Brushless Motor Controller

◇ **Thank you for purchasing BEAK series products.**

- "SA series" is the new brushless motor controller series of BEAK.
- It can furthest meet various functions required for controlling the motor.
- It realizes the unprecedented small size, high speed, high efficiency and multifunction.
- The controller is equipped with a display device. The knob is only turned to simply control the speed while confirming the rotation speed.

◇ **The User Manual explains the use method and precautions of the product.**

- Please read carefully the User Manual before using the product and pay attention to safety when using the product.
- After reading the User Manual, please keep it in the appropriate place so as to view it at any time.

◇**The users of the product shall have the corresponding technology or knowledge.**

- Before use, please read carefully "1 precautions" so as to correctly use the product.
- The product belongs to the accessories of industrial automation equipment. Please do not use it in the medical field or other life-related fields without the permission of the Company.
- It is hereby declared that the Company will not assume any liability to pay compensation on the damage caused by ignoring this warning. Thanks for understanding.

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1 Safety precautions

In order to make you safely and correctly use the product and nip it in the bud to avoid harm and damage to you and others, please use the product after fully understanding its contents. Meanwhile, please do not use the product in the medical field or other life-related special fields without the permission of the Company.

1.1 Warning ⚠

The following operations may cause an electric shock. Please do not carry out the following operations.

- Carry out the movement, wiring and maintenance operations in a power-on state.
- During installation of the product, the protective grounding terminals of the motor and controller are not grounded.
- During maintenance and inspection, the power supply is not cut off.

The following operations may cause a fire or electric shock. Please do not carry out the following operations.

- Touch the marked high voltage terminal on the motor controller in a power-on state.
- Fail to correctly carry out the wiring according to the wiring diagram.
- Forcedly bend, pull or clamp the cable.
- Process and remould the motor cable and connecting cable.
- The power supply input voltage of the controller is not controlled within the rated range.

The following operations may cause a fire, electric shock or injury. Please do not carry out the following operations.

- Use the product in the explosive environment, inflammable gas environment, corrosive environment and place easy to touch water and near inflammable matters.

The following operations may cause an injury or damage to equipment. Please do not carry out the following operations.

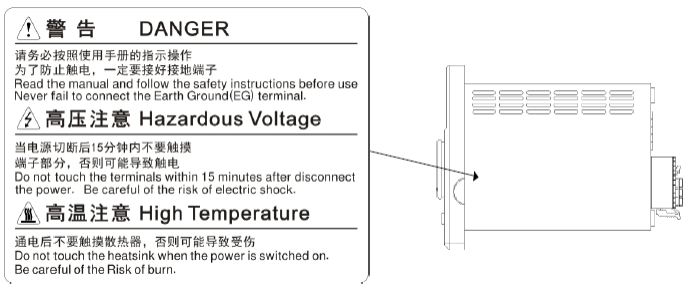
- Use the product on the vertical device. Once the protective function of the controller works, the motor will stop so as to cause the falling of the load equipment.

The following operations may cause an electric shock, injury or damage to equipment. Please do not carry out the following operations.

- Dismantle or modify the motor (speed reducer) and controller. If the interior needs to be checked or repaired, please contact the original factory of BEAK.

◆Warning and Notice Marks

The controller is marked with the warning and notice labels during use. During the use of the controller, please be sure to comply with the contents shown in the warning and notice labels.



1.2 Notice ⚠

The following operations may cause an injury or damage to the motor controller and motor.

- Touch the rotating part (output shaft) during running.
- Use hands to touch the motor output shaft (spline, gear cutting part)
- Hold the motor (speed reducer) output shaft and cables in hands during carrying.
- Fail to firmly install the load on the motor (speed reducer) output shaft.
- Fail to install the outer housing on the rotating part (output shaft) of the motor (speed reducer).
- During the assembly of the motor (gear shaft) and speed reducer, place fingers, etc. between the motor and speed reducer.
- Fail to install the emergency stop button or emergency protection circuit outside the equipment. When the equipment fault or abnormal action occurs, it cannot be ensured that the whole equipment is in a safe state.

The following operations may cause scalds.

- Touch the motor (speed reducer) and controller within a short time after running or stopping.

The following operations may cause an electric shock.

- Fail to use the insulation screw driver to adjust the acceleration and deceleration time setter of the controller.
- Fail to use the primary and secondary insulation DC power supply for the input/output signal power supply.

The following operations may cause an injury or damage to equipment.

- Stack the ventilation-obstructing obstacles around the motor and controller.
- Fail to firmly fix the motor (speed reducer) and controller on the installation plate so as to cause falling.

The following operations may cause a fire, electric shock or injury.

- Insert other objects into the opening of the controller.
- Fail to stop running and cut off the controller power supply when abnormity occurs.
- During the use of the motor (speed reducer) and controller, their rated values are exceeded.

◆Even though the motor is in a normal running state, its surface temperature will also exceed 70°C sometimes.

People may be close to the motor in service. Please post the warning sign shown in the picture on the right at a prominent position so as to ensure the personal safety.

⚠

Warning signs

2 Notice for use

2.1 Operating environment

- ◇ No direct sunlight
- ◇ Elevation: altitude of less than 1000 m
- ◇ Operating environment humidity: less than 85%
- ◇ Operating environment temperature: 0 to + 40 ℃
- ◇ No explosive environment, harmful gases (hydrogen sulfide gas, etc.) and liquid
- ◇ Less salt
- ◇ Less dust, iron powder, etc
- ◇ No continuous vibration or excessive shock
- ◇ Less electromagnetic interference (such as welding machine, etc.)
- ◇ No magnetic and radioactive materials or magnetic field, etc., anti-vacuum environment

2.2 Use limitation.

◇ **Please do not use it in the vertical load situation.**
In the situation of similar vertical load running, the motor speed cannot be controlled. In addition, during the vertical load running, the variable frequency voltage of the controller will exceed the permissible value and the protection function will work so that the motor stops, which may cause the load falling and cause the personal injury or equipment damage.

◇ **Please do not use the relay to control the power supply.**
Please do not use the relay to control the connection and disconnection of the power supply. Using the relay to connect or disconnect the power supply may cause damage to the motor and controller.

2.3 Machinery maintenance

◇ **Lubricating oil leakage**
When a small amount of lubricating oil leaks from the speed reducer, please install the oil-receiving tray and other devices to avoid damage to the equipment. Please check whether the leakage of lubricating oil occurs during regular inspection. Otherwise, the customer's equipment and products may malfunction due to oil leakage.

◇ **Precautions during use in a low temperature environment**
When the environment temperature is lower, the oil seal used for the speed reducer and the lubricating oil viscosity will increase the load torque and reduce the output torque so that the overload fault may occur. After running for some time, the oil seal and lubricating oil will adapt to the current environment and the overload fault will not occur so as to make the motor run.

◇ **Leakage current**
There are stray capacitances between the controller power supply line and other power lines and the ground and motor. These stray capacitances will produce high frequency leakage current so as to cause adverse effects on surrounding machines. Please use the anti-high-frequency residual-current circuit breaker for the connecting line between the controller and motor and the ground.

◇ **Anti-interference**
The shielded cable shall be used as the input/output signal cable. If the unshielded cable is used, the ferrite core can be installed to improve effects.

◇ **Electrostatic protection**
The controller is provided with the semiconductor element, and therefore the electrostatic protection shall be made in operation. Static electricity, etc. may cause damage to the controller.

◇ **Connecting line between the motor and controller**
Please use the cable connecting line (accessory or optional part) to extend the distance between the motor and controller.

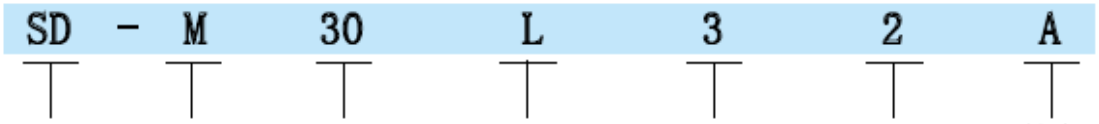
3 Product series

3.1 Naming rules

◇ Driving controller naming rules

Series name	Type	Power (W)	Power supply voltage	Communication	Rotation speed display
SA:SA series SD:SD series SH:SH series SK:SK series	Controller	30：30W、 60：60W、 90：90W、 120：120W	M：AC110 H：AC220 L：DC24 N：DC48	R: RS-485 No: no RS-485	D: with display No: no display

◇ Brushless motor naming rules



Series name	Type	Power (W)	Power supply voltage	Rotation speed	Flange	Output shaft number
SA:SA series SD:SD series SH:SH series SK:SK series	Motor	30：30W、 60：60W、 90：90W、 120：120W	M：AC110 H：AC220 L：DC24 N：DC48	1：1000RPM 2：2000RPM 3：3000RPM	2：60MM 4：80MM 5：90MM	A：8 B：10 C：12 No: speed reducing motor

◇ Reduction gearbox naming rules

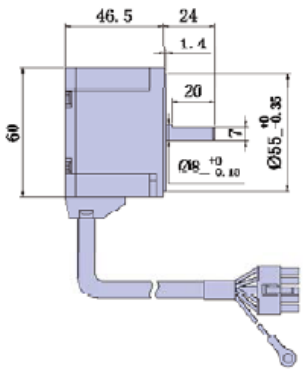
Flange	Speed reducing ratio
2：60MM 4：80MM 5：90MM	G5：1:5 G10：1:10 G20：1:20

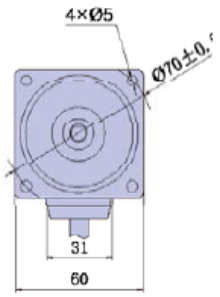
3.2 Motor parameters

◇ **60 brushless motor**

Specifications	Model	
	M30H32A	M30L32A
Rated rotation speed (RPM)	3000	
Maximum rotation speed (RPM)	3500	
Flange dimensions (MM)	60×60	
Machine body length (MM)	46.5	
Rated power (W)	30	30
Input voltage (V)	AC220	DC24
Number of phases (P)	3	
Rated torque (NM)	0.1	0.1
Maximum torque (NM)	0.2	0.2
Rated current (A)	0.175	1.6
Maximum current (A)	0.35	3.2
Allowable voltage fluctuation range	±10%	
Protection grade	IP40	
Operating temperature	0 ～ +40° C	
Storage temperature	-25 ～ +75° C	
Operating humidity	85% RH or below (no condensation)	

External dimension drawing

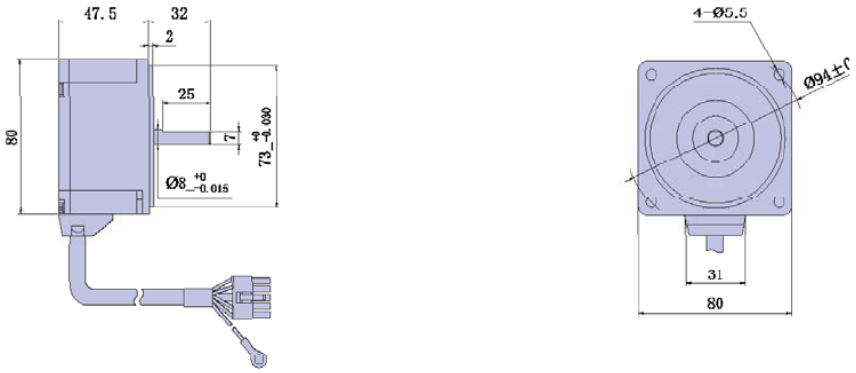




◇ 80 Brushless motor

Specifications	Model	
	SD-M60H34A	SD-M60L34A
Rated rotation speed (RPM)	3000	
Maximum rotation speed (RPM)	3500	
Flange dimensions (MM)	60×60	
Machine body length (MM)	47.5	
Rated power (W)	60	60
Input voltage (V)	AC220	DC24
Number of phases (P)	3	
Rated torque (NM)	0.2	0.2
Maximum torque (NM)	0.4	0.4
Rated current (A)	0.35	3.2
Maximum current (A)	0.7	6.4
Allowable voltage fluctuation range	±10%	
Protection grade	IP40	
Operating temperature	0 ～ +40° C	
Storage temperature	-25 ～ +75° C	
Operating humidity	85% RH or below (no condensation)	

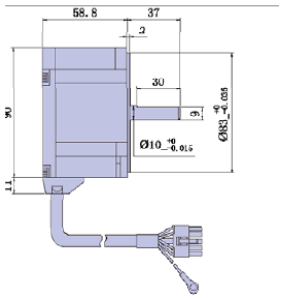
External dimension drawing

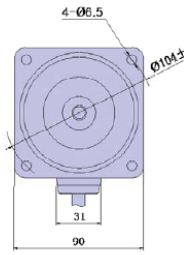


◇ **90 brushless motor**

Specifications	Model					
	M60H35B	M60L35B	M90H35B	M90L35B	M120H35B	M120L35B
Rated rotation speed (RPM)	3000					
Maximum rotation speed (RPM)	3500					
Flange dimensions (MM)	90×90					
Machine body length (MM)	58.8					
Rated power (W)	60		90		120	
Input voltage (V)	AC220	DC24	AC220	DC24	AC220	DC24
Number of phases (P)	3					
Rated torque (NM)	0.2	0.2	0.3	0.3	0.4	0.4
Maximum torque (NM)	0.4	0.4	0.6	0.6	0.8	0.8
Rated current (A)	0.34	3.2	0.53	4.8	0.68	6.25
Maximum current (A)	0.68	6.4	1.06	9.6	1.36	12.5
Allowable voltage fluctuation range	±10%					
Protection grade	IP40					
Operating temperature	0 ～ +40° C					
Storage temperature	-25 ～ +75° C					
Operating humidity	85% RH or below (no condensation)					

External dimension drawing

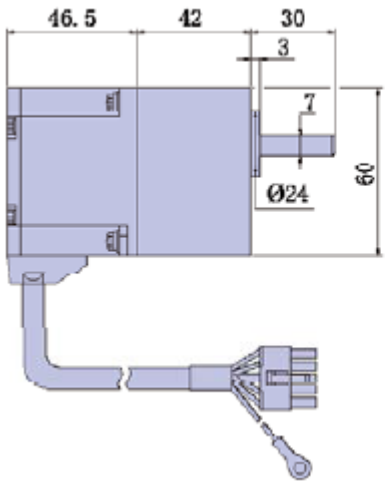


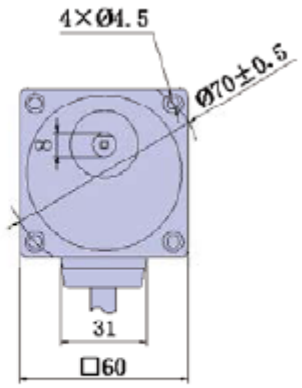


◇ 60 brushless gear speed reducing motor

Specifications	Model	
	Motor: M30H32 Reduction gearbox: 2-G □	Motor: M30L32 Reduction gearbox: 2-G □
Rated rotation speed (RPM)	3000	
Maximum rotation speed (RPM)	3500	
Flange dimensions (MM)	60×60	
Machine body length (MM)	46.5	
Rated power (W)	30	30
Input voltage (V)	AC220	DC24
Number of phases (P)	3	
Rated torque (NM)	0.1	0.1
Maximum torque (NM)	0.2	0.2
Rated current (A)	0.175	1.6
Maximum current (A)	0.35	3.2
Allowable voltage fluctuation range	±10%	
Protection grade	IP40	
Operating temperature	0 ～ +40° C	
Storage temperature	-25 ～ +75° C	

External dimension drawing

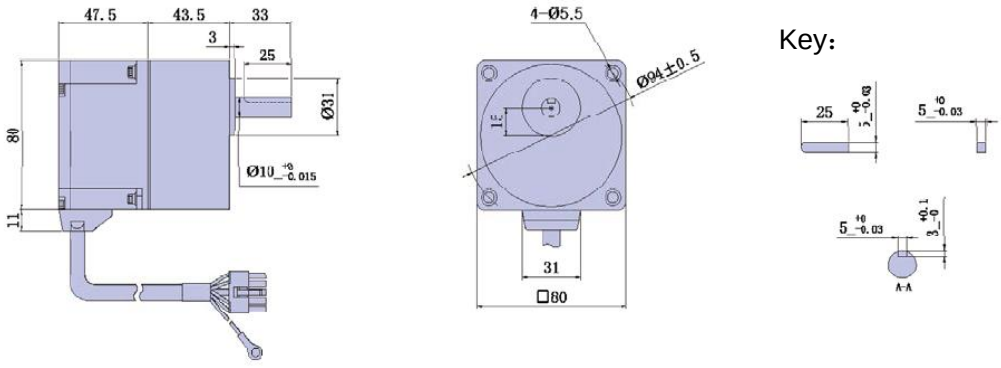




◇ 80 brushless gear speed reducing motor

Specifications	Model	
	Motor: M60H34 Reduction gearbox: 4-G □	Motor: M60L34 Reduction gearbox: 4-G □
Rated rotation speed (RPM)	3000	
Maximum rotation speed (RPM)	3500	
Flange dimensions (MM)	60×60	
Machine body length (MM)	47.5	
Rated power (W)	60	60
Input voltage (V)	AC220	DC24
Number of phases (P)	3	
Rated torque (NM)	0.2	0.2
Maximum torque (NM)	0.4	0.4
Rated current (A)	0.35	3.2
Maximum current (A)	0.7	6.4
Allowable voltage fluctuation range	±10%	
Protection grade	IP40	
Operating temperature	0 ～ +40° C	
Storage temperature	-25 ～ +75° C	

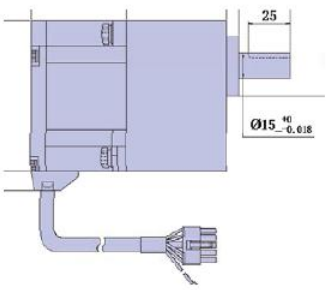
External dimension drawing

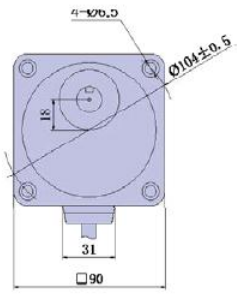


◇ **90 brushless gear speed reducing motor**

Specifications	Model					
	Motor: M60H35 Reduction gearbox: 5-G □	Motor: M60L35 Reduction gearbox: 5-G □	Motor: M90H35 Reduction gearbox: 5-G □	Motor: M90L35 Reduction gearbox: 5-G □	Motor: M120H35 Reduction gearbox: 5-G □	Motor: M120L35 Reduction gearbox: 5-G □
Rated rotation speed (RPM)	3000					
Maximum rotation speed (RPM)	3500					
Flange dimensions (MM)	90×90					
Machine body length (MM)	58.8					
Rated power (W)	60		90		120	
Input voltage (V)	AC220	DC24	AC220	DC24	AC220	DC24
Number of phases (P)	3					
Rated torque (NM)	0.2	0.2	0.3	0.3	0.4	0.4
Maximum torque (NM)	0.4	0.4	0.6	0.6	0.8	0.8
Rated current (A)	0.34	3.2	0.53	4.8	0.68	6.25
Maximum current (A)	0.68	6.4	1.06	9.6	1.36	12.5
Allowable voltage fluctuation range	±10%					
Protection grade	IP40					
Operating temperature	0 ～ +40° C					
Storage temperature	-25 ～ +75° C					

External dimension drawing





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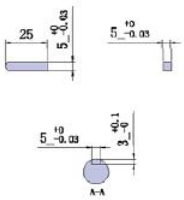
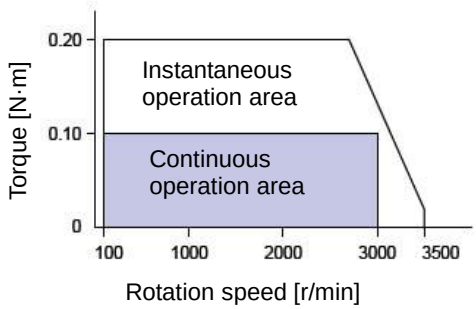
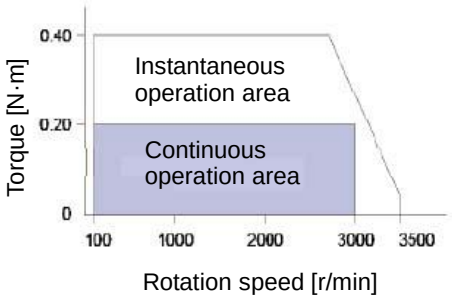


Torque curve graph

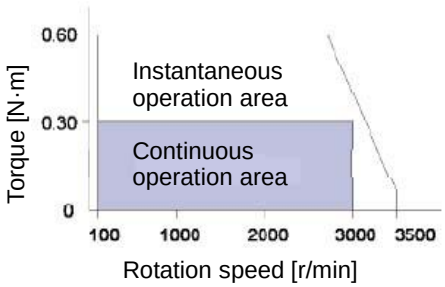
30 W



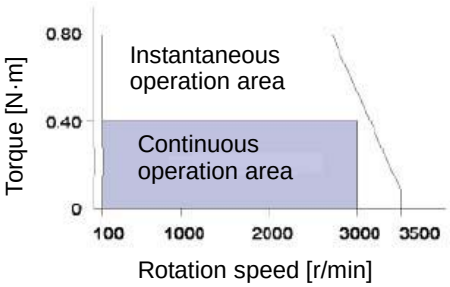
60W



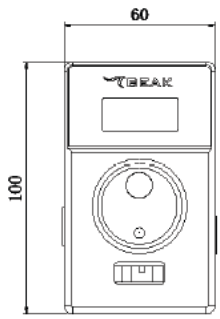
90W

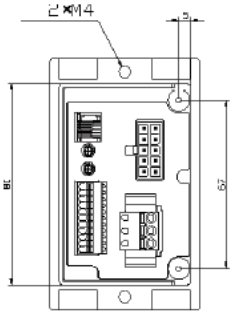


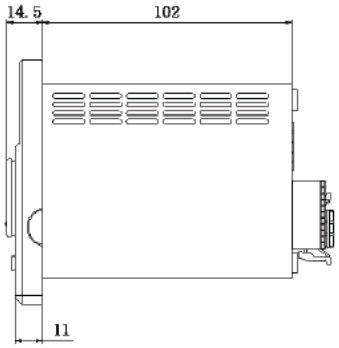
120W

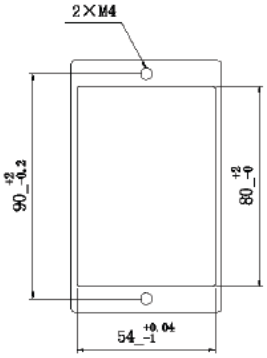


3.3 Driving controller dimension parameters









3.4 Brushless motor controller series

For this series of controller products, the parameter functions of each model are different. During model selection, please pay attention to the selection of parameters and functions. The User Manual is a series of specification documents and does not explain each model. During model selection, please pay attention to the difference of parameters, functions and specific use methods.

◇ **AC220V power supply input series (purchase guide)**

Model	Input voltage	Output power	RS-485	Display	Matched optical axis motor	Matched speed reducing motor
SA-D30H-RD	AC220V	30W	■	■	M30H32A	M30H32
SA-D60H-RD		60W	■	■	M60H34A/M60H35B	M60H34/M60H35
SA-D120HRD		120W	■	■	M120H35B	M120H35
SA-D200HRD		200W	■	■	M200H3C	M200H35
SA-D30HD		30W		■	M30H32A	M30H32
SA-D60HD		60W		■	M60H34A/M60H35B	M60H34/M60H35
SA-D120HD		120W		■	M120H35B	M120H35
SA-D200HD		200W		■	M200H35C	M200H35
SA-D30H		30W			M30H32A	M30H32
SA-D60H		60W			M60H34A/M60H35B	M60H34/M60H35
SA-D120H		120W			M120H35B	M120H35
SA-D200H		200W			M200H35C	M200H35

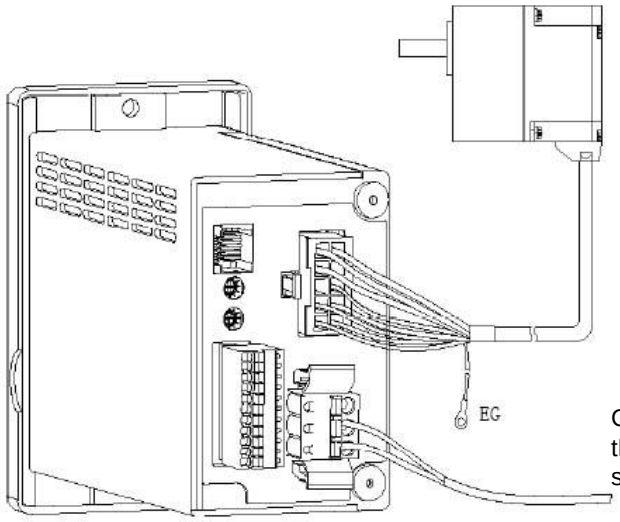
◇ **DC24V power supply input series (purchase guide)**

Model	Input voltage	Output power	RS-485	Display	Matched optical axis motor	Matched speed reducing motor
SA-D30LRD	DC24V	30W	■	■	SD-M30L32A	SD-M30L32
SA-D60LRD		60W	■	■	SD-M60L34A/SD-M60L35B	SD-M60L34/SD-M60L35
SA-D120LRD		120W	■	■	M120L34C/M120L35B	M120L34/M120L35
SA-D30LD		30W		■	SD-M30L32A	M30L32
SA-D60LD		60W		■	M60L34A/M60L35B	M60L34/M60L35
SA-D120LD		120W		■	M120L35B	M120L35
SA-D30L		30W			M30L32A	M30L32
SA-D60L		60W			M60L34A/SD-M60L35B	M60L34/SD-M60L35
SA-D120L		120W			M120L35B	M120L35

4 Motor running

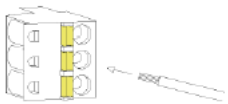
According to the ex-factory setting state, simply explain the running method.

4.1 Connecting line



CN2 connection method

Use a slot type screwdriver to press and hold the orange button so as to insert the lead wire.



Orange

◆Importance

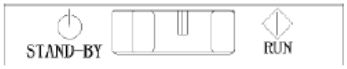
When powering on again or unplugging and inserting the connector, please make an interval of at least one minute after power failure.

Please firmly insert the connector. If the connection of the connector is not firm, it will result in the abnormal action of the motor or cause product damage.

4.2 Power-on

According to the diagram above, power on after connection.

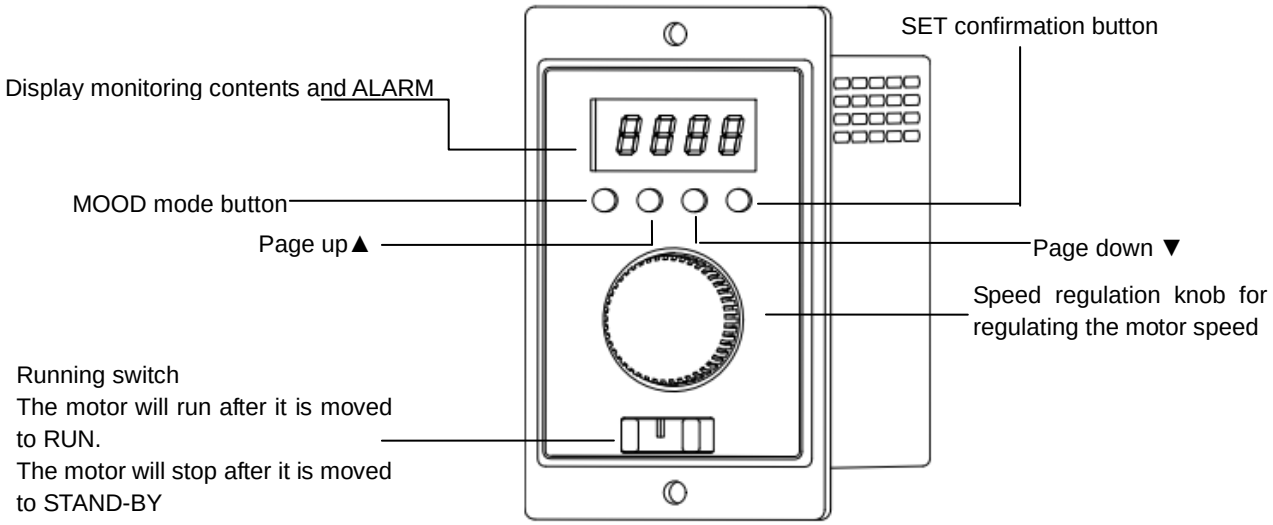
Importance	During power-on, if the running switch is moved to RUN and the Alarm code (AL07) is displayed, the motor cannot run. (Alarm is prohibited during running after power-on). Please move the running switch from RUN to STAND-BY and then move the running switch to RUN again for normal start.



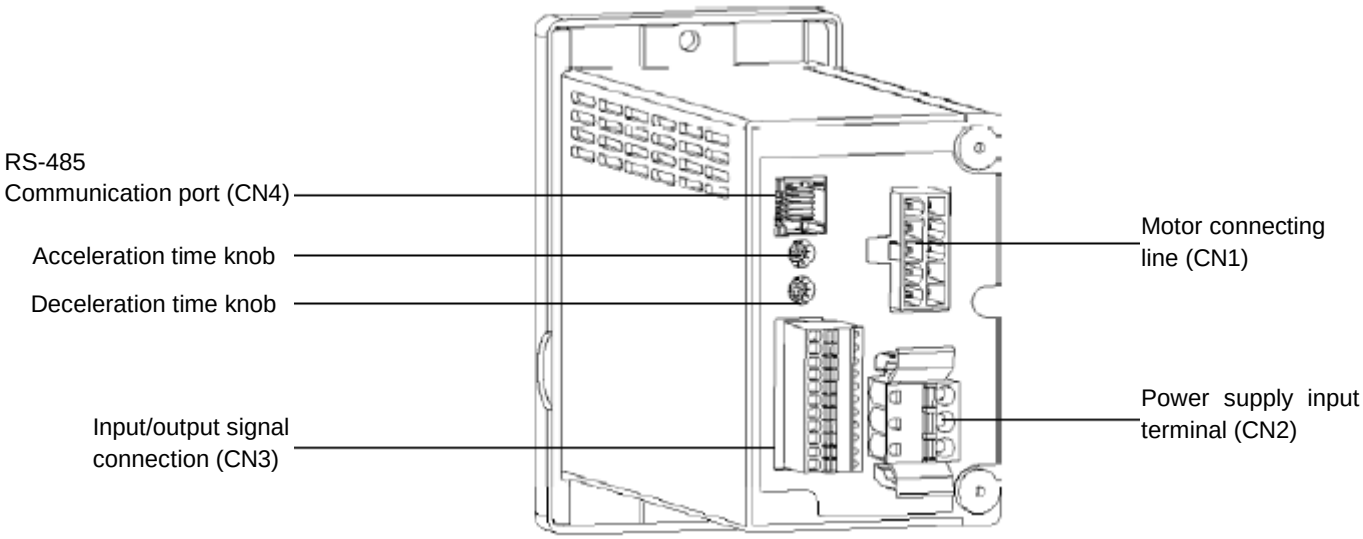
Please refer to P.20 for the running parameter setting of power-on initial running prohibition fault (Alarm code: AL07).

4.3 Running

Driving controller panel



Driving controller backside



Start
Move the running switch to RUN, and turn the knob rightwards so that the motor starts rotating.

Speed regulation
Slowly turn the knob rightwards to gradually increase the speed, and turn it leftwards to gradually reduce the speed.
Rapidly turn the knob to quicken the speed change.

Stop
Move the running switch to STAND-BY so that the motor slows down and stops.
Move the running switch to RUN again so that the motor starts rotating according to the set rotation speed.

Rotation direction
Press the Page Up▲/Page Down▼ button for 3s,the motor will rotate clockwise/anticlockwise. Direction conversion is available when motor is running.

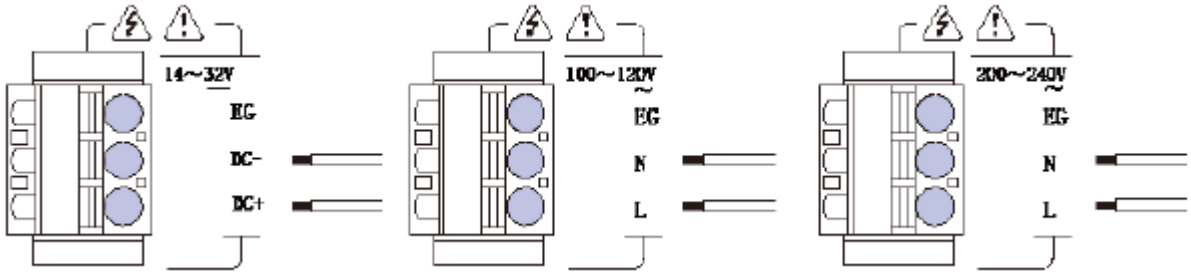
5 Port and wiring

5.1 Connection of power supply

Connect the power supply cable to CN2

Input voltage	Connection mode
Low voltage DC input DC24V	Power supply DC+ is connected with the positive terminal of power supply input, and power supply DC- is connected with the negative terminal of power supply.
High voltage single phase 100-120V	Power supply LIVE (phase line) is connected with L terminal, and power supply NEUTRAL (neutral line) is connected with N terminal.
High voltage single phase 200-240V	Power supply LIVE (phase line) is connected with L terminal, and power supply NEUTRAL (neutral line) is connected with N terminal.

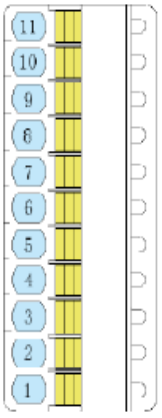
● Low voltage 14-32V ● Single phase 100-120V ● Single phase 200-240V



5.2 Input/output signal connection

◇ **CN3 port introduction**

No.	Terminal name	Signal name	Instructions
11	COM0	COM0	Control power supply +5V
10	XO	FWD*	Motor rotation in FWD direction
9	X1	REV*	Motor rotation in REV direction
8	X2	M0*	Multistage speed setting
7	X3	M1*	Multistage speed setting
6	COM1	COM1	Control power supply 0V
5	PWM	PWM	PWM/ frequency speed regulation input
4	ALM+	ALM+	It is ON during ALM, and it is OFF during normal operation.
3	ALM-	ALM-	
2	SPD+	SPD+	The number of pulses outputted after the motor shaft rotates by a circle. Refer to the number of magnetic poles for the number of pulses.
1	SPD-	SPD-	



Note: * is the ex-factory setting. The function change can be made through parameters. Please refer to P.21 for details.

◇Input signal circuit

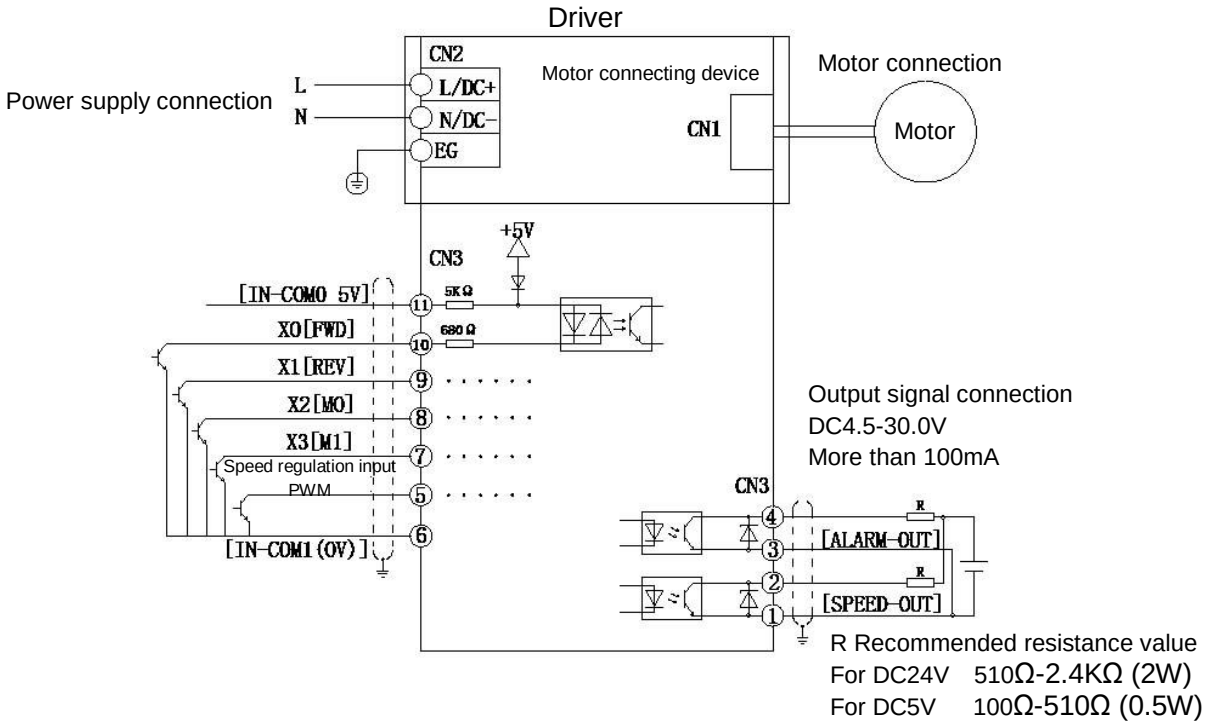
The input signal is the built-in optical coupling isolation input.
Carry out the control through the internal power supply (+ 5V).

When the external power supply is used, it can be corresponding to NPN control input and PNP control input through the change of the wiring mode.
Connectable external power supply: DC24V -15% to + 20%, more than 100 mA.

5.3 Wiring diagram

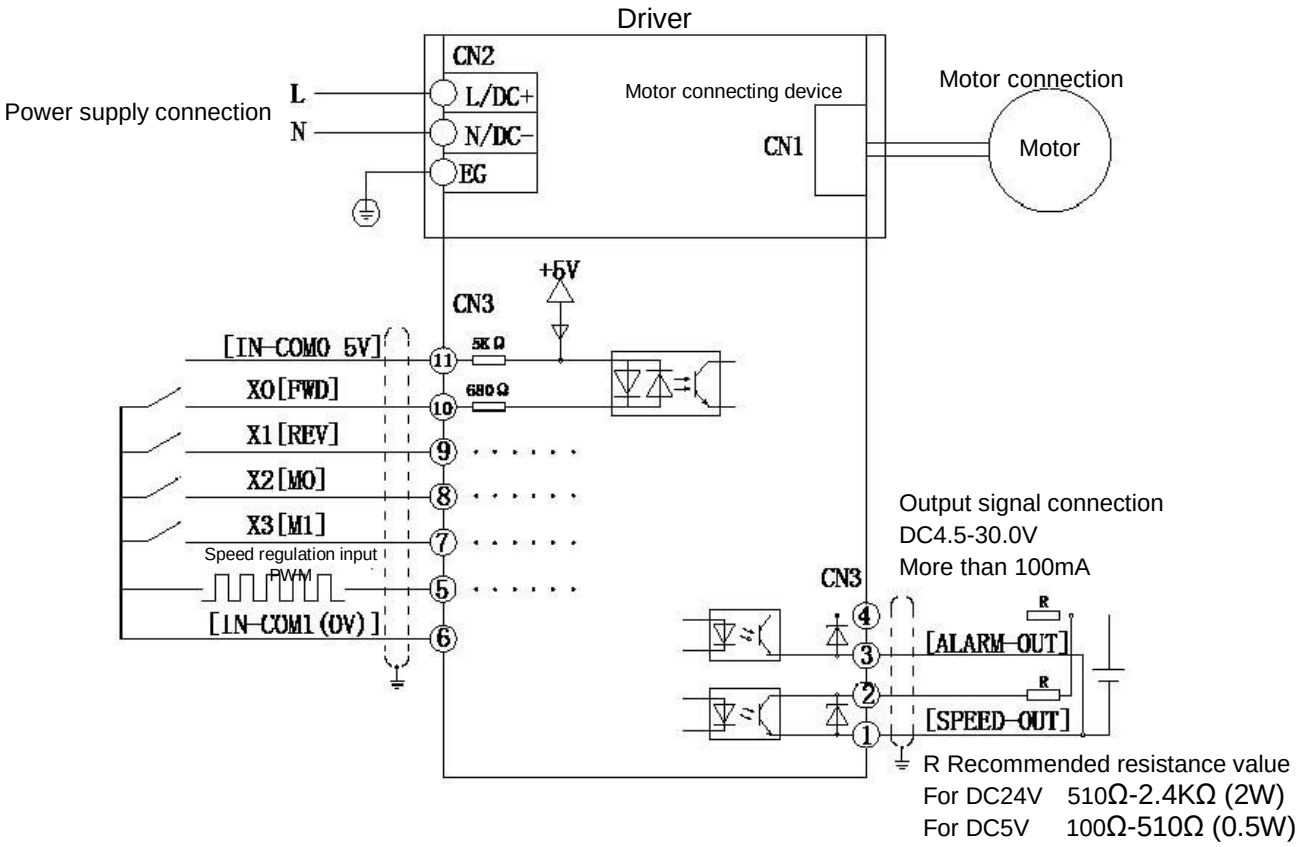
◇ NPN logical control

Wiring when using the transistor output-type upper controller to control the motor.



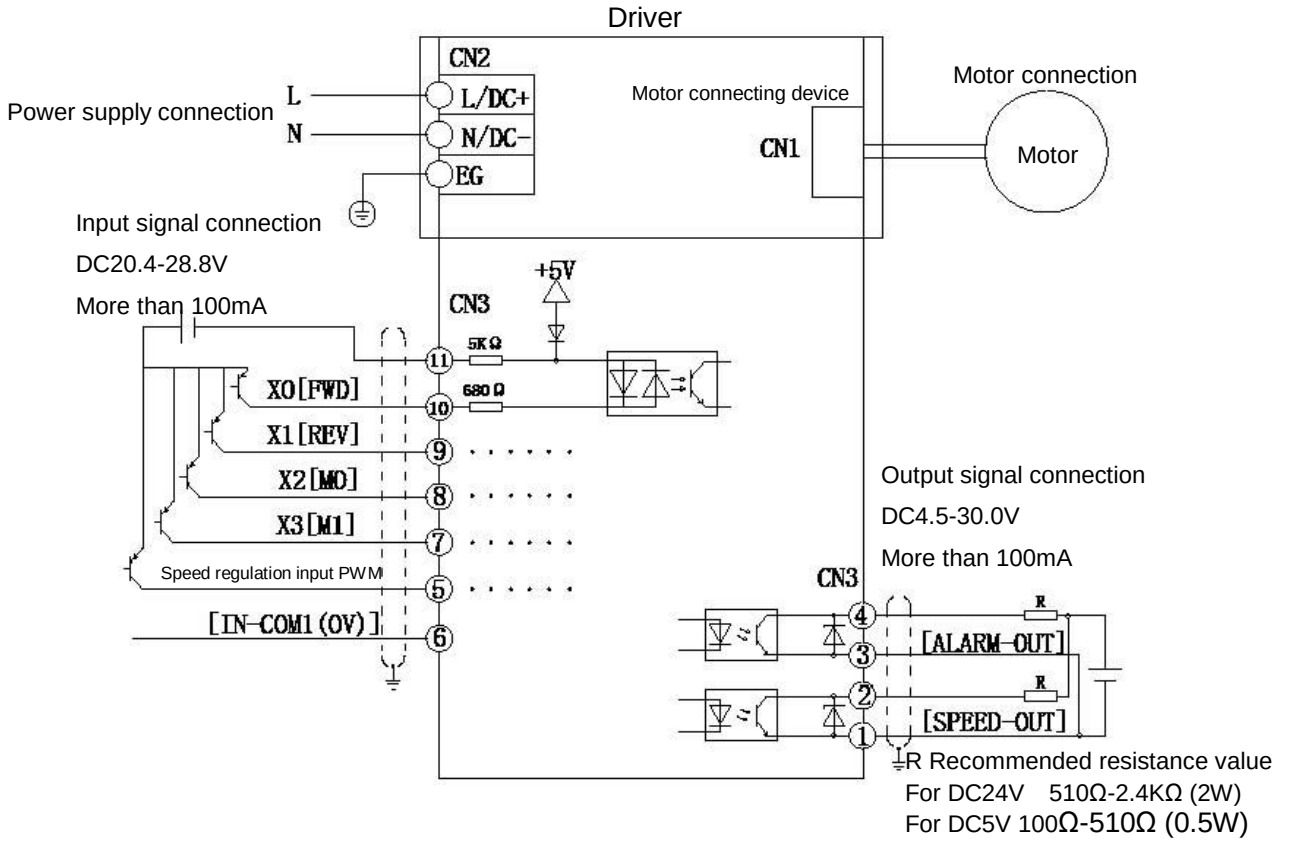
◇ Switch type wiring

Wiring when using the switch, relay and other contact switches to control the motor.



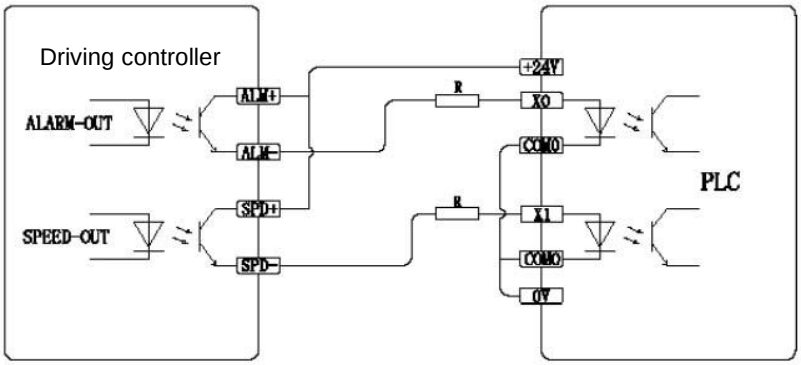
◇ PNP logical control

Wiring when using the transistor output-type upper controller to control the motor

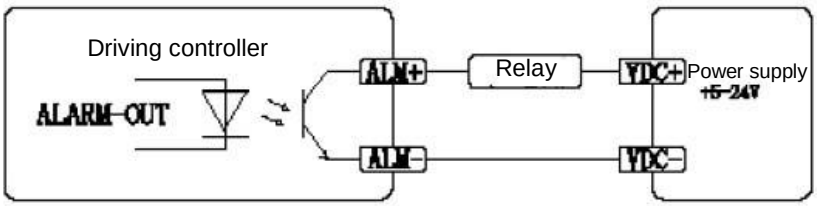


◇ Output port wiring diagram

PLC detection output signal wiring



Output control relay



6 Function introduction

6.1 Function list

Function	Contents	Operation mode	Reference source
Display	1: Rotation speed display	Monitoring	
	2: Current display		
	3: Voltage display		
	4: Temperature display		
	5: ALARM code display		
	6: Speed of speed reducer output shaft after the setting of conversion		
Rotation speed setting	1: Set the motor speed through the knob	Parameters	
	2: Set the motor speed through figures		
	3: Set the motor speed through the external signal input		
Setting of acceleration and deceleration time	1: Set the acceleration and deceleration time of the motor through the knob		
	2: Set the acceleration and deceleration time of the motor through figures		
Operation carried out through external signals	Control the operation through external signals		
Rotation speed setting range limitation	Set the upper and lower limits of rotation speed		
Keep it simple	Keep the load during stopping		
485 control	Carry out the address selection and control		
Gear ratio setting	Set the speed ratio of the adaptive speed reducer		

Magnetic polarity setting	Set different magnetic poles.		
Overload time setting	Set the time from overload to output		
Multistage speed data setting	Set the multistage speed data		
Data initialization	Restore the operating data to the factory default setting		

Note	Some models of BEAK products have no display and setting function or no RS-485 function. Please pay attention to the required function during model selection so as to avoid the wrong model selection.

6.2 Driving controller setting

0000 Rotation speed display

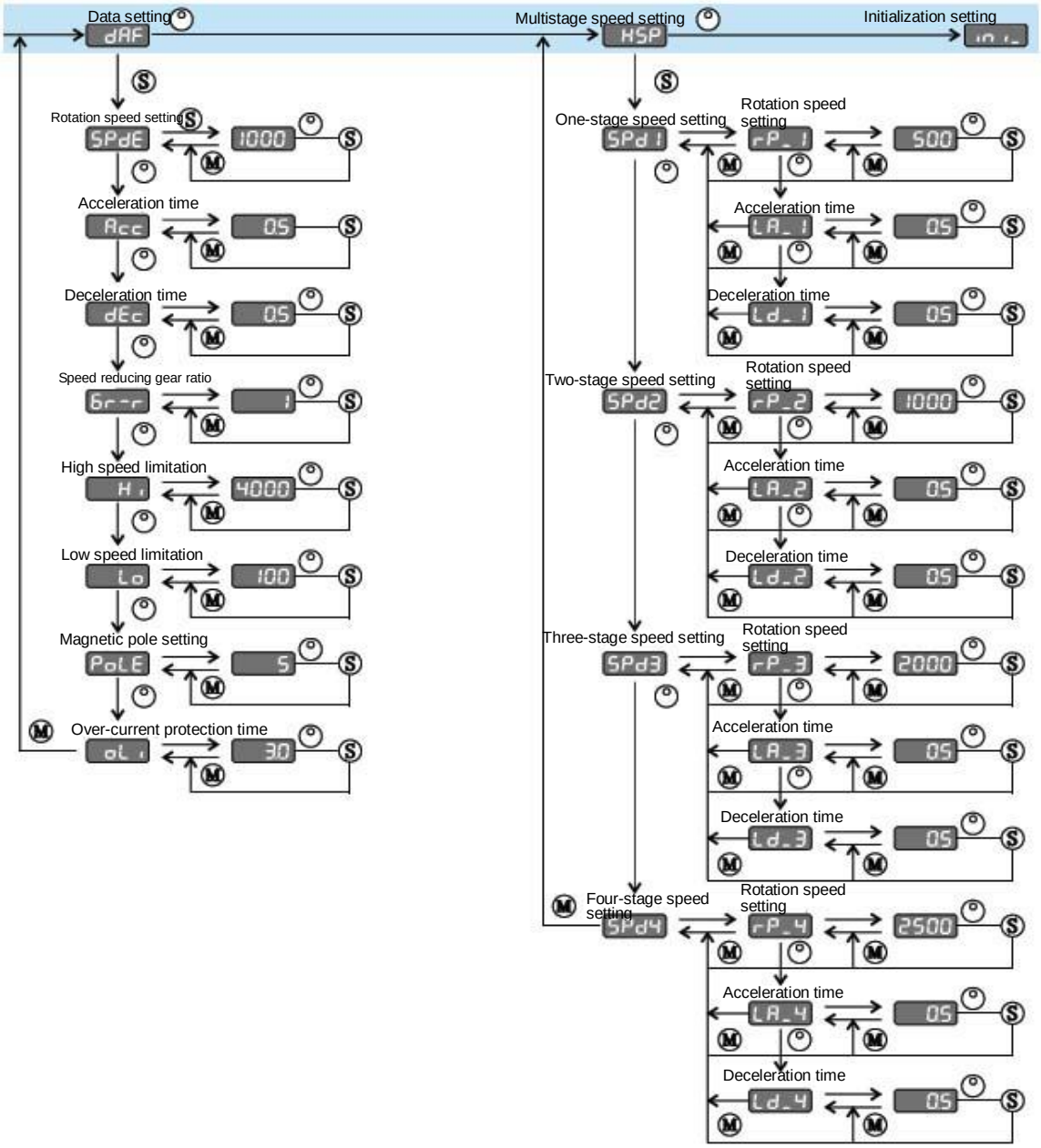
▲▼ Page up/page down button

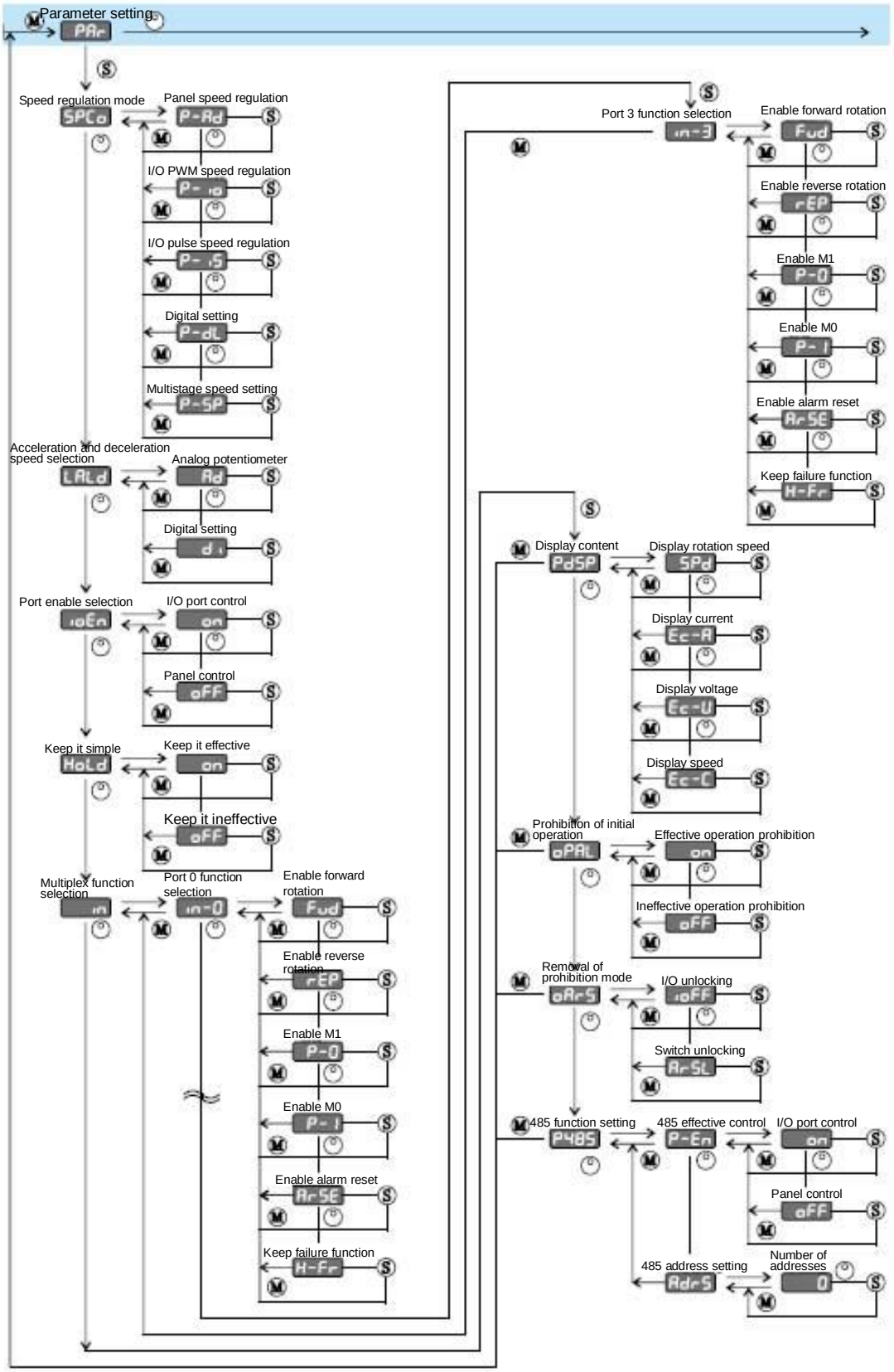
Ⓢ SET button

Ⓜ MODE button

Initialization setting → Initialization confirmation

Note: In this flow sheet, ⊙ means you can press ▲ or ▼




Parameter setting
PAr
Speed regulation mode
SPCd
Panel speed regulation
P-Ad
I/O PWM speed regulation
P-io
I/O pulse speed regulation
P-PS
Digital setting
P-dL
Multistage speed setting
P-SP
Acceleration and deceleration speed selection
tAtd
Analog potentiometer
Ad
Digital setting
di
Port enable selection
ioEn
I/O port control
on
Panel control
oFF
Keep it simple
HoLd
Keep it effective
on
Keep it ineffective
oFF
Multiplex function selection
in
Port 0 function selection
in-0
Enable forward rotation
Fud
Enable reverse rotation
rEP
Enable M1
P-0
Enable M0
P-1
Enable alarm reset
ArSE
Keep failure function
H-Fr
Port 3 function selection
in-3
Enable forward rotation
Fud
Enable reverse rotation
rEP
Enable M1
P-0
Enable M0
P-1
Enable alarm reset
ArSE
Keep failure function
H-Fr
Display content
PdSP
Display rotation speed
SPd
Display current
Ec-A
Display voltage
Ec-U
Display speed
Ec-C
Prohibition of initial operation
oPAL
Effective operation prohibition
on
Ineffective operation prohibition
oFF
Removal of prohibition mode
oArS
I/O unlocking
ioFF
Switch unlocking
ArSL
485 function setting
P485
485 effective control
P-En
I/O port control
on
Panel control
oFF
485 address setting
AdrS
Number of addresses
0

6.3 Parameters list

◇ Operation mode: parameter mode

Item	Display	Contents	Setting range	Ex-factory setting
Speed regulation mode	SPCo	Change the input mode of speed regulation	P-Ad Potentiometer of the panel for speed regulation P-io Input I/O port PWM for speed regulation P-iS Input I/O port pulse for speed regulation P-dL Panel digital button for speed regulation P-SP Multistage speed work for speed regulation	P-Ad
Acceleration and deceleration setting selection	LALd	Selection of acceleration and deceleration setting mode	Ad Rear potentiometer for settling time d Panel digital button for settling time	Ad
Port enable selection	ioEn	The motor runs through the external signal FWD/REV	on Controlled through the external signal oFF Controlled through the panel switch	oFF
Keep it simple	HoLd	Keep the load when the motor stops.	on Effective oFF Ineffective	oFF
Multiplex function selection	in	Change the input signal distributed on the external input terminal	See P16 port multiplex mode for details	
Display content	PdSP	Monitor the content selection under the monitoring mode	SPd Monitor the actual motor speed Ec-A Monitor the actual motor current Ec-U Monitor the working voltage Ec-C Monitor the controller heating temperature	SPd
Prohibition of initial operation	oPAL	Set the initial operation prohibition of effective/ineffective ALARM	on Effective oFF Ineffective	on
Removal of prohibition mode	oArS	Select the ALARM removal method of initial operation prohibition	ioFF Remove the running switch STAND-BY through OFF of FWD and REV signals. ArSL Remove the [ ] through ALARM-RESET signal or depending on the Alarm reset of the mode.	ioFF
485 function setting	P485	485 operation enable and 485 address setting	See P20 for details	oFF
485 control function enable	P-En	Check whether 485 function setting is effective	on Effective oFF Ineffective	oFF
485 address setting	AdrS	Set the 485 multi-machine control address	0-255	0

◇ in mode: port multiplex mode

Item	Display	Contents	Setting range	Ex-factory setting
X0 function setting	in-0	Set the input function of X0 port	Fud Enable in the motor clockwise direction rEP Enable in the motor counterclockwise direction P-0 Multistage speed M0 enable P-1 Multistage speed M1 enable ArSE ALM alarm reset port H-Fr Keep the ineffective enable simple	Fud
X1 function setting	in-1	Set the input function of X1 port		rEP
X2 function setting	in-2	Set the input function of X2 port		P-0
X3 function setting	in-3	Set the input function of X2 port		P-1

◇ Operation mode: data mode

Item	Display	Contents	Setting range	Ex-factory setting
Rotation speed setting	SPdE	When the speed regulation mode is set as the digital mode, the motor speed can be set.	60-9999	1000
Acceleration time setting	Acc	When the acceleration time mode is set as the digital mode, the motor acceleration time can be set.	0.2--15	0.2
Deceleration time setting	dEc	When the deceleration time mode is set as the digital mode, the motor deceleration time can be set.	0.2--15	0.2
Speed reducing gear ratio	Gr-r	Set the speed reducing ratio relative to the motor output shaft rotation speed. Under the monitoring mode, display the speed reducing ratio of the transmission shaft calculated through the speed obtained from the conversion of speed reducing ratio and input it, and also display it as the conveyor belt carrying speed.	1--200	1
High speed limitation	H.	Set the speed upper limit.	9999	4000
Low speed limitation	Lo	Set the speed lower limit	80	80
Magnetic pole setting	PoLE	Set the number of pole pairs of the motor	2--99	5
Over-current protection time setting	oL.	Set the time form overload detection to Alarm output when the power exceeds the actual motor power during continuous operation.	1-10S	3S

◇ Operation mode: data mode

Item	Display	Contents	Setting range	Ex-factory setting
The first-stage function setting	SPd1	The first-stage function setting		
One-stage rotation speed	rP_1	One-stage rotation speed	100-9999	1000
One-stage acceleration time	tA_1	One-stage acceleration time	0.2—15S	0.5S
One-stage deceleration time	td_1	One-stage deceleration time	0.2—15S	0.5S
The second-stage function setting	SPd2	The second-stage function setting		
Two-stage rotation speed	rP_2	Two-stage rotation speed	100-9999	1000
Two-stage acceleration time	tA_2	Two-stage acceleration time	0.2—15S	0.5S
Two-stage deceleration time	td_2	Two-stage deceleration time	0.2—15S	0.5S
The third-stage function setting	SPd3	The third-stage function setting		
Three-stage rotation speed	rP_3	Three-stage rotation speed	100-9999	1000
Three-stage acceleration time	tA_3	Three-stage acceleration time	0.2—15S	0.5S
Three-stage deceleration time	td_3	Three-stage deceleration time	0.2—15S	0.5S
The fourth-stage function setting	SPd4	The fourth-stage function setting		
Four-stage rotation speed	rP_4	Four-stage rotation speed	100-9999	1000
Four-stage acceleration time	tA_4	Four-stage acceleration time	0.2—15S	0.5S
Four-stage deceleration time	td_4	Four-stage deceleration time	0.2—15S	0.5S

6.4 Contents displayed by the driver

Display mode: monitoring contents

Item	Display	Monitoring contents
Rotation speed	0000	Display the motor speed. When the speed reducing ratio parameters are set, display the speed reducer output shaft speed or conveyor belt speed.
Current	0000	Display the current actual current value (A) of the motor
Voltage	0000	Display the power supply voltage (V) of the current system
Temperature	0000	Display the internal temperature of the current controller

◇ **Display of rotation speed after setting the speed reducing ratio**

- Number of digits displayed during the setting of the speed reducing ratio
  After setting the speed reducing ratio, the number of digits displayed will be changed due to the change of effective number of digits of the integral part.

Setting of speed reducing ratio	Monitoring mode display
1-10	0--999
10-100	0-99
100-1000	0-9

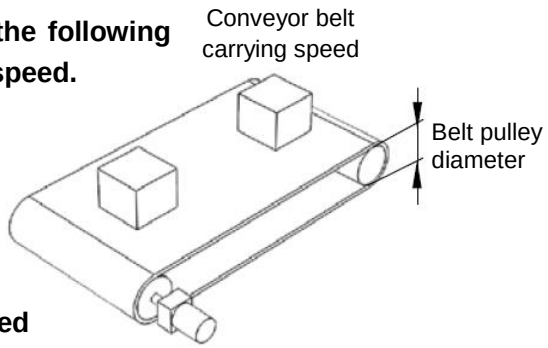
- **Calculation of conveyor belt carrying speed**

During the calculation of conveyor belt carrying speed, please use the following formula to calculate the conveyor belt speed reducing ratio and set the “speed reducing ratio” parameters.

$$\text{Conveyor belt speed reducing ratio} = \frac{1}{\text{Transmission quantity of the motor rotating by a circle}} = \frac{\text{Speed reducing ratio of the speed reducer}}{\text{Belt pulley diameter [m]}\times\pi}$$

- **After the conveyor belt speed reducing ratio is calculated, the following formula shall be used to calculate the conveyor belt carrying speed.**

$$\text{Conveyor belt carrying speed [m/min]} = \frac{\text{Rotation speed of the motor output shaft [r/min]}}{\text{Conveyor belt speed reducing ratio}}$$



For instance, when the belt pulley diameter is 0.2m and the speed reducing ratio of the speed reducer is 5.

$$\text{Conveyor belt speed reducing ratio} = \frac{\text{Speed reducing ratio of the speed reducer}}{\text{Belt pulley diameter [m]}\times\pi} = \frac{5}{0.2\text{[m]}\times\pi} = 8$$

According to the conversion formula, the conveyor belt speed reducing ratio in this example is 8.
If the motor rotation speed is 1500r/min at a speed reducing ratio of 8, the conveyor belt carrying speed is as follows:

$$\text{Conveyor belt carrying speed [m/min]} = \frac{1500}{8} = 187.5$$

6.5 Setting of acceleration and deceleration time

When the motor runs according to the set acceleration and deceleration time in the set data, please set the acceleration and deceleration selection [LALd] parameters as the digital setting [d1]. Please refer to P.21 for details

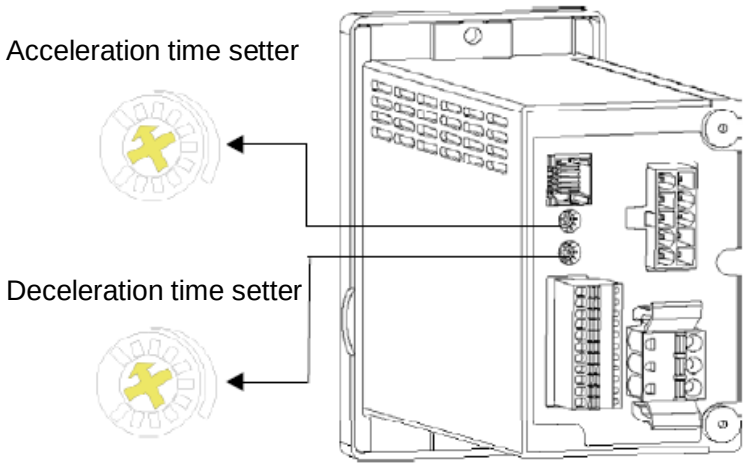
When the motor runs according to the analog-regulating acceleration and deceleration time, please set the acceleration and deceleration selection [LALd] parameters as the digital setting [Ad]. Please refer to P.21 for details

The controller rear end is provided with two adjusting knobs, and the acceleration and deceleration time can be adjusted through the left and right rotation.

Acceleration time refers to the time required by the motor from the stop state to the rated rotation speed (3000 r/min).

Deceleration time refers to the time required by the motor from the rated rotation speed to the stop state.

The actual acceleration and deceleration time will be different due to the operating conditions, load inertia, load torque, etc.

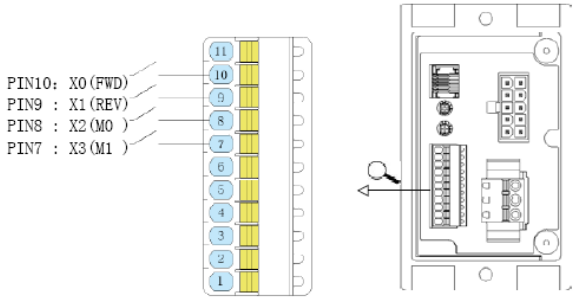


6.6 Running of externally-inputted signals

◇ Running method

Method of motor running through external signal

1. Connect the external switch signal shown in the diagram below to CN3
2. Turn on the power supply.
3. Set the “external running signal input” parameters as “ON (effective)”. Please refer to P.21 for the change method of parameters.
4. Move the running switch to RUN.
5. Set FWD input or REV input as ON so that the motor rotates. Turn the running signal set as ON into OFF so that the motor slows down and stops.



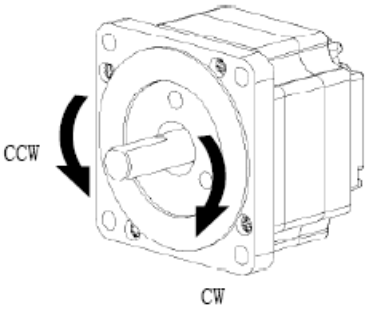
◇ Instructions of input/output signal

• FWD

When FWD is ON, the motor will rotate clockwise. When it is OFF, the motor will slow down and stop.
When FWD and REV are OFF simultaneously, the motor will slow down and stop.
When FWD and REV are ON simultaneously, the motor will stop instantaneously.
(When FWD/REV and COM1 are OFF for disconnection.) Please refer to P.16 for the specific use of wiring.

• REV

When REV is ON, the motor will rotate counterclockwise. When it is OFF, the motor will slow down and stop.
When FWD input and REV input are OFF simultaneously, the motor will slow down and stop.
When FWD and REV are ON simultaneously, the motor will stop instantaneously.
(When FWD/REV and COM1 are OFF for disconnection.) Please refer to P.16 for the specific use of wiring.

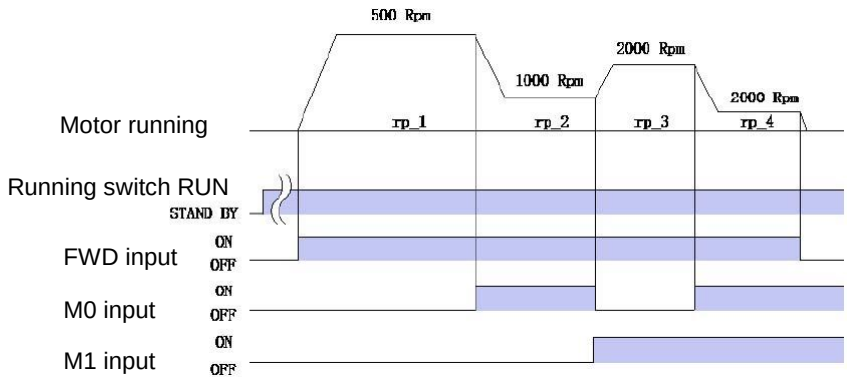


Signal	Terminal	Signal name	Contents
Input	X0 X1 X2 X3 PWM	FWD	If one of FWD and REV is inputted, the motor will rotate. If FWD and REV are set as OFF simultaneously, the motor will slow down and stop. If FWD and REV are set as ON simultaneously, the motor will instantaneously stop.
		REV	
		M0	When the multi-stage speed is selected, the ON/OFF combination will results in different rotation speeds. Please refer to the multistage speed setting.
		M1	
		ALM-RESET	When the protection function works, remove ALARM.
		H-FRREE	Removal of keeping it simple
Output	ALM+ ALM- SPD+ SPD-	ALM+	When the motor actual value exceeds the parameter set value or the overload ALARM occurs, the output (normally closed) will occur.
		ALM-	
		SPD+	During the operation of the motor, 24 pulses are outputted every time motor output shaft rotates by a circle. The pulse width of the pulse signal outputted is 0.2ms. The motor speed can be calculated through SPEED-OUT. Rotation speed (RPM/MIN) = Frequency of SPEED-OUT / 6×POLE (number of pole pairs) = 60
		SPD-	

◇ M0 and M1 multistage speed selection

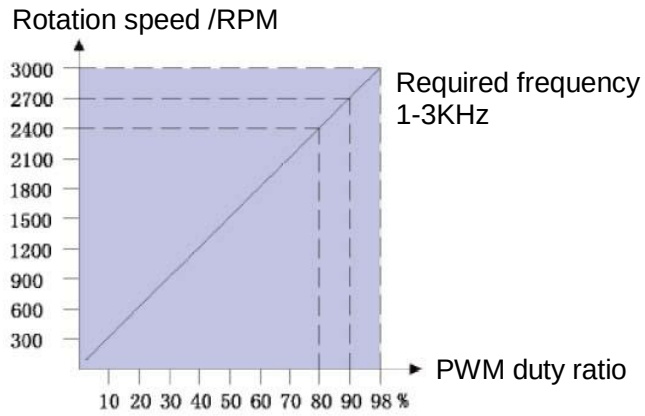
Four running data can be selected through M0 and M1.
The setting of acceleration and deceleration time will become effective after the “simulation acceleration and deceleration” parameters are changed. Please refer to P.19 or P.22 for the change method of parameters.

M0	M1	Running data No.	Rotation speed	Acceleration time	Deceleration time
OFF	OFF	1	1	1	1
ON	OFF	2	2	2	2
OFF	ON	3	3	3	3
ON	ON	4	4	4	4

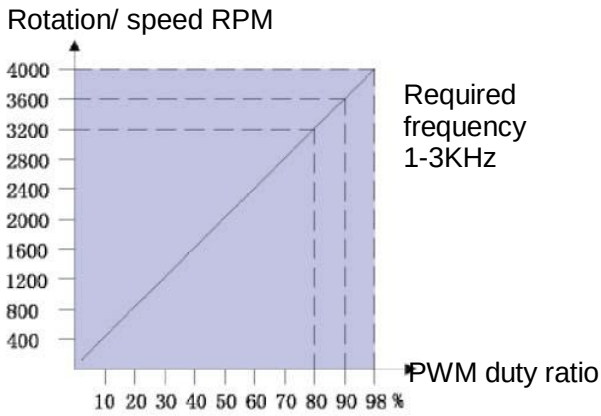


◇ **External input speed regulation mode**

A: PWM speed regulation input: When setting the speed regulation mode as PWM input, it will be effective after change (please refer to P.20 for the parameter setting). When PWM duty ratio ranges from 1% to 98%, the rotation speed will be changed simultaneously. The rotation speed corresponding to the duty ratio will be changed according to the actual regulating range of the upper limit set value of rotation speed. (As shown in the diagram below)



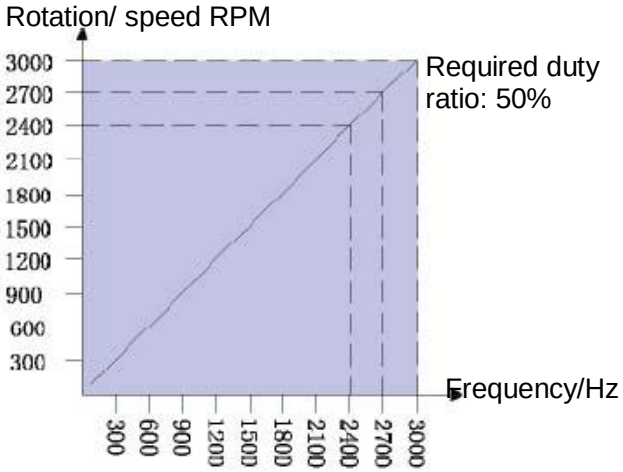
When the rotation upper limit HI is set as 3000RPM



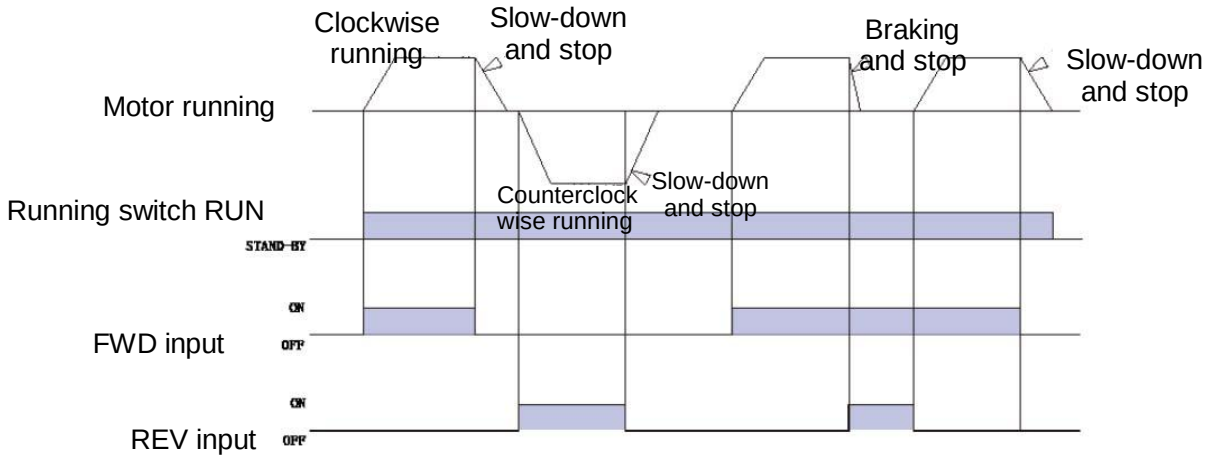
When the rotation upper limit HI is set as 4000RPM

B: Pulse speed regulation input: When setting the speed regulation mode as pulse input, it will be effective after change (please refer to P.20 for the parameter setting).
When the pulse frequency ranges from 100Hz to 3KHz, the rotation speed will be changed simultaneously.

C: If the external analog quantity is needed for speed regulation, please contact BEAK to purchase the AD module.



Pulse frequency speed regulation control



This diagram introduces the time sequence chart which shows that the rotation direction switch is set at the [FWD] side.

6.7 Two-stage speed running method

More than two speeds can be switched through the external input for running.

◇ **Two-stage speed running**

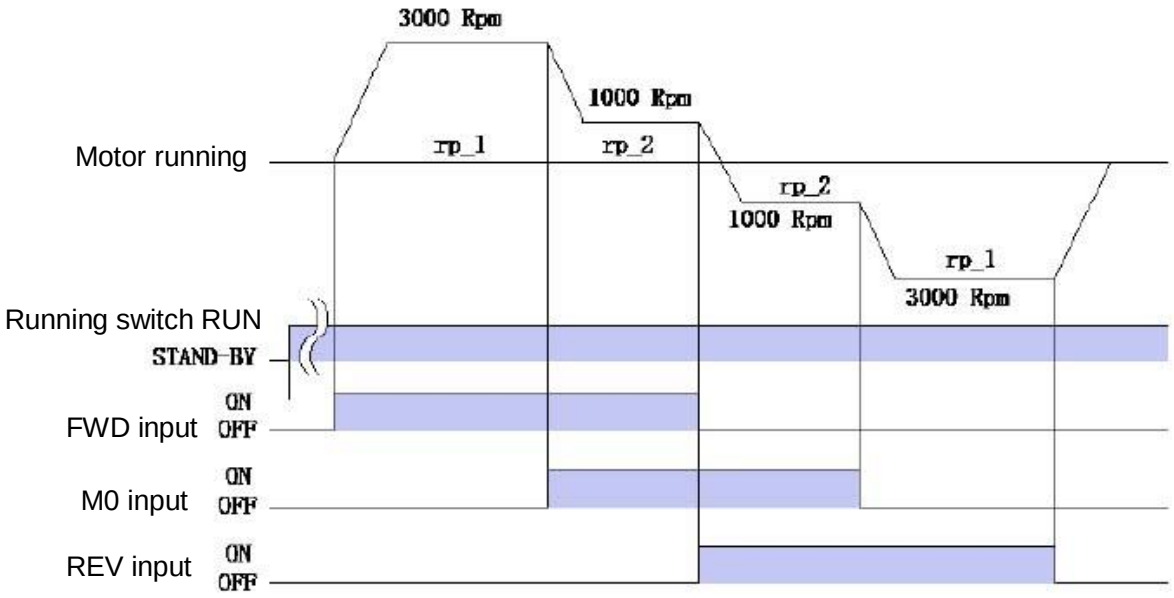
During the setting of the running data SPd 1 and SPd2 , the two-stage speed running can be carried out through M0 input switching.

◆ **Running method**

Method of switching the rotation direction for running

Running conditions	1. Rotation speed: running data SPd 1 :3000 r/min; running data SPd2 : 1000 r/min. 2. Move the running switch in the panel to RUN.
Running method	1. Set the port enable selection as the externally-inputted signal for running. 2. Set the running rotation speed in the data mode. rP_ 1: 3000 r/min; RP_2: 1000 r/min. Please refer to P.19 for the setting method of running rotation speed. 3. Set FWD input as ON. The motor rotates at 3000r/min. (Running data rP_ 1) 4. Turn M0 input into ON in the midway. Switch the motor speed into 1000r/min for continuous running. (Running data rP_2) 5. Set FWD input as OFF and REV input as ON. The motor slows down and stops so as to switch the rotation direction. 6. Turn M0 input into OFF in the midway. Switch the motor speed into 3000r/min for continuous running. (Running data rP_ 1) 7. Set REV input as OFF. The motor slows down and stops.

◆ **Logical diagram**



◇ **Four-stage running method**

The combination mode and the 4-stage speed running can be carried out through M0 and M1. The specific mode is shown in the diagram below.

◆ **Running method**

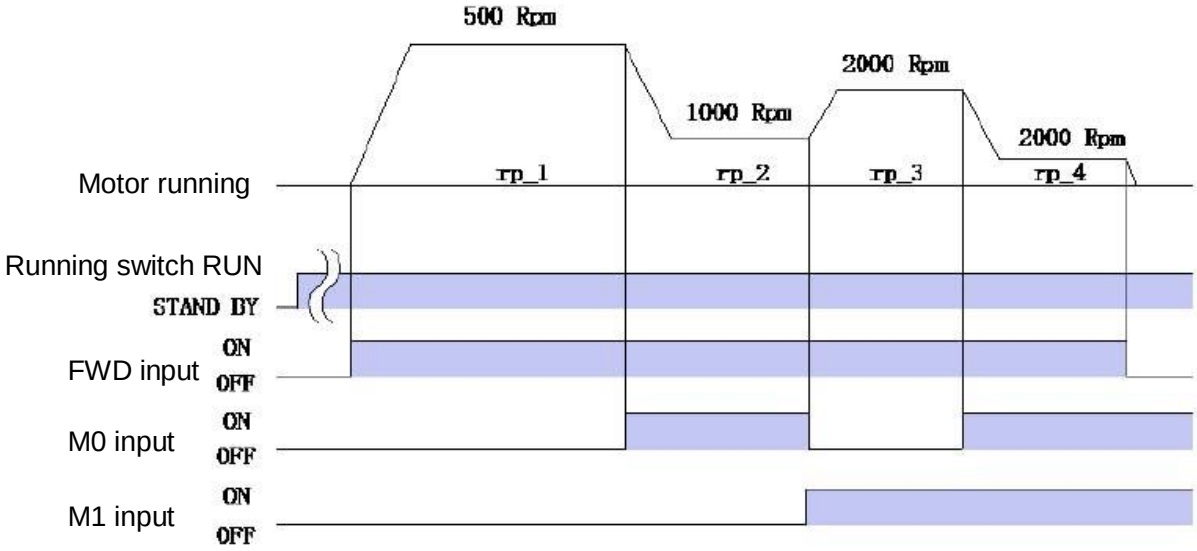
［**Parameter setting**］

Rotation speed	Rotation speed setting ⌐P_1: 500 r/min
	Rotation speed setting ⌐P_2 :1000 r/min
	Rotation speed setting ⌐P_3 : 2000 r/min
	Rotation speed setting ⌐P_4 : 2500 r/min
Running direction setting	Direction setting: set [FWD] as ON

［**Input signal**］

Terminal name	Signal name
X0	FWD
X1	REV
X2	MO
X3	M1

◆ Logical diagram



6.8 Setting range of rotation speed limitation

◇ **Speed upper limit**

Set the upper limit of rotation speed in the “speed upper limit” of the “speed upper and lower limits” parameters.

The set motor speed shall not exceed the rotation speed of the “speed upper limit”. If the running data of exceeding the “speed upper limit” rotation speed has been set, please modify the set rotation speed in the speed upper limit parameters.

◇ **Speed lower limit**

Set the lower limit of rotation speed in the “speed lower limit” of the “speed upper and lower limits” parameters.

The set motor speed shall not be less than the rotation speed of the “speed lower limit”. If the running data of less than the “speed lower limit” rotation speed has been set, please modify the set rotation speed in the speed lower limit parameters.

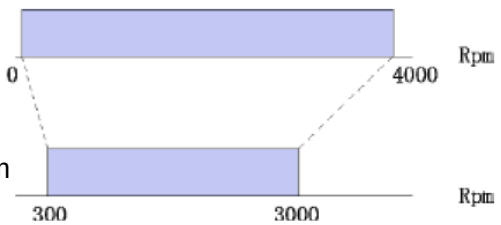
Rotation speed setting range

Ex-factory setting

[For example]

Speed upper limit: 3000Rpm

Speed lower limit: 300Rpm



7 Fault alarm instructions

7.1 Alarm code description

When the fault occurs, the motor will naturally stop and the motor output shaft state will be turned into the free rotation state.

Simultaneously display the fault code. The fault type can be confirmed through the fault code.

Fault code	Fault name	Cause	Handling	Fault reset *1
AL01	Over-current	The earthing short circuit, etc. result in that the excessive current flows into the controller.	Please confirm whether the wiring between the controller and motor is damaged.	Ineffective
AL02	Over-temperature	The internal temperature of the controller exceeds the detection temperature of Alarm.	Please lower the environmental temperature and improve the ventilation conditions of the machine frame interior.	Effective
AL03	Overvoltage	The power supply voltage reaches about 130% of the rated voltage.	Please confirm the power supply voltage. If overvoltage occurs during running, please lighten the load or extend the acceleration time/acceleration time.	
AL04	Under-voltage	The power supply voltage is less than 60% of the rated voltage.	Please confirm the power supply voltage. Please confirm the wiring of power supply cable.	
AL05	Sensor abnormity	During running, the sensor signal line of the motor is broken, or the motor signal connector falls off.	Please confirm the connection between the controller and motor.	
AL06	Over-speed	The rotation speed of the motor output shaft is more than 4800 r/min.		
AL07	Prohibition of initial operation	When the “external running signal input” parameters are ineffective and the running switch is moved to RUN, power on again.	Please move the running witch from RUN to STAND-BY	
		When the “external running signal input” parameters are effective, FWD input or REV input is set as ON and the running switch is moved to RUN, power on again.	Please move the running witch from RUN to STAND-BY. Please turn FWD input or REV input from ON to OFF.	
AL08	Rotation-clogging protection	The instantaneously overlarge external load results in that the motor stops.	Please check the load running situation.	Ineffective
AL09	System error	The control system loop malfunctions.	Please contact the customer service department of BEAK.	
AL 10	Short circuit protection	The short circuit phenomenon of the motor or connecting line occurs.	Please check whether the short circuit of the motor and connecting line occurs.	

* 1 When the fault occurs, ALARM-RESET shall be distributed to the input port to remove Alarm.

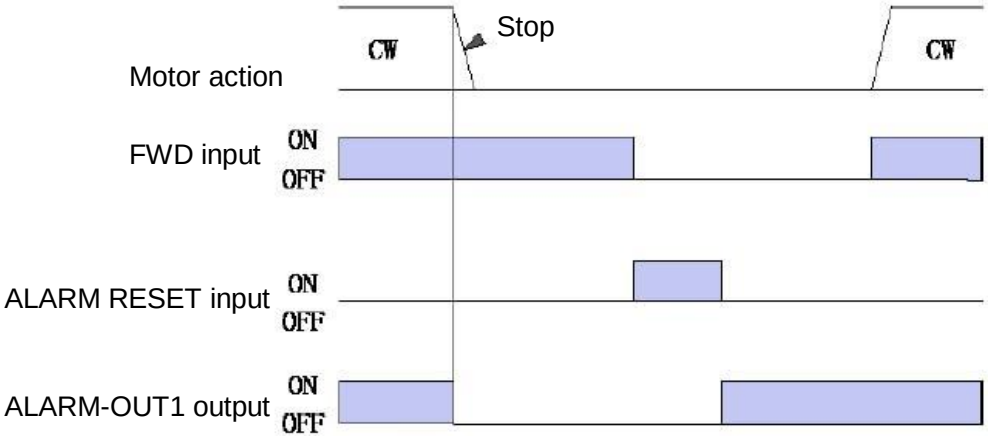
7.2 Fault removal method

(1) OFF is turned into ON through ALARM-RESET port input so as to remove the fault.
(2) Cut off the power supply and turn on the power supply again after 1 minute so as to remove the fault.

Importance	If it still cannot work normally after powering on again, the internal circuit may be damaged. Please contact BEAK. If the Alarm cause is not excluded for continuous running, the device fault may occur.

◆ When it removed through ALARM-RESET input

ALARM-RESET input is ON to remove Alarm. ALARM-RESET input. The diagram below shows that the running signal is FWD input.



7.3 Fault diagnosis and handling

Sometimes, the speed setting or connection error may result in that the motor and controller cannot run normally.

When the motor cannot run normally, please refer to the contents of this chapter for proper handling. If the motor still cannot run normally after handling, please contact the customer consultation center.

Phenomenon	Possible causes	Handling
The motor does not rotate.	Power supply connection is not correct.	Please confirm the power supply connection
	The running switch is moved to STAND-BY	Please move the running switch to RUN
	When the “external running signal input” parameters are ineffective, FWD input or REV input is set as ON.	Please set the input running signal as OFF, and then set the “external running signal input” parameters as Effective.
	FWD input and REV input are set as OFF	Please set one of them as ON
	FWD input and REV input are set as ON.	
	Alarm occurs.	The protection function works, and Alarm occurs. Remove Alarm after eliminating causes.
The rotation direction is opposite to the assigned direction.	FWD input and REV input are connected inversely or incorrectly.	Please confirm the connection of FWD input and REV input.
	The speed reducers with the speed reducing ratio of 30%, 50% and 100% in the conjoined parallel shaft speed reducers are used.	During the use of these speed reducers, the rotation direction of the speed reducer output shaft is opposite to that of the motor output shaft. Please carry out the reverse operation of FWD input and REV input.
	The setting of rotation direction switch is wrong.	Please confirm the setting of the rotation switch
The setting cannot be carried out through the knob.	The speed regulation mode is set as other mode.	Please check the setting of the speed regulation mode (see P.20)
The rotation speed cannot be increased.	The speed upper limit is set.	Please set the speed upper limit as 4000 r/min.
The rotation speed cannot be reduced.	The speed lower limit is set.	Please set the speed lower limit as 0 r/min.
The motor action is not stable with excessive vibration.	The motor (speed reducer) output shaft is not aligned with the center of the load shaft.	Please confirm the combination state of the motor (speed reducer) output shaft and load shaft.
	It is affected by interference	Please use the external machine required for the motor, controller and running to confirm the running state. When the interference effect is confirmed, please take the following measures. • Isolate the interference occurring source • Adjust the wiring • Change the signal cable as the shielded cable • Install the ferrite core

Importance	• If Alarm occurs, please confirm the Alarm contents. • The input/output signal can be monitored in the monitoring mode. Please use it to confirm the wiring status, etc. of input/output signal.

• It is forbidden to reprint and copy the partial or full contents of the User Manual without authorization.

When the User Manual is damaged or lost, please contact BEAK to get it.

• If the industrial property right problem related to the contents of the User Manual in the aspect of use occurs, the Company will assume no responsibility.

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