SFIDA®

01 Series

CONTROL PACK
MT01CP

OPERATION MANUAL

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20230630 IME-MT01CP

MINITOR CO., LTD. JAPAN

Contents

Thank you for buying the SFIDA 01 series Control-pack MT01CP. When using this equipment, a Motor Spindle is necessary. Read the Operation Manual for the motor spindle and the robot/NC machine tools etc., to understand all of its functions.
Keep this operation manual in a safe place and read it when required.

1 Safety Precautions

Definitions of Warning Symbols
In this manual, symbols are used to highlight warnings and cautions for you to read so that accidents can be prevented. The meanings of these symbols are as follows:

⚠ Warning	This symbol indicates explanations about extremely dangerous matter. If users ignore this symbol and the matters appearing in this manual, serious injury or death by fire or electric shock could result.
⚠ Caution	This symbol indicates explanations about dangerous matters. If users ignore this symbol and the matters appearing in this manual, bodily injury and damage to the equipment could result.

⚠ Warning

- This device shall be grounded using the ground wire of the power cord. Make sure that the ground wire is connected to the earth to avoid an electric shock when using this device. In addition, confirm that the ground wire has been grounded correctly before connecting a cable to this device.
- If any malfunctions such as smoke, peculiar smells and/or sounds are present, turn off the main switch and unplug the power supply immediately. Consult an electrician for repair after confirming that all smoking has stopped. If the machine is damaged and used without proper repair, fire and electric shock could result.
- Do not attempt to modify or disassemble the machine since this can cause serious loss in performance and safety; otherwise, fire and electric shock could result.
- Be sure to only use the input voltage specified in this device since fire and electric shock could result.
- Do not block ventilation openings since this can result in a failure or fire from heat.
- Do not put Control Pack on unstable locations such as a shaky stand or a leaning surface, etc. If it falls or topples over it can cause injury.
- Do not use this device under an environment where corrosive gas (chlorine gas, hydrogen sulfide, sulfurous acid gas, etc.) generates, because it may lead to an unexpected failure of parts.
- When the power supply cord or plug is damaged, replace it with the normal cord(option). Continuous use may cause fire and/or electric shock.
- To prevent the risk of fire and electric shock, do not plug or unplug the machine from the AC outlet with wet hands.
- Wear safety protective glasses to protect eyes and an anti-dust mask to prevent inhalation of debris. You may suffer from unexpected injuries caused by flying debris generated through use of this machine.

⚠ Caution

- Operate machinery in a dry location free of condensation, otherwise this could result in a fire and/or electric shock.
- Operate in temperatures of 0～40℃.
- When installing do not block the filter panel where cool air is taken in or the exhaust ventilation slits.
- Do not allow children to operate machinery by any means; keep machine out of their reach.
- Do not hit or drop objects on the device as this may damage it.
- Be careful so that dust, oil and water do not enter the device. When foreign substances such as liquid enter the device, turn off the main switch, unplug the power supply from the AC outlet and consult with a qualified technician. Fire and electric shock could result if used as is.
- Do not place heavy objects on the power cord as this may damage the cord resulting in a fire and or electric shock.
- Do not place power cord near heat sources. The cord casing may melt resulting in a fire and electric shock.
- When unplugging the power cord, always grasp the plug itself and do not pull at the cord; otherwise, this may damage the cord resulting in a fire and electric shock.
- Before maintenance cleaning, unplug the power cord from the AC outlet for safety.
- Use cutting tools and magnets at the number of revolutions recommended by the manufacturer. Do not use it at the number of revolutions beyond the permissible range, since this can result in damage to the device.
- In the case of electric overload, use it after reducing the load since it means the state used in the load beyond setting.

2 Equipment Features

●Maximum Output

A stable, high torque is achieved with a high-power 370W of sufficient output by loading of a high-power electric source.

●Worldwide Power Supply

It is equipped with an AC100～240V-compliant worldwide power supply. Thus, gone are troublesome changes in power-supply settings and failures by voltage difference.

●Various Security

It is equipped with a safety security function to constantly monitor the load condition of the main axis, overcurrent to motor, heat generated by power-supply and air pressure.

●Maximum Speed of Rotation 60,000min^{-1}

Motor spindles of the 01 series are equipped with a high-performance, brushless motor with ceramic angular bearings, allowing a maximum speed of 60,000min^{-1}. The adopted forced air-cooling system (outer burner cooling) allows for high durability.

●Air-Cooling System

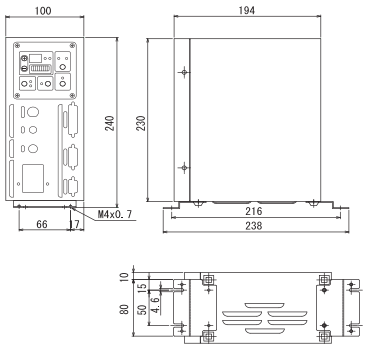
The adopted forced air-cooling system requires only a small amount of air(30L/min), preventing heat generated by motor over prolonged use.

3 Specifications and Dimensions

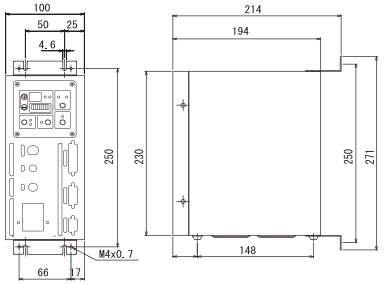
3-1 Specifications

Model	MT01CP
Electric Power	AC100～240V 50/60Hz
Input Current	Maximum 8.7A (for AC100V) Maximum 4.4A (for AC200V)
Service Temperature Range	0℃～40℃
Air Consumption	30L/min (0.25～0.3MPa)
Range of RPM setting	500～60,000min^{-1} ＊500min^{-1} is the alignment setting.
An effective use range	5,000～60,000min^{-1}
Weight	4.1Kg
Dimension	W100×D194×H230
Storage temperature	-10～60℃ ＊Do not use in an enviroment with heavy condensation.
Storage humidity	10～85% ＊Do not use in an enviroment with heavy condensation.

3-2 Dimensions of External Appearance

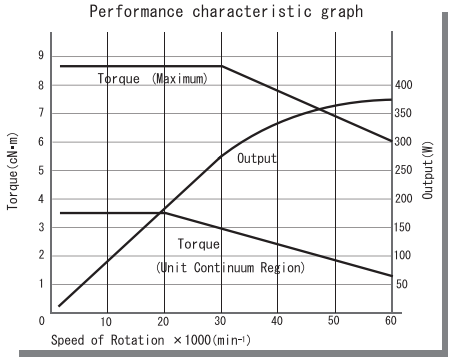


・Fig.-1 Floor mounting type



・Fig.-2 Back face mounting type

3-3 Torque Output Characteristics(Motor Spindle)



・Chart-1

3-4 The confirmation of a level meter used consecutively

When operating the device continuously,check the aspect of loads in the LEVEL meter.Refer to Chart-2 for the tolerance level per speed of rotation.

The Number of Revolution Displayed	The Number of LEVEL Lightings	Color of the Light
10	6	Yellow
20	6	Yellow
30	5	Green
40	5	Green
50	4	Green
60	4	Green

・Chart-2

3-5 Accessories

AC cable

◆CA20 / CA21 / CA22 ※

※Either one of them

※It is attached to CA20 a 3p→2p adapter.

blackest

◆MTB1…2pieces

◆MTB2…2pieces

air-hoses

◆AH6-40 φ6.0×4m

Rubber feet

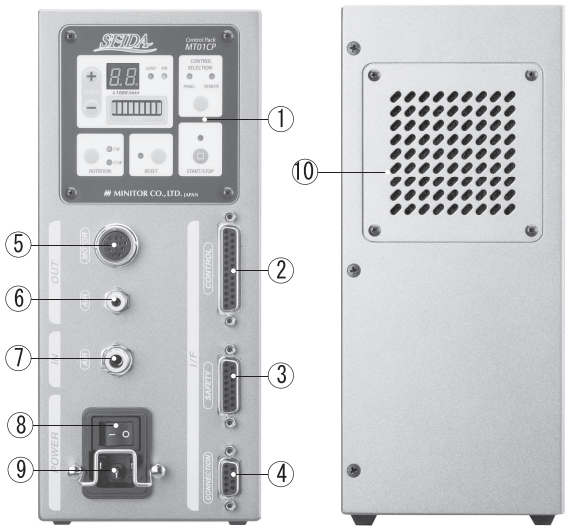
◆MRZ2…4pieces

Mounting screw

◆MRZ3…4pieces

4 Names and Functions of Each Component

4-1 Overall Configuration



・Fig.-3　・Fig.-4

①Operation Panel
4-2 See "Operation Panel Details"

②CONTROL Connector
For connection of external input/output signal.

③SAFETY Connector
Connect when using the status signal of this product.

④CONNECTION Connector
Connect communication cable.

⑤Connector for Connecting Motor
For connecting the Spindle connectuion cord.

⑥AIR OUT Coupler
For connecting air-hose (4mm Φ4) .

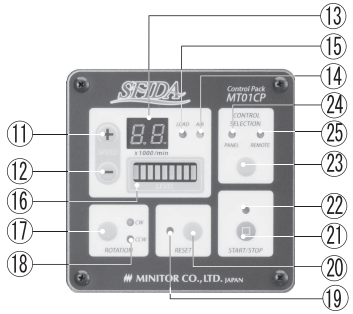
⑦AIR IN Coupler
For connecting air-hose (6mm Φ6).Working range is 0.18～0.5 MPa.
＊Please adjust the supplied air pressure with 0.25～0.5MPa.

⑧MAIN Switch
It's the main power switch.

⑨AC Socket
For plugging AC cord.

⑩Filter Panel
For the intake of cool air; periodical inspection and cleaning of the dust proof-filter are required.

4-2 Details of Operation Panel



・Fig.-5

⑪"＋"Switch (for increasing the speed of rotation)
When this switch is pushed during panel operation mode, the speed of rotation increases in devices of 1,000 min^{-1}. When it is held onto for more than two seconds, the speed of rotation will continue to increase, to a maximum setting of 60,000 min^{-1}.

⑫"－"Switch (for decreasing the speed of rotation)
When this switch is pushed during panel operation mode, the speed of rotation decreases in devices of 1000min^{-1}. When it is held onto for more than two seconds, the speed of rotation will continue to decrease, to a minimum setting of 1,000min^{-1}.
When the "－"switch is pressed in the indication of 1,000min^{-1} at the time of a motor stop, it will be set at 500min^{-1} for alignment.
Note: Effective working range is 5,000min^{-1} or more.

⑬Indicator
This indicates the speed setting or the speed of rotation per minute (rpm), and also indicates when malfunctions occur by blinking error numbers.

⑭AIR Lamp
This lamp lights when the motor is off and blinks when an error occurs such as abnormal air pressure.

⑮LOAD Lamp
This lamp lights when the motor is running and blinks when the over-current protection is activated.

⑯LEVEL Indication
This indicates air pressure volume and motor loads, and also the number of the first place in two digits of error number at the time of error occurrence. Refer to "9-3 Error Numbers and Their Contents" for further details, and also "3-4 The confirmation of a level meter used consecutively" for motor loads.

⑰ROTATION Switch
This switch sets up the rotation orientation of the motor.

⑱CW Lamp / CCW Lamp
This lamp lights when the rotation of the motor is set to a clock-wise rotation (CW) and a counter clock-wise rotation (CCW).

⑲RESET Lamp
This lamp blinks when malfunctions occur in this device.

⑳RESET Switch
This switch cancels the error.
＊Note: When the error number reads E.9, it is unable to cancel the error even if the switch is ppushed.
First, turn off MAIN switch, then turn on after about three minutes to reset the error display.

㉑START/STOP Switch
This switch turns the motor ON or OFF.

㉒START/STOP Lamp
This lamp lights up in accordance with the state of the motor.

(State of motor)	(State of lamp)
During pauses	Red illuminates
During operation → Stop	Red blinks
Operation at fixed speed of rotation	Green illuminates
Operation outside fixed speed of rotation	Green blinks
Error number being displayed	Orange blinks

㉓MODE Switch
This switch changes the operation mode.

㉔PANEL Mode Lamp
This lamp lights when it's in Panel Operation Mode.

㉕REMOTE Mode Lamp
This lamp lights when it is in Remote Operation Mode.

5 Operating Procedure

5-1 Type of Operation Mode

Therr different modes are available -to switch mode press the MODE switch while the motor is paused. The modes change in the following order:"Panel Operation Mode" "Panel/Remote Operation Mode" and "Remote Operation Mode". When the power is turned on, it returns to the previous operation mode. If the mode changes, all lamps on the operation panel will light up once.

- Panel Operation Mode
  This is operated by a switch on this operation panel.
- Panel/Remote Operation Mode
  The setting of the number of rotations is controlled from the operation panel, and other operations are to be operated by the external signal from the CONTROL connector.
- Remote Operation Mode
  This is operated by an external signal from the CONTROL connector, and the mode can be changed even if the device indicates an error number.

5-2 Panel Operation Mode

1. Turn on the MAIN switch. "P.P." is displayed once in the Indicator.
   Make sure that the PANEL mode lamp on the operation panel is lit.
2. Supply air to the motor. Control the amount of air pressure so that four lamps of LEVEL Indicator are lighted and then adjust it in accordance with the exothermic heat condition by details of the task.
   Note: When the air pressure is too low, the first lamp of the LEVEL Indicator blinks;
3. Press the ROTATION switch so that the lamp of intended rotation direction lights up.
4. Press the ＋(UP) or －(DOWN) switch so that the intended speed of rotation is displayed on the indicator.
5. Press the START/STOP switch to start or stop the motor.

5-3 Panel/Remote Operation Mode

1. Turn on the MAIN switch. "P.E." is displayed once in the Indicator.
   Make sure that operation PANEL and both REMOTE lamps of are lit.
2. Supply air to the motor. Refer to the details of "5-2 Panel Operation Mode."
3. Turn the external ROTATION signal on or off so that LED of the intended rotation direction is lit. Complete the setup of the rotation direction 100ms before turning on the external START signal.
4. Press the ＋(UP) or －(DOWN) switch so that the intended speed of rotation is displayed on the indicator.
5. Switch the external START/STOP signal to turn the motor ON or OFF.

(Operation of motor)	(External START signal)
Stop	OFF (applied voltage 0V)
Start	ON (applied voltage 12V～24V)

5-4 Remote Operation Mode

1. Turn on the MAIN switch. The indicator will display "E.E." once. Make sure that the REMOTE mode lamp on the operation panel is lit.
2. Supply air to the motor. Refer to the details of "5-2 Panel Operation Mode."
3. Turn the external ROTATION signal on or off so that LED of the intended rotation direction is lit. Complete the setup of the rotation direction 100ms before turning on the external START signal.
4. Set up the external signal so that the number of rotations which are intended to set by the indicator may be shown.

   - SPEED signal voltage range is DC 0V ～12V.
   - Setting speed of rotation 60,000min^{-1}(max)/SPEED signal voltage is DC9V (±5%)/SPEED_UD・SPEED_PULSE signal.

5. Turn the external START/STOP signal ON or OFF to start or stop the motor.
   The external signal to operate the motor is the same as "Panel/Report Operation Mode".

(Functioning of Memory)
If settings such as operation mode, rotation direction and the speed of rotation of motor are changed, this data is recorded after the motor stops. When the MAIN switch is turned on, the device can be operated in the previously set mode.

(Measures for resetting when malfunctions occur)
When malfunctions occur, the indicator displays an error number as "E. □"(□ is figures). Push the RESET switch to reset. Since error "E.9" cannot be reset, turn off the MAIN switch, fix the cause of the malfunction, and turn on the MAIN switch after about three minutes.
*Please refer to "9-2 When Malfunctions Are Detected".

5-5 Setting of the function

This device is able to set the following functions; e.g. Setting the maximum number of rotations by the motor at 60,000min^{-1} or less.

○F.0 Sets restrictions on the maximum number of rotations.
Display "on" : This restricts the maximum number of rotations.
Display "of." : This does not restrict the maximum number of rotations.
When "on" is selected, the number of rotations by panel operation or an external signal can not be set at more than the preset number of rotations.

○F.1 Sets up the maximum number of rotations.
Display "1～60" kmin^{-1}
When "F.0" is in the "on" position, the preset number of rotations will be the maximum.

○F.2 Sets up the signal (voltage and pulse signal) to be used when setting the speed from an external signal.
Display "An" : It will be set up by "SPEED Signal".
Display "PL" : It will be set up by a signal of either "SPPED_UD" or "SPEED_PULSE".
＊ When fixing speed-settings by the pulse count signal, the number of set rotations will be set at 1,000min^{-1} when the MAIN power is turned on. The number of rotations will be set at 1,000min^{-1} after switching the exterior speed set-point signal.

○F.3 Sets up a signal starting or stopping a motor.
Display "on" : Press the "START Signal" switch to rotate the motor in a normal direction, or press the "ROTATION Signal" switch for the reverse direction.
Display "of." : Press the "START Signal" switch to start or stop the motor,or press the "ROTATION Signal" switch to set up the rotation direction.

○F.8 Sets up an output signal from the 6th terminal of CONTROL Connector in either "RUN Signal" or "STOP Signal".
Display "un" : This sets the output signal in "RUN Signal".
When output is "ON" : The motor is rotating.
When output is "OFF" : The motor is stopped.
Display "oP" : This sets the output signal in "STOP Signal".
When output is "ON" : The motor is stopped but is ready for prompt operation.
When output is "OFF" : The motor is rotating, or is in the process of stopping, or an error has occurred.

Note : Since the function number "F.4"～"F.7" are not used,it will be displayed as "- -"

(Setup Method of Functions)
1. Turn on the MAIN Switch. The operation panel will be displayed on the screen.
2. Push the ㉓ MODE switch while pushing ⑳ RESET switch on the operation panel.
3. It will be in the state where the functional setup can be performed after "F.0" (the function number) is displayed in ⑬ the indicator.
4. Firstly confirm that "F.0" is being indicated. Then the display of the "F.0" shall flash after having released the MODE switch.
5. When pushing the ⑪+switch, the indication shall change e.g. "F.0", "F.1", "F.2", "F.3" … "F.8" and "F.0" in turn, and when pushing the ⑫−switch, it shall change e.g. "F.0", "F.8", "F.7" …"F.1" and "F.0" in turn while the display is flashing.
6. The set-up content of the function number will be displayed by pushing the ㉑START/STOP switch while the function number for presetting is flashing
7. For changing the set-up contents, push the START/STOP switch while the contents are being displayed to get the state of flashing, and then push either ＋ or −switch to display the contents to be set up
8. When the START/STOP switch has been selected after changing the set-up contents, the modification descriptions will be recorded and the function number will be flashing on the display. When the contents have not been changed, push the RESET switch. the modification descriptions will not be recorded, and it will return to the flashing function number.
9. Return to No.6 above when intending to change the setup of the multiple functions continuously. After finishing the setup, it will return to the state where the MAIN switch is turned on by pressing the RESET switch.

5-6 Initialization of Settings

This is the method to return this device to its initial setting.
1. Turn the MAIN switch ON while pushing ⑳ RESET switch and ㉓ MODE switch on the operation panel.
2. Let go of the switches when blinking "y.n" is displayed in the indicator. The "y.n" will blink.
3. If you are trying to initialize settings,push ㉑ START/STOP switch.

(Content of initialization)
- Operation mode:Panel operation mode
- Number of rotations : 1,000min^{-1}
- Direction of rotation : "CW"
- The 6th terminal of CONTROL Connector : "RUN signal"
- Setting values of the maximum number of rotation : 10,000min^{-1}
- Setting of the maximum number of rotations : "OFF"
- Setting of the external SPEED : "SPEED Signal"
- Setting of the external START signal : "OFF"

※ If not initializing,it will return to a state in which the MAIN switch is ON when the RESET switch is pushed.

6 Connection Method

6-1 Connection of the Power Cable

・Fig.-6

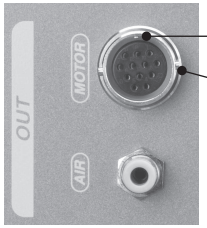
・Fig.-7

1.Connect the AC cord of accessories to the AC plug ⑨ in the front of this device.(Fig.-6)
2.Fix the connector part with a stopper to prevent disconnecting AC cord.(Fig.-7)

Warning

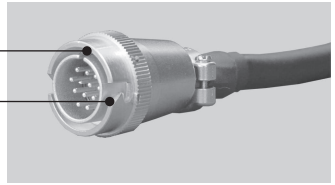
This device shall be grounded using the ground wire of the power cord. It is essential to connect the ground wire to the earth to avoid an electric shock when using this device. Be sure to use the supplied power cords with earth points. In addition, confirm that the ground wire has been grounded correctly before connecting a cable to the input-output terminal of this device. When disconnecting the AC cord from the outlet, always grasp the plug itself and not at the cable; otherwise, it could cause a disconnection.

6-2 Connection of Spindle connection cord



Match to
a key groove

Fix with
the lock part



▪ Fig.-8

▪ Fig.-9

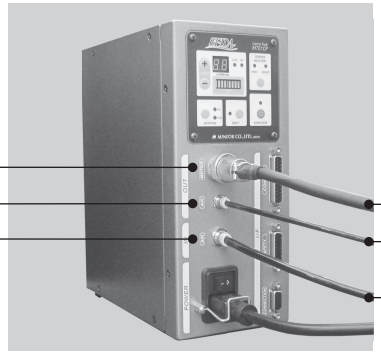
1. Connect the plug (Fig.-9) of the spindle connection cord to a connector ⑤ "MOTOR" (Fig.-8) for the motor connection in the front of this device.
2. After securely putting a plug into the socket, fix it by turning the lock part.

Caution

Be sure to turn off the MAIN switch of the device when connecting the spindle connecton cord.

6-3 Connection of the Air Hose

1. Plug the air hose (outside diameter 6.0mmΦ) to the air supply valve in "AIR IN" coupler ⑦ in the front of this device. (Fig.-10)
2. Plug the air hose (outside diameter 4.0mmΦ) in the "AIR OUT" coupler ⑥ of this device and connect it with the air coupling on the motor side.(Fig.-10)
3. Air pressure setting range is 0.25MPa ～ 0.5MPa.



⑤ MOTOR
⑥ AIR OUT
⑦ AIR IN

Connection Code
4mmΦ Air hose
6mmΦ Air hose

▪ Fig.-10

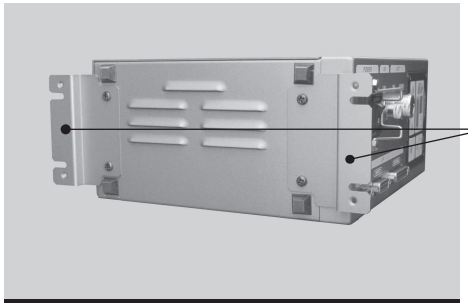
Caution

The air pressure supplying to AIR IN coupler ⑦ will be controlled within 0.25～0.5MPa.
Be sure the connecting air hose does not have any kinks or acute angle bends.
Unreasonable force to the air hose will disturb the cooling effect of the motor spindle, causing degradation and failure.
When not using the respective connectors for an extended period, place a cover on them for safety.

7 Mounting of Brackets

There are two kinds of bracket accessories.
There are two fixation methods available: the floor type fixation (Fig.-11) and the back mounting (Fig.-12).

Install accessory two brackets in the bottom aspect hole of this device.



Brackets for the
Floor type fixation

Floor type fixation

▪ Fig.-11

Install accessory two brackets in the hole of up-and-down each face of this device back direction.

Brackets for the
Back mounting

Back mounting

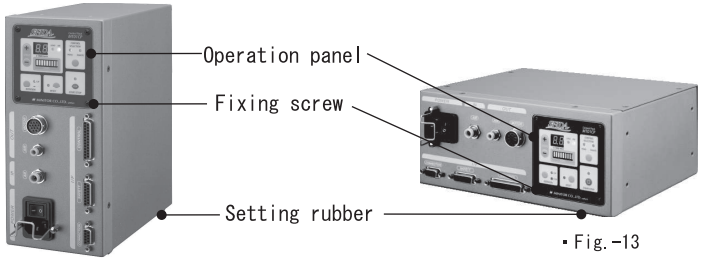
▪ Fig.-12

Caution

Install this device in an environment free from powder, dust and oil.
For cooling purposes, the air intake on the filter panel surface must be at least 2cm from the installation surface.
Be careful not to block the slit on the bottom of the chassis, as it needs to expel air.

8 Replacement of the Operation Panel

8-1 Changing the Mounting Direction of the Operation Panel

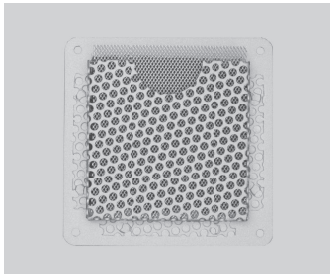


▪ Fig.-13

The mounting direction of the Operation Panel can be changed vertically or horizontally (Fig.-13). Remove the screws in the four corners when demounting the operation panel.
As the need arises, change the direction of the panel. Fix the setting rubber accessories (4 pieces) in the marked positions.

8-2 Replacement of the Operation Panel and Filter Panel

▪ Fig.-14



▪ Fig.-15

First, remove the Operation Panel and see that the cable is connected from Operation Panel foundation bed to the connector on the main foundation bed of this device. Push-expand each lock-lever attached to the upper part of the connector to the outside direction when removing the connector.
The connector for connections on this device foundation bed is mounted respectively on the front and rear faces of the cubicle. As for the connection method, plug the connector in the state that the lock-lever was opened in the right and left, and then close both sides lock-lever.

8-3 Cleaning of Filter

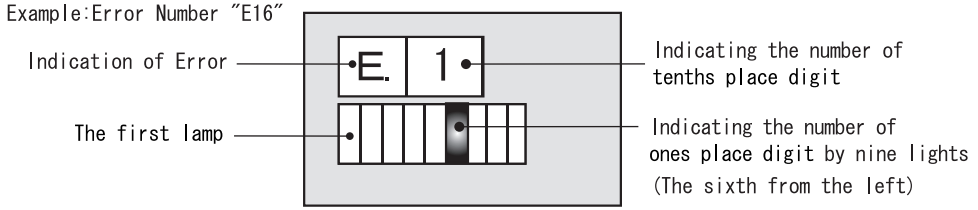
Since the filter panel is equipped with a dustproof filter, carry out periodic inspection and cleaning. (Fig.-15)
When installing the filter panel, turn the filter insertion-opening up.

Caution

When changing the installation position of the operation panel, be sure to turn off the MAIN switch of the device and perform in the state that the AC cord is unplugged.

9 Error Number Display

9-1 How Error Number Is Displayed



Error numbers are displayed in a numerical value of two-digits. As for the display method, tenths place digit is displayed after "E." by the indicator. The LEVEL indicator displays ones place digit of the error number and consists of nine (9) lamps.
The first lamp Indicates "1" of ones place digit of error number, the second lamp indicates "2" and the third lamp indicates "3."
Refer to the details of "9-3 Error Numbers and Their Contents".

9-2 When Malfunctions Are Detected

In powered on, when malfunctions is detected from storage data after the previous setting data (Operation mode, rotation directions and setting speed of rotation) is loaded from the memory, , Error numbers "08" or "09" is indicated.

●When Error number indicates "09" :
Errors can be released after initializing the setting contents by pushing the RESET-switch on the operation panel. Refer to "5-6 Initialization of Settings" concerning the details of setting initializations.

●When Error number indicates "08" :
It is displayed when malfunctions of the rotation direction and setting speed of rotation are detected at Panel Operation mode. When the RESET switch on a panel is pressed, the data which set the rotation direction as "CW" and setting speed of rotation as "1,000min^{-1}" is written into the memory, and an error will be released.

●When malfunction of the error number "the 90s" was detected:
As far as the error number "the 90's" is concerned, releasing an error by RESET switch or external RESET signal is impossible.
In this case, turn off MAIN switch once, and turn on after about 3 minutes.
In case of the error caused by internal temperature rising, it takes more than 3 minutes until the temperature falls down.
When the error number "the 90s" is still displayed even if turning on the MAIN switch again, a failure is considered.

Note: Error numbers in the 90s may appear for the following reasons:
① An error that needs to turn on the MAIN switch again for release
② Failure of the power supply
Also, it may be due to the impossibility of cancelling errors by the RESET signal; it is for hazard control as well.

9-3 Error Numbers and Their Meanings

No	Meanings
02	Immediately after having turned on the power supply in Remote Operation Mode, the exterior START signal will already be ON.
07	Error was detected in the machine. (changed to RESTART mode)
08	Error was detected in setting memory data of "Rotation Direction and Speed of Rotation" in this device.
09	Error was detected in setting memory data of "Operation Mode" in this device.
11	Air pressure for motor cooling is low.
19	Air pressure for motor cooling is high.
22	Abnormal motor connection.
23	The motor can not be activated, or it took at least three seconds before reaching the preset number of rotations.
31	Current value at the time of motor in operation is low.
39	Over-current protection to the motor was activated.
51	Protection functions of the motor power supply were activated.
59	Transistor for the motor-brake overheated.
61	The speed of rotation does not reach number of revolutions set.
62	The speed of rotation is low at 3000～5000 min^{-1} or more than speed of rotation set.
68	Revolution of motor is high at 3000～5000 min^{-1} or more than speed of rotation set.
69	Motor rotated at more than 65,000 min^{-1}.
82	Immediately after having turned on the power supply in Remote Operation Mode, the exterior START signal will already be ON
83	Communication with this device is unavailable, or this device has not been set in the Selector Operation Mode.
91	Protection functions of the motor power supply were activated.
92	Operation panel is not connected, or an operation switch is turned on.
93	Output voltage of power supply for motor is too low.
94	Output voltage of power supply for motor is too high.
95	Stopping the motor took 10 seconds or more.
96	Abnormal output current when motor stopped.
98	Malfunctions were detected in the memory of Control Pack,or Malfunctions were detected with the circuit.

(Error Detecting Threshold Value)

Air pressure is the cause:

- When air pressure is less than 0.18Pa.
- When air pressure exceeds 0.5MPa.

Motor current is the cause:

- If the flowing current which exceeds unit-continuum region (Chart-1) continues for about 30 seconds.
- If the electric current is more than 10.5A and continues for more than 5 seconds.

Power supply for motor driving is the cause:

- When the internal temperature of the motor power supply has risen to more than 85℃.
- When the output exceeds 70V.
- When a malfunction has arisen in the cooling fan.
- When transistor surface temperature for the motor-brake has risen to more than 100℃.

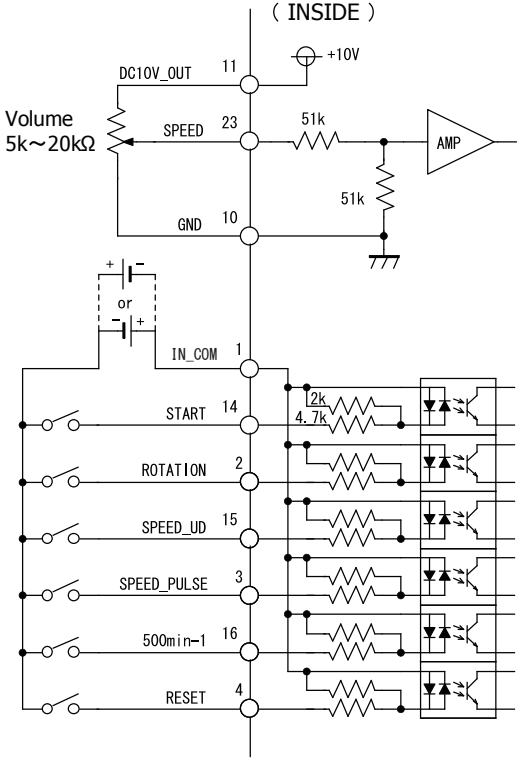
10 External Input/Output Signals

When in Remote Operation Mode, controlling this device by an external signal, an external signal will be inputted from the CONTROL connector. Moreover, this connector outputs signals showing the state of this device. Refer to the contents of "CONTROL Connector Signal Contents" the signal for each terminal to."

10-1 External Input Signals

The connection in this device of each signals such as "SPEED","START","ROTATION", "SPEED_PULSE","5000min^{-1}" and "RESET" etc. are shown in Fig.-16.
As for the external signal and circuit of this device, SPEED signal is insulated by the insulated amplifier and other signals are insulated by the photo-coupler.Connect "＋" or "－" side of the power supply for the external signal to the 5th end-terminal "COMMON," and suppose opposite-electrodes of electric supply were connected to the 2nd end-terminal "START" signal, this device will detect that the external "START" signal has been turned on.

(This device Internal connection of the external input signal)



・Fig.-16

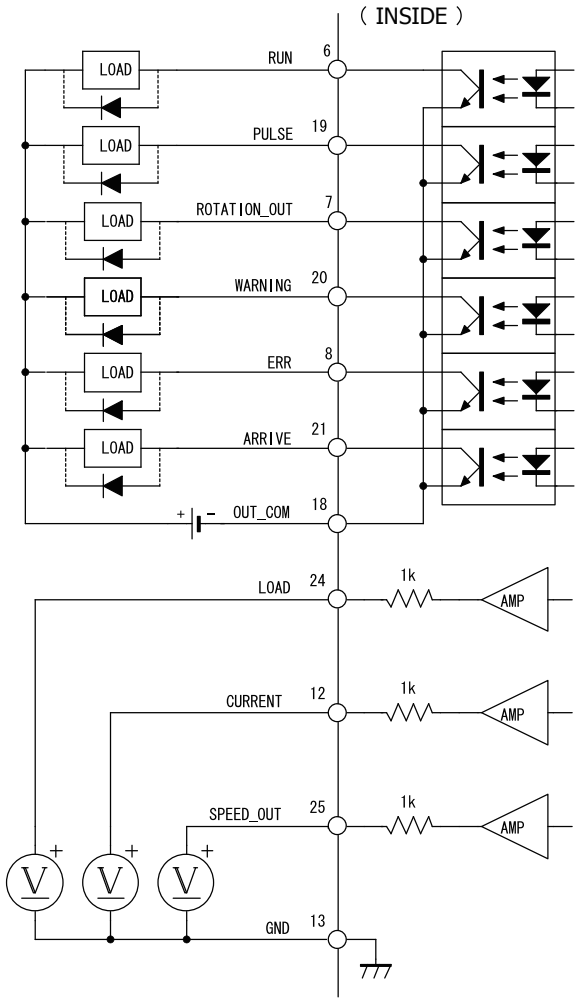
The photo-coupler is an AC input type.
Although the voltage polarity applying to the IN_COM terminal is out of question, use DC output electric sources for the external signal.

10-2 External Output Signals

The connection in this device of each signal such as "RUN", "PULSE", "ROTATION_OUT, "WARNING","ERR" and "ARRIVE" etc. are shown in Fig.-17. As for the external output signal and circuit of this device, it is being insulated by a photo-coupler, and the collector side and emitter side of photo-coupler output are being outputted per every signal. The voltage applying to the photo-coupler output will be used within DC30V and, in case of electric current, will be used within 100mA.

● At the time of turning on the photo-coupler output V_{CE}=1.2V max.
(when load current is at 100mA)

(The device internal connection of the external output signal)



・Fig.-17 (Internal wiring of the external output signal in CONTROL Connector)

10-3 Serial Signals

Data in this device can be output to external parties by using serial signals of the CONNECTION connector in this device. Serial number is based on RS232-C.

●Serial Communication Parameter

Communication system	Asynchronous communication
Transfer rate	9,600bps
Data	8 bits
Stop bits	1 bit
Parity	nil
Flow control	nil

●Wiring

Connect respective terminals of CONNECTION connectors with signal terminals of the controller side sending and receiving data.

(Control Pack : CONNECTION Connector side) (Controller side)
[D−Sub 9pins]
・the 2nd terminal(T x D) ——— (R x D)
・the 3rd terminal(R x D) ——— (T x D)
・the 5th terminal(G N D) ——— (G N D)

●Data Receiving Method

When receiving data from the Control Pack, transmit data transmission request-command to Control pack from the controller. Once data has been sent, data corresponding to the respective commands will be sent from Control Pack. Data transmission request command is the following two:

Command 1	$44	$41	$0D
Command 2	$44	$42	$0D

「$」・・・・Data of hexadecimal number display
$41・・・・ASCII code 「A」
$42・・・・ASCII code 「B」
$44・・・・ASCII code 「D」
$0D・・・・Control code「CR」

●Data Transmission Timing

When transmitting data transmission request-command from the controller, be sure to transmit three data (e.g. $44, $41, $0D) continuously. When data interval is set to 255ms or more, the proper receiving cannot be performed. Unless proper data has been received, the following data will be transmitted from the Control Pack.

$3F	$0D

$3F・・・・ASCII code「?」

●Data Contents (Command 1)

When Control Pack receives a command 1 "$44 $41 $0D", the following data 20 bytes shall be transmitted.

1	$2A		The head of data is shown. It's ASCII code "*".
2	Selector operating mode		$31 Panel operation mode $32 Remote operation mode $34 Panel/RemoteSelector operating mode.
3	Setting rotation directions		$30 CW (Forward rotation) $31 CCW(Reverse rotation)
4	Setting rpm.	10^{+1}	Two-digit number of setting rpm. is shown by ASCII code.(unit:kmin^{-1})
5	Setting rpm.	10^{0}	One-digit number of setting rpm. is shown by ASCII code.
6	Setting rpm.	10^{-1}	1/10-digit number of setting rpm. is shown by ASCII code.
7	Rpm	10^{+1}	Two-digit number of the motor rpm. is shown by ASCII code.(unit:kmin^{-1})
8	Rpm	10^{0}	One-digit number of the motor rpm. is shown by ASCII code.
9	Rpm	10^{-1}	1/10-digit number of the motor rpm. is shown by ASCII code.
10	Motor current value	10^{+1}	Two-digit number of the motor current value is shown by ASCII code.(unit:A)
11	Motor current value	10^{0}	One-digit number of the motor current value is shown by ASCII code
12	Motor current value	10^{-1}	1/10-digit number of the motor current value is shown by ASCII code
13	Motor voltage value	10^{+1}	Two-digit number of the motor voltage value is shown by ASCII code(unit:V)
14	Motor voltage value	10^{0}	One-digit number of the motor voltage value is shown by ASCII code
15	Motor voltage value	10^{-1}	1/10-digit number of the motor voltage value is shown by ASCII code
16	Error number	10^{+1}	Two-digit number of the error number is shown by ASCII code. when error has not arisen, it's "00" ($30 $30)
17	Error number	10^{0}	One-digit number of the error number is shown by ASCII code.
18	Checksum	(H)	Higher rank checksum data is shown.
19	Checksum	(L)	Lower rank checksum data is shown.
20	$0D		The last of data is Control Code "CR".

(For checksum calculation method)

From data No.1 to the 17th
「$2A」～「Error number10＾0」

Upper 4 bits Lower 4 bits

(Calculation example)

Transmitting data

Lower 8 bits of total to the transmitting data
＝1011 0101

▼

●Checksum (H)
1011 + $30 ＝ $0B + $30 ＝ $3B

●Checksum (L)
0101 + $30 ＝ $05 + $30 ＝ $35

Transmitting data total
「○○○○○・・○○○○ ○○○○」 ←Lower 8 bits

▼ ▼

Add "$30" respectively.

▼ ▼

Checksum (H) Checksum (L)

(Relation between a number and ASCII code)

Number	0	1	2	3	4	5	6	7	8	9
ASSCII code	$30	$31	$32	$33	$34	$35	$36	$37	$38	$39

●Data Contents (Command 2)

When Control Pack receives a command 2 "$44 $42 $0D", the following data 20 bytes shall be transmitted.

1	$2A		It is the head of data. It's ASCII code "*".
2	Air pressure	10^{-1}	1/10-digit number of the air pressure value is shown by ASCII code.(unit:Mpa)
3	Air pressure	10^{-2}	1/100-digit number of the air pressure value is shown by ASCII code.
4～6			Confirming the operation of factory shipment
7	External input signal		Refer to Chart-3 "Contents of External input signal".
8	External output signal		Refer to Chart-4 "Contents of External output signal".
9～17			Confirming the operation of factory shipment
18	Checksum	(H)	Higher rank checksum data of transmitting data is shown.
19	Checksum	(L)	Lower rank checksum data of transmitting data is shown.
20	$0D		The last of data is Control Code "CR".

●Contents of External Input/Output Signals

The input signal from CONTROL connector is shown in "Chart-3" and output signal is shown in "Chart-4". In the relation between the input signal and the bit value, Bit is "1" in case of the input signal "ON" and is "0" in case of "OFF".

External Input Signal

Bit 7	always 0
Bit 6	always 0
Bit 5	always 1
Bit 4	always 1
Bit 3	always 0
Bit 2	external reset signal
Bit 1	external start signal
Bit 0	external rotation signal

Chart-3

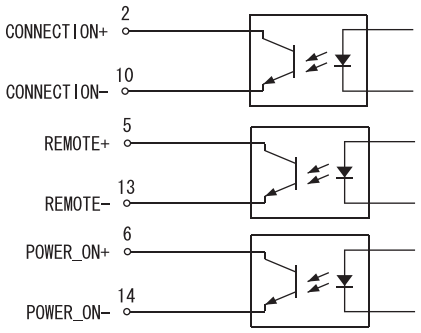
External Output Signal

Bit 7	always 0	
Bit 6	always 0	
Bit 5	always 1	
Bit 4	always 1	
Bit 3	Motor stop signals	"1" during pauses/ "0" be in action
Bit 2	Speed attainment signals	"1" attainment / "0" in transit
Bit 1	Motor connection signals	"1" normal connection /"0" error
Bit 0	Alarm signals	"1" normal operation / "0" error

Chart-4

11 Signal Contents of SAFETY Connector

Terminal No.		Terminal Cord	Names	I/O	Signals	Descriptions
1		–	–	–	–	–
	9	–	–	–	–	–
2		CONNECTION+	Motor connection signal +	Output	ON: Abnormal OFF: Normal	Between the No.2~No.10, it will be OFF when connection errors with the motor are normal, and it will be ON in case of a malfunction. This terminal post is "+" side.
	10	CONNECTION–	Motor connection signal –	Output	0V	Between the No.2~No.10, it will be OFF when connection errors with the motor are normal, and it will be ON in case of a malfunction. This terminal post is "–" side.
3		–	–	–	–	–
	11	–	–	–	–	–
4		–	–	–	–	–
	12	–	–	–	–	–
5		REMOTE+	Operation mode+	Output	ON:External-controllable mode OFF:Panel operation mode	It's OFF at the time of the panel-operationmode between the No.5~No.13, and it's ON in case of the other outer-controllable operation modes. This terminal post is "+" side.
	13	REMOTE–	Operation mode–	Output	0V	It's OFF at the time of the panel-operation mode between the No.5~No.13, and it's ON in case of the other outer-controllable operation modes. This terminal post is "–" side.
6		POWER_ON+	Main power ON+	Output	ON:Power ON OFF:Power OFF	The power supply turns on when the main power of this device is inputted between the No.6~No.14. This terminal post is "+" side.
	14	POWER_ON–	Main power ON–	Output	0V	The power supply turns on when the main power of this device is inputted between the No.6~No.14. This terminal post is "–" side.
7		–	–	–	–	–
	15	–	–	–	–	–
8		–	–	–	–	–



SAFETY Connector Type :D-Sub 15pins
(Screw M2.6x0.45)

12 Signal Contents of CONTROL Connector

Terminal No.		Terminal Cord	Names	I/O	Signals	Descriptions
1		IN_COM	Input signal common(COM)	Input	0V, or DC12~24V	This is the common (COM) terminal post of the external power source for input signal. Connect 0V or DC12~24V of an external power source. This is common to the input terminals of 2, 3, 4, 5, 14, 15, 16 and 17.
	14	START	Motor setup of the operation	Input	ON:Rotation OFF:Pause	This sets up rotation/pause of the motor.
2		ROTATION	Setup of rotation direction	Input	ON:Counter-rotations OFF:Positive-rotations	This sets up the rotation direction of the motor. Set rotation direction 100ms before turning START Signal on.
	15	SPEED_UD	Increase-decrease in pulse counts	Input	ON:UP OFF:DOWN	This switches speed-up and speed-down of the number of rotations to be set by the pulse for setting the number of rotations.
3		SPEED_PULSE	Pulse for setup of the number of rotations.	Input	OFF → ON	This is the pulse for setting the number ofrotations. By changing the setup from ON to OFF, the preset rotation speed can be adjusted in the range of 1000min^{-1}. Hold the ON-signal for 50ms or more. On the other hand, please turn on after outputting the OFF-signal for 50ms or more when feeding the signal continuously.
	16	500min^{-1}	Number of rotations 500min^{-1}	Input	ON:500min^{-1} OFF:Original setup number of rotations	This sets up the setup number of rotations in 500min^{-1}.
4		RESET	Error release	Input	ON → OFF	In this example, this releases the error number display state. The error can be released when it is turned off and on once. Keep ON while the 20th terminal "WARNING" signal is tuned off (about 100ms). During this time, please turn off the START signal. (※ When it is in using ROTATION signal as START signal, this signal must also be turned off.)
	17	–	–	–	–	–
5		–	–	–	–	–
	18	OUT_COM	Output signalcommon	Output	External output signalGND	This is the GND of the external power source for output signal.
6		RUN	During rotation	Output	ON:Rotation OFF:Stop	This is the output of the rotational state of the motor.
	19	PULSE	Rotation pulse	Output	1 pulse/rotation	This is the output of 1 pulse per 1 rotation of the motor.
7		ROTATION_OUT	Rotation direction	Output	ON:Counter-rotations OFF:Positive-rotations	This displays the preset direction of rotation.
	20	WARNING	Warning	Output	ON: Abnormality OFF: Normal	This is the output signal which notifies abnormalities.
8		ERR	Error	Output	ON: Normal OFF: Error occurrence	This is the output signal which notifies an error occurrence.
	21	ARRIVE	Attainment of rotations	Output	ON: Attainment OFF: Un-attainment	When it is at 90% or more of the preset number of rotations and it is 6000min^{-1} or less of the preset number of rotations, please turn it on when the number of rotations has reached within -600min^{-1} of the preset number of rotations.
9		–	–	–	–	–
	22	–	–	–	–	–
10		GND	Ground	Output	Ground	This is the analog power source GND. It is the power source GND for speed setting signal. *1.
	23	SPEED	Speed settings	Input	Input voltage range DC 0V~12V 0.15V or less: 1,000min^{-1} 9V or more: 60,000min^{-1}	Signal inputs ("+" side) for setting rotation speed of the motor.
11		DC10V_OUT	Power for speed Setting signal	Output	DC 10V	The power source for speed setting signal.
	24	LOAD	Loading factor	Output	DC 0~10V 0V:0%、10V:200%	This is the voltage signal indicating the loading factor of the motor. The continuous running-duty range covers up until 100% (5V) of the loading factor.
12		CURRENT	Motor current value	Output	DC 0~10V 0V:0A、10V:20A	This is the voltage signal indicating the electric current which flows to the motor.
	25	SPEED_OUT	Number of rotation	Output	DC 0~10V 0.5V:5,000min^{-1} 6V:60,000min^{-1}	This is the voltage signal indicating the number of rotations of the motor. It is outputted according to the number of rotations of the motor.
13		GND	Ground	Output	Ground	It is the analog power source GND. *1

*1: The terminal post "GND" of the No.10 and No.13 are connected in the inside of this device.
SAFETY Connector Type :D-Sub 25pins (Screw M2.6x0.45)