AC SERVO SYSTEM

EPS-BS SERIES

User Manual

(V1.3)

Table of Contents

Safety Precautions

This section explains important items that users must observe when confirming, storing, moving, installing, wiring, operating, inspecting, and disposing of products when they arrive.

Risk

■Input **power.**

The input power of this driver is AC220V .

■ When **installing on a machine and starting operation, please put the motor in a state that can be stopped immediately at any time.**

Failure to do so could result in personal injury or mechanical damage.

■ **In the power-on state, be sure to install the cover of the power terminal block.**

Otherwise it may cause electric shock.

■ After **turning off the power or performing a withstand voltage test, do not touch the power terminals while the charging indicator is on.**

Otherwise, it may cause electric shock due to residual voltage.

■Please **carry out trial operation according to the steps and instructions described in the user manual corresponding to the product.**

If the servo motor is installed in a mechanical state, if an operation error occurs, it will not only cause mechanical damage, but may also cause personal injury.

■ **Never modify this product, and do not set up, disassemble or repair it unless specified.**

Failure to do so could result in personal injury, mechanical damage, or fire.

■Please **install a stop device on the machine side to ensure safety.**

The holding brake of a servo motor with a brake is not a stopping device to ensure safety.

Failure to do so could result in injury.

■ **Be sure to connect the ground terminal of the servo driver to the ground electrode (the ground resistance of the power input servo driver is 100 Ω or less) .**

Doing so may cause electric shock or fire.

Storage & Handling

■ **Do not store or install in the following environment.**

Failure to do so may cause fire, electric shock, or machine damage.

- Places exposed to direct sunlight
- Use the place where the ambient temperature exceeds the storage and setting temperature conditions
- Places where relative humidity exceeds storage and humidity conditions
- Places with corrosive gas and flammable gas
- Places with a lot of dust, dust, salt and metal powder
- Places subject to splashing with water, oil and drugs
- Vibration or shock will be transmitted to the subject's place

■ **Do not hold the cable, motor shaft or detector for transportation.**

Doing so may cause injury or malfunction.

Installation

■Do **not block the air inlet and air outlet. Also do not allow foreign matter to enter the product.**

Failure to do so may cause malfunction or fire due to aging of internal components.

■ **Be sure to observe the requirements of the installation direction.**

Doing so may cause a malfunction.

■ When **installing, please ensure that there is a prescribed interval between the servo driver and the inner surface of the control cabinet and other machines.**

Doing so may cause fire or malfunction.

■ **Do not apply excessive impact.**

Doing so may cause a malfunction.

Wiring

■ **Make wiring correctly and reliably.**

Failure to do so could result in loss of motor control, personal injury, or machine failure.

■ **Do not connect commercial power to the servo motor connection terminals U , V , W of the servo driver .**

Failure to do so could result in injury or fire.

■Please **connect the power terminal and the motor connection terminal securely.**

Doing so may cause fire.

■ **Do not use the same sleeve for the main circuit cable, the input and output signal cables, and the encoder cable, and do not bundle them together. When wiring, the main circuit cable and the input and output signal cables should be more than 30cm away .**

■ **Please use double-stranded or multi-core double-stranded overall shielded cable for input and output signal cables and encoder cables.**

■The **wiring length of the input and output signal cables: up to 3 m ; encoder cables: up to 30 m .**

■ **Even if the power is turned off, high voltage may remain in the servo drive. Therefore, do not touch the power terminal while the charging indicator is on.**

After confirming that the charging indicator is off, perform wiring and inspection.

■ **Please install a safety device such as a circuit breaker to prevent external wiring from being shorted.**

Doing so may cause fire.

■When **using in the following places, please take appropriate shielding measures.**

- When interference occurs due to static electricity, etc.
- Places producing strong electric or magnetic fields
- Places where there may be radiation radiation

Doing so may cause damage to the machine.

■ **Pay attention to polarity when connecting batteries.**

Otherwise, the battery, servo driver and servo motor will be damaged and exploded.

Operations

■ **To prevent accidents, perform a trial operation on the servo motor alone (with the machine not connected to the drive shaft of the servo motor).**

After the test run is correct, connect the machine to run. Failure to do so could result in injury.

■ When **installing on the supporting machinery and starting operation, please set the parameters in accordance with the machinery in advance.**

If you start running without parameter setting, it will cause the machine to run out of control or malfunction.

■ **Do not turn the power on / off frequently .**

Since the power supply portion of the servo drive with a capacitor, so the power ON time, will flow through a large charging current. Therefore, if the power is turned on and off frequently, the performance of the main circuit components inside the servo drive will be reduced.

■When **using the servo motor on the vertical axis, please install a safety device to prevent the workpiece from falling in the state of alarm, overtravel, etc. When overtravel occurs, set a fixed stop with zero position.**

Failure to do so may cause the workpiece to fall under overtravel.

■ **Extreme parameter adjustment and setting changes will cause the operation of the servo system to become unstable. Do not perform such operations.**

Failure to do so may result in personal injury or machine damage.

■ When **an alarm occurs, reset the alarm after removing the cause and ensuring safety, and restart the operation.**

Failure to do so may cause machine damage, fire, or injury.

■ **Do not use the brake of a servo motor with a holding brake for braking.**

Doing so may cause a malfunction.

■ Use the **servo motor and servo driver in the specified combination.**

Doing so may cause fire or malfunction.

Maintenance Note Italian

■ **Do not change the wiring while the power is on.**

Failure to do so may result in electric shock or injury.

■ When **replacing the servo driver, please copy the parameters of the driver to be replaced to the new driver, and then restart the operation.**

Doing so may cause damage to the machine.

Others

- For detailed explanation, some illustrations in this manual have been removed from the cover or safety protection. In actual operation, please be sure to install the cover or safety protection body to the original position according to the regulations, and then operate according to the instructions in the user manual.
- The illustrations in this manual are representative examples and may differ from the product you received.
- Please set up relevant protection and safety devices during driver debugging. The company is not responsible for special damage, indirect losses, and other related losses caused by our products.
- The information contained in this manual is a general description or feature introduction, which is not always completely consistent with the description in actual applications, or may not be completely suitable due to further development of the product.

★★★ Quick start guide

★ Basic wiring

1. Power cord: L1 , L2 , L3 (see section 3.1 for details)

It can be connected to three-phase AC 220V ; or any two terminals can be connected to single-phase AC 220V .

2. the motor power line: U, V, W

These three wires need to be connected to U, V, W marked on the driver one by one. Connect the PE wires to the driver's wiring screws .

3. Encoder line (see section 3.3 for signal definition)

Motor flange	Motor Power	Power line model	Encoder line model
60/80/90	-	DA-002	BD -031
110/130	0.8 ～1.0KW	DB-002	BC -031
	1.2 ～1.5KW	DC-002	
	1.8 ～2.0KW	DD-002	
	2.2 ～3.0KW	DE-002	

4. Braking resistor (braking resistor) wiring

1) 400W and below power driver has no internal braking resistor. If necessary, an external braking resistor is required. Connect the two ends of the external braking resistor to the P + and C terminals respectively.

2) 750W and above power drivers, standard internal braking resistor (P + , D terminals are equipped with a short wiring). If the internal braking resistor is too small, an external braking resistor is required. First , remove the short wires at terminals P+ and D , and connect the two ends of the external braking resistor to terminals P+ and C respectively .

5. I/O signals (see section 3.2 and 3.4 for details)

Pin	Symbol	Definition	Description
1	DGND	Digital ground	Communication terminal
2	RS +	485 communication positive	
3	RS-	485 communication negative	
4	PL	24V common terminal	1, **Differential input** : connect to P+ P- S+S-; 2, **Open collector (24V, NPN)**: PL connects to 24V, the pulse output (e.g. Y0) connects to the P- , direction output (e.g. Yl) connected S-; 3 , **Siemens PLC (PNP)** : P-, S- connect to 0V, pulse output (Y0) serial 2K resistor connects to P+, direction output (Yl) serial 2K resistor connects to S+ .
5	P+	Pulse positive (5V)	
6	P-	Pulse negative	
7	S+	Sign positive (5V)	
8	S-	Sign negative	
9	COM +	Switching value common terminal positive (12V ~ 24V)	Switching power supply 12V ~ 24V
10	DI1	Digital input 1	Default: S-ON (PA145 can be redefined)
11	DI2	Digital input 2	Default: Alarm clear (PA146 can be redefined)
12	DI3	Digital input 3	Default: Deviation clear (PA147 can be redefined)
13	COM-	Switching value common terminal negative (0V)	Switching power 0V
14	DO1	Digital output 1	Default: Servo alarm (PA148 can be redefined)
15	DO2	Digital output 2	Default: holding brake (PA149 can be redefined)
16	DO3	Digital output 3	Default: position reached (PA150 can be redefined)

★ Basic parameters

1. Setting method of these following parameters (PA2, PA8, PA9)

- Set PA0 into 1234 ;
- Modify the relevant parameters in turn according to the following instructions and confirm;
- Restore factory settings (EEPOP → EE-1);
- Power on again.

2. Set the matching parameters according to the motor nameplate: PA2, PA8, PA9

- Check whether the motor pole pair number PA2 is consistent with the motor nameplate.

PA2 = 4 : four pairs of pole motors

PA2 = 5 : five pairs of pole motors

- Check whether the motor encoder type parameter PA8 is consistent with the motor nameplate (the brackets are the encoder identification in the motor model) .

PA8 = 0 : (H) Magnetic encoder 1024 line

PA8 = 1 : (P) Magnetic encoder 2500 line

PA8 = 2 : (E) Line-saving incremental 2500 line

PA8 = 3 : (K) Line-saving incremental 5000 line, (Q) Magnetic encoder 5000 line

- Check whether the motor current parameter PA9 is consistent with the motor nameplate.

PA9 parameter	**Motor rated current**	**PA9 parameter**	**Motor rated current**
0	-	20	10A
1	0.5A	21	11A
2	1.0A	22	12A
3	1.5A	23	13A
4	2.0A	24	14A
5	2.5A	25	15A
6	3.0A	26	16A
7	3.5A	27	17A
8	4.0A	28	18A
9	4.5A	29	19A
10	5.0A	30	20A
11	5.5A	31	21A
12	6.0A	32	22A
13	6.5A	33	23A
14	7.0A	34	24A
15	7.5A	35	25A
16	8.0A		
17	8.5A		
18	9.0A		
19	9.5A		

3. Does the motor and driver capacity match?

If the rated current of the motor is more than 1A than the rated current of the driver , please consider replacing with a higher power driver! The current is marked on the nameplate.

Chapter 1 Product Overview

1.1 Product inspection

In order to avoid various problems during the purchase and shipping of this product, please check the items listed in the table below in detail.

Items	Reference
Does the product match the model you ordered?	Check the product models on the motor and drive nameplates
Is the motor shaft normal?	Rotate the motor shaft by hand. If it can run smoothly, it means that the motor shaft is normal. However, a motor with an electromagnetic brake cannot run by hand!
Is the appearance damaged?	Check visually for any damage.
Are there loose screws?	Use a screwdriver to check whether the screws of the servo drive are locked.

If you encounter any of the above situations, please contact the agent or manufacturer for a proper solution.

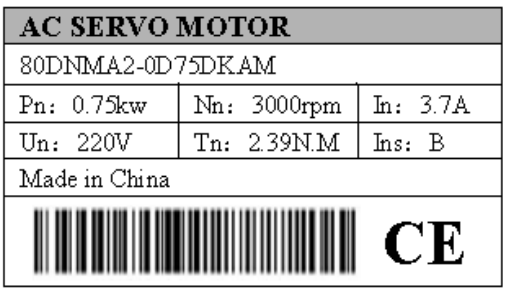
A complete servo system should include the following items:

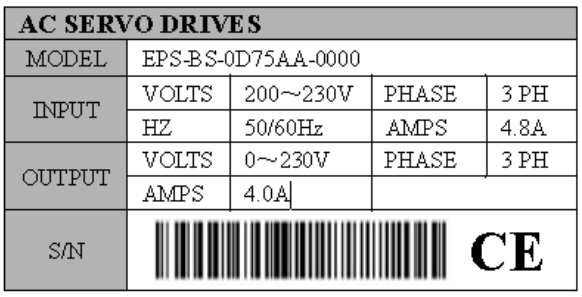
Items	Reference
1	Servo driver and matching servo motor.
2	Motor power cable
3	Motor encoder cable
4	Servo control line
5	An instruction manual

1.2 Product Model

1.2.1 Nameplate description

■ EPS-BS series servo driver nameplate





1.2.2 Model descriptions

■ EPS-BS series servo drive model description

EPS – BS – 0D75 A A – □□□□

[1] [2] [3][4] [5]

[1] Servo driver series

Symbol	Specifications
BS	BS series

[2] Driver power

Symbol	Specifications
0D20	200W
0D40	400W
0D75	750W
0001	1.0KW
01D5	1.5KW
02D2	2.2KW
0003	3.0KW

[3] Rated input voltage

Symbol	Specifications
A	**220V**

[4] Hardware version

Symbol	Specifications
A	

[5] factory code

Symbol	Specifications
0000	General 1
1000	General 2

■ Servo motor model description

130 DN MA 2– 0D75 D K A M

【1】 【2】 【3】 【4】 【5】 【6】 【7】 【8】 【9】

【 1 】Flange

Symbol	Specifications
60	60 flange
80	80 flange
130	130 flange
180	180 flange

【2】Name

Symbol	Specifications
DN	

【3】Inertia

Symbol	Specifications
MA	Medium 220V
HA	High 220V

【4】Pole pair

Symbol	Specifications
1	4 pole pairs
2	5 pole pairs

【5】Rated power

Symbol	Specifications
0D20	200W
0D40	400W
0D75	750W
0001	1.0KW
01D2	1.2KW
01D5	1.5KW
0002	2KW
0003	3.0KW

【6】Rated speed

Symbol	Specifications
A	1000rpm
B	1500rpm
C	2000rpm
D	3000rpm

【7】Encoder type

Symbol	Specifications
E	2500 line
H	Magnetic 1024 line
K	5000 line
P	Magnetic 2500 line
Q	Magnetic 5000 line

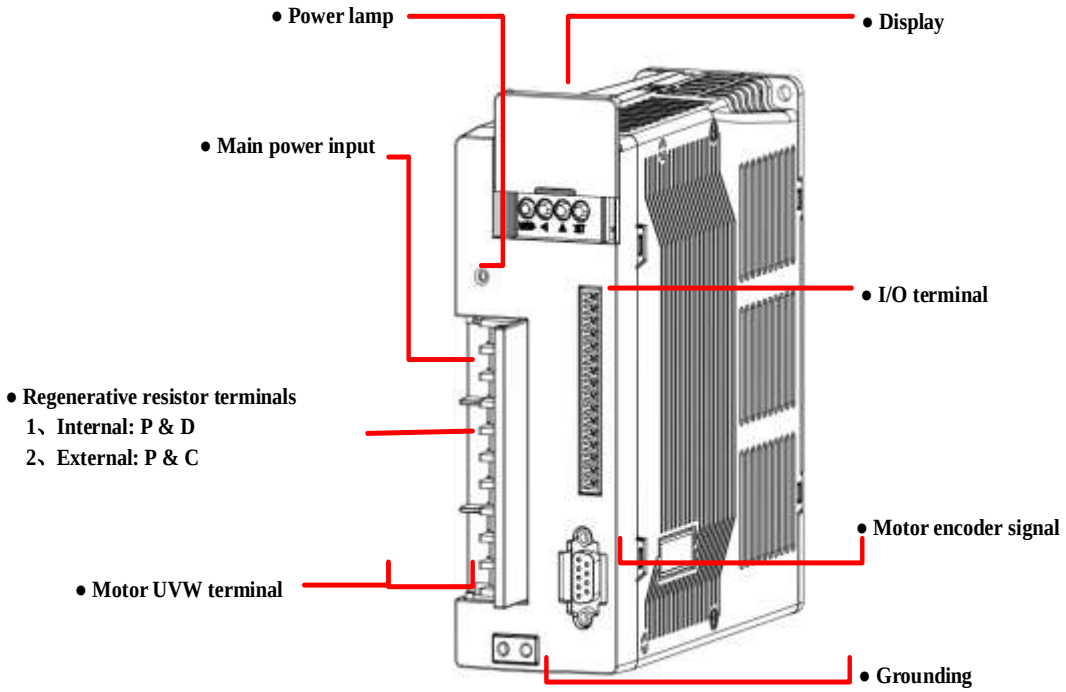
【8】Brake

Symbol	Specifications
A	No brake
B	With brake

【9】Shaft

Symbol	Specifications
K	Key, no oil seal
Y	No key, oil seal
M	Key, oil seal
N	No key, no oil seal

1.3 Name of each part of servo drive



1.4 Maintenance & Inspection

Please perform regular maintenance & inspection on the driver & motor to ensure safe & normal use. Routine inspections and regular inspections should be implemented according to the following items .

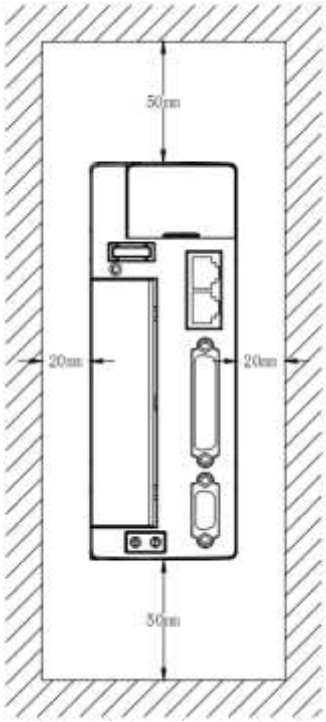
Types	Cycle	**Check item**
Daily inspection	daily	· Ambient temperature, humidity, dust and foreign matter · Is there abnormal vibration, abnormal sound · The INPUT power supply voltage is normal · Is there a smell? · Are the vents sticky fiber thread · Clean situation drives the front of the connector · The control device, the device motor connector portion for loose & core leg departing · Load section whether the foreign body embedded
Periodic inspection	1 year	· Fastening parts for loose · Are there signs of overheating · Whether the terminals are damaged or loose

Chapter 2 Installation

2.1 Installation direction and space

The installation direction must be in accordance with the regulations, otherwise it will cause malfunctions. In order to make a good cooling effect, the upper and lower, left and right with the adjacent items and baffle (wall) must have enough space, otherwise it will cause malfunctions. The AC servo drive's suction, exhaust hole cannot be sealed, nor placed upside down, otherwise it will cause malfunctions.

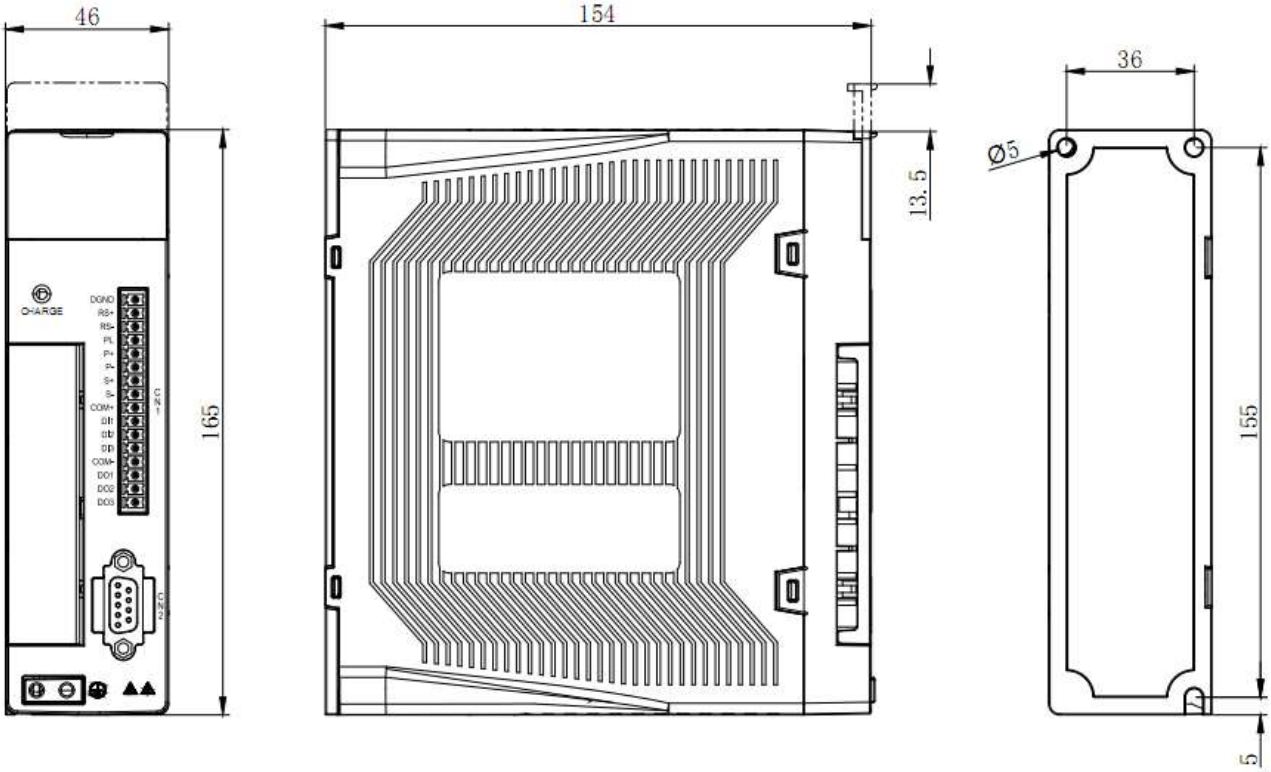
In order to lower the wind resistance to the radiator fan and let heat discharge effectively, users shall follow the recommended installation spacing distance of one or several AC servo drivers (see the figure below).2.2 EPS-BS



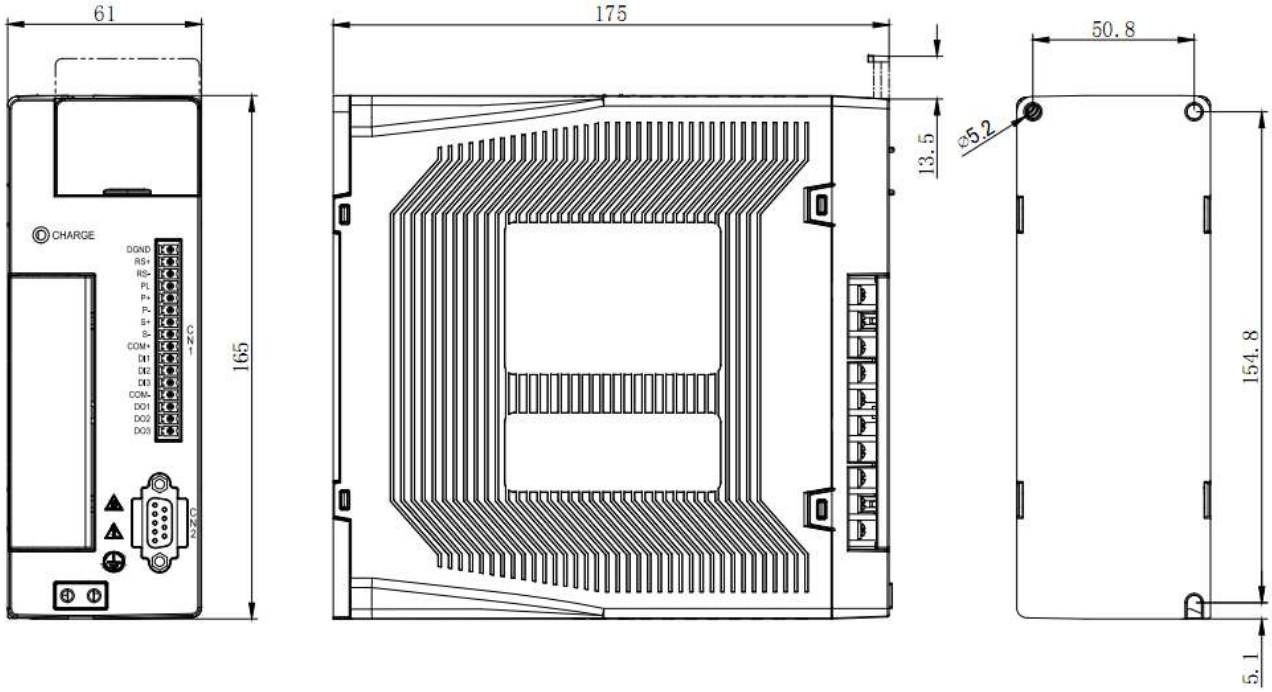
2.2 Servo drive dimensions

(Unit: mm)

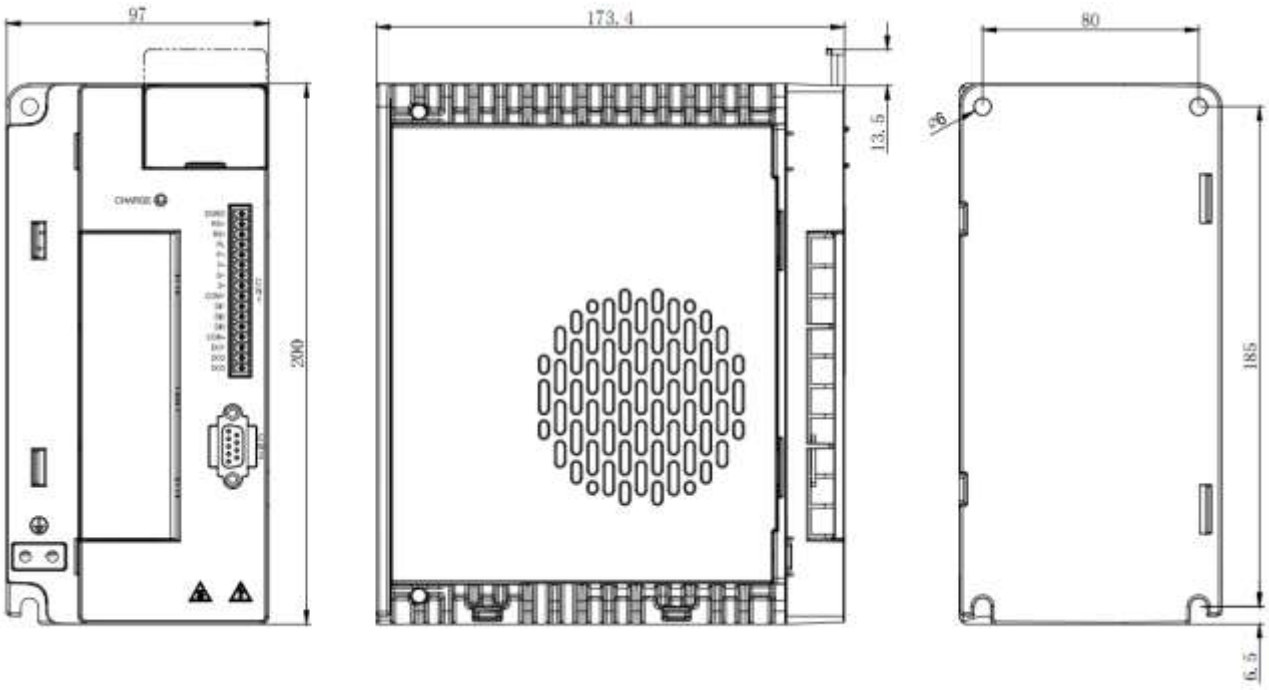
(1) A type case: EPS-BS-0D20AA, EPS-BS-0D40AA



(2) B type case: EPS-BS-0D75AA, EPS-BS-0D75AA -**-G, EPS-BS-0001AA, EPS-BS-01D5AA**



(3) C type case: EPS-BS-01D5AA-**-G, EPS-BS-02D2AA, EPS-BS-02D2AA-****-G, EPS-BS-0003AA**



2.3 Recommended specifications for circuit breakers and fuses

■ 220V class

Drive type	Power	breaker	Fuse (Class T)
Type A	400W or less	10A	20A
Type B	750W ~ 1.5KW	20A	40A
Type C	2.2KW ~ 3KW	30A	80A

Note:

1. Strongly recommended: the fuse and circuit-breaker must comply with UL/CSA standards.
2. When an earth leakage circuit breaker (ELCB) is added for leakage protections, please choose ELCB with sensitivity current over 200mA and action time over 0.1s

2.4 Countering noise interference and higher harmonics

The main circuit of servo drive uses a high-speed switching device, so the peripheral wiring and earthing of servo drive may be affected by the noise of the switching device. In order to prevent noise, the following measures can be taken:

- ◆ Please install EMI filter on the main power supply side;
- ◆ Connection of AC/DC reactor for suppression of higher harmonic;
- ◆ Please install the command input equipment (such as PLC) and EMI filter as close as possible to the servo drive;
- ◆ The power line (cable for power supply from servo drive to servo motor) shall be over 30cm from the input-output signal cable. Do not house them in the same bushing or tie them together.
- ◆ Do not use the same power supply with a welding machine or electro spark machine.

◆ When there is a high frequency generating device nearby, an EMI filter shall be connected to the input side of the main circuit cable.

◆ Ensure the earthing is appropriate.

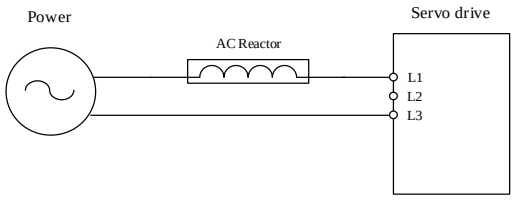
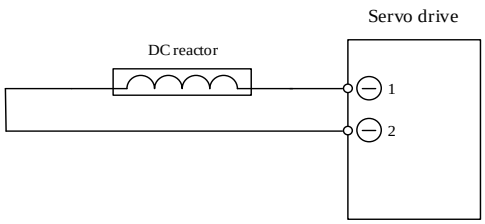
2.4.1 Installation of EMI filter

In order to ensure the EMI filter can fully suppress the interference, please note:

Item	Reference
1	Servo drives and EMI filters must be installed on the same metal surface.
2	The wiring has to be as short as possible.
3	The metal surface shall be well grounded.
4	The metal housing or earthing of both servo drive and EMI filter shall be reliably fixed to the metal surface, with the contact area as big as possible.
5	The motor power line shall have shielded (double shielding layer is preferred) .
6	Ground shielding copper with the shortest distance and maximum contact.

2.4.2 Installation of AC/DC reactor

An AC/DC reactor can be connected to the servo drive for suppression of higher harmonic. Please connect the reactor according to the figure below:

AC Reactor	DC Reactor
	

2.5 Selection of regenerative resistors

When the motor is outputting torque opposite to the rotating direction, energy is regenerated from the load to the drive. DC bus voltage will rise and at a certain level, the regenerated energy can only be consumed by the regenerative resistor. The drive contains an internal regenerative resistor, and users can also connect an external regenerative resistor. The table below shows the specifications of regenerative resistor contained in EPS-B1 series servo drives.

Drive enclosure	Internal regenerative resistor specifications		Minimum allowable resistance (Ohm)
	Resistance (Ohm)	Capacity (Watt)	
Type A	-	-	30
Type B	30	60	20
Type C	30 (220V)	80	13 (220V)

When the regenerative capacity exceeds the disposable capacity of the internal regenerative resistor, an external regenerative resistor shall be connected. Please note:

Item	Reference
1	Please set the external resistor value and capacity correctly.
2	The external resistance value shall not be smaller than the minimum allowable resistance value. If parallel connection is to be used to increase the power, please confirm whether the resistance value satisfies the limiting conditions.
3	In natural environment, when the disposable regenerated capacity (mean value) of regenerative resistor is used within the limit of nominal capacity, the temperature of resistor will rise to be above 120℃ (under continual regeneration). In order to ensure safety, it is suggested to use a regenerative resistor with a thermo-switch.
4	When external regenerative resistor is used, the resistor shall be connected to P, C end, and P, D end shall be open. External regenerative resistor shall follow the resistance value suggested in the table above.

Chapter 3 Wiring

3.1 System structure & wiring

3.1.1 Connectors and terminals of the driver

Terminal symbol	name
L1, L2, L3	Power input terminal
P, D, C	External regeneration resistor connection terminal
⊖	DC bus negative terminal
U, V, W	Servo motor connection terminal
⏚	Ground terminal
CN1	Communication port, I / O connector
CN2	Encoder connector

3.1.2 Wiring of the main circuit

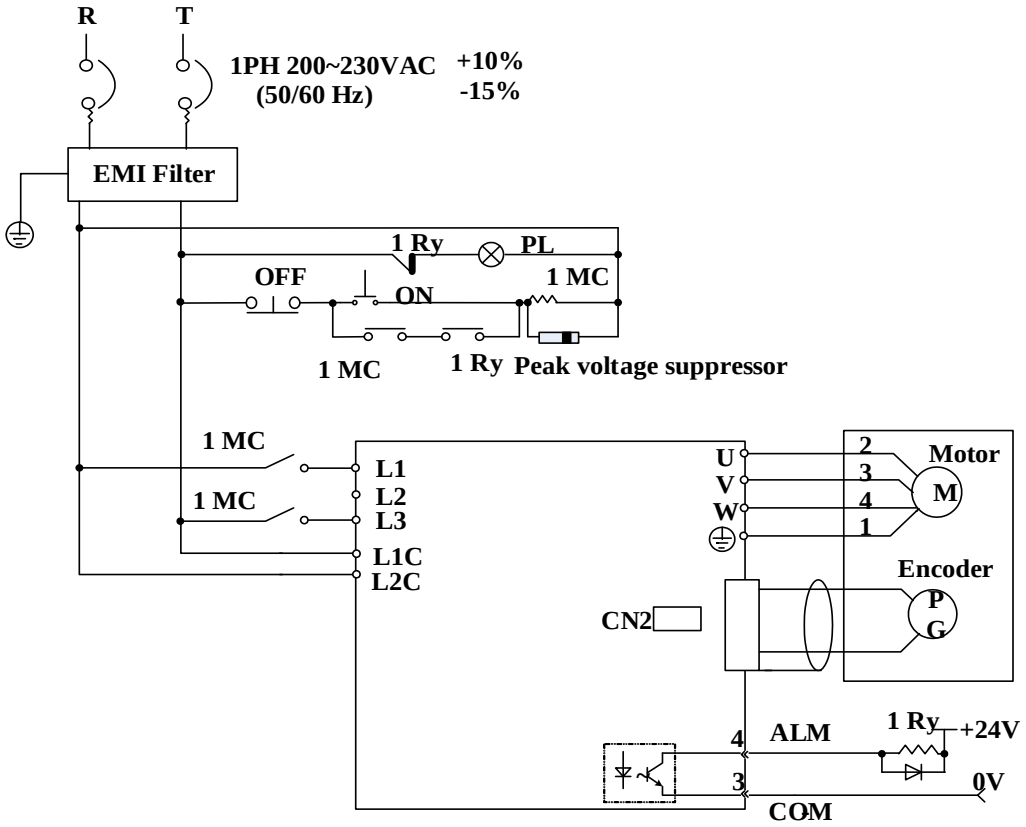
1) Wire size of servo drive main circuit

External terminal name	Terminal symbol	Wire diameter mm2 (AWG)						
		EPS-BS (A type chassis)		EPS-BS (B type chassis)			EPS-BS (C type chassis)	
		0D02A	0D04A	0D75A	0001A	01D5A	02D2A	0003A
Main circuit power cable	L1 , L2 , L3	1.25 (AWG-16)		2.0 (AWG-14)			3.0 (AWG-14)	
Motor power line	U , V , W	1.25 (AWG-16)		2.0 (AWG-14)			3.0 (AWG-14)	
External regeneration resistance line	P, D, C	1.25 (AWG-16)						
Ground wire	⏚	2.0 (AWG-14) or more						

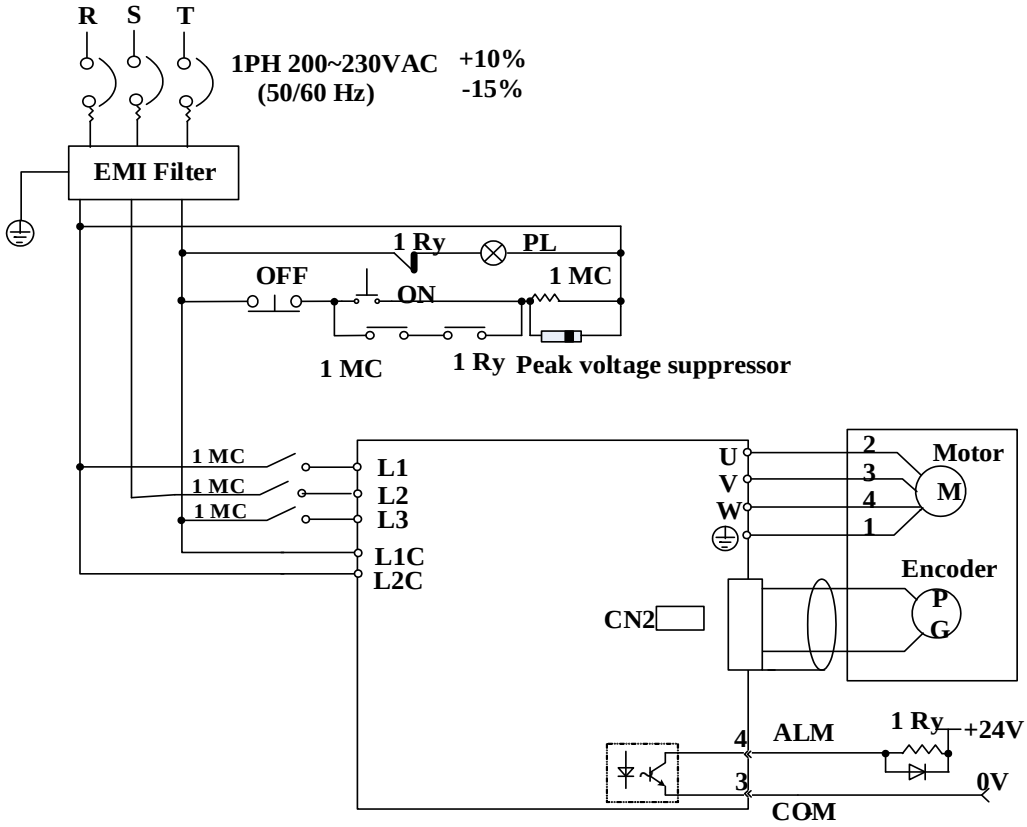
2) Typical main circuit wiring example

◆ When the signal of ALM is active, power supply of the main circuit shall be OFF.
◆ Main circuit & control circuit shall be powered on at the same time, or the control circuit first.
◆ The main circuit shall be powered off before the control circuit.

■ 1PH AC220V input



■ 3PH AC220V input



3.2 CN1 wiring

3.2.1 Arrangement of connector CN1 terminal

Pin	Symbol	Definition	Description
1	DGND	Digital ground	Communication terminal
2	RS +	485 communication positive	
3	RS-	485 communication negative	
4	PL	24V common terminal	1, **Differential input** : connect to P+ P- S+S-; 2, **Open collector (24V, NPN)**: PL connects to 24V, the pulse output (e.g. Y0) connects to the P- , direction output (e.g. Yl) connected S-; 3 , **Siemens PLC (PNP)** : P-, S- connect to 0V, pulse output (Y0) serial 2K resistor connects to P+, direction output (Yl) serial 2K resistor connects to S+ .
5	P+	Pulse positive (5V)	
6	P-	Pulse negative	
7	S+	Sign positive (5V)	
8	S-	Sign negative	
9	COM +	Switching value common terminal positive (12V ~ 24V)	Switching power supply 12V ~ 24V
10	DI1	Digital input 1	Default: S-ON (PA145 can be redefined)
11	DI2	Digital input 2	Default: Alarm clear (PA146 can be redefined)
12	DI3	Digital input 3	Default: Deviation clear (PA147 can be redefined)
13	COM-	Switching value common terminal negative (0V)	Switching power 0V
14	DO1	Digital output 1	Default: Servo alarm (PA148 can be redefined)
15	DO2	Digital output 2	Default: holding brake (PA149 can be redefined)
16	DO3	Digital output 3	Default: position reached (PA150 can be redefined)

Note

◆ Do not use empty terminals.

◆ Connect the shield of the cable to the connector housing.

◆ All input signals can parameter be configured by parameters.

3.2.2 I/O Signal allocations

I. Input signal settings

■ PA145 ~ PA147.

PA	Name	Default	Effective
PA145	**Control terminal DI1 input signal function selection** [0] Control mode switching (C-MODE) [1] Forward rotation prohibited (CWL) / internal torque selection 1 [2] Negative rotation prohibited (CCWL) / Internal torque selection 2 [3] Deviation Clear (CLE) / Internal position reset / Internal multi-step speed 1 [4] Alarm Clear (A-CLR) / Internal Multi-speed 3 [5] Pulse input inhibit (INH) / Internal position stop / Internal multi-step speed 2 [6] Servo enable (S-ON) [7] Zero speed clamp (ZEROSPD) / internal position pause [8] Jog positive direction [9] Jog negative direction / internal position selection 1 [10] Position start in internal position mode [11] Finding the mechanical zero start signal [12] Mechanical zero input signal / torque signal negation [13] Internal position selection 2 [14] Gear ratio switching / internal position signal negation [15] Internal position selection 3	**6**	**Immediate**
PA146	**Control terminal DI2 input signal function selection**	**4**	**Immediate**
PA147	**Control terminal DI3 input signal function selection**	**3**	**Immediate**

(2) Description of input signal form selection

PA64 bit number	b7	b6	b5	b4	b3	b2	b1	b0
Corresponding function number	【7 】	【6 】	【5 】	【4 】	【3 】	【2 】	【1 】	【0 】
Input signal polarity selection	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

PA64 bit number	b15	b14	b13	b12	b11	b10	b9	b8
Corresponding function number	【15 】	【14 】	【13 】	【12 】	【11 】	【10 】	【9 】	【8 】
Input signal polarity selection	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

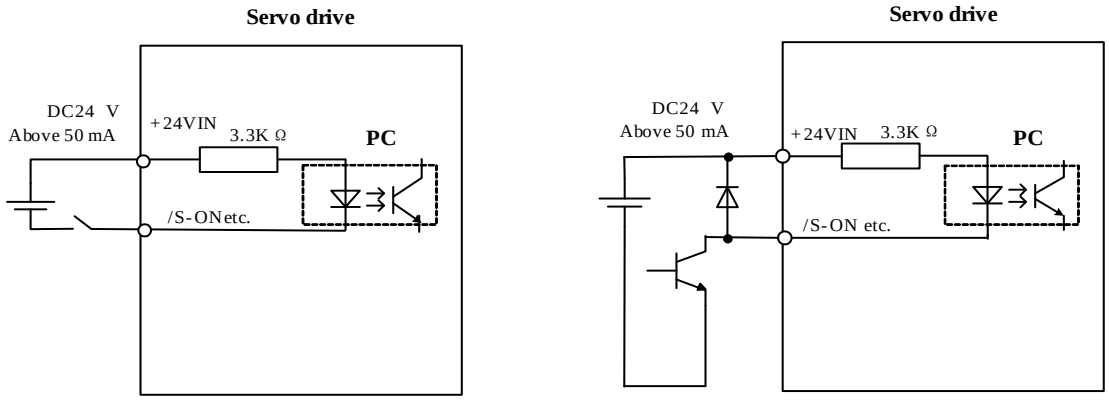
Calculation method (by converting binary number into decimal number):

$$PA64 = b15 \times 2^{15} + b14 \times 2^{14} + \ldots\ldots + b2 \times 2^{2} + b1 \times 2 + b0$$

(3) When used after changing the input signal assignment

When signals like S-ON, CWL, CCWL are used through "polarity inversion", if there are abnormal states like breakage of signal line, it will cause movement deviating from the safety direction. If such setting has to be adopted, please confirm the action and ensure there are no safety problems. The typical circuit of input

signal is as follows:



Take the above figure as an example. When the optocoupler is conductive, S-ON signal is L level; when the optocoupler is not conductive, S-ON signal is H level.

(4) Confirmation of input signal states

Input signal states can be monitored in DP12.

II. Output signal settings

(1) Description of output signal form selection

PA	Name	Defaults	Effective
PA148	**Control terminal DO1 input signal function selection** [0] Servo ready (S_RDY) [1]Alarm (ALM) [2] Motor holding brake (BRK) [3] Position reached (COIN) [4] Torque reached (TLC) [5] Zero speed (ZSP) * [6] Z signal (Restart to take effect)	**1**	**Immediate**
PA149	**Control terminal DO2 input signal function selection**	**2**	**Immediate**
PA150	**Control terminal DO3 input signal function selection**	**3**	**Immediate**

(2) Description of output signal form selection

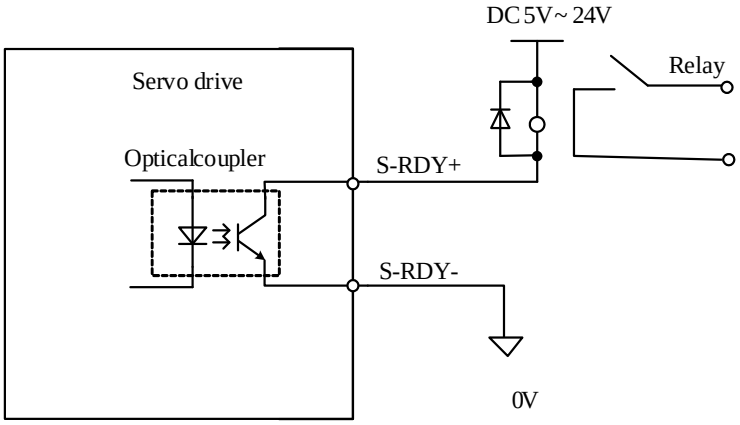
PA66 digit number	* b6	b5	b4	b3	b2	b1	b0
Corresponding function number	【6 】	【5 】	【4 】	【3 】	【2 】	【1 】	【0 】
	Z	ZSP	TLC	COIN	BRK	ALM	S_RDY
Output signal polarity selection	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

Calculation method (by converting binary number into decimal number):

$$PA66 = b6 \times 2^6 + b5 \times 2^5 + \ldots\ldots + b2 \times 2^2 + b1 \times 2 + b0$$

(3) Use of output signal

If an output signal is not detected, then it is regarded as invalid.The output signal typical circuit is shown below :



Maximum allowable voltage: DC 30V
Maximum allowable current: DC 50mA

4) Confirmation of output signal

Output signal states can be monitored in DP13.

(5) Relevant matters needing attention

Brake signal is a differential signal, others are single-ended output signals (open-collector).

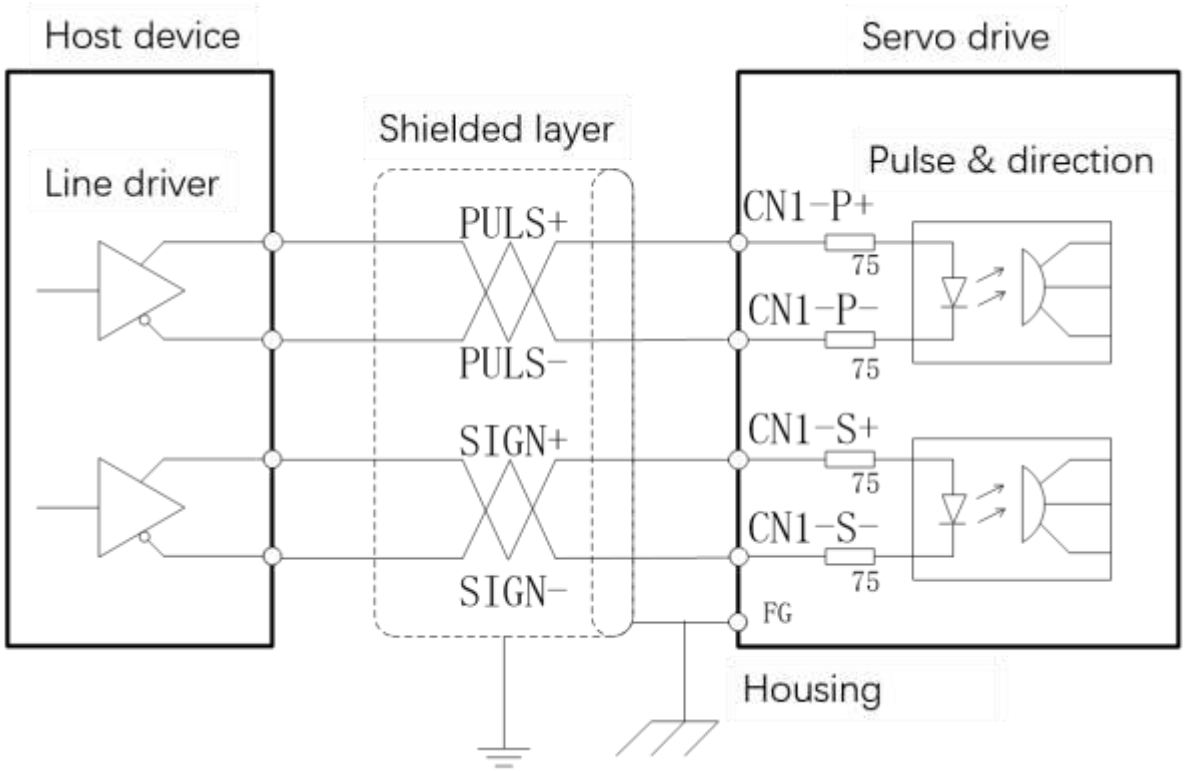
3.2.3 Examples of connection to the host device

Servodrive input, output signals and their connection examples with the host device are shown below .

I. Instruction input loop

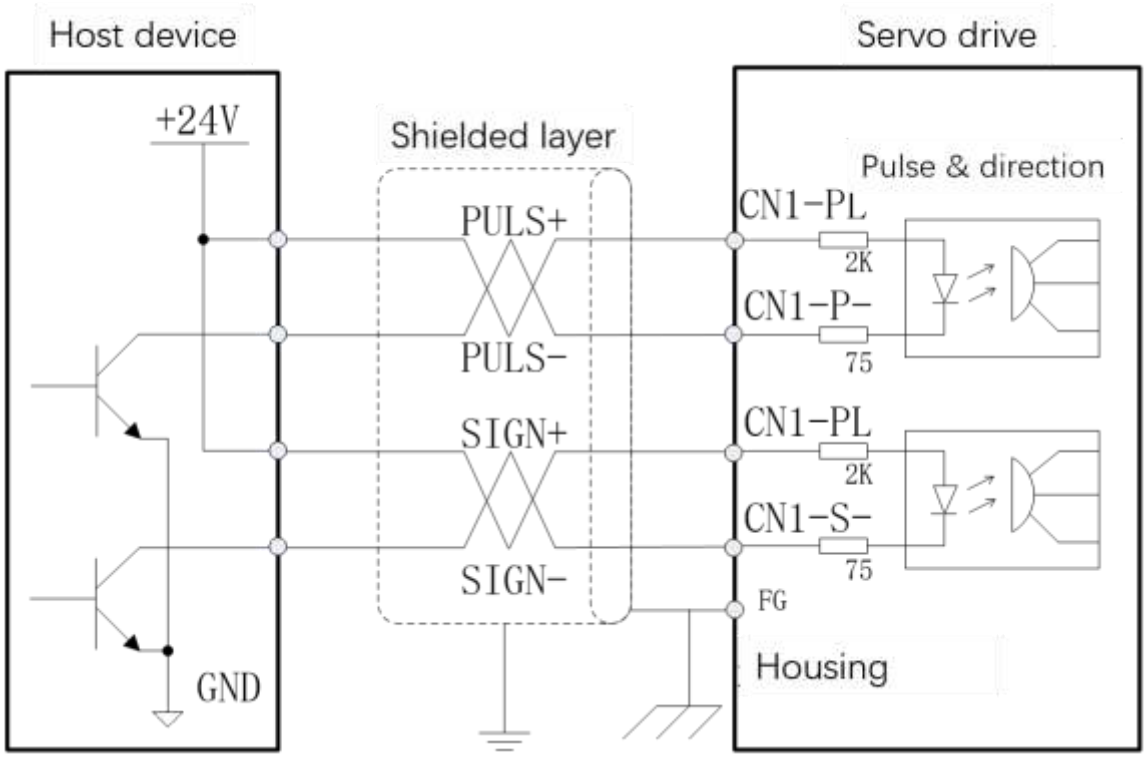
1) Position instruction input loop

■ Linear driver output

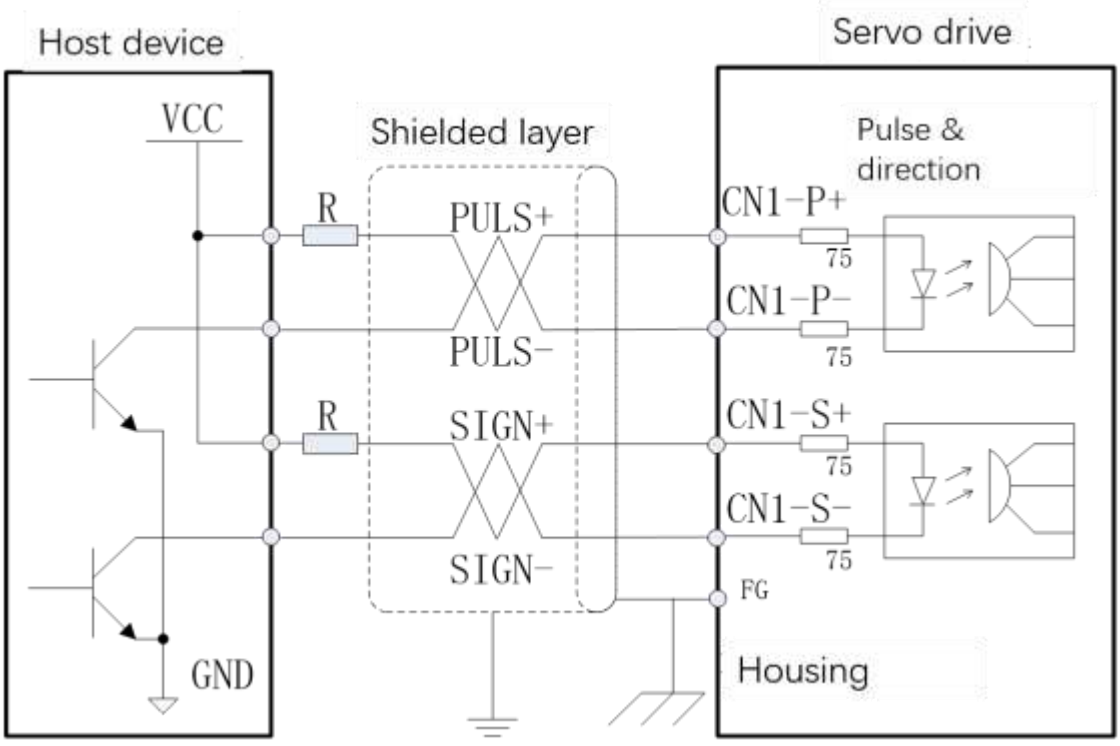


■ Open-collector output

When the host device is with open collector output and provides VCC = 24VDC signal power, connection method 1



When the host device is with an open collector output and provides 5VDC, 12VDC, 24VDC signal power, connection method 2



Set the resistance R according to the input current range required below.

Input current i = 10~15mA:

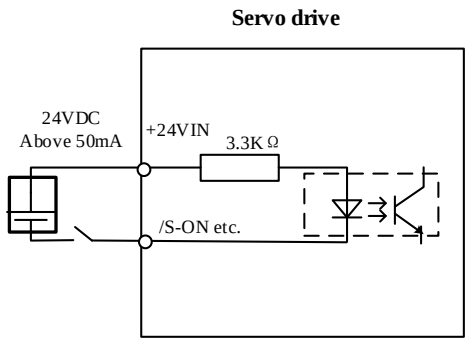
When VCC is 24V, R = 2.0KΩ

When VCC is 12V, R = 510Ω

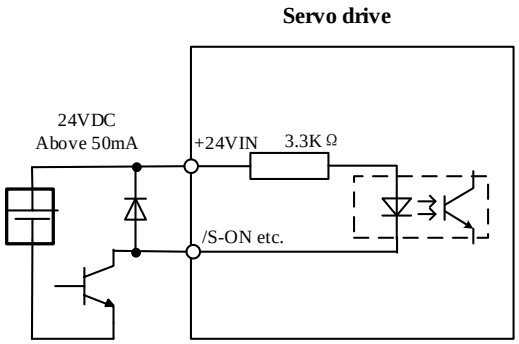
When VCC is 5V, R = 180Ω

2) Sequential input loop

Connected by a relay or an open collector transistor circuit. When using relay connections, select the micro current relay. If you do not use small current relay, it will cause bad contact.



Relay

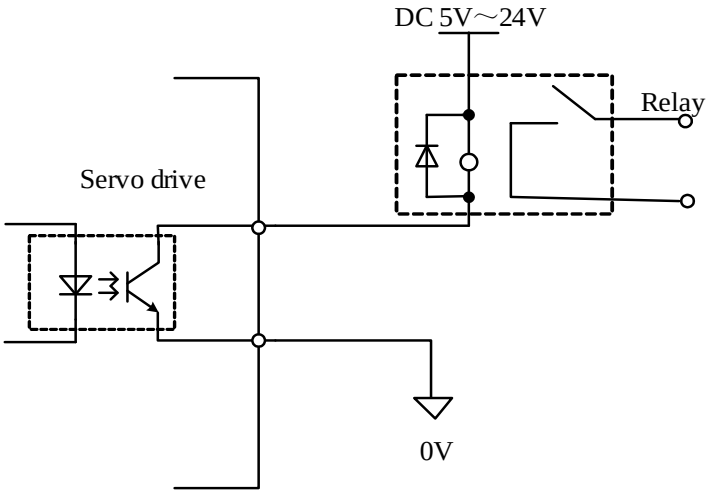


Open collector transistor

II. output circuit

1) Sequence output circuit

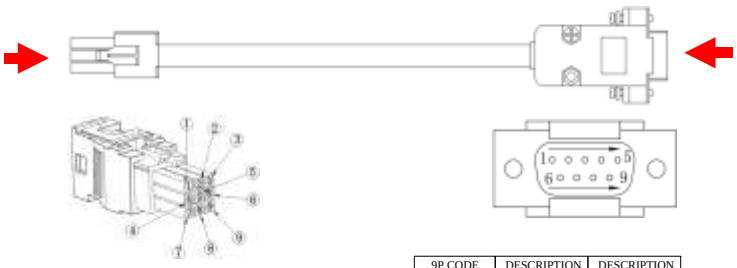
Servo alarm, brake output and other sequence output signals are composed of photocoupler output circuits. Please use relay connections**.**



Maximum DC voltage: 30VDC
Maximum DC current: 50mA

3.3 CN2 wiring

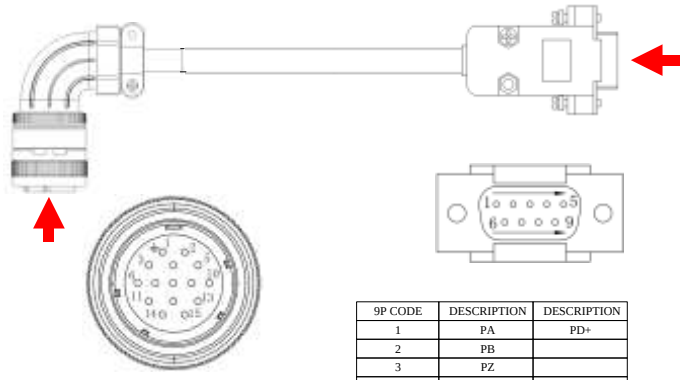
Quick Plug Encoder Cable



CABLE CODE	DESCRIPTION	DESCRIPTION
1	+5V	+5V
2	0V	0V
3	PA	PD+
4	/PA	PD-
5	PB	BAT+
6	/PB	BAT-
7	PZ	
8	/PZ	
9	FG	FG

9P CODE	DESCRIPTION	DESCRIPTION
1	PA	PD+
2	PB	
3	PZ	
4		
5	+5V	+5V
6	/PA	PD-
7	/PB	
8	/PZ	
9	0V	0V
	FG	FG

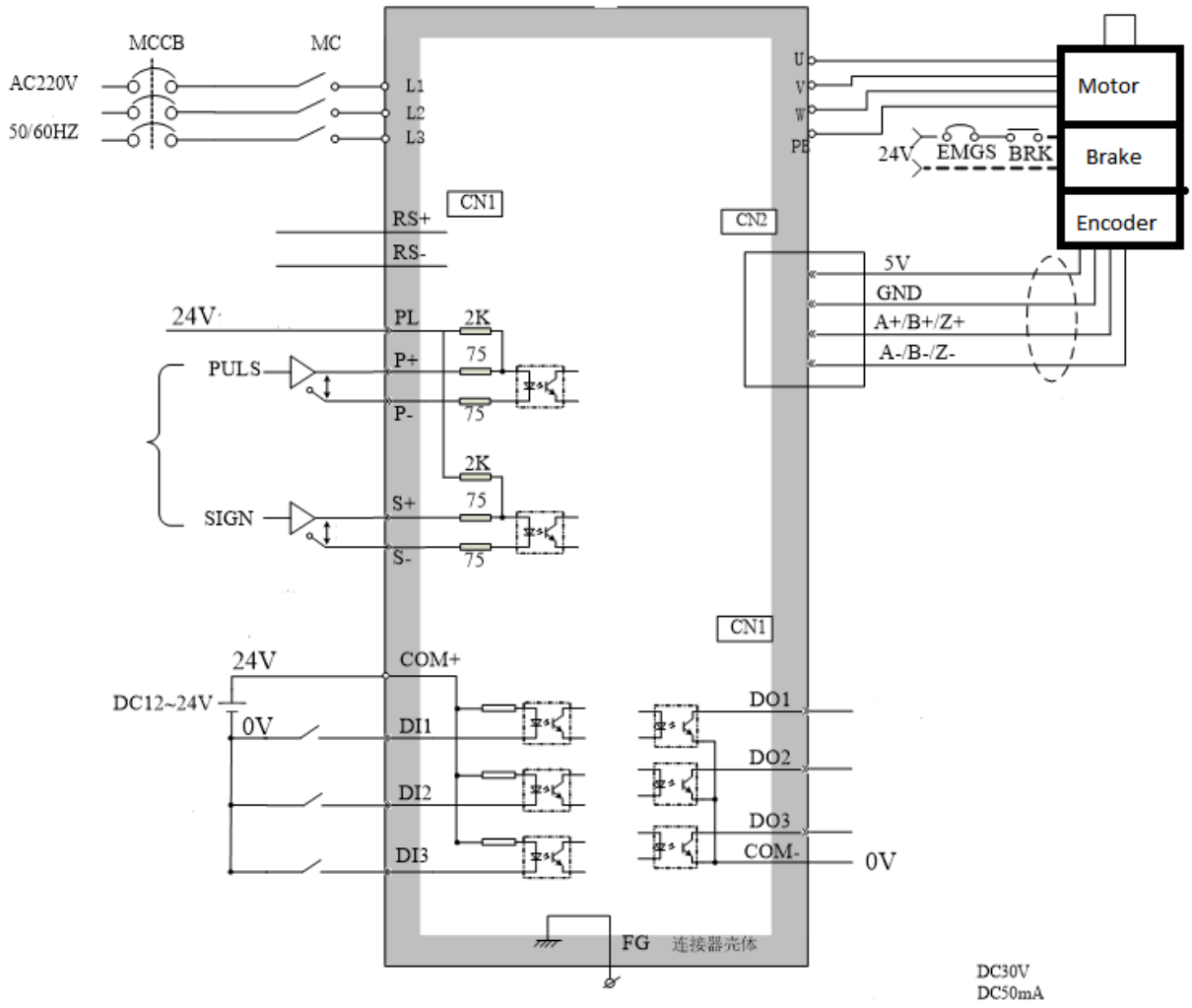
Encoder cable for aviation plug



CABLE CODE	DESCRIPTION	DESCRIPTION
1	FG	FG
2	+5V	+5V
3	0V	0V
4	PA	PD+
5	PB	BAT+
6	PZ	
7	/PA	PD-
8	/PB	BAT-
9	/PZ	

9P CODE	DESCRIPTION	DESCRIPTION
1	PA	PD+
2	PB	
3	PZ	
4		
5	+5V	+5V
6	/PA	PD-
7	/PB	
8	/PZ	
9	0V	0V
	FG	FG

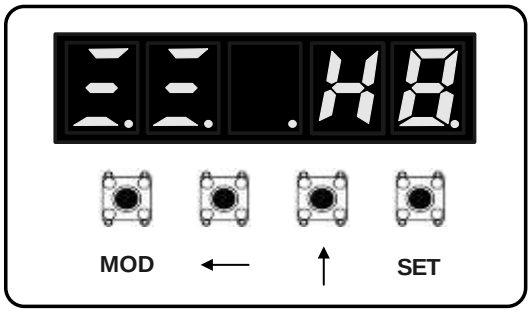
3.4 Standard wiring diagram



Chapter 4 Panel Operations

4.1 Panel operator

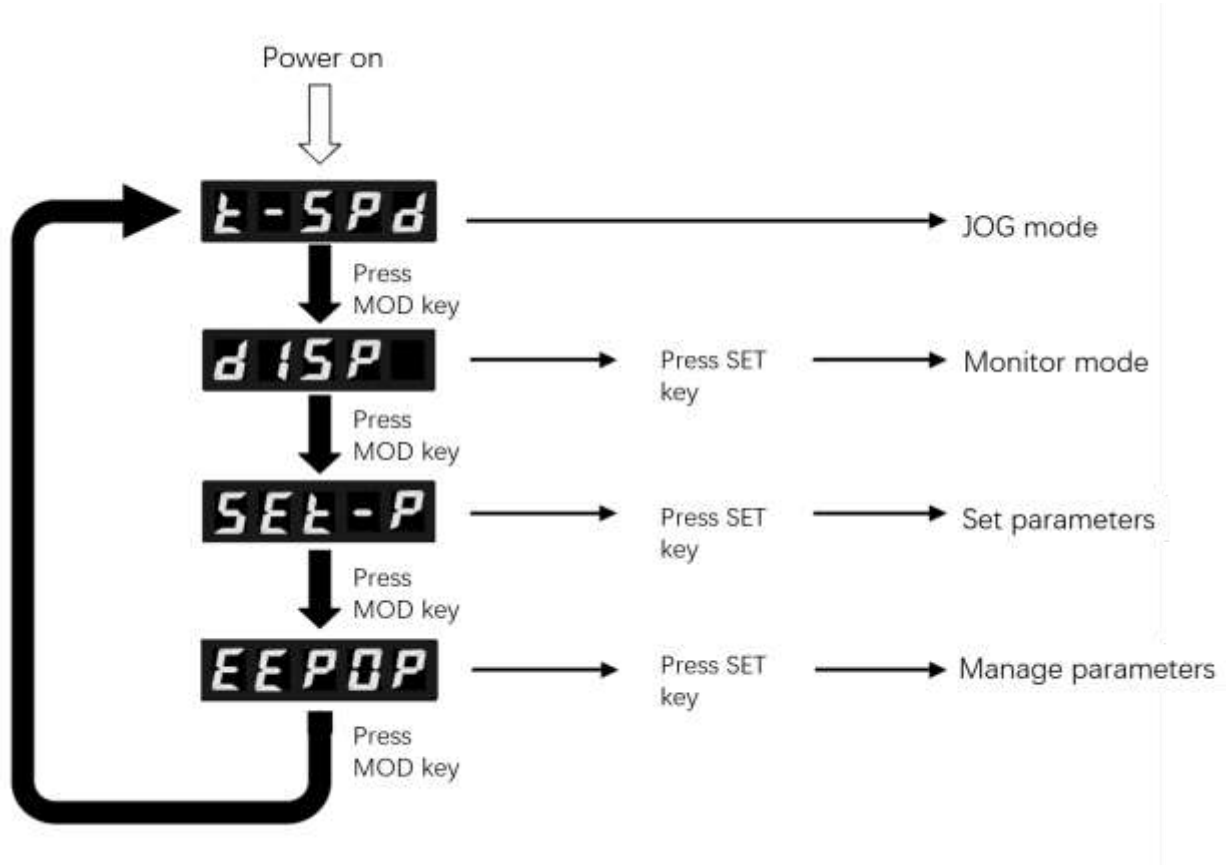
The panel operator consists of panel operator display & panel operator keys . The panel operator can display status, perform auxiliary functions, set parameters, and monitor the operation of the servo driver. The names and functions of the panel operator keys are shown below .



button	Function Description
MOD	Switch between modes or exit as a cancel button
←	Cyclic shift left
↑	Cyclic increase. If the data is the sign value, it shifts between + and -.
SET	Enter parameter and display menu, equivalent to ENTER

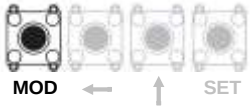
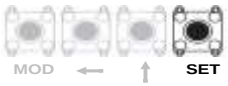
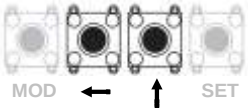
Hold & press ↑ & ← keys together can clear servo drive alarms. BUT please find out the cause of alarms first.

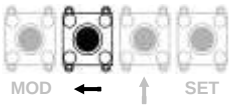
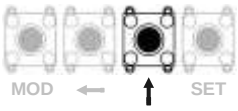
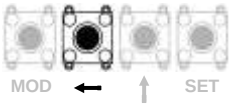
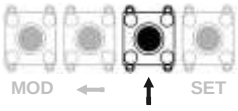
4.2 Function switching



4.3 Parameter setting method

Below is an example to illustrate modify parameter PA100 value from 40 to 200.

Step	Panel display	Keys	Operations
1			Press MOD key to select parameter setting interface.
2			Press the SET key to enter the parameter setting function .
3			Press "↑" or "←" to display "PA100".
4			Press SET to enter the parameter edit screen, displaying as left , indicating the current value of 40.

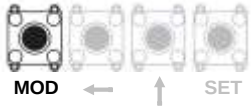
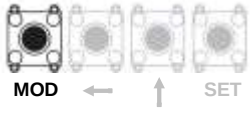
5			Press the "←" key to move the decimal point corresponding to the flashing display, so that the decimal point corresponding to 4 flashes . (The flashing digit indicates the digit that can be changed .)
6			By pressing 6 times "↑" key, the displayed value is changed to "00."
7			Press the "←" key, to move the blinking digit display, so the display is as left .
8			Press 2 times "↑" key , the displayed value is changed to "200."
9			Press SET key , i.e. the PA100 value is modified to 200. If the value set in this parameter within the setting range, the display will be shown as left.

4.4 Operation example of parameter management function (EEPOP)

Parameter management features include parameter storage in EEPROM & parameter initialization.

4.4.1 Parameter storage function (EE - 0) example

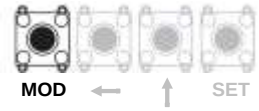
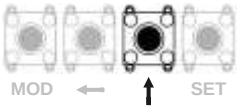
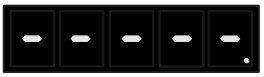
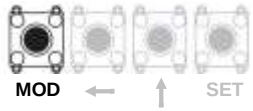
Method 1:

Step	Panel display	Keys	Operations
1			Press MOD key to enter parameter management function (EEPOP);
2			Press the SET key once;
3			Hold and press SET key, until no display, then release the SET key ;
4			When the left figure is displayed , the operation is complete .
5			Press the MOD key to exit this function and return to the display of step 2 .

Method 2: Set PA10 to 0, press the SET button (note PA10 will automatically change back to 2, so when you view again PA10 becomes 2. It does not matter), and parameter has been saved.

4.4.2 Parameter Factory Reset Function (EE - 1) operation example

Method 1: **First change PA0 to 1234**, and then perform the following factory reset operations.

Step	Panel display	Keys	Operations
1			Press MOD key to enter EEPOP;
2			Press the SET key once ;
3			Press the "↑" key once ;
4			Hold and press SET key, until no display, then release the SET key ;
5			When the left figure is displayed , the operation is complete .
6			Press the MOD key to exit this function and return to the display of step 2 .

Method 2: Set PA10 to 1, press the SET button (note PA10 will automatically change back to 2, so when you view again PA10 becomes 2. It does not matter), and then restart power to finish.

Chapter 5 Monitor Display

5.1 Monitor display list

Monitor display means to set the servo drive instruction value, input output signal internal state and the state of the servo drive function to display .

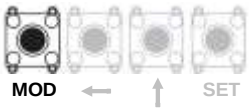
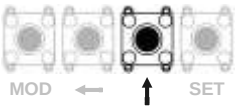
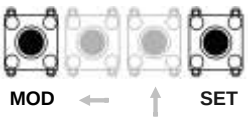
PA	Display content	Unit	Address
dP 00	**motor speed**	【R / min 】	0X0600
dP 01	**Motor feedback pulse number (Encoder Unit, lower 4 bits)**	【1 Encoder Pulse 】	0X0601

<table>
<tr><th>PA</th><th>Display content</th><th>Unit</th><th>Address</th></tr>
<tr><td></td><td>Display Motor Encoder feedback Pulse low 4 bit .</td><td></td><td></td></tr>
<tr><td>dP 02</td><td>Motor feedback pulse number (Encoder Unit, upper 4 digits)
Display Motor Encoder feedback Pulse high 4 bit .</td><td>【10000 Encoder Pulse 】</td><td>0X0602</td></tr>
<tr><td>dP 03</td><td>Input pulse number before electronic gear (lower 4 digits)
In position control , the lower 4 digits of total pulse input quantity is displayed.</td><td>【1 instruction Pulse 】</td><td>0X0603</td></tr>
<tr><td>dP 04</td><td>Input pulse number before electronic gear (upper 4 digits)
In position control , the upper 4 digits of total pulse input quantity is displayed.</td><td>【10000 instruction Pulse 】</td><td>0X0604</td></tr>
<tr><td>dP 05</td><td>Deviation Pulse Number (Encoder Unit, lower 4 bits)
In position control , the lower 4 digits of total deviation pulse quantity is displayed.</td><td>【1 Encoder Pulse 】</td><td>0X0605</td></tr>
<tr><td>dP 06</td><td>Deviation Pulse Number (Encoder Unit, upper 4 bits)
In position control , the upper 4 digits of total deviation pulse quantity is displayed.</td><td>【10000 Encoder Pulse 】</td><td>0X0606</td></tr>
<tr><td>dP 07</td><td>Analog input speed instruction (not available)</td><td>【0.0025V 】</td><td>0X0607</td></tr>
<tr><td>dP 08</td><td>Internal speed instruction .</td><td>【R / min 】</td><td>0X0608</td></tr>
<tr><td>dP 09</td><td>Analog input torque instruction (not available)</td><td>【0.0025V 】</td><td>0X0609</td></tr>
<tr><td>dP 10</td><td>Internal torque instruction .</td><td>【% 】</td><td>0X060A</td></tr>
<tr><td>dP 11</td><td>Internal torque feedback</td><td>【% 】</td><td>0X060B</td></tr>
<tr><td>dP 12</td><td>Input signal monitoring</td><td>-</td><td>0X060C</td></tr>
<tr><td>dP 13</td><td>Output signal monitoring</td><td>-</td><td>0X060D</td></tr>
<tr><td>dP 14</td><td>Instruction Pulse input frequency</td><td>【Khz 】</td><td>0X060E</td></tr>
<tr><td>dP 15</td><td>Load current</td><td>【A 】</td><td>0X060F</td></tr>
<tr><td>dp16</td><td>Bus voltage</td><td>V</td><td>0X0610</td></tr>
<tr><td>dp17</td><td>Motor rotation angle</td><td>deg</td><td>0X0611</td></tr>
<tr><td>dP19</td><td>Encoder rotation (Z signal)
Display Motor Encoder number of revolutions .</td><td>-</td><td>0X0613</td></tr>
<tr><td>dP21</td><td>Drive power:
<table>
<tr><th>dP21</th><th>Drive model</th></tr>
<tr><td>2</td><td>EPS-BS-0D20AA-****</td></tr>
<tr><td>2</td><td>EPS-BS-0D40AA-****</td></tr>
<tr><td>3</td><td>EPS-BS-0D75AA-****</td></tr>
<tr><td>4</td><td>EPS-BS-0D75AA-****-G</td></tr>
<tr><td>4</td><td>EPS-BS-0001AA-****</td></tr>
<tr><td>4</td><td>EPS-BS-01D5AA-****</td></tr>
<tr><td>5</td><td>EPS-BS-01D5AA-****-G</td></tr>
<tr><td>5</td><td>EPS-BS-02D2AA-****</td></tr>
<tr><td>6</td><td>EPS-BS-02D2AA-****-G</td></tr>
<tr><td>6</td><td>EPS-BS-0003AA-****</td></tr>
<tr><td>15</td><td>EPS-BS-01D5AA-****-GS</td></tr>
</table></td><td></td><td>0X0615</td></tr>
</table>

PA	Display content		Unit	Address
	15	EPS-BS-02D2AA-****-S		
	16	EPS-BS-02D2AA-****-GS		
	16	EPS-BS-0003AA-****-S		
dP 25	**Displays the latest alarm log of the drive.**		-	0X0619
dP 26	**Displays the second alarm log of the drive.**		-	0X061A
dP 27	**Displays the third alarm log of the drive.**		-	0X061B
dP 28	**Displays the fourth alarm log of the drive.**		-	0X061C
dP 34	**Encoder Z signal capture position**		-	0X0622
dP 35	**Encoder Z signal capture total**		-	0X0623
dP 36	**CPLD software version**		-	0X0624
dP 37	**DSP software version**		-	0X0625
dP48	**Current alarm number**			0X0630

5.2 Operation example of monitor display

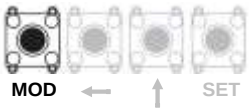
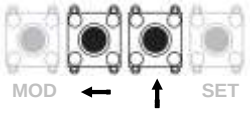
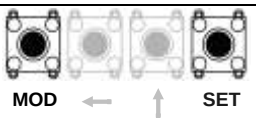
Take dP0 as an example , the operation example of the monitoring display is shown below.
The following is an example of the display when the servo motor speed is 1600 rpm.

Step	Panel display	Keys	Operations
1			Press MOD key to select monitor display function (dISP);
2			Press the SET key once ;
3			If the display is not DP0, press "↑" key & "←" key to display DP0;
4			Press SET to enter the monitoring screen, as displayed on the left which shows that the motor speed is 1600rpm.
5			Press the SET or MOD key to return to the display of step 2 .

5.3 Input signal monitoring dP12

5.3.1 DP12 operation procedures

The display steps of the input signal are shown below .

Step	Panel display	Keys	Operations
1			Press MOD key to select monitor display function (dISP);
2			Press the SET key once;
3			If the display is not DP12, press "↑" key & "←" key to display DP 12;
4			Press the SET key to enter the input signal monitoring interface , and the left picture is displayed;
5			Press SET or MOD key to returns to the step 3.

5.3.2 DP12 display explanations

The assigned input signal is displayed by the lighting status of the segment (LED) of the panel operator.
The corresponding relationship of input pin & LED number is shown in the table below .

- When the input signal is valid, the upper segment (LED) lights up .
- When the input signal is L level (input optocoupler is on), the lower segment (LED) lights up .

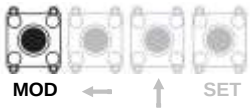
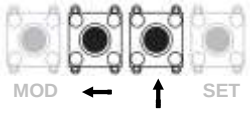
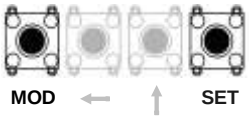
Display LED number	input pin	signal name (Default)
1	DI1	Servo enable
2	DI2	Alarm Clear
3	DI3	Deviation clear

[Note] Without external input, modifying parameter PA64 will also make corresponding input signal effective .

5.4 Output signal monitoring dP13

5.4.1 DP13 operation procedures

The display steps for the display signal output are shown below.

Step	Panel display	Keys	Operations
1			Press MOD key to select monitor display function (dISP);
2			Press the SET key once;
3			If the display is not DP13, press "↑" key & "←" key to display DP 13;
4			Press the SET key to enter the input signal monitoring interface , and the left picture is displayed;
5			Press SET or MOD key to returns to the step 3.

5.4.2 DP13 display explanations

The assigned output signal is displayed by the lighting status of the segment (LED) of the panel operator.

When the output signal is valid, the upper segment (LED) lights up .
When the output signal is L level (the output optocoupler is on), the lower segment (LED) lights up .
The corresponding relationship of input pin & LED number is shown in the table below .

Display LED number	Output pin	signal name (Default)
1	DO1	Alarm
2	DO2	Brake
3	DO3	Position reached

[Note] Without external input, modifying parameter PA66 will also make corresponding output signal effective .

5.5 Monitoring display when power is turned on

PA03 setting determines the display on the operation panel when the power is turned on.

PA	Name	Range	Unit	Defaults	Effective
PA03	Initial display selection. For example, if set to 0, when power is turn on, the display shows motor speed.	0 to 40		0	Turn on the power again

Chapter 6 JOG Run

6.1 Preparations before JOG run

Please check the following items before JOG run:

Item	What to check
Servo motor	Whether the motor has been released from load?
	Whether the wiring and connection are correct?
	Whether the fastening parts are loose?
	If the servo motor has a holding brake, whether the brake has been released (by separate 24VDC) in advance?
Servo driver	Whether the wirings and connections are correct?
	Whether the input voltage to the servo drive is stable?

6.2 JOG run by panel operations

JOG run is the function to confirm the servo motor action through speed control without connecting to the upper controller. During JOG run, the overtravel prevention function (CWL, CCWL) is inactive. User shall pay close attention to mechanical movement of the machinery caused by JOG run.

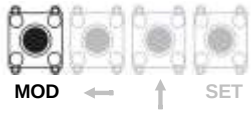
1) Preparing for JOG run

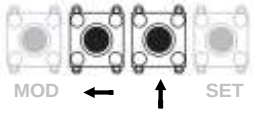
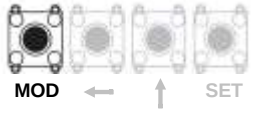
Before JOG run, the following settings are necessary.

- When S-ON input signal is ON, please switch it to OFF.
- Please take necessary safety measures and ensure it can stop at any emergency.

In order to ensure safety, a stop device shall be set on the machine side.

2) JOG run operation procedures

Step	Panel display	Keys	Operations
1			Press MOD until shows as left.
2			Press SET.
3			Press SET again.

4			Press ↑ to increase positive direction speed; press ← to decrease negative direction speed.
5			Press MOD to exit to Step 2.

6.3 JOG run of the servo motor alone by host command

When JOG run servo motor by upper command, confirm the following items:

Item	Content
1	Check whether the servo motor movement command and input / output signal input from the host device to the servo driver are set correctly.
2	Check whether the wiring between the host device and the servo driver is correct and the polarity setting is correct.
3	Check if the operation setting of the servo driver is correct.

6.3.1 Input signal circuit wiring and confirmation

For the test run of position control by the host command, the connection confirmation shown in step 1 below is required. Follow the steps below to confirm the connection and status of the input signals.

Step	Operation
1	Please connect the input signal circuit required for trial operation to CN1. The following conditions must be met when connecting. · Servo ON input signal (S-ON) is enabled · CWL, CCWL signals are valid
2	Connect the connector of the host device to CN1
3	Turn on the power of the servo driver. Check the status of the input signal with input monitor (dP012).
4	Input S-ON signal to enable the servo
5	At this point, the trial run preparation is complete.

6.3.2 JOG run of position control

The following describes the trial operation method for position control. This section describes the trial operation procedures after the position control input signal wiring is completed.

Step	Operation
1	Check the power supply and input signal circuit again, and then turn on the control power of the servo driver.
2	According to the pulse output form of the host device, PA28 is used to set the command pulse form.
3	Set the command unit, and set the electronic gear ratio through PA31 and PA32 according to the host device .
4	Power on again. Make the parameter change in step 3 effective. Turn on the main circuit power of the servo driver.
5	Set the servo enable (S-ON) input signal to ON .
6	A low-speed pulse command is output from the host device with an easy-to-check motor rotation amount (example: 1 turn).
7	According to the input command pulse counter (dP03 , dP04), monitor the pulse change amount before and after the command is issued to confirm the number of command pulses input to the servo driver.
8	According to the feedback pulse counter (dP0 1, dP02), monitor the pulse change amount before and after the command is issued to confirm the actual rotation amount of the motor.
9	Check if the servo motor rotates in the direction specified.
10	Stop the pulse command and turn the servo off .

6.4 JOG run after connecting the servo motor to the machine

After the test run of the unit is correct, connect the servo motor and the machine and perform the test run after connecting the machine.

Step	Item	Content
1	Parameter setting 1	Turn on the control power and main circuit power, and make settings related to safety functions, overtravel, braking, and other protective functions.
2	Parameter setting 2	Set the necessary parameters according to the control method used.
3	Installation	When the power is off , connect the servo motor and the machine through a coupling or the like.
4	Examination	After turning on the power of the host device and setting the servo driver to servo off, check whether the protection function set in step 1 works normally.
5	Run	Perform the trial operation and confirm that the trial operation result

		is the same as the trial operation of the servo motor alone. Make sure that the setting of the command unit is in accordance with the machine.
6	Adjustment	Adjust the servo gain as needed to improve the response characteristics of the servo motor. (Note) During the trial operation, the servo motor and the machine may not adapt well. Please fully run in.
7	S-ON signal input	At this point, the trial operation operation ends.

6.5 JOG run of servo motor with brake

Please observe the following precautions for the trial operation of the servo motor with brake.

Item	Content
1	When performing a trial operation of a servo motor with a brake, be sure to take measures to prevent the machine from falling or vibration due to external forces before confirming the operation of the brake.
2	When performing a trial operation of a servo motor with a brake, check the operation of the servo motor and the holding brake before the servo motor and the machine are disconnected. After no problem, connect the servo motor to the machine and perform trial operation again.
3	Use the BRK signal of the servo driver to control the holding brake operation.

Chapter 7 Operations

7.1 Control mode selection

The following describes the control modes that the EPS-BS series servo driver can perform.

User parameters		Control method (control mode)
PA04	**0** **[Factory setting]**	**Switch between position control (pulse train command) and external JOG control.** Use the pulse train position command to control the position of the servo motor. The position is controlled by the number of input pulses, and the speed is controlled by the frequency of input pulses. Used in situations where positioning action is required. Use the input signal BIT8 and BIT9 a total of 2 input signals to achieve the external JOG function, the speed is set in PA131.

	7	**Internal speed control** Using the input signals BIT3, BIT4 and BIT5 to select among 8 preset speeds. When this control mode is selected, no analog command is required.

7.2 Setting of general basic functions

7.2.1 SERVO ON setting

A servo motor enters energized state by S-ON instruction signal.

(1) Servo ON signal (S-ON)

Type	Signal	Status	Input level	Description
Enter	S-ON	ON	" L " level	Servo motor energized state (Servo ON state).
		OFF	" H " level	Non-energized state servo motor (servo OFF state).

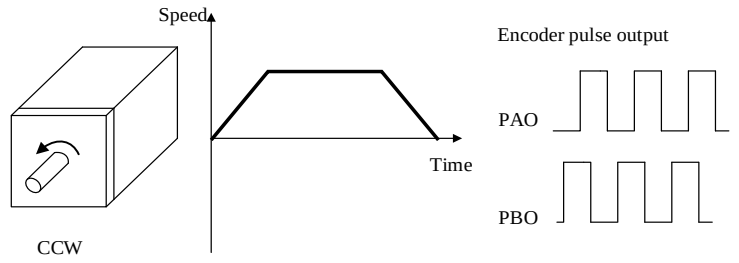
(2) Input level selection of servo ON signal

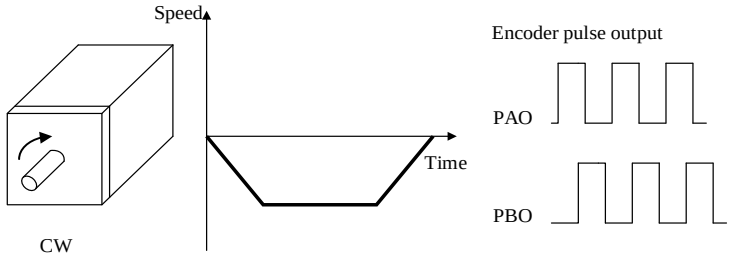
The input level can be selected through user parameters. That is , the effective level of the servo ON signal is set.

User parameters		Said Ming
PA64	0	The S-ON signal input from the input terminal CN1 is active low. (factory setting)
	64	The S-ON signal input from input terminal CN 1 is active high.

7.2.2 Motor over travel prohibitation

The standard setting of forward rotation direction is counterclockwise rotation when viewed from the load side of the servo motor .

Instruction	Overtravel (OT)
■ Operation during forward rotation  	When turning forward: Stop by CCWL

■ Operation when the command is reversed  	When reversing: Stop by CWL

7.2.3 Overtravel settings

Overtravel refers to the safety function which can make the limit switch function (ON) and force the servo motor to stop when the moving parts of a machine go beyond the movable area.

Attention
Installation of limit switches Limit switches must be installed in applications such as linear motions. When the limit switch has bad contacts or broken wires, please use 'normally closed nods' to ensure the motor moves to the safer side. **Use of servo motors in vertical axis** Work piece might fall when overtravel. To prevent this, please set the servo into zero-speed clamp when overtravel.

Connection of overtravel signals

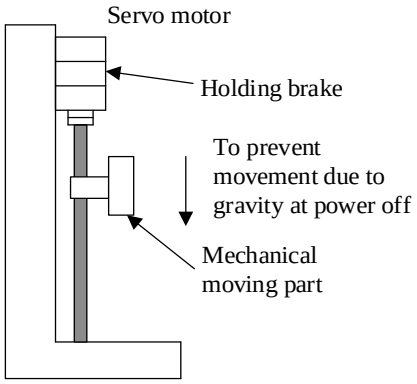
To use the overtravel function, make sure the following overtravel signals are being correctly connected to the servo drive CN1.

Type	Signal name	Set up	Significance
Input	CCWL	ON = L level	Prohibition of forward drive (forward overtravel)
		OFF = H level	Forward drive (normal operation)
Input	CWL	ON = L level	Reverse side drive prohibited (reverse side overtravel)
		OFF = H level	Reverse drive (normal operation)

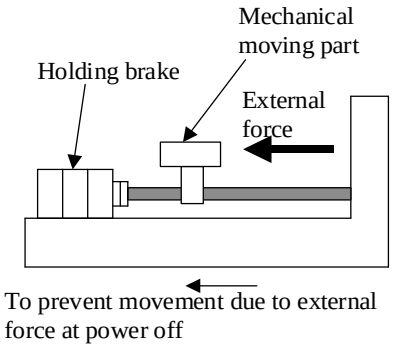
7.2.4 Holing brake settings

The holding brake is often used when the motor is used in the vertical axis. When the power of servo drive is OFF, the servo motor with a brake can keep the moving parts from moving due to gravity

■ Vertical axis



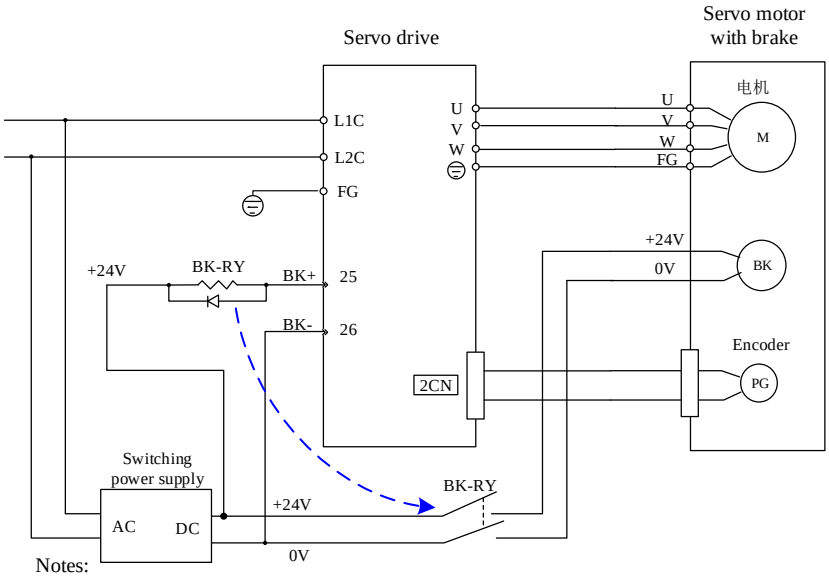
■ Horizontal axis



- The holding brake can only be used to maintain the halt state, not braking, of the servo motor. The brake torque is 70% or above of the rated torque of servo motor.
- If only the speed loop is used to activate the servo motor, when the brake functions, set the servo OFF and input instruction to be "0V".
- When setting the position loop, because the servo motor is under servo locked state at stop, the mechanical brake shall not function.

(1) Example of connection

The sequential output signal of servo drive (BK) and brake power supply forms the ON/OFF of the brake. Standard connection of a circuit is illustrated as follows.



Notes:

1. BK-RY: the relay for brake control
2. The current provided by switching power supply shall be determined by the brake; different brakes have different working currents. Normally, the DC24V of switching power supply shall be provide the current >1A;
3. DC24V input of the brake is not restricted by direction

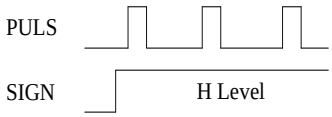
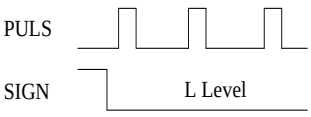
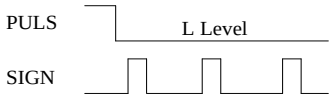
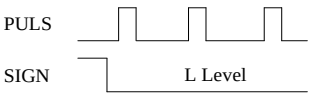
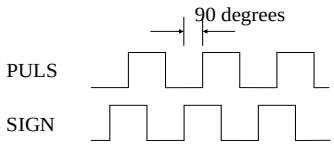
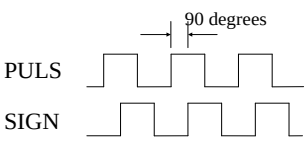
7.3 Position control operations

7.3.1 User parameter settings

(1) Control mode selection

Parameter		Meaning
PA4	0	Control mode: postion control

(2) Pulse form selection

Parameter		Pulse form	Forward instruction	Reverse instruction
PA28	0	PULS+SIGN (default)		
	1	CW+CCW (positive logic)		
	2	A phase +B phase (positive logic)		
To negate logic, user can change PA06 bit1 & bit2.				

7.3.2 Electronic gear setting

(1) Encoder resolution

Encoder lines	Encoder resolution (4 times)
1024	4096
2500	10000
5000	20000

Remarks: encoder resolution is 4 times (quadruple frequency) of physical encoder pulses per revolution.

(2) Electronic gear

The function of electronic gear is for setting the work-piece moving distance by 1 pulse instruction (1 instruction unit).

(3) User parameters

PA31	First electronic gear ratio numerator			
	Range	Unit	Default	Effective
	1～65535	—	1	Immediate

PA32	First electronic gear ratio denominator			
	Range	Unit	Default	Effective
	1～65535	—	1	Immediate
Electronic gear ratio = B/A = PA31/PA32 Suggested range: 0.01≤ (B/A) ≤100				

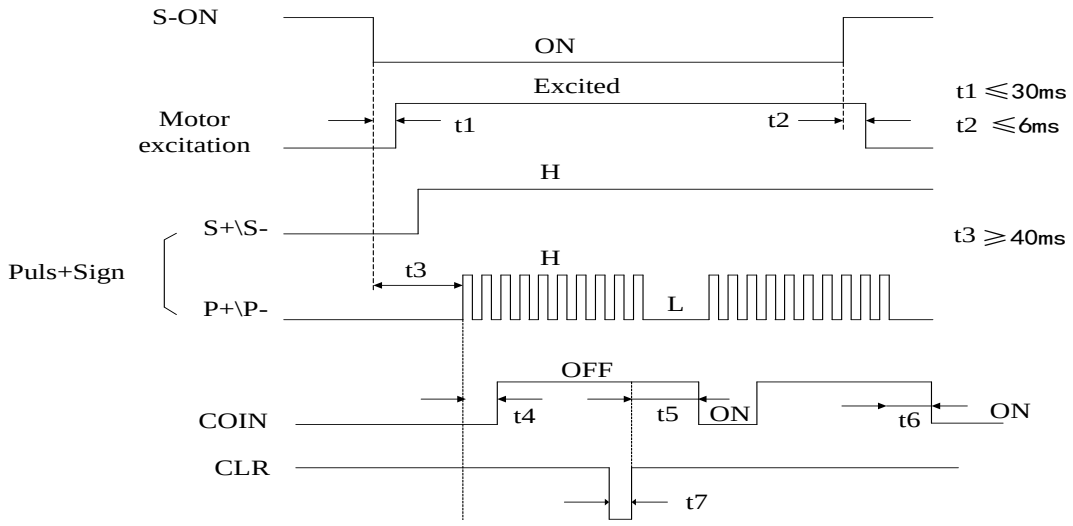
7.3.3 Position instructions

Upper controller's output forms include the following:

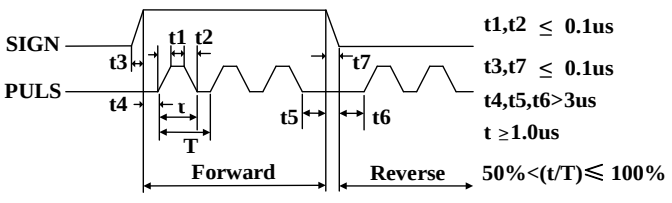
- Field-bus output
- +24V open-collector output
- +12V open-collector output
- +5V open-collector output

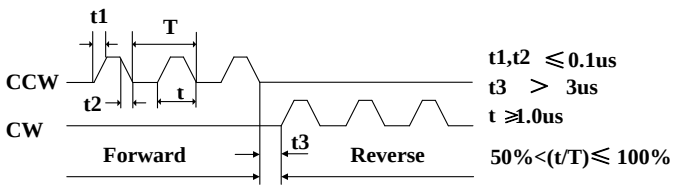
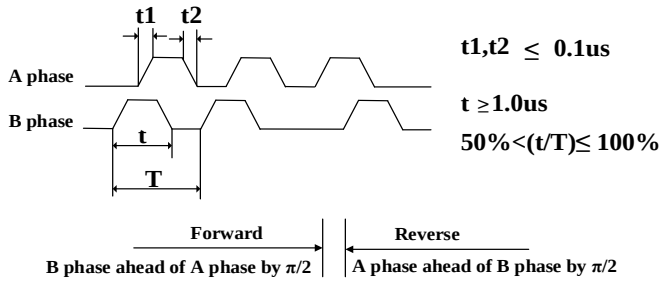
In case of open-collector pulse input, the interference tolerance for input signal will decrease. In case of deviation due to interference, changes should be made in the following user parameters.

(1) Input/output signal time sequence



- The interval between S-ON signal and input pulse instructions should be above 40ms. If this interval is less than 40ms, servo drive may fail to receive the pulse instructions.
- Please set CLR signal to be above 20 μs.

Pulse forms	Maximum frequency	Specifications
SIGN+ PULS	500Kbps. Open-collector: 200Kbps	

CW+ CCW	500Kbps. Open-collector: 200Kbps	
A phase+ B phase	200Kbps. Open-collector: 150Kbps	

7.3.4 Positioning completed signal (COIN)

This signal means that servo motor positioning is completed at position control.

Type	Signal	Level	Name
Output	COIN	ON= L level	Positioning completed
		OFF=H level	Positioning not completed

Position control:

PA50	COIN signal threhold			
	Range	Unit	Default	Effective
	0～100	Pulse	50	Immediate

- If the difference between the upper controller's instruction pulse input count and the servo motor's movement amount (deviation pulse) is lower than the set value of this use parameter, then the COIN signal will output; this also depends on the electronic gear setting.
- If the set value of PA50 is too high and servo is running in low speed, COIN signal may still output even though positioning is not completed. Please pay close attention to this.
- Setting of this user parameter does not affect the final positioning precision.

7.3.5 ZSP (zero speed) signal setting

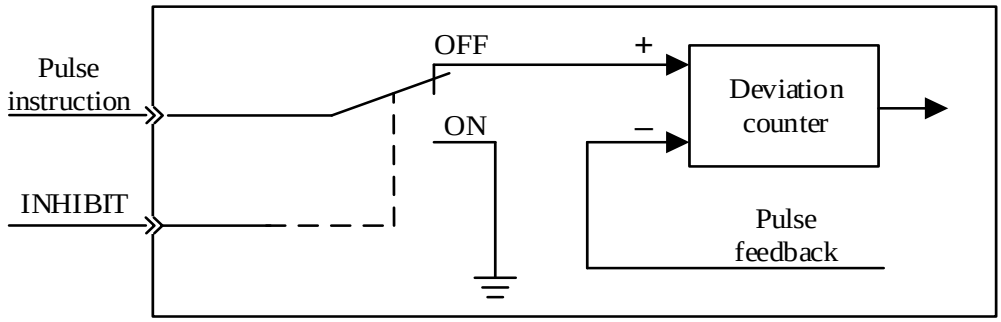
ZSP signal will output when servo motor is less than setting speed.

Type	Signal	Level	Name
Output	ZSP	ON=L level	Speed reached.
		OFF=H level	Speed not reached.

PA51	ZSP signal width			
	Range	Unit	Default	Effective
	0～3000	rpm	50	Immediate

7.3.6 Pulse instruction inhibition function (INH)

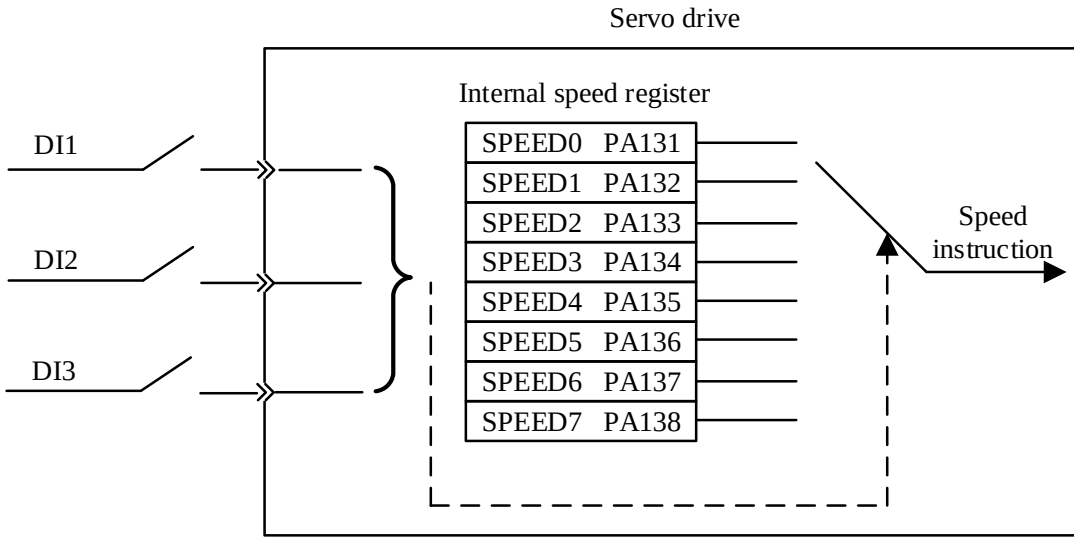
This is a function that stops (inhibits) instruction pulse input counting in case of position control. It is in servo locking (clamping) state when this function is used.



Type	Signal	Level	Name
Input	INH	ON=L level	INH function is ON
		OFF=H level	INH function is OFF

7.4 Internal speed control

Internal speed control is to set 8 speeds beforehand through parameters inside servo drive and to select among them by using external input signals INSPD2, INSPD1 and INSPD0.
It's unnecessary to configure speed generator or pulse generator outside.



User parameter		Meaning
PA004	7	Control mode selection: internal speed control
PA145	3	Use DI1 as internal speed selection 1
PA146	5	Use DI2 as internal speed selection 2
PA147	4	Use DI3 as internal speed selection 3

Chapter 8 Troubleshooting

8.1 List of alarms

Error code	Name	Remarks	Can clear
ERR.01	Overload 1	Refer to PA081, PA082	Yes
ERR.02	Under voltage		No
ERR.03	Over voltage		No
ERR.04	AC detection error	Input phase loss	-
ERR.05	Over speed	Refer to PA119	Yes
ERR.06	Overload 2	Refer to PA120, PA121	Yes
ERR.07	Overload 3	Refer to PA122, PA123	Yes
ERR.08	Motor stall		Yes
ERR.09	Position deviation 1	Refer to PA053	Yes
ERR.12	Extremely overload	Motor current is over 250% rated current	Yes
ERR.16	Parameter error		Yes
ERR.20	IGBT alarm	Caused by over-current	No
ERR.21	Current detection abnormity 1	Internal circuit error	No
ERR.22	Current detection abnormity 2	Internal circuit error	No
ERR.26	Encoder AB Pulse loss		No
ERR.27	Encoder UVW error		No
ERR.28	Encoder UVW broken cable		No
ERR.29	Encoder ABZ broken cable		No
ERR.30	Encoder Z Pulse loss		No
ERR.31	Encoder status error	Magnetic encoder wrong initital position	No
ERR.32	Electronic gear protection	Gear ratio too large	Yes
ERR.33	Input signal error	Input pin duplicate or meaningless	Yes
ERR.34	Output signal error	Output pin duplicate or meaningless	Yes
ERR.36	Servo drive wrong capacity		Yes
ERR.37	Matching error	Servo drive & motor do not match	Yes

8.2 Alarm troubleshooting

No	Alarm name	Cause of issue	Action
ERR.01	Overload 1	The motor was continuously running with a torque exceeding 130% of the rated value .	1, check motor U, V, W Connection; 2, check motor parameters PA2, PA7, PA8, PA9 are correct; 3, check the mechanical structure; 4, the actual operating load of the machine is too large, and it needs to be replaced with a higher power servo.
ERR.02	Main circuit undervoltage	DC voltage of main circuit is insufficient	Check the input power voltage
ERR.03	Main circuit overvoltage	DC voltage of main circuit is abnormally high	1, check the input supply voltage 2, check regenerative resistor
ERR.04	AC detection abnormal	AC input phase loss	Check input power
ERR.05	Overspeed	Motor speed exceeds 1.5 times of its rated speed	1, check motor U, V, W Connection; 2, check the servo parameters. If the load inertia is large, and if the system gain parameter setting is small, there will be a greater overshoot causing this alarm .
ERR.06	Overload 2	The motor was continuously running with a torque exceeding 160% of the rated value	1, check motor U, V, W Connection; 2, check motor parameters PA2, PA7, PA8, PA9 are correct; 3, check the mechanical structure; 4, the actual operating load of the machine is too large, and it needs to be replaced with a higher power servo.
ERR.07	Overload 3	The motor was continuously operated with a torque exceeding 200% of the rated value	1, check motor U, V, W Connection; 2, check motor parameters PA2, PA7, PA8, PA9 are correct; 3, check the mechanical structure; 4, the actual operating load of the machine is too large, and it needs to be replaced with a higher power servo.
ERR.08	Motor stall	Motor speed time does not match the given speed	1, check motor U, V, W Connection; 2, check motor parameters PA2, PA7, PA8, PA9 are correct; 3, check the mechanical structure; 4, the actual operating load of the machine is too large, and it needs to be replaced with a higher power servo.

No	Alarm name	Cause of issue	Action
ERR.09	Out of position	Position deviation exceeds the setting value of user parameter PA53 .	1, check if the servo can do JOG run without load; 2, check the electronic gear setting; 3, check the mechanical structure; 4, the actual operating load of the machine is too large, and it needs to be replaced with a higher power servo.
ERR.12	Extreme Overload	Current exceeds 250% of rated value	1, check motor U, V, W Connection; 2, check motor parameters PA2, PA7, PA8, PA9 are correct; 3, check the mechanical structure; 4, the actual operating load of the machine is too large, and it needs to be replaced with a higher power servo.
ERR.16	Parameter error	Parameter check exception	Perform factory reset operation (EE--1)
ERR.20	Power module alarm	Power module alarm	1, check the driver & motor matching is correct; 2, reduce the driver's overload multiple; 3, increase the torque filter time;
ERR.21	Current detection 1st channel abnormal	Internal circuit abnormal	Power failure, over 1 Minutes on again ; if the power is still on the police , you need to Depot Repair .
ERR.22	Current detection channel 2 abnormal	Internal circuit abnormal	Power off and power on again after 1 minute. If this alarm still persists, contact the manufacturer.
ERR.26	Encoder AB Pulse is missing	Incremental Encoder AB Pulse is lost	Check Encoder wiring
ERR.27	Encoder UVW error	Incremental Encoder UVW error	Check Encoder wiring
ERR.28	Encoder UVW disconnected	Encoder signal line is broken	1, check Encoder wiring 2, check PA8 setting
ERR.29	Encoder ABZ disconnected	Encoder signal line is broken	1, check Encoder wiring 2, check PA8 setting
ERR.30	Encoder ZPulse is missing	Encoder Z-Pulse is missing	Check Encoder wiring
ERR.31	Encoder status error	Magnetic Encoder initial state error	1,check encoder parameter; 2 , check Encoder wiring ;
ERR.32	Electronic gear protection	Electronic gear ratio setting is too large	Modify electronic gear ratio parameter PA31 & PA32 or PA141 & PA142
ERR.33	Input signal configuration error	Duplicate or meaningless input signal pin configuration	Modify input parameters PA145, PA146 & PA147

No	Alarm name	Cause of issue	Action
ERR.34	Output signal configuration error	Duplicate or meaningless output signal pin configuration	Modify output parameters PA148, PA149 & PA150
ERR.36	Drive power error	Reset PA7 parameter	1, view DP21, determine the drive power is correct. Then set correctly PA7 value.
ERR.37	Match alarm	The motor current PA9 set by the driver is much larger than the rated current of the driver	1, view DP21, determine the drive power is correct. Then set correctly PA7 value; 2, set the correct PA9 matching value; 3, replace with a higher capacity drive.

Chapter 9 Product Specifications

9.1 Servo drive specifications

Input voltage	220VAC		Singe/Three Phase 220VAC -15%~+10%, 50/60Hz
Control mechanism			Single/Three phase full wave rectification. IGBT PWM control, sine-wave current control
Feedback devices			▪ 2500/5000-LINE OPTICAL ▪ 1024-LINE MAGNETIC
Use conditions	Ambient temperature		▪ Use temperature: 0~+45℃ ▪ Storage temperature: -20~55℃
	Humidity		Below 90%RH (no freezing or condensing)
	Vibration		4.9 m/s^2~19.6 m/s^2
	Protection class/cleanness		Protection class: IP10; Cleanness: 2. But should be:With no corrosive or combustible gas; With no water, oil or drug splashing; With little dust, ash, salt or metallic powder
	Altitude		Below 1000m
Performance	Speed control precision		1:5000
	Speed fluctuation rate	Load fluctuation	0 ~100% load: below ±0.01% (at rated speed)
		Voltage fluctuation	Rated voltage ±10%：0.001% (at rated speed)
		Temperature fluctuation	25 ±25℃: below ±0.1% (at rated speed)
	Torque control precision		±3% (repeatable)
	Soft start time		0~10s (acceleration or deceleration)
	Sequential input signals		Pin number: 3
			Functions: S-ON, C-MODE, etc.
	Sequential output signals		Pin number: 3
			Functions: ALM, COIN, etc.
Communication functions	RS485	1: N	With relay, maximum N=31
		Address	By parameter setting
		Devices	PC, upper controller
Display/keypad			7 LED X 5 bit, 4 buttons
Regenerative functions			Internal or external
Protection functions			Over-current, over-voltage, under-voltage, over-load, regenerative fault, etc.

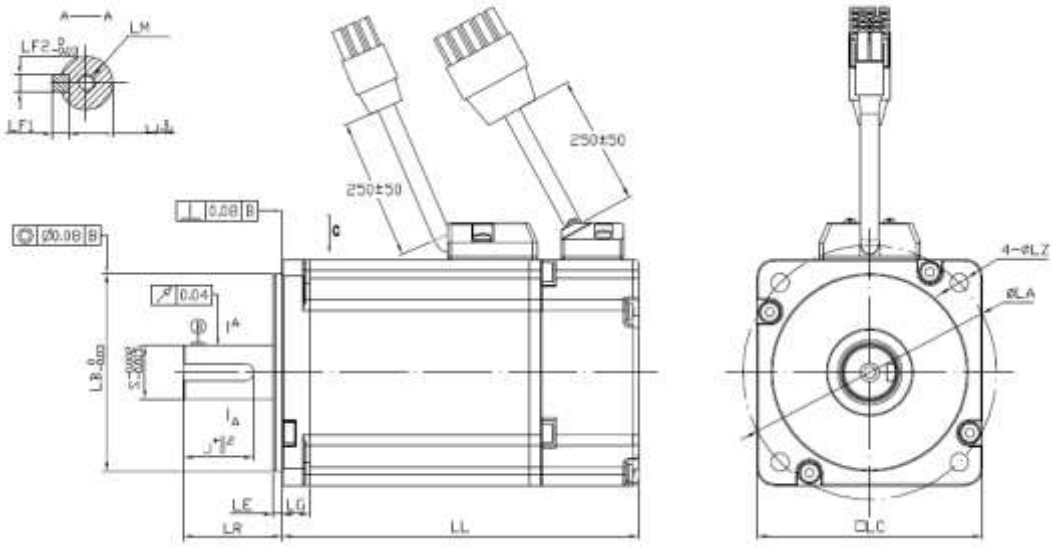
9.2 Servo motor specifications

Working system: S1 continuous	Heat resistance class: B
Vibration: 5G	Insulation voltage class: AC1500V, 1 minute
Insulation resistance: DC500V, above 10MΩ	Installation mode: Flange

Working temperature: 0~40℃ (no freezing)	Operating humidity: 20%~80% (no dewing)
Altitude: Below 1000m	Protections: Full-enclosed IP65 (except the shaft-through part)

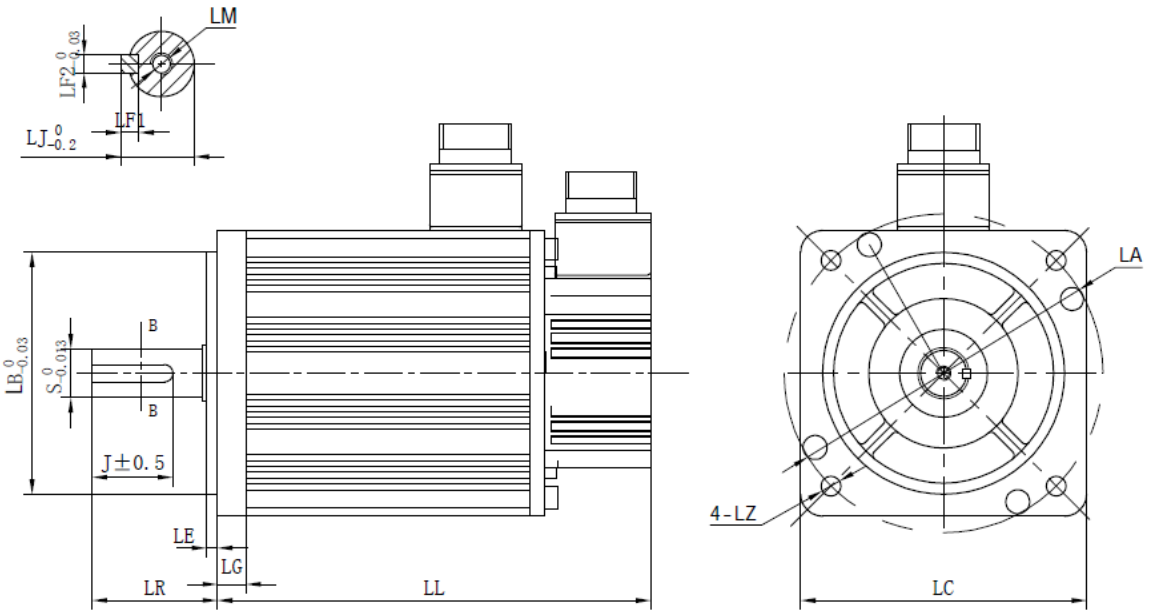
60/80 Series

Servo Motor series	**60 series**		**80 Series**	
Servo Motor model	60DNMA2-0D20	60DNMA2-0D40	80DNMA2-0D75	80DNMA2-0001
Input voltage	220VAC			
Inertia	High	High	High	Medium
Rated power (W)	200	400	750	1000
Rated torque (N*m)	0.64	1.27	2.39	3.18
Rated current (A)	1.4	2.5	3.7	5.1
Maximum current (A)	4.2	7.5	11.1	15.3
Rated speed (rpm)	3000	3000	3000	3000
Maximum speed (rpm)	5000	5000	5000	5000
Torque constant (N*m/Amp)	0.45	0.508	0.64	0.62
Back EMF constant (V/Krpm)	29	33	43	41
Rotary inertia (with brake) (10-4Kg*m2)	0.14 (0.16)	0.67 (0.68)	1.5 (1.53)	1.12 (1.15)
Resistance (line-line) (Ω)	8.4	4.28	1.5	1.2
Inductance (line-line) (mH)	26.5	15.4	7.9	6.1
Mass (with brake) (kg)	1.03 (1.53)	1.59 (2.05)	2.93 (4.03)	3.12 (4.12)
LL (with brake) (mm)	105(140)	140(175)	144.7(183.9)	144.7(183.9)
LR (mm)	30	30	35	35
LE (mm)	3	3	3	3
LG (mm)	8	8	8	8
S (mm)	14	14	19	19
LJ1 (mm)	0	0	0	0
LJ (mm)	11	11	15.5	15.5
J (mm)	20	20	25	25
LF1 (mm)	5	5	6	6
LF2 (mm)	5	5	6	6
LM (mm)	M4 deep 15	M4 deep 15	M5 deep 20	M5 deep 20
LA (mm)	70	70	90	90
LB (mm)	50	50	70	70
LC (mm)	60	60	80	80
LZ (mm)	5.5	5.5	6.5	6.5



130 Series (220V class)

Servo Motor series	130 Series			
Servo Motor model	130DNMA2-0001C	130DNMA2-01D5C	130DNMA2-0002C	130DNMA2-0003C
Input voltage	220VAC	220VAC	220VAC	220VAC
Inertia	Medium			
Rated power (W)	1000	1500	2000	3000
Rated torque (N*m)	4.77	7.16	9.55	14.33
Rated current (A)	5	8.4	10.3	13.5
Maximum current (A)	15	25.2	30.1	40.5
Rated speed (rpm)	2000	2000	2000	2000
Maximum speed (rpm)	3000	3000	3000	3000
Torque constant (N*m/Amp)	0.95N.m/Arms	0.85N.m/Arms	0.93N.m/Arms	1.07N.m/Arms
Back EMF constant(V/Krpm)	66V/Krpm	59.8V/Krpm	72.6V/Krpm	76V/Krpm
Rotary inertia (with brake) (10^{-4}Kg*m^2)	7.1 (7.5)	10.6 (11.1)	13.8 (14.3)	20.4 (20.9)
Resistance (line-line) (Ω)	1.08	0.543	0.52	0.32
Inductance (line-line) (mH)	12.8	6.3	6.8	4.7
Mass (with brake) (kg)	6.5 (8.8)	8 (10.5)	9.6 (11.9)	12.6 (14.9)
LL (with brake) (mm)	154 (198)	173 (217)	192 (236)	230 (274)
LR (mm)	58	58	58	58
LE (mm)	6	6	6	6
LG (mm)	12	12	12	12
S (mm)	22	22	22	22
LJ1 (mm)	0	0	0	0
LJ (mm)	18	18	18	18
J (mm)	36	36	36	36
LF1 (mm)	7	7	7	7
LF2 (mm)	8	8	8	8
LM (mm)	M6 deep 15	M6 deep 15	M6 deep 15	M6 deep 15
LA (mm)	145	145	145	145
LB (mm)	110	110	110	110
LC (mm)	130	130	130	130
LZ (mm)	9.5	9.5	9.5	9.5



9.3 Motor parameter PA9

PA9 value	Motor rated current	PA9 value	Motor rated current
0	-	20	10A
1	0.5A	21	11A
2	1.0A	22	12A
3	1.5A	23	13A
4	2.0A	24	14A
5	2.5A	25	15A
6	3.0A	26	16A
7	3.5A	27	17A
8	4.0A	28	18A
9	4.5A	29	19A
10	5.0A	30	20A
11	5.5A	31	21A
12	6.0A	32	22A
13	6.5A	33	23A
14	7.0A	34	24A
15	7.5A	35	25A
16	8.0A		
17	8.5A		
18	9.0A		
19	9.5A		

9.4 EPS-BS Servo motor and servo drive matching table

Servo drive	Rated current (A)	Servo motor	Power (KW)	Rated/max speed (rpm)	Rated current/torque	Motor pole pairs (PA2)	Motor current setting (PA9)
EPS-BS-0D20AA	2.0	60DNMA1-0D20D	0.2	3000/6000	1.7A/0.64N	4	4
EPS-BS-0D20AA	2.0	60DNMA2-0D20D	0.2	3000/6000	1.4A/0.64N	5	3
EPS-BS-0D40AA	3.0	60DNMA1-0D40D	0.4	3000/6000	2.8A/1.27N	4	6
EPS-BS-0D40AA	3.0	60DNMA2-0D40D	0.4	3000/6000	2.5A/1.27N	5	5
EPS-BS-0D75AA	4.0	80DNMA1-0D75D	0.75	3000/4500	4A/2.4N	4	8
EPS-BS-0D75AA	4.0	80DNMA2-0D75D	0.75	3000/4500	3.7A/2.4N	5	8
EPS-BS-0D75AA-****-G	6.0	80DNMA1-0D75C	0.75	2000/3000	5.5A/3.5N	4	11
EPS-BS-0D75AA	4.5	80DNMA2-0D75C	0.75	2000/4000	4.5A/3.5N	5	9
EPS-BS-0001AA	6.0	80DNMA1-0001D	1.0	3000/4500	5.1A/3.2N	4	10
EPS-BS-0001AA	6.0	80DNMA2-0001D	1.0	3000/4000	4A/3.2N	5	8
EPS-BS-0D75AA	4.0	90DNMA1-0D75D	0.75	3000/4500	4A/2.4N	4	8
EPS-BS-0D75AA	4.0	90DNMA1-0001D	1.0	3000/4500	4A/2.4N	4	8
EPS-BS-0D75AA	4.0	110DNMA1-0D80C	0.8	2000/3000	4A/3.6N	4	8
EPS-BS-0001AA	6.0	110DNMA1-0001D	1.0	3000/4000	4.5A/3.2N	4	9
EPS-BS-01D5AA	7.6	110DNMA1-01D2C	1.2	2000/3000	5.6A/5.7N	4	11
EPS-BS-01D5AA	7.6	110DNMA1-01D2D	1.2	3000/4000	5.6A/3.8N	4	11

Servo drive	Rated current (A)	Servo motor	Power (KW)	Rated/max speed (rpm)	Rated current/torque	Motor pole pairs (PA2)	Motor current setting (PA9)
EPS-BS-01D5AA	7.6	110DNMA1-01D5D	1.5	3000/4000	6.5A/4.8N	4	13
EPS-BS-01D5AA	7.6	110DNMA1-01D8D	1.8	3000/4000	7A/5.7N	4	14
EPS-BS-0001AA	6.0	130DNMA1-0001A	1.0	1000/1500	4.8A/10N	4	10
EPS-BS-01D5AA	7.6	130DNMA1-01D5A	1.5	1000/1500	7.9A/15N	4	16
EPS-BS-01D5AA	7.6	130DNMA2-01D5A	1.5	1000/1500	8A/14.33N	5	16
EPS-BS-0001AA	6.0	130DNMA1-0D85C	0.85	2000/3000	5A/4N	4	10
EPS-BS-0001AA	6.0	130DNMA1-0D85B	0.85	2000/3000	5.2A/5.4N	4	10
EPS-BS-0001AA	6.0	130DNMA1-0001C	1.0	2000/3000	5.1A/5N	4	10
EPS-BS-0001AA	6.0	130DNMA2-0001C	1.0	2000/3000	4.8A/4.77N	5	10
EPS-BS-01D5AA	7.6	130DNMA1-01D2C	1.2	2000/3000	6.3A/6N	4	13
EPS-BS-01D5AA	7.6	130DNMA2-01D2C	1.2	2000/3000	5.4A/6N	5	11
EPS-BS-01D5AA	7.6	130DNMA2-01D2D	1.2	2000/3000	3.7A/3.8N	5	8
EPS-BS-01D5AA	7.6	130DNMA2-01D3B	1.3	1500/3000	8.4A/8.3N	5	17
EPS-BS-01D5AA	7.6	130DNMA1-01D5C	1.5	2000/3000	7.9A/7.2N	4	16
EPS-BS-01D5AA	7.6	130DNMA2-01D5C	1.5	2000/3000	8A/7.2N	5	16
EPS-BS-01D5AA-****-G (S)	11.5	130DNMA1-01D5B	1.5	1500/2250	10.5A/10.5N	4	21
EPS-BS-01D5AA-****-G (S)	11.5	130DNMA2-01D5B	1.5	1500/2250	10.3A/9.55N	5	21
EPS-BS-01D5AA	7.6	130DNMA1-01D2D	1.2	3000/4000	6.3A/4N	4	13
EPS-BS-01D5AA	7.6	130DNMA1-01D5D	1.5	3000/4000	7.9A/5N	4	16
EPS-BS-01D5AA	7.6	130DNMA2-01D5D	1.5	3000/3200	5.3A/4.77N	5	11
EPS-BS-02D2AA	11.5	130DNMA1-02D2C	2.2	2000/3000	10.5A/10.5N	4	21
EPS-BS-02D2AA	11.5	130DNMA2-0002C	2.0	2000/3000	10.3A/9.55N	5	21
EPS-BS-02D2AA-****-G (S)	15.5	130DNMA1-02D2B	2.2	1500/2250	16.9A/15N	4	27
EPS-BS-02D2AA-****-G (S)	15.5	130DNMA2-0002B	2.0	1500/3000	13.8A/14.3N	5	24
EPS-BS-02D2AA	11.5	130DNMA2-0002D	2.0	2000/3000	6.7A/9.55N	5	14
EPS-BS-0003AA	15.5	130DNMA1-0003C	3.0	2000/3000	16.9A/15N	4	27
EPS-BS-0003AA	15.5	130DNMA2-0003C	3.0	2000/3000	15.6A/14.33N	5	26
EPS-BS-0003AA	15.5	130DNMA2-0003D	3.0	2000/3000	10.5A/9.55N	5	21
EPS-BS-02D2AA	11.5	130DNMA1-01D8D	1.8	3000/4000	9.5A/6N	4	19
EPS-BS-02D2AA	11.5	130DNMA2-01D8D	1.8	3000/4000	6.7A/5.7N	5	14
EPS-BS-02D2AA	11.5	130DNMA1-02D2D	2.2	3000/4000	12A/7.2N	4	22
EPS-BS-0003AA	15.5	130DNMA1-0003D	3.0	3000/4000	16.5A/9.55N	4	27
EPS-BS-0003AA	15.5	130DNMA2-0003D	3.0	3000/3300	10.5A/9.55N	5	21

Chapter 10 Appendix

10.1 Parameters

PA	Function	Range	Unit	Default	Effective
PA000	**Password setting** Set this parameter to 58 before editing parameters	0~9999	-	58	Immediate
PA001	**Carrier wave frequency**	5~15	KHz	12	Restart
PA002	**Motor pole pair selection**	4~5	-	5	Restart
4 pole pair motor, PA2=4; 5 pole pair motor, PA2=5.					
PA003	**Initial display selection** To select what is shown after power-on: 0: DP0 1: DP1 2: DP2 ……etc.	0~80		0	Restart
PA004	**Control mode selection** 0: Position control mode 7: Internal speed control mode	0~7		0	Restart
PA006	**Function selection parameter:** bit0: CWL & CCWL signal (0: valid; 1: invalid) bit1: PULSE signal negation (0: invalid; 1: valid) bit2: SIGN signal negation (0: invalid; 1: valid) bit 3: Power failure parameter storage (0: invalid; 1: valid) bit 4: Parameter eidit real-time saving (0: invalid; 1: valid) bit 5: DP0 negation (0: invalid; 1: valid) bit 6: ZEROSPD signal (0: invalid; 1: valid) bit 7: INH signal (0: invalid; 1: valid) bit 8: - bit 9: ZEROSPD edge selection bit A: Dividing machine (0: zero torque; 1: rated torque) bit B: Position control & internal torque control switch (0: normal output; 1: not output position control) bit C: Position & torque control switch (0: internal torque 1 only; 1: switch to 4 internal torques) bit D: Internal speed control reciprocate movement (0: electrical level; 1: rising edge)	0~65535		0	Restart
PA007	**Servo drive capacity selection**	0~6		0	Restart
PA008	**Motor encoder type selection:** 0: Magnetic 1024*4 ppr (H) 1: Magnetic2500*4 ppr (P) 2: Incremental 2500*4 ppr (E) 3: Incremental 5000*4 ppr (K) or Magnetic 5000*4 ppr (Q)	0~3		3	Restart
PA009	**Servo motor capacity parameter**	0～35		10	Restart
To change PA2, PA7~9, first set PA0=1234, then edit parameters and set EEPOP→EE-1, then restart.					
PA010	**Parameter management** 0: parameter saving (same as EE-00) 1: parameter reset (same as EE-01) 2: no operation	0~2		2	Restart
PA011	**Position loop gain**	100～9900		2000	Immediate
PA 012	**Speed feedforward gain**	0～100	%	0	Immediate
PA 013	**Speed feedforward filter**	0～8150	0.1ms	0	Immediate
PA014	**Speed loop gain**	300～8000		1000	Immediate
PA015	**First speed loop time integral constant**	0～1000	0.1 ms	200	Immediate

<table>
<tr><th>PA</th><th>Function</th><th>Range</th><th>Unit</th><th>Default</th><th>Effective</th></tr>
<tr><td>PA019</td><td>Parameter function selection:
bit0: Restart without full discharge except PA2, PA4, PA6, PA7, PA8, PA9.
(0: Cannot restart; 1: Can restart).
bit1: -
bit2: Electronic gear ratio swtich
(0: Can switch; 1: Cannot switch)
bit3:
bit4: CLE signal function
(0: Clear DP5~DP6; 1: Clear DP1~DP6)
bit5: -
bit6: Internal position loop run (0: Invalid; 1: Valid)
bit7: -
bit8: -</td><td>0~65535</td><td></td><td>0</td><td>Immediate</td></tr>
<tr><td>PA020</td><td>Acceleration/deceleration type selection
0: linear
1: S-curve</td><td>0~1</td><td></td><td>0</td><td>Immediate</td></tr>
<tr><td>PA021</td><td>S-curve coefficient</td><td>1~100</td><td></td><td>1</td><td>Immediate</td></tr>
<tr><td>PA022</td><td>Pulse input filter time constant<table><tr><th>PA022</th><th>Filter frequency (KHz)</th></tr><tr><td>20</td><td>200</td></tr><tr><td>40</td><td>100</td></tr><tr><td>60</td><td>67</td></tr><tr><td>80</td><td>50</td></tr><tr><td>100</td><td>40</td></tr><tr><td>120</td><td>33</td></tr></table></td><td>1~127</td><td></td><td>1</td><td></td></tr>
<tr><td>PA023</td><td>Second speed loop integral time constant</td><td>0～1000</td><td>0.1 ms</td><td>10</td><td>Immediate</td></tr>
<tr><td>PA027</td><td>Pulse input logic negation
Can use this parameter to change motor rotation direction.</td><td>0~1</td><td></td><td>0</td><td>Immediate</td></tr>
<tr><td>PA028</td><td>Pulse input form selection
0: Pulse+Sign
1: CW/CCW
2: A+B</td><td>0~2</td><td></td><td>0</td><td>Restart</td></tr>
<tr><td>PA029</td><td>CLE signal trigger selection
0: by electric level; 1: by edge</td><td></td><td></td><td>0</td><td>Immediate</td></tr>
<tr><td>PA030</td><td>Z Pulse output width<table><tr><th>PA030</th><th>Z Pulse width (ms)</th></tr><tr><td>500</td><td>4</td></tr><tr><td>1000</td><td>8</td></tr><tr><td>2000</td><td>16</td></tr><tr><td>4000</td><td>32</td></tr><tr><td>6000</td><td>48</td></tr></table></td><td>1~6500</td><td></td><td>4000</td><td>Restart</td></tr>
<tr><td>PA031</td><td>First electronic gear ratio numerator</td><td>1~65535</td><td></td><td>1</td><td>Immediate</td></tr>
<tr><td>PA032</td><td>First electronic gear ratio denominator</td><td>1~65535</td><td></td><td>1</td><td>Immediate</td></tr>
<tr><td>PA035</td><td>Pulse input filter</td><td>1~1000</td><td></td><td>1</td><td>Restart</td></tr>
<tr><td>PA038</td><td>Current loop gain</td><td>100~9000</td><td></td><td>1000</td><td>Immediate</td></tr>
<tr><td>PA039</td><td>Acceleration time constant</td><td>1~9000</td><td>ms</td><td>200</td><td>Immediate</td></tr>
<tr><td>PA040</td><td>Deceleration time constant</td><td>1~9000</td><td>ms</td><td>200</td><td>Immediate</td></tr>
<tr><td>PA041</td><td>Current integral constant</td><td>0~100</td><td></td><td>30</td><td>Restart</td></tr>
<tr><td>PA044</td><td>Speed instruction input logic negation</td><td>0~1</td><td></td><td>0</td><td>Immediate</td></tr>
<tr><td>PA047</td><td>Torque instruction input logic negation</td><td>0~1</td><td></td><td>0</td><td>Immediate</td></tr>
<tr><td>PA048</td><td>Torque limit constant
This parameter is to limit the maximum torque output compared to motor rated torque.</td><td>0~300</td><td></td><td>250</td><td>Immediate</td></tr>
<tr><td>PA050</td><td>COIN signal threhold
When position deviation is less than this parameter, COIN signal will output.</td><td>0~9000</td><td>pulse</td><td>50</td><td>Immediate</td></tr>
<tr><td>PA051</td><td>ZSP (zero speed) signal width</td><td>0~3000</td><td>rpm</td><td>50</td><td>Immediate</td></tr>
</table>

PA	Function	Range	Unit	Default	Effective
PA052	**ZSP (zero speed) signal time setting**	0~9000	0.1ms	50	Immediate
PA053	**Position deviation alarm threshold at S-ON**	0~500	0.01*encoder ppr	300	Immediate
PA054	**Position deviation alarm** 0: ERR09 will output if deviation is larger than PA053 1: No alarm will output even if deviation is larger than PA053	0~1		0	Immediate
PA055	**TLC (torque reached) signal threshold**	0~300	1% rated torque	50	Immediate
PA056	**TLC (torque reached) signal time setting**	0~9000	ms	50	Immediate
PA058	**Internal position start delay time (PA200=12)**		PA117		Immediate
PA060	**Time from BRK signal to motor free run**	0~9000	ms	150	Immediate
PA061	**Motor speed at BRK**	0~100	rpm	10	Immediate
PA062	**Internal position stop delay time (PA200=12)**		PA117		Immediate
PA063	**Motor stop mode after servo off** 0: decelerate to PA61, then power off after PA060 1: coast to stop	0~1		0	Immediate
PA064	**Input signal polarity selection**	0~65535		0	Immediate
PA065	**Delay time between S-ON and BRK off.**	0~9000	ms	150	Immediate
PA066	**Output signal polarity selection**	0~65535		0	Immediate
PA070	RS485 communication standard 0: RTU 1: ASCII	0~1		0	Restart
PA072	**RS485 communication address**	1～31		1	Restart
PA073	**RS485 bit rate** 0: 2400bps 1: 4800bps 2: 9600bps 3: 19200bps 4: 38400bps 5: 57600bps 6: 115200bps	0~6		5	Restart
PA074	**RS485 protocol:** 0: 7, N, 2 1: 7, E, 1 2: 7, O, 1 3: 8, N, 2 4: 8, E, 1 5: 8, O, 1 6: 8, N, 1	0~6		5	Restart
PA075	**Dynamic brake selection** 0: Brake to stop when speed is below PA76 fter PA77; 1: coast to stop	0~1		0	Immediate
PA076	**Dynamic brake speed**	0~3000	rpm	1000	Immediate
PA077	**Dynamic brake delay time**	0~9000	ms	10	Immediate
PA078	**COIN signal threshold** Valid when speed is below this parameter in speed control				Immediate
PA081	**Overload alarm threshold 1 (ERR 01)**	1~300	%	130	Immediate
PA082	**Overload alarm time 1 (ERR 01)**	1~120	S	30	Immediate
PA083	**Internal position 0: number of turns**	-9999~9999	turn	1	Immediate
PA084	**Internal position 0: number of pulses**	-9999~9999	pulse	0	Immediate
PA085	**Internal position 1: number of turns**	-9999~9999	turn	1	Immediate
PA086	**Internal position 1: number of pulses**	-9999~9999	pulse	0	Immediate
PA087	**Internal position 2: number of turns**	-9999~9999	turn	1	Immediate

PA	Function	Range	Unit	Default	Effective
PA088	**Internal position 2: number of pulses**	-9999~9999	pulse	0	Immediate
PA089	**Internal position 3: number of turns**	-9999~9999	turn	1	Immediate
PA090	**Internal position 3: number of pulses**	-9999~9999	pulse	0	Immediate
PA091	**Internal position 4: number of turns**	-9999~9999	turn	1	Immediate
PA092	**Internal position 4: number of pulses**	-9999~9999	pulse	0	Immediate
PA093	**Internal position 5: number of turns**	-9999~9999	turn	1	Immediate
PA094	**Internal position 5: number of pulses**	-9999~9999	pulse	0	Immediate
PA095	**Internal position 6: number of turns**	-9999~9999	turn	1	Immediate
PA096	**Internal position 6: number of pulses**	-9999~9999	pulse	0	Immediate
PA097	**Internal position 7: number of turns**	-9999~9999	turn	1	Immediate
PA098	**Internal position 7: number of pulses**	-9999~9999	pulse	0	Immediate
PA099	**Valid internal positions**	1~8		1	Immediate
PA100	**Internal parameter**	0~2		0	Immediate
PA101	**Internal position settings** 0: turns, pulses (incremental) 1: negative turns, negative pulses (incremental) 2: low 16-bits, high 16-bits (incremental) 3: negative low 16-bits, negative high 16-bits (incremental) 4: low 16-bits, high 16-bits (absolute) 5: negative low 16-bits, negative high 16-bits (absolute) 6: turns, pulses (absolute) 7: negative turns, negative pulses (absolute)	0~7		0	Immediate
PA102	**Internal position 0 speed**	0~5000	rpm	120	Immediate
PA103	**Internal position 1 speed**	0~5000	rpm	130	Immediate
PA104	**Internal position 2 speed**	0~5000	rpm	140	Immediate
PA105	**Internal position 3 speed**	0~5000	rpm	150	Immediate
PA106	**Internal position 4 speed**	0~5000	rpm	160	Immediate
PA107	**Internal position 5 speed**	0~5000	rpm	170	Immediate
PA108	**Internal position 6 speed**	0~5000	rpm	180	Immediate
PA109	**Internal position 7 speed**	0~5000	rpm	190	Immediate
PA110	**Position control selections (PA004=0)** 0: external position control (pulse train) 2: switch between internal position control & external JOG 4: switch between position control & internal torque control	0~4		0	Immediate
PA111	**Stall alarm threshold (ERR 08)**	0~9000	rpm	600	Immediate
PA112	**Stall alarm time (ERR 08)**	0~9000	0.1S	10	Immediate
PA113	**Internal parameter**	0~65535		12288	Immediate
PA115	**I/O terminal input filter**	0~2000		1	Immediate
PA116	**Internal position completion waiting time**	1~9000	ms	1	Immediate
PA117	**Internal position start/stop delay time**	1~9000	ms	1	Immediate
PA118	**Top seed coefficient (compared to rated speed)**	50~300	%	150	Restart
PA119	**Over-speed alarm threshold 1 (ERR 05)**	50~300	%	150	Restart
PA120	**Overload alarm threshold2 (ERR 06)**	1~300	%	160	
PA121	**Overload alarm time 2 (ERR 06)**	1~60	S	10	Immediate
PA122	**Overload alarm threshold 3 (ERR 07)**	1~300	%	200	Immediate
PA123	**Overload alarm time 3 (ERR 07)**	1~30	S	5	Immediate
PA128	**Torque control 1**	0~300		0	Immediate
PA129	**Torque control 2**	0~300		0	Immediate

PA	Function	Range	Unit	Default	Effective
PA130	**Torque control 3**	0~300		0	
PA131	**Internal speed 0** External JOG speed at internal position mode	-5000~ 5000	rpm	100	Immediate
PA132	**Internal speed 1** Homing speed at internal position mode	-5000~ 5000	rpm	200	Immediate
PA133	**Internal speed 2**	-5000~ 5000	rpm	300	Immediate
PA134	**Internal speed 3**	-5000~ 5000	rpm	400	Immediate
PA135	**Internal speed 4**	-5000~ 5000	rpm	500	Immediate
PA136	**Internal speed 5**	-5000~ 5000	rpm	600	Immediate
PA137	**Internal speed 6**	-5000~ 5000	rpm	700	
PA138	**Internal speed 7**	-5000~ 5000	rpm	0	Immediate
PA139	**Automatic saving parameter 1 at power failure**	0~249		0	Immediate
PA140	**Automatic saving parameter 2 at power failure**	0~249		0	Immediate
PA141	**Second electronic gear ratio numerator**	1~65535		1	Immediate
PA142	**Second electronic gear ratio denominator**	1~65535		1	Immediate
PA143	**IGBT alarm temperature threshold (over 2.2kw model)**	0~120		100	Immediate
PA145	**DI1 function selection** 【0】Control mode switch (C-MODE) 【1】Positive rotation prohibited (CWL) / Internal torque selection 1 【2】Negative rotation prohibited (CCWL) / Internal torque selection 2 【3】Deviation Clearance (CLE) / Internal position homing / Internal speed selecition 1 【4】Alarm Clearance (A-CLR) / Internal speed selecition 3 【5】Pulse input prohibited (INH) / Internal position stop/ Internal speed selecition 2 【6】Servo enabled (S-ON) 【7】Zero speed clamp (ZEROSPD) / Internal position pause 【8】Forward JOG 【9】Reverse JOG / Internal position selection 1 【10】Internal position start 【11】Homing start signal 【12】Home signal input signal / torque signal negation 【13】Internal position selection 2 【14】Gear ratio switch / Internal position signal negation 【15】Internal position selection 3			6	Immediate
PA146	**DI2 function selection**			4	Immediate
PA147	**DI3 function selection**			3	Immediate
PA148	**DO1 signal selection** 【0】Servo ready (S_RDY) 【1】Alarm (ALM) 【2】Holding brake signal (BRK) 【3】Position reached (COIN) 【4】Torque reached (TLC) 【5】Zero speed (ZSP) 【6】Z signal (need restart)			1	Restart
PA149	**DO2 signal selection**			2	Restart
PA150	**DO2 signal selection**			3	Restart
PA151	**Regenerative circuit duty cycle**	0~100		50	Immediate
PA152	**Regenerative threshold compensation**	-20~25	V	0	Immediate
PA153	**Control circuit under-voltage alarm time**	1~2000	ms	40	Immediate
PA154	**Control circuit under-voltage alarm time threshold**	0~9000	-	2000	Immediate
PA155	**Alarm parameter 1**	-	-	-	-
PA156	**Alarm parameter 2**	-	-	-	-
PA157	**Alarm parameter 3**	-	-	-	

PA	Function	Range	Unit	Default	Effective
PA158	**Alarm parameter 4**	-	-	-	-
PA160	**Waiting time after internal position 0**	1~9000	PA116	100	Immediate
PA161	**Waiting time after internal position 1**	1~9000	PA116	100	Immediate
PA162	**Waiting time after internal position 2**	1~9000	PA116	100	
PA163	**Waiting time after internal position 3**	1~9000	PA116	100	Immediate
PA164	**Waiting time after internal position 4**	1~9000	PA116	100	Immediate
PA165	**Waiting time after internal position 5**	1~9000	PA116	100	Immediate
PA166	**Waiting time after internal position 6**	1~9000	PA116	100	Immediate
PA167	**Waiting time after internal position 7**	1~9000	PA116	100	Immediate

10.2 MODBUS Communication

There are two MODBUS modes: ASCII (American Standard Code for Information Interchange) or RTU (Remote Terminal Unit).

10.2.1 Communication modes

1. ASCII mode

Every 8-bit data consists of two ASCII bytes.

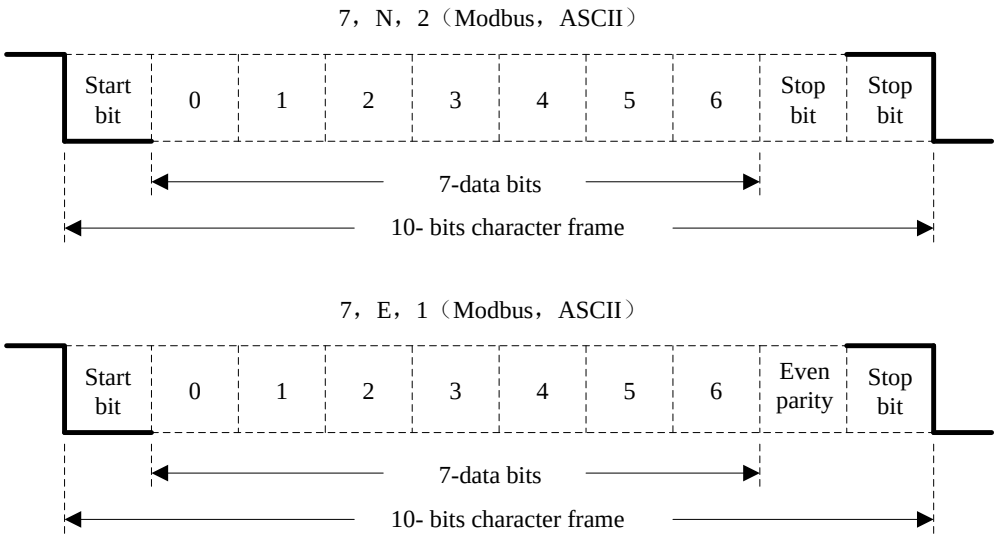
Byte symbol	**'0'**	**'1'**	**'2'**	**'3'**	**'4'**	**'5'**	**'6'**	**'7'**
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H
Byte symbol	'8'	'9'	'A'	'B'	'C'	'D'	'E'	'F'
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

2. RTU mode

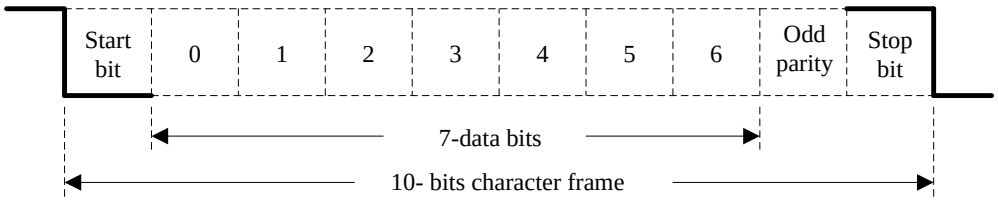
Every 8-bits data consists of two 4-bits hexadecimal bytes.

10.2.2 Byte structure

10-bits byte box (used for 7-bits data)

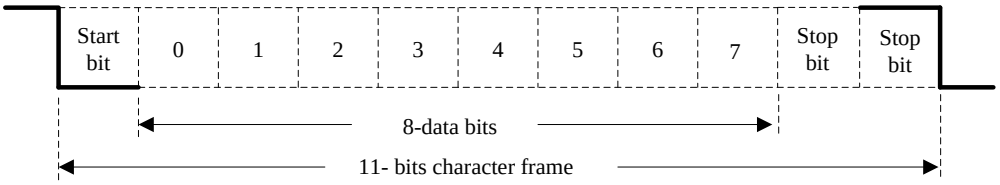


7，O，1（Modbus，ASCII）

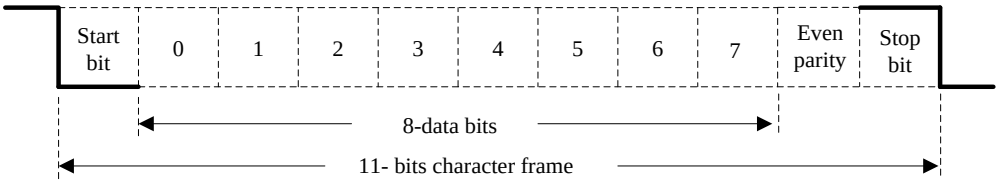


11-bits byte box (used for 8-bits data)

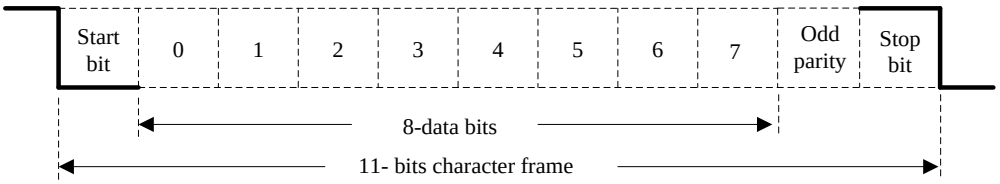
8，N，2（Modbus，ASCII / RTU）



8，E，1（Modbus，ASCII / RTU）



8，O，1（Modbus，ASCII / RTU）



10.2.3 Communication data structure

◆ **ASCII mode:**

STX	Communication starting byte: ‘:’ (3AH)
ADR	Communication address: 1-byte contains 2 ASCII codes
CMD	Command code: 1-byte contains 2 ASCII codes
DATA (n-1)	Data content (n≤12) : Word number=n; Byte number=2n; ASCII code number=4n;
…….	
DATA (0)	
LRC	Command code: 1-byte contains 2 ASCII codes

End 1	End code 1: (0DH) (CR)
End 0	End code 0: (0AH) (LF)

RTU mode

STX	Static time exceeding 3.5 bytes
ADR	Communication address: 1-byte
CMD	Command code: 1-byte
DATA (n-1)	Data content (n≤12) : Word number=n; Byte number=2n;
…….	
DATA (0)	
CRC	Command code: 1-byte
End 1	Static time exceeding 3.5 bytes

Detailed explanations are as below:

Detailed explanations are as below:

- **STX (Communication starting)**

ASCII mode:':' byte (3AH) .

RTU mode：Static time exceeding 3.5 bytes under current communication speed.

- **ADR (communication address)**

Valid communication address is between 1 and 127. For example: to communicate with servo drive of Axis 16 (hexadecimal: 10H) :

ASCII mode: ADR='1', '0'=> '1'=31H, '0'=30H

RTU mode: ADR = 10H

- **CMD (command code) & DATA (data content)**

DATA format is determined by CMD. Common CMD listed below:

Command	Meaning	Remarks
03H	Read N words, N≤29	Standard command 03
06H	Write 1 word	Standard command 06
10H	Write N words, N≤29	Standard command 10

1) CMD：03H (Read N words, N≤29)

For example, to continuously read 2 words from starting address 0200H of servo drive Axis 01H:

ASCII mode:

Command

STX	**':'**
ADR	**'0'**
	'1'
CMD	**'0'**
	'3'
Starting address (high to low)	**'0'**
	'2'
	'0'
	'0'
Data quantity (WORD)	**'0'**
	'0'
	'0'
	'2'
LRC Check (high to low)	**'F'**
	'8'
End 1	**(0DH)**
End 0	**(0AH)**

Response

STX	**':'**
ADR	**'0'**
	'1'
CMD	**'0'**
	'3'
Data quantity (bytes)	**'0'**
	'4'
Starting address 0200H (high to low)	**'0'**
	'0'
	'B'
	'1'
Second address 0200H (high to low)	**'1'**
	'F'
	'4'
	'0'
LRC Check (high to low)	**'E'**
	'8'
End 1	**(0DH) (CR)**
End 0	**(0AH) (LF)**

RTU mode：

Command

ADR	**01H**
CMD	**03H**
Starting address (high to low)	**02H**
	00H
Data byte number (high to low)	**00H**
	02H
CRC check low	**C5H**
CRC check high	**B3H**

Response

ADR	**01H**
CMD	**03H**
Data quantity (bytes)	**04H**
Starting address 0200H (high to low)	**00H**
	B1H
Second address 0200H (high to low)	**1FH**
	40H
CRC check low	**A3H**
CRC check high	**D4H**

2) CMD: 06H (write one word)

For example, write 100 (0064H) to starting address 0200H of servo drive Axis 01H:

ASCII mode:

Command		Response	
STX	**':'**	**STX**	**':'**
ADR	**'0'**	**ADR**	**'0'**
	'1'		**'1'**
CMD	**'0'**	**CMD**	**'0'**
	'6'		**'6'**
Starting address (high to low)	**'0'**	**Starting address 0200H (high to low)**	**'0'**
	'2'		**'2'**
	'0'		**'0'**
	'0'		**'0'**
Data content (high to low)	**'0'**	**Data content (high to low)**	**'0'**
	'0'		**'0'**
	'6'		**'6'**
	'4'		**'4'**
LRC Check (high to low)	**'9'**	**LRC Check (high to low)**	**'9'**
	'3'		**'3'**
End 1	**(0DH) (CR)**	**End 1**	**(0DH) (CR)**
End 0	**(0AH) (LF)**	**End 0**	**(0AH) (LF)**

RTU mode:

Command		Response	
ADR	**01H**	**ADR**	**01H**
CMD	**06H**	**CMD**	**06H**
Starting address (high to low)	**02H**	**Starting address (high to low)**	**02H**
	00H		**00H**
Data content (high to low)	**00H**	**Data content (high to low)**	**00H**
	64H		**64H**
CRC check low	**89H**	**CRC check low**	**89H**
CRC check high	**99H**	**CRC check high**	**99H**

1) CMD: 10H (write N words, N≤29)

For example, write 100 (0064H) , 102 (0066H) to starting address 0200H of servo drive Axis 01H:

ASCII mode:

Command

STX	**':'**
ADR	**'0'**
	'1'
CMD	**'1'**
	'0'
Starting address (high to low)	**'0'**
	'2'
	'0'
	'0'
Data word number (high place)	**'0'**
	'0'
Data word number (low place)	**'0'**
	'2'
Data byte number	**'0'**
	'4'
Data 1 content (high to low)	**'0'**
	'0'
	'6'
	'4'
Data 2 content (high to low)	**'0'**
	'0'
	'6'
	'6'
LRC Check (high to low)	**'1'**
	'D'
End 1	**(0DH) (CR)**
End 0	**(0AH) (LF)**

Response

STX	**':'**
ADR	**'0'**
	'1'
CMD	**'1'**
	'0'
Starting address (high to low)	**'0'**
	'2'
	'0'
	'0'
Data word number (high to low)	**'0'**
	'0'
	'0'
	'2'
LRC Check (high to low)	**'9'**
	'3'
End 1	**(0DH) (CR)**
End 0	**(0AH) (LF)**

RTU mode:

Command	
ADR	**01H**
CMD	**10H**
Starting address (high to low)	**02H**
	00H
Data word number (high to low)	**00H**
	02H
Data byte number	**04H**
Data 1 content	**00H**
	64H
Data 2 content	**00H**
	66H
CRC check low	**50H**
CRC check high	**11H**

Response	
ADR	**01H**
CMD	**10H**
Starting address (high to low)	**02H**
	00H
Data word number (high to low)	**00H**
	02H
CRC check low	**40H**
CRC check high	**70H**

- **LRC (ASCII mode) & CRC (RTU mode) detected error value calculation**

ASCII mode：

ASCII mode uses LRC (Longitudinal Redundancy Check) to detect error value. LRC detected error value is the sum from ADR to last data content and use 256 as unit to remove excess part (for example: sum is 128H, then only use 28H) , and then calculate supplement number of 2.

RTU mode：

RTU mode uses CRC (Cyclical Redundancy Check) detected error value.
Step 1: CRC register is a 16-bits register whose content is FFFFH;
Step 2: **Exclusive OR** compute first byte of command & low place byte of 16-bits CRC register and store the result back to CRC register.
Step 3: Check lowest place (LSB) of CRC register. If this place is 0, then move to the right by 1 place； If this place is 1, then CRC register value move to the right by 1 place and **Exclusive OR** compute with A001H.
Step 4: Go back to Step 3 until Step 3 has been executed 8 times; then to Step 5.
Step 5: Repeat Step 2 to Step 4 for next byte of the CMD until all bytes have been processed.

At this point, CRC register content is CRC detected error value.

Notes:
After calculated CRC detected error value, in command, shall first fill in CRC low place, then CRC high place.

3) End1、End0 (communication end)

ASCII mode：
(0DH) i.e. byte as'\r' (carriage return) & (0AH) i.e. byte as '\n' (new line) , means communication end.

RTU mode：
Static time exceeding 3.5 bytes in current communication speed.

10.2.4 Communication troubleshooting

Common error causes are:

- When reading-writing parameters, data address is wrong；
- When writing parameters, data exceeds upper/lower limit of this parameter；
- Communication is interfered, data transmission error or verification error.

When above communication error occurs, the servo drive will continue running, meanwhile will send back an error frame.

Error frame format:

Upper controller data frame:

Start	Slave address	Command	Data address	Verification

Servo drive feedback error frame:

Start	Slave address	Response code	Error code	Verification

Error frame response code = command + 80H

Error code＝00H: communication normal；
＝01H: servo drive cannot recognize the request;
＝02H: data address of the request does not exist in the servo drive;
＝03H: data of the request is not allowed (exceeding upper/lower limit) ;
＝04H: servo drive started to execute the request but failed；

For example: servo drive Axis number is 03H, write data 06H to parameter PA004. As both upper/lower limit of PA004 is 0, data cannot be written. Servo drive will send back an error frame; error code is 03H (exceeding upper/lower limit) . Structure is as below.

Upper controller data frame:

Start	Slave address	Command	Data address	Verification
	03H	06H	0004H, 0006H	

Servo drive feedback error frame:

Start	Slave address	Response code	Error code	Verification
	03H	86H	03H	

If slave address is 00H, this is broadcast data and the servo drive will send no feedback.

10.2.5 Communication parameters

Related parameters:

PA070	RS485 **communication mode** 0: RTU 1: ASCII	0~1		0	Restart
PA072	**RS485 communication address**	1～31		1	Restart
PA073	**RS485 baud rate setting** 0: 2400bps 1: 4800bps 2: 9600bps 3: 19200bps 4: 38400bps 5: 57600bps 6: 115200bps	0~6		5	Restart
PA074	**RS485 protocol** 0: 7, N, 2 1: 7, E, 1 2: 7, O, 1 3: 8, N, 2 4: 8, E, 1 5: 8, O, 1 6: 8, N, 1	0~6		5	Restart

10.2.6 Servo drive parameter address

1. User parameter (PA***) address is the same as parameter number (change decimal value to hexadecimal):
For example,
PA0 communication address is 0x0000(H)
PA3 communication address is 0x0003(H)
PA31 communication address is 0x001F(H)
2. Monitor parameter (dP**) address please refer to Chapter 5.1