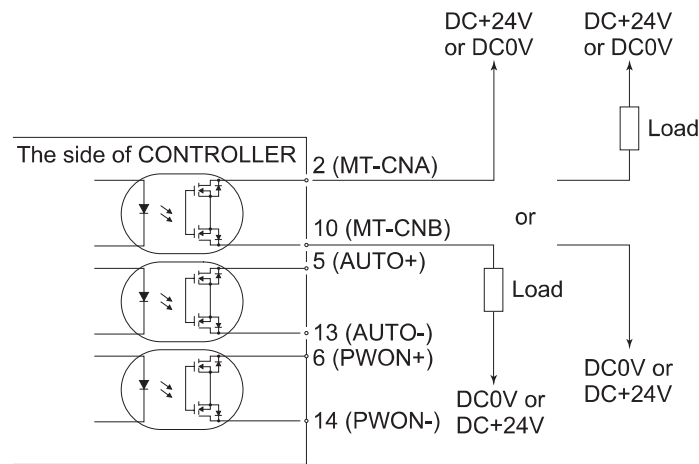


Fig. 39

② Emergency Stop Signal Input

Pin No. 1 - 9

This signal is a switched DC+24V output.

Please use a separate power source that is capable of applying DC+24V $\pm$ 10%, 50mA. Refer to Fig. 40 below for connections.

Normal Operation circuit is ' ON (Closed) ' Emergency Stop circuit is ' OFF (Open) '.

If the Emergency Stop Signal is ' OFF (Open) ' the Safety Relay is OFF and the power supply to the motor is interrupted and the motor stops.

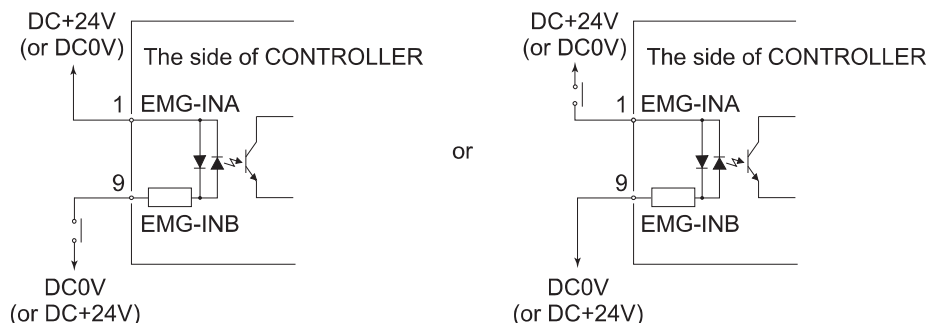


Fig. 40

③ Safety Relay Signal

⚠ CAUTION

If the Emergency Stop Function is not installed, the Emergency Stop Signal (EMG - IN) will not function. If enabling the Emergency Stop Function, it is necessary to set parameter **P9 . (Refer to " 18 - 4 ⑨ **P9** Selection of Emergency Stop Function " section.)**

Pin No. 3 - 1 1, 4 - 1 2

- The Safety Relay will be ON or OFF depending on the state of the " Emergency Stop (Pin No. 1 : EMG - INA - Pin No. 9 : EMG - INB) ".
- When there is continuity between Pin No. 3 (SAFE - 1A) and Pin No. 11 (SAFE - 1B) or between Pin No. 4 (SAFE - 2A) and Pin No. 12 (SAFE - 2B) the motor is off. If there is no continuity between these pairs of pins then the system is operating normally.
- If the Emergency Stop Signal is ' OFF (Open) ' the Safety Relay will be ' OFF (Open) ' and the motor power will be interrupted and the motor will stop.
- If the (NO) Normally Open contacts of the Safety Relay are welded together by an over load or short circuit the (NC) Normally Closed contacts separation are maintained with more than 0.5mm spacing by the relay's recoil mechanism.
- The voltage / current specifications of Pin No. 3 - 11 and Pin No. 4 - 12.
Applied Voltage (V) $\leq$ DC+30V
Working Current (Ip) $\leq$ 2A

Refer to Fig. 41 below for connections.

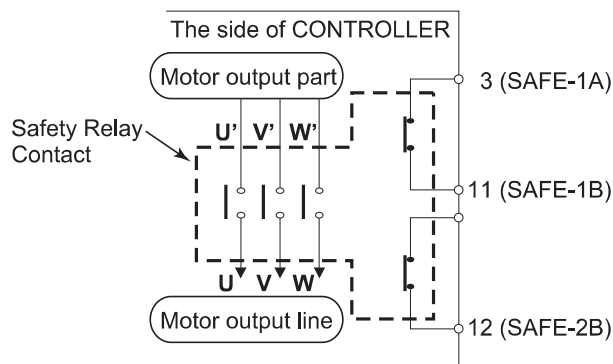


Fig. 41

* Safety Relay

If an N - O contact becomes welded, all N - C contacts will maintain a minimum distance of 0.5 mm when the coil is not energized.

N - O contacts (Normally - opened contacts) : Contacts of U - U', V - V', W - W'.

N - C contacts (Normally - closed contacts) : Contacts of (SAFE - 1A) - (SAFE - 1B), (SAFE - 2A) - (SAFE - 2B)

* Machine Safety Circuit is possible when using the Safety Relay Contacts Output

- When an Emergency Stop Signal input that is coupled to a door open switch of an Industrial Machine, the Safety Relay will energize and open the Motor Power Line circuit.
- Contact outputs ((SAFE - 1A) - (SAFE - 1B), (SAFE - 2A) - (SAFE - 2B)) of the N - C contacts can be used for detecting the opening of the Motor Power Line. If N - O contacts become welded, contact outputs will maintain an OFF condition (Open), by Forced Guide Mechanism. Therefore, Safety Relay can be used as an open signal of a movable guard or operator door with a locking (switch) mechanism for Industrial Machinery.

16 - 3 External Input / Output Connector Specifications

⚠ CAUTION

- To minimize RF interference and noise, please keep the length of the cables as short as possible and route them separately or as far away as possible from high voltage electrical cables.
- Use only shielded cables to minimize RF interference and noise. Connect the shield to the plug cover.
- Connect the shielded line to the Input / Output connector (The shielded line is grounded). Do not connect another shielded line to any externally powered instrument.

① External Input / Output Connector A ③

Plug Part Number : XM3A - 2521 OMRON (or other similar high-quality product)

Cover Part Number : XM2S - 2511 OMRON (or other similar high-quality product)

② External Input / Output Connector B ④

Plug Part Number : XM3A - 1521 OMRON (or other similar high-quality product)

Cover Part Number : XM2S - 1511 OMRON (or other similar high-quality product)

Please prepare a Cover and Plug.

The shielding should be connected to the Cover.

* Use Mounting Screws that are (M2.6)

Fasten the Connector to the CONTROLLER using Mounting Screws (M2.6).

16 - 4 External Input / Output Connector A ③ / B ④ Pin configuration (Controller side)

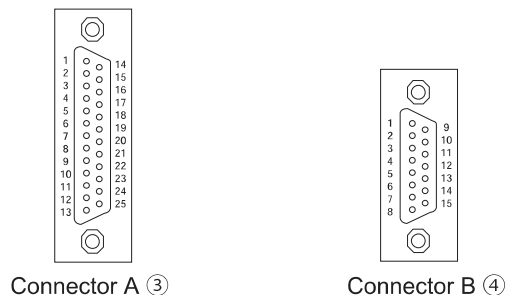


Fig. 42

17. PROTECT FUNCTION

17 - 1 WARNING DETECTION

CAUTION

When the Warning LED (WARNING) ⑳ on the CONTROLLER blinks, conditions exist that could result in dangerous operation.
Check operating conditions and continue to use only after correcting the problem.

Always check the CONTROLLER, Motor Spindle and the condition of the cooling air prior to use. This will help prevent system errors that will result in non - operational conditions.

(1) The WARNING LED (WARNING) ⑳ will blink.

(2) The Warning Code (listed in Table. 7) will be displayed on the Digital Speed Indicator ⑪ .

(3) A Warning Signal is output to the " WARNING (PIN No. 20 : WARNING) " of Input / Output Connector A ③ .

Table. 7

Warning Code	Warning Function	Trouble
A0	Motor Cord	Motor Cord or Connector are not connected or damaged.
A1	Low Air Pressure	Low Air Pressure during motor rotation.
A2	CONTROLLER Overheat	CONTROLLER Overheat.
A3	Over Load	Motor Torque Load exceeding safe limits.
A4	Emergency Stop Signal	Emergency Stop Signal 'OFF (Open)' in Emergency Stop Mode Condition.
A5	Over Air Pressure	Excessive Air Pressure.

CAUTION

When the Warning LED (WARNING) ⑳ blinks with the control in Mode AUTO, be sure to confirm the Warning Code displayed on the Digital Speed Indicator ⑪ by referring to the " Warning Code " in Table. 7.

17 - 2 Detection of Error (unsafe operating conditions)

Always check the CONTROLLER, motor, spindle and the condition of the cooling air prior to operation. This will help prevent system errors that will result in unproper operating conditions.

When an Error Occurs, the following events may occur:

(1) Motor stops.

(2) The Error LED (ERROR) ⑲ will light.

(3) The Error Code in Table. 8 will displayed on Digital Speed Indicator ⑪ .

(4) An Error signal is output to the " Error (PIN No. 8 : ERR) " of Input / Output Connector A ③ .

* Setting parameter  , will Change the Error Output Mode of the Error Signal. (Refer to " 18 - 4 ①  Setting of Error Output Mode " section.)

17 - 3 Resetting System after Error Codes

There are 2 methods of releasing Error Code.

(1) When the control is in MANUAL Mode:

Push the Error Reset Button (RESET) ⑱ on the Control Panel ② .

(2) When the control is in AUTO Mode :

Toggle the signal on " Error Release (Pin No. 4 : RESET) " of Input / Output Connector A ③ ' OFF (Open) ' → ' ON (Closed) ' → ' OFF (Open) ' .

* When releasing Error using the " Rotate Command (Pin No. 14 : START) " is ' ON (Closed) ' , ' OFF (Open) ' Motor Start / Stop before resuming operation.

Table. 8

Error Code	Problem Area	Trouble
E1	Excess Current	Motor Current beyond safe limits.
E2	Over Voltage	Motor Voltage beyond safe limits.
E3	Motor Sensor Malfunction	The sensor signal has malfunctioned or Motor Cord Connector is not connected.
E4	CONTROLLER overheat	CONTROLLER overheat.
E5	Break Circuit Trouble	Trouble with the Brake Circuit.
E6	Rotor Lock	Motor Stalled for more than 3 seconds.
E7	Low Air Pressure	Inadequate air is supplied for more than 4 seconds during rotation or inadequate air pressure is supplied when a motor start commanded.
E8	Torque Over Load	Torque limits are exceeded for too long a period of time. (Refer to " 17 - 4 Torque Over Load ".)
E9	Communication Interception	Intercept communication with SELECTOR. (Only if using CONTROLLER connect to SELECTOR.)
EA	External Control Signal Error	• When Control Mode is in AUTO, the Control Command Signal is ' ON (Closed) ' before Main Power Switch ⑨ is turned ON. • When Control Mode is AUTO, the ERROR command is released without stopping the Control Command Signal ' OFF (Open) ' .
EL	Incompatible Motor	An unrecognizable motor is connected to the CONTROLLER.
EH	Over Speed	Rotating Speed is beyond the motors capability.
EE	Emergency Stop Error	Activated when Emergency Stop Signal is ' OFF (Open) ' , or when rotating, Emergency Stop occurred by Emergency Stop Signal ' OFF (Open) ' .
EC	Internal Memory Error	Internal Memory Problem (EEPROM).

CAUTION

- If when using the Input / Output Connector A ③ / B ④ and External Monitoring, please check and resolve source of the problem whenever an Error Code is displayed on the Digital Speed Indicator ⑪.
- When an error occurs due to internal damage of the CONTROLLER, the Error Signal can not be reset.
Please send the Motor spindle and CONTROLLER to a NAKANISHI dealer for repair.

17 - 4 Torque Over Load

CAUTION

If you constantly operate the system in an overload condition, even for short periods of time, the CONTROLLER will overheat and damage to the CONTROLLER, motor and spindle are possible. NAKANISHI recommends only continuous duty operation (LOAD LED's with 3 LED's lit) : Torque Load Monitor (LOAD) Voltage should be less than 5V.

When the Load Monitor LED (LOAD) ⑫ lights 4 or more LED's (3 Green LED's and 1 of more yellow LED's) an over-load condition exists. During a motor overload period, the following will occur :

- (1) Warning LED (WARNING) ⑳ will blink.
- (2) Warning Code " A3 " is displayed on the Digital Speed Indicator ⑪ .
- (3) Pin No. 20 (WARNING) of the External Input / Output Connector A ③ is ' ON (Closed) '.

Overload operation is considered a short-term operation mode. The allowable operation time depends on the number of lighted LED's on the Load Monitor LED (LOAD) ⑫.

The allowable time is detailed below.

- (1) Load Monitor LED (LOAD) ⑫ 4 LED's (Green LED 3, Yellow LED 1) : 30 Seconds
- (2) Load Monitor LED (LOAD) ⑫ 5 LED's (Green LED 3, Yellow LED 2) : 10 Seconds
- (3) Load Monitor LED (LOAD) ⑫ 6 LED's (Green LED 3, Yellow LED 2, Red LED 1) : 5 Seconds

When the allowable time is exceeded the motor will stop and the following occurs :

- (1) Error LED (ERROR) ⑲ lights.
- (2) Error Code " E8 " is displayed on the Digital Speed Indicator ⑪ .
- (3) Pin No. 8 (ERR) of the External Input / Output Connector A ③ is ' ON (Closed) '.

* Set the parameter  can be Change the Error Output Mode of the Error Signal for an Open or Closed state. (Refer to " 18 - 4 ①  Setting of Error Output Mode " section.)

18. SETTING OF OPERATING PARAMETERS

18 - 1 Entering Parameter Setting Mode

CAUTION

When in the parameter mode, normal operation of starting, stopping, etc. operation is not possible.

When changing from the parameter mode to normal operation, be sure to toggle the Main Power Switch ⑨ OFF and ON again.

1. Make sure that the Main Power Switch ⑨ is turned OFF.
2. While push and holding the Error Reset Button (RESET) ⑱ while turning the Main Power Switch ⑨ ON at the front of the CONTROLLER.
3. Hold the Error Reset Button (RESET) ⑱ down for 3 seconds while the CONTROL is powering up.  is Displayed.
4. The buzzer will ' BEEP ' 3 times, then release the Error Reset Button (RESET) ⑱ and Parameter Setting Mode will start.  is Displayed.

18 - 2 Parameter Types

Parameter types, contents, and default are detail in Table. 9.

When checking a parameter or changing a setting, refer to " 18 - 4 Setting procedures " section.

Table. 9

Code	Types	Contents	Default
	Setting of Error Output Mode	Changes the Error Output Signal, when an error occurs from normally open to normally closed.	
	Error (warning) code signal output	The error (warning) code can be output as a patterned signal.	
	Setting AUTO Mode for Motor Speed Control	When the control is in AUTO mode, the speed control is adjustable from the Control Panel ② of the CONTROLLER or the SELECTOR, set the parameter to on to adjust the speed in AUTO Mode.	
	Setting Fixed Motor Speed	When Fixed Motor Speed is desired, set the parameter to  and set the desired locked in speed. (When CONTROLLER and SELECTOR are connected, 4 motors are set to the same motor rotation speed.)	
	Setting Maximum Motor Speed	When Maximum Motor Speed is desired, set the parameter to  and set the maximum speed. (When CONTROLLER and SELECTOR are connected, 4 motors are set to the same maximum motor rotation speed.)	
	Selection of External Speed Control Mode	The following Rotation Speed options can be selected when control mode is AUTO.  : Analog Signal  : Pulse Signal  : Speed Point Signal	
	Selection of External Motor Start Signal Control Mode	When control mode is in AUTO, please set the parameter to  and set the desired rotating direction of the motor. Activate Pin 2 to set a reverse direction along with the start command.	
	Selection of Air Input Monitoring Override	If want to start the motor without supplying cooling air, please set the parameter to  . (When set this parameter, motor speed will be limited to 30,000min ⁻¹ (rpm).)	
	Selection of Motor Speed Control Voltage / DC+10V Signal Method	When using the Motor Speed Control Voltage Signal and using a 80,000min ⁻¹ (rpm) motor, in AUTO Control Mode, please set the parameter to  .	
	Selection of Emergency Stop Function	When using the Emergency Stop Selection Mode, please set the parameter to  .	
	Error History	Error code history of the last 5 error events can be confirmed. (No parameter setting is necessary.)	
	Confirmation of Parameter Setting	Contents of the parameters that are set can be confirmed. ( -  .) No parameter setting is necessary.)	

⚠ CAUTION

The operating parameters can be preset depending on the application requirements.
 The operating parameter presets (" Setting of Error Output Mode ", " Setting AUTO mode for Motor Speed Control ", " Setting Fixed Motor Speed ", " Setting Maximum Motor Speed ", " Selection of External Speed Control Mode ", " Selection of External Motor Start Signal Control Mode ", " Selection of Air Input Monitoring Override ", " Selection of Motor Speed Control Voltage / DC+10V Signal Method ", " Selection of Emergency Stop Function " and, " Error History ") are retained in non-volatile memory and will be maintained even if power is disconnected.
Please operate only after confirming contents of parameter settings.

The following parameters can be set.

- ① **P1** Error output logic settings or error / warning code signal output selection
- External input and output connector A ③ (terminal No.8: ERR) to select the output of the error signal.
 - To select the output logic of the error signal when an error occurs, select **oF** or **oN**.
 - Select **cd** to output a patterned error / warning code signal of the error / warning signal when an error / warning occurs.

Table. 10

Parameter P1	Set Contents
oF	Error Occurred : Signal is ' OFF (Open) '.
oN	Error Occurred : Signal is ' ON (Closed) '.
cd	Error / warning code signal output due to error / warning occurrence

cd If an error / warning occurs during selection, a signal with the error / warning code patterned as shown below is output.

When an error occurs, an error signal is output to the external Input / Output Connector A ③ (terminal No. 8: ERR). (Refer to Fig. 43.)

When a warning occurs, a warning signal is output to the external Input / Output Connector A ③ (terminal No. 20: WARNING). (Refer to Fig. 44.)

The signal when no error / warning has occurred is OFF (open).

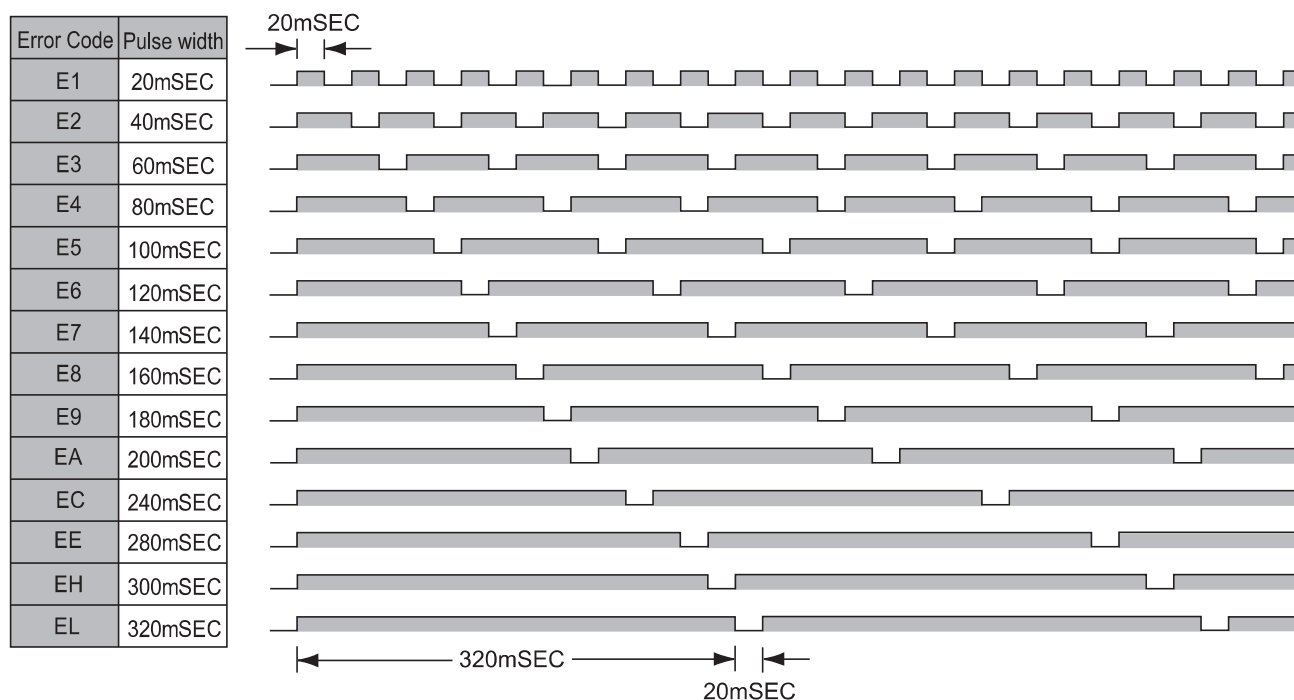


Fig. 43

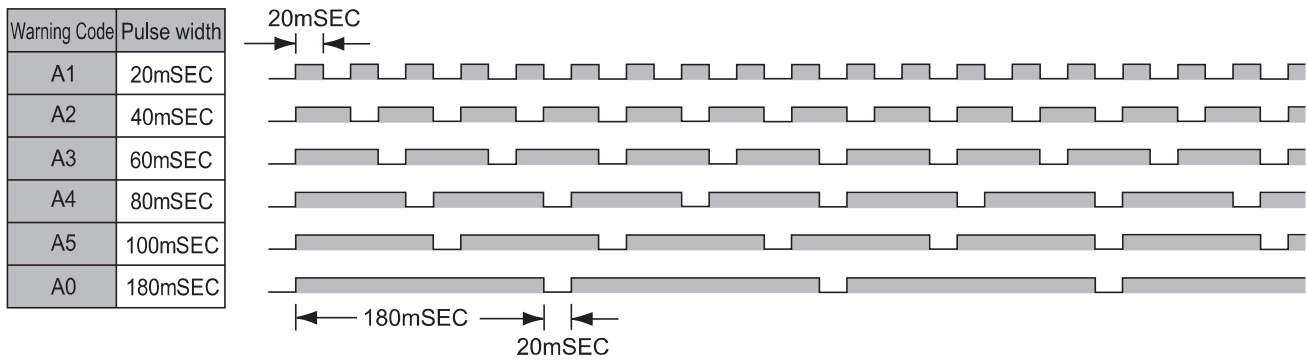


Fig. 44

② **P2** Setting AUTO Mode for Motor Speed Control

- Allows the setting of the manner in which Motor speed can be controlled when the system is being used in the Controls' AUTO MODE (External Command Signal Control).
- This parameter selects between speed control with the Motor Speed Adjustment Button (SPEED ,) ⑬ of the Control Panel ② or by External Command Signal through Input / Output Connector A ③.

Table. 11

Parameter P2	Set Contents
	Set the Motor Rotation Speed by External Command Signal through External Input / Output Connector A ③ .
	Set the Motor Rotation Speed by Motor Speed Adjustment Button (SPEED ,) ⑬ via the Control Panel ② .

③ **P3** Setting Fixed Motor Speed

CAUTION

If you set the rotation speed higher than the rotation speed set at **P4** , rotation speed will be set according to **P4** .

- Allows the Motor speed to be fixed.
- Proactively prevents inadvertent change in speed.
- The Fixed Motor Speed can set by Control Mode MANUAL or AUTO.

Table. 12

Parameter P3	Set Contents
	Fixed Motor Speed is enabled.
	Fixed Motor Speed is not enabled.

④ P4 Setting Maximum Motor Speed

- Maximum Motor Speed can be set.
- Allows a safe maximum rotational speed limit depending on the application.
- The Maximum Motor Speed can set by Control Mode MANUAL or AUTO.

Table. 13

Parameter P4	Set Contents
of	Setting of Maximum Motor Speed is enabled.
on	Setting of Maximum Motor Speed is not enabled.

⑤ P5 Selection of External Speed Control Mode

- When Control Mode is in AUTO, it is possible select the External Speed Control Mode from Analog Signal **AN**, Pulse Signal **EN**, or Speed Point Signal Parameter **PO**. Speed preset in the control according to U1 - U4.

Table. 14

Parameter P5	Set Contents
AN	Set speed by Analog Signal.
EN	Set speed by Pulse Signal.
PO	Set speed by Speed Point Signal.

- When setting by Analog Signal **AN**, use the External Input / Output Signal " Motor Speed Control Voltage (Pin No. 23 : VR) ".
- When setting via the Pulse Signal **EN**, use the External Input / Output Signal " Count Pulse Signal for Setting Motor Speed (Pin No. 3 : CNT_IN) " and External Input / Output Signal " UP / DOWN Signal for Setting Motor Speed (Pin No.15 : UD_IN) ". The motor speed change per pulse is 1000min⁻¹ (rpm).
External Input / Output Signal " UP / DOWN Signal for Setting Motor Speed (Pin No. 15 : UD_IN) " is as follows :
OFF (Open) : Rotation speed decreases
ON (Closed) : Rotation speed increases
- When setting by Speed Point Signal **PO**, select the Speed Point (U1 - U4) by using the combination of " Speed Point Select 0 (Pin No.17 : SEL0) " and " Speed Point Select 1 (Pin No. 5 : SEL1) ".

Table. 15

Speed Point	SEL1 (Pin No. 5)	SEL0 (Pin No. 17)
U1	OFF (Open)	OFF (Open)
U2	OFF (Open)	ON (Closed)
U3	ON (Closed)	OFF (Open)
U4	ON (Closed)	ON (Closed)

- Can setting the different rotation speed in 4 Speed (U1 - U4).
Speed ranges from 1,000 - 80,000min⁻¹ (rpm) can be set.

⑥ **P6** Selection of External Motor Start Signal Control Mode

- When in Auto Control Mode, the Motor Start Signal can be used for either forward or reverse direction by commanding a Direction Signal and a Start Signal. When set, the rotation direction is controlled by " Rotating Direction Setting (Pin No.2 : DIR_IN) ", ' OFF (Open) ' : FWD, ' ON (Closed) ' : REV and the Start Signal is controlled by " Rotate Command (Pin No.14 : START) ".
- When **P6** is set to **0n** FWD. rotation is controlled by " Rotate Command (Pin No.14 : START) " and REV. rotation is controlled by " Rotating Direction Setting (Pin No.2 : DIR_IN) ".

Table. 16

Parameter P6	Set Contents
0f	Motor startup and rotating direction is not commanded by signal.
0n	The startup motor with FWD. rotation or the startup motor with REV. rotation.

⑦ **P7** Selection of Air Input Monitoring Override

⚠ CAUTION

- When using without supplying cooling air as recommended, do not spray coolant directly on the spindle body.
- Motor start is possible without supplying cooling air, however maximum motor speed is limit to 30,000min⁻¹ (rpm).

Table. 17

Parameter P7	Set Contents
0f	Air pressure is supplied.
0n	Air pressure is not supplied.

⑧ **P8** Selection of Motor Speed Control Voltage / DC+10V Signal Method

- Select the Motor Speed Control Voltage Signal and characteristics of the rotational speed according to the motor.

⚠ CAUTION

When using the Motor Speed Control Voltage Signal and the maximum motor speed is 80,000min⁻¹ (rpm), it is necessary to set parameter **P8** to **0n** when Control Mode is AUTO.

- If parameter **P8** is set to **0f**, the motor characteristics will be set to the motors maximum rotation speed (60,000min⁻¹ (rpm)) .
- If parameter **P8** is set to **0n**, the characteristics will be set to the motors maximum rotation speed (80,000min⁻¹ (rpm)) .
- The Fig. 45 are Characteristics of the VR and rotation speed by parameter **P8** set to **0f**. The Fig. 46 are Characteristics of the VR and rotation speed by parameter **P8** set to **0n**.

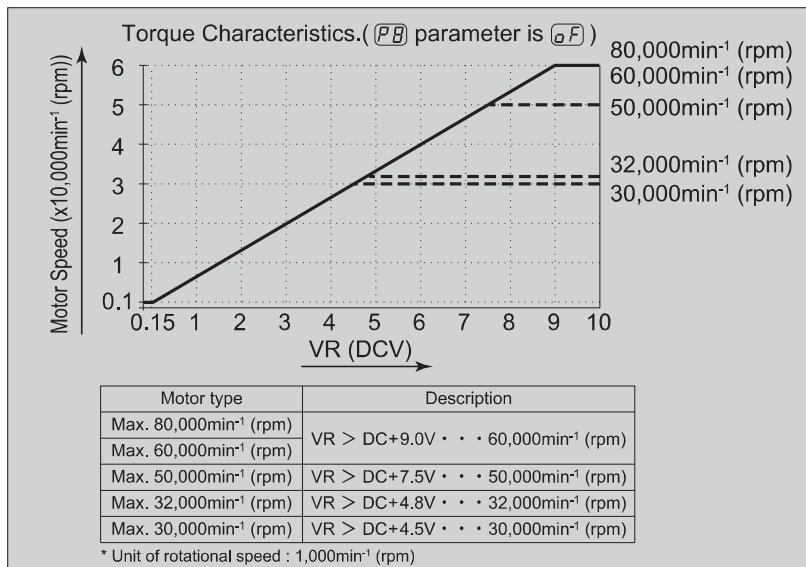


Fig. 45

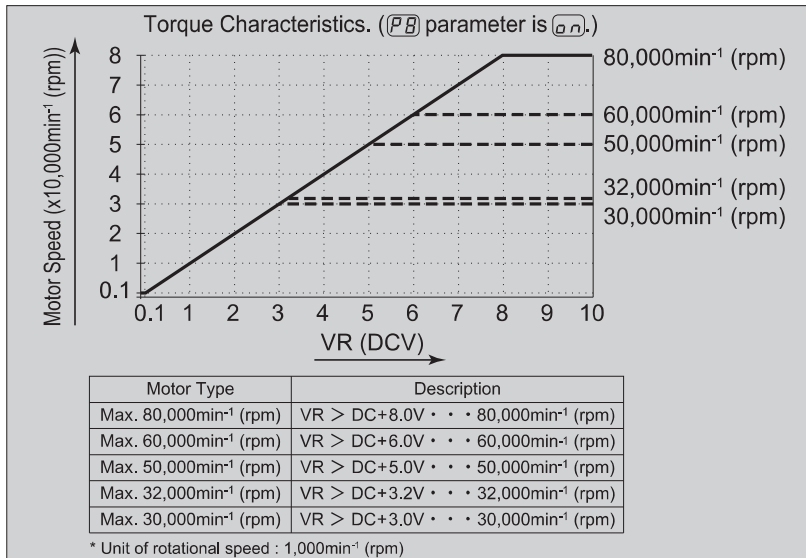


Fig. 46

Table. 18

Parameter $\overline{PB}$	Set Contents
$\overline{of}$	The characteristics of the motors maximum rotation speed 60,000min ⁻¹ (rpm).
$\overline{on}$	The characteristics of the motors maximum rotation speed 80,000min ⁻¹ (rpm).

⑨ **P9** Selection of Emergency Stop Function

- The Emergency Stop Function can be enabled or disabled.
- When " Emergency Stop A (Pin No.1 : EMG - INA) " and " Emergency Stop B (Pin No.9 : EMG - INB) " of the External Input / Output Connector B ④'s input signal are set to ' OFF (Open) ', Safety Relay will activate and block the Motor Power Line and make an emergency stop.
Normally, " Emergency Stop A (Pin No.1 : EMG - INA) " and " Emergency Stop B (Pin No.9 : EMG - INB) " input signal need to be set to ' ON (Closed) '.
- Allows the establishment of a safe machine operating system.

Table. 19

Parameter P9	Set Contents
o f	Emergency Stop Function is deactivated.
o n	Emergency Stop Function is activated.

⑩ **PR** Error History

- The Error History, which records previous error codes can be confirmed by the Error Code displayed on the digital Speed Indicator ⑪.
- Records Error Codes for viewing when machines are being run unattended.
- In case there is no Error History, **- -** will be displayed on the Digital Speed Indicator ⑪.
- The last Error Code recorded will be **H1** and the oldest will be **H5** The Error code is displayed on the Digital Speed Indicator ⑪.
- The Error History cannot be erased or deleted.
- If Error History contains more than five errors, oldest Error History, H5 will be deleted.

⑪ **Pb** Confirmation of Parameter Setting

- This mode allows the user to check the settings of parameters **P1** - **P9**. The parameter **PR** can not be checked.

18 - 4 Error output logic, error / warning code signal output selection

① **P1** Error output logic, error / warning code signal output selection

CAUTION

If the Error Output Mode has been changed from the default setting, that setting will be displayed the next time you enter Parameter Setting Mode.

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2. **o f** is displayed. This indicates that when an error occurs, the output will be ' OFF (Open) '.
3. Push the Motor Speed Adjustment Button (SPEED **▲**, **▼**) ⑬.
4. **o n** is displayed. This indicates that when an error occurs, the output will be ' ON (Closed) '.
5. Push the Motor Speed Adjustment Button (SPEED **▲**, **▼**) ⑬.
6. **c d** is displayed. with this setting, when an error or warning occurs, the error code or warning code is output as a patterned signal.
7. You can cycle through the choices by pushing the Motor Speed Adjustment Button (SPEED **▲**, **▼**) ⑬.
8. Push the Error Reset Button (RESET) ⑮. When set, **P1** will be displayed.
9. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED **▲**, **▼**) ⑬ to select the parameter that needs to be set.
10. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮ then turn the Main Power Switch ⑨ is OFF.

② Setting AUTO Mode for Motor Speed Control

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that speed control by the Motor Speed Adjustment Button (SPEED , ) ⑬ is disabled. (The External Command Signal Control will be operational.)
3. Push the START / STOP Button (START / STOP) ⑭.
4.  is displayed. This indicates that speed control is changeable by the Motor Speed Adjustment Button (SPEED , ) ⑬.
When connecting the CONTROLLER to the SELECTOR, use the SELECTOR for Motor Speed Adjustment Button (SPEED , ) ⑬.
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP) ⑭.
6. Push the Error Reset Button (RESET) ⑱ to send the settings to memory,  will be displayed.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑱, then turn the Main Power Switch ⑨ is OFF.

③ Setting Fixed Motor Speed

CAUTION

Actual motor rotation speed of the motor will be limited, based on maximum motor rotation speed and the type of motor connected.

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that Fixed Motor Rotation Speed can not be set.
3. Push the START / STOP Button (START / STOP) ⑭.
4. The setting motor rotation speed displayed on Digital Speed Indicator ⑪.
5. Push the Motor Speed Adjustment Button (SPEED , ) ⑬ to set the motor rotation speed.
The Motor Rotation Speed range is 1,000 - 80,000min⁻¹ (rpm).
6. Push the Error Reset Button (RESET) ⑱ to send the settings to memory,  will be displayed.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑱, then turn the Main Power Switch ⑨ is OFF.

④ Setting Maximum Motor Speed

CAUTION

Actual motor rotation speed of the motor will be limited, based on maximum motor rotation speed and the type of motor connected.

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that Maximum Motor Rotation Speed can not be set.
The Maximum Motor Rotation Speed is 80,000min⁻¹ (rpm).
3. Push the START / STOP Button (START / STOP) ⑭.
4. The Maximum Motor Rotation Speed is displayed on Digital Speed Indicator ⑪.
5. Push the Motor Speed Adjustment Button (SPEED , ) ⑬ to set the motor rotation speed.
The Motor Rotation Speed range is 1,000 - 80,000min⁻¹ (rpm).
6. Push the Error Reset Button (RESET) ⑱ to send the settings to memory,  will be displayed.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑱, then turn the Main Power Switch ⑨ is OFF.

⑤ Selection of External Speed Control Mode

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that motor rotation speed by Motor Speed Control Voltage is possible.
Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
3. Push the Motor Speed Adjustment Button (SPEED , ) ⑬.  displayed on Digital Speed Indicator ⑪. When this is indicated, it is possible to set the motor rotation speed by Pulse Signal.
Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
4. Push the Motor Speed Adjustment Button (SPEED , ) ⑬.  will be displayed on Digital Speed Indicator ⑪.
This indicates  to  the 4 Speed points can be set. Push the START / STOP Button (START / STOP) ⑭.
 - 4-1. Alternately displayed are  and setting speed. The Speed Point  can be set.
Push the Motor Speed Adjustment Button (SPEED , ) ⑬ to set the motor rotation speed.
Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
If you are continuously setting these parameters, push the START / STOP Button (START / STOP) ⑭.
 - 4-2. Alternately displayed are  and setting speed. The Speed Point  can be set.
Push the Motor Speed Adjustment Button (SPEED , ) ⑬ to set the motor rotation speed.
Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
If you are continuously setting these parameters, push the START / STOP Button (START / STOP) ⑭.
 - 4-3. Alternately displayed are  and the setting speed. The Speed Point  can be set.
Push the Motor Speed Adjustment Button (SPEED , ) ⑬ set the motor rotation speed.
Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
If you are continuously setting these parameters, push the START / STOP Button (START / STOP) ⑭.
 - 4-4. Alternately displayed are  and the setting speed. The Speed Point  can be set.
Push the Motor Speed Adjustment Button (SPEED , ) ⑬ set the motor rotation speed.
Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
If you are continuously setting these parameters, push the START / STOP Button (START / STOP) ⑭.
5. Push the Error Reset Button (RESET) ⑮ while displayed on  to store settings.
6. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
7. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮, then turn the Main Power Switch ⑨ is OFF.

⑥ Selection of External Motor Start Signal Control Mode

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that motor startup and setting the rotation direction can not performed simultaneously.
3. Push the START / STOP Button (START / STOP) ⑭.
4.  is displayed. This setting is right hand rotation with motor startup by " Rotation Command (Pin No. 14 : START) " or left hand rotation with motor startup by " Rotating Direction Setting (Pin No. 2 : DIR_IN) " can be set.
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP) ⑭.
6. Push the Error Reset Button (RESET) ⑮ while displayed on  to store settings.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮, then turn the Main Power Switch ⑨ is OFF.

⑦ Selection of Air input Monitoring Override

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that supplying cooling air into the motor spindle and motor speed will perform normally at start-up.
3. Push the START / STOP Button (START / STOP) ⑭.
4.  is displayed. This indicates that without supplying cooling air, motor startup is possible with limited speed.
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP) ⑭.
6. Push the Error Reset Button (RESET) ⑮ while displayed on  to store the setting.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮, then turn the Main Power Switch ⑨ is OFF.

⑧ Selection of Motor Speed Control Voltage / DC+10V Signal Method

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2.  is displayed. This indicates that the motor characteristics will be maximum motor rotation speed (60,000min⁻¹ (rpm)).
3. Push the START / STOP Button (START / STOP) ⑭.
4.  is displayed. This indicates that the motor characteristics will be maximum motor rotation speed (80,000min⁻¹ (rpm)).
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP) ⑭.
6. Push the Error Reset Button (RESET) ⑮ to send the settings to memory,  will be displayed.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED , ) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮ and turn the Main Power Switch ⑨ is OFF.

⑨ **P9** Selection of Emergency Stop Function

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2. **oF** is displayed. This indicates that Emergency Stop Function can not be used.
3. Push the START / STOP Button (START / STOP) ⑭.
4. **on** is displayed. This indicates that Emergency Stop Function is active.
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP) ⑭.
6. Push the Error Reset Button (RESET) ⑮ to send the settings to memory, **P9** will be displayed.
7. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬ to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮, then turn the Main Power Switch ⑨ is OFF.

⑩ **PR** Error History

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2. Alternately displayed are Error History **H1** and the Error Code.
3. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
4. Alternately displayed are Error History **H2** and the Error Code.
5. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
6. Alternately displayed are Error History **H3** and the Error Code.
7. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
8. Alternately displayed are Error History **H4** and the Error Code.
9. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
10. Alternately displayed are Error History **H5** and the Error Code.
11. You can cycle through the choices by pushing the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
12. To clear the error history, press and hold the START / STOP Button (START / STOP) ⑭ for 3 seconds while the error history is displayed. The buzzer beeps and the error history is cleared.
13. Push the Error Reset Button (RESET) ⑮ while **PR** is displayed.
14. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬ to select the parameter that needs to be set.
15. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮, then turn the Main Power Switch ⑨ is OFF.

⑪ **Pb** Confirmation of Parameter Setting

Procedure

1. Push the START / STOP Button (START / STOP) ⑭.
2. The setting contents of the **P1** (**oF** or **on**) and **P1** are displayed.
3. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
4. The setting contents of the **P2** (**oF** or **on**) and **P2** are displayed.
5. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
6. The setting contents of the **P3** (**oF** or **on**) and **P3** are displayed.
When motor rotation speed is 30,000min⁻¹ (rpm), **30** is displayed.
7. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
8. The setting contents of the **P4** (**oF** or **on**) and **P4** are displayed.
9. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
10. The setting contents of the **P5** (**Rn**, **en** or **Pa**) and **P5** are displayed.
11. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
12. The setting contents of the **P6** (**oF** or **on**) and **P6** are displayed.
13. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
14. The setting contents of the **P7** (**oF** or **on**) and **P7** are displayed.
15. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.
16. The setting contents of the **P8** (**oF** or **on**) and **P8** are displayed.
17. Push the Motor Speed Adjustment Button (SPEED ▲, ▼) ⑬.

18. The setting contents of the **P9** (**off** or **on**) and **P9** are displayed.
19. You can cycle through the choices by pushing the START / STOP Button (START / STOP) ⑭.
20. Push the Error Reset Button (RESET) ⑮ and **Pb** will be displayed.
21. If you desire to set other parameters, push the Motor Speed Adjustment Button (SPEED ⬆, ⬇) ⑬ to select the parameter that needs to be set.
22. When you are finished setting parameters, press the Error Reset Button (RESET) ⑮, then turn the Main Power Switch ⑨ is OFF.

19. BREAK IN PROCEDURE

During transportation, storage or installation the grease inside the bearings will settle. If the spindle is suddenly run at high-speed, the lack of evenly distributed grease will cause excessive heat leading to bearing damage.

After installation, repair, initial operation, or long periods of non operation please follow the break-in procedure.

Please refer to the " BREAK IN PROCEDURE " in Operation Manual of the Motor / Spindle.

20. TROUBLESHOOTING

If a problem or concern occurs, please check the following prior to consulting your dealer.

Trouble	Cause	Inspection / Corrective Active
Motor does not run.	Power is not supplied.	• Make sure to turn ON the Main Power Switch ⑨ on the front of the CONTROLLER. • Insert the power cord Plug correctly into the Main Power Inlet with Power Supply Fuses ⑩ of the CONTROLLER. • Check if a fuse is blown.
	Motor Cord Plug is not connected to the Motor, CONTROLLER or SELECTOR.	Connect the Motor Cord plug correctly to the Motor and CONTROLLER or SELECTOR.
	Incompatible motor or motor spindle is connected to the CONTROLLER. (The Error Code " EL " is displayed on the Digital Speed Indicator ⑪.)	Connect the connectable brushless motor or brushless motor spindle to the CONTROLLER after released the Error Code " EL " (Refer to " 7. SYSTEM CHART Fig. 3, 4 and 5 " section).
	Control Button (CTRL) ⑮ is set to Manual mode but trying to start with an External Command Signal through External Input / Output Connector A ③.	Start with the START / STOP Button (START / STOP) ⑭, or set the Control Button (CTRL) ⑮ on the Control Panel ② to Auto mode.
	Control Button (CTRL) ⑮ is set to Auto mode but trying to manually start with the START / STOP Button (START / STOP) ⑭ on the Control Panel ②.	Start with an External Command Signal or set the Control Button ⑮ on the Control Panel ② to Manual mode. (When Start with an External Command Signal, refer to " 16 - 1 (1) Details of External Input / Output Connector A ③ Signal Table. 5 Pin No. 14 ")
When started the motor, " E.E " is displayed and motor does not rotate.	Emergency Stop Signal is ' OFF (Open) '.	Check the setting of parameter P9 . (Refer to " 18 - 4 ⑨ P9 Selection of Emergency Stop Function " section.)

Trouble	Cause	Inspection / Corrective Active
When starting the motor, " E7 " is displayed and motor does not rotate.	Low air pressure.	Adjust to the air pressure 0.25 - 0.3MPa (36.3 - 43.5psi).
An Error Code occurs and motor does not run.	An Error has occurred. (Error LED (ERROR) ⑨ is lit.)	Check " 17 - 3 Resetting System after Error Codes. Refer to Table 8 ". Error will not be released until cause of the error has been removed.
Can not set the increase or decrease of the motor rotation speed.	Motor Fixed Speed is set in the P3 parameter.	Release parameter P3 . (Refer to " 18 - 4 ③ P3 Setting Fixed Motor Speed " section.)
Can not set the motor speed to its maximum allowable speed.	Either the required speed value is higher than the maximum rotation speed of the motor, or the upper limit of the rotational speed has been set in parameter P4 .	Set the Maximum Rotation Speed to a value less than the Motor Rotation Speed set in Parameter P4 . (Refer to " 18 - 4 ④ P4 Setting Maximum Motor Speed " section.)
	Parameter P8 is 0 F .	Check the setting of parameter P8 . (Refer to " 18 - 3 ⑧ P8 Selection of Motor Speed Control Voltage / DC+10V Signal Method " section.) (Refer to " 18 - 4 ⑧ P8 Selection of Motor Speed Control Voltage / DC+10V Signal Method " section.)
	Air Input Monitoring Override is set in the P7 parameter to ON and the motor's maximum speed has been limited to 30,000 min ⁻¹ (rpm).	Check the setting of parameter P7 . (Refer to " 18 - 4 ⑦ P7 Selection of Air Input Monitoring Override " section.)
A blinking dot appears on Digital Speed Indicator ⑪. Cannot set the desired rotation speed.	Gear Ratio is set to a value other than " 1.0 ".	Check the setting of Gear Ratio. (Refer to " 15 - 2 - 1 (3) Setting Gear Ratio " section.)
Spindle does not rotate or rotate smoothly.	The spindles bearings have been damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The motor has been damaged.	Replace the motor. (Return to NAKANISHI dealer service.)
Overheating during rotation.	Cutting debris has contaminated the ball bearings, and the ball bearings are damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
Abnormal vibration or noise during rotation.	The tool shank is bent.	Replace the cutting tool.
	Cutting debris has contaminated the ball bearings.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The spindle ball bearings have been damaged.	

Trouble	Cause	Inspection / Corrective Active
Tool slippage.	Collet or collet nut are not correctly installed.	Check and clean the collet and collet nut. Reinstall the collet and collet nut.
	The collet and the collet nut are worn.	Replace the collet and collet nut.
High run-out.	The cutting tool is bent.	Change the cutting tool.
	Collet nut is not correctly installed.	Secure the collet and the collet nut correctly.
	The collet and the collet nut are worn.	Replace the collet and the collet nut.
	Inside of the spindle is worn.	Replace the spindle shaft. (Return to NAKANISHI dealer service.)
	Contaminants inside the collet and the collet nut or the spindle.	Clean the collet, collet nut and the inside of the taper and spindle.
	The spindle ball bearings have been damaged.	Replace the ball bearings. (Return to NAKANISHI dealer service.)

21. DISPOSAL OF THE CONTROLLER

When disposal of a CONTROLLER is necessary, follow the instructions from your local government agency for proper disposal of industrial components.

取扱説明書のダウンロード ▶
Download operation manual



ウェブサイト ▶
Our website



株式会社ナカニシ

〒322-8666
栃木県鹿沼市下日向700
TEL: 0289-64-3380
FAX: 0289-62-5636
www.nakanishi-inc.com

NAKANISHI INC.

700 Shimohinata, Kanuma
Tochigi 322-8666
Japan
www.nakanishi-inc.com

NSK America Corp.

1800 Global Parkway
Hoffman Estates
IL 60192, USA
www.nskamericacorp.com

NSK Europe GmbH

Elly-Beinhorn-Strasse 8
65760 Eschborn
Germany

NSK United Kingdom Ltd.

UK Authorised Representative
Office 4, Gateway 1000
Arlington Business Park, Whittle Way
Stevenage, SG1 2FP, UK