[2013]
Ver.1.1

Operation manual

OMICRON AC Servo Drives

MK7-series

750w up to 1.5kw,

Digital pulse command input,

1 or 3 phase 220VAC input supply voltage,

Matched for OMEGA AC Servo Motors

(with 15-line 2500 ppr incremental encoder),

Servo Tech M.E. Co. Ltd
www.ServoTechLtd.com

Contents

Chapter I Product Inspection and Installation

1.1 Product Inspection

Complete functional test is conducted for products before they leave the factory. For fear of non-conforming products arising from negligence in the transportation, please make detailed inspection over the following items upon unwrapping:

Check whether the ordered product model is the same with the model of servo driver and servo motor.

Check whether there is any damage in the appearance of servo driver and servo motor. In case of any damage arising from transportation, do not power on.

Check whether any part or component of servo driver and servo motor is loosened and whether there is any loosened screw or screw unfastened or dropped off.

Check whether the rotor shaft of servo motor can run smoothly by hand. Motors with brake can not be rotated directly.

Please contact the dealers promptly in case of any fault or abnormal conditions mentioned.

1.2 Product Nameplate

MK7 – 2A06 – IUN0

1.3 Matched Servo Motor Models

OMA 13 – 05025 – 3NU – 3PE, 5n.m., 2500rpm, 1.2kw

OMA 13 – 07020 – 3NU – 3PE, 7n.m., 2000rpm, 1.5kw

OMA 13 – 10010 – 3NU – 3PE, 10n.m., 1000rpm, 1kw

1.4 Installation of Servo Driver

1.4.1 Environmental Conditions for Installation

The environmental conditions for servo driver installation will directly affect the normal function and service life of servo driver so that the environmental conditions must meet the following requirements:

Working environment temperature: 0-40 ; working environment humidity:40%-80% (no condensing).

Storage environment temperature: -40-50; storage environment humidity: less than 93% (no condensing).

Vibration: less than 0.5G

Storage conditions that can prevent products from rainwater or moisture.

No direct sunlight.

Oil mist and salt erosion prevention.

Avoid corrosive liquid and gas.

Avoid dust, cotton fiber and metal fines intrusion.

Keep away from radioactive substance and inflammable materials.

When several drivers are installed in the control cabinet, sufficient installation clearance is required to be left for air flowing and heat dissipation. Cooling fan should be provided so as to reduce the ambient temperature of servo drivers. Long-term safe working temperature is less than 40deg Celsius.

If vibration sources (such as punching machine) nearby can not be avoided, vibration absorber or rubber gasket for vibration proof is required.

Noise filter or other anti-interference measures can be taken if there is interference on the power line and control line of servo driver resulting from any [?] jamming equipment nearby, which may lead to false operation of

driver, so as to ensure the normal operation of driver. However, the noise filter may increase the leakage current so that isolation transformer is required to be installed at the power input terminal of the driver.

1.4.2 Installation Method

The correct direction for servo driver installation is vertical installation, with the top upward for the ease of heat dissipation.

During installation, M5 screws at the back of the servo driver should be tightened.

The installation clearance between the servo driver and other equipment is shown in the reference diagram. In order to ensure the usability and service life of driver, sufficient installation clearance should be left.

Cooling fan should be installed in the electrical control cabinet so as to ensure that there is wind to cool the driver at the vertical direction.

During the installation of electrical control cabinet, dust or scrap iron should be prevented from entering into the servo driver.

1.4.3 Mounting Dimensions of MK7-Series

The front view of mounting dimensions of MK7- series is shown in Figure 1-1.

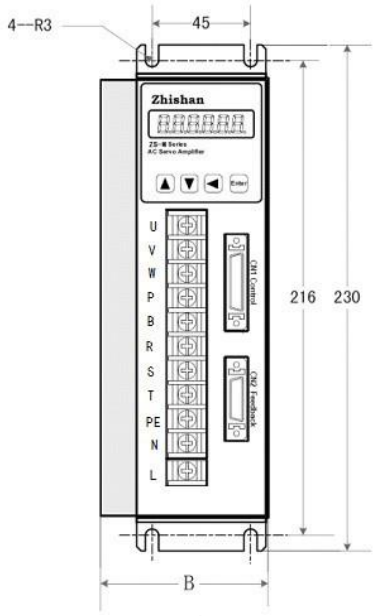


Figure 1-1 Front View of Mounting Dimensions of MK7-Series

The side view of mounting dimensions of MK7-series is shown in Figure 1-2.

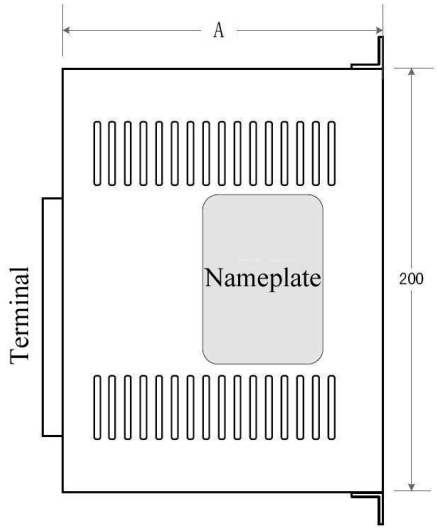


Figure 1-2 Side View of Mounting Dimensions of MK7-Series

Size (mm)	A	B
MK7 – 2A06 – IUN0	152	77

1.4.4 Installation Clearance

Required clearance between the driver and control cabinet box and between other electronic equipment should be left. Minimum clearance requirements are shown in Figure 1-3.

1.4.5 Ventilation and Heat Dissipation

If more than one driver needs to be provided, the cooling requirements for each of them should be taken into account. Cooling fan should be provided in the electrical control cabinet, ensuring that there is wind to cool the driver at the vertical direction. The minimum clearance requirements for this purpose are shown in Figure 1-4.

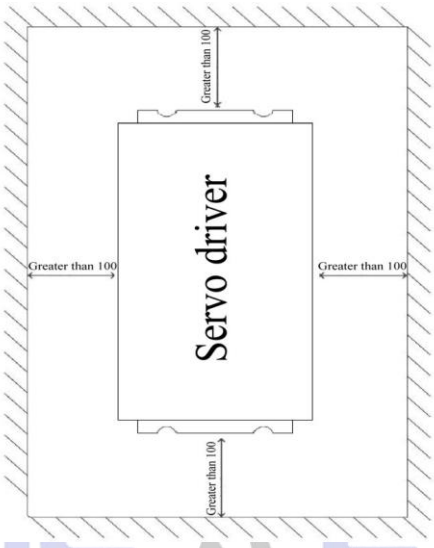


Figure 1-3 Minimum Installation Clearance Requirements

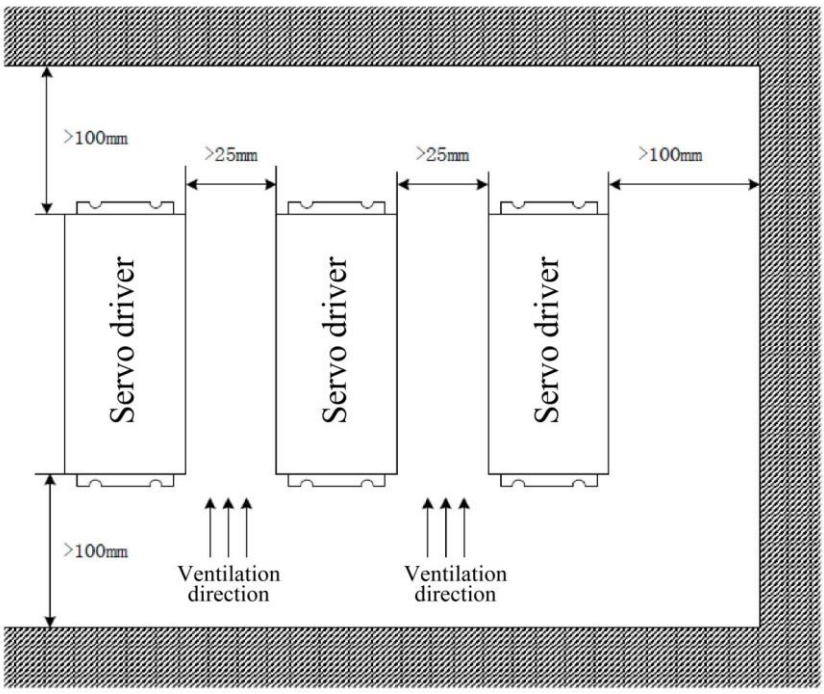


Figure 1-4 Minimal Installation Clearance and Cooling Requirements for Multiple Drivers

1.5 Installation of Servo Motor

1.5.1 Installation Method

Horizontal installation: To avoid water, oil or liquid from flowing into the port of motor line, the cable outlet should be provided at the bottom

Vertical Installation: If the motor shaft is provided upward and a reducer is equipped, measures to prevent grease of the reducer from entering into the motor via the motor shaft.

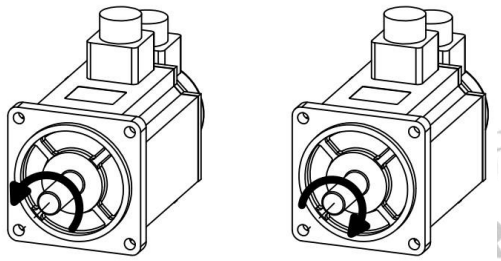
1.5.2 Installation Precautions

- In the installation and disassembly of pulleys, do not knock the motor or the motor shaft with a hammer to avoid damage to the motor bearing or the encoder. Use a spiral pressure pulling tool for the disassembly.
- The motor shaft should have sufficient stretching for fear of vibration when the motor operates.
- Use loose washer to fasten the motor.

- Do not apply excessive axial or radial force against the motor. A flexible coupling is recommended for the connection.

1.6 Determination of Motor Rotation Direction

In this manual, the motor rotation direction is defined as follows: when you face the stretched part of the motor shaft, if the rotation axis rotates counterclockwise, it is called positive rotation; otherwise, it is negative rotation. See Figure 1-5.



CCW CW

Figure 1-5 Rotation Direction of Motor

Chapter 2 Connection

2.1 Description for Connection

2.1.1 Notes:

The materials for connection should be used according to wire specification.
Cable length: instruction cable: within 3m; encoder cable: within 20m.

Check whether power and connection of R, S, T and L, N are correct.

Do not connect it to power of 380V at all!

There is a one-to-one correspondence relation between the phase sequence of motor Terminal U, V and W and corresponding terminal of motor. In case of any wrong correction, motor can not be operated normally. Replacement

of three-phase terminal should not be applied for motor reversal, and it will be totally different for the asynchronous motor.
Ground connection should be reliable and single point grounding should be applied.
For relay installed for output signal, its diode for absorption should be connected correctly. In case of incorrect connection, the signal has no output.

In order to prevent the malfunction arising from noise, devices such as insulating transformer and noise filter should be provided in the power.

Wiring of power line (strong current circuit of power line and motor line) and signal line should be conducted at an interval of over 30cm. Do not place them in the same wiring tube.

Please provide a non-fuse breaker to promptly cut off the external power supply in case of driver failure.

2.2 Descriptions of Terminals

As shown in Figure 2-1, the power indicator shows whether the power is connected. If the power indicator is still on, it means that electricity remains in the capacitance. Please do not open the housing or start wiring operations in order to avoid electric shock. Buttons and nixie tubes are components for settings and display. Refer to Table 2.1 for designations of other terminals in the driver panel and their respective functions.

Table 2.1 Descriptions of terminals of driver panel

Terminal	Functions	Precautions for Use
U, V, W	Motor power lines connection terminal	Must be connected with the motor U, V and W, correspondingly
R, S, T L, N	Connection terminal of the main power supply and control power	R, S, T is the main circuit power input terminal AC220V, 50HZ. **Do not connect it with the motor output terminals U, V or W.** L, N is the control circuit power supply input terminal AC220V, 50HZ
CN1	UPPER COMPUTER COMMUNICATION TERMINAL CN1	Note the definition of each terminal port.
CN2	MOTOR ENCODER TERMINAL CN2	Note the definition of each terminal port.
PE	Ground terminal	In the operations, the motor and driver must be reliably grounded
B, P	External brake resistance terminal	Connect two sides of brake resistance to B and P if any external brake resistance is required

2.2.1 Terminals of MK7-Series Drive

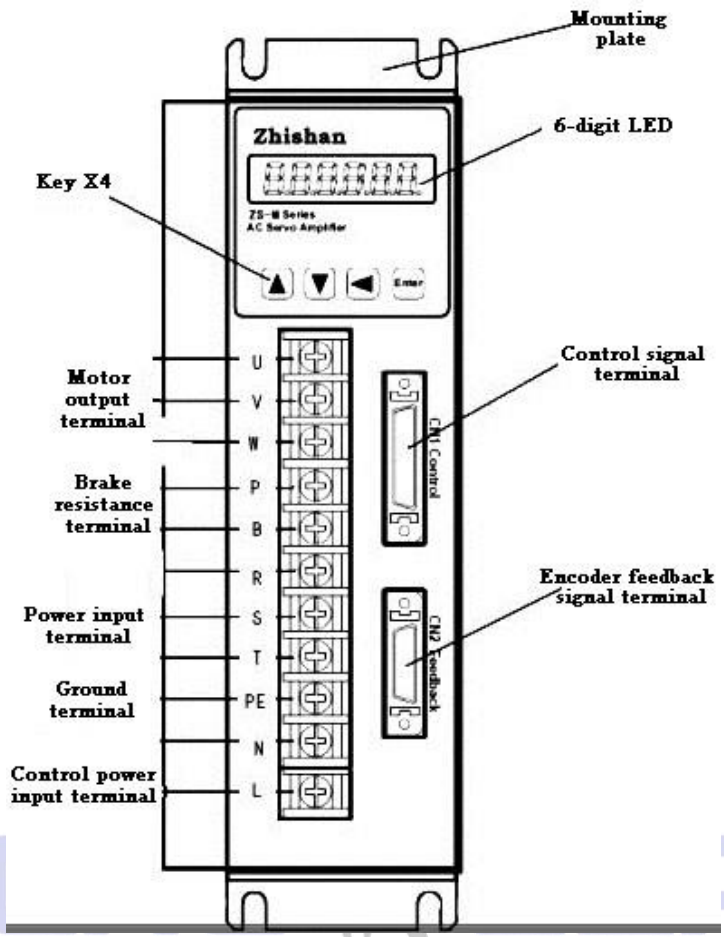


Figure 2-2 Terminals of MK7-Series Drive

2.3 Upper Computer Communication Terminal CN1 of MK7-Series

2.3.1 Configuration of CN1 terminal

Figure 2-3 shows the configuration of the upper computer communication terminal CN1.

CN1 is a 44-pin socket.

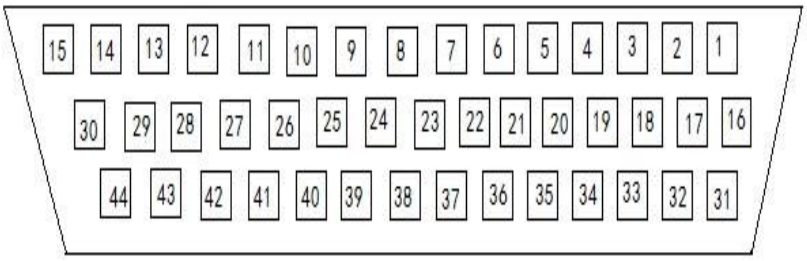


Figure 2-3 Upper PC communication terminals of MK7-Series (facing the soldering side of connector)

2.3.2 CN1 Functional Description

Abbreviation of control mode:

(P) refers to position control

(S) refers to speed control

Table 2.2 CN1 functional descriptions of upper controller communication terminals

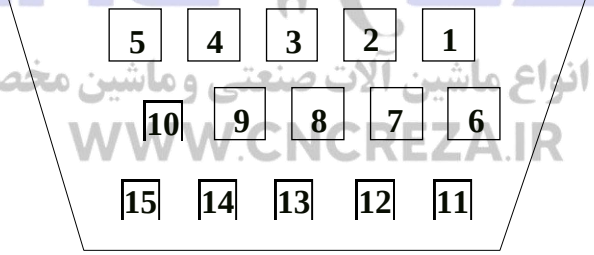
Terminal No.	Signals	Code	I/O	Control mode	Functions
18	Positive power supply of input terminals	**COM +**	Type 1	P, S	Positive power supply of input terminals. Used to connect to the opto-coupler input terminal; DC12-24V, current ≥ 100mA;
10	Servo enabled	**SON**	Type 1	P, S	Servo-enabled input terminal; SON ON: Short-circuit with COM-, allowing the driver to work; SON OFF: Disconnected from COM-, the driver is off and stops working and the motor is in a free state; Note 1: Before turning it from SON ON to SON OFF, the motor must be stationary; Note 2: When it is turned to SON ON, wait for 50ms before inputting any command;
11	Alarm clear	ACLR	Type 1	P, S	Alarm clear input terminal; ACLR ON: When the system is in alarm state, short circuit COM- to clear system alarms; ACLR OFF: Disconnect COM- to keep the system in alarm state;
26	Servo alarm output	ALM+	Type 2	P, S	Servo alarm output terminal; ALM ON: the servo driver does not sound the alarm, and servo alarm outputs ON. ALM OFF: the servo driver sounds the alarm, and servo alarm outputs OFF.
27		ALM-			
7	The encoder Z phase collector open circuit output	Z	Type 6	P, S	▯ Encoder Z phase signals are output via the open-collector. When the encoder Z phase signals appear, it outputs ON (output turn-on), otherwise it outputs OFF (output turn-off); ▯ Non-isolated output (non-insulated); ▯ Since in the upper PC, Z phase signal impulse is usually narrow, high-speed optocoupler is recommended;
9	Encoder common ground wire	DGND		P, S	Encoder common ground wire
36	Shielding ground line	**FG**		P, S	Shielding ground line terminal

Terminal No.	Signals	Code	I/O	Control mode	Functions
32	Command pulse input	PULS +	Type 3	P	External command pulse input terminal
33		PULS -			
34	Command pulse direction input	DIR +	Type 3	P	
35		DIR -			
14	Deviation counter resetting	CLE	Type 1	P	Under the position control mode (parameter PA4=0), the position deviation counter will reset in the input terminal. CLE ON: in the position control mode, the position deviation counter will reset.
8	Servo ready signal	SRDY+	Type 2	P, S	Servo is ready for output terminal SRDY ON: control power and main power are in normal condition, driver does not sound alarm and servo is ready for output ON. SRDY OFF: main power is not closed or driver sounds alarm, and servo is ready for output OFF.
25		SRDY-			
16	*CCW torque limitation*	*FIL*	*Type 1*	*P, S*	*CCW (counter clock-wise direction) torque limitation input terminal*
17	*CW torque limitation*	*RIL*	*Type 1*	*P, S*	*CW (clock-wise direction) torque limitation input terminal*
1	Encoder A-phase signal	A+	Type 5	P, S	1. Encoder ABZ signal differential driver output (26LS31 output, equivalent to RS422) 2. Non-isolated output (non-insulated)
2		A-			
3	Encoder B-phase signal	B+	Type 5	P, S	
4		B-			
5	Encoder Z-phase signal	Z+	Type 5	P, S	
6		Z-			
28	Positioning completion output	COIN+	Type 2	P	Positioning completion output terminal COIN ON: when the position deviation counter value is within the set positioning range, the positioning is completed and outputs ON.
29		COIN-			
15	Command pulse prohibition	**INH**	Type 1	P	Under the position control mode (parameter PA4=0), the position deviation command will prohibit to input terminal. INH ON: Command pulse input disabled; INH OFF: Command pulse input enabled.

12	CCW drive disabled	FSTP	Type 1	P, S	CCW (counter clock-wise direction) drive disabled input terminal FSTP ON: if CCW drive enabled; motor can be rotated in counter clock-wise direction; FSTP OFF: if CCW drive disabled; motor is prohibited be rotated in counter clock-wise direction; Note: For over-ranging, when turn off the switch, torque in CCW direction will remain 0.

Terminal No.	Signals	Code	I/O	Control mode	Functions
13	CW drive disabled	RSTP	Type 1	P, S	CW (clock-wise direction) drive disabled input terminal FSTP ON: if CW drive enabled; motor can be rotated in clock-wise direction; FSTP OFF: if CW drive disabled; motor is prohibited be rotated in clock-wise direction; Note: For over-ranging, when turn off the switch, torque in CW direction will remain 0.
30	*Mechanical brake releasing*	*BRK*	*Type 2*	*P, S*	*When motor is provided with mechanical brake (power loss retainer), the terminal can be used to control brake.* *BRK ON: brake is powered on, braking is invalid and motor can be operated;* *BRK OFF: brake is cut off, braking is valid and motor is locked.* *Note: BRK function is under internal control of driver.*
31		*BRK-*	*Type 2*		
19	*Analog speed command input*	*AS+*	*Type 4*	*S*	*External analog speed command input terminal, differential mode, input impendence: 10kΩ and range of input voltage: -10V to +10V.*
20		*AS-*			
23	*Analog*	*AGND*			*Ground wire for analog input.*
21	*Analog torque command input*	*AT+*	*Type 4*	*T*	*External analog torque command input terminal, differential mode, input impendence: 10kΩ and range of input voltage: -10V to +10V.*
22		*AT-*			
24	*Analog*	*AGND*			*Ground wire for analog input.*

2.4 Encoder Terminal CN2 +



2.4.1 Configuration of CN2 Terminal

Figure 2-4 shows the configuration of the motor encoder terminal CN2.

CN2 is a 15-pin socket.

Figure 2-4 Motor Encoder Terminal (facing the soldering side of connector)

2.4.2 CN2 functional descriptions

Table 2.3 Functional Descriptions of Motor Encoder Terminal CN2

Terminal No.	Signals	Code	I/O	Functions
6	Power output	+5V		The servo motor photoelectric encoder uses +5 V power supply; when the power cable is long, use multi-core lines for parallel connection.
1	Power supply	GND		
2	Encoder A + input	A+	Type 7	Connected to servo motor photoelectric encoder A+ phase
3	Encoder A - input	A-		Connected to servo motor photoelectric encoder A- phase
4	Encoder B + input	B+	Type 7	Connected to servo motor photoelectric encoder B+ phase
5	Encoder B - input	B-		Connected to servo motor photoelectric encoder B- phase
10	Encoder Z + input	Z	Type 7	Connected to servo motor photoelectric encoder Z+ phase
15	Encoder Z - input	Z-		Connected to servo motor photoelectric encoder Z- phase
14	Encoder U + input	U+	Type 7	Connected to servo motor photoelectric encoder U+ phase
9	Encoder U - input	U-		Connected to servo motor photoelectric encoder U- phase
13	Encoder V + input	V+	Type 7	Connected to servo motor photoelectric encoder V+ phase
8	Encoder V - input	V-		Connected to servo motor photoelectric encoder V- phase
12	Encoder W + input	W+	Type 7	Connected to servo motor photoelectric encoder W+ phase
7	Encoder W - input	W-		Connected to servo motor photoelectric encoder W- phase
11	Shielding	FG		Shielding ground line terminal

+

2.5 Input/Output Interface Type

2.5.1 Type1 switch input interface

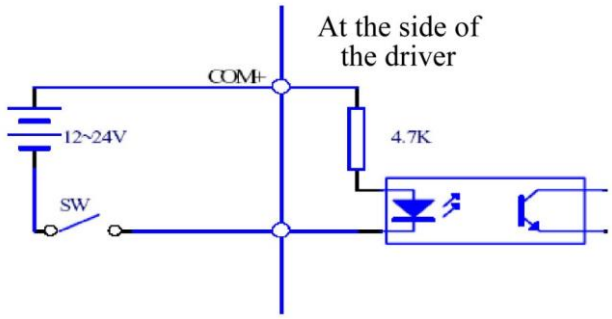


Figure 2-5: Type1 Switch Input Interface

Power supply provided by the user, input DC 12-24V from the COM + terminal, current ≥ 100mA;
Note that if the current polarity is reversed, the servo driver will not work;

2.5.2 Type2 switch input interface

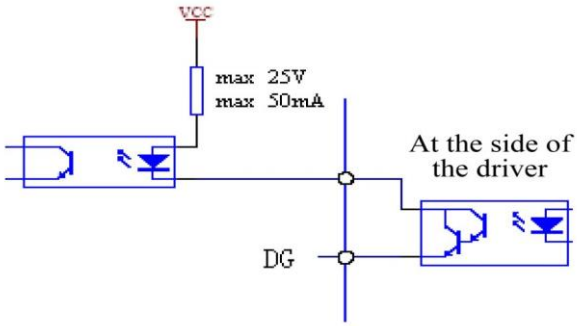


Figure 2-6a: Type2 Switch Output Interface (Optocoupler)

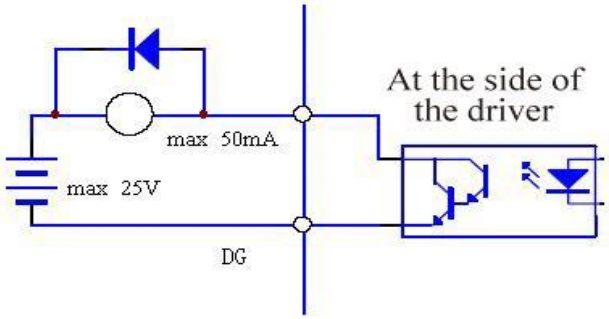


Figure 2-6b: Type2 Switch Output Interface (Relay)

Use Darlington transistor for the output, connected with the optocoupler (Figure 2-6a) or relay (Figure 2-6b);

- External power supply is provided by the user, but note that if the power supply polarity is reversed, the servo driver would be damaged;
- The output is of an open-collector, with the maximum current of 50mA, and external power supply voltage of 25V. Therefore, the load of switch output signal must meet this limit. If it exceeds this limit or the output is directly connected to the power supply, the servo driver would be damaged;
- If the load is inductive load (e.g. relay), anti-parallel of freewheeling diode at both ends of the load is required. If the freewheeling diode is reversed, damage to the servo driver may occur;
- The output transistor is a Darlington transistor. In the conduction, the voltage drop V_{ce} between the collector and the emitter is about 1V, which can't meet the TTL low level requirements, and should not be directly connected with the TTL IC;

2.5.3 Type3 pulse input interface

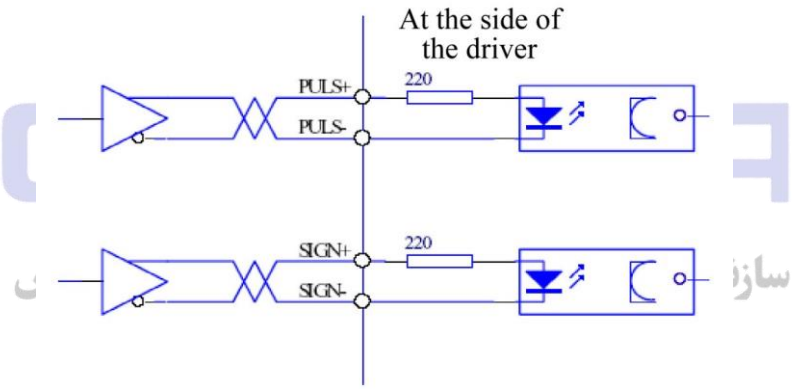


Figure 2-7a: Differential drive mode of type-3 pulse input interface

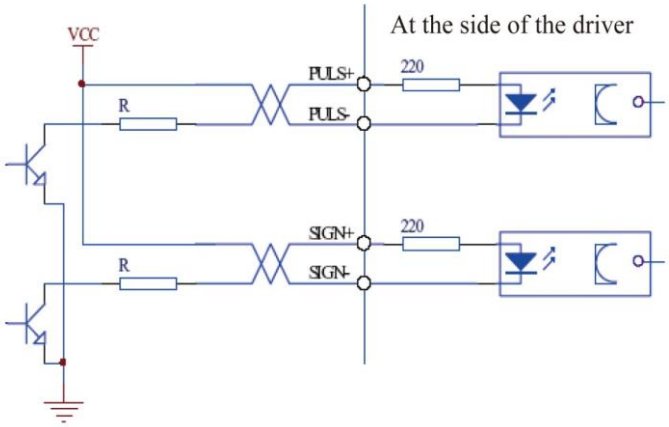


Figure 2-7b: Type3 Single-ended Drive Mode of Type-3 Pulse Input Interface

- In order to properly transmit pulse volume data and improve anti-jamming capability, differential drive

mode (Figure 2-6a) is recommended;

- Differential drive mode adopts AM26LS31, MC3487 or similar RS422 line driver;
- Using single-ended driver to reduce the movement frequency. According to the pulse input circuit, the driver current is 10-15mA. The maximum voltage of the external power supply is 25V in order to determine the resistor R. Empirical data: VCC = 24V, R = 1.3-2K; VCC = 12V, R = 510-820Ω; VCC = 5V, R = 82-120Ω.
- When the single-ended drive mode is adopted, the external power supply needs to be provided by the user. Note that if the power supply polarity is reversed, the servo driver would be damaged.
- The pulse input mode is shown in Table 2.4. The arrow indicates the count. Table 2.5 shows the timing and parameters of pulse input. When the 2-phase input mode is used, its four-octave pulse frequency is ≤ 500kH.

Table 2.4: Pulse Input Mode

Pulse command form	CCW	CW	Parameter set value
Pulse train sign Sign	PULS SIGN		0 Command pulse + sign
CCW pulse train CW pulse train	PULS SIGN		1 CCW pulse / CW pulse

Table 2.5: Pulse Input Timing and Parameters

Parameters	Differential drive input	Single-end drive input
t_{ck}	>2 μ S	>5 μ S
t_h	>1 μ S	>2.5 μ S
t_l	>1 μ S	>2.5 μ S
t_{rh}	<0.2 μ S	<0.3 μ S
t_{rl}	<0.2 μ S	<0.3 μ S
t_s	>1 μ S	>2.5 μ S
t_{qck}	>8 μ S	>10 μ S
t_{qh}	>4 μ S	>5 μ S
t_{ql}	>4 μ S	>5 μ S
t_{qrh}	<0.2 μ S	<0.3 μ S
t_{qrl}	<0.2 μ S	<0.3 μ S
t_{qs}	>1 μ S	>2.5 μ S

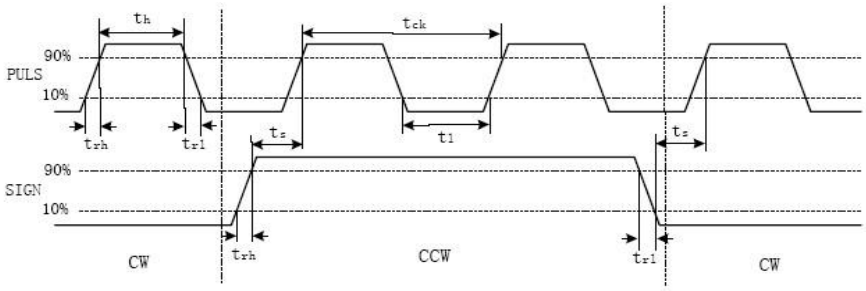


Figure 2-8: Pulse + Symbol Input Interface Timing Diagram (Maximum pulse frequency is 500kHz)

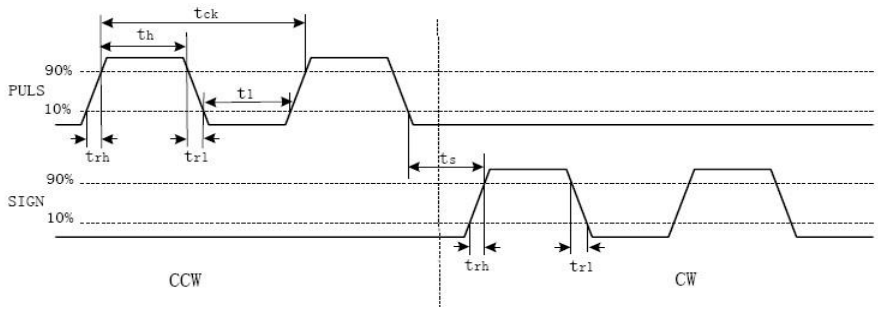


Figure 2-9: CCW Pulse and CW Pulse Input Interface Timing Diagram (Maximum pulse frequency is 500KHz)

2.5.4 Type5 encoder signal output interface

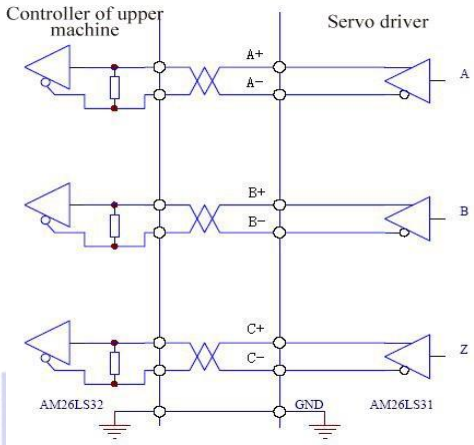


Figure 2-11a: Type5 Photoelectric Encoder Output Signal

- Encoder signals are output via the differential driver (AM26LS31);
- The input end of controller may be ATM26LS32 receiver and must be connected to a terminating resistor of approximately 330Ω;
- The ground line of controller and the ground line of driver must be reliably connected;
- Non-isolated output, as shown in Figure 2-11a;
- The input end of controller may be an optocoupler for the receiving purpose, but high-speed optocoupler (e.g. 6N137) (as shown in Figure 2-11b) must be used;

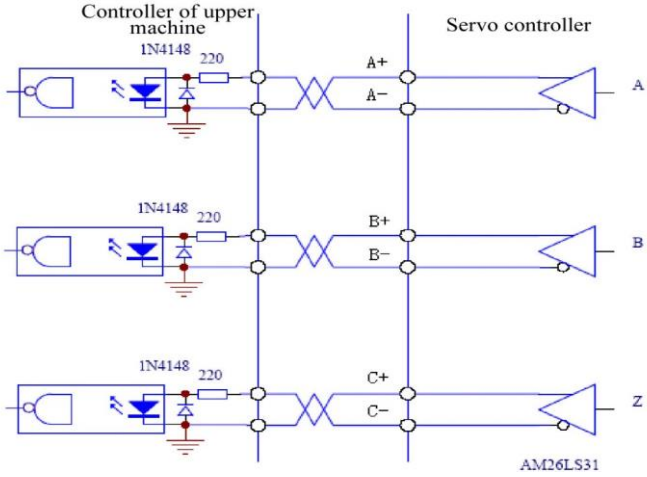


Figure 2-11b: Type5 Photoelectric Encoder Output Signal

2.5.5 Type 6 encoder Z-phase signal open-collector output interface

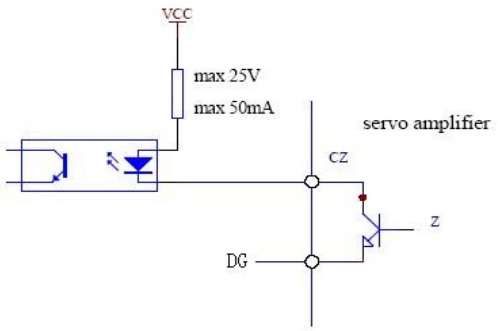


Figure 2-12: Type 6 Photoelectric Encoder Output Interface

- Encoder Z-phase signals are output via the open-collector. When the encoder Z-phase signals appear, it outputs ON (output turn-on), otherwise it outputs OFF (output turn-off);
- Since in the upper PC, Z-phase signal impulse is usually narrow, high-speed optocoupler (e.g. 6N137) is recommended;

2.5.6 Type 7 Servo motor photoelectric encoder input interface

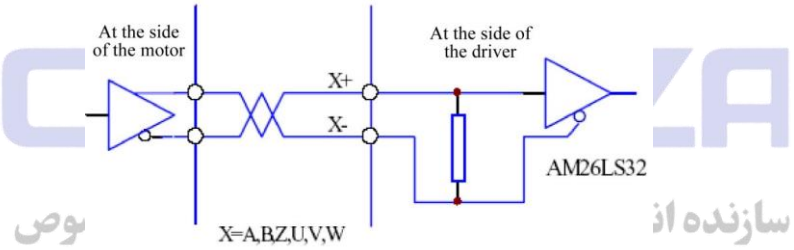


Figure 2-13: Type 7 Servo Motor Photoelectric Encoder Input Interface

2.6 Connection Requirements

1 A three-phase isolation transformer is recommended to supply power, as this reduces the possibility of electric shock;

2 Noise filter is recommended to improve anti-jamming capability;

3 Please provide a non-fuse short-circuiter to promptly cut off the external power supply in case of driver failure;

4 The grounding line should be ≥ 2.5mm², as thick as possible, and is of a single-point grounding mode. The

- ground terminal of the servo motor and the ground terminal PE of servo driver must be connected;

5 To prevent malfunction due to interference, noise filter is recommended and note that:

noise filter, servo driver and the host controller should be provided as close as possible;

- relay, AC contactor, brake and other coils should be provided with surge suppressor;

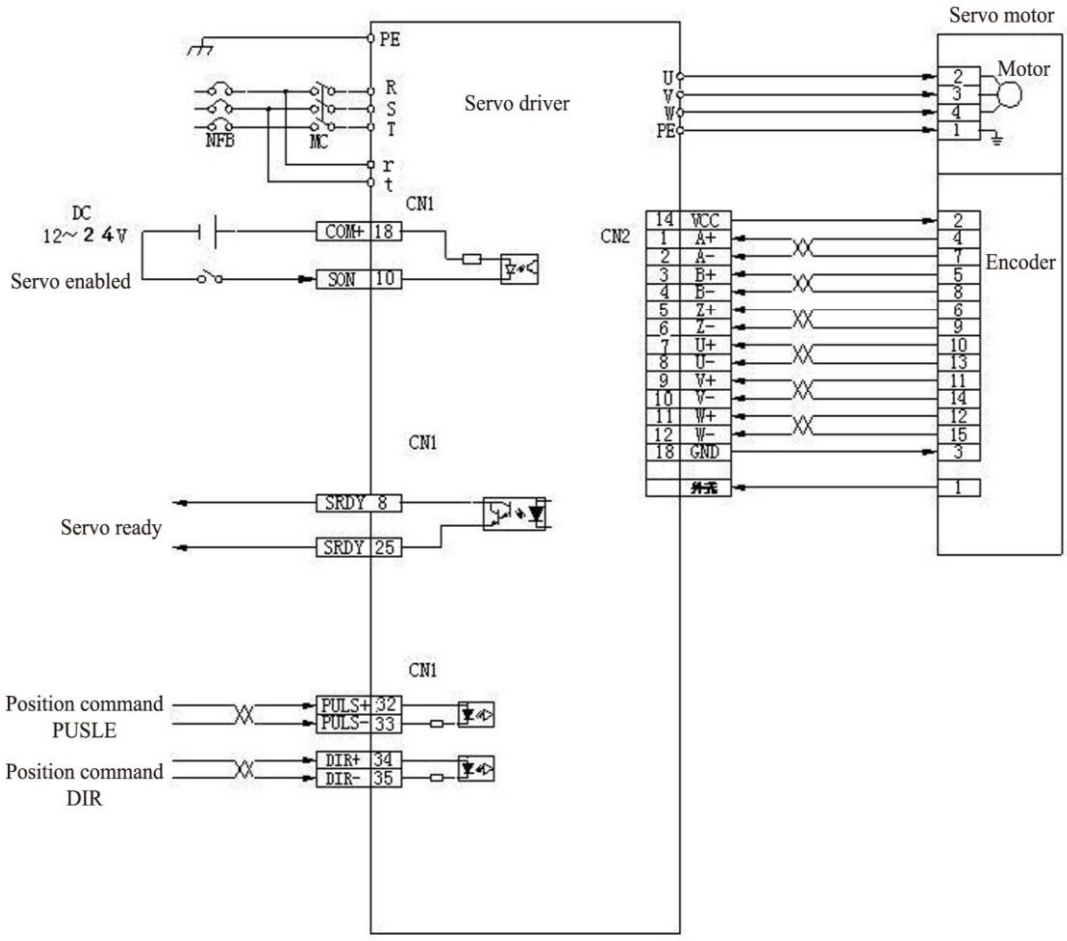
the power circuit cables and signal lines should not be bundled together;

6 Proper connection of the shield layer of cables;

-

2.7 Standard Wiring Diagram

2.7.1 Position control wiring diagram



Chapter 3

Panel Operation

3.1 Description of Drive Panel

3.1.1 Panel composition

The driver panel consists of six LED digital displays and four keys ↑, ↓, ← and Enter to display various states and for setting parameters.

Key functions are as follows:

↑: To increase the serial number or value, or to move forward the option.

↓: To reduce the serial number or value or to move back the option.

←: To return to the operation menu at the previous layer, or to cancel the operation.

Enter: press 3 seconds to enter the operation menu at the next layer or to input for confirmation. Short press for transposition.

The operations are designed in layers. ← and the Enter key means to move backwards and forwards in the layer, respectively. The Enter key has the meaning to enter and to confirm, and short press means transposition; while the ← key has the meaning to exit and cancel. ↑ and ↓ means to increase and decrease the serial number or value, respectively. If ↑ and ↓ are pressed down together, it has the double effect. The longer it is maintained is the higher the repetition rate.

3.2 Layer 1

[Note 1] Both the position pulse and the command pulse are the amplified value through the electronic gear value.

[Note 2] Pulse unit is the pulse unit of the system and n this system, it is 10,000 pulses / rev. The pulse volume is represented using high 4 digits + low 4 digits and is calculated as follows:

Pulse volume = high 4-digit value × 10,000 + low 4-digit value

[Note 3] Control mode: 0 - position control; 1 - Pulse speed control;

[Note 4] Under the pulse speed mode, the position command pulse frequency is the pulse speed. The unit is rpm. It is a positive number in the positive direction and a negative number in the negative direction.

[Note 5] The motor current I is determined as follows

$$I = \sqrt{\frac{2}{3}(I_U^2 + I_V^2 + I_W^2)}$$

[Note 6] In one rotation, the absolute position of the rotor refers to the position relative to the location of stator. One rotation is a cycle and the range is 0 to 9,999.

[Note 7] The input terminal display is shown in Figure 5-3, the output terminal is shown in Figure 5-4, and the encoder signal display is shown in Figure 3-5.

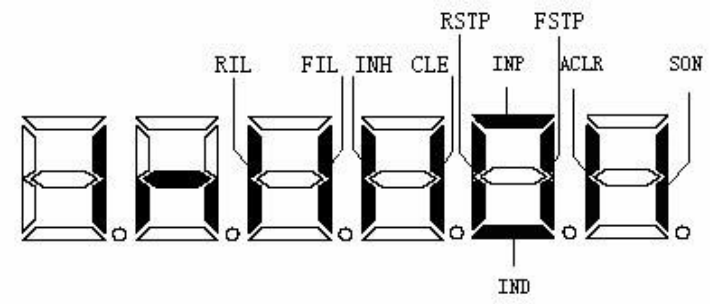


Figure 3-2: Input terminal display (strokes are on when it is ON and are off when it is OFF)

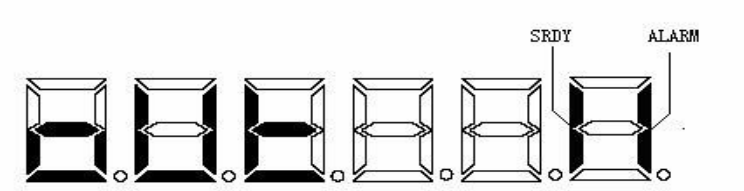


Figure 3-3: Output terminal display (strokes are on when it is ON and are off when it is OFF)

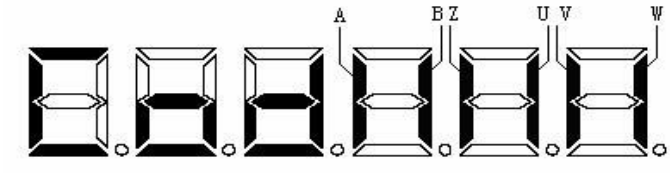


Figure 3-4: Encoder signal display

(The bottom part of the strokes are constantly on. When the upper part is on it indicates on and when it is off, it indicates OFF)

(Z signal: It turns ON or OFF for each Z pulse) [Note

8] The operation status is expressed as follows:

"on- oFF": The main circuit is not charged and the servo system is not running;

"on- CH": The main circuit is charged and the servo system is not running;

(The servo is not enabled or the alarm exists); "cn- on":

The main circuit is charged and the servo system is running.

[Note 9] The alarm displays "Err -", indicating normal status and without alarm.

3.3 Parameter Settings

Select "PA-" in the first layer, and press Enter to enter the parameter setting mode. Use ↑ or ↓ to select the parameter number and press Enter to display the parameter value. Use ↑ or ↓ to change the parameter value. Press ↑ or ↓ key once and the parameter value increases or decreases by 1. Press and hold ↑ or ↓, the parameter continuously increases or decreases. When the parameter value is modified but not determined yet, the decimal point at the rightmost LED digital tube is on. Press Enter to confirm the value and the decimal point is off. The modified value will be immediately reflected in the control. Press ↑ or ↓ to continue to modify the parameter. After the parameter is changed, press ← to return to the parameter selection state. If you are not satisfied with the value being modified, do not press Enter for confirmation, but you should press ← to cancel it and the parameter will restore the original value and it returns to parameter selection state.

Please be noted that some important parameters require for parameter writing operations and you need to re-power on it before it becomes effective!

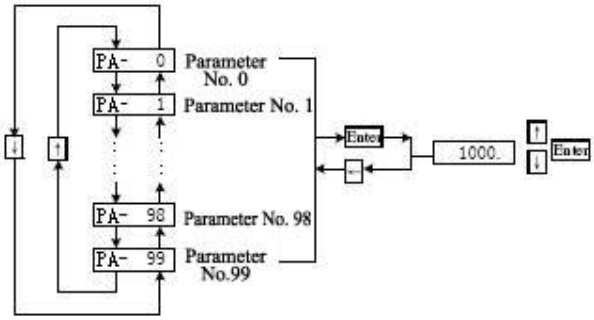


Figure 3-5: Operating Diagram of Parameter Settings

3.4 Parameter Management

- Enter parameter writing: to write parameters in the memory to the EEPROM parameter zone. When the parameter is modified by the user, it is only a change to the parameter value left in the memory and it will be restored to the original value next time you power it on. To permanently change the parameter value, you need to perform parameter writing operations. Write the parameter in the memory to the EEPROM parameter zone and it will not be restored to the original value next time it is powered on.
- Parameter reading: to read data in the EEPROM parameter zone to the memory. It runs automatically the time it is powered on. At first, the memory parameter value is the same as that in the EEPROM parameter zone. The memory parameter will be changed once the parameter is changed by the user. If the user is not satisfied with the modified parameter or the parameters become disordered, parameter reading operation will once again read the data in the EEPROM parameter zone to the memory and thus restoring to the value when it is powered on.
- Parameter backup: to write memory parameter to the EEPROM backup zone. The EEPROM is divided into parameter zone and backup zone for storage of two sets of parameters. System power-up, parameter writing and parameter reading operations use the EEPROM parameter zone, while parameter backup and restoration backup use the EEPROM backup zone. In parameter setting, if the user is relatively satisfied with a set of parameters but would like to continue to modify the parameter, the user may firstly start parameter backup operations to save the memory parameters in the EEPROM backup zone, and then modify the parameters. If the effect becomes worse, the user may read parameters saved in the EEPROM backup zone last time to the memory, and then the user may once again start to change the parameter. In addition, when the parameters are set, the user may perform parameter writing or parameter backup operations so that the data in the EEPROM parameter zone is the same as those in the backup zone. In case of accidental parameter change, you may restore the backup to read the data in the EEPROM backup zone into the memory. Then you may start parameter writing operations to write the memory parameter into the EEPROM parameter zone.
- Restoration backup: to read the data in the EEPROM backup zone to the memory. Note that no parameter writing operation is performed and the data from the EEPROM parameter zone will be read to the memory next time it is powered on. If the user needs to use the parameter in the EEPROM backup zone, parameter writing operations are required.

Restoration default value: to read the default value of all parameters to the memory and write them to the EEPROM parameter zone. The default parameters will be used next time it is powered on. If the parameters are disordered, whereby it fails to work property, use this operation to restore all parameters back to the default value. Since different driver models correspond to different parameter default value, in using the restoration default parameters, you must ensure the correctness of the driver model (parameter No.1).

Chapter 4

Parameters

4.1 Summary of Parameters

NO.	Items	Applicable method	Parameter range	Default value	Unit
0	Password				
1	Model code				
2	Software version (read only)				
3	Initial display state				
4	Control mode selection				
5	Speed proportional gain				
6	Speed integral time constant				
7	Torque filter				
8	Speed detection filter				
9	Position proportional gain				
10	Position feedforward gain				
11	Position feedforward filter cut-off frequency				
12	Position command pulse frequency division numerator				
13	Position command pulse frequency division denominator				
14	Position command pulse input mode				
15	Position command pulse direction reversed				
16	Positioning completion range				Pulse
17	Position-tolerance detection range				x100 pulse
18	Position-tolerance error invalid				
19	Position instruction smoothing filter				

20	Driving inhibiting input invalid				
21	JOG running speed				

NO.	Items	Applicable method	Parameter range	Default value	Unit
22	Internal and external speed command selection				
23	Maximum speed limit				
24	Internal speed 1				
25	Internal speed 2				
26	Internal speed 3				
27	Internal speed 4				
28	Speed achieved				
29	Analog torque command input gain				
30	User torque overload alarm value				
31	User torque overload alarm detection time				
32	Control mode switch allowed				
33	Analog torque command input direction reversed	Not exist in this version			
34	Internal CCW torque limitation				
35	Internal CW torque limitation				
36	External CCW torque limitation	Not exist in this version			
37	External CW torque limitation	Not exist in this version			
38	Speed test-JOG running torque limitation				
39	Analog torque command null				

	bias compensation	Not exist in this version			
40	Acceleration time constant				
41	Deceleration time constant				
42	S-shaped eration/deceleration time constant	Not exist in this version			
43	Analog speed command gain	Not exist in this version			
44	Analog speed command direction reversed	Not exist in this version			
45	Analog speed command null bias compensation	Not exist in this version			
46	Analog speed command filter	Not exist in this version			

NO.	Items	Applicable method	Parameter range	Default value	Unit
47	Setting of mechanical brake action when motor stops	Not exist in this version			
48	Setting of mechanical brake action when motor runs	Not exist in this version			
49	Speed of mechanical brake when motor runs	Not exist in this version			
50	Speed limitation under torque control				
51	Dynamic electronic gear vali l	Not exist in this version			
52	Second position command pulse frequency division numerator	Not exist in this version			
53	Low 4 digits input terminal force ON control word	Not exist in this version			Binary system
54	High 4 digits input terminal				

	force ON control word	Not exist in this version			Binary system
55	Low 4 digits input terminal reversed control word	Not exist in this version			Binary system
56	Low 4 digits input terminal reversed control word	Not exist in this version			Binary system
57	Output terminal reversed control word	Not exist in this version			Binary system
58	Input terminal dithering time constant				
59	Demonstration operation	Not exist in this version			
60	Encoder output pulse frequency division numerator				
61	Encoder output pulse frequency division denominator	Not exist in this version			
62	Encoder output B-pulse phase				
63	Encoder output Z-pulse phase	Not exist in this version			
64	Encoder output Z-pulse width	Not exist in this version			
68	Analog speed command dead zone 1	Not exist in this version			
69	Analog speed command dead zone 2	Not exist in this version			

4.2 Parameter Description

Table 4.2 Detailed Description for User Parameters

NO.	Items	Functions	Parameter range

0	Password	Used to prevent parameters from being mistakenly modified. Generally, if you need to set the parameters, firstly this parameter is set to the desired password. After completion of debugging, this parameter needs to be set to 0 to ensure that parameters will no longer be mistakenly modified. There are different levels of passwords corresponding to the user parameter, system parameters and all parameters. To modify the driver model parameter (PA1), driver model password is required. User password is 315. **Model password is 385.**	0-9999
1	Model code	Corresponding to the driver and motor of the same series but different power levels. Different models correspond to different parameter default values. In using restoration default parameters, you must ensure the correctness of this parameter. In case of EEPROM alarm (Err 20), reset the parameter after restoration firstly and then restore the default parameter. Otherwise the driver will be damaged or can not be operated normally. **When modifying the parameter, set password PA0 as 385 and then modify it**. Refer to Chapter 8.4 for the detailed meaning of parameters. Refer to Chapter 7.13.1 for the operation of restoration to default parameter.	0-51
2	Software version	To inquire software version number, but no change is allowed.	*
3	Power-on display mode	Selecting the display state after power-on the driver. 0: motor speed; 1: current position low 5 digits; 2: current position high 5 digits; 3: position command (command pulse accumulation) low 5 digits; 4: position command (command pulse accumulation) high 5 digits; 5: position error low 5 digits; 6: position error high 5 digits; 7: motor torque; 8: motor current; 9: straight-line speed; 10: control mode; 11: position command pulse frequency;	0-20

NO.	Items	Functions	Parameter range

		12: speed command; 13: torque command; 14: absolute position of a turn of the rotor; 15: input terminal state; 16: state of output terminal; 17: encoder input signal; 18: operating status; 19: alarm code; 20: retention.	
4	Control mode selection	To set the control mode of the driver via this parameter: 0: position control mode; 1: position control mode; 3: JOG control mode; 4: encoder zero setting mode 5: Open loop running mode (used for testing motor and encoder) 6: torque control mode; Position control mode: position command is input from the pulse input port. Speed control mode: speed command is input from the input terminal or analog quantity, which is determined by parameter (PA22) (internal and external speed command selection). When internal speed is used, internal speed is selected according to the combination of SC1 and SC2; SC1 OFF, SC2 OFF: internal speed 1 SC1 ON, SC2 OFF: internal speed 2 SC1 OFF, SC2 ON: internal speed 3 SC1 ON, SC2 ON: internal speed 4 Test run control mode: speed command is input by keyboard and used for testing driver and motor. JOG control mode: electric mode. After entering into the JOG operation, press and hold, then the motor will run at the JOG speed; release the button, motor will stop and keep zero speed; press and hold, motor will run in the opposite direction at JOG speed; release the button, motor will stop and keep zero speed. Encoder zero setting mode: used for factory-adjusted control of null point of encoder.	0-6

NO.	Items	Functions	Parameter range

5	Speed proportional gain	To set the proportional gain of speed loop regulator. Greater value leads to higher gain and rigidity. The parameter values are determined according to the model and load of the servo driver system. Generally, the greater the load inertia, the greater the set value. The value should be as large as possible if only no oscillation occurs to the system.	5-2000Hz
6	Speed integral time constant	To set the speed loop integral time constant regulator. Smaller value leads to faster integral and stronger resistance deviation and higher rigidity. However, if the value is too small, it may cause overshoot.	1-1000ms
7	Torque filter	Tor set torque command filter characteristics: Used for restraining the oscillation generated from torque: The smaller the value, the lower the cutoff frequency and the smaller the noise and vibration generated by the motor. If the load inertia is very large, the set value may be appropriately reduced. If the value is too small, the response would be lowered down and oscillation may occur. The greater the value, the higher the cutoff frequency, and the faster the response speed feedback. If high torque response is required, the set value may be appropriately increased.	20-500%
8	Speed detection filter	To set the speed detection filter characteristics. The smaller the value, the lower the cutoff frequency and the smaller the noise generated by the motor. If the load inertia is very large, the set value may be appropriately reduced. If the value is too small, the response would be lowered down and oscillation may occur. The greater the value, the higher the cutoff frequency, and the faster the response speed feedback. If high speed response is required, the set value may be appropriately increased.	20-500%
9	Position proportional gain	To set the proportional gain of position loop regulator. Greater value leads to higher gain and rigidity. Under the same frequency command pulse conditions, the position lag is diminished. However, if the value is too large, it may cause oscillation or overshoot. Parameter value may be determined according to the specific servo driver system model and load.	

10	Feed forward gain for position loop	To set the feed forward gain of position loop. When the gain is set as 100%, the position lag will always be 0 at any frequency command pulse conditions. The greater feed forward gain of position loop, the high-speed response characteristic will be improved. However, the position loop of system will be unstable and oscillation may occur.	

NO.	Items	Functions	Parameter range
		The feed forward gain of position loop will be 0 unless high response characteristic is required.	
11	Position feed forward filter cut-off frequency	To set the low-pass filter cutoff frequency of the position loop front feed amount. This filter is used to increase the stability of the composite position control.	
12	Position command pulse frequency division numerator	To set the frequency division of the position command pulse (electronic gear). In the position control mode, PA12 and PA13 parameter settings easily match a variety of pulse sources in order to achieve the desired control resolution (i.e., the angle / pulse). ***P×G=N×C×4*** P: number of pulses of the input command; G: Electronic gear ratio; $G = \frac{\text{frequency division numerator}}{\text{frequency division denominator}}$ N: number of motor coils; C: number of optical encoder lines / rev., the system is C = 2,500. [Example] When the input command pulse is 600, the servo motor rotates a circle $G = \frac{N \times C \times 4}{P} = \frac{1 \times 2500 \times 4}{6000} = \frac{5}{3}$ Parameter Pr012 is set 5 and Pr013 is set 3. Recommended range for electronic gear ratio: $\frac{1}{50} \le G \le 50$	
13	Position command pulse frequency division denominator	Refer to Pr012	

14	Position command pulse input mode	To set the input form of position command pulse. Three input modes can be set through parameters: 0: pulse + sign; 1: CCW pulse / CW pulse; 2: Two-phase orthogonal pulse input CCW is based on the servo motor inspection in axial direction, which is rotated in counter clock-wise direction and defined as the forward direction. CCW is based on the servo motor inspection in axial direction,	

NO.	Items	Functions	Parameter range
		which is rotated in clock-wise direction and defined as the reverse direction.	
15	Position command pulse direction reversed	Settings: 0: normal; 1: Position command pulse direction reversed.	
16	Positioning completion range	To set the positioning completion pulse range in position control mode. The parameter provides the basis for driver to determine the completion progress under position control mode. If the remaining pulse value of position deviation counter is lower than or equal to the set value, it is considered that the positioning is completed, with the signal of COIN ON. Otherwise the signal is COIN OFF. In position control mode, if the output positioning is completed, the signal is COIN; while in other control mode, if the output speed is achieved, the signal is SCMP.	0-30000 pulses
17	Position-tolerance detection range	To set the position tolerance alarm detection range. In the position control mode, when the count value of the position deviation counter exceeds the value of this parameter, the servo driver sends the position tolerance alarm.	0-30000 x100 pulses
18	Position-tolerance error invalid	Settings: 0: Position -tolerance alarm detection is valid. 1: Position -tolerance alarm detection is invalid, and the detection of position-tolerance error is stopped.	

19	Position command smoothing filter	Smoothing filtering is conducted for command pulse. Acceleration and deceleration time in exponential form and time constant in numerical tables are provided. Filter will not loss the input pulse but command latency may occur. The filter is used for: 1) Upper controller is not provided with acceleration and deceleration functions 2) The frequency division of electronic gear is larger (>10) 3) Command frequency is lower Stepping jump will occur during the running of motor, with less stability. When the value is set as 0, the filter will not work.	
20	Driving inhibiting input invalid	Settings: 0: CCW and CW inhibiting input is valid. If CCW driving disable switch (FSTP) is ON, CCW driving is enabled. If CCW driving disable switch (FSTP) is OFF, the torque in CCW direction will remain 0; same for CW. If CCW and CW driving disable switches are OFF, alarm for wrong driving inhibiting input will be sent. 1: Cancel CCW and CW input inhibiting. No matter what state the CCW and CW driving disable switches are, CCW and CW driving is enabled.	

NO.	Items	Functions	Parameter range
		Meanwhile, if CCW and CW driving disable switches are OFF, there is no alarm for wrong driving inhibiting input.	
21	JOG running speed	T o set running speed for JOG operation.	
22	Internal and external speed command selection	Settings: 0: Speed command based on internal speed; 1: Speed command based on external analog input; For drivers with analog quantity function, command can be set as “0” or “1”; while for drivers without analog quantity function, command can only be set as “0”.	
23	Maximum speed limit	To set the maximum speed limit of the servo motor. Not relevant to the direction of rotation. If the set value is greater than the rated speed, the actual maximum speed limit is the rated speed.	
24	Internal speed 1	To set internal speed 1 In speed control mode, if SC1 is OFF and SC2 is OFF, the internal speed 1 will be selected as speed command.	

25	Internal speed 2	To set internal speed 2 In speed control mode, if SC1 is ON and SC2 is OFF, the internal speed 2 will be selected as speed command.	
26	Internal speed 3	To set internal speed 3 In speed control mode, if SC1 is OFF and SC2 is ON, the internal speed 3 will be selected as speed command.	
27	Internal speed 4	To set internal speed 4 In speed control mode, if SC1 is ON and SC2 is ON, the internal speed 4 will be selected as speed command.	
28	Speed achieved	To set speed achieved. In non-position control mode, if motor speed is greater than the set value, SCMP will be ON. Otherwise the SCMP will be OFF. In position control mode, the parameter is not applied. Not relevant to the direction of rotation. The comparator features hysteresis.	0-3000 r/min
29	Analog torque command input gain	To set the proportional relation between analog torque input voltage and actual torque of motor: Default value is 30, which corresponds to 3V/100%, meaning that 100% rated torque will generated if 3V voltage is input.	10-100 (0.1V/100%)
30	User torque overload alarm value	To set user torque overload value and the value will be the percentage of rated torque. Regardless of direction, the forward and reverse directions of limit value of torque are protected. If PA31>0, when motor torque >PA30 and the duration>PA31, the driver will send an alarm, with alarm No. Err-29 and the motor will stop. After generating the alarm, driver should be powered on again to clear the alarm.	
31	User torque overload alarm detection time	User torque overload detection time: unit: ms When the parameter is set as 0, user torque overload alarm function is disabled;	

NO.	Items	Functions	Parameter range
		Generally, the parameter should be set as 0.	
32	Control mode switch allowed	0: No switch is allowed. 1: Switching allowed. ALRS (alarm clear) is input for switching, and the original alarm clear function is disabled; Pr004	

ALRS	Control mode
OFF	Position
ON	Speed
OFF	Speed

				ON	Torque	
			6	OFF	Torque	
				ON	Position	
33	Analog torque command input direction reversed	Polarity reversal of analog torque input. When the parameter is set as 0 and analog torque command is positive, the torque directio when the parameter is set as 1 and the analog speed command is positive, the torque direct n is CCW; ion is CW.				
34	Internal CCW torque limitation	To set the internal servo motor torque limit at CCW direction. The set value is the percentage of rated torque. For instance, if the value is set as 2 times of the rated torque, the set value will be 200. This limit is always valid. If the set value is more than overload allowed for the system, th e actual torque limit is the maximum overload allowed for the system.				
35	Internal CCW torque limitation	To set the internal torque limit of servo motor at CW direction. The set value is the percentage of rated torque. For instance, if the value is set as 2 times of the rated torque, the set value will be -200. This limit is always valid. If the set value is more than overload allowed for the system, th e actual torque limit is the maximum overload allowed for the system.				
36	External CCW torque limitation	To set the external servo motor torque limit at CCW direction. The set value is the percentage of rated torque. For instance, if the value is set as 1 time f the rated torque, the set value will be 100. The limitation is valid only when the CCW torque limitation input terminal (FIL) is ON. If the limitation is valid, the actual torque limitation will be the least value of allowable maximum overload capacity, internal CCW torque limitation and external CCW torque limitation.				
37	External CW torque limitation	To set the external servo motor torque limit at CW direction. The set value is the percentage of rated torque. For instance, if the value is set as 1 time f the rated torque, the set value will be 100. The limitation is valid only when the CCW torque limitation input terminal (RIL) is ON. If the limitation is valid, the actual torque limitation will be the least value of allowable maximum overload capacity, internal CW torque limitation and external CW torque limitation.				
38	Speed test-JOG running torque limitation	To set the torque limit value under speed test mode and JOG running mode. Not relevant to the direction of rotation. Both directions are valid. The set value is the percentage of rated torque. For instance, if the value is set as 1 time torque, the set value will be 100. f the rated				

NO.	Items	Functions	Parameter range
		Internal and external torque limitation are still valid.	
39	Analog torque command	Null bias compensation for analog torque input	

	null bias compensation		
40	Acceleration time constant	The set value means the acceleration time of motor from 0-1000r/min. Acceleration and deceleration are characterized by linear fashion. Used for speed control mode only, rather than the position control mode. If the driver and external position loop are combined, the parameter will be 0.	
41	Deceleration time constant	The set value means the deceleration time of motor from 1000-0r/min. Acceleration and deceleration are characterized by linear fashion. Used for speed control mode only, rather than the position control mode. If the driver and external position loop are combined, the parameter will be 0.	
42	S-shaped time on/deceleration constant	To set S-shaped acceleration and deceleration time in curve part to make motor start and stop operation stably.	
43	Analog speed command input gain	To set the proportional relation between analog speed input voltage and actual torque of motor.	
44	Analog speed command direction reversed	Polarity reversal of analog speed input. When the parameter is 0 and the analog speed command is positive, the speed direction is CCW. When the parameter is 1 and the analog speed command is positive, the speed direction is CW.	
45	Analog speed command null bias compensation	Null bias compensation for analog speed input	
46	Analog speed command filter	Low-pass filter for analog speed input. Greater value leads to faster response speed of speed input analog and louder noise; smaller value leads to slower response speed and lower noise.	
47	Action setting for mechanical brake when motor stops	Define delay time from action of mechanical brake (output terminal BRK is turned from ON to OFF) to current cutoff of the motor during motor stop period: The parameter should not be less than delay time of mechanical brake (Tb) to prevent micro-displacement or working fall of the motor: See Fig. 7.5 for corresponding time sequence.	0~200×10 ms
48	Action setting for		0~200×10 ms

	mechanical brake during operation of the motor	Define delay time from current cutoff of the motor (output terminal BRK is turned from ON to OFF) to action of mechanical brake during motor stop period: This parameter is to reduce the rotating speed of the motor to low speed and then initiate mechanical brake action to avoid damaging the brake; Time for actual action is the less value of time that required for PA48 or the motor to lower the speed to PA49. See Fig. 7.6 for corresponding time sequence.	
49	Action speed of	Define delay time from current cutoff of the motor (output terminal BRK is turned from OFF to ON)	0~3000 r/min

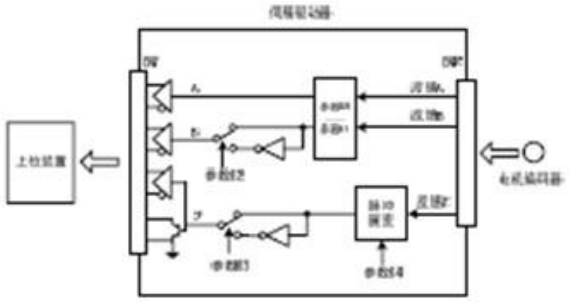
NO.	Items	Functions	Parameter range
	mechanical brake during operation of the motor	to action of mechanical brake during motor stop period: Time for actual action is the less value of time that required for PA48 or the motor to lower the speed to PA49. See Fig. 7.5 for corresponding time sequence.	
50	Speed limit during torque control	Motor operation speed should be limited within this parameter during torque control to prevent over-running of light load.	0~5000 r/min
51	Valid dynamic electronic gear	Set to be "zero", dynamic electronic gear is invalid and input terminal INH functions as command pulse inhibiting. Set to be 1, dynamic electronic gear is valid and input terminal INH functions as gear switch. When INH terminal is OFF, input electronic outlet is No.52/No.13: to change electronic gear proportion by controlling INH terminal.	0~1
52	Second position command pulse frequency division numerator	Set frequency division/doubling of second position command pulse (electronic gear). While using dynamic electron, in addition to setting parameter PA51=1, input terminal INH (command pulse inhibiting) is transferred to electronic gear input switch control terminal: When INH terminal is OFF, input electronic gear is PA12/PA13; when INH terminal is ON, input electronic gear is PA52/PA13: to change electronic gear proportion by controlling INH terminal. Note that first and second single gears have identical frequency division denominator.	1~32767
53	Low 4 digit input		0000~1111

	terminal mandatory ON control word	Set input terminal internal mandatory ON as valid, otherwise the terminals need to be control through external connection ON/OFF. Mandatory ON terminals need no external connection and actuator is automatically set ON from the internal. Binary number with 4 digits is used for representing input terminal non-mandatory ON while 1 represents the said input terminal mandatory ON. The following are input terminal represented by the binary numbers: 3 (2 / 1 / 0) RSTP / FSTP / ALRS / SON SON: Servo Enable: ALRS: Alarm removes: FSTP: CCW drive prohibited: RSTP: CCW drive prohibited:	
54	High 4 digits input terminal mandatory ON control word	Set input terminal internal mandatory ON as valid, and non mandatory input terminals need to be control through external connection ON/OFF. Mandatory ON terminals need no external connection and actuator is automatically set ON. Represented by binary number with 4 digits, among which 0 is used for representing input terminal non-mandatory ON while 1 represents the said input terminal mandatory ON. The following are input terminal represented by the binary numbers: 3 (2 / 1 / 0) RIL / FIL / INH/SC2 / CLE/SC1/ZEROSPD CLE/SC1/ZEROSPD: deviation counter reset/speed selection 1/slot space at zero speed:	0000~1111

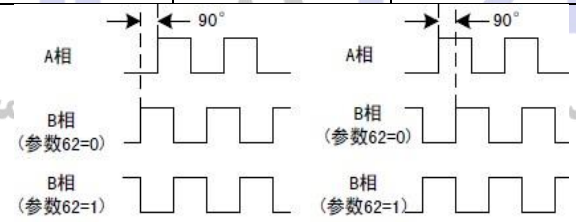
NO.	Items	Functions	Parameter range
		INH/SC2: command pulse inhibiting/speed selection 2: FIL: CCW torque restriction: RIL: CCW torque restriction:	
55	Low 4 digit input terminal reversed control word	Set input terminal reversed. Non-reversed terminal is valid when switched on and invalid when switched off; reversed terminal is invalid when switched on and valid when switched off. Represented by binary number with 4 digits, among which 0 is used for representing input terminal non-reversed while 1 represents the said input terminal reversed. The following are input terminal represented by the binary numbers: 3 (2 / 1 / 0) RSTP / FSTP / ALRS / SON SON: Servo Enable: ALRS: Alarm clear: FSTP CCW drive disabled: RSTP CCW drive disabled:	0000~1111
56	High 4 digits input		0000~1111

	terminal reversed control word	Set input terminal reversed. Non-reversed terminal is valid when switched on and invalid when switched off; reversed terminal is invalid when switched on and valid when switched off. Represented by binary number with 4 digits, among which 0 is used for representing input terminal non-reversed while 1 represents the said input terminal reversed. The following are input terminal represented by the binary numbers: 3 2 1 0 RIL FIL INH/SC2 CLE/SC1/ZEROSPD CLE/SC1/ZEROSPD: deviation counter reset/speed selection 1/slot space at zero speed: INH/SC2: command pulse inhibiting/speed selection 2: FIL: CCW torque limitation: RIL: CCW torque limitation:	
57	Output terminal reverse control word	：Set output terminal reserved. Definitions for breakover and cutoff of reversed terminal are opposite Represented by binary number with digits, among which is used for representing input terminal non-reversed while represents the said input terminal reversed. The following are input terminal represented by the binary numbers: 3 2 1 0 BRK COIN ALM SRDY to standard definition: SRDY: Servo ready ALM: Servo alarm COIN: Positioning completed/speed achieved: BRK: mechanical brake release.	0000~1111

NO.	Items	Functions	Parameter range

<table>
<tr><td>58</td><td>Io input termina
dithering time constant</td><td>Shake removal filtering time for input terminal;
The less the value, the quicker the input response of the t erminal;
The less the value, the better the anti-disturbance perfo mance of terminal input but the slower the response.</td><td>1~1000
×0.1 ms</td></tr>
<tr><td>59</td><td>Demonstrative operation</td><td>Test exclusive</td><td>0~11</td></tr>
<tr><td>60</td><td>Encoder output puls
frequency divisio
numerator</td><td>r pulse and
Encoder output electronic gear for frequency division of encode change pulse resolution ration delivered to upper monitor.
ıbling and
Frequency division is allowed rather than frequency do parameter 60 should be set no more than parameter 61.
ɔn function
If setting parameter 60=1 and parameter 61=1, frequency divisi will be cancelled and AB signal has direct connection.
· (less than
Frequency division can change output line number of encode motor encoder line number) to facilitate connection with up Especially when there is a limit in highest frequency of receivi upper device, frequency division can be set to lower enc frequency.
ɔer device.
ıg pulse in
ɔder pulse
ıcoder line
When adopting C line encoder for motor encoder, output e number should be
$\frac{参数60}{参数61} \times C$
number
For example, 2500 lines encoder is adopted, then output encoder lin should be
$\frac{参数60}{参数61} \times C$
Numerator can be used for output encoder line number.
 
<table><tr><td>Servo driver</td><td></td></tr><tr><td>Upper device</td><td></td></tr><tr><td>参数60
参数61</td><td>Parameter 60
Parameter 61</td></tr><tr><td>Feedback A</td><td></td></tr><tr><td>Feedback B</td><td></td></tr></table></td><td>1~31</td></tr>
</table>

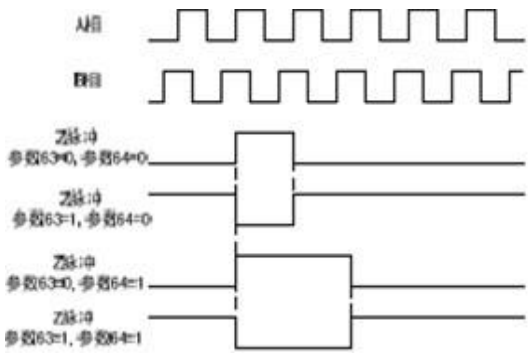
		Parameter 62			

<table>
<tr><th>NO.</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>Parameter 64</td><td></td></tr>
<tr><td>Pulse width</td><td></td></tr>
<tr><td>Feedback Z</td><td></td></tr>
<tr><td>Motor encoder</td><td></td></tr>
</table>
</td><td></td></tr>
<tr><td>61</td><td>Encoder output pulse frequency division denominator</td><td>Refer to the description for parameter 60</td><td>1~31</td></tr>
<tr><td>62</td><td>Encoder output B pulse phase</td><td>Meanings of parameter:
0: In-phase
1: Phase reversal
<table>
<tr><td>This parameter can adjust phase relations between Phase B signal and Phase A signal;
62</td><td>FDW (CCW)</td><td>Reversal (CW)</td></tr>
<tr><td>0</td><td>Phase A lags behind Phase B 90</td><td>Phase A lags behind Phase B 90</td></tr>
<tr><td>1</td><td>Phase A leads behind Phase B 90</td><td>Phase A leads behind Phase B 90</td></tr>
</table>


<table>
<tr><td></td><td>正转(CCW)</td><td>反转(CW)</td></tr>
<tr><td>Phase A</td><td></td><td></td></tr>
<tr><td>Phase B Parameter (62=0)</td><td></td><td></td></tr>
<tr><td>Phase B Parameter (62=1)</td><td></td><td></td></tr>
<tr><td>FWD (CCW)</td><td></td><td></td></tr>
<tr><td>Reversal (CW)</td><td></td><td></td></tr>
</table></td><td>0~1</td></tr>
<tr><td>63</td><td>Encoder output Z pulse phase</td><td>Meanings of parameter:
0: In-phase
1: Phase reversal</td><td>0~1</td></tr>
<tr><td>64</td><td>Encoder output Z pulse width</td><td>
<table>
<tr><td>upper equipment can not capture narrower pulse, can be widened and the parameter means: 64</td><td>Width of Z pulse</td></tr>
<tr><td>0</td><td>Conduction through, encoder original Z pulse width</td></tr>
</table></td><td>0~15</td></tr>
</table>

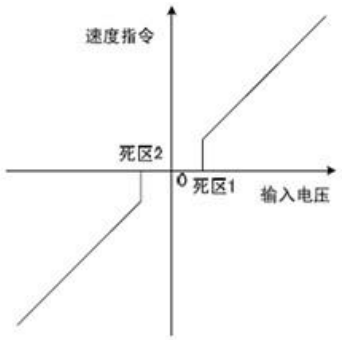
		1-15	Value of the parameter multiplies 2 times of output A (or B) signal width	

38 ◦ ◦◦

NO.	Items	Functions	Parameter range
			

Phase A	
Phase B	
Pulse Z parameter 63=0, parameter 64=0	
Pulse Z parameter 63=1, parameter 64=0	
Pulse Z parameter 63=0, parameter 64=1	
Pulse Z parameter 63=1, parameter 64=1	

NO.	Items	Functions	Parameter range
68	Analog speed command dead zone 1	If input voltage is between dead zone 2 (parameter 69)-dead zone 1 (parameter 68), the command is forced to be 0	



Speed command	
Dead zone 2	
Dead zone 1	
Input voltage	

NO.	Items	Functions	Parameter range
69	Analog speed command dead zone 2	Refer to the description for parameter 68	

Chapter 5

Alarms

5.1 Alarm List

5.1.1 Servo alarm protection and countermeasures

Error code	Fault cause	Countermeasures
1	Parameter correction error	Reinitialize parameters
2	Parameters not used	No measures required
	Over-speed	Check whether motor is operated under torque mode and whether the limit value under torque mode is set correctly
	Overvoltage	Check whether the network voltage is stable or very high Check whether motor is overloaded Replace high-power brake resistance
5	Under-voltage	Check whether the supply voltage is too low
6	Great tracking error of position loop	Increase the gain parameter of position loop Reduce the input pulse frequency
7	Brake resistance overload	Increase the brake resistance power
8	Wrong password during parameters initialization	Reinitialize parameters correctly
3 9	Hardware over-current	Check whether encoder line is connected correctly Check whether motor UVW power line is connected correctly Check whether motor can match the driver Check whether the power module of driver is damaged
10	Wrong encoder	Check the encoder wiring and check whether reliable ground connection is conducted for motor; whether the electromagnetic interference is serious
11	Encoder unconnected	Reconnect the encoder correctly
12	Overload	Reduce the motor load
13	Software over-current	Check whether there is any blockage for motor, whether encoder line is loosened and whether the power line of motor is loosened.
15	Blockage	Check whether encoder line is loosened and whether power line of motor is loosened.

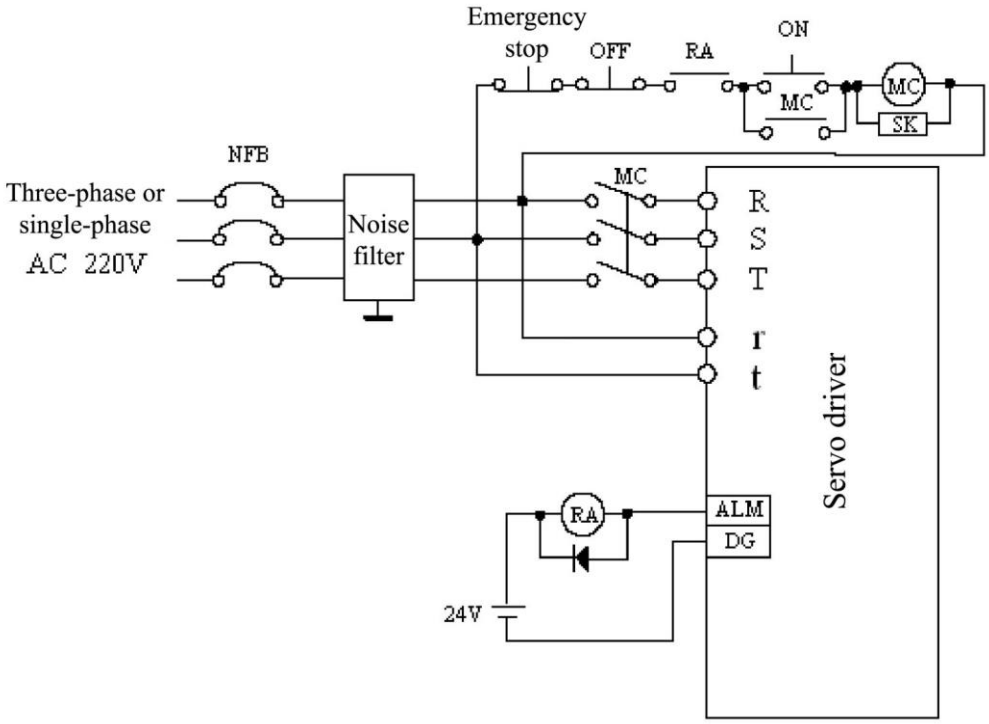
4

Chapter 6

Operations

6.1 Working Sequences

6.1.1 Power-on sequence:



Please refer to Figure 6-1 for power-on sequences and according to the following sequences:

Figure 6-1: Power wiring diagram

1) Connect power to the main circuit power input terminals (three phases to R, S and T, single phase to R and S) via the AC contactor.

2) Switch on the power L and N of the control circuit at the same time with or before the main circuit power. If only the control circuit power is connected, the servo readiness (SRDY) signal is OFF.

3) After the main circuit power is turned on, servo readiness signal (SRDY) is ON (with delay 1.5s). Then it receives servo enabling (SON) signal, servo enabling is effective, the driver output is effective and it is in the running state. If the servo enabling is ineffective, alarm may be sent, the base circuit would be shut down, and the motor is in a free state.

4) When the servo enabling is connected concurrently with the power, the base circuit is connected in 1.5 seconds.

5) Frequent connection and disconnection to the power may damage the soft-start circuit and the dynamic braking circuit. On/off frequency should be no more than five times per hour and less than 30 times a day. If the driver or motor is overheated, wait for 30 minutes after troubleshooting before connecting it to the power.

6.1.2 Timing diagram

Power connection sequences and alarm sequences:

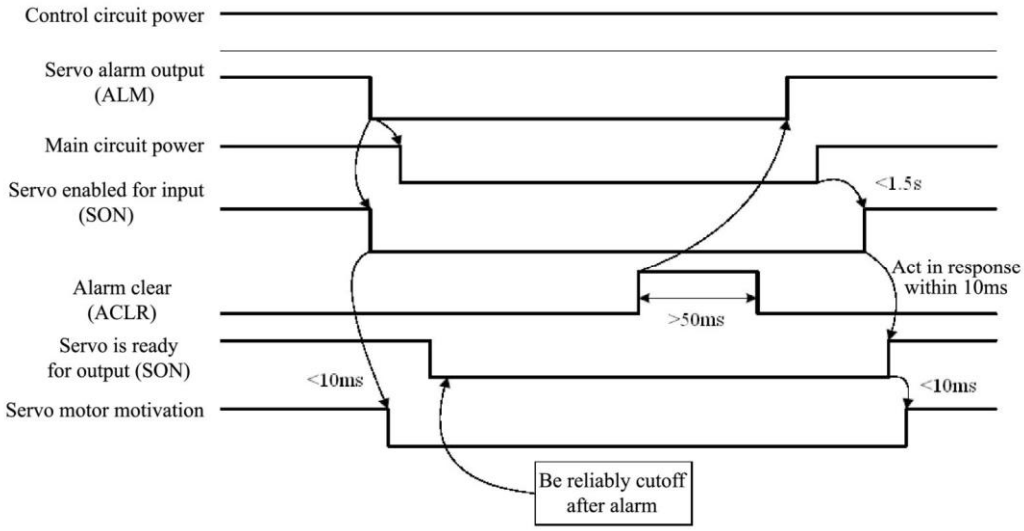


Figure 6-2: Power connection timing sequence diagram

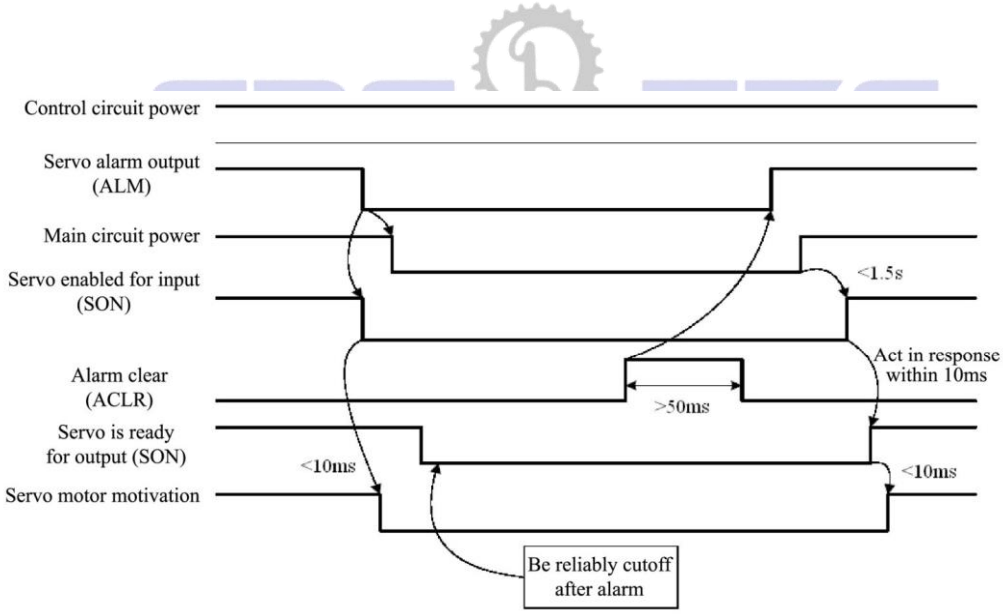


Figure 6-3: Alarm Timing Sequence Diagram

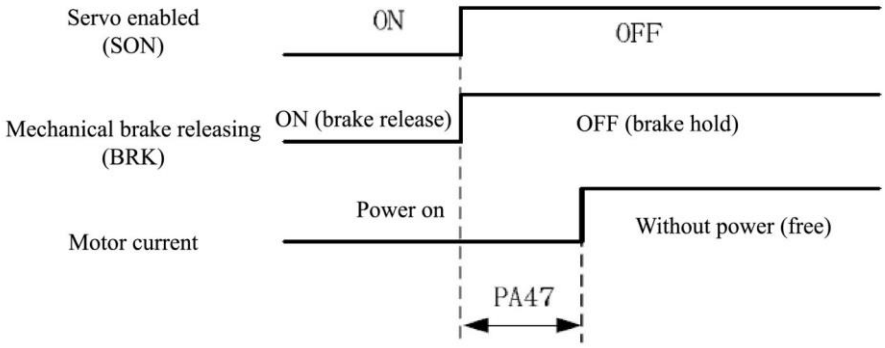


Figure 6-4: Sequences of mechanical brake actions when the motor stops running

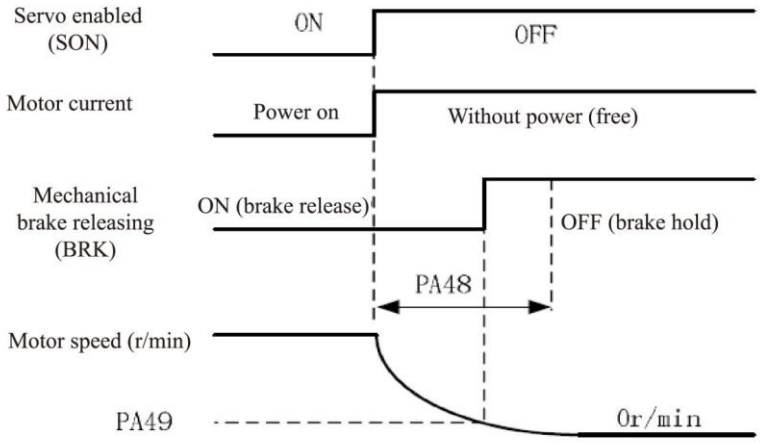


Figure 6-6: Sequences of mechanical brake actions when the motor is running

6.2 NOTES

1 Start-on / shutting-down frequency should be determined according to the servo driver and motor and must concurrently meet the two conditions.

(1) Frequency allowed for the servo driver

If high frequency is required, check whether it is within the allowed frequency range. The allowed frequency range varies along with the motor type, capacity, load inertia and motor speed. Firstly set the deceleration time to prevent too large renewable energy (in the position control mode, set the output pulse acceleration and deceleration time for the host controller). When the load inertia is m times of the motor inertia, the frequency allowed for the servo motor is as follows:

Multiple of load inertia	Allowed frequency
m≤3	> 100 times / minute; acceleration and deceleration time: 60 ms or less
m≤5	60 to 100 times / minute; acceleration and deceleration time: 150 ms or less
m>5	< 60 times / minute; acceleration and deceleration time: 150 ms or less

If it still fails to meet the requirements, reduce the internal torque limit (parameter Pr034 and Pr035) and lower down the maximum motor speed (parameterPr023).

(2) The allowed frequency for the servo motor varies with the load conditions, running time and other factors. Please refer to the motor manual.

2 Generally, if the multiple of load inertia is less than five times, use the motor under large inertia conditions. Main circuit over voltage or braking anomalies may occur from time to time and the countermeasures are as follows:

Reduce internal torque limit (parameter Pr034 and Pr035);

Reduce the maximum motor speed (parameter Pr023);

Providing an additional regeneration device;

-

3 As the servo driver is provided with a power supply for the encoder, to ensure normal operation of the encoder, the output voltage should be maintained at 5V ± 5%. If long cables are used, voltage loss may occur. In this case, please use the multi-core encoder for power supply in order to reduce the voltage drop of the cable line.

6.3 Pre-operation Inspection

6.3.1 Pre-operation inspection

After completing installation and wiring, check the following items before power connection:

Whether TB wiring of power terminal is correct and reliable and whether the input voltage is correct?

Whether power line or the motor line is short circuit or properly grounded?

Whether the encoder cable is connected correctly?

Whether the control signal terminal is properly connected? Whether the power polarity and size are correct?

Whether the driver and the motor are firmly fixed?

Whether the motor shaft is not connected to the load?

6.4 Simple Wiring Operations in Position Control Mode

6.4.1 Wiring

1. Main circuit terminal, three-phase AC220V, connected to R, S and T terminals; single-phase AC220V, connected to R and S terminals;
2. Control voltage terminal L and N should be connected to single-phase AC220V; 3. Encoder signal connector CN2 should be properly connected with the servo motor;
4. Control signal connector CN1 should be connected as per the figure shown.

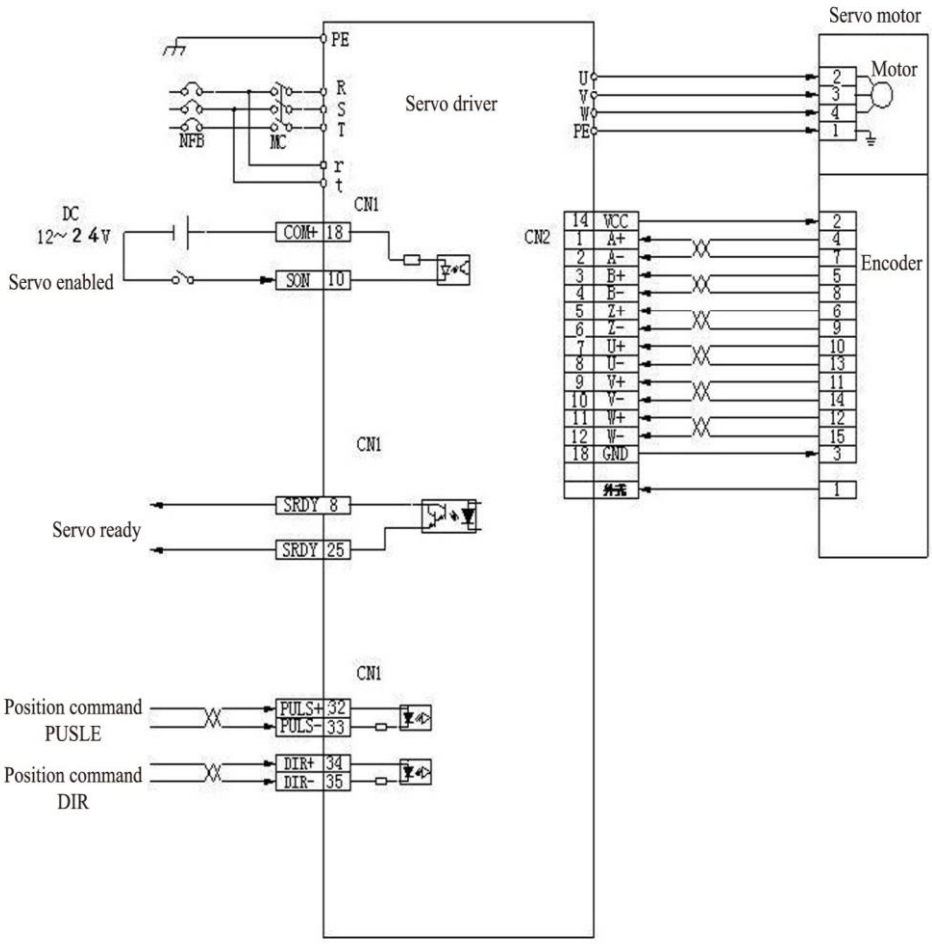


Figure 6-6 Simple Wiring Diagram of Position Control Mode

6.4.2 Operations

(1) Turn on the control circuit power supply and main power and the monitor displays;

(2) Set parameter values according to in the table below and write the parameters into EEPROM

Parameter No.	Meanings	Parameter value	Default value
Pr004	Control mode selection	0	0
Pr012	Electronic gear numerator	To be set by the user	1
Pr013	Electronic gear denominator	To be set by the user	1
Pr019	Position instruction smoothing filter	0	0
Pr020	Driving inhibiting input invalid	1	0

(3) If no alarm or any anomaly is detected, enable the servo (SON) ON. Send low-frequency pulse signal to the driver from the controller so that the motor runs at a low speed;

6.4.3 Setting of electronic gear

The encoder for this driver is 2,500 pulses / revolution. Any pulse equivalent is available by setting the electronic gear parameters Pr007 andPr008.

Note: Any ratio is available by setting any value for the numerator and denominator, but preferably within the range from 1/50 to 50.

Table 6.1: The relationship between pulse number and number of rotations

Number of pulses Pulse	Number of motor rotations; $\frac{Pulse \times Pr012}{10000 \times Pr013}$	Electronic gear numerator Pr012	Electronic gear denominator Pr0013
10000	1	1	1
5000	1	2	1
3000	1	10	3
800	1	25	2
20000	1	1	2
1000	2/3	20	3
4000	3	30	4

Table 6.2: The relationship between pulse frequency and rotation speed

(Hz) Input pulse frequency (Hz)	Motor speed (r/min) $\frac{Frequency \times \times 60\ Pr012}{10000 \times Pr013}$	Electronic gear numerator Pr012	Electronic gear denominator Pr013
300k	1800	1	1
500k	3000	1	1
100k	1200	2	1
100k	1800	3	1
50k	1000	10	3
200k	800	2	3
100k	300	1	2

Chapter 7

FAQs

7.1.1 Restore to default parameters

Restore to the default parameters under any of the following circumstances:

- Parameter are disordered, whereby the system fails to work properly;
- The power happens to fail in saving the parameters, whereby the system automatically restore to the default parameters, but the model code (Pr001) does not match with the driver and motor;
- The original motor needs to be replaced for the driver, but the new one does not match the model of the original motor;

To restore to default parameters:

1. Check the driver model (MK7 – 2A06 – IUN0) and the adaptation motor model. Find the model code according to Table 1 of Appendix I. Make sure the model is correct. Otherwise, the drive may be damaged. Take the MK7 – 2A06 – IUN0 drive for OMA13-05025-3PE motor for example, the model code is 30 according to Table 1;
2. Change the password parameter Pr000 to 385;
3. Change the model code parameter Pr001 to the selected model code. It is 30 in this example;
4. Write the default parameter value to EEPROM. Select Pr000 the first layer and press Enter to enter the parameter management mode. Firstly select the operating mode. There are five modes available. Use ↑ and ↓ to select. Select EE-dEF and then press Enter and hold for more than 3 seconds, it displays donE, indicating that the parameters are successfully saved. If it fails, it displays Error.
5. If the previous operation is successful, disconnect the driver power, and then re-power on and complete the operation.

7.7.2 Frequent Err-10 alarm

Err-11 alarm indicates defectives in the encoder and its connecting cable. Please check:

- Whether the connection cable and plug are in poor contact;
- Whether the connection cable is properly welded;
- Whether the grounding PE terminal of the driver is well grounded;

- Make sure the connection cable and the power cable should not share one trough. Try to change the wiring mode of the connection cable.

  Please contact the seller if the problem is not solved.

Appendix I: Motor Model Comparison Table

The set value of parameter PA1 (model code) must match the driver and motor used. Refer to Table 1. If they do not match, performance degradation or alarm may occur. Each model code has a unit combination of default parameters. Parameter PA1 has its default value and corresponding default parameter combination. If you need to modify the model code or to restore to the factory default parameter combination, please refer to 7.1.1.

Table 1

Motors Applicable to MK7 – 2A06 – IUN0 Drive

Model code	Applicable motor model	Power (kW)	Rated torque (N.m)	Rated speed (r/min)	Remark
23	OMA8-04025-1CC1	1.0	4	2500	
25	OMA9-04025-1CC1	1.0	4	2500	
27	OMA11-05030-3PE1	1.5	5	3000	
28	OMA11-06020-3PE1	1.2	6	2000	
29	OMA11-04030-3PE1	1.2	4	3000	
32	OMA13-04025-3PE1	1.0	4	2500	
13	OMA13-05020-3PE1	1	5	2000	
30	OMA13-05025-3PE1	1.3	5	2500	
37	OMA13-05020-3PE1	1	5	2000	
12	OMA13-06015-3PE1	0.9	6	1500	
31	OMA13-06025-3PE1	1.5	6	2500	
36	OMA13-06015-3PE1	0.9	6	1500	
33	OMA13-07020-3PE1	1.5	7	2000	
5	OMA13-10010-3PE1	1	10	1000	For Knitting machine

7	OMA13-10010-3PE1	1	10	1000	
11	OMA13-10015-3PE1	1.5	10	1500	

Appendix II: Driver Specifications

Model		MK7 – 2A06 – IUN0
Output power (KW)		1.5kw
Input power		Three-phase AC220V (-15% to +10%), 50 to 60Hz; Single-phase AC220V (-15% to +10%), 50 to 60Hz
Encoder type		5V, 2500 line incremental encoder, ABZUVW pulses
Control mode		Position control; pulse speed control
Regenerative braking		Internal
Control characteristics	Speed frequency response	200Hz or more
	Speed fluctuation rate	<± 3% (load 0 to 100%); <± 2% (power -15 to +10%) (the value corresponding to the rated speed)
	Speed ratio	1:5000
	Pulse frequency	≤500kHz
Position control	Input mode	(1)Pulse + symbol; (2) CW pulse + CCW pulse; (3) Orthogonal AB phase pulse
	Electronic gear ratio	1-9999/1-9999 (0.02<G<50)
	Feedback pulse	500 to 10,000 pulses / rev (adjustable)
Feedback mode	Motor shaft incremental pulse encoder feedback	
Parameter setting method	Keyboard input	
Load inertia used	Less than 3 times of the motor inertia	
Brake mode	Resistance dynamic braking	
Installation mode	Wall mounted	
Grounding mode	The housing grounded, grounding resistance ≤0.1Ω	

Monitoring functions	Rotation speed, current position, command pulse accumulation, positional deviation, motor current, command pulse frequency, operating status, input and output terminal signal	
Protection functions	Over-speed, main power supply over-voltage / under-voltage, over-current, overload, braking abnormity, encoder abnormity, position-tolerance	
Display and operation	6-dibit LED digital tube, 4 keys	
Working environment	Temperature	Operation: 0 to 55°C; Storage: -20°C to 80°C
	Humidity	Less than 90% (no condensation)
	Vibration	Less than 0.5G (4.9m/S^2), 10 to 60 Hz (non-continuous operation)

PRODUCT WARRANTY

1. WARRANTY PERIOD

The Company provides one-year warranty for its products in terms of raw materials and defective workmanship from date of shipment. We provide repairing services on a free of charge basis within the warranty period.

2. EXEMPTIONS

- Inappropriate wiring, such as incorrect polarity connection and hot plugging.
- Unauthorized change to any internal device.
- Using product exceeding the electrical and environmental requirements.
- Poor heat emission conditions.

3. REPAIRING PROCEDURES

Follow such procedures to apply for repairing the product:

(1) Contact the Company via phone call before delivery, explaining the failure conditions.

(2) Enclose a written explanation with the product, giving descriptions on the failure of the driver; the voltage, current, and the environment when the failure occurs; name, phone number and mailing address information of the contact person.

4. WARRANTY LIMITATIONS

The warranty is limited to devices and processes of the product (i.e. consistency).

The Company does not guarantee that the product is suitable for any specific purpose intended by the user, as the suitability is also subject to technical indicator requirements and use conditions. This product is not recommended for any clinical use.