

E6040K

6040K SYSTEM

Operation Manual





OM-K0337E Rev. A





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1. General Warnings

- This operation manual contains procedures and precautions for the safe use of the E6040K system. Please read this manual carefully and follow the procedures to ensure years of trouble free operation.
- NAKANISHI Inc. assumes no responsibility for damage or injury resulting from uses other than those described in this manual.
- Please keep this manual available for reference whenever you are operating the E6040K.
- [ Warning] and [ Caution] are used in this manual at points where special care is needed to ensure safe operation.
- This operation manual refers to the motor-spindle as “Motor”.

Caution and Warning Marks

Mark	Degree of Danger of Damage or Injury
 Warning	This marking indicates that serious damage or injury may occur if proper care is not taken during operation.
 Caution	This mark indicates that damage to the system or unsatisfactory results may occur if care is not taken during handling and operation.

2. Operating Cautions

- The EMS-6040K is not a hand tool. It is designed to be used on a NC lathe or special purpose machine.
- Always use a protective cover around the spindle, wear safety glasses, dust mask and hearing protection whenever the motor is operating. Do not touch the spindle or tools while the spindle is running.
- Make sure that the collet chuck is firmly tightened prior to rotating the motor. If the collet chuck and chuck are not firmly tightened, the tool may be ejected during rotation resulting in injury.
- Check the tool shank and collet prior to use to ensure they are clean and free of burs. The introduction of foreign particles or metal chips into the collet or motor can cause damage and loss of precision.
- During long term continuous use do not exceed the limits described for continuous use on the Motor Speed-Torque Graph.
- Never exceed the maximum rated speed of the cutting tool as published by the cutting tool manufacturer.
- Mounted grindstones should be operated with a maximum overhang of 13mm. If 13mm overhang is exceeded, rotate the grindstone less than the manufacturer's maximum rated speed.
- Never use tools with cracks, bent shanks, runout, scratches, damage or sub-standard tools as they may shatter or explode and cause injury.
- Always dress grindstones prior to initial use.
- When grinding use, a maximum infeed step of 0.02mm or 0.01mm for single position grinding and reciprocate the spindle several times prior to the next infeed step.
- For drills, end mills or metal saws, never exceed the tool manufacturer's maximum recommended speed. If the maximum recommended speed is exceeded, the tool may shatter or explode and cause injury.
- Do not install in such a way as to cover the cooling fan intake holes. If the efficiency of the cooling system is compromised, the Unit may overheat and cause damage to internal components.

- The Centering function rotates the motor at 500rpm. This function is strictly for the purpose of centering the spindle and tool. It is not intended to be used for cutting or grinding.
- Do not give impact or shock to the control unit and the motor. Any impact to the flinger could deform or unbalance it, causing abnormal vibration.
- Do not disassemble, modify or attempt to repair the unit or motor as it will damage internal components and there are no user serviceable parts.
- Do not operate the unit with wet hands to avoid electric shock.
- Do not alter, connect or disconnect the AC power cord, motor connectors or other wiring while the power switch is on. Failure to follow this warning can result in electric shock, damage to components and injury.
- Do not use in area where flammable materials are present or explosive gases exist.
- Always check for alarm details when alarm LED flashes or alarm output signal is detected.
- When errors occur, check and correct the cause of the malfunction before continuing use. Failure to correct the problem will result in damage to the unit and motor.
- If smoke, noise or strange odors emanate from the unit or motors immediately turn off the power switch, disconnect and take to a NAKANISHI distributor for repair.

3. Features

- A high-speed brushless motor is used to achieve a maximum speed of 40,000rpm and eliminate the nuisance of brush maintenance.
- Speed control and protection functions utilize a high performance microprocessor.
- Automatic control and monitoring of motor functions are possible.
- Maximum of 4 motors can be controlled sequentially from the control unit enabling multi-motor applications.
- Wide speed range, 2,000~40,000rpm, and highly accurate speed control makes high precision machining possible.
- High power output of 600W makes heavy duty machining possible.
- The motor housing is made of Stainless Steel (SUS-416), precision ground to 60mm making the motor very versatile and easy to mount on NC or special purpose machines.
- Wide range of collet chucks are available.

4. Specifications

• Unit

Model		NE123
Power Requirements		Single Phase 200~240V 50/60Hz
Speed Range		1) 2,000~40,000rpm 2) 500rpm (for centering only)
Control Signal	Input	Photocoupler Connection 5 Analog Connection 1
	Output	Photocoupler Connection 6 Analog Connection 3
Protection Circuits		Over-Voltage, Over-Current, Over-Load, Sensor Malfunction, Overheat, Brake Malfunction, Spindle Lock, Low Air Pressure, Unit Power Source Malfunction, Start-Up Error, Over-Speed
Power Consumption		750W
Current Consumption		8A
Weight		15.0kg
Dimensions		W430 X D487 X H177mm

Table 1

• Motor

Model		EMS-6040K
Speed Range		1) 2,000~40,000rpm 2) 500rpm (for centering only)
Peak Power Output		600W
Continuous Power Output		400W
Collet Chucks and Attachments		Collet Chucks Standard Size: 6.0mm, 6.35mm USA Optional Size: 0.5mm~6.0mm in 0.1mm increments 2.35mm, 3.175mm Attachments: Drill Chuck Arbor (Jacobs 0 Taper) Metal Saw Arbor Grindstone Axis
Cooling Air Consumption		130 NI/min at 0.5MPa
Weight		4.1kg (with motor cord)
Dimensions		L176.5 X ϕ 60mm

Table 2

5. Motor Speed-Torque Graph

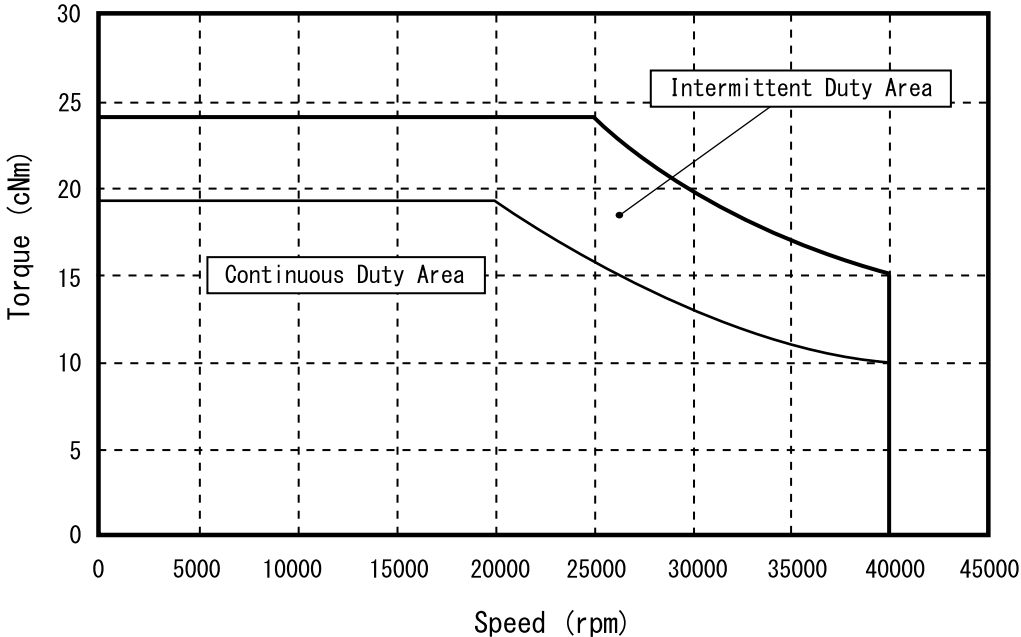


Fig 1

6. Nomenclature

▪ System

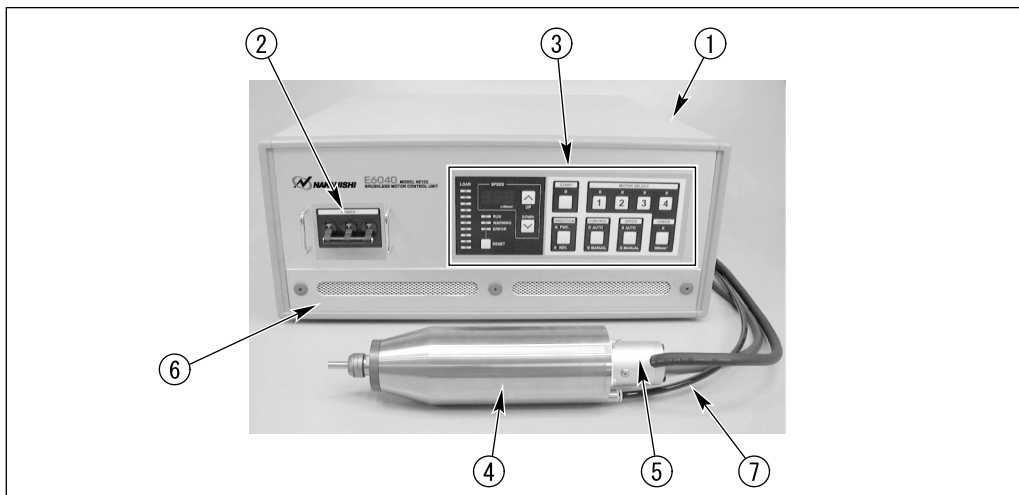


Fig 2

- ① Unit
 - Model NE123
- ② Power Switch
 - Power Switch with built-in circuit breaker. Power will be automatically cut when current draw exceeds maximum safe limits.
- ③ Control Panel
 - (P8, Fig 3)
- ④ Motor
 - EMS-6040K
- ⑤ Motor Cord
 - Connect the Motor cord to the motor and Motor Connectors ②① located on the back of the unit.
- ⑥ Front Panel Filter
 - Air intake filter for unit air-cooling. Periodic cleaning is required.
(See Section P26, No. 19)
- ⑦ Air Hose for Motor Cooling
 - Connect the air hose to the Cooling Air Output Connectors ②② on the back of the unit and motor.

• Control Panel

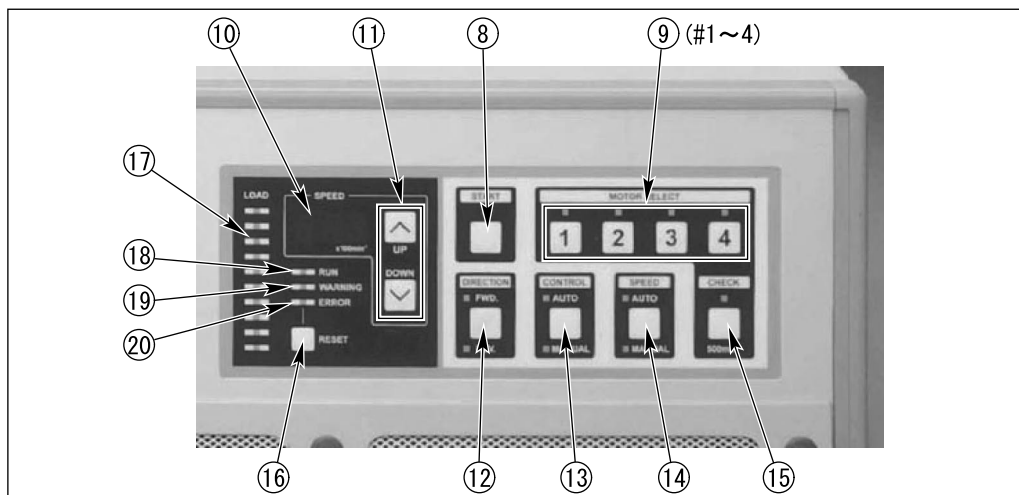


Fig 3

- ⑧ Start Switch (START)
 - Starts and Stops the motor.
- ⑨ Motor Select Switch (MOTOR SELECT)
 - Selects the Motor to be controlled 1 through 4.
- ⑩ Digital Speed Indicator (SPEED)
 - Preset Speed, Actual Speed, Warning and Error Codes are displayed to 3 digits. When the motor is stopped, the Preset Speed is displayed. When the motor is rotating, the actual speed is displayed.
- ⑪ Speed Adjustment Switch (UP, DOWN)
 - Rotating speed can be controlled in 100rpm increments (2,000~40,000rpm). If this switch is depressed while the motor is running, the Digital Speed Indicator ⑩ briefly displays the Preset Speed.
- ⑫ Forward/Reverse Switch (DIRECTION)
 - This switch controls the direction of rotation, forward (FWD) or reverse (REV). Forward rotation is counter-clockwise rotation when looking from the output axis side.
- ⑬ Auto/Manual Motor Control Switch (CONTROL)
 - This switch selects motor control from the Control Panel or from an external source.
 - Manual : Control Panel ③
 - Auto : External control through the External Input/Output Connector ⑳.
- ⑭ Auto/Manual Speed Control Switch (SPEED)
 - This switch selects motor speed control from the Control Panel or from an external source.
 - Manual : Speed Adjustment Switch (UP, DOWN) ⑪
 - Auto : External control through the External Input/Output Connector ⑳.

- ⑮ Centering Mode Switch (CHECK)
-This switch activates the centering mode, which maintains a constant 500rpm spindle speed for centering the tool.
- ⑯ Reset Switch (RESET)
-This switch resets and allows restarting of the motor after an error has been corrected. Some error codes will not allow the unit to be reset until after the power switch has been turned off.
- ⑰ Load Monitor LED (LOAD)
-The motor/spindle load is displayed by 10 LED's (7 Green and 3 Red). Continuous operation is possible with upto all 7 green LED's lit. If any of the red LED's are lit, the motor can only be run for a short time. Please refer to Section 15 Error Codes and Corrections part 3 of this manual for allowable duration of high load operation. When any of the red LED's are lit, the Warning LED (WARNING) ⑲ will flash, if this condition is continued beyond the allowable interval, the Error LED (ERROR) ⑳ will flash and the motor will be shut down.
- ⑱ Rotating LED (RUN)
-This LED indicates if the motor is rotating or not. When the motor is rotating, the LED is lit.
- ⑲ Warning LED (WARNING)
-The operating and working conditions of the system are constantly monitored and this LED blinks when a hazardous condition has been detected. When a hazardous condition is detected, the LED blinks and the Digital Speed Indicator ⑩ alternates between the warning code and the actual or preset speed, depending on whether or not the motor is rotating.
- ⑳ Error LED (ERROR)
-When a serious problem with the system is detected this LED blinks, the motor is shut down and the Digital Speed Indicator ⑩ displays the error code.

• Rear Panel

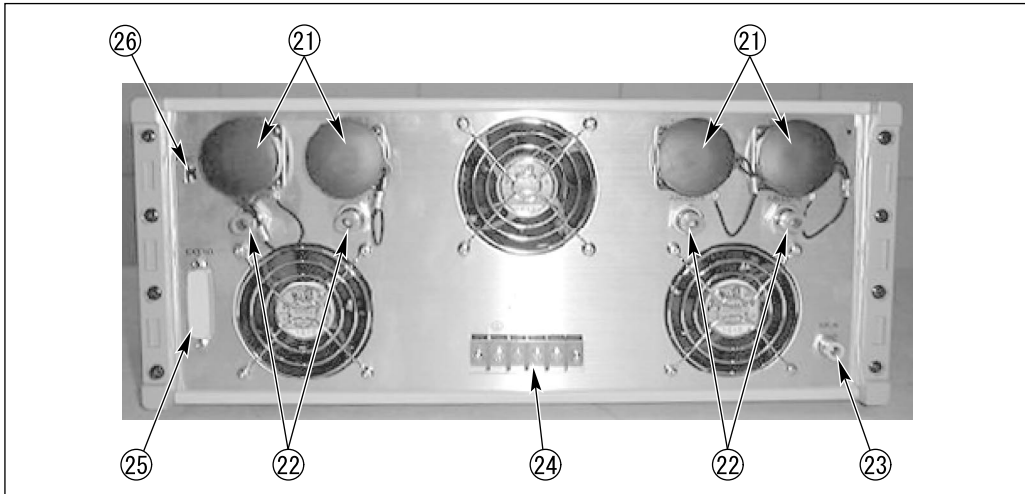


Fig 4

- ②① Motor Connectors
 - A maximum of 4 motor can be connected. The connectors are protected by dust covers. Keep these in place whenever the connector is not being used to avoid damage to the connector or unit. (P16, No.9)
- ②② Cooling Air Output Connector
 - This connector supplies cooling air to the motor. (P16, No.10)
- ②③ Cooling Air Input Connector
 - This connector is for the incoming air supply from your compressor. This must be clean, dry air, regulated to 0.5MPa with a dew point of less than 5°C at 1 atmosphere pressure. (P16, No.10)
- ②④ AC Power Terminal
 - Single Phase AC200~240V (P17, No.11)
- ②⑤ External Input/Output Connector
 - This connector allows external inputs for automatic control and output for monitoring of system operating conditions. (P12, No.8)
- ②⑥ Output Signal Reversing Switch
 - This switch reverses the error and warning code output signals between ON (close) and OFF (open)
 - Switch in the down position : Warning or Error Code Signal ON (close)
 - Switch in the up position : Warning or Error Code Signal OFF (open)

7. Motor Dimensions

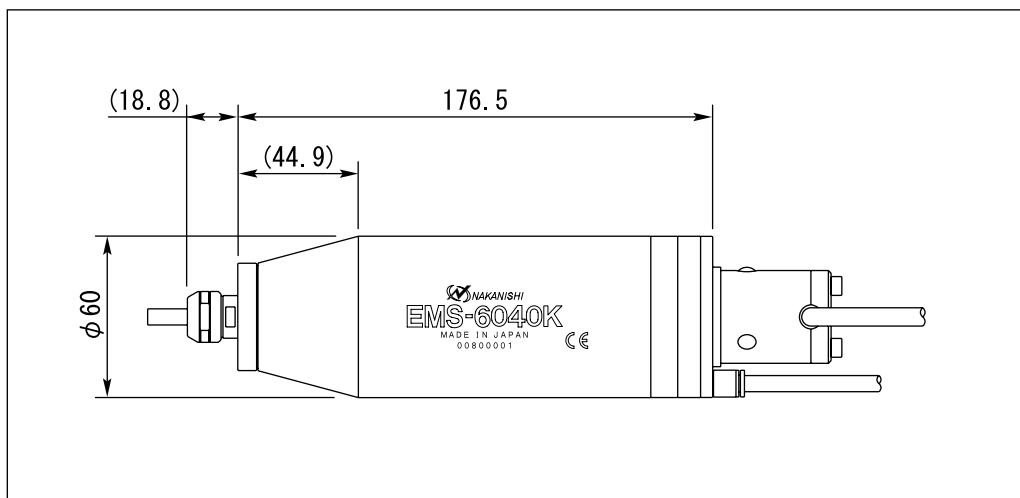


Fig 5

8. External Input/Output Signal Specifications

(1) External Input/Output Signal Connectors

Terminal No.	Terminal Marking	Description	Input/Output	Signal	Function
1	COM	24Vdc Power Source for External Control Inputs	Input	DC24V or External GND	Power Source to be used for External Inputs DC24V or External GND is connected to terminal No.1
2	DIR_IN	Rotating Direction Signal	Input	OFF (open): Forward ON (close): Reverse	Controls the direction of rotation of the motor
3	SEL_B	Motor Select Signal B	Input	See Pg13 Table 4	Selects the motor
4	OP_IN1	Reserved Signal	—	—	Reserved Signal DO NOT USE
5	OP_IN3	Reserved Signal	—	—	Reserved Signal DO NOT USE
6	RUN	Rotating Signal	Output	ON (close): Rotating OFF (open): stopped	Voltage output shows that the motor is rotating
7	DIR_OUT	Rotating Direction Signal	Output	OFF (open): Forward ON (close): Reverse	Voltage output shows the direction the motor is rotating
8	ERR	Error Signal	Output	(※1)	This output shows an Error has occurred. The Error Code is shown on the Digital Speed Indicator
9	OP_OUT1	Reserved Signal	—	—	Reserved Signal DO NOT USE
10	GND	GND for External Control Input	Output	Internal GND	Internal GND (※2)
11	VCC	DC10V Power Source for External Control Inputs	Output	DC10V	Power Source for External Speed Control Signal
12	MOTOR_I	Motor Current Monitor	Output	DC0~10V 0V: 0A 10V: 20A	Voltage Output shows the motor's current consumption. Output voltage is proportional to the motor current consumption
13	GND	GND for External Monitoring Signal	Output	Internal GND	Internal GND (※2)
14	START	Rotate Command Signal	Input	ON (close): Rotate OFF (open): stop	Starts and Stops motor rotation
15	SEL_A	Motor Select Signal A	Input	See Pg13 Table 4	Selects the motor
16	CHECK_SPD	Rotates Motor at Centering Speed	Input	ON (close): 500rpm OFF (open): Normal Operation	Maintains constant 500rpm motor speed for centering
17	OP_OUT2	Reserved Signal	—	—	Reserved Signal DO NOT USE
18	-COM	External Power Source GND	Input	External GND	Connect to GND of external Power Source (※2)
19	PULSE	Rotating Pulse	Output	1 pulse/rotation	1 revolution of the motor generates one pulse. Duty 50%
20	WARNING	Warning Signal	Output	(※1)	This output shows a Warning has occurred. The Warning Code is shown on the Digital Speed Indicator
21	COIN	Speed Achievement Signal	Output	ON (close): Set Speed OFF (open): Speed Not Achieved	Voltage output shows that the motor has achieved more than 90% of the set speed.
22	OP_OUT2	Reserved Signal	—	—	Reserved Signal DO NOT USE
23	VR	Rotating Speed Command Signal	Input	DC0~10V 0V: 2,000rpm 8V: 40,000rpm	Controls the rotating Speed from an external source. Rotating Speed and the command voltage is a linear relationship in 100rpm increments
24	LOAD	Load Monitor	Output	DC0~10V 0V: 0% 10V: 200%	Voltage Output shows the load on the motor
25	MOTOR_V	Motor Voltage Monitor	Output	DC0~10V 0V: 0V 10V: 100V	Voltage Output shows the voltage being applied to the motor

Table 3

※1. The warning and error code output signal vary depending on the position of the Output Signal Reversing Switch (26). Warning and error code output signal is ON (close) when the switch is in the down position and OFF (open) when the switch is in the up position.

※2.

 Caution
Do Not Connect terminals 10 & 13 (Internal GND) to Terminal 18 (External GND)

• Automatic Motor Selection SEL_A, SEL_B Signals

Motor to be Run	SEL_A	SEL_B
Motor #1	OFF (open)	OFF (open)
Motor #2	OFF (open)	ON (close)
Motor #3	ON (close)	OFF (open)
Motor #4	ON (close)	ON (close)

Table 4

(2) External Input/Output Circuit

• Input Signals

There are 5 kinds of input signals: rotation command, rotation direction, motor selection A/B, centering rotation speed command. These signals are DC+24V signals from an external power source. Please use a separate power source that is capable of supplying DC+24V±10%, 25mA (5mA/ 1circuit). Refer to Fig 6 for connections.

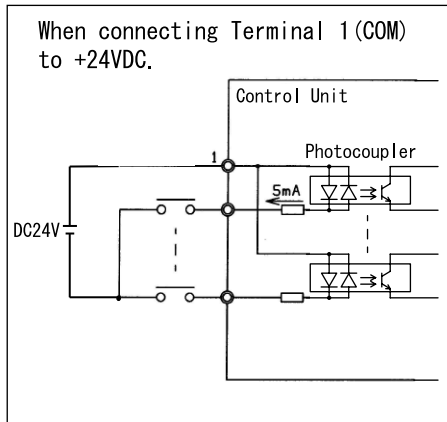


Fig 6.1

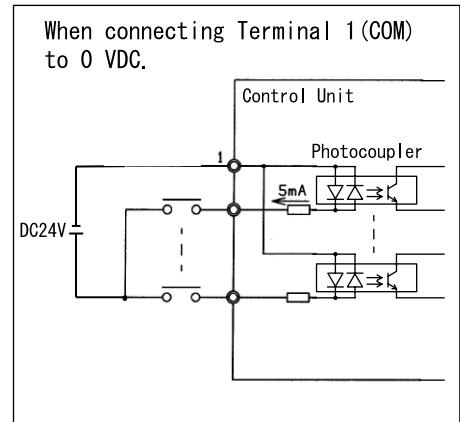


Fig 6.2

• Output Signals

There are 6 kinds of output signals: rotating, rotating direction, rotating pulse, rotating speed achieved, warning, and error. These signals are pulsed transistor activation signals.

Voltage and Current Specifications

● Applied Voltage (V_{max}) \leq DC+30V

● Working Current (I_p) \leq 100mA

Use an external power source for output circuits. It is recommended to use the same DC+24V power source used for input signals. Please refer to Fig 7 for connections.

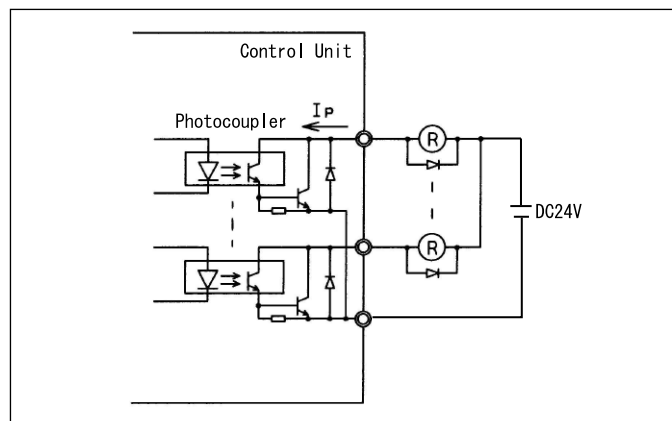


Fig 7

• Rotating Speed Command Circuit

Connect as shown in Fig 8.

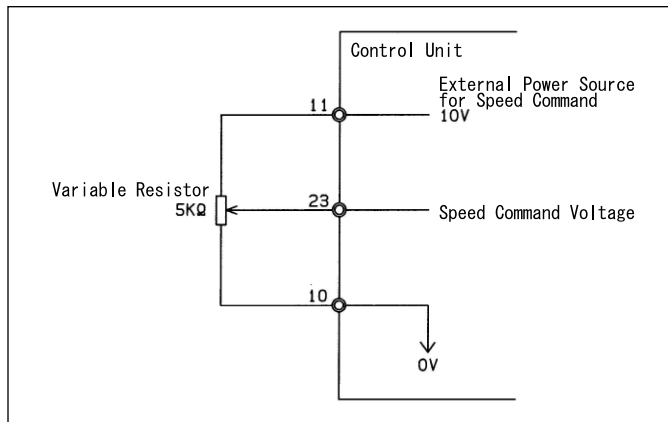


Fig 8

• Monitoring Signals

There are 3 kinds of monitoring signals: motor current consumption, motor voltage, and load. Please refer to Fig 9 for connections.

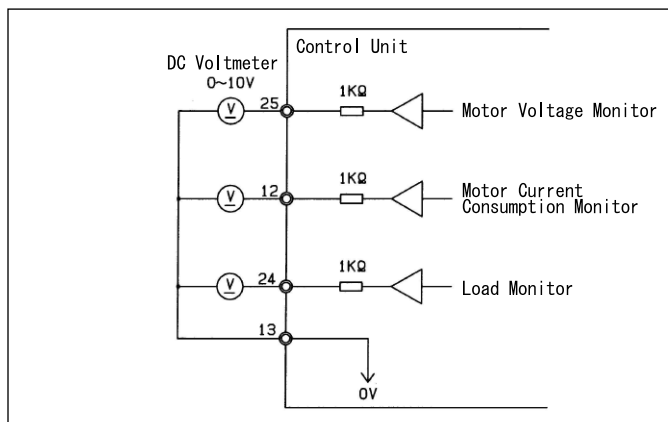


Fig 9

(3) External Input/Output Signal Connector Specifications

Manufacturer: OMRON
 Part No. : XM3B-2522-502
 Plug No. : XM2A-2501 (or equivalent)
 Cover No. : XM2S-2512 (or equivalent)

- Assemble appropriate plug and cover.
- Use shielded cable to prevent RF noise interference. Connect the cable shielding to the cover.
- Types of covers may vary depending on manufacturer.

9. Connecting Motor Cord

Securely connect the female connector of Motor Cord (5) to the back end of Motor Spindle with 4 pieces of Hex. socket head screws. Insert the male connector into Motor Connector (21) at the back of Control Unit and fasten the locking ring. Be sure to align the shapes and insert the connector. (Fig. 10)

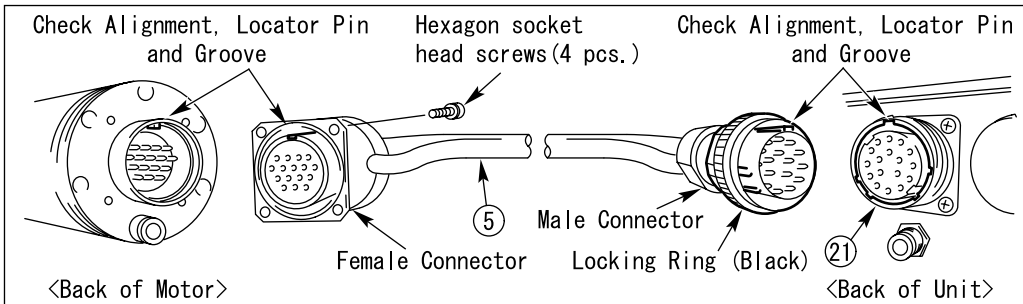


Fig 10

10. Connecting Air Hose

- 1) Connect one end of the Air Hose for Motor Cooling (7) to the cooling air connector on the back of the motor and the other end to the Cooling Air Output Connector (22) on the back of the unit as shown in Fig 11.

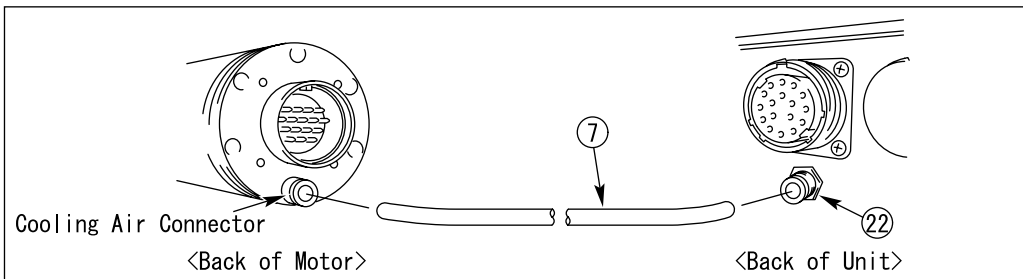


Fig 11

- 2) Connect the provided incoming Air Hose to the Cooling Air Input Connector (23) on the back of the unit and supply regulated **CLEAN, DRY AIR**

⚠ Caution

- The air supplied to the Cooling Air Input Connector (23) must be connected to an air dryer regulated to (0.5MPa). Dust or moisture in the air lines will severely shorten the service life of the motor.

- Air must be supplied at (0.5MPa) the system is designed not to operate without sufficient air supply.
- Air supplied from the air dryer must have a dew point of less than 5°C at atmospheric pressure.
- Air hose OD is 6mm.

11. Connecting AC Power Cord

⚠ Caution

Do not connect to power source (wall socket or distribution panel) before connecting the power cord to the AC Power Terminal ②④. Be Sure to turn off the power switch and air supply during AC power connections.

- 1) Use the provided screws to firmly fasten the AC power cord to the AC Power Terminal ②④ on the rear of the control unit as shown in Fig 12.

⚠ Caution

If the AC power cord fastening screws are not fastened firmly, the AC power cord may come loose or overheat causing possible danger of electric shock or other injury.

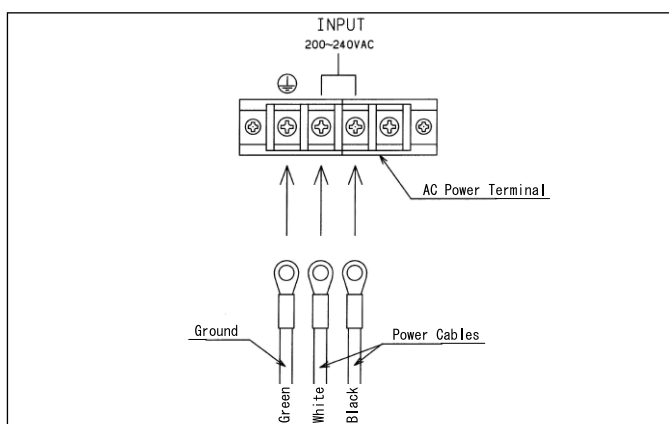


Fig 12

- 2) Connect wall socket or distribution panel end of the AC Power Cable to appropriate plug. Use a plug of minimum AC20A capacity.
- 3) Rated Voltage: AC200~240V Single Phase.
- 4) To prevent electric shock danger, be sure to properly ground the Earth terminal.

⚠ Caution

Electric shock hazard exists if the Earth Terminal is not properly grounded.

⚠ Caution

Failure to properly ground the Earth Terminal may cause the control unit to be overly susceptible to RF noise or increase the control units generation of RF noise.

- 5) Be sure to install the AC Power Terminal Cover after connecting the AC Power Cord, prior to connecting the AC Power Cord to the power supply to prevent risk of electrical shock.
 - Route the power cable to the AC Power Terminal ②④ in such a way as to prevent accidental snagging or force being applied to the cable.
 - The provided AC Power Cable is 4m long.

12. Bracket Mounting

For rack mounting use the brackets listed below and mount as shown in Fig 13.

- Bracket : MSM-177G (Takachi Electric)

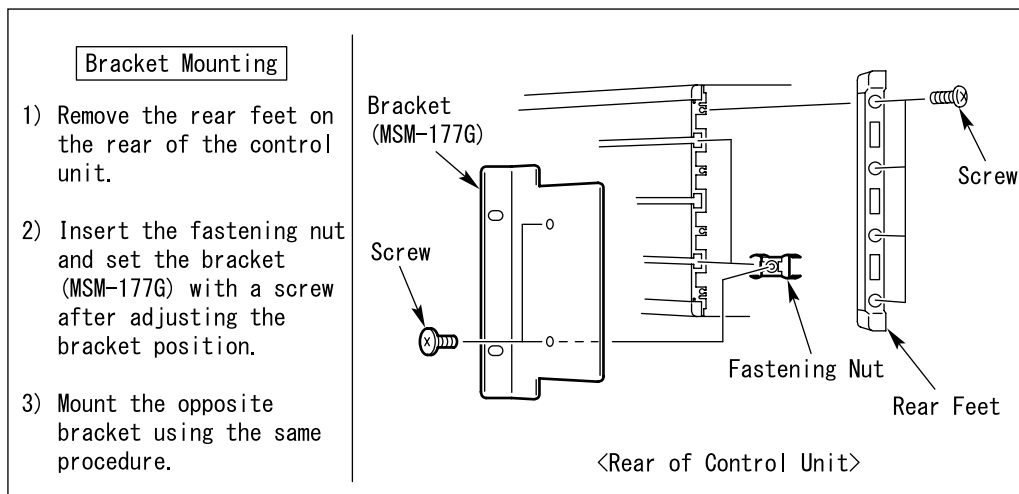


Fig 13

13. Break-In Procedure

The EMS-6040K is a high-precision, high-speed motor, the following procedure must be followed to ensure proper operation and longevity.

During transportation, storage or installation, the grease inside the bearings will settle. If the motor is suddenly run at high-speed, excessive heat will cause bearing damage. After installation, repair, initial operation, or long periods of non operation please follow the break-in procedure detailed in Table 5.

Steps	1	2	3	4
rpm	12000	24000	32000	40000
Running Time	15 Min	10 Min	10 Min	15 Min
Items to Check	No Abnormal Noises.	Spindle Housing no hotter than 20°C. If hotter than 20°C check installation and restart Break-In procedure.	Spindle Housing no hotter than 20°C. If hotter than 20°C stop for at least 20 minutes, check installation and restart Break-In procedure.	Spindle Housing less than 20°C.

Table 5

14. Operating Procedures

(1) Manual Operation

1. Turning the Control Unit On

- Turn the Power Switch (POWER) ② ON.
- Buzzer sounds and the LEDs on the Control Panel ③ illuminate.
- Digital Speed Indicator ⑩ shows the preset speed.

2. Selecting Control Mode, Rotational Speed

- Select Manual on the Auto/Manual Motor Control Switch (CONTROL) ⑬.
- Select the method of controlling rotating speed with the Auto/Manual Speed Control Switch (SPEED) ⑭.
 - Manual : Speed Adjustment Switch (UP, DOWN) ⑪.
 - Auto : External Signal connected to the External Input/Output Connector ⑫ on the rear of the control unit.

3. Motor Selection

- Select the motor to be used with the Motor Select Switch (MOTOR SELECT) ⑨.
More than 1 motor may not be run simultaneously.

4. Selecting Rotational Direction

- Select the rotating direction with the Forward/Reverse Switch (DIRECTIN) ⑫.
FWD:Counter-Clockwise direction, REV:Clockwise direction.
(Looking from the output axis side).

5. Rotating Speed Setting

- Control Panel ③ Operation, In the case that the Auto/Manual Speed Control Switch (SPEED) ⑭ is set to Manual, speed is set using the Speed Adjustment Switch (UP, DOWN) ⑪.
- External Control Signal Operation, in the case that the Auto/Manual Speed Control Switch (SPEED) ⑭ is set to Auto, the rotating speed is set with a command voltage on (Terminal 23: VR) on the External Input/Output Connector ⑫.
Speed: 0V=2,000rpm 8V=40,000rpm
- Preset Speed is shown on the Digital Speed Indicator ⑩. The speed is indicated in 100rpm increments with a range from 2,000~40,000rpm.
(When the rotating speed is 40,000rpm the indicator shows 400.)
- For Centering, select Centering rotation on the Centering Switch (CHECK) ⑮.
Rotating speed is held at constant 500rpm. Do not attempt to machine with spindle operating in Centering Mode.

6. Starting

- Push the Start Switch (START) ⑧ to start rotation.
The Digital Speed Indicator ⑩ shows the actual rotating speed.
The Digital Speed Indicator indicates in 100rpm increments.

(2) Automatic Operation with External Control Signals

1. Initializing Command Signal

- Apply OFF(open) to Rotate Command Signal (Terminal 14: START) on the External Input/Output Connector (25).
- If Rotate Command Signal (Terminal 14: START) is ON when the Power Switch (2) is ON the Auto/Manual Moter Control Switch (13) is switched from Internal to External, the error code E10 is displayed in the Digital Speed Indicator (10).

2. Turning the Control Unit On

- Turn the Power Switch (POWER) (2) ON.
- Buzzer sounds and the LEDs on the Control Panel illuminate.
- Digital Speed Indicator (10) shows the preset speed.

3. Selecting Auto Control and Auto or Manual Speed Control

- Select Auto on the Auto/Manual Control Switch (CONTROL) (13).
- Select Auto or Manual speed control on the Auto/Manual Speed Control Switch (SPEED) (14).
 - Manual : Speed Adjustment Switch (UP, DOWN) (11).
 - Auto : External Signal connected to the External Input/Output Connector (25) on the back of the control unit.

4. Selecting the motor

- Select the motor using the Motor Selecting Signal on (Terminal 15: SEL_A and Terminal 3: SEL_B) on the External Input/Output Connector (25).
- Refer to Table 4 on Page 13.

5. Selecting the Direction of Rotation

- Select the rotating direction using the rotating direction set signal (Terminal 7: DIR_OUT) on the External Input/Output Connector (25).
- Forward Rotation is OFF(open) and Reverse is ON(close).

6. Setting Rotating Speed

- Control Panel (3) Operation, in the case that Auto/Manual Speed Control Switch (SPEED) (14) is set to Manual, speed is set using the Speed Adjustment Switch (UP, DOWN) (11).
- External Control Signal Operation, in the case that Auto/Manual Speed Control Switch (SPEED) (14) is set to Auto, the rotating speed is set with a command voltage on (Terminal 23: VR) on the External Input/Output Connector (25).
Speed: 0V=2,000rpm 8V=40,000rpm
- Preset Speed is shown on the Digital Speed Indicator (10). The speed is indicated in 100rpm increments with a range from 2,000~40,000rpm. (When the rotating speed is 40,000rpm the indicator shows 400.)
- For Centering, turn ON(close) the Terminal 16: (CHECK_SPD) of External Input/Output Connector (25). Rotating speed is held at constant 500rpm rotation. Do not attempt to machine with spindle operating at 500rpm.

7. Starting the Motor

- Apply to ON(close) (Terminal 14: START) on the External Input/Output Connector (25).

(3) Preset Condition Resume Function

Resumes the Control Panel settings prior to power being turned OFF. When restarting operation there is no need to reset the Control Panel the Control Unit will restart with the same settings as when power was shut down. When the Auto/Manual Motor Control Switch (CONTROL) (13) is set to Auto only the Auto setting is maintained. In Manual Mode the following settings are maintained.

- Setting of Auto/Manual Motor Control Switch (CONTROL) (13)
- Setting of Speed Adjustment Switch (UP, DOWN) (11)
- Setting of Motor Select Switch 1~4 (MOTOR SELECT) (9)
- Setting of Speed Setting for Motors 1~4
- Setting of Forward/Reverse Switch (DIRECTION) (12)
- Setting of Centering Mode Switch (CHECK) (15)

15. Protect Function

(1) Warning Function

The Control Unit, Motor, Cooling Air flow, and operating conditions are constantly monitored. If a non-critical problem happens when motor is rotated or abnormal condition exists when motor is stopped, the Warning LED flashes and the Warning Code appears in the Digital Speed Indicator (10).

- Warning LED (WARNING) (19) flashes.
- Digital Speed Indicator (10) indicates the warning code, shown in Table 6.
- Warning Signal is output to the warning signal (Terminal 20: WARNING) of the External Input/Output Connector (25).

Indication	Warning Mode	Trouble
A0	Motor Cord	Motor Cord, Power Cable or Connector disconnected
A1	Low Air Pressure	Air Pressure Inadequate
A2	Control Unit Temperature	Internal Temperature of the Control Unit too High
A3	Over Load	Motor load exceeding safe limits

Table 6

- During Auto operation be sure to check the Warning Code on the Digital Speed Indicator (10) a warning signal is detected on Terminal 20 of the External Input/Output Connector (25).

(2) Error Function

The Control Unit, Motor, Cooling Air flow, and operating conditions are constantly monitored. If hazardous conditions exist the Error LED flashes and the Error Code appears in the Digital Speed Display.

- Error LED (ERROR) (20) flashes.
- Error Code shown in Table 7 is displayed in the Digital Speed Indicator (10).
- Error Signal is output to the error signal Terminal 8 (ERR) of the External Input/Output Connector (25).

Control Unit is reset by depressing the Reset Switch (RESET) (16) on the Control Panel.

Indication	Problem Area	Trouble
E 1	Over-Current	Motor Current beyond safe limits
E 2	Over-Voltage	Motor Voltage beyond safe limits
E 3	Motor Sensor	Trouble with the sensor signal in the motor
E 4	Control Unit Overheat	Internal Temperature of the Control Unit too High
E 5	Brake Circuit Trouble	Trouble with the motor brake circuit
E 6	Rotor Lock	Motor stalled for more than 3 seconds
E 7	Low Air Pressure	Inadequate air supplied for more than 4 seconds
E 8	Over-Load	Load limits exceeded for too long a period of time. See (3) on Page 23
E 9	Trouble with Power Source	Trouble with the power source inside the control unit
E 10	External Start Error	External control sequencing problem
E 11	Over Speed	Rotating speed is beyond the set speed for too long
E 12	Internal Memory Problem	Trouble with memory (EEPROM)

Table 7

- During Auto operation, be sure to check the Error Code on the Digital Speed Indicator (10) when an Error Signal is detected on Terminal 8 of the External Input/Output Connector (25).
- Error Codes E4 (Control Unit Overheat), E5 (Brake Circuit Trouble), E9 (Trouble with Power Source), and E12 (Internal Memory Problem) can not be reset with the Error Reset Switch (RESET) (16). Turn the Power Switch (2) Off and On again after eliminating the cause of the error.

(3) Over-Load

When the Load Monitor LED (LOAD) ⑰ lights 8 or more LED's (7 green LED's and 1 or more red LED's) an overload condition exists. During overload operation the following occurs.

- Warning LED (WARNING) ⑲ flashes.
- Warning Code A3 is displayed on the Digital Speed Display ⑩.
- Warning Signal is output to the warning signal Terminal 20 (WARNING) of the External Input/Output Connector ⑳.

Overload operation is considered short term operation mode. The allowable operation time depends on the number of lighted LED's on the Load Monitor LED (LOAD) ⑰. The allowable time is detailed below.

- Load Monitor LED 8 LED's : 40 Seconds
- Load Monitor LED 9 LED's : 20 Seconds
- Load Monitor LED 10 LED's : 10 Seconds

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

- Error LED (ERROR) ㉑ flashes.
- Error Code E8 is displayed in the Digital Speed Indicator ⑩.
- Error Signal is output to the error signal Terminal 8 (ERR) of the External Input/Output Connector ㉒.

16. Changing Tools

- 1) Place the provided 14mm spanner on the spindle shaft.
- 2) Place the provided 16mm spanner on the collet nut and turn counterclockwise. Turn the collet nut until the tool can be removed.
- 3) Insert the new tool into the collet and turn the collet nut clockwise to fasten the tool. (Fig 14)

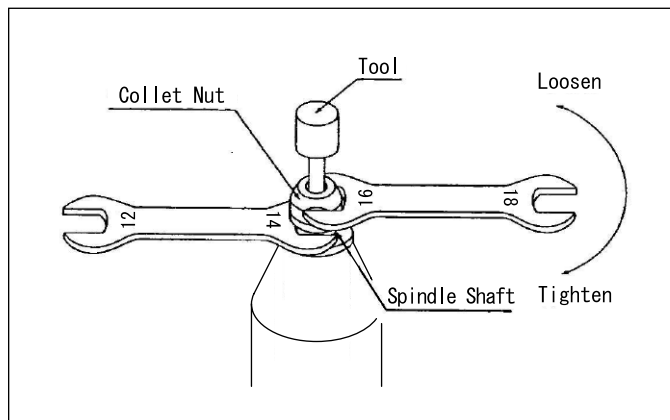


Fig 14

17. Changing Collet Chucks

- 1) Follow the Changing Tools procedure described above; keep turning the collet nut with the tool mounted until the collet chuck comes out of the motor ④. (Fig 15)
- 2) Hold the collet nut in your fingers and apply pressure diagonally until the collet snaps out of the collet nut. (Fig 16)
- 3) Insert the new collet chuck into the collet nut diagonally making sure the slit in the collet nut engages in the collet nut internal flange. Push straight down on the collet nut until the collet chuck snaps in place.

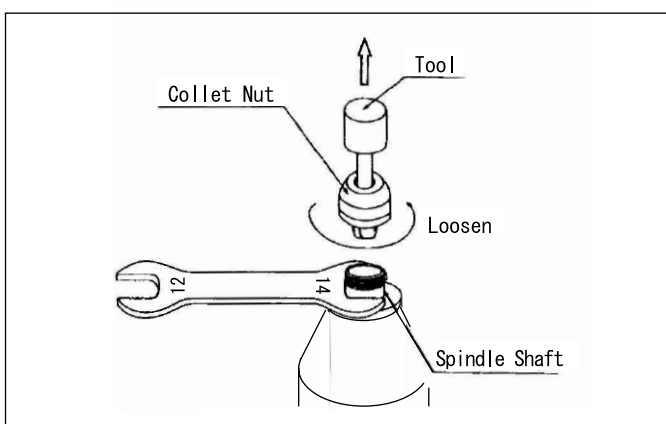


Fig 15

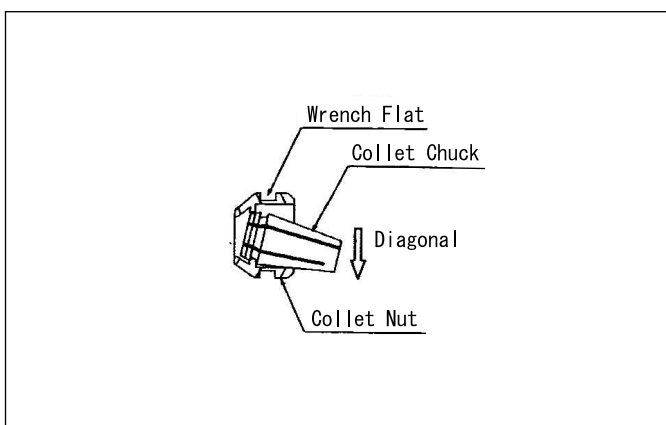


Fig 16

18. Installing Motor

Install the motor using a split clamp as shown in Fig 17. If this is not possible install as shown in Fig 18.

Do not install the motor with set screws in direct contact with the motor body as shown in Fig 19, this can deform the motor body and cause overheating and premature failure of the motor.

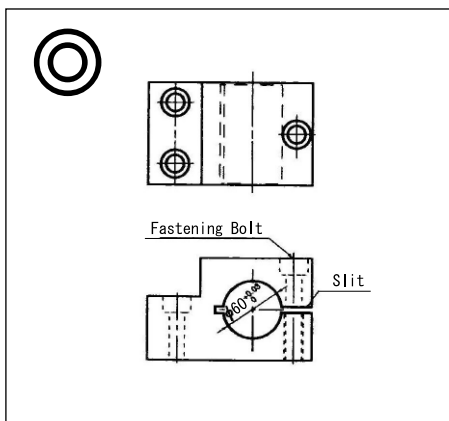


Fig 17

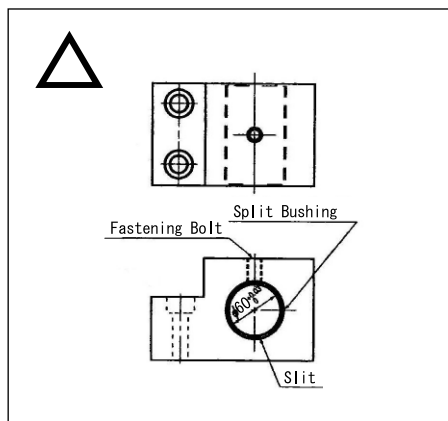


Fig 18

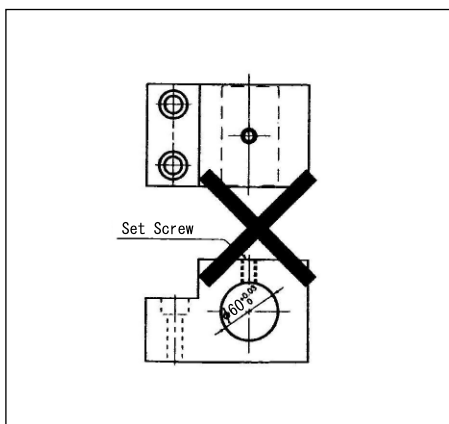
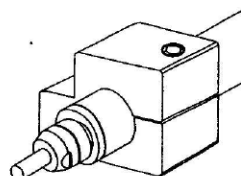


Fig 19



19. Cleaning the Front Panel Filter

⚠ Caution

Before removing the Front Panel Filter (6), be sure to turn the Power Switch (2) OFF.

- 1) Remove the Front Panel Filter (6) by removing the 3 push turn rivets. (Fig 20)
The turn part of the rivet is released by a small turn; there is no need to remove the screw part.
- 2) Clean the screen with a brush.
If the Front Panel Filter (6) is very dirty it can be washed. DO NOT reinstall the Front Panel Filter (6) until it is completely dry.
- 3) When installing the Front Panel Filter (6) into the control unit, push in the push turn rivet with light finger pressure, then screw in the screw part.

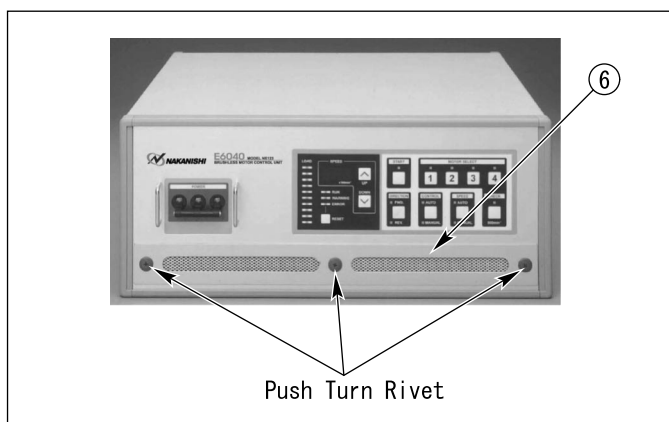


Fig 20

20. E6040K System Chart

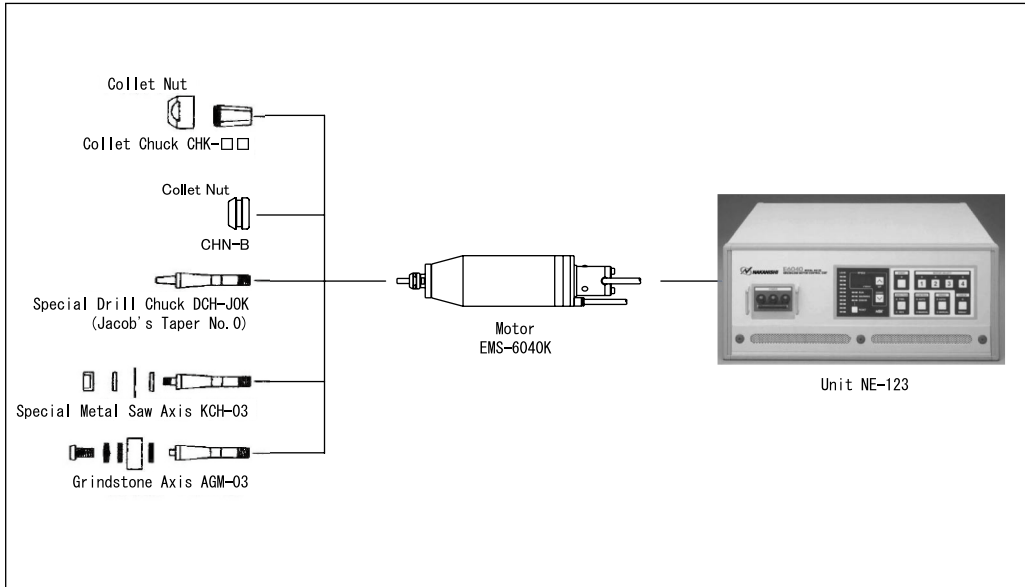


Fig 21

21. Parts List

• Collet Chuck List

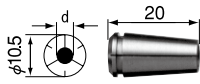

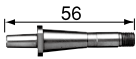
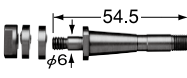
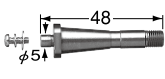
Product	Model	Internal Diameter d (Unit:mm)
	CHK-□□ I. D. =d	$\phi 2.35, \phi 3.0, \phi 3.175, \phi 6.0, \phi 6.35$ $\phi 0.5 \sim \phi 5.9$ in 0.1mm increments
	CHN-B	

Table 8

• Special Axis List

Product	Description-Model
	Special Drill Axis DCH-JOK For Jacob's Taper No.0 Drill Chuck Run-Out : Less than 0.05mm
	Special Metal Saw Axis KCH-03 For Metal Saw $\phi 6.0$ I. D. X $\phi 30$ mm O. D. Run-Out : Less than 0.02mm
	Grindstone Axis AGM-03 Run-Out : Less than 0.02mm For grindstones $\phi 5.0$ mm I. D.

※ In addition to the $\phi 6$ mm special metal saw axis, $\phi 5$ mm and $\phi 8$ mm are also available.

Table 9

22. Troubleshooting

Trouble	Cause	Inspect-Corrective Action
Motor Does Not Run	Power is not supplied	Check the AC Power Terminal ⑳ on the back of the unit
	Motor Cord ⑤ Connector Disconnected	Connect the Motor Cord ⑤ to the connector or check the Motor Cable
	Auto/Manual Motor Control Switch (CONTROL) ⑬ is set to Manual but trying to start with external signal through the External Input/Output Connector ㉕	Start with the Start Switch ⑧ on the Control Panel. Or set the Auto/Manual Motor Control Switch (CONTROL) ⑬ to Auto
	Auto/Manual Motor Control Switch (CONTROL) ⑬ is set to Auto but trying to start with the Start Switch (START) ⑧ on the Control Panel	Start with an external command signal or set the Auto/Manual Control Switch (CONTROL) ⑬ to Manual
	Motor ④ is not connected to the selected Motor Connector ㉑	Connect the motor ④ to the selected Motor Connector ㉑
	Low Air Pressure	Check the air pressure and adjust the air pressure to 0.5MPa
	Error Code Indicated	Check and correct the Error Code
Motor does not reach the preset speed	Auto/Manual Speed Control Switch (SPEED) ⑭ is set to Manual but trying to set speed with Speed Command Signal through the External Input/Output Connector ㉕	Set the speed with the Speed Adjustment Switch (UP, DOWN) ⑪ or set the Auto/Manual Speed Control Switch (SPEED) ⑭ to Auto
	Auto/Manual Speed Control Switch (SPEED) ⑭ is set to Auto but trying to set speed with Speed Adjustment Switch (UP, DOWN) ⑪	Set the speed with the external signal through the External Input/Output Connector ㉕ or set the Auto/Manual Speed Control Switch (SPEED) ⑭ to Manual
	Centering Mode Switch (CHECK) ⑮ activated	Push the Centering Mode Switch (CHECK) ⑮ to release it or set the external command signal to OFF (open) on Terminal 16 (CHK_SPD) on the External Input/Output Connector ㉕
High Run-Out	Foreign Particles stuck in the collet chuck or spindle	Clean the inside of the collet chuck and spindle
	Collet Nut is not properly positioned	Position the collet nut properly (P23 Fig 14)
	Ball Bearings Worn	Send to NAKANISHI for Repair
Abnormal Vibration or Noise during Operation	Foreign Particles in the ball bearings. Ball Bearings Worn	Send to NAKANISHI for Repair
	Tool out of Balance	Change the tool
Power Switch shuts OFF Automatically	Excessive Current	Send to NAKANISHI for Repair

Table 10

※Specifications may be changed without notice.

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

NSK Europe GmbH 
www.nsk-europe.de
 Elly-Beinhorn-Strasse 8
 65760 Eschborn,
 Germany

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