NAKANISHI

iSpeed5 CONTROLLER

取扱説明書 / OPERATION MANUAL

日本語:P 1 – P 48 English:P 50 – P 105

OM-K0632 001

Thank you for purchasing the iSpeed 5 Ultra-Precision, High-Speed Sensorless Motor system. The iSpeed 5 system was designed for use on CNC lathes, robots, NC lathes and special purpose machines. The Sensorless Motor, Spindle and iSpeed 5 CONTROLLER are designed to work as an integrated system capable of 80,000 min $^{-1}$. This system utilizes air to cool the Sensorless Motor and protect the Spindle. Always use an Air Line Kit to ensure clean, dry, properly regulated air is supplied to the Sensorless Motor and Spindle. The iSpeed5 system is capable of being used with coolants and cutting lubricants. Please read this Operation Manual carefully before use. Also read <Blushless Motor>, <Spindle> and <Air Line Kit> Operation Manuals.
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

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.**
2. **Improper connection of the grounding conductor can risult in electric shock. The conductor with insulation having an outer surface that is green with yellow stripes is the grounding conductor. If repair or replacement of the electric cord is necessary, do not connect the gorunding conductor to a live terminal.**
3. **Check with a qualified electrician or service person if the grounding instructions are not completely understood, or if in doubt as whether the tool is properly grounded.**
4. **Repair or replace damaged or worn electrical cord immediately.**

B. OTHER WARNING INSTRUCTIONS

1. **For your own safety read instruction manual before operating this tool.**
2. **Replace cracked collet chuck or chuck nut immediately.**
3. **Do not over tighten the chuck nut.**
4. **Use only NAKANISHI manufactured collet chucks 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 ENVIRONMENT. 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. **TO REDUCE THE RISK OF UNINTENTIONAL STARTING. Make sure Main Power Switch is in OFF position before connecting the Power Cord.**
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 are classified as follows in accordance with the seriousness of the risk.

Class	Degree of Risk
DANGER	Existence of a hazard that could result in personal death or serious injury, if the safety precautions are not followed.
WARNING	「A safety hazard 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.
INFORMATION	Be sure to keep the usage for your safety.

DANGER

① Nakanishi warns all end-users not to remove the Controls Rear Cover while the Control Power is ON, or if there is power to the main power cord. Disconnect the main power from its power source before removing the Rear Cover. Not following these instructions may lead to serious injury or death due to electric shock.

② Attach the Rear Cover before use. Touching a power terminal connection by mistake may cause risk that leads to death or serious injury by electric shock.

③ Make sure the input power supply is OFF before wiring. If the incoming power supply is ON, it may cause risk that leads to death or serious injury by electric shock.

④ Be sure to connect the ground wire to the earth ground. Insufficient grounding could cause an electric shock or malfunction.

⑤ Be sure to connect the ground wire of the Power cord to the AC input power terminal block (Earth Mark). Insufficient grounding could cause an electric shock or fire and malfunction.

⑥ Be sure to connect the ground wire of the Motor Cord to the Motor Output Terminal Block. Failure to connect the ground wire of the Motor Cord to the Motor Output Terminal Blocks may cause an electric shock.

WARNING

① The CONTROLLER is not a hand tool. It is designed to be used on CNC machines or special purpose machines.

② Do not touch the cutting tool while it is running. It is very dangerous.

③ Wear safety glasses, dust mask, and use a protective cover around the spindle whenever the spindle is rotating.

④ Never operate the Control Panel, connect, disconnect or touch the Connector, Power Cord and Motor Cord Connector and 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 owner's manual for each component, 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, motor or 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, motor and 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 To protective CONTROLLER or electric wiring from a possible short circuit, place a circuit breaker (MCCB) between the power source and the AC Power Input Terminal Block of the CONTROLLER. Select the circuit breaker with a 10A current capacity.

⑧ Check to ensure that the supply voltage is the same as the CONTROLLER rated voltage.

⑨ Be sure to connect the specified Motor to the Motor Output Terminal Block. If non-specified motor is connected to the Motor Output Terminal Block, damage to the CONTROLLER and the non-specified motor are certain to occur.

⑩ When tightening the Terminal Screws of the AC Power Input Terminal Block (AC INPUT), ensure that the Terminal Screws are tightened securely (Specified tightening torque : 1.2 - 1.4N・m). If the terminal screws are loose, this may cause electric shock and damage to the CONTROLLER.
⑪ When installing a tool, tighten the collet chuck correctly and check again the collet chuck and chuck nut before use. Do not over-tighten the collet chuck. This may cause damage to the spindle.
⑫ Do not use bent, broken, chipped, out of round or sub-standard tools as they may cause shatter or explode. Tool 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.
⑬ Do not exceed the maximum recommended allowable tool speed. For your safety, use speeds below the maximum allowable speed.
⑭ Do not apply excessive force. This may cause tool slippage, tool damage, injury to the operator or loss of concentricity and precision.
⑮ When installing the motor and the spindle, make sure the Main Power Switch of the CONTROLLER turned OFF before installing.

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 0.25MPa - 0.35MPa must be supplied.
② The electric 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, motor and spindle will cause damage to the internal components.
③ 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.
④ Be sure to attach the Brackets to the CONTROLLER when there is a possibility of the CONTROLLER to fall.
⑤ Do not disassemble, modify or attempt to repair the CONTROLLER, motor or spindle as it will damage internal components. There are no user serviceable parts available.
⑥ 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, motor and spindle.
⑦ When using CONTROLLER continuously, refer to continuous area on torque Characteristics Graph and check LOAD Monitor LED for a maximum output of (3 Green Lamps).
⑧ Do not install the CONTROLLER next to RF noise sources, as malfunctions can occur.
⑨ If smoke, noise or strange odors eminate from the CONTROLLER, or motor spinsles, immediately turn OFF the Main Power Switch.
⑩ Do not place anything on top of the CONTROLLER.
⑪ When installing the CONTROLLER, never place them in areas where vibration and shock are present. This may cause a malfunction to occur.
⑫ Do not place the CONTROLLER near any source of heat. The temperature inside the CONTROLLER will rise, resulting in a CONTROL unit failure.
⑬ Be sure to attach the Rear Cover before use. Without the cover, metal chips and other particles may stick to the AC Power Input Terminal Block and Motor Output Terminal Block, causing electrical leakage and damage to the CONTROLLER.
⑭ The air drawn through the air inlet of the CONTROLLER is exhausted from the Duct Connector. When using the CONTROLLER without the provided Duct Hose, provide a space of approximately 5cm around the Dust Connector in order to not obstruct the air flow. Otherwise, the temperature inside the CONTROLLER could rise which could limit the performance of, or cause damage to the CONTROLLER.
⑮ When using the Duct hose, do not place anything near the Duct Hose.
This may cause pose an impediment of the exhaust. In that case the temperature inside the CONTROLLER will rise, this may cause malfunctions or limit availability of the CONTROLLER.
⑯ Do not Block the air inlet on the both side of the CONTROLLER. The temperature inside the CONTROLLER will rise, this may resulting in failure.
⑰ When disposal of a CONTROLLER is necessary, follow the instructions from your local government agency and dispose as an industrial waste.

⑱ **Be sure to clean the collet chuck and chuck 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 chuck, damage to the collet chuck or spindle can occur due to the loss of precision.**

⑲ **Always clean the tool shank and the machine spindle taper before installing the tool in the machine.**

⑳ **When sizing the correct collet chuck 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.**

21 **Select suitable products or tools for all applications. Do not exceed the capabilities of the motor, spindle or tools.**

22 **Carefully direct coolant spray to the tool. Do not spray directly on the motor and spindle body.**

23 **Stop working immediately when abnormal rotation or unusual vibrations are observed. If vibrations occur, please check the contents of page number P103 " 20. TROUBLESHOOTING ".**

24 **Always check if the tool, collet chuck or chuck nut are damaged before and after operating.**

25 **After installation, repair, initial operation, or long periods of non operation, please refer to Operation Manual of the spindle detailed in " BREAK-IN PROCEDURE ". When checking the spindle, no vibration or unusual sound should be observed during rotation.**

2. FEATURES

① A high-speed sensorless motor is used to achieve a maximum speed of 60,000 min^{-1} (when using EM-3060ATC and BM-325ATC) and 80,000min^{-1} (EM-3080ATC and BM-320ATC) and eliminating the need for brush replacement maintenance.

② Speed control and protection functions utilize a high performance microprocessor.

③ Automatic control and monitoring of spindle functions are possible.

④ A wide speed range from 1,000 - 80,000 min^{-1} makes high speed precision machining possible. The Digital Speed Indicator is displayed in a 3 digit format. Motor Speed can be set in 100 min^{-1} increments.

⑤ Compact CONTROLLER design allows for easy installation in space restricted machines. Connector area is rear mounted and the Control Panel functions are front mounted for easy access. Additional devices can be easily wired.

⑥ The CONTROLLER is capable of being connected to AC100V or AC240V power sources. The Auto Sensing feature reduces installation time and elminates the possibility of connecting the wrong voltage.

⑦ By setting the parameter P8, 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 CONTROLLER to establish a safe spindle system.

⑧ By setting parameter P10, 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.

⑨ The accurate rotational speed control, interfacing with external machine controls, protection functions, input/output signals and an emergency stop function allow the CONTROLLER to establish a safe spindle system with a variety of controllable features.

⑩ The control enclosure is designed to prevent debris / dust and splattered oil / water from entering it.

⑪ The Duct Hose is designed to allow exhaust air and heat from the CONTROLLER out of the Machine Cabinet. (The Hose prevents the exhaust air and heat from directly blowing onto surrounding equipment).

⑫ The CONTROLLER is equipped with a convenient carrying handle.

⑬ Equipped with a Motor Current Display Function, clamping pressure can be monitored during motor / spindle installation. **A Key Hold Function is also equipped to prevent erroneous operation by touching the control panel.**

⑭ The CONTROLLER can be operated remotely from a location away from the CONTROLLER by using the HANDY CONTROLLER (Optional).

3. SPECIFICATIONS AND DIMENSIONS

3 - 1 Specification of the CONTROLLER

Table 1

Product Name		iSpeed 5 CONTROLLER
Model		NE287
Input Voltage		AC 100 - 240V, 50 / 60Hz, 2.2A
Output		AC 33V, 0 - 1.33KHz, 3 PHASE, 3.2A
Over Voltage Category		Ⅱ
Pollution Degree		Class 2
Speed Range		1000 - 80,000min^{-1}
External Control Signal	Input Signal	Digital 10 (Photo Coupler) Analog 1
	Output Signal	MOS Relay 7 Photo Coupler 1 Relay Contact 2, Analog 3
Protection Function		Over Voltage, Trouble with the Input Power Supply, Motor Cord Disconnect, CONTROLLER Overheat, Brake Circuit Trouble, No Speed Signal, Low Air Pressure, Over Load, External Control Signal Error, Over Speed, Emergency Stop Error, Internal Memory Error
Weight		4.75kg
Dimensions		W214mm × D337mm × H93.7mm (With out Duct Connector)
Opration Environment	Temperature	0 - 40°C
	Humidity	MAX. 75% (No condensation)
	Atmospheric pressure	700 - 1,060hPa
Transportation and Storage Environment	Temperature	-10 - 50°C
	Humidity	10 - 85°%
	Atmospheric pressure	500 - 1,060hPa
Height above Sea Level		Less than 2,000m

3 - 2 Compatibility

(1) The CONTROLLER is compatible with the following overseas safety standard.
- Safety standard in North America (UL,CSA)
  UL508C CSA C22.2 No.14-05
- EC Directive CE
  Low Voltage Directive IEC / EN61800-5-1
  EMC Directive EMS：EN61000-6-2
  EMI：EN61000-6-4

（2） The iSpeed 5 CONTROLLER is *RoHS Compliant.
*RoHS : Restriction of Hazardous Substances by the European Union (EU).

3 - 3 Standard Accessories

Confirm the following Accessories are present after opening the Packing Box.

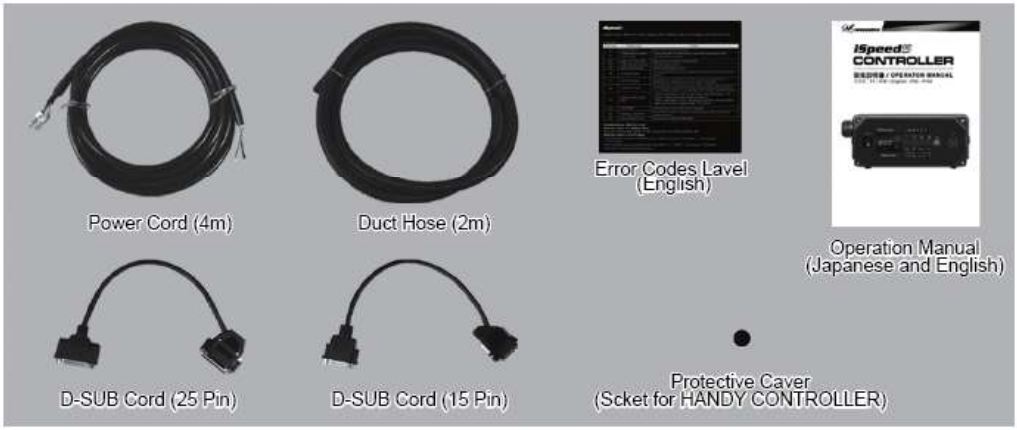

Table 2.

Standard Accessories	
・Power Cord (4m) …1pc.	・D-SUB Cord (25 Pin) ・・・1pc.
・D-SUB Cord (15 Pin) ・・・1pc.	・Duct Hose (2m)・・・1pc.
・Allen Wrench・・・1pc.	・Error Code Label・・・1set.
・Protective Cap (Socket for HANDY CONTROLLER) ・・・1pc.	・Operation Manual・・・1set.

3 - 4 Outside View of the CONTROLLER

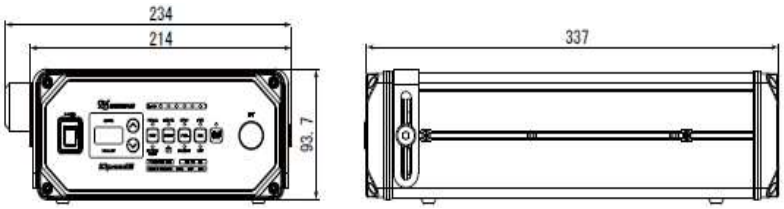

Fig. 1

4. SYSTEM CHART (Motor Speed 80,000min^{-1} and 60,000min^{-1})

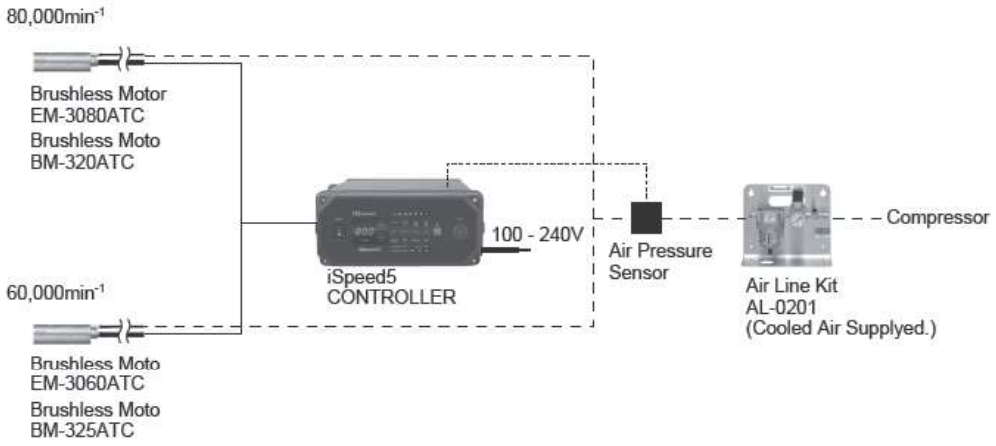

Fig. 2

5. TORQUE CHARACTERISTICS

（1）EM-3080 ATC (80,000min^{-1})

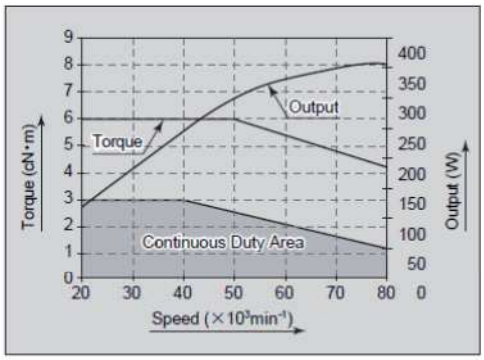

Fig. 3

（2）EM-3060 ATC (60,000min^{-1})

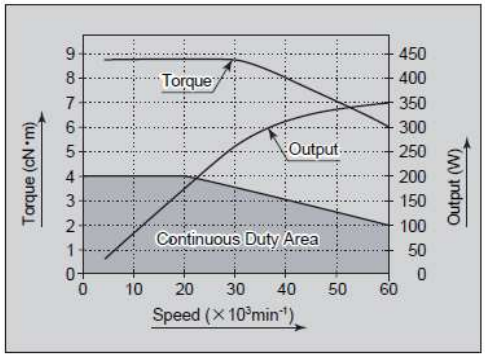

Fig. 4

（3）BM-320 ATC (80,000min^{-1})

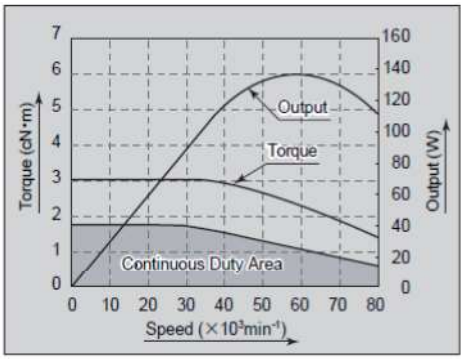

Fig. 5

（4）BM-325ATC (60,000min^{-1})

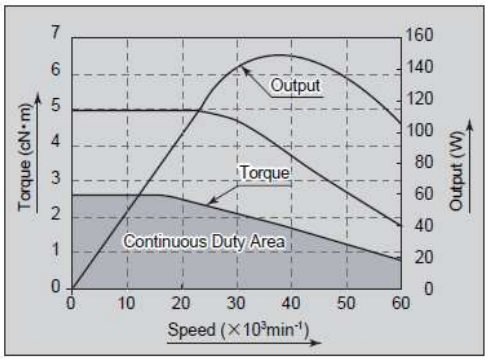

Fig. 6

6. PARTS NAME

6 - 1 Front Face Details

Fig. 7

① CONTROLLER

② Control Panel
Refer to P74 "14 - 1 Button and LED Features of the Control Panel" section.

③ Main Power Switch
ON / OFF main power source. The designation " I " Indicates ON. The designation " O " Indicates OFF.

④ Digital Speed Indicator
Preset Speed, Actual Speed, Motor Current Display, Motor Class Number, Error Codes are displayed (3 digit). When the motor spindle is stopped, the Preset Speed is displayed. When the motor spindle is rotating, the actual speed is displayed. This display also shows the Error Codes when an error has occurred.

⑤ Socket for HANDY CONTROLLER
By connecting the HANDY CONTROLLER (optional) to the Socket of the CONTROLLER, the CONTROLLER can be operated by the HANDY CONTROLLER.

CAUTION

- **When the HANDY CONTROLLER is connected to the iSpeed5 CONTROLLER, the iSpeed5 Control Panel will no longer be functional.**
- **When connecting or disconnecting the HANDY CONTROLLER from the control, make sure the Main Power Switch is turned OFF. If Main Power Switch remains ON when connecting or disconnecting the HANDY CONTROLLER, unexpected changes to the display preferences may occur.**
- **Attach the provided Protective Cover (for "Socket for HANDY CONTROLLER") into the HANDY CONTROLLER SOCKET of the CONTROLLER for safety and dust proof protection when not using the HANDY CONTROLLER.**

⑥ Handle
To use the CONTROLLERS Carrying Handle, push lightly to the rear to extend it.
Turn OFF the Main Power Switch of the CONTROLLER before connecting the Plug of the HANDY CONTROLLER to the CONTROLLER.

6 - 2 Rear Face Detailes

Fig. 8

① Duct Connector

For Duct Hose installation directions (2m : provided) Refer to P71 " 13. ATTACHING AND REMOVING OF THE DUCT HOSE ". Connecting the Duct Hose from the CONTROLLER will exhaust the CONTROLLER's heat generated when installed in the machines electrical cabinet.

CAUTION

Do not insert your finger or anything other than Duct Hose into the Duct Connector. It may cause injury to the operator, the fan or the fan motor internal to the CONTROLLER.

② Rear Cover

This cover is for the prevention of electric shock, safety and dust proofing of the connection area. Refer to P61 " 8. REMOVING AND ATTACHING THE REAR COVER " section.

DANGER

Be sure to attach the Rear Cover before use. If you come in contact with the electrical connections, serious risks that can lead to death or serious injury due to electric shock.

CAUTION

Be sure to attach the Rear Cover before use. Without the cover, metal chips and other debris may stick to the AC Power Input Terminal Block and Motor Output Terminal Block which could cause electrical leakage or damage to the CONTROLLER.

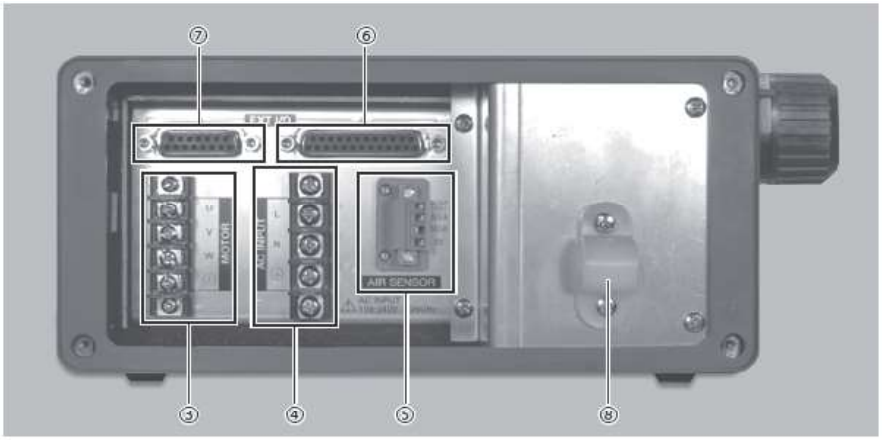

Fig. 9

③ Motor Output Terminal Block (MOTOR OUT)

The Motor Output Terminal Block connects to the Motor Cord Terminals. Refer to P64 " 10. MOTOR CORD CONNECTION " section.

④ AC Power Input Terminal Block (AC INPUT)

The AC Power Input Terminal Block (AC INPUT) connects to the Power Cord terminals. Refer to P63 " 9. POWER CORD CONNECTION " section.

⑤ Air Pressure Sensor Connector

The Air Pressure Sensor Connector connects to the external air pressure sensor output cord. Refer to P65 " 11 - 1 Connection of the Air Pressure Sensor " section.
The external air pressure sensor should be prepared by the end-user.

CAUTION

If the inlet air pressure is too low, output voltage from the air sensor voltage will sense the low pressure and the motor will not start.

⑥ External Input / Output Connector A

External Input / Output Connector A is for automatic control and monitoring of motor/spindle system. Attached the D-SUB Cord (25 Pin) to the External Input / Output Connector A. Refer to P69 " 12 - 1 Connecting to the External Input / Output Connector A and B " and P79 " 15 - 1 (1) Details of External Input / Output Connector A Signals "section.

⑦ External Input / Output Connector B

External Input / Output Connector B is for automatic monitoring of emergency conditions. Attached the D-SUB Cord（15 Pin) to the External Input / Output Connector B. Refer to P69 " 12 - 1 Connecting to the External Input / Output Connector A and B " and P86 " 15 - 2 (1) Details of External Input / Output Connector B Signals " section.

⑧ Securing Band

This band secures the power cord connected to the AC Power Input Terminal Block (AC INPUT).

7. PROPER CLEARANCE

CAUTION

When installing the CONTROLLER in the machines electrical cabinet, it is recommended that you connect the provided (2 Meter) Duct Hose to exhaust the heat generated by the CONTROLLER.
Refer to P71 " 13. ATTACHING AND REMOVING OF THE DUCT HOSE ".
Insufficient clearance will cause heat damage to the CONTROLLER and the machines electrical components.

When installing the CONTROLLER on the machine, refer to Fig. 10.

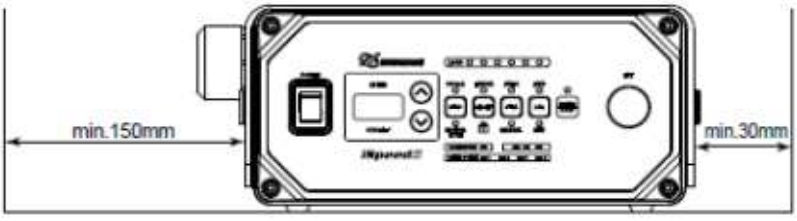

Fig. 10

8. REMOVING AND ATTACHING THE REAR COVER

DANGER

Nakanishi warns all end-users not to remove the Controls Rear Cover while the Control Power is ON, or there is power to the main power cord. Disconnect the main power from its power source before removing the Rear Cover. Not following these instructions may lead to serious injury or death due to electric shock.

The Rear Cover must be removed to connect the Power Cord, Motor Cord, D-SUB Cord and Air Pressure Sensor Cord.

8 - 1 Removing of the Rear Cover

（1） Remove the Mounting Screw (4 pcs.) of the Rear Cover using an Allen Wrench.
（2） Remove the Rear Cover.

Fig. 11

8 - 2 Attaching of the Rear Cover

WARNING

When re- attaching of the Rear Cover, ensure that the Power Cord, Motor Cord, D-SUB (25 / 15 pin) Cord, Air Pressure Sensor Cordare not protruding between the Rear Cover and edge of the end of the CONTROLLER. If a cord becomes severed, electric shock, fire and damage can occur to the CONTROLLER.

（1） Place the all cords in the provided wiring space (Fig. 12).

CAUTION

Do not overlap the D-SUB (15 pin) Cord and the D-SUB (25 pin) Connector Housings. This may cause signal interference with between the D-SUB (15 pin) Cord and the D-SUB (25 pin) Connector Housing when attaching the Rear Cover.

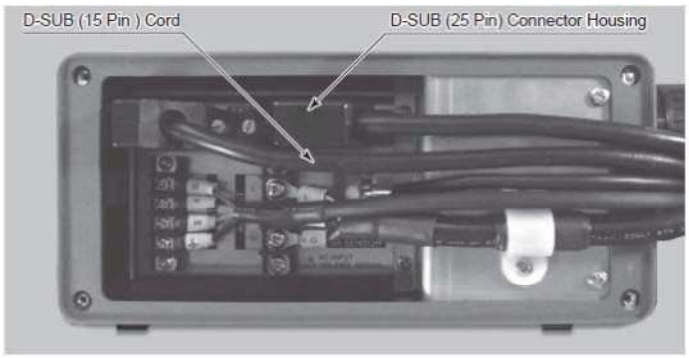

Fig 12

（2） Loosely install the Rear Cover to the Rubber Packing.
Ensure each connected cord (Power Cord, Motor Cord, D-SUB (25 / 15 pin) Cord and Air Pressure Sensor Cord) is secured neatly into the Wiring Space .
Re-install the Rear Cover using provided Screws and Allen Wrench.

CAUTION

When attaching the Rear Cover ensure the cover is tightly secured to the CONTROLLER. Any open gaps will allow oil mist, dust, cutting debris or other contaminants to infiltration to the CONTROLLER. This may eventually cause damage to the CONTROLLER.

Fig. 13

9. POWER CORD CONNECTION

DANGER

- **Nakanishi warns all end-users not to remove the CONTROLLER's Rear Cover while the Control Power is ON, or there is power to the main power cord. Disconnect the main power from its power source before removing the Rear Cover. Not following these instructions may lead to serious injury or death due to electric shock.**
- **After connecting the Power Cord, be sure to attach the Rear Cover for safety, dust proofing and electric shock prevention. If the Rear Cover is not attached to the CONTROLLER, it may lead to the risk of death or serious injury by electric shock.**

WARNING

- **Only use grounded power sources. Using a non-specified Power Cord, the risk of fire by over-heat of the cord is possible.**
- **Mis-wiring will cause damage to the CONTROLLER.**
- **Be sure to connect the ground wire to the earth ground. Insufficient grounding could cause an electric shock or malfunction.**
- **Tighten the Terminal Screw of the AC Power Input Terminal Block securely（specified tightening torque : 1.2 - 1.4 N･m). Loose Terminal Screws to the AC Power Input Terminal Block will cause over-heating leading to damage and fire in the CONTROLLER.**

（1） When removing the Rear Cover, Refer to the P61 " 8 - 1 Removing of the Rear Cover " section.

（2） The round terminal lug with marking are attached to the one side of the Power Cord.
Remove the Terminal Screw from the AC Power Input Terminal Block (AC INPUT).
Make sure to connect the round terminal to the AC Power Input Terminal Block (AC INPUT) securely. (Table 3, Fig. 14)

（3） After connecting the Terminal Screw to the AC Power Input Terminal Block (AC INPUT), be sure to tighten the Terminal Screw according to the specified tightening torque : 1.2 - 1.4 N･m.

Table 3.

Cord Collar	Mark	AC Power Input Terminal Block (INPUT)connection position.
White	L	L
Black	N	N
Green / Yellow	⏚	⏚

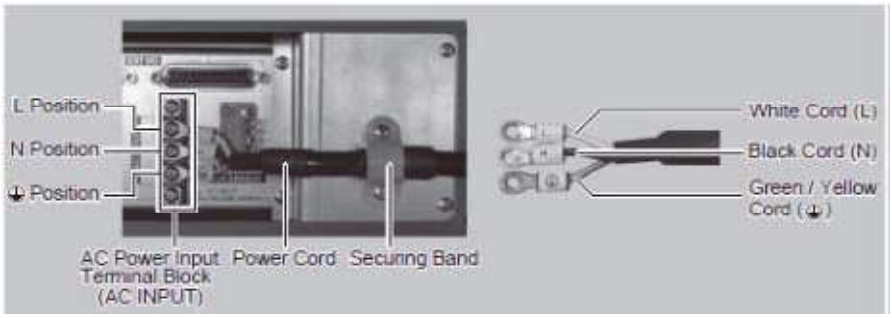

Fig. 14

（4） Secure the Power Cord using the Securing Band.

（5） Attach the Rear Cover. Refer to the P62 " 8 - 2 Attaching of the Rear Cover " section.

10. MOTOR CORD CONNECTION

DANGER

- **Nakanishi warns all end-users does not wiring of the Motor Cord while the Control Power is ON, or there is power to the main power cord. Disconnect the main power from its power source before wiring of the Motor Cord. Not following these instructions may lead to serious injury or death due to electric shock.**

- **After connecting the Motor Cord, be sure to install the Rear Cover for safety, dust proofing and prevention of electric shock.**

WARNING

- **Mis-wiring will cause damage to the CONTROLLER and the Motor.**
- **Connect only iSpeed 5 approved motors to the CONTROLLER.**
- **Use onlyhigh quality AWG-18 Motor Cord.**

CAUTION

Tighten the Terminal Screw of the Motor Output Terminal Block (MOTOR OUT) securely（specified tightening torque : 0.5 - 0.6 N･m).

（1） Remove the Rear Cover. Refer to the P61 " 8 - 1 Removing of the Rear Cover " section.

（2） Locate the round terminal and marking attached to the one side of the Motor Cord. Remove the Terminal Screw of the Motor Output Terminal Block (MOTOR OUT).
Make sure to connect the round terminal to the Motor Output Terminal Block (MOTOR OUT) (Table 4, Fig. 15).

（3） After connecting the Terminal Screw to the Motor Output Terminl Block (MOTOR OUT), be sure to tighten the Terminal Screw according to the specified torque :0.5 - 0.6 N･m.

Table 4.

Cord Collar	Mark	Motor Output Terminal Block (MOTOR OUT) connection position.
Red	U	U
White	V	V
Black	W	W
Blue	⏚	⏚

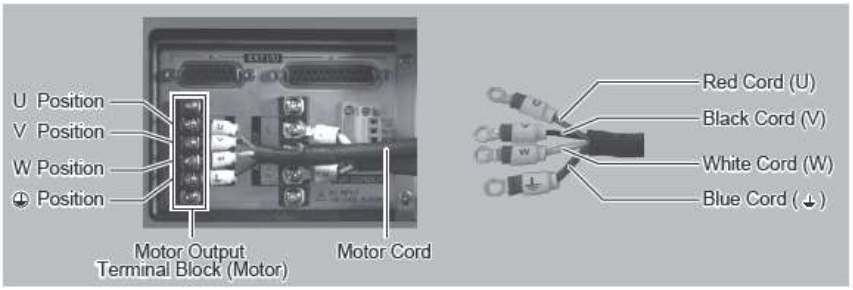

Fig. 15

（4） Attach the Rear Cover. Refer to the P62 " 8 - 2 Attaching of the Rear Cover " section.

11. CONNECTION FOR AIR PRESSURE SENSOR

11 - 1 Connection of the Air Pressure Sensor

DANGER

Nakanishi warns all end-users not to remove the Controls Rear Cover and connect the Air Pressure sensor while the Control Power is ON, or there is power to the main power cord. Disconnect the main power from its power source before removing the Rear Cover and connecting the Air Pressure Sensor. Not following these instructions may lead to serious injury or death due to electric shock.

CAUTION

- **Please use a separete Air Pressure Sensor that is capable of supplying power source voltage DC+12V and an air pressure range 0 - 1.0MPa.**
- **If the Air Pressure Detection Signal of Air Pressure Sensor is less than specified value, the motor will not rotate.**
- **In case of mounting the Air Pressure Sensor between the CONTROLLER and the Motor, be sure to adjust the air pressure to secure the air flow rate of 30ℓ/min to the motor.**

The Air Pressure Sensor output type that can be used are the following three types.

- Analog Output Type
- PNP Open Collector Output Type
- NPN Open Collector Output Type

(1) Analog Output Type

If Air Pressure Sensor output type selected is Analog Type, use a output voltage DC+1V - DC+5V.

Connect the Output wire of the Air Pressure Sensor to the SIG - A of the Connector for Air Pressure Sensor (Fig. 17).

Please use the same as Output characteristic described in Fig. 16.
It is advised that you use the recommended pressure sensor Table 5.

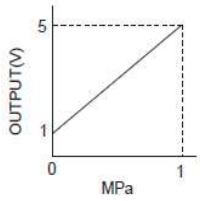

Fig. 16

Table 5.

Recommended Air Pressure Sensoer	Recommended
PSE530, ISE30A-C, ISE30A-D	SMC Corporation
E8F2-B10B, E8F2-B10C	OMRON Corporation
DP-102 (Z) A, DP-102 (Z) A-P	Panasonic Corporation

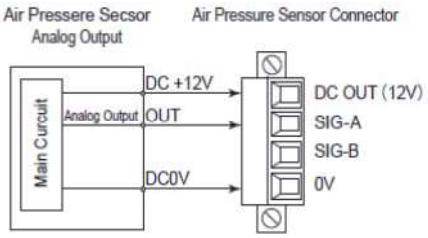

Fig. 17

（2） PNP Open Collector Output Type

Connect the Output wire of the Air Pressure Sensor to the SIG - A of the Connector for Air Pressure Sensor (Fig. 18).

Wire the PNP Transistor Switch to ON when input air pressure becomes larger than the specified air pressure. It is advised that you use the recommended pressure sensor Table 6.

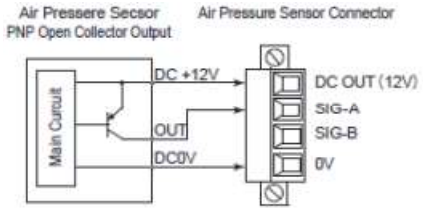

Fig. 18

Table 6

Recommended Air Pressure Sensoer	Recommended manufacturer
ISE30A-P	SMC Corporation
E8F2-B10B	OMRON Corporation
DP-102 (Z) A-P	Panasonic Corporation

(3) NPN Open Collector Output Type

Connect the Output wire of the Air Pressure Sensor to the SIG - B of the Connector for Air Pressure Sensor (Fig. 19).

Wire the NPN Transistor Switch to ON when input air pressure becomes larger than the specified air pressure. It is advised that you use the recommended pressure sensor Table 7.

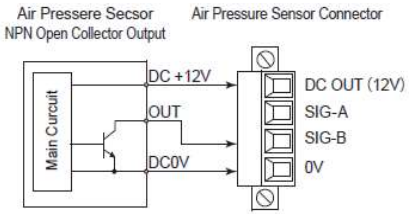

Fig. 19

Table 7.

Recommended Air Pressure Sensoer	Recommended manufacturer
ISE30A-N	SMC Corporation
E8F2-B10C	OMRON Corporation
DP-102 (Z) A	Panasonic Corporation

11 - 2 Wiring to the Connector for Air Pressure Sensor

The Air Pressure Sensor connects to the " AIR SENSOR " of the rear of the CONTROLLER.

(1) Loosen the Socket Head Screw of the Connector for Air Pressure Sensor to the Connector Socket in the rear of the CONTROLLER by using a minus type (Flat Blade) screw driver.
Remove the Connector for Air Pressure Sensor from rear of the CONTROLLER.

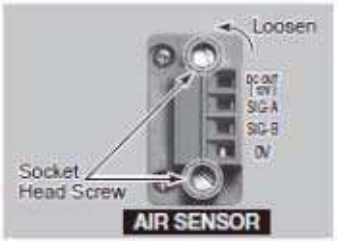

Fig. 20

(2) Loosen the Lead Wire Fixing Screw of the Connector for Air Pressure Sensor by using the correct sized screwdriver.

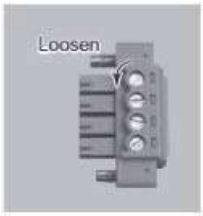

Fig. 21

(3) Strip the insulation (about from 5 - 6mm) from core wire of lead wires (3 pcs.) of the Air Pressure Sensor Cord.

Fig. 22

(4) Insert the Lead Wire to the Connector for Air Pressure Sensor. Refer to Fig. 23, 24.
Tighten the Lead Wire Fixing Screw of the Connector for Air Pressure Sensor by using the correct sized Screwdriver.
Pull lightly the Lead Wire by hand, ensuring the Lead Wire is securely tightened.

①Analog Output Type /
PNP Open Collector Output Type

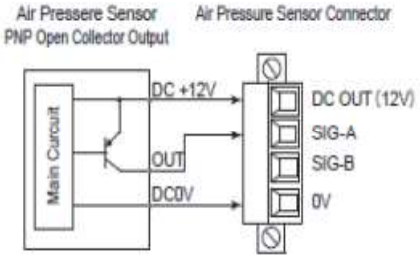

Fig. 23

②NPN Open Collector Output

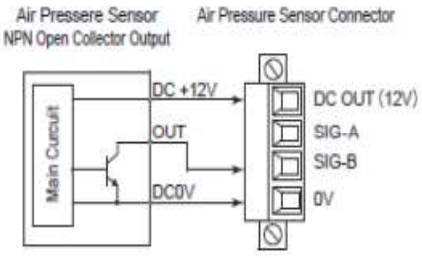

Fig. 24

(5) Insert the Connector for Air Pressure Sensor to the Connector Socket in rear of the CONTROLLER. Make sure to tighten the Socket Head Screw by using a minus type (Flat Blade) screw driver.

① Analog Output Type /
PNP Open Collector Output Type
*The sensor output connect to the SIG-A.

② NPN Open Collector Output Type
*The sensor output connect to the SIG-B.

Fig. 25

Fig. 26

11 - 3 Setting of the Air Pressure Detection Signal and Detection Level of the Air Pressure Sensor

11 - 3 - 1 Air Pressure Detection Signal

CAUTION

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

The Air Detection Signal can be detected by the illumination of the Air Pressure Monitor LED (ON AIR) of the Control Panel.

Table 8.

Air Pressure Monitor LED (ON AIR)	Detection	Condition
L.E.D. on	Normal	The Air Pressure Detection Signal Output Voltage is more than recommended specified value.
L.E.D. off	Error	The Air Pressure Detection Signal Output Voltage is less than the recommended specified value.

(1) Regulate the air pressure between 0.25 - 0.35MPa.

(2) If using an Analog Output Type sensor, Output Voltage of more than DC+1.8V will is normal.

(3) If using an PNP, NPN Open Collector Output Type Sensor, set the supply air pressure 0.25 - 0.35MPa. Set the ON level of the air pressure sensor so that the ON (normal) is output.
For instructions on how to set the ON level of air pressure sensor, refer to air pressure sensor manual.

* The setup air pressure varies depending on the length of the air hose. For details, refer to the operation manual for the motor.
* When it is required to rotate the motor without the air pressure sensor, rotation of the motor is possible using the following method. Make sure to re-connect the air pressure sensor for normal operation.
  ▪Install a jumper wire between "0V and SIG-B" or "DC OUT (12V) and SIG-A". Refer to Fig. 27.

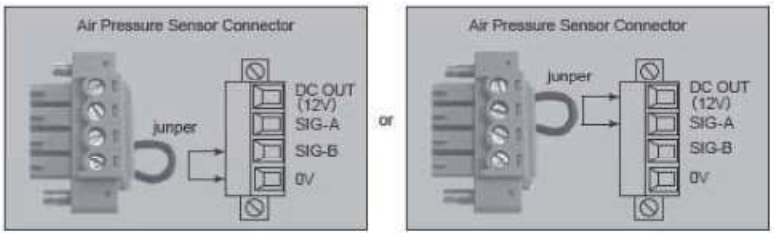

Fig. 27

12. D-SUB CORD (25 / 15 pin) CONNECTION

CAUTION

When connecting the D-SUB Cords (25/15 pin) to the CONTROLLER, use the connector with the side exit to connect to the CONTROLLER. Failure to do so with cause damage to the cord and the inability to install the Rear Cover.

The D-SUB Cord (25 / 15 pin : provided) connects to the interface (Relay) cord of the D-SUB (25 / 15 pin) Connector (prepared by the end-user) between the CONTROLLER and machine I/O.

12 - 1 Connecting to the External Input / Output Connector A and B

(1) Insert the D-SUB Cord (25 / 15 pin : provided) Connector (connector with the side exit of the cord) into the External Input / Output Connector A / B of the rear of the CONTROLLER (Refer to the Fig. 28, 29).
Tighten the Thumb Screws of the D-SUB Cord (25 / 15 pin : provided) and make sure they are securely affixed to the External Input / Output Connector A and B.

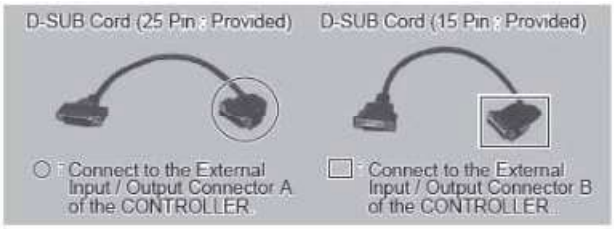

Fig. 28

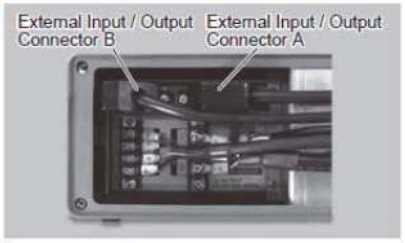

Fig. 29

12 - 2 Specification and Connection of the D-SUB (25 / 15) Connector (not included / prepared by the end-user)

12 - 2 - 1 Specification of the D-SUB (25 / 15) Connector (not included / prepared by the end-user)

- 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 pin to the D-SUB (25 / 15) Connector shell.
- Do not connect the shielded line to any externally powered instrument.
- Secure the D-SUB Connectors to the CONTROLLER using the correct thumb screws (Inch Screw : # 4 - 40).

Table 9.

Connector	Applicable Plug	Applicable Hood	Manufacturer
D-SUB Cord（25 pin : provided) Connector	XM3A-2521	XM2S-2511	OMRON Corporation (or other similar high-quality product)
D-SUB Cord（15 pin : provided) Connector	XM3A-1521	XM2S-1511	

12 - 2 - 2 D-SUB Cord (25 / 15 pin : provided) Pin configuration

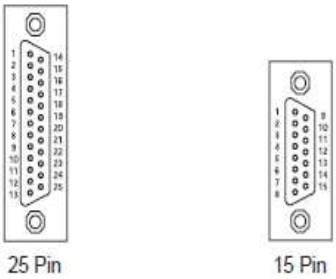

Fig. 30

12 - 2 - 3 Connection of the D-SUB (25 / 15 pin) Connector cable (to be supplied by the end-user)

Connect the D-SUB (25 / 15 pin provided) Connectors (1 Provided from the CONTROLLER) to the D-SUB（25 / 15 pin end-user provided) Connector cable to the machine control using a screws and firmly secure them to each other.

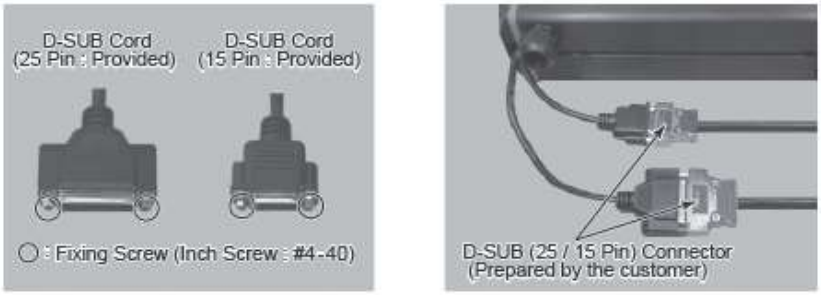

Fig. 31

13. ATTACHING AND REMOVING OF THE DUCT HOSE

CAUTION

When attaching the Duct Hose (2m : provided) to the Duct Connector, insert the Duct hose into the inside of the Duct Connector firmly. Failure to correctly insert the Duct Hose will result in an air leak.

INFORMATION

- **Use the Duct Hose when installing the CONTROLLER in the machine's electrical cabinet.**
- **If adversely affect other product by heat emitted from CONTROLLER, it is advised to use the Duct Hose to the CONTROLLER for protect the other components in the electrical cabinet.**

13 - 1 Attaching of the Duct Hose

(1) Loosen the Securing Ring of the Duct Connector.
(2) Insert the Duct Hose into the Duct Connector opening. Twist and push the Duct Hose to be sure is fully inserted.

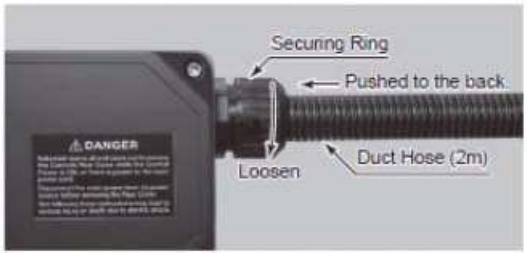

Fig. 32

(3) Tighten the Securing Ring around the Duct Connector.

Fig. 33

(4) After tightening the Duct Connector, make sure there is no space between Duct Connector and Securing Ring.

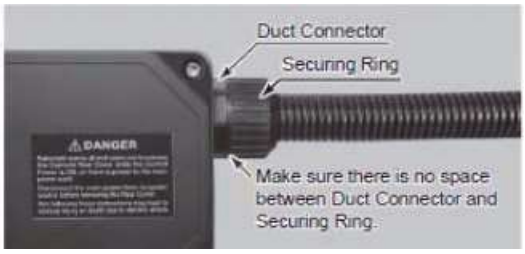

Fig. 34

13 - 2 Removing the Duct Hose

(1) Turn the Securing Ring counterclockwise, until the Securing Ring is free from the Duct Connector.

Fig. 35

(2) Remove the Duct Hose from the Duct Connector as well as the Ground Packing and Securing Ring from the Duct Hose.

Fig. 36

13 - 3 Re-attaching of the Duct Hose

(1) Ensure the Flat surface of the Ground Packing is positioned upward. Insert the Ground Packin into the Securing Ring.

Fig. 37

(2) Turn the Securing Ring clockwise, attaching it to the Duct Connector. Turn the Securing Ring clockwise until it clicks into position.

Fig. 38

(3) Attach the Duct Hose according to the instructions on P71 " 13 - 1 Attaching of the Duct Hose (2) to (4).

14. OPERATIONAL PROCEDURES

14 - 1 Button and LED Features of the Control Panel

Table 10.

Button / LED	Name	Description
	Motor Speed Adjustment Button（SPEED ↑、↓）	(Manual adjustable speed control is possible. (↑or ↓.)) (1 digit = 100min^{-1}.) Speed is adjustable from 1,000 - 80,000 min^{-1}. Maximum motor speed depends on the type of motor.
	Load Monitor（LOAD）	The motor spindle load is displayed by 6 LED‘s (3 Green, 2 Yellow and 1 Red). Continuous operation is possible with all 3 green LED‘s lit. If one of the yellow LED‘s is lit the motor spindle can be run for a short time. When any of the yellow or red LED‘s are lit, the Error LED will light and the motor spindle will shut down. Please refer to P90 “16. PROTECT FUNCTION” section of this manual for allowable duration of high load conditions.
	x 100min^{-1}LED	x 100min^{-1} LED lights : Motor Speed Indication.
	DISPLAY (DISP) Button	By pushing the DISPLAY (DISP) Button, will can be displayed switch the following 3 indicator. ▪Motor Rotation Speed ▪Motor Current Display ▪Motor Class Number
	Error Reset Button (RESET)	This switch resets and allows restarting of the motor spindle after an error has been corrected. Some error codes will not allow the CONTROLLER to be reset.
	Control Button (CTRL)	This button will change the control mode to either MANUAL or AUTO.
	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.
	START / STOP Button (START / STOP)	Starts and stops motor rotation.

Button / LED	Name	Description
	x 10mA LED	x 10mA LED lights : Motor Current Indication.
	MOTOR TYPE LED	MOTOR TYPE LED lights : Motor Class Number Indicator.
	Error LED（ERROR)	When a serious problem with the system orrurs, the alarm is detected this LED illuminates. The motor may shut down and the Digital Speed Indicator will display the error code.
	KEY HOLD Button (🔒)	Hold the Error Reset Button (RESET) for (1 to 2 seconds). This disables all button functions. If Key Hold is activated, a Dot (.) is displayed in Digital Speed L.E.D. area. When releasing Key Hold, push and hold the Error Reset Button (RESET) down for 1 - 2 seconds.
	AUTO LED	AUTO LED lights : System is controlled by Input / Output Connector A from External Signal Source.
	MANUAL LED	MANUAL LED lights : Operation by Control Panel.
	FWD LED	FWD LED lights : Motor rotation direction is in right hand rotation.
	REV LED	REV LED lights : Motor rotation direction is in left hand rotation.
	START / STOP LED	START / STOP LED is illuminated : Motor is rotating. START / STOP LED not illuminated : Motor is not rotating.
	MOTOR CONNECTION MONITOR LED (CONNECTED)	MOTOR CONNECTION MONITOR LED is illuminated : Motor is connected.
	AIR PRESSURE MONITOR LED (AIR ON)	AIR PRESSURE MONITOR LED is illuminated : Air supply pressure is normal (The Air Pressure Detection Signal is normal).
	SPEED POINT MONITOR LED (SPEED POINT 1, 2, 3, 4)	When selecting the Speed Point, Parameter P5 (" Selection of External Speed Control Mode ") while in AUTO Mode (Input / Output Connector A from External Signal Source), the SPEED POINT MONITOR LED (SPEED POINT 1, 2, 3, 4) that corresponds to the signal input of External Speed Signal SEL0 and SEL1 is illuminated. For the coralation between the signal and LED illumination, refer to Table 11.

Table 11.

SPEED POINT LED	SEL1 (Pin No. 5)	SEL0 (Pin No. 17)
1	OFF (Open)	OFF (Open)
2	OFF (Open)	ON (Closed)
3	ON (Closed)	OFF (Open)
4	ON (Closed)	ON (Closed)

14 - 2 Select Control Mode (MANUAL / AUTO).

(1) Using the CONTROL (CTRL) Button 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 with the External Signal Source, push the Control Button (CTRL) of Fig .39 and select AUTO.
MANUAL Mode : Controlled by Control Panel.
AUTO Mode : Controlled by Input / Output Connector A from External Signal Source.

Fig. 39

14 - 3 Setting Motor Start / Stop (START / STOP), Motor Rotating Direction (DIR), Display Mode (DISP), Motor Speed (SPEED)

14 - 3 - 1 Manual Mode Operation

(1) Set Motor Rotating Direction (Set the Rotation Direction Button (DIR) of the Fig. 39.)
Push the Rotation Direction Button (DIR).
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) Motor Start / Stop (Motor Start / Stop by pushing the START / STOP Button (START / STOP) of the Fig. 39.)
The motor spindle will start and the START / STOP LED will illuminate.
Push START / STOP Button (START / STOP) again and the motor will stop and the START / STOP LED will go out.

(3) Setting Display (Set the DISPLAY (DISP) Button of the Fig. 39.)
Puch the DISPLAY (DISP) Button.
- x 100min^{-1} LED lights : Motor Speed Indication.
- x 10mA LED lights : Motor Current Indication.
- MOTOR TYPE LED lights : Motor Class Number Indication.

(4) Setting Motor Class Number (Set the DISPLAY (DISP) Button of the Fig. 39.)
Set the Motor Class Number when the MOTOR TYPE LED is illuminated.
Select the Motor Class Number by presssing the Motor Speed Adjustment Button (SPEED ↑, ↓).
To locate the correct of Motor Class Number and Motor Class, refer to Table 12.

Table 12.

Motor Class Number	Motor Class
1	EM-3060ATC
2	EM-3080ATC
3	BM-325ATC
4	BM-320ATC

CAUTION
If using an incompatible motor or incorrect Motor Class Number, improper rotation may occur.

(5) Setting Motor Speed (Spindle Speed Adjustment Button (SPEED ↑, ↓) of the Fig. 39.)

CAUTION

When the motor type is switched from EM-3080ATC (or BM-320ATC) to EM-3060ATC (or BM-325ATC) with the preset rotation speed of 60,000min^{-1}, the preset speed value is maintained.
In this condition, if the motor is switched again to EM-3080ATC (or BM-320ATC), then the rotation speed is limited up to 60,000min^{-1}. If the new speed needs to be increased to more than 60,000min^{-1}, the new speed will need to be reset.

▪×100min^{-1} LED lights : Set the Motor Speed by pressing the Speed Adjustment Button (SPEED ↑, ↓).
▪×100min^{-1} LED go out : Push the Display Button (DISP) to illuminate the ×100min^{-1} LED. Set the Motor Speed by pressing the Speed Adjustment Button (SPEED ↑, ↓).

Motor Rotaton Speed : 1,000 - 80,000 min^{-1} (EM-3080ATC, BM320ATC)
Motor Rotaton Speed : 1.000 - 60,000 min^{-1} (EM-3060ATC、BM325ATC)
The Motor speed is displayed in min^{-1}. 800 equals 80,000min^{-1}.

14 - 3 - 2 Setting Auto Mode

Use the External Input / Output Connector A to input control signals to the CONTROLLER.

(1) Set Motor Rotating Direction
Input the “Rotating Direction Setting” to 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) Motor Start / Stop
Input the Motor Start Signal (Pin No.14 : START).
Motor rotating is “ON” (Close). When startup, START / STOP LED of the CONTROLLER will light and motor will rotate.
Motor Stop is OFF “Open“ (START / STOP LED go out).

(3) Setting the Motor Class Signals
The" Motor Class Signal 0 " to Pin No. 9 : ID0 and " Motor Class Signal 1 " to Pin No. 22 : ID1 to select Motor Classes.
Refer to Table 13 about relationship between Motor Class Number and Motor Class Signal.

CAUTION

If an incompatible motor type or Motor Class Number is used, abnormal motor behavior will be experienced.

Table 13.

Motor Class	Motor Class Signal	Motor Class Signal
EM-3060ATC	OFF (Open)	OFF (Open)
EM-3080ATC	OFF (Open)	ON (Closed)
BM-325ATC	ON (Closed)	OFF (Open)
BM-320ATC	ON (Closed)	ON (Closed)

(4) Setting the Motor Speed

Motor Speed Range is 1,000 - 80,000 min^{-1}. Maximum motor speed depends on motor and spindle model. Input the “Motor Speed Control Voltage” to Pin No. 23 : VR.
Setting parameter P2 to ON allows the motor speed to be adjusted in Auto Mode ueing the Motor Speed Adjustment Button (SPEED ↑, ↓) of the Fig. 39
(Refer to P97 “17 - 4 ② P2 Setting AUTO mode Motor Speed Control” section).
Rotational speed can be set by the using one of the following 3 methods. The Rotation Speed is setting to an analog Signal before shipment.

① Setting by Analog signal
Input the “Motor Speed Control Voltage” to Pin No. 23 : VR.
Refer to P84 “15 - 1 (3) ④ Motor Speed Control Signal” section.

② Setting by Pulse Signal
(Set parameter P5 of the CONTROLLER (Refer to P99 ”17 - 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 100min^{-1} in Spindle Speed. Counted on the leading edge of the signal.
“UP / DOWN Signal for Setting Motor Speed is “ON “(Close) : increase speed, “OFF” (Open) : decrease speed.

③ Set by the Speed Point Signal
(Need to set parameter P5. (Refer to P99 “17 - 4 ⑤ P5 Selection of External Speed Control Mode” section.)

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. 14.

Table 14.

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)

(5) Resetting System after Error Codes
Releasing Error Code by The “Error Release” (Pin No. 4 : RESET). Switch the signal on Pin No. 4 (RESET) of Input / Output Connector A OFF (Open) → ON (Closed) → OFF (Open).
Error Signal will not be released until cause of the error has been removed.
Refer to P90 ”16 - 2 Resetting System after Error Codes” section.

15. EXTERNAL INPUT / OUTPUT CONNECTOR

15 - 1 External Input / Output Connector A

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

WARNING

- **DO NOT connect any circuit other than SELV (DC+24) (Safety Extra Low Voltage) to the External Input / Output Connector A 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

- **External Input / Output Connector A DOES NOT use Pins No. 10, No. 16, No. 20 and No. 22. If Pins No. 10, No. 16 and No. 20 are connected, the CONTROLLER will be damage.**
- **NEVER Connect the pin No.1（COM_1) or No.18（COM_2）to the No.13 (GND).**

Table 15.

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	OFF (Open) : FWD. ON (Closed) : REV.	Controls the rotational direction of the motor spindle. Setting parameter P6, can start with reverse rotation. (Refer to P100 " 17 - 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 100min^{-1} in Spindle Speed depending on parameter P5 setting. (Refer to P99 " 17 - 4 ⑤ P5 Selection of External Speed Control Mode" section.) The increase speed and decrease speed are set by UD_IN.
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.

Pin No.	Code	Function	Input / Output	Description	
5	SEL1	Speed Point Select 1	Input	Refer to P78 " 14 - 3 - 2 (4) ③ Set by the Speed Point Signal Table14 ".	Speed Point (U1 – U4) can be selected by SEL0 and SEL1 signal combination. Need to set parameter P5. (Refer to P99 " 17 - 4 ⑤ 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. When setting parameter P1, Error Output Mode can be changed. (Refer to P97 " 17 - 4 ① P1 Setting of Error Output Mode " section.)
9	ID0	Motor Class Signal 0	Input	Refer to P77 "14 - 3 - 2 (3) Setting the Motor Class Signal ".	Select the Motor Class by using both ID0 and ID1 signals.
10	Not Used	—	—	—	*Note : Never use pin labeled not used.
11	Vcc	Internal Power Source for Motor Speed Control Voltage	Output	DC+10V	Internal Power Source for " Motor Speed Control Voltage (VR) ".
12	MOTOR_I	Motor Current Monitor	Output	2Amp / V DC0V - DC+10V	Output Motor Current Monitor with Analog Monitor Voltage. 2Amp / 1V. Max. 20Amp.
13	GND	Internal GND for Analog Monitor and Motor Speed Control Voltage ONLY	Output	Internal CONTROLLER GND	This GND will be used for analog monitor and Motor Speed Control Voltage (MOTOR_I, SPEED_V, and LOAD).
14	START	Rotate ommand	Input	OFF (Open) : Stop ON (Closed) : Start	Motor Start and Motor Stop Signal Setting parameter P6, can start with forward rotation. (Refer to P100 " 17 - 4 ⑥ P6 Selection of External Motor Start Signal Control Mode" section.)

Pin No.	Code	Function	Input / Output	Description	
15	UD_IN	UP / DOWN Signal for Setting Motor Speed	Input	OFF (Open) : Speed Down ON (Closed) : Speed Up	This signal is for increasing and decreasing the desired speed by the use of a Pulse Signal. Whether it increases or decreases speed is determined by CNT_IN. It is requred that parameter P5 is set. (Refer to P99 " 17 - 4 ⑤ P5 Selection of External Speed Control Mode " section.)
16	Not Used	—	—	—	*Note : Never use pin labeled not used.
17	SEL0	Speed Point Select 0	Input	Refer to P78 " 14 - 3 - 2 (4) ③ Set by the Speed Point Signal Table14 ".	Speed Point (U1 – U4) can be selected by SEL0 and SEL1 signal combination. Need to set parameter P5. (Refer to P99 " 17 - 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%.
16	Not Used	—	—	—	*Note : Never use pin labeled not used.
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. (The Speed Achievement amount can change by parameter P9.)
22	ID1	Motor Class Signal 1	Input	Refer to P77 "14 - 3 - 2 (3) Setting the Motor Class Signal	Select the Motor Class by using both ID0 and ID1 signals.
23	VR	Motor Speed Control Voltage	Input	Speed (min^{-1}) = Speed Control Voltage Signal × 10000 DC 0 - DC+10V	Sets rotating speed of the motor. Refer to Fig. 46 about relationship between motor speed and control signal.
24	LOAD	Torque Load Monitor	Output	Torque Load Monitor (%) = Torque Load Monitor Voltage × 20	Shows that the torque being applied to the motor. 20%/ V 100% (rating) / 5V Torque Load Monitor : 0 - 200% (DC0V - DC+10V)
25	SPEED_V	Rotating Speed	Output	10,000min^{-1} / V	Output the rotation speed of rotating motor with Analog Monitor Voltage. 10,000min^{-1} / V DC0V - DC+10V

(2) Input / Output Diagram

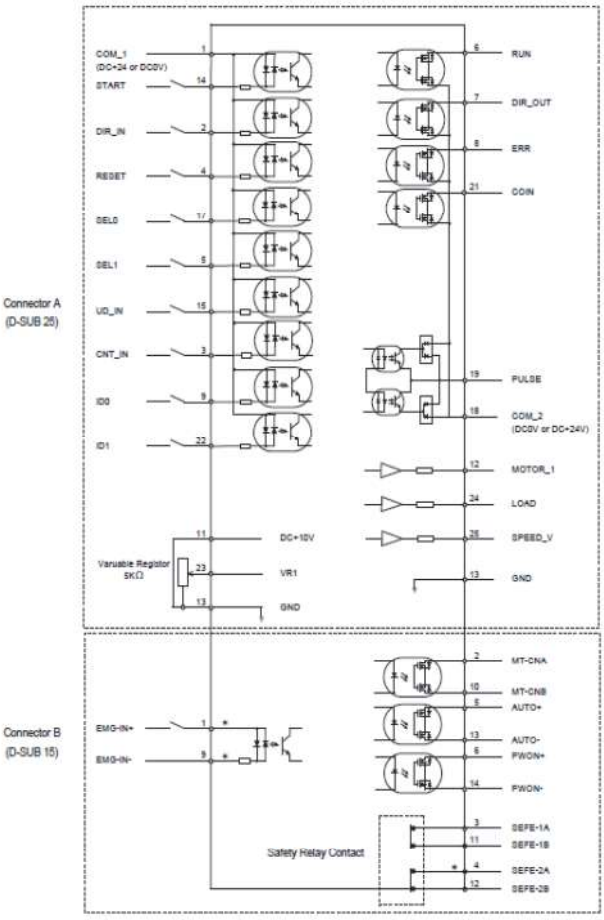

Fig. 40

*1 When using the "EMG - IN" Signal, set parameter P8. (Refer to P101 “17 - 4 ⑧ P8 Selection of Emergency Stop Function” sectional.)

*2 When using the "UD_IN and CNT_IN" Signal, set parameter P5. (Refer to P99 “17 - 4 ⑤ P5 Selection of External Speed Control Mode” section.

(3) Input / Output Signal

① There are 9 different input signals : “Rotate Command (START)”, “Rotating Direction Setting (DIR_IN)”, “Error Release (RESET)”, Speed Up or Down Signal, Speed Command Pulse Signal, Motor Class Selection Signal, “UP / DOWN Signal for Setting Motor Speed (UD_IN)”, “Count Pulse Signal for Setting Motor Speed (CNT_IN)”, “Motor Class Slelection Signal '0' and '1' ” and “Speed Point Selection Signal '0' and '1' ".

Refer to Fig. 41 for connections.

▪Please use a separate power source that is Capable of supplying 24VDC±10%, 100mA .

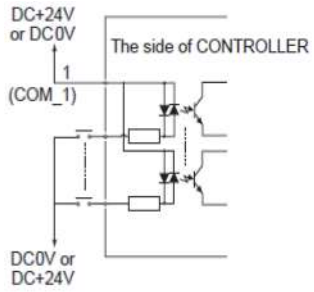

Fig. 41

② Output Signal Ⅰ

There are 4 kinds of output signals : “Rotating (RUN)”, “Rotating Direction (DIR_OUT)”, “Error (ERR)”, 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) ≦ 30V DC

▪Working Current (Ip) ≦ 100mA

Use an external power source for output circuits. It is recommended to use the same 24VDC power source used for input signals. Please refer to Fig. 42 for connections.

CAUTION

Never supply more that 100mA of current to the input / output circuit. It is recommended to add a LOAD (resistor) to the output circuit. Over Current Will Cause Damage To The CONTROLLER.

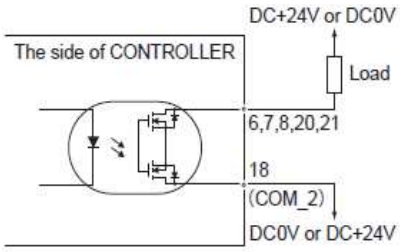

Fig. 42

③ Output Signal Ⅱ

Refer to Fig. 43 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) ≦ 30V DC
- Working Current (Ip) ≦ 50mA

CAUTION

Do not send excess current into the input / output circuit. Verify the working-current will is less than 50mA after connected the LOAD (resistor) of the output circuit. EXCESS CURRENT WILL CAUSE DAMAGE TO THE CONTROLLER.

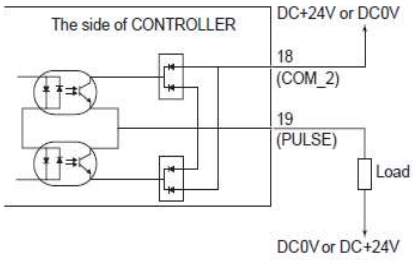

Fig. 43

④ Motor Speed Control Signal

Rotation Speed can be selected by, applying analog voltage to the " Motor Speed Control Voltage (VR)". Refer to Fig. 44, 45 for connections. Refer to Fig. 46 for the relationship between Motor Speed and Control Signal.

CAUTION

When applying the DC0V to DC+10V, never input more than DC+10V (Fig. 45). This will cause serious damage to the I / O Board in the CONTROLLER.

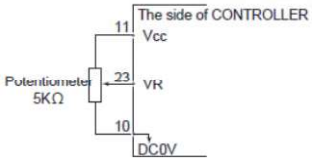

Fig. 44

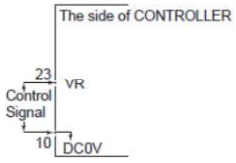

Fig. 45

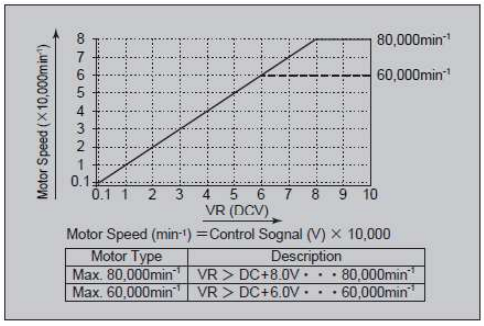

Fig. 46

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. 47 for connections.

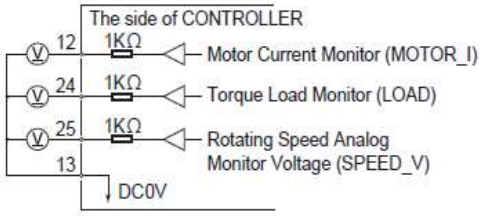

Fig. 47

15 - 2 External Input / Output Connector B

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

WARNING

- **DO NOT CONNECT any circuit other than SELV (DC+24V) (Safety Extra Low Voltage) to the External Input / Output Connector B 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 DOES NOT use Pins No. 7, No. 8 and No. 15. If Pins No. 7, No. 8 and No. 15 are connected, the CONTROLLER will be damage.**

Table 16.

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 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 P8. (Refer to P101 " 17 – 4 ⑧ P8 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 the motor is connected.	When there is continuity, OFF, 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 ON (Closed) Safety Relay is OFF (System Stopped), no continuity Safety Relay is OFF (Open) Normal Operation.
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 (ON / Closed), the Safety Relay is OFF (System Stopped), no continuity Safety Relay is OFF (Open) is 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).

Pin No.	Code	Function	Input / Output	Description	
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 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)	Normal Operation ON (Closed), Emergency OFF (Open). When using the Emergency Stop Signal, set parameter P8. (Refer to P101 " 17 - 4 P8 ⑧ 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 between the contacts of Pin No. 2 and Pin No. 10 (OFF), 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 ON (Closed) Safety Relay is OFF (System Stopped). If there is no continuity Safety Relay is OFF (Open) for 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 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, Pin No. 5 and Pin No. 13 are ON (Closed).
14	PWON -	CONTROLLER Power Source Monitor (-)	Output	ON (Closed) : Main Power Supply is connected OFF (Open) : Main Power Supply is disconnected	IIf the Main Power Switch 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 Signal

① Pin No. 2 - No. 10、No. 5 - No. 13、No. 6 - No. 14

There are 3 kinds of output signals : “Motor Signal Connect Contact (MT-CN)”, “Control Mode AUTO (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) ≦ 30VDC

▪Working Current (Ip) ≦ 100mA

Use an external power source for output circuits. It is recommended to use a separate power supply Input / Output Connector A. Please refer to Fig. 48 for connections.

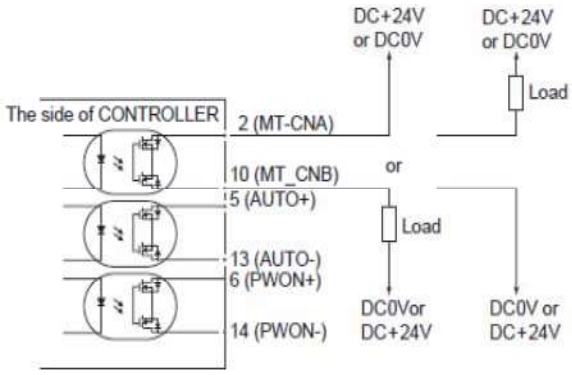

Fig. 48

② Emergency Stop Signal Input

Pin No. 1 - No. 9

This signal is a switched 24V DC output.

Please use a separate power source that is capable of applying 24VDC ± 10%, 50mA.

Refer to Fig. 49 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.

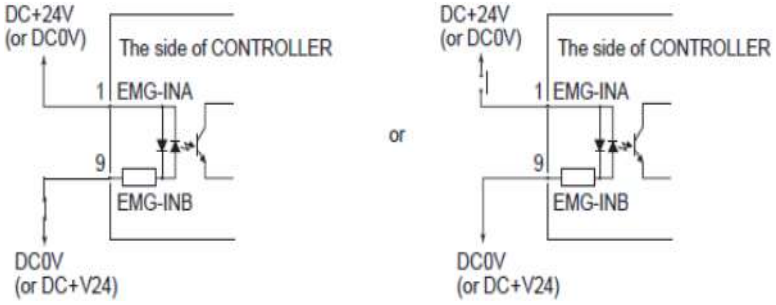

Fig. 49

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 P8. (Refer to P101 " 17 - 4 ⑧ P8 Selection of Emergency Stop Function " section.)

Pin No. 3 - No. 11, No. 4 - No. 12

- The Safety Relay will be ON or OFF depending on the state of the Emergency Stop Signal pins No. 1 and No. 9.
- 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 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 installed Safety Relay is designated to comply with EN standards.
- 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) ≦ DC+30V
  Working Current (Ip) ≦ 2A
  Refer to Fig. 50 below for connections.

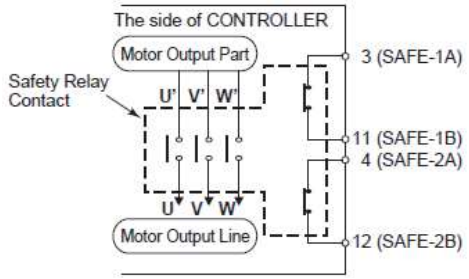

Fig. 50

* 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 beused 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. PROTECT FUNCTION

16 - 1 Detection of 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) will light (flash).
(3) The Error Code in Table. 17 will displayed on Digital Speed Indicator.
(4) An Error signal is output to the “ERR (PIN No. 8 : ERROR)” of Input / Output Connector A.
* Setting parameter P1 , will Change the Error Output Mode of the Error Signal. (Refer to P97 “17 - 4 ① P1 Setting of Error Output Mode” section.)

16 - 2 Resetting System after Error Code

There are 2 methods of releasing Error Code.

(1) When the control is in MANUAL Mode:
Push the Error Reset Button (RESET) of the Control Panel.
(2) When the control is in AUTO Mode:
Toggle the signal on Pin No. 4 (RESET) of Input / Output Connector A OFF (Open) → ON (Closed) → OFF (Open).

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

Table 17.

Error Code	Problem Area	Trouble
E1	Excess Current	Motor Current beyond safe limits.
E2	Trouble with the Internal Power Source	Trouble with the Internal Power Circuit of the CONTROLLER has occurred.
E3	Motor Cord Disconnect	Motor Cord is disconnected, misaligned or damaged.
E4	CONTROLLER overheat	CONTROLLER overheat.
E5	Break Circuit Trouble	Trouble with the Motor Brake Circuit.
E6	No Speed Signal	Loss of speed control sensing inside the motor caused by impact or torque overload.
E7	Low Air Pressure	Inadequate air pressure 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 P91 " 16 - 3 Torque Over Load ".)
EA	External Control Signal Error	▪ When Control Mode is in AUTO, the Control Command Signal is “ON (Closed)” before Main Power Switch is turned ON. ▪ When Control Mode is AUTO, the ERROR command is released without stopping the Control Command Signal “OFF (Open)”.
EH	Over Speed	Rotating Speed is beyond the motors capability.
EE	Emergency Stop Error	Safety Relay has been activated and the Emergency Stop System has stopped the Motor.
EC	Internal Memory Error	Internal Memory Problem (EEPROM).

CAUTION

- **If when using the Input / Output Connector A / B and External Monitoring, please check and resolve source of the problem whenever an Error Code is displayed on the Digital Speed Indicator.**
- **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.**

16 - 3 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 control, 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 lights 4 or more LED's (3 Green LED's and 1 of more yellow LED's) an over-load condition exists. 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).

(1) Load Monitor LED 4 LED's : 30 Seconds
(2) Load Monitor LED 5 LED's : 10 Seconds
(3) Load Monitor LED 6 LED's : 5 Seconds

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

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

* Set the parameter P1, can be Change the Error Output Mode of the Error Signal for an Open or Closed state. (Refer to P97 "17 - 4 ① P1 Setting of Error Output Mode" section.)

16 - 4 Warning indication for the Fan

CAUTION

If "FA" is displayed and blinking on the Digital Speed Indicator, the internal Fan of the CONTROLLER has been damaged. Return to a NAKANISHI dealer for service.

An internal fan is installed in the CONTROLLER to dissipate heat.

The heat generated within the CONTROLLER is expelled by the fan to the outside through the Duct Connector.

If the Fan has stopped functioning, an Alarm "FA" will be flashing on the Digital Speed Indicator.

If "FA" is displayed on Digital Speed Indicator and internal CONTROLLER is not Overheating, the system can be operated in this state.

If the CONTROLLER has Overheat, an " E4 " will displayed on Digital Speed Indicator.

17. SETTING OF OPERATING PARAMETERS

17 - 1 Parameter Types

Parameter types, contents, and default are detail in Table 18.
When checking a parameter or changing a setting, refer to P97 " 17 - 4 Setting procedure " section.

Table 18.

Code	Code	Contents	Default
P1	Setting of Error Output Mode	Changes the Error Output Signal, when an error occurs, from normally open to normally closed.	oFF
P2	Setting AUTO Mode for Motor Speed Control	When the control is in AUTO mode, the speed control is adjustable from the CONTROLLER Panel or SELECTOR, set the parameter to on to adjust the speed in AUTO Mode.	oFF
P3	Setting Fixed Motor Speed	When a Fixed Motor Speed is desired, set the parameter to on and set the desired locked in speed.	oFF
P4	Setting Maximum Motor Speed	When a Maximum Motor Speed is desired, set the parameter to on and set the maximum speed.	oFF
P5	Selection of External Speed Control Mode	The following Rotation Speed options can be selected when control mode is AUTO. An : Analog Signal cn : Pulse Signal Po : Speed Point Signal	An
P6	Selection of External Motor Start Signal Control Mode	When control mode is in AUTO, please set the parameter to ON and set the desired rotating direction of the motor. Activate Pin 2 to set a reverse direction along with the start command.	oFF
P7	Setting of Motor Acceleration and Deceleration Time	If acceleration time of the Motor startup to Motor Maximum Rotation Speed or deceleration time of from Maximum Rotation Speed to motor stop need to be lengthened. set the parameter to ON and set the desired acceleration / deceleration time.	oFF
P8	Selection of Emergency Stop Function	When using the Emergency Stop Selection Mode, please set the parameter to on.	oFF
P9	Setting Speed Achievement Level	If want to change the Arrival Percentage Time, please set the parameter to on and set the desired Arrival Percentage Time. Range of Speed Achievement Level : 50 - 100%.	oFF
P10	Error History	Error code history of the last 5 error events can be confirmed. (No parameter setting is necissary.)	- -
P11	Confirmation of Parameter Setting	Contents of the parameters that are set can be confirmed. (P1 - P9.) No parameter setting is necissary.)	

17 - 2 Contents of Parameter

CAUTION

The operating parameters can be preset depending on the application requirements. Please operate only after confirming contents of parameter settings.

The following parameters can be set.

① P1 Setting of Error Output Mode

- Election of the error output mode is on Pin No. 8: ERR of External Input / Output Connector A.
- When an error occurs the output can be select to ON (Closed) or OFF (Open).
- Signals can be output according to the required machine control logic of the system.

Table 19.

Parameter P1	Set Contents
oFF	Error Occurred : Signal is OFF (Open).
on	Error Occurred : Signal is ON (Closed).

② P2 Setting AUTO Mode Motor Speed Control

- Allows the setting of the Motor Speed while in AUTO Mode. This parameter selects between speed control with the Speed Adjustment Button (SPEED ↑, ↓) of the Control Panel or by External Command Signal through External Input / Output Connector A.

Table 20.

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

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 21.

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

④ P4 Setting Maximum Motor Speed

CAUTION

Actual motor rotation speed of the motor will be limited, based on maximum motor rotation speed of the Motor Class selected.

- 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 22.

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

⑤ P5 Selection of External Speed Control Mode

CAUTION

Actual motor rotation speed of the motor will be limited, based on maximum motor rotation speed of the Motor Class selected.

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

Table 23.

Parameter P5	Set Contents
An	Set speed by Analog Signal.
cn	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 cn, 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 100min $^{-1}$.
  External Input / Output Signal UP / DOWN Signal for Setting Motor Speed is as follows:
  OFF (Closed) : Rotation speed decreases
  ON (Open) : 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 24.

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 Points. (U1 - U4.)
  Speed ranges from 1,000 - 80,000min $^{-1}$ can be set.

⑥ P6 Selection of External Motor Start Signal Control Mode

- During Auto Control Mode the motor Start signal can either by a direction signal and a Start signal or a FWD. Start and a REV. Start signal.
- 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)”, FWD. (Open), Rev. (Closed) and the Start Signal is controlled by “Rotate Command (Pin No.14 : START)”.
  When P6 is set to on 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 25.

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

⑦ P7 Setting of Motor Acceleration Time and Deceleration Time

- Sets the time from the Motor start-up until reaching the maximum Motor speed, and the Deceleration Time from the maximum Motor speed to stop.
- Display unit is second. Acceleration Time and Deceleration Time setting range : 4 - 60 seconds.

- Acceleration Time and Deceleration Time are common.

Table 26.

Parameter P7	Set Contents
oFF	Acceleration / Deceleration Time of the motor is not enabled.
on	Acceleration / Deceleration Time of the motor is enabled.

Table 27.

setup value (Unit : Seconds)	display
4	4
8	8
10	10
12	12
14	14
16	16
18	18
20	20
25	25
30	30
45	45
60	60

⑧ P8 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’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 28.

Parameter P8	Set Contents
oFF	Emergency Stop Function is deactivated.
on	Emergency Stop Function is activated.

⑨ P9 Setting Speed Achievement Level

- A predetermined At-Speed (Spindle Arrival Percentage Time) can be set by in P9 and is output to Pin 21.
- By selecting the percentage of level from 50% to 100%. Speed Achievement is used to make sure that the Spindle is close to full speed before cutting occurs. The preset value from the factory is 90%.

Table 29.

Parameter P9	Set Contents
oFF	Speed Achievement Level is not enabled
on	Speed Achievement Level is enabled

⑩ P10 Error History

- The Error History, which records previous error codes can be confirmed by the Error Code displayed on the digital Speed Indicator.
- Records Error Codes for viewing when machines are being run unattended.
- This Error History records 5 events. The last error code recorded will be H.1 and the oldest will be H.5. The Error code is displayed on the Digital Speed Indicator.
- The Error History and the Error Code are displayed on Digital Speed Indicator (When Error History is No.1 and Error Code is E7, Digital Speed Indicator displayed on 1.E7).
- In case there is no Error History, Error History Number and _._ will be displayed on the Digital Speed Indicator.
- If error history is more than five, oldest error history No. 5 will be deleted.

⑪ P11 Confirmation of Parameter Setting

- This mode allows the user to check the settings of parameters P1 - P9. The parameter P10 can not be checked.

17 - 3 Entering Parameter Setting Mode

1. While push and holding the Error Reset Button while turning the Power Switch ON at the front of the CONTROLLER.
2. Hold the Reset Button down for 3 seconds while the CONTROL is powering up.
3. The buzzer will 'BEEP' 3 times, then release the Reset Button and Parameter Setting Mode will start. P1 is Displayed.
4. To Select a Parameter, press the Speed Adjustment Button (SPEED ↑, ↓). The parameters will be shown in the following order. P2 -->P3-->P4 ・・・・・・ P9---->P10--->P1.

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 OFF and ON again.

17 - 4 Setting Procedure

① P1 Setting of Error Output Mode

CAUTION

If the Error Output Mode has been changed from the default setting, the parameter setting will be displayed the next time you enter Parameter Setting Mode.
The following procedures ase described, based on the contents of parameter settings from the factory.

Procedure

1. When P1 is displayed, push the (START / STOP) button to change from OFF to ON.
2. oFF is displayed.
   This indicates that when an error occurs, the output will be OFF (Open).
3. Push the START / STOP Button (START / STOP).
4. on is displayed.
   This indicates that when an error occurs, the output will be ON (Closed).
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP).
6. Push the Error Reset Button (RESET) to send the settings to memory, P1 will be displayed.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

② P2 Setting AUTO Mode Motor Speed Control

Procedure

1. When P2 is displayed, push the (START / STOP) button to change from OFF to ON.
2. oFF is displayed.
   This indicates that speed control by the Speed Adjustment Button (SPEED ↑, ↓) is disabled.
   The External Command Signal Control will be operational.
3. Push the START / STOP Button (START / STOP).
4. on is displayed.
   This indicates that speed control is changeable by the Speed Adjustment Button (SPEED ↑, ↓).
   The External Command Signal Control will not be operational.
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP).
6. Push the Error Reset Button (RESET) to send the settings to memory, P2 will be displayed.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

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.

Procedure

1. When P3 is displayed, push the (START / STOP) button to change from OFF to ON.
2. oFF is displayed.
   This indicates that Fixed Motor Rotation Speed can not be set.
3. Push the START / STOP Button (START / STOP).
4. Alternately the setting motor rotation speed and on displayed on Digital Speed Indicator. The Fixed Motor Rotation Speed can be set.
5. Push the Speed Adjustment Button (SPEED ↑, ↓) to set the motor rotation speed.
   The Moto Rotation Speed range is 1,000 - 80,000min^{-1}.
6. Push the Error Reset Button (RESET) to send the settings to memory, P3 will be displayed.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

④ P4 Setting Maximum Motor Speed

CAUTION

Actual motor rotation speed of the motor will be limited, based on maximum motor rotation speed of the Motor Class selected.

Procedure

1. When P4 is displayed, push the (START / STOP) button to change from OFF to ON.
   oFF is displayed.
2. This indicates that Maximum Motor Rotation Speed can not be set.
   The Maximum Motor Rotation Speed is 80,000min^{-1}.
3. Push the START / STOP Button (START / STOP).
4. Alternately the Maximum Motor Rotation Speed and on displayed on Digital Speed Indicator. The Fixed Motor Rotation Speed can be set.
5. Push the Speed Adjustment Button (SPEED ↑, ↓) to set the motor rotation speed.
   The Motor Rotation Speed range is 1,000 - 80,000min^{-1}.
6. Push the Error Reset Button (RESET) to send the settings to memory, P4 will be displayed.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑤ P5 Selection of External Speed Control Mode

CAUTION

Actual motor rotation speed of the motor will be limited, based on Maximum Motor Rotation Speed of the Motor Class selected.

Procedure

1. When P5 is displayed, press the (START / STOP) button to change from OFF to ON.
2. An (Motor Speed Control Voltage) is displayed.
   Press the Speed Adjustment Button (SPEED ↑, ↓). The display will be change in the following order. An <---> cn <----> Po < ---->An.
   When setting the Motor Rotation Speed by Motor Speed Control Voltage, select An.
   When setting the Motor Rotation Speed by Pulse Signal, select cn.
   When setting the Motor Rotation Speed by Speed Point, select Po.
3. When selecting the An (Motor Speed Control Voltage), and in a state that is displayed An, press the START / STOP Button.
   The setting of An has that has been set in memory, P5 will displayed.
4. When selecting the cn (Pulse Signal), and An is displayed, press the START / STOP Button until cn appears.
   The setting of cn has been memory, P5 will displayed.
5. When setting by Speed Point, change the display to Po.
   This indicates u1 to u4 the 4 Speed points can be set.
   Press the START / STOP Button (START / STOP).
   1) Setting of the Speed Point 1 (u1)
      Alternately displayed is u1 and the setting speed.
      Press the Speed Adjustment Button (SPEED ↑, ↓) to set the motor rotation speed.
      When you have finished setting Speed Point (u1), press the START / STOP Button (START / STOP).
   2) Setting of the Speed Point 2 (u2)
      Alternately displayed u2 and setting speed.
      Press the Speed Adjustment Button (SPEED ↑, ↓) to set the motor rotation speed.
      When you finished setting Speed Point (u2), press the START / STOP Button (START / STOP).

3) Setting of the Speed Point 3 (u3)
Alternately displayed u3 and setting speed.
Press the Speed Adjustment Button (SPEED ↑, ↓) to set the motor rotation speed.
When you finished setting Speed Point (u3), press the START / STOP Button (START / STOP).

4) Setting of the Speed Point 4 (u4)
Alternately displayed u4 and setting speed.
Press the Speed Adjustment Button (SPEED ↑, ↓) to set the motor rotation speed.
When you finished setting Speed Point (u4), press the START / STOP Button (START / STOP).

6. When set the Speed Point 1 - 4 (u1 - u4) to the memory, press the Error Reset Button (RESET) to write the settings to memory.
   P5 is displayed. Press the Error Error Reset Button (RESET). The Speed Point (u1 - u4) has been memory.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑥ P6 Selection of External Motor Start Signal Control Mode

Procedure

1. When P6 is displayed, press the START / STOP Button (START / STOP).
2. oFF is displayed.
   This indicates that motor startup and setting the rotation direction can not performed simultaneously.
3. Push the START / STOP Button (START / STOP).
4. on 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 (Pin No. 2: DIR_IN) are can be set.
5. You can cycle through the choices by pushing the START / STOP Button (START / STOP).
6. Push the Error Reset Button (RESET) to send the settings to memory.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑦ P7 Setting of Motor Acceleration Time and Deceleration Time

Procedure

1. When P7 is displayed, press the START / STOP Button (START / STOP).
2. oFF is displayed.
   In this setting, the Acceleration Time and Deceleration Time is 2 seconds.
3. Push the START / STOP Button (START / STOP).
4. Alternately displayed on and the Acceleration Time / Deceleration time.
5. Push the Speed Adjustment Button (SPEED ↑, ↓) ⑬ select the setting time.
   (The Acceleration Time / Deceleration time.)
6. Push the Error Reset Button (RESET) to send the settings to memory.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑧ P8 Selection of Emergency Stop Function

Procedure

1. When P8 is displayed, press the START / STOP Button (START / STOP).
2. oFF is displayed.
   This indicates that Emergency Stop Function can not use.
3. Push the START / STOP Button (START / STOP).
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).
6. Push the Error Reset Button (RESET) to send the settings to memory.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑨ P9 Setting Speed Achievement Level

Procedure

1. When P9 is displayed, press the START / STOP Button (START / STOP).
2. oFF is displayed.
   With this setting Speed Achievement Level is 90%, which is the factory default percentage.
3. Push the START / STOP Button (START / STOP).
4. Alternately displayed on and Speed Achievement Level (%).
5. Push the Speed Adjustment Button (SPEED ↑, ↓) select the Speed Achievement Level (%).
6. Push the Error Reset Button (RESET) to send the settings to memory.
7. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
8. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑩ P10 Error History

Procedure

1. When P10 is displayed, press the START / STOP Button (START / STOP).
2. Error History No. 1 and Error Code are Displayed.
   In case there is no Error History _._ will be displayed.
3. Push the Speed Adjustment Button (SPEED ↑, ↓).
   Error History No. 2 and Error Code are Displayed.
4. Push the Speed Adjustment Button (SPEED ↑, ↓).
   Error History No. 3 and Error Code are Displayed.
5. Push the Speed Adjustment Button (SPEED ↑, ↓).
   Error History No. 4 and Error Code are Displayed.
6. Push the Speed Adjustment Button (SPEED ↑, ↓).
   Error History No. 5 and Error Code are Displayed.
7. Push the Error Reset Button (RESET). P10 is displayed.
8. If you desire to set other parameters, push the Speed Adjustment Button (SPEED ↑, ↓) to select the parameter that needs to be set.
9. When you are finished setting parameters, press the Error Reset Button (RESET), then turn the Main Power Switch is OFF.

⑪ P11 Confirm setting of parameters

Procedure

1. When P11 is displayed, press the START / STOP Button (START / STOP).
2. The setting contents of the P1 (oFF or on) and P1 are displayed.
3. Push the Speed Adjustment Button (SPEED ↑, ↓).
4. The setting contents of the P1 (oFF or on) and P2 are displayed.
5. Push the Speed Adjustment Button (SPEED ↑, ↓).
6. The setting contents of the P1 (oFF or on) and P3 are displayed.
7. Push the Speed Adjustment Button (SPEED ↑, ↓).
8. The setting contents of the P1 (oFF or on) and P4 are displayed.
9. Push the Speed Adjustment Button (SPEED ↑, ↓).
10. The setting contents of the P5 (An, cn, or Po) and P5 are displayed.
11. Push the Speed Adjustment Button (SPEED ↑, ↓).
12. The setting contents of the P1 (oFF or on) and P6 are displayed.
13. Push the Speed Adjustment Button (SPEED ↑, ↓).
14. The setting contents of the P1 (oFF or on) and P7 are displayed.
15. Push the Speed Adjustment Button (SPEED ↑, ↓).
16. The setting contents of the P1 (oFF or on) and P8 are displayed.
17. Push the Speed Adjustment Button (SPEED ↑, ↓).
18. The setting contents of the P1 (oFF or on) and P9 are displayed.
19. You can cycle through the choices by pushing the Speed Adjustment Button (SPEED ↑, ↓).
20. When finished **VIEWING** parameters and wish to exit the Parameter Mode, press Error Reset Button (RESET).
21. When finished **CHANGING** parameters and wish to exit the Parameter Mode, press Error Reset Button (RESET), the cycle the controls main power switch off, then on.

18. CONTROL PANEL SETTING RESUME FUNCTION

（1）On power up, the system will resume all the control panel settings in the state they were in when the CONTROLLER was Powered OFF.

（2）The following settings will be maintained

- Motor Rotation Speed
- Rotation Direction（FWD., REV）
- Control Mode（AUTO, MANUAL）
- Display Mode（× 100min^{-1}, × 10mA and Motor Class Number.）
- Motor Class Number.
- Parameter Settings P1 - P11
- Key Hold

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 cuse 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 on the front of the CONTROLLER. ▪ Make sure to connect the round terminal to the AC Power Input Terminal Block (AC INPUT) securely. (Refer to P63 " 9. POWER CORD CONNECTION " section.)
	The Round Terminal of the Motor Cord is not properly connected to the Motor Output Terminal Block (MOTOR OUT) with the Terminal Screw.	Re-connect the Round Terminal of the Motor Cord to the Motor Output Terminal Block (MOTOR OUT) securely. (Refer to P64 " 10. MOTOR CORD CONNECTION " section.)
	Incompatible Motor is connected to the CONTROLLER.	Connect the motor spindle that can be connected to the CONTROLLER. (Refer to P57 " 4. SYSTEM CHART Fig. 2 "section)
	Control Button (CTRL) is set to Manual mode but trying to start with an External Command Signal through Input / Output Connector A.	Start with the Start / Stop Button (START/STOP), or set the Control Button (CTLR) on the Control Panel to Auto mode.
	Control Button (CTRL) is set to Auto mode but trying to manually start with the Start Button (START/STOP) on the Control Panel.	Start with an External Command Signal or set the Control Button on the Control Panel to Manual mode. (When Start with an External Command Signal, refer to P79 " 15 - 1 (1) Details of External Input / Output Connector A Signal Table 15 Pin No. 14 ".)
	Emergency Stop Signal on External Input / Output Connector B is OFF (Open). (Only when the parameter P8 is set to on.)	Set Emergency Stop Signai to be "ON" (close).
	An Error has occurred. (Error LED is lit.)	Check P90 “ 16 - 2 Resetting System after Error Codes. Refer to Table 17 ”. Error will not be released until cause of the error has been removed.
	Low Air Pressure Signal activated or the Air Pressure Sensor is not connected.	Confirm the connection of the Air Pressure Sensor. (Refer to P65 " 11. CONNECTOR FOR AIR PRESSURE SENSOR " section.)

Trouble	Cause	Inspection / Corrective Active
Motor does not run.	The Motor and Motor Class Number are not correctly input.	Select the Motor Class Number consistent with the Motor being used.
No Control Panel functions.	Key Hold is enabled.	Release the Key Hold Button ( ).
When started the motor, “E.E” is displayed and motor does not rotate.	Emergency Stop Signal is OFF (Open).	Check the setting of parameter P8. (Refer to P101 “17 - 4 ⑧ P8 Selection of Emergency Stop Function” section.)
When starting the motor, “E7” is displayed and m otor does not rotate.	Low air pressure.	Adjust to the air pressure 0.25 – 0.35MPa.
	Air Pressure Sensor is not connected to the CONTROLLER.	After connecting the Air Pressure Sensor Connector to the CONTROLLER, secure the Air Pressure Sensor Connector using the Socket Head Screw. (Refer to P66 " 11 - 2 Wiring to the Connector for Air Pressure Sensor " section.)
	Wiring of the Air Pressure Sensor is not correctly corrected.	Correct the wiring to the Air Pressure Sensor Connector in accordance with the Air Pressure Sensor type. (Refer to P66 " 11 - 2 Wiring to the Connector for Air Pressure Sensor " section.)
Motor Speed is not displayed correctly.	Motor Fixed Speed is set in the parameter P3.	Release parameter P3. (Refer to P98 " 17 - 4 ③ P3 Setting Fixed Motor Speed " section.)
	The Maximum Motor Rotation Speed not more than desired Motor Rotation Speed set by parameter P4.	Setting the Maximum Motor Rotation Speed more than Motor Rotation Speed by parameter P4. (Refer to P99 " 17 - 4 ④ P4 Setting Maximum Motor Speed " section.)
	The Motor and Motor Class Number are not correct for the motor selected.	Select the Motor Class Number that is correct for the selected Motor.
	Incorrect setting of the Motor Rotation Speed as set by parameter P5.	Correct the value set in parameter P5.
Can not set the increase or decrease of the Motor Rotation Speed.	Motor Fixed Speed is set in the parameter P3.	Release parameter P3. (Refer to P98 " 17 - 4 ③ P3 Setting Fixed Motor Speed " section.)

Trouble	Cause	Inspection / Corrective Active
Can not set the increase or decrease of the Motor Rotation Speed.	Incorrect setting of the Motor Rotation Speed selected by parameter P5.	Setting the Motor Rotation Speed by selected Motor Speed Rotation set in parameter P5. If in AUTO, P2 is set to OFF, change P2 to ON.
Can not set the motor speed to its maximum allowable speed.	Either trying to set the value, more than the rotation speed of the connected motor, or the upper limit of the rotation speed is set by parameter P4.	Check the Maximum Motor Rotation Speed of the motor connected or Check the setting of parameter P4. (Refer to P99 " 17 - 4 ④ P4 Setting Maximum Motor Speed " section.)
	The Motor and Motor Class Number do not match the motor in use.	Verify and correct the Motor Class Number that it agrees with the Motor.
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 is bent.	Replace the tool.
	Cutting debris has contaminated the ball bearings.	Replace the ball bearings. (Return to NAKANISHI dealer service.)
	The spindle bearings has been damaged.	
Tool slippage.	Collet chuck or chuck nut are not correctly installed.	Check and clean the collet chuck and chuck nut. Reinstall the collet chuck and chuck nut.
	The collet chuck and the chuck nut are worn.	Replace the collet chuck and chuck nut.
High run-out.	The tool is bent.	Change the tool.
	Collet chuck is not correctly installed.	Secure the collet chuck and the chuck nut correctly.
	The collet chuck and the chuck nut are worn.	Replace the collet chuck and the chuck nut.
	Inside of the spindle is worn.	Replace the spindle shaft. (Return to NAKANISHI dealer service.)
	Contaminants inside the collet chuck and the chuck nut or the spindle.	Clean the collet chuck, chuck nut and the inside of the taper and spindle.
	The spindle bearings has 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 electrical components .

株式会社ナカニシ www.nakanishi-inc.com

本社・工場 〒322-8666 栃木県鹿沼市下日向 700
TEL : 0289(64)3380 FAX : 0289(62)5636

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

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

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