XINJE

DS3 series servo drive

User manual

Safety Precautions

Be sure to review this section carefully before use this product. In precondition of security, wire the product correctly.

The following defines the symbols used in this manual to indicate varying degrees of safety precautions and to identify the corresponding level of hazard inherent to each. Failure to follow precautions provided in this manual can result in serious, possibly even fatal, injury, and/or damage to the persons, products, or related equipment and systems.

⚠ **CAUTION**	Indicates a potentially hazardous situation, which, if not heeded, could result in death or serious injury
⚡ **WARNING**	Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.

● **Checking Products upon Delivery**

⚠ CAUTION
1. DO NOT install any driver which is damaged, lack of accessories or not the same with the model ordered.   Doing so may result in electric shock.

● **Installation**

⚡ WARNING
1. Cut off external power supply before installation.   Not doing so may result in electric shock.

⚠ CAUTION

1. Always use the servomotor and servo amplifier in one of the specified combinations.
    Never use the products in an environment subject to water, corrosive gases,
    inflammable gases, or combustibles.
    Doing so may result in electric shock, fire or malfunction.
2. DO NOT touch any metallic part.
    Doing so may result in malfunction.

● **Wiring**

⚡ WARNING

1. Cut off external power supply before wiring.
    Not doing so may result in electric shock.
2. Connect AC power supply to the corresponding terminals.
    Faulty wiring may result in fire.

<table>
<tr><td align="center">⚠ **CAUTION**</td></tr>
<tr><td>
1. Do not connect a three-phase power supply to the U, V, or W output terminals.
   Doing so may result in injury or fire.
2. Use 2mm^2 wire to grounding the groud terminals.
   Not doing so may result in electric shock.
3. Securely fasten the power supply terminal screws and motor output terminal screws.
   Not doing so may result in fire.
</td></tr>
</table>

- **Operation**

<table>
<tr><td align="center">⚡ **WARNING**</td></tr>
<tr><td>
1. Never touch any rotating motor parts while the motor is running.
   Doing so may result in injury.
2. DO NOT touch the inside the driver.
   Doing so may result in electric shock.
3. Do not remove the panel cover while the power is ON.
   Doing so may result in electric shock.
4. Do not touch terminals for five minutes after the power has been turned OFF.
   Residual voltage may cause electric shock.
</td></tr>
</table>

<table>
<tr><td align="center">⚠ **CAUTION**</td></tr>
<tr><td>
1. Conduct trial operation on the servomotor alone with the motor shaft disconnected from machine to avoid any unexpected accidents.
   Not doing so may result in injury.
2. Before starting operation with a machine connected, change the settings to match the parameters of the machine.
   Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
3. Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.
   Not doing so may result in injury.
4. Do not touch the heat sinks during operation.
   Not doing so may result in burns due to high temperatures.
5. Do not attempt to change wiring while the power is ON.
   Doing so may result in electric shock or injury
</td></tr>
</table>

Catalog

Preface

This chapter describes the constitution of this manual, the intended user, and how to acquire this manual.

Constitution of This Manual

This manual is divided into 7 chapters.

1. Checking Product and Part Names

This chapter describes the procedure for checking products upon delivery as well as names for product parts.

2. Installation

This chapter describes precautions for servomotor and servo driver installation.

3. Wiring

This chapter describes the procedure used to connect DS3 Series products to peripheral devices and gives typical examples of main circuit wiring as well as I/O signal connections.

4. Parameter Settings and Functions

This chapter describes the procedure for setting and applying parameters.

5. Use Digital Panel

This chapter describes the basic operation of the digital panel and the features it offers.

6. Ratings and Characteristics

This chapter provides the ratings, torque-speed characteristics diagrams, and dimensional drawings of the DS3 series servo drives and MS series servomotors.

7. Alarm Information

This chapter describes the alarm information of DS3 series servo drivers.

Intended User

This manual is intended for the following users.

➢ Those designing DS3 Series servodrive systems.

➢ Those installing or wiring DS3 Series servodrives.

➢ Those performing trial operation or adjustments of DS3 Series servodrives.

➢ Those maintaining or inspecting DS3 Series servodrives.

How to AcquireThis Manual

1．Electrical Manual
   (1) Log on Xinje official website www.xinje.com to download.
   (2) Acquire this manual on a CD from an authorized distributor.

1 Check Product and Part Names

This chapter describes the procedure of checking products upon delivery as well as names for product parts.

1-1．Check Products on Delivery

Use the following checklist when products are delivered.

Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the servomotor and servo driver.
Does the servomotor shaft rotate smoothly?	The servomotor shaft is normal if it can be turned smoothly by hand. Servomotors with brakes, however, cannot be turned manually.
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Are there any loose screws?	Check screws for looseness using a screwdriver.
Is the motor code the same with the code in driver?	Check the motor code marked on the nameplates of the servomotor and the parameter F0-00 on the servo driver.

If any of the above is faulty or incorrect, contact Xinje or an authorized distributor.

1-1-1. Servomotors

■ **External Appearance**

■ **Nameplate**

MS -110 ST - M 06030 A Z- 2 1P8
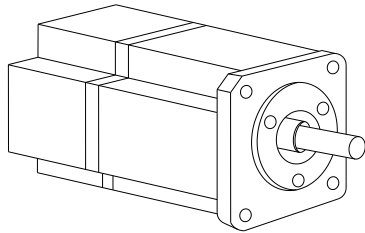
- Power
- Voltage class
- Power-loss brake
- Shaft Specifications
- Performance code
- Feedback part code
- Sinewave-drive motor
- Base no.
- Motor series name
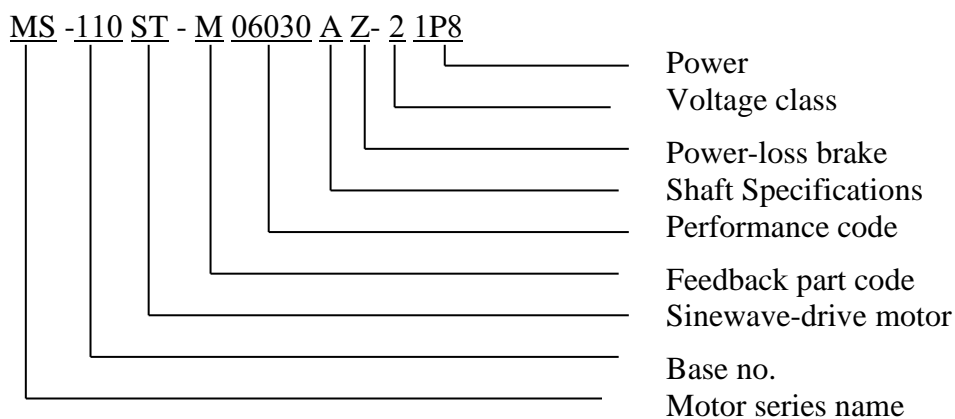
Base number	80, 110, 130	
Feedback component no.	M	Optical pulse encoder
Performance parameter no.	First 3 bits mean rated torque, last 2 bits mean rated speed	
	02430	Rated torque 2.4 N m, rated speed 3000rpm;
	06030	Rated torque 6.0 N m, rated speed 3000rpm;
	10015	Rated torque 10.0 N m, rated speed 1500rpm;

Shaft spec	A	No bond
	B	With bond
Power-loss brake	Vacant	No
	Z	With DC24V power-loss brake
Voltage class	2	220V
	4	380V
Power	0P7	0.75kW
	1P5	1.5kW
	1P8	1.8kW

1-1-2．Servo Driver

■ **External Appearance**

DS3 series
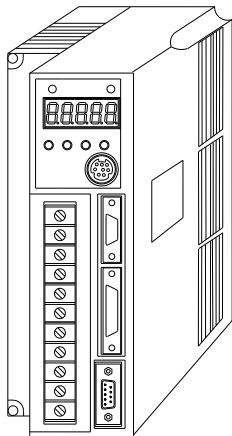
■ **Nameplate**

$$\underline{DS3} - \underline{2}\ \underline{1P8}$$

——— Suitable motor capacity

——— Voltage class

——— Series name
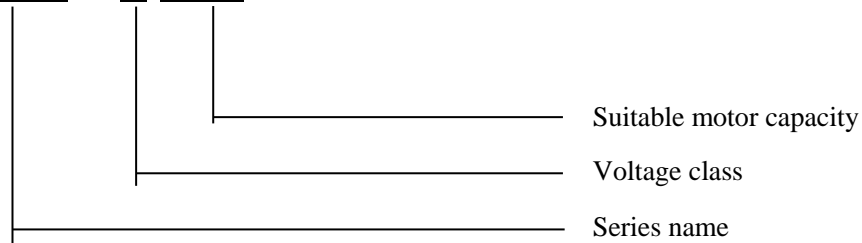
suitable motor capacity	0P7	0.75kW
	1P5	1.5kW
	1P8	1.8kW
Voltage level	2	220V
	4	380V

1-2. Product Part Name

1-2-1. Servo motor

Encoder part   Frame   Flange

Output (transmission) shaft
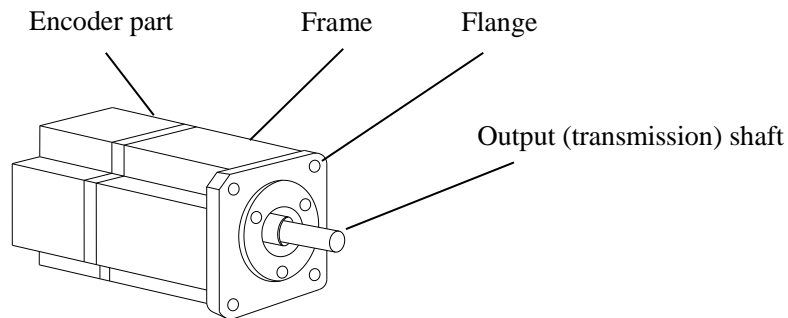
1-2-2. Servo Drivers
■ DS3 series

POWER LED
It lights when power on

CHARGE LED
It lights when the main circuit power on. It lights after power off.
and the charge is still in the capacitance, don't touch the servo at this time.

Panel
Display the servo state, alarm, parameter input

Panel button
Set the parameter

COM1
Connect to the PC and debug.

CN2 encoder port

Connect to the encoder port on the servo motor.

CN1 I/O signal port

Command/sequence input, signal output

Power and servo motor terminal

Power supply input, connect to servo motor power terminal

COM2

Communicate with HMI, PLC and other devices

2 Installation

This chapter describes precautions for servo motor and servo driver installation.

2-1．Servo motor

MS series servomotors can be installed either horizontally or vertically. The service life of the servomotor can be shortened or unexpected problems might occur if it is installed incorrectly or in an inappropriate location. Follow these installation instructions carefully.

⚠ **CAUTION**

1．The end of the motor shaft is coated with antirust. Before installing, carefully remove all of the paint using a cloth moistened with paint thinner.
2．Avoid getting thinner on other parts of the servomotor.

Antirust
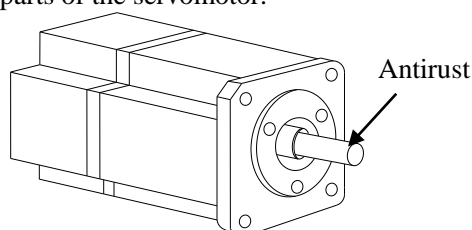
2-1-1．Storage Temperature

Store the servo motor within -20~+60 ℃ as long as it is stored with the power cable disconnected.

2-1-2．Installation Site

MS series servo motors are designed for indoor use. Install the servomotor in environments that satisfy the following conditions.

➢ Free of corrosive or explosive gases.
➢ Well-ventilated and free of dust and moisture.
➢ Ambient temperature of 0 °to 50 ℃.
➢ Relative humidity (r.h.) of 20 to 90% with no condensation.
➢ Accessible for inspection and cleaning.

2-1-3．Concentricity

Please use coupling when connecting to machine; keep the shaft center of servo motor and machine at the same line. It should be accord to the following diagram when installing the servo motor.

Measure it at 4 places of the circle, the difference should be below 0.03mm. (Rotate with the shaft coupler)
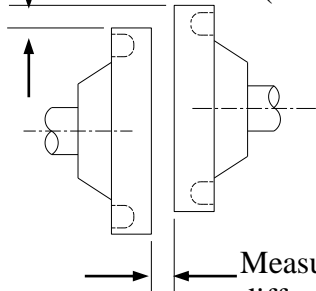
Measure it at 4 places of the circle, the difference should be below 0.03mm. (Rotate with the shaft coupler)

Note: (1) If the concentricity is not enough, it will cause the vibration and bearing damage.

(2) When installing the coupler, prevent direct impact to the shaft. This can damage the encoder mounted on the shaft end at the opposite side of the load.

2-1-4．Orientation

MS series servomotors can be installed either horizontally or vertically.

2-1-5．Handling Oil and Water

Install a protective cover over the servomotor if it is used in a location with water or oil mist. Also use a servomotor with an oil seal when needed to seal the through-shaft section. The connector must install downwards.

Through part of the shaft
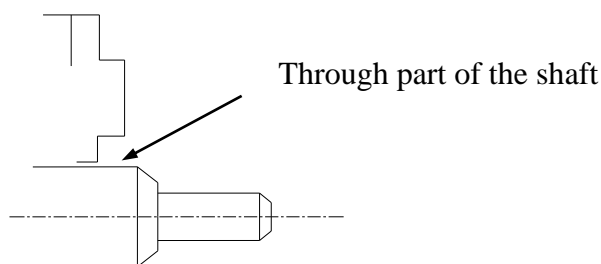
2-1-6．Cable Stress

Make sure that the power lines are free from bends and tension. Be especially careful to wire signal line cables so that they are not subject to stress because the core wires are very thin, measuring only 0.2 to 0.3mm^2.

2-2．Servo Drivers

The DS3 series servo drivers are base-mounted servo drivers. Incorrect installation will cause problems. Follow the installation instructions below.

2-2-1．Storage Conditions

Store the servo driver within -20~+85℃, as long as it is stored with the power cable disconnected.

2-2-2．Installation Site

The following precautions apply to the installation site.

Situation	Installation Precaution
Installation in a Control Panel	Design the control panel size, unit layout, and cooling method so the temperature around the servo drivers does not exceed 50 ℃.
Installation Near a Heating Unit	Minimize heat radiated from the heating unit as well as any temperature rise caused by natural convection so the temperature around the servo drivers does not exceed 50 ℃.
Installation Near a Source of Vibration	Install a vibration isolator beneath the servo driver to avoid subjecting it to vibration.
Installation at a Site Exposed to Corrosive Gas	Corrosive gas does not have an immediate effect on the servo drivers, but will eventually cause electronic components and terminals to malfunction. Take appropriate action to avoid corrosive gas.

Other Situations	Do not install the servo driver in hot and humid locations or locations subject to excessive dust or iron powder in the air.

2-2-3．Orientation

Install the servo driver perpendicular to the wall as shown in the figure. The servo driver must be oriented this way because it is designed to be cooled by natural convection or by a cooling fan.
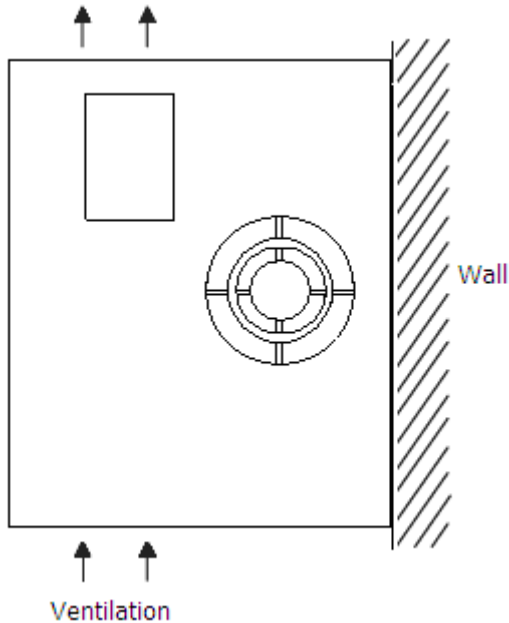
2-2-4．Installation

Follow the procedure below to install multiple servo drivers side by side in a control panel.
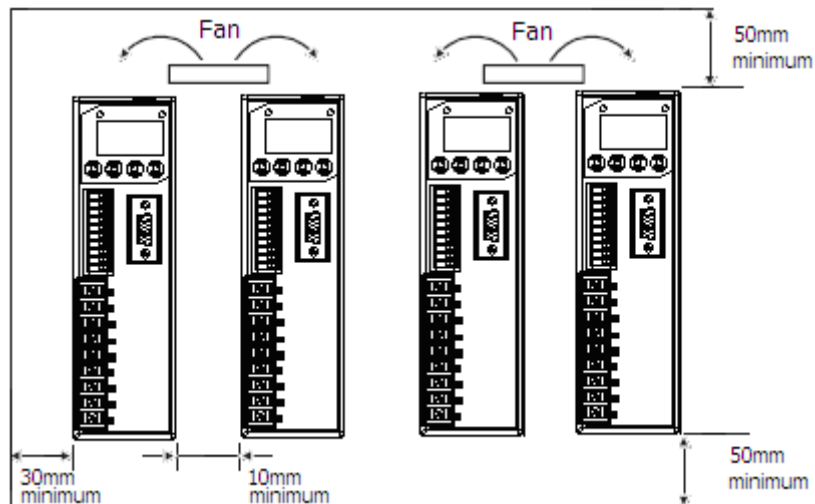
■ **Servo Driver Orientation**

Install the servo driver perpendicular to the wall and the up side faces operator.

■ **Cooling**

As shown in the figure above, leave enough space for servo drive to ensure better ventilation.

■ **Side-by-side Installation**

In the above diagram, leave 10mm at both sides on landscape; leave 50mm at both sides on portrait. Install cooling fan above servo drive. Make the temperature average in the control cabinet, prevent part temperature too high.

■ **Environmental Conditions in the Control cabinet**

- Ambient Temperature: 0~50 ℃
- Humidity: 90%RH or less
- Vibration: 4.9m/s^2
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 50 ℃ maximum

3 Wiring

This chapter describes the procedure used to connect DS3 Series products to peripheral devices and gives typical examples of main circuit wiring as well as I/O signal connections.

3-1．Main Circuit Wiring

This section shows typical examples of main circuit wiring for DS3 Series servo products, functions of main circuit terminals, and the power ON sequence.
Observe the following precautions when wiring.

⚠ Caution
1. Do not bundle or run power and signal lines together in the same duct. Keep power and signal lines separated by at least 11.81inch(30cm)
2. Use twisted pair wires or multi-core shielded-pair wires for signal and encoder (PG) feedback lines. The maximum length is 118.11inch (3m) for reference input lines and is 787.40inch (20m) for encoder (PG) feedback lines.
3. Do not touch the power terminals for 5 minutes after turning power OFF because high voltage may still remain in the servo amplifier. Please make sure to check the wiring after the CHARGE light is going off.
4. Avoid frequently turning power ON and OFF. Do not turn power ON or OFF more than once per minute. Since the servo amplifier has a capacitor in the power supply, a high charging current flows for 0.2s when power is turned ON. Frequently turning power ON and OFF causes main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.

3-1-1．Names and Descriptions of Main Circuit Terminal

DS3 series main circuit terminals:

Terminal	Function	Explanation
⊕1, ⊕2	Current high harmonic suppression, DC reactor connection terminal	⊕1 and ⊕2 are shorted when out of factory. Connect DC reactor between them if needs to suppress the high harmonic.
R, S, T	Power input terminal of main circuit	3-phase or single-phase 200~240V, 50/60Hz
⏚	Ground terminal	Connect with motor ground and power supply ground.
U, V, W	Motor terminal	Connect with the motor
P+, PB	Regenerative resistor terminal	Connect regenerative resistor between P+ and PB

3-1-2．Typical Wiring Example

1MCCB : breaker for inverter

FIL: noise filter
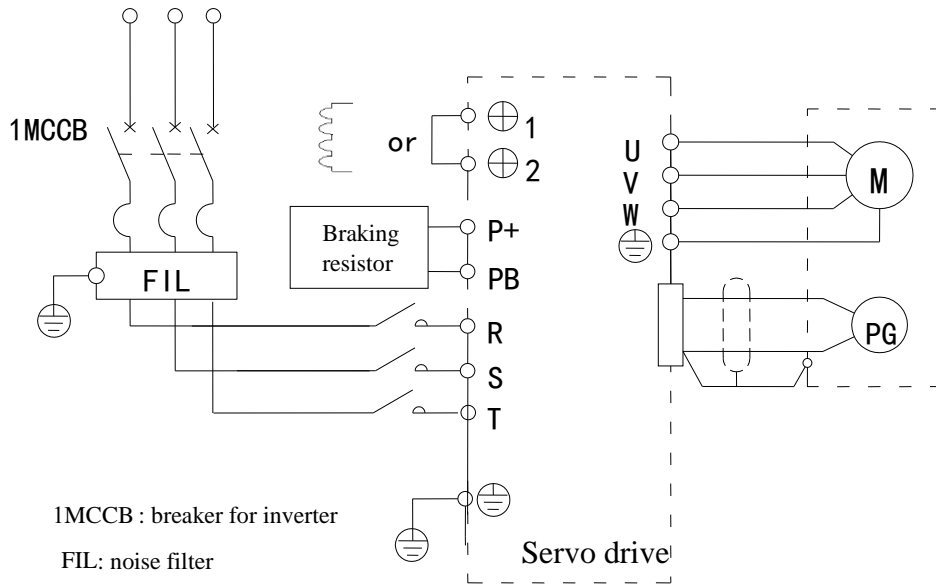
Note: For single power supply, connect any 2 terminals among R, S, T.

3-1-3．Winding Terminals on Servo motor

Symbol	80 Series	110, 130 Series
PE	4	1
U	1	2
V	3	3
W	2	4

3-2．I/O Signals

This section describes I/O signals for the DS3 series servo driver.

3-2-1．Layout of CN1

The diagram is CN1 terminal layout (look at the solder side):
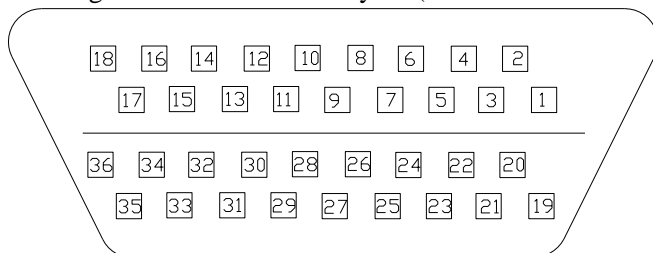
3-2-2. CN1 terminal

No.	Terminal	Explanation	No.	Terminal	Explanation
1	GND	Z-phase	19	V-REF	Analog setting, speed
2	CZ	transistor output	20	GND	
3	SO3-	Output terminal 3	21	T-REF	Analog setting, torque
4	SO3+		22	GND	
5	SO2-	Output terminal 2	23	PL1	Power supply for open collector command
6	SO2+		24	PULS-	Input pulse A or input pulse signal
7	SO1-	Output terminal 1	25	PULS+	
8	SO1+		26	SIGN-	Input pulse B or input direction signal
9	+24V	+24V for output terminal	27	SIGN +	
10	SI7	Input terminal 7	28	PL2	Power supply for open collector command
11	SI6	Input terminal 6	29	NC	Vacant
12	SI5	Input terminal 5	30	ZO+	Z-phase difference output
13	SI4	Input terminal 4	31	ZO-	
14	NC	Vacant	32	BO+	B-phase difference output
15	SI3	Input terminal 3	33	BO-	
16	SI2	Input terminal 2	34	AO+	A-phase difference output
17	SI1	Input terminal 1	35	AO-	
18	GND	Ground	36	GND	Ground

3-2-3．I/O Signals

■ Input Signals

Item	Input terminal	Function	Reference chapter
Digital input	SI1～SI7	Multi-function input terminal	4-1-6, 4-4-2
Pulse input	PULS+ PULS-	P2-00=1: A-phase pulse P2-00=2: pulse	4-3-2
	SIGN+ SIGN-	P2-00=1: B-phase pulse P2-00=2: pulse direction (sign)	4-3-2
Analog input	V-REF	Set speed or limit speed, analog input	3-2-4, 4-3-1
	T-REF	Set torque or limit torque, analog input	3-2-4, 4-3-7

■ Output Signals

Item	Output terminal	Function	Reference chapter
optocoupler	SO1～SO3	Multi-functional output	3-2-4, 4-1-6, 4-4-3
Transistor output	CZ	Z-phase transistor output	3-2-4
	GND		
Difference output	AO+, AO-	A-phase difference output	3-2-4, 4-3-3
	BO+, BO-	B-phase difference output	
	ZO+, ZO-	Z-phase difference output	

3-2-4．Interface Circuits

This section shows examples of servo driver I/O signal connection to the host controller.

■ The interface with the command input circuit

　(1) Analog input circuit

Analog signal is speed command or torque command. The input resistance is shown below:

Speed command input: about 13kΩ

Torque command input: about 13kΩ

The max available voltage of input signal is ±10V.
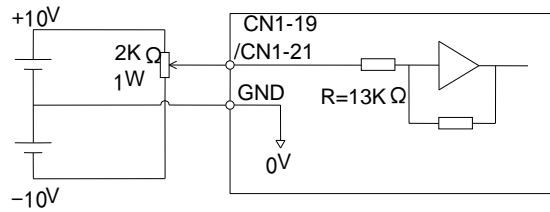
(2) Position command input circuit

➢ Open collector output (power supplied by user)
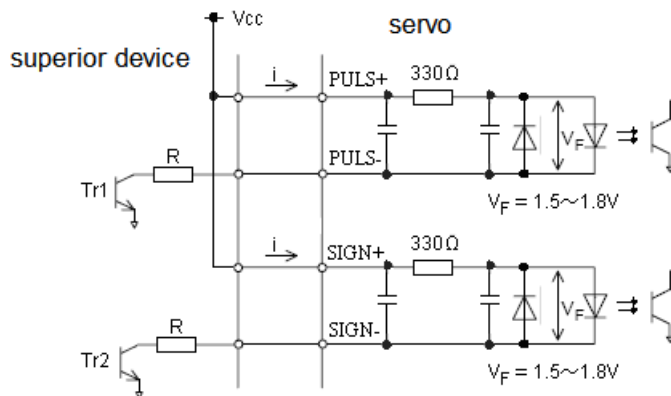
Please refer to below application and set the resistor R (current I is in the range of 7-15mA).

Application		
Vcc =24V ±5% R=2.2kΩ	Vcc =12V ±5% R=1kΩ	Vcc =5V ±5% R=0Ω

➢ Open collector output (power supplied by servo +5V)
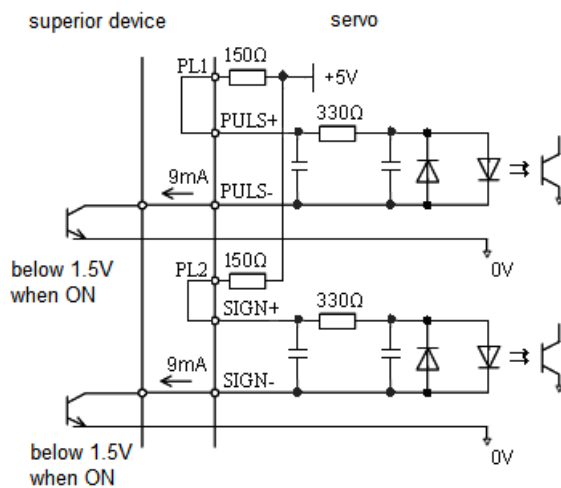
➢ Bus-driver output
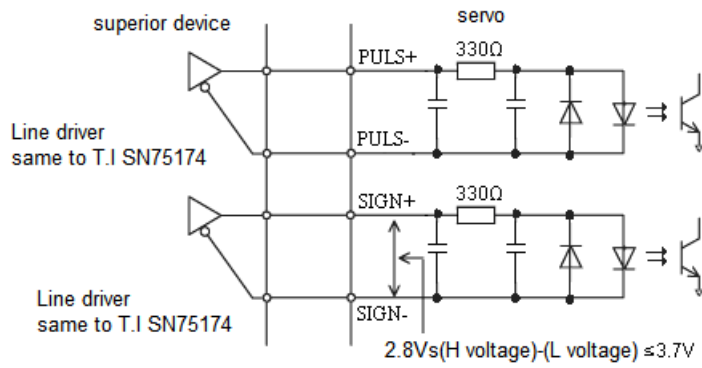
■ The interface with the sequence input circuit

Use relay or open collector transistor circuit to connect. Please choose micro-current relay when using relay. Otherwise, the contactor will be not good.
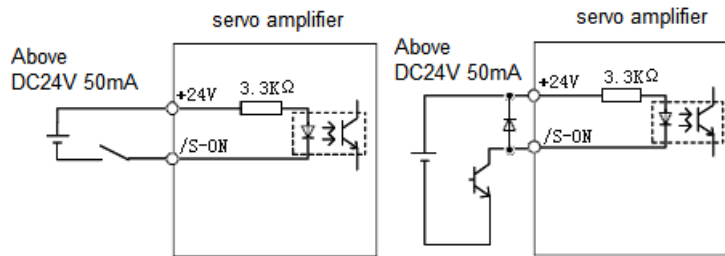
■ The interface with the output circuit

There are 3 kinds of signal output circuit of servo unit.
➢ Connect with bus-driver output circuit
Output encoder 2-phse pulse (AO+, AO-, BO+, BO-) and origin pulse (ZO+, ZO-) through bus-driver output circuit. Generally, it is used when the superior device is position control mode. Please use line receiving circuit at superior device side.
➢ Connect with open collector output circuit
The servo drive support 1 channel origin pulse (Z-phase) transistor output , connect by optocoupler circuit.
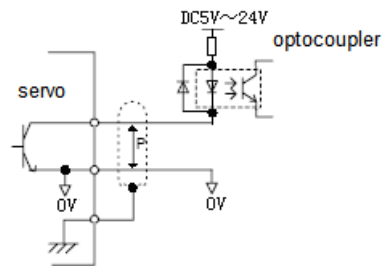
Note: the max current and voltage of open collector output circuit:
Voltage: DC 30V
Current: DC 50mA

➢ Connect with optocoupler output circuit
Servo alarm, servo ready and other sequence output circuit are made up by optocoupler circuit. Connect by relay, line receiving circuit or optocoupler.
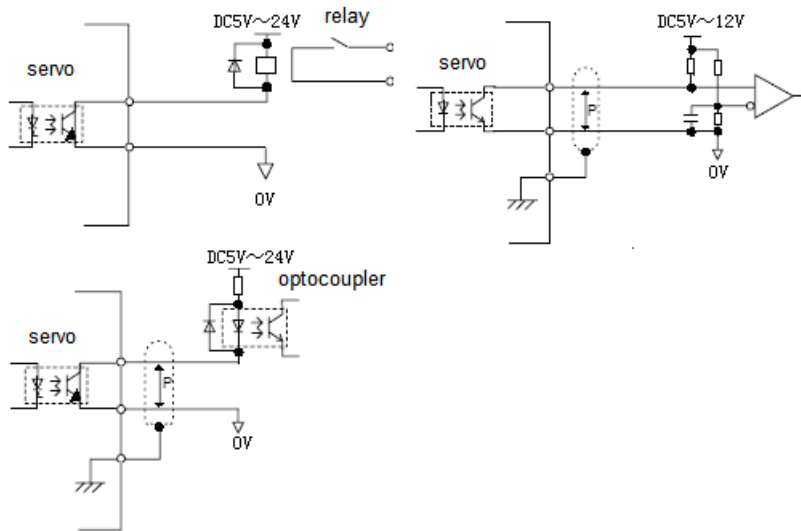
Note: the max current and voltage of optocoupler:
Voltage: DC 30V
Current: DC 50mA

3-3．Wiring Encoders

3-3-1．Encoder Connections
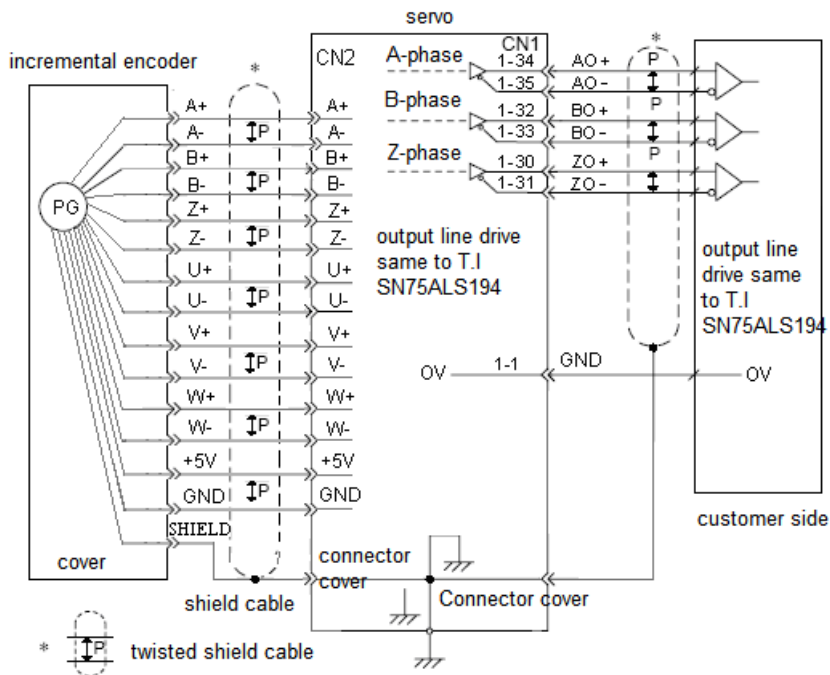
3-3-2．CN2 Encoder Connector Terminal Layout

■ **CN2 Connector Terminal Layout**

The following diagrams are the layout of CN2 connector (face the solder side).
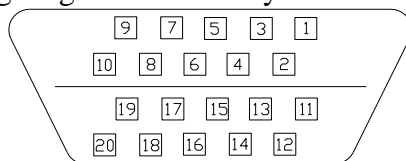
■ **CN2 Connector Terminal Description**

Drive port	Motor encoder port		Name	Drive port	Motor encoder port		Name
	80 series	110/130 series			80 series	110/130 series	
1	9	4	A+	2	13	7	A-
3	4	5	B+	4	14	8	B-
5	7	6	Z+	6	5	9	Z-
7	2	2	+5V	8			+5V
9			+5V	10			+5V
11	6	10	U+	12	8	13	U-
13	10	11	V+	14	12	14	V-
15	11	12	W+	16	15	15	W-
17	3	3	GND	18			GND
19			GND	20			GND
Cover	1	1	Shield cable				

3-4．**Standard connection examples**

In below diagram, the I/O function is default. In actual application, the function can be set, please refer to chapter 4-1-6.

3-4-1. Position control wiring

3-phase AC 220V
(50/60Hz)

FIL

⊕1
⊕2
R
S
T
P+
PB

U
V
W
PE

M

CN2

PG

Well deal with the
shield wire

Position
command

PULS

PULS+ 25
PULS− 24

SIGN

SIGN+ 27
SIGN− 26

10Ω 34 AO+
35 AO−
32 BO+
33 BO−
30 ZO+
31 ZO−
2 CZ
1 GND

Encoder
Signal output

Power for
Open collector
command

PL1 23 150Ω +5V
PL2 28

+24VIN 9 3.3KΩ

Servo enable ON
(servo enable when ON)

/S−ON 17

Paction
(P action when ON)

/P−CON 16

Ban forward run
(ban forward when OFF)

/P−OT 15

Ban reverse run
(ban reverse when OFF)

/N−OT 13

Alarm reset
(clear alarm when ON)

/ALM−RST 12

External torque limit at
forward side
(Limit when ON)

/P−CL 11

External torque limit at reverse side

/N−CL 10

(Limit when ON)

8 COIN+
7 COIN−
6 ALM+
5 ALM−
4 S−RDY+
3 S−RDY−

Self-define the
output terminal

3-4-2．Speed control wiring

3-phase AC220V
(50/60Hz)

FIL

⊕1
⊕2
R
S
T
P+
PB

U
V
W
PE

M

CN2

PG

Well deal with the shield cable

Speed command
±10V/rated speed

V−REF 19
GND 20

A/D

Torque limit input
±10V/rated torque

T−REF 21
GND 22

10Ω 34 AO+
35 AO−
32 BO+
33 BO−
30 ZO+
31 ZO−
2 CZ
1 GND

Encoder
Signal output

+24VIN 9 3.3KΩ

Servo enable ON
(servo enable when ON)

/S−ON 17

Paction
(P action when ON)

/P−CON 16

Ban forward run
(ban forward when OFF)

/P−OT 15

Ban reverse run
(ban reverse when OFF)

/N−OT 13

Alarm reset
(clear alarm when ON)

/ALM−RST 12

External torque limit at
forward side
(Limit when ON)

/P−CL 11

/N−CL 10

External torque limit at reverse side
(Limit when ON)

8 V−CMP+
7 V−CMP−
6 ALM+
5 ALM−
4 S−RDY+
3 S−RDY−

Self-define the
output terminal

3-4-3．Torque control wiring

3-phase AC220V
(50/60Hz)

Well deal with the shield cable

Speed limit input
±10V/rated speed

Torque command
±10V/rated torque

Encoder Signal output

Servo enable ON
(servo enable when ON)
Paction
(P action when ON)
Ban forward run
(ban forward when OFF)
Ban reverse run
(ban reverse when OFF)
Alarm reset
(clear alarm when ON)
External torque limit at
forward side
(Limit when ON)
External torque limit at reverse side
(Limit when ON)

Self-define the output terminal

3-5．Communication Port

3-5-1．Serial Port 1 (COM1)

COM1 supports RS232, and is often used to connect with PC for debugging. Before doing this, "F5-00" on the panel should be set to "C-OUT", and the panel will be invalidated. On leaving this status, use the panel to exit, and PC disconnect from servo driver. Please refer to chapter 5-4-5.

Pin diagram of com1 face to the drive:
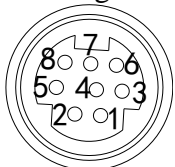
Pin	Name	Explanation
4	RXD	RS232 receive
5	TXD	RS232 send
8	GND	RS232 ground

Communication parameters of COM1 cannot be changed:
Baudrate: 19200bps; Data bits: 8 bits; Stop bits: 1 bit; Parity: even parity; Modbus station number: 1.
Note: please use the cable provided by Xinje Company.

3-5-2．Serial Port 2(COM2)

Serial port 2 supports RS485 and RS232. It supports Modbus-RTU protocol, can realize 1:N communication. It is used to communicate with PLC, HMI. The communication parameters of com2 can be configured.

The pin diagram of com2 faces to drive side:
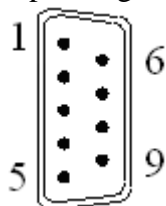
Pin	Name	Explanation
2	RXD	RS232 receive
3	TXD	RS232 send
5	GND	RS232 ground
7	B	RS485－
4	A	RS485＋

Set COM2 parameters via P0-04:

Code	Function	Default	Setting range
P0-04.0	Baud rate	3	0～9 0：300 1：600 2：1200 3：2400 4：4800 5：9600 6：19200 7：38400 8：57600 9：115200
P0-04.1	Data bit	0	0：8
P0-04.2	Stop bit	0	0：1
P0-04.3	Parity bit	2	0～2 0：no parity 1：odd parity 2：even parity

Modbus station number can be set via P0-03:

Parameter Number	Name	Unit	Default Setting	Range
P0-03	Modbus Station Number	-	1	1~255

Note: Parameters above will take effect after repower on.

3-6. Regenerative Resistor

When the servo motor operates in generator mode, power is returned to the servo driver side. This is called regenerative power. The regenerative power is absorbed through charging the smooth capacitor in servo amplifier. But when the capacitor's charging limit is exceeded, the regenerative power needs to be reduced by the regenerative resistor.
The servo motor is driven by regeneration (generator) mode in the following conditions:

➢ The duration of decelerating stop when acceleration/deceleration running.
➢ The load on the vertical axis.
➢ Continuous operation of the servo motor driven from the load side (negative load).

Connecting Regenerative Resistors
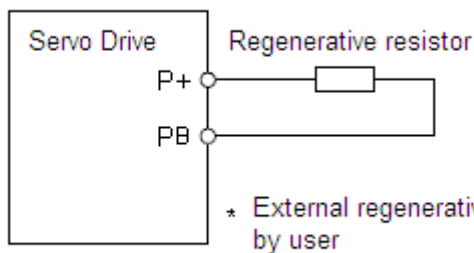
Connect an external regenerative resistor between P+ and PB.

Note: Adequate cooling must be provided for regenerative resistors because they reach very high temperatures. Also use heat-resistant, non-flammable wire and make sure that the wiring does not come into contact with the resistors.

Motor	Recommended Resistor	Recommended Power	Min resistor
MS-80ST-M02430□□-20P7	50Ω	100W	40Ω
MS-110ST-M06030□□-21P8	50Ω	500W	40Ω
MS-130ST-M10015□□-21P5	50Ω	300W	40Ω

Note: The *Recommended Power* means that the value may be suitable to most applications. Nervertheless, in real conditions, actual power could be more or less than the recommended value, please select the value as the actual heating power of resistor.

4 Parameters

This chapter introduces the DS3 servo parameters and operation.

4-1．Parameters

Onset time: "○"servo OFF;
    "●"power on;
    "√"can set during running.
Parameter: PX－XX＝<u>××</u> <u>××</u>
      PX－XX. H ↵ ↳ PX－XX.L

4-1-1. Functions select P0

Modbus address: 0000~00FF

P0-	Function	Unit	Default	Range	Onset time	Chapter
00	Main mode	-	0	0		4-4-1
01	Submode 1	-	0	0~7	○	4-4-1
02	Submode 2	-	0	0~7	○	4-4-1
03	Modbus station NO. of COM2	-	1	1~255	●	3-5-2
04	Parameters of COM2	-	2206	0~2209	●	3-5-2
05	Select rotate direction	-	0	0, 1	●	4-2-1
06	06.L: stop mode of servo OFF or alarm 0: stop by dynamic brake (DB). Keep DB after stop. 1: stop by dynamic brake (DB). Switch to inertia motion after stop. 2: stop inertia motion. Motor is not power on. Stop by mechanical friction.	-	2	0~2	●	4-5-1
	06.H: stop mode when over range(OT). 0: stop by dynamic brake (DB). Switch to inertia motion after stop. 1: inertia stop, keep inertia motion after stop. 2: deceleration stop. Switch to zero clamp after stop. Torque: P4-06. 3: deceleration stop. Switch to inertia motion after stop. Torque: P4-06 urgent stop torque.	-	2	0~3	●	4-2-2
07	T-REF distribution 0: no 1: T-REF is assigned to external torque limit input. 2: undefined. 3: T-REF is assigned to external torque limit input when P-CL, N-CL is ON.	-	0	0~3	○	4-2-4
08	V-REF distribution 0: no 1: V-REF is assigned to external	-	0	0, 1	○	4-2-5

	speed limit input					
09	Reserved	-				
10	Reserved					

4-1-2. Control parameters P1

Modbus address: 0100~01FF

P1-	Name	Unit	Default	Range	Effect time	Chapter
00	Speed loop gain	1Hz	100	1~500	√	4-8-1
01	Speed loop integral time constant	0.1ms	400	1~5000	√	4-8-1
02	Position gain	1/s	30	1~200	√	4-8-1
03	Inertia ratio	%	0	0~20000	√	
04	Second speed loop gain	1Hz	150	1~500	√	4-8-3
05	Second speed loop integral time	0.1ms	100	1~5000	√	4-8-3
06	Second position loop gain	1/s	80	1~200	√	4-8-3
07	Reserved					
08	Reserved					
09	Position loop feedforward gain	1%	0	0~100	√	4-3-2
10	Feedforward filter time	0.01ms	0	0~65535	√	

4-1-3. Position control P2

Modbus address: 0200~02FF

P2-	Function	Unit	Default	Range	Effect time	Chapter
00	Command pulse state 1: AB-phase pulse (90 degree phase, 4 times) 2: sign + pulse	-	2	1, 2	●	4-3-2
01	Position command filter select 0: first-order inertia filter 1: smooth filter	-	0	0, 1	●	4-7-1
02	Electronic gear ratio (molecular)	-	1	1~65535	○	4-3-5
03	Electronic gear ratio (denominator)	-	1	1~65535	○	4-3-5
04	Position command filter time	ms	0	0~100	●	4-7-1
05	Reserved					
06	Command pulse frequency at rated speed	100Hz	5000	1~10000	○	4-3-1
07	Speed command pulse filter time	0.1ms	20	0~1000	√	4-3-1

4-1-4. Speed control P3

Modbus address: 0300~03FF

P3-	Name	Unit	Default	Range	Effect time	Chapter
00	Analog value of rated speed	0.01V	1000	150~3000	○	4-3-1
01	Internal set speed 1	rpm	100	-5000~+5000	√	4-3-6
02	Internal set speed 2	rpm	200	-5000~+5000	√	4-3-6
03	Internal set speed 3	rpm	300	-5000~+5000	√	4-3-6
04	JOG speed	rpm	100	0~1000	√	4-4-4
05	Soft-start speed up time	ms	0	0~65535	○	4-3-6
06	Soft-start speed down time	ms	0	0~65535	○	4-3-6
07	Speed command filter time	0.01ms	0	0~65535	○	
08	Speed feedback filter time	0.01ms	20	0~65535	○	
09	Max speed limit (max speed)	rpm	Rated speed 3000:4000 Rated speed 1500:2000	0~5000	○	

4-1-5. Torque control P4

Modbus address: 0400~04FF

P4-	Name	Unit	Default	Range	Effect time	Chapter
00	Analog value of rated torque	0.01V	1000	150~3000	○	4-3-7
01	Torque command filter time	0.01ms	0	0~65535	○	
02	Forward torque limit	1%	300	0~300	√	4-2-4
03	Reverse torque limit	1%	300	0~300	√	4-2-4
04	Forward external torque limit	1%	100	0~300	√	4-2-4
05	Reverse external torque limit	1%	100	0~300	√	4-2-4
06	Urgent stop torque	1%	300	0~300	○	4-2-2
07	Internal speed limit when torque control	rpm	2000	1~5000	○	4-2-5
08	Reserved					
09	Internal torque command	1%	0	-300~300	√	4-3-7

4-1-6. Signal P5

Modbus address: 0500~05FF

P5-	Name	Unit	Default	Range	Effect time	Chapter
00	Positioning completed width /COIN	Command pulse	7	0~250	○	4-6-3
01	Zero clamp speed /ZCLAMP	rpm	10	0~300	○	4-5-2
02	Rotate check speed /TGON	rpm	20	1~1000	○	4-6-5
03	Same speed signal check width /V-CMP	rpm	10	1~250	○	4-6-4
04	Near signal width /NEAR	Command pulse	50	0~10000	○	4-6-7
05	Bias pulse limit	256* command	1000	0~65535	○	4-8-1

		pulse				
06	Servo OFF delay time(Brake command)	1ms	0	0~500	○	4-2-6
07	Brake command output speed	rpm	100	0~5000	○	4-2-6
08	Brake command wait time	1ms	500	10~1000	○	4-2-6
09	Reserved					
10	10.L: input signal distribution 0: use default set for external input, P5-10.H~P5-17.H are unchangable 1: set external input, P5-10.H~P5-17.H are changeable.	—	1	0, 1	●	4-4-2
	10.H: /S-ON servo signal 00: set signal to invalid. 01: input positive signal to SI1 02: input positive signal to SI2 03: input positive signal to SI3 04: input positive signal to SI4 05: input positive signal to SI5 06: input positive signal to SI6 07: input positive signal to SI7 80: set signal to valid 81: input negative signal to SI1 82: input negative signal to SI2 83: input negative signal to SI3 84: input negative signal to SI4 85: input negative signal to SI5 86: input negative signal to SI6 87: input negative signal to SI7	—	01	00~C7	●	4-6-2
11	11.L: /P-CON proportion action command Ibid	—	02	00~C7	●	4-8-2
	11.H: P-OT ban forward drive Ibid	—	83	00~C7	●	4-2-2
12	12.L: N-OT ban reverse drive Ibid	—	84	00~C7	●	4-2-2
	12.H: /ALM-RST reset alarm Ibid	—	05	00~C7	●	4-6-1
13	13.L: /P-CL external torque limit at forward side Ibid	—	06	00~C7	●	4-2-4
	13.H: /N-CL external torque limit at reverse side Ibid	—	07	00~C7	●	4-2-4
14	14.L: /SPD-D internal speed select Ibid	—	00	00~C7	●	4-3-6
	14.H: /SPD-A internal speed select Ibid	—	00	00~C7	●	4-3-6
15	15.L: /SPD-B internal speed select Ibid	—	00	00~C7	●	4-3-6
	15.H: /C-SEL control mode select Ibid	—	00	00~C7	●	4-4-1
16	16.L: /ZCLAMP zero clamp Ibid	—	00	00~C7	●	4-5-2
	16.H: reserved					
17	17.L: /G-SEL gain switching Ibid	—	00	00~C7	●	4-8-3
	17.H: /CLR clear pulse offset Ibid	—	00	00~C7	●	4-3-2
18	Reserved					
19	Input terminal filter time	5ms	4	0~100	●	

20	20.L: /COIN positioning completed 00: not output to terminal 01: output positive signal from SO1 02: output positive signal from SO2 03: output positive signal from SO3 81: output negative signal from SO1 82: output negative signal from SO2 83: output negative signal from SO3	—	01	00~83	●	4-6-3
	20.H: /V-CMP same speed checking Ibid	—	00	00~83	●	4-6-4
21	21.L: /TGON rotation checking Ibid	—	00	00~83	●	4-6-5
	21.H: /S-RDY ready Ibid	—	03	00~83	●	4-6-6
22	22.L: /CLT torque limit Ibid	—	00	00~83	●	4-2-4
	22.H: /VLT speed limit checking Ibid	—	00	00~83	●	4-2-5
23	23.L: /BK brake interlocking Ibid	—	00	00~83	●	4-2-6
	23.H: /WARN warn Ibid	—	00	00~83	●	4-6-8
24	24.L: /NEAR near Ibid	—	00	00~83	●	4-6-7
	24.H: /ALM alarm Ibid	—	02	00~83	●	4-6-1
25	Reserved					

4-2．Mechanical setting

4-2-1. Switch motor direction

The reverse mode can change motor rotation direction without changing the motor wiring. The servo encoder AB-phase output changed at this time. Default setting is forward direction, the motor is rotating counterclockwise.

	Default setting	Reverse mode
Forward command		
Reverse command		

● **Reverse mode setting**
Set reverse mode through P0-05.

Parameter	Function	Unit	Range	Default
P0-05	Select motor rotate direction	-	0, 1	0

P0-05	Contents	
0	CCW is forward direction, look at motor load side	Default value
1	CW is forward direction, look at motor load side	Reverse mode

Note: please repower on the servo to make the setting effective.

## 4-2-2. Overrange setting (P-OT, N-OT)

Overrange function can stop the machine when it exceeds the movable range.

● **Overrange function**

Connect P-OT, N-OT (input signal of limit switch) to CN1 of servo.

Input signal	Function	Control mode
P-OT	Forward drive limit switch (forward overrange)	Speed control, torque control, position control
N-OT	Reverse drive limit switch (reverse overrange)	Speed control, torque control, position control

Please connect limit switch as the following diagram to avoid machine damage when line driving.
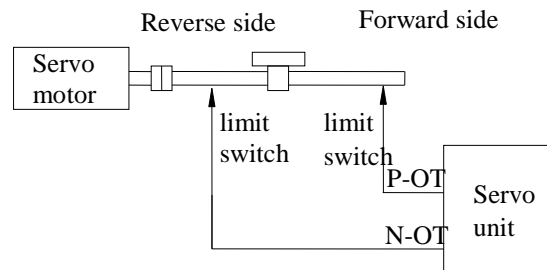
Driving state when P-OT, N-OT are ON/OFF.

Input signal	Input state	Input mode	Terminal state		Description
/P-OT (P5-11.H)	ON Signal valid	Input positive signal	CN1-9 connect to 24V	SI=0V (optocoupler ON)	Ban forward drive. (reverse is valid)
		Input negative signal		SI=24V or cut off (optocoupler OFF)	
	OFF Signal invalid	Input positive signal		SI=24V or cut off (optocoupler OFF)	Enable forward drive. (normal running state)
		Input negative signal		SI=0V (optocoupler ON)	
/N-OT (P5-12.L)	ON Signal valid	Input positive signal	CN1-9 connect to 24V	SI=0V (optocoupler ON)	Ban reverse drive. (forward is valid)
		Input negative signal		SI=24V or cut off (optocoupler OFF)	
	OFF Signal invalid	Input positive signal		SI=24V or cut off (optocoupler OFF)	Enable reverse drive. (normal running state)
		Input negative signal		SI=0V (optocoupler ON)	

● **Use/unused overrange signal**

Set below parameter to select use/unused overrange signal. The default value is to use overrange signal.

Parameter	Explanation	Unit	Range	Default
P5-11.H	P-OT always protect: set P5-11.H to 80, rarely used. P-OT always not protect: set P5-11.H to 00, used when no limit protection. Terminal protect: assign bit0 of P5-11.H to	-	00~C7	83

	SI1~SI7 input terminal; bit8 of P5-11.H select always ON/OFF of limit switch, 8 is always ON, 0 is always OFF.			
P5-12.L	N-OT always protect: set P5-12.L to 80, rarely used. N-OT always not protect: set P5-12.L to 00, used when no limit protection. Terminal protect: assign bit0 of P5-12.L to SI1~SI7 input terminal; bit8 of P5-12.L select always ON/OFF of limit switch. 8 is always ON, 0 is always OFF.	-	00~C7	84

Note: stranded pulse will produce after motor stop by overrange function in position control mode. Clear the stranded pulse by clear signal.

● **Motor stop mode when overrange**

Motor stop mode when using overrange function.

Parameter	Function	Unit	Range	Default
P0-06.H	Motor stop mode when servo is overrange	-	0~3	2

P0-06.H value	Contents
0	Stop by dynamic brake (DB). Change to inertia motion after stop.
1	Inertia stops. Keep inertia motion after stop.
2	Deceleration stops. Change to zero clamp after stop. Torque setting: P4-06 urgent stop torque.
3	Deceleration stops. Change to inertia motion after stop. Torque setting: P4-06 urgent stop torque.

Note:

1. If P0-06.H=0/1, servo enable signal is forced set to 0 when overrange signal arrives;

If P0-06.H=3, servo enable signal is forced set to 0 after motor stop when overrange signal arrives;

If P0-06.H=2, servo enable signal will not be forced set to 0 as long as it is always effective.

2. Stop judging is based on rotate speed P5-02 (unit: rpm).

4-2-3. Motor stop mode when servo is OFF

DS series servo drive will close servo enable in these cases:

- Power supply is ON, input signal is OFF (/S-ON)
- Alarming (/ALM)
- Power supply is OFF

Parameter	Function	Unit	Range	Default
P0-06.L	Motor stop mode when servo is OFF	-	0~2	2

P0-06.L	Contents
0	Stop by dynamic brake (DB). Keep DB state after stop.
1	Stop by dynamic brake (DB). Change to inertia motion after stop.
2	Stop inertia motion. Motor is power off. Stop by mechanical friction.

Please refer to chapter 4-5-1 for DB brake.

4-2-4. Torque limit

Torque control, speed contrl and position control have torque limit function.
Torque output exceeds limit value, /CLT signal will be ON. Parameter P5-22.L can assign /CLT to any terminal among SO1~SO3.

Signal name	Output state	Output mode	Terminal state		Description
/CLT (P5-22.L)	Output is ON, signal is valid	Output positive signal	DS3	S0+ and S0- pass through	Torque is overrange
		Output negative signal		S0+ and S0- shut off	
	Output is OFF, signal is invalid	Output positive signal	DS3	S0+ and S0- shut off	Torque is normal
		Output negative signal		S0+ and S0- pass through	

DS series servo has 4 kinds of torque limit modes:
1. Internal torque limit
2. External torque limit
3. Torque limit based on analog (T-REF)
4. Torque limit based on external torque limit and analog (T-REF)

- **Internal torque limit (max output torque limit)**

Internal torque limit is to limit the the max output torque via parameter.

Parameter	Function	Unit	Range	Default	Control mode
P4-02	Forward torque limit	1%	0~300	300	Speed control, position control
P4-03	Reverse torque limit	1%	0~300	300	Speed control, position control

The setting of the parameters is always effective. The setting unit is percentage of motor rated torque.
If the setting value exceeds the max motor torque, it will limit the motor as the actual max torque. The default value is 300%.
Note: if P4-02 and P4-03 are set too small, the torque will be not enough when motor accelerates or decelerates.

- **External torque limit via input signal**

External torque limit is used when machine needs torque limit or it needs torque limit at certain moment. For example, the applications of press stop action or robot workpiece holding. The parameters will be effective by the input signal.

Parameter	Function	Unit	Range	Default	Control mode
P4-04	Forward external torque limit	1%	0~300	100	Speed control, torque control, position control
P4-05	Reverse external torque limit	1%	0~300	100	Speed control, torque control, position control

Note: the unit is percentage of rated motor torque. The limit of rated torque is 100%.

Signal	Input state	Input mode	Terminal state		Description
/P-CL (P5-13.L)	ON, signal is valid	Input positive signal	CN1-9 connect to 24V	SI=0V (optocoupler ON)	Forward external torque limit, limit value P4-02 or P4-04 (limit the minor one)
		Input negative signal		SI=24V or cut off (optocoupler OFF)	

				SI=24V or cut off (optocoupler OFF)	Forward external torque not limit (use internal torque limit P4-02)
	OFF, signal is invalid	Input positive signal			
		Input negative signal		SI=0V (optocoupler ON)	
/N-CL (P5-13.H)	ON, signal is valid	Input positive signal	CN1-9 connect to 24V	SI=0V (optocoupler ON)	Reverse external torque limit, limit value P4-03 or P4-05 (limit the minor one)
		Input negative signal		SI=24V or cut off (optocoupler OFF)	
	OFF, signal is invalid	Input positive signal		SI=24V or cut off (optocoupler OFF)	Reverse external torque not limit (use internal torque limit P4-03)
		Input negative signal		SI=0V (optocoupler ON)	

- **Torque limit by analog voltage command**

The function is to limit the torque by analog voltage command. Input the analog voltage command to terminal T-REF. this function only can be used in speed control or position control mode.

The diagram of using this function in speed control mode:
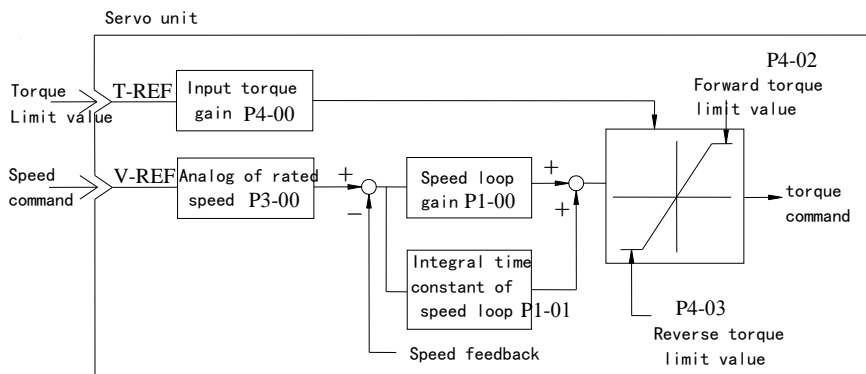
Note: the analog voltage for torque limit has no polarity. It is fit for forward and reverse direction.

Parameter	Function	Unit	Range	Default
P0-07	T-REF distribution	-	0~3	0

0: no

1: T-REF is used to external torque limit input.

2: un-defined

3: When P-CL, N-CL are ON, T-REF is used to external torque limit input.

Here we set P0-07 to 1. Set rated torque analog value via P4-00

- **Torque control by external torque limit and analog voltage command**

When /P-CL or /N-CL is ON, limit the torque by the min value among analog voltage command, internal torque limit value and external torque limit value.
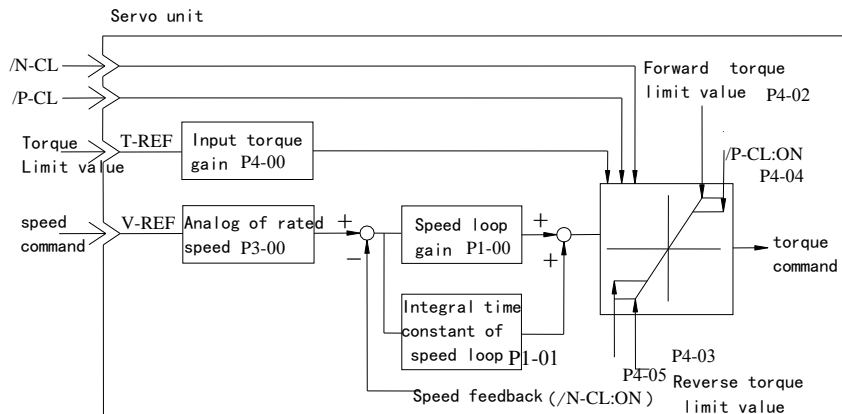
Parameter	Function	Unit	Range	Default
P0-07	T-REF distribution	-	0~3	0

Here, we set P0-07 to 3.

Parameter	Function	Unit	Range	Default	Control mode
P4-04	Forward external torque limit	1%	0~300	100	Speed/torque/position control
P4-05	Reverse external torque limit	1%	0~300	100	Speed/torque/position control

Input signal:

Signal	Input state	Input mode	Terminal state		Description
/P-CL (P5-13.L)	ON, signal is valid	Input positive signal	CN1-9 connect to 24V	SI=0V (optocoupler ON)	Forward external torque limit, limit value P4-02 or P4-04 (limit the minor one)
		Input negative signal		SI=24V or cut off (optocoupler OFF)	
	OFF, signal is invalid	Input positive signal		SI=24V or cut off (optocoupler OFF)	Forward external torque not limit (use internal torque limit P4-02)
		Input negative signal		SI=0V (optocoupler ON)	
/N-CL (P5-13.H)	ON, signal is valid	Input positive signal	CN1-9 connect to 24V	SI=0V (optocoupler ON)	Reverse external torque limit, limit value P4-03 or P4-05 (limit the minor one)
		Input negative signal		SI=24V or cut off (optocoupler OFF)	
	OFF, signal is	Input positive signal		SI=24V or cut off	Reverse external torque not limit (use internal

	invalid			(optocoupler OFF)	torque limit P4-03)
		Input negative signal		SI=0V (optocoupler ON)	

4-2-5. Speed limit in torque control mode

It outputs /VLT signal to limit the speed in torque control mode.

Signal	Output state	Output mode	Terminal state		Description
/VLT	Output is ON,signal is valid	Output positive signal	DS3	S0+ and S0- pass through	Speed over-range
		Output negative signal		S0+ and S0- shut off	
	Output is OFF, signal is invalid	Output positive signal	DS3	S0+ and S0- shut off	Speed normal
		Output negative signal		S0+ and S0- pass through	

Below parameter will assign the /VLT signal to the output terminal:

Parameter	Function	Unit	Range	Default
P5-22.H	Output terminal distribution /VLT	-	00~83	00

The default setting is 00, output between SO1+ and SO1-. Please see chapter 4-4-3 for details.

- **Internal speed limit**

Parameter	Function	Unit	Range	Default	Control mode
P4-07	Set the limit speed	rpm	0~5000	2000	Torque control

- **External speed limit analog value**

P0-08 is set to 1; V-REF is set to external speed limit input. The final limit value is the smaller one between P4-07 and V-REF.

4-2-6. Power-off brake (BK)

BK is used when servo controls the vertical shaft. The purpose to use servo motor with brake: when the power supply is OFF, the movable part will not move by gravity.

Servo motor

Power-off brake

Prevent part moving by gravity when power is off
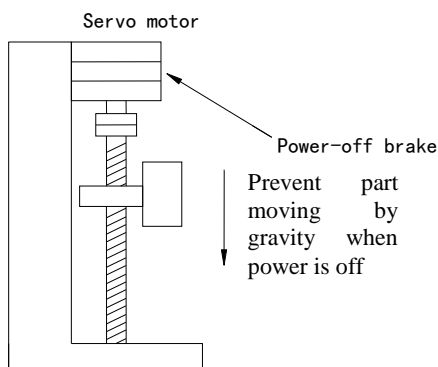
The power-off brake in MS series servo motor is no excitation model. It cannot be used to brake but only to keep the stop state of motor. The torque of this brake is above 120% of rated torque of servo motor.

- **Wiring example**

The brake ON/OFF circuit includes /BK output signal and brake power supply. Typical wiring diagram is shown below:
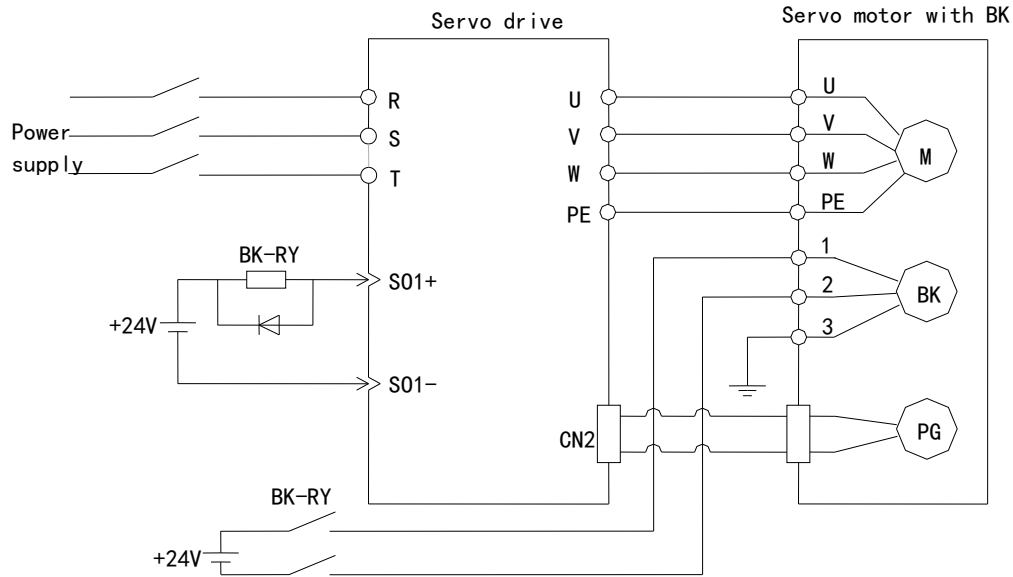
Note:
1. The power supply of BK is DC 24V.
2. SO1+ and SO1- are the terminals of DS3.

In above diagram, SO1 terminal outputs BK signal, set P5-23.L to 81.

Output signal	State	Control mode
BK	Brake interlocking output	Speed/position/torque mode

Signal name	Output state	Output mode	Terminal state		Description
/BK	Output is ON, signal is valid	Output positive signal	DS3	S0+ and S0- pass through	Brake close (brake)
		Output negative signal		S0+ and S0- shut off	
	Output is OFF, signal is invalid	Output positive signal	DS3	S0+ and S0- shut off	Brake open
		Output negative signal		S0+ and S0- pass through	

- **Servo OFF delay time (after servo motor stop)**

The machine will move with gravity because of servo OFF delay time. Please use below parameter to adjust.

Parameter	Function	Unit	Range	Default	Control mode
P5-06	Servo OFF delay time (brake command)	1ms	0~500	0	Speed/torque/position control

The time of servo OFF and /BK output when set servo motor with brake.

| /S-ON input |
| Servo ON | Servo OFF |

| /BK output |
| Brake OFF | Brake ON |

| Motor power on |
| Motor power on | Motor power off |

Servo OFF
delay time
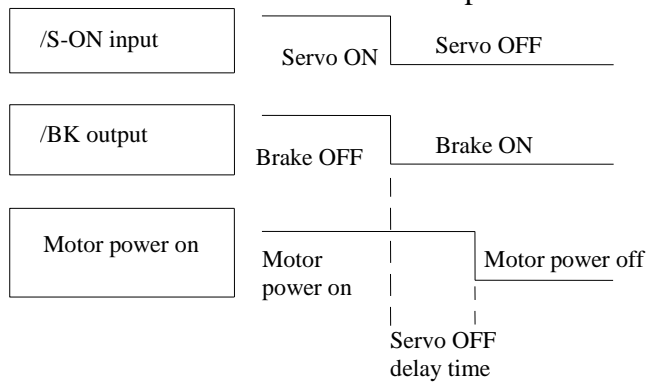
The standard setting is that /BK output and servo OFF at the same time. But the machine will move with gravity at this time. Delay the servo OFF by parameter can avoid the movement.
The setting is the time when servo motor stop.

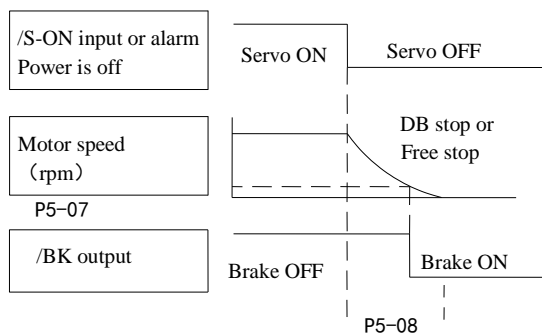- **Brake ON parameter (servo motor is rotating)**

The brake action is P5-07 and P5-08 when servo motor is rotating.
Note: motor will be power off when alarming. The machine will move because of gravity before brake is ON.
Use power-off brake when motor stops rotating. Please set below parameters:

Parameter	Function	Unit	Range	Default	Control mdoe
P5-07	Brake command output speed	rpm	0~5000	100	Speed/torque/position control
P5-08	Brake command wait time	1ms	10~1000	500	Speed/torque/position control

Set the brake time of servo OFF when inputing /S-ON or alarming.

| /S-ON input or alarm Power is off |
| Servo ON | Servo OFF |

| Motor speed （rpm） |
| | DB stop or Free stop |
P5-07

| /BK output |
| Brake OFF | Brake ON |

P5-08

The brake is used to keep the position, it must work at the right time when motor stop.
Please set the parameter as the machine movement.
The condition of /BK change ON to OFF when motor is rotating:
1. Motor speed is lower than P5-07 after servo is OFF
2. the time is larger than P5-08 after servo is OFF
If the set speed is larger than max speed in P5-07, the real value is always max speed.
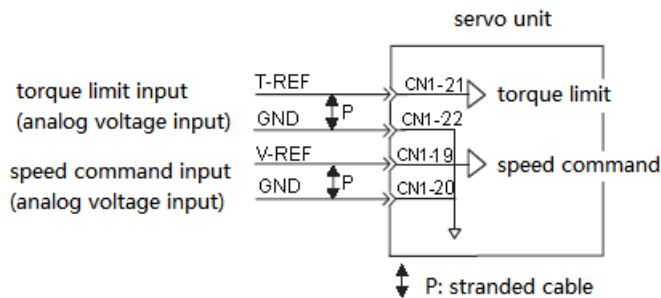
4-3．The setting fit for superior device

4-3-1. Speed command

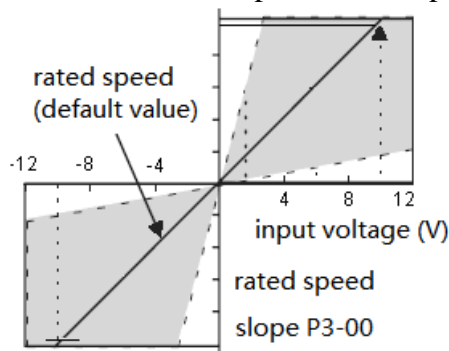Speed command is transferred to speed command input terminal (see below diagram).
1. Analog input

Input signal	State	Control mode
V-REF	Speed command input	Speed control
GND	Ground	Speed control

It is used to speed control (analog command). Make sure to wiring in normal speed control mode.
Control the motor speed as the input voltage between V-REF and GND.
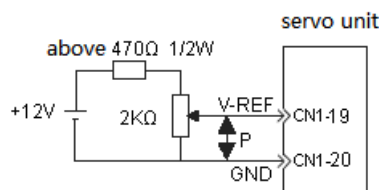

● **Setting example**
P3-00 = 600, 6V corresponding speed.
Please see below example.

| Speed command	Direction	Speed	For motor of 3000rpm
+6V	Forward	Rated speed	3000rpm
+1V	Forward	1/6 of rated speed	500rpm
-3V	Reverse	-(1/2) of rated speed	-1500rpm

Change the input voltage range via P3-00.

● **Example of input circuit**
Make sure to use stranded wire to avoid interference.
Please connect to the speed command output terminal of host machine in position control mode.
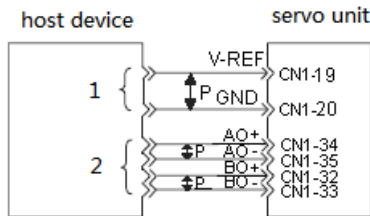
P: stranded wire
1. speed command output
2. feedback pulse input

Please adjust the value of P3-00 as the output voltage.

Adjust the input gain of speed command via below parameter.

Parameter	Function	Unit	Range	Default	Control mode
P3-00	Analog value of rated speed	0.01V	150~3000	1000	Speed control, torque control

Set the voltage range of speed command V-REF according to the host device and output condition.
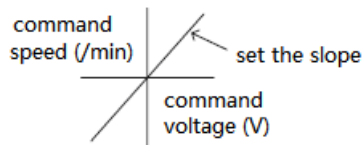
The command voltage is set to 10V when out of factory.

2. Input pulse frequency

The speed command is decided by external pulse frerquency, but not pulse quantity.

The circuit wiring is the same to position command. AB-phase pulse (4-time frequency) and direction plus pulse can be selected.

Select pulse mode via below parameter:

Parameter	Function	Unit	Range	Default	Control mode
P2-00	Pulse command mode	-	1, 2	2	Position control, speed control

Please select the pulse command mode as the host device condition:

Parameter	Set value	Pulse mode
P2-00	1	AB-phase pulse (4-time frequency)
	2	Pulse plus direction

Adjust the input gain of pulse frequency speed command by below parameter:

Parameter	Function	Unit	Range	Default	Control mode
P2-06	Pulse frequency of rated speed	100Hz	1~10000	5000	Speed control

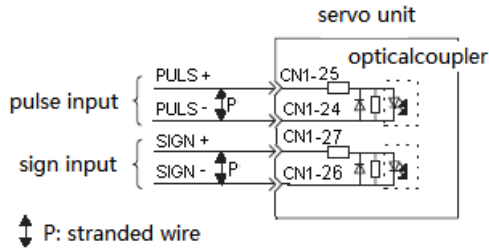Adjust the filter time of pulse frequency speed command by below parameter:

Parameter	Function	Unit	Range	Default	Control mode
P2-07	Filter time of speed command	0.1ms	0~1000	20	Speed control

4-3-2．Position command

The position commands contain pulse input, sign input, clear input.

● **Pulse input command**

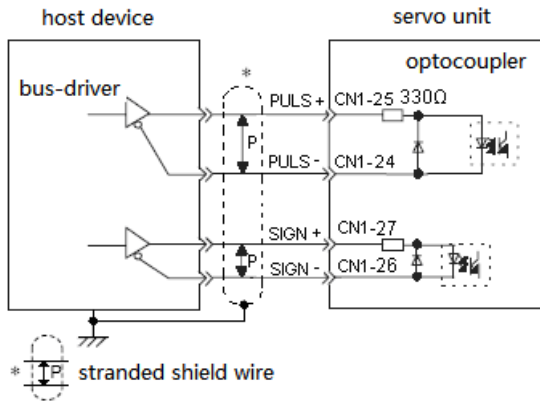It is fit for the following input conditions.
 Bus-driver input
 the host device provides power, open collector input
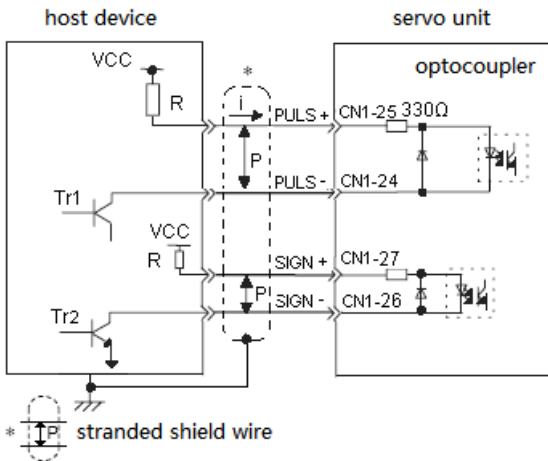 servo unit provides power, open collector input

● **Wiring example**
E1: Bus-driver output
Suitable bus-driver: TI SN75174 or MC3487

E2: open collector output (host device provides power)

Please select the right R value for different input current range.
Input current i= 7~15mA

Vcc =24V $\pm$5% R=2.2kΩ	Vcc =12V $\pm$5% R=1kΩ	Vcc =5V $\pm$5% R=0Ω

Note: the signal principle is shown below in open collector circuit:

Tr1, Tr2 is ON	ON signal input
Tr1, Tr2 is OFF	OFF signal input

E3: open collector output (servo provides power)
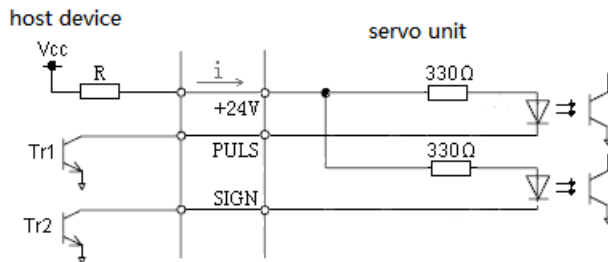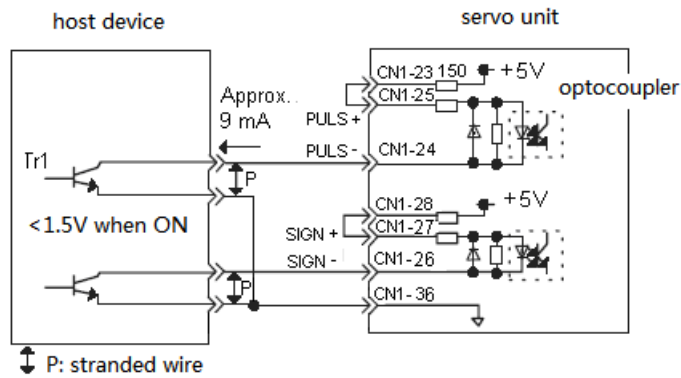
● **The state of pulse command**

Please set the pulse command state via below parameter:

Parameter	Function	Unit	Range	Default	Control mode
P2-00	Pulse command state	-	1, 2	2	Position mode, speed mode

The state of pulse command:

Parameter	Settings	State
P2-00	1	AB-phase pulse (4-time frequency)
	2	Pulse + direction

AB-phase pulse (4-time frequency):
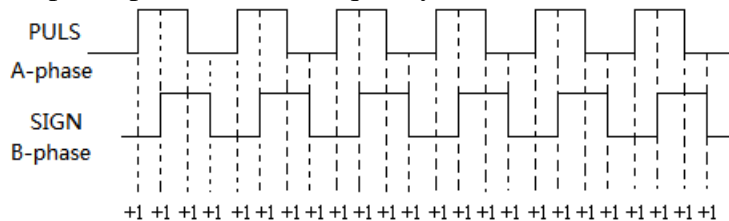
The time of pulse command signal:

State of pulse command	Electrical specification	Mark
Sign + pulse (SIGN+PULS signal) Max frerquency: Bus-driver: 500kbps Open transistor: 200kbps	$t1, t2 \leq 0.1\mu s$ $t3, t7 \leq 0.1\mu s$ $t4, t5, t6 > 3\mu s$ $\tau \geq 2.5\mu s$ $(\tau/T) \times 100 = 40\% \sim 60\%$	SIGN 1=forward 0=reverse
90°phase difference 2-phase pulse (A-phase +B-phase) Max frequency: Bus-driver: 500kbps Open transistor: 200kbps		

| | | | | t1，t2 ≤ 0.1μs
τ≥ 2.5μs
(τ/T) × 100 = 40% ~ 60% | |

- **Clear pulse input /CLR**

Signal	Input state	Input mode	Terminal state		Description
/CLR	ON, signal is valid	Input positive signal	CN1-9 connects to 24V	SI=0V (optocoupler is ON)	Clear the shift counter
		Input negative signal		SI=24V or cut off (optocoupler is OFF)	
	OFF, signal is invalid	Input positive signal		SI=24V or cut off (optocoupler is OFF)	Work normally, not clear shift counter
		Input negative signal		SI=0V (optocoupler is ON)	

After set ON /CLR signal, shift counter is set to 0, and position loop is set to current position.

- **Control diagram**

Servo unit (position control mode)
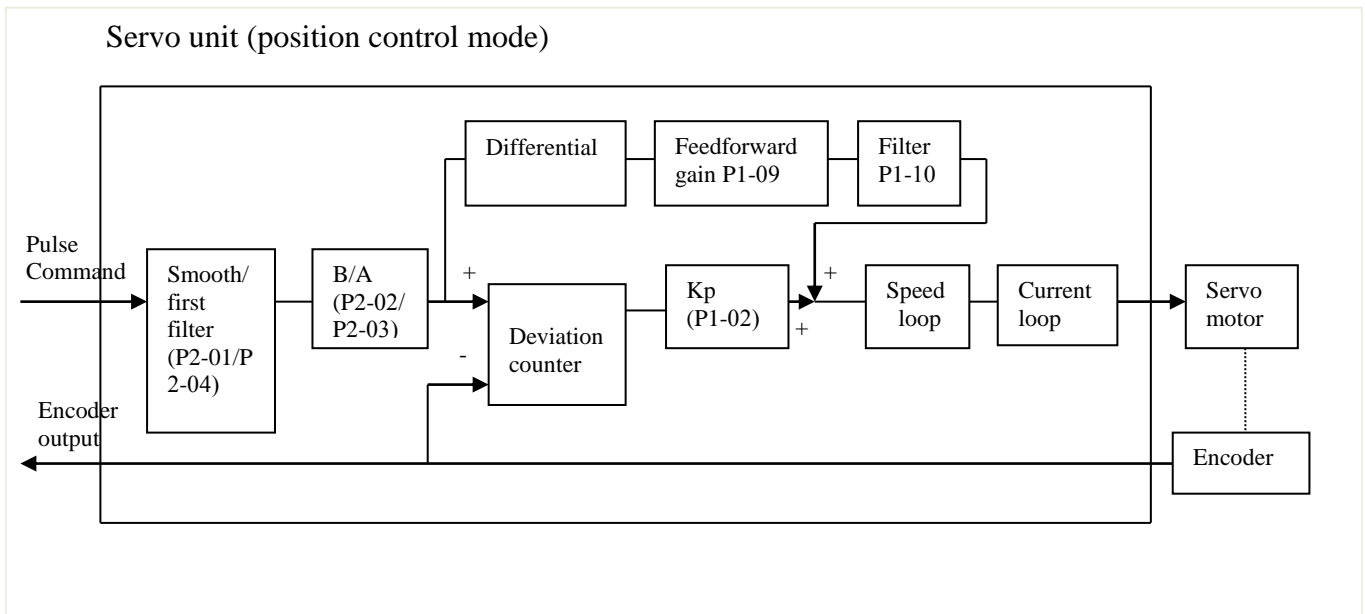
4-3-3．Encoder position output

DS3 series can output encoder position. This function can be used to configure the position loop in the host device.
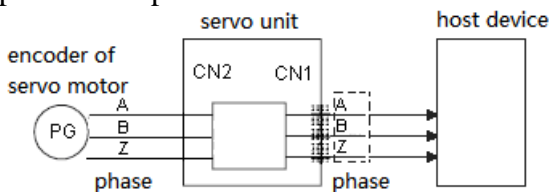
The output circuit is bus-driver output. Please wiring as the following circuit.
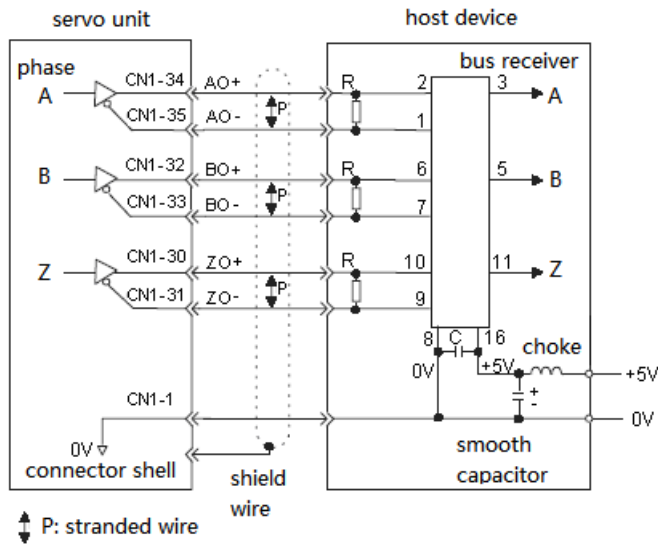
Suitable line receiver: same product of TI SN7517.5 or MC3486
R (terminal resistor): 220~470Ω
C (decoupling capacitor): 0.1 μF

- **Output signal**

Connect the output signal when the host device needs to configure the position loop and make position controlling.

4-3-4．Sequence I/O signal

The sequence I/O signal can control the servo action. Please connect them as your needs.

- **The wiring of input signal**

- **The wiring of output signal**

optocoupler output:
max voltage: DC30V
max current: DC50mA

4-3-5．Electronic gear

Electronic gear function can set the motor moving distance to any value. The host device which sends the command don't need to consider the deceleration ratio and encoder pulse quantity.。
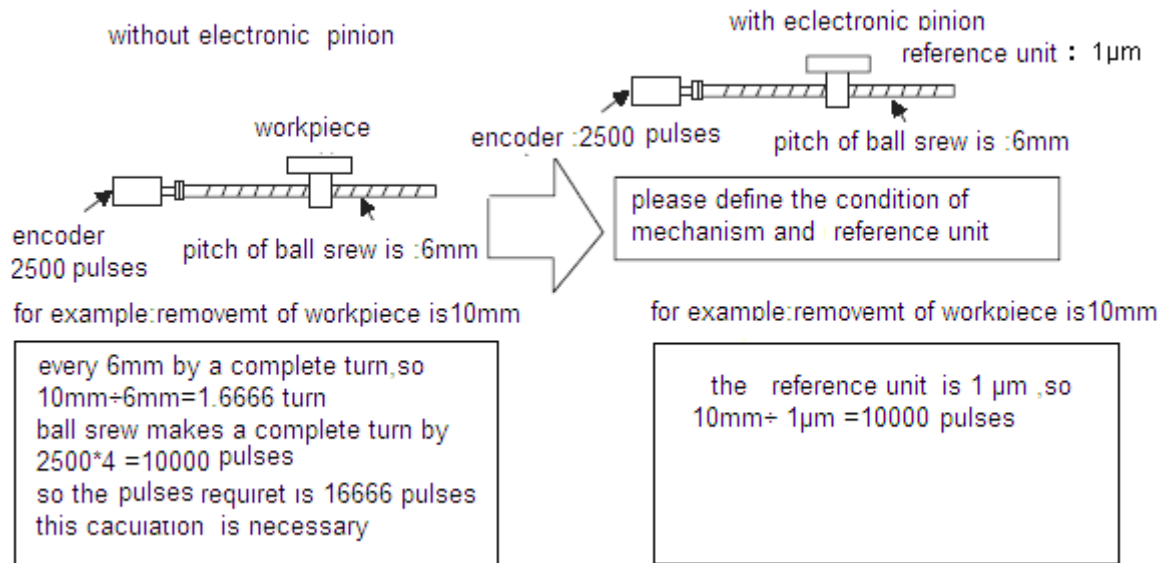
- **Set the electronic gear**

Calculate the electronic gear ratio (B/A) using the following procedure, and set the values in parameters P2-02 and P2-03.

1. Check equipment specifications related to the electronic gear:
   - ➢ Deceleration ratio
   - ➢ Ball screw pitch
   - ➢ Pulley diameter

2. Check the number of encoder pulses for the servo motor.

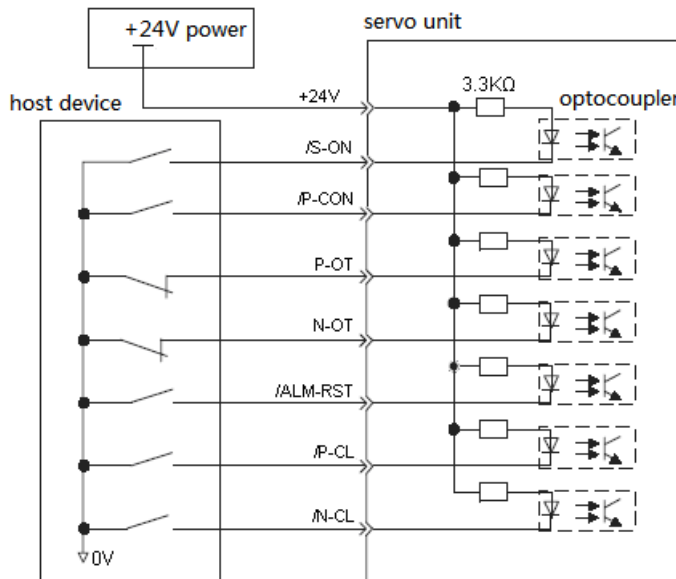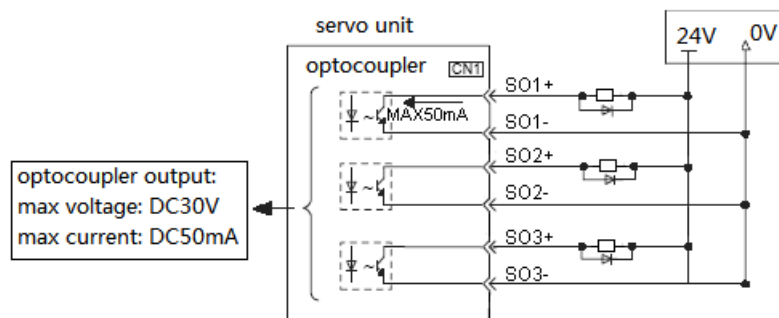3. Determine the reference unit.

   A reference unit is the minimum position unit used to move a load (Minimum unit of the host device).
   - ➢ Reference unit can be 0.1in or 0.01in or 0.01mm or 0.001mm, etc.
   - ➢ Input one pulse command, the device moves 1 reference unit distance.
   - ➢ When the reference unit is 1 μm, input 50000 reference units, the load moves 50000 $\times$ 1 μm = 50mm.

4. Find the reference unit of load shaft turning 1 circle.

The reference unit of load shaft turning 1 circle is:
The moving distance of load shaft turning 1 circle/reference unit
For example: ball screw pitch=5mm, reference unit=0.001mm, so 5/0.001=5000.

Ball Screw	Disc Table	Belt and Pulley
load shaft ← P → 1 revolution= $\dfrac{P}{\text{reference unit}}$ note: p means pitch	load shaft 1 revolution= $\dfrac{360°}{\text{reference unit}}$	load shaft πD 1 revolution= $\dfrac{\pi D}{\text{reference unit}}$ D：dia. of pulley

5. Find the electronic gear ratio (B/A):

The ratio of motor shaft and load shaft is m/n (motor turns m circles, load shaft turns n circles)

$$\text{electronic gear ratio} \left(\frac{B}{A}\right) = \frac{\text{encoder pulses} \times 4}{\text{reference unit of load shaft turning one circle}} \times \frac{m}{n}$$

Please confirm if the electronic gear meets the below condition:

$$0.01 \le \text{Electronic Gear Ratio} \left(\frac{B}{A}\right) \le 100$$

The servo driver will not work properly if the electronic gear ratio exceeds this range. In that case, modify either the mechanical structure or the reference unit.

6. Set the parameters

Reduce the electronic gear ratio to the lower terms, both A and B are integers smaller than 65535, then set A and B as the parameters:

$$\left(\frac{B}{A}\right) \longrightarrow \begin{array}{l|l} \text{P2-02} & \text{Electronic Gear Ratio (Numerator)} \\ \hline \text{P2-03} & \text{Electronic Gear Ratio (Denominator)} \end{array}$$
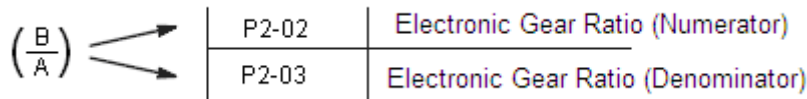
Parameter	Name	Unit	Setting Range	Default Setting	Control Mode
P2-02	Electronic Gear Ratio (Numerator)	-	1~65535	1	Position Control
P2-03	Electronic Gear Ratio (Denominator)	-	1~65535	1	Position Control

- **Example of setting electronic gear**

The example for different loads:

Ball screw

reference unit: 0.001mm

$$\text{distance of load shaft turning 1 circle} = \frac{6mm}{0.01mm} = 6000$$

load shaft

2500 ppr incremental encoder

ball screw pitch: 6mm
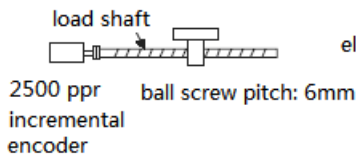
$$\text{electronic gear ratio} \left(\frac{B}{A}\right) = \frac{2500 \times 4 \times 1}{6000 \times 1} = \frac{\text{P2-02}}{\text{P2-03}}$$

Settings	P2-02	10000
	P2-03	6000

Circular table

reference unit: 0.1°

deceleration ratio 3:1

load shaft

2500 ppr incremental encoder

$$\text{distance of load shaft turning 1 circle} = \frac{360°}{0.1°} = 3600$$
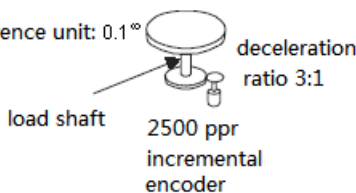
$$\text{electronic gear ratio} \left(\frac{B}{A}\right) = \frac{2500 \times 4 \times 3}{3600 \times 1} = \frac{\text{P2-02}}{\text{P2-03}}$$

Settings	P2-02	30000
	P2-03	3600

Belts and pulleys

reference unit: 0.02mm

load shaft

deceleration ratio 2:1

pulley diameter 100mm

2500 ppr incremental encoder

distance of load shaft turning 1 circle $= \dfrac{3.14 \times 100mm}{0.02mm} = 15700$

electronic gear ratio $\left(\dfrac{B}{A}\right) = \dfrac{2500 \times 4 \times 2}{15700 \times 1} = \dfrac{P2\text{-}02}{P2\text{-}03}$

Settings	P2-02	20000
	P2-03	15700

4-3-6．Internal speed settings

Set 3 kinds of speed inside the servo, and select one of them by terminal command.
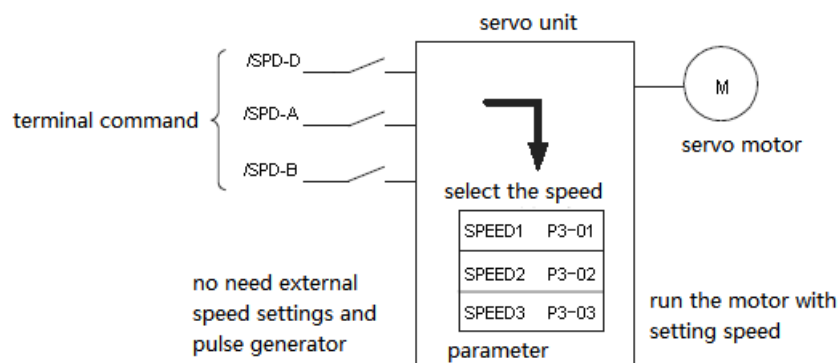
● **Use the internal speed settings**

Please follow the step from 1 to 3.

1. Set below parameter

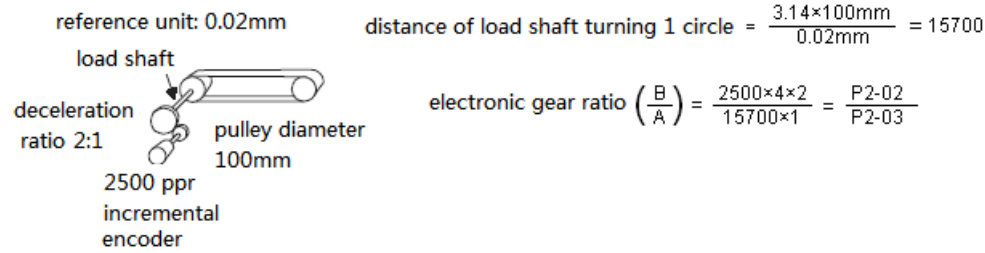| Parameter	Function	Default	Range	Settings
P0-00	Main mode	0	0	0
P0-01	Sub mode 1	0	0~7	3: speed (terminal command)
P0-02	Sub mode 2	0	0~7	

The following input signals will change in internal speed settings:

Sub mode	Contents	Input signal			
		/SPD-D	/SPD-A	/SPD-B	Speed settings
Speed (terminal command)	Use internal speed settings	direction 0: forward 1: reverse	0	0	0 command (run at the speed of 0)
			0	1	V-REF1 (P3-01)
			1	1	V-REF2 (P3-02)
			1	0	V-REF3 (P3-03)

Note: 0: OFF, 1: ON.

2. Set the running speed

Parameter	Function	Unit	Default	Range	Control mode
P3-01	1st speed (V-REF1) (internal speed settings)	rpm	100	-5000 ~ +5000	Speed control
P3-02	2nd speed (V-REF2) (internal speed settings)	rpm	200	-5000 ~ +5000	Speed control
P3-03	3rd speed (V-REF3) (internal speed settings)	rpm	300	-5000 ~ +5000	Speed control

If the speed setting is larger than MAX speed, the motor will run at MAX speed.

To run the motor by the speed selection signal /SPD-A, /SPD-B and direction signal

SPD-D.

3. Set the soft-start time

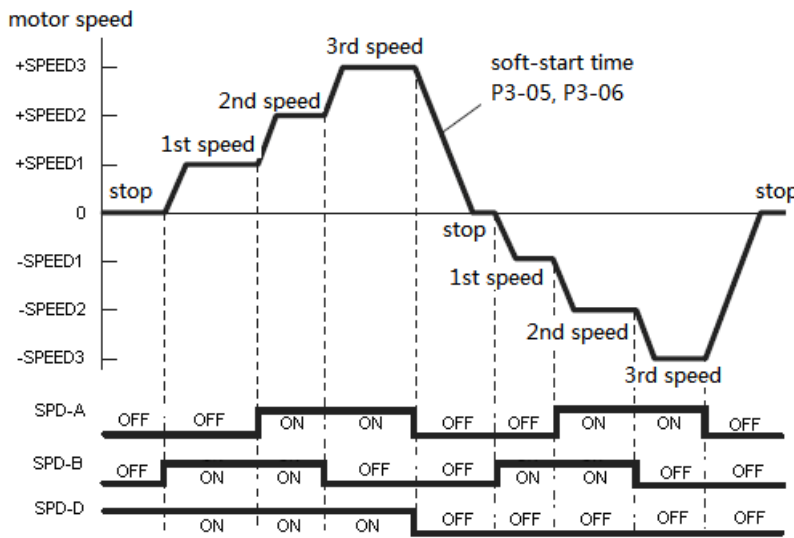| Parameter	Function	Unit	Default	Range	Control mode
P3-05	Soft-start accelerate time	ms	0	0~65535	Speed control
P3-06	Soft-start decelerate time	ms	0	0~65535	Speed control

Please control the speed with the accelerate/decelerate time for the speed command. When input step-speed command or select internal speed settings, it can do smooth speed control. Please set P3-05 and P3-06 to 0 for normal position control.

 P3-05: The time from stop to rated speed

 P3-06: The time from rated speed to stop

The example of internal speed settings is shown below. If using soft-start, the impact of speed changing will be smaller.

4-3-7. Torque control

DS series servo has two kinds of torque control modes: internal command, analog command (only for DS3 series).

The parameters for torque control:

Parameter	Function	Unit	Range	Default	Settings
P0-00	Main mode	—	0	0	0
P0-01	Submode 1	—	0~7	0	1 (internal command)
P0-02	Submode 2	—	0~7	0	or 2 (analog command)

1. Internal command mode

Parameter	Function	Unit	Default	Range
P4-09	Internal torque command	1%	0	-300~300

2. External analog command mode (only for DS3 series)

3. Internal speed limit of torque controlling

Parameter	Function	Unit	Default	Range
P4-07	Speed limits of torque controlling	rpm	2000	0~5000

4-4．Servo settings

This chapter will introduce the setting method of user parameters for servo normal running.

4-4-1．Choose the control mode

User can choose two submodes. Submodes can be switched from each other by input signal /C-SEL. /C-SEL=OFF, submode1 is valid, /C-SEL=ON, submode2 is valid.

Signal	Input state	Input mode	Terminal state		Result
/C-SEL	ON	Positive signal	CN1-9 connect to 24V	SI=0V (optocoupler is ON)	Submode 2
		Negative signal		SI=24V or cut off (optocoupler is OFF)	
	OFF	Positive signal		SI=24V or cut off (optocoupler is OFF)	Submode 1
		Negative signal		SI=0V (optocoupler is ON)	

The input terminal of /C-SEL can be set by below parameter:

Parameter	Function	Unit	Default	Range	Control mode
P5-15.H	Choose control mode	—	00	00~87	Torque, speed, position control

The default value of P5-15.H is 00 which means /C-SEL is invalid. To make this function valid, set P5-10.L to 01; distribute the signal of /C-SEL to the input terminal via parameter P5-15.H. Please refer to chapter 4-4-2 for details.

The parameters related to working mode:

Parameter	Function	Unit	Default	Range
P0-00	Main mode	—	0	0
P0-01	Submode 1	—	0	0~7
P0-02	Submode 2	—	0	0~7

Main mode	Submode 1	Submode 2
0 normal	0 idle	0 idle
	1 torque (command)	1 torque (command)
	2 torque (analog)	2 torque (analog)
	3 speed (terminal command)	3 speed (terminal command)
	4 speed (analog)	4 speed (analog)
	5 position (internal)	5 position (internal)
	6 position (pulse)	6 position (pulse)
	7 speed (pulse)	7 speed (pulse)

The description for the table:

0: idle

Idle mode, motor is power on but doesn't rotate.

1: torque control (internal command)

The torque command is internal parameters; please refer to chapter 4-3-7.

2: torque control (analog command)

The torque command is external analog value; please refer to chapter 4-3-7.

3: speed control (terminal command)

Use the input signal of /SPD-A and /SPD-B to select 3 kinds of speed stored in the servo. Please refer to chapter 4-3-6.

4: speed control (analog command)

The speed control mode of analog voltage input command. Please refer to chapter 4-3-1.

5: position control (internal command)

The position command is internal settings for the position control mode. This function is developing.
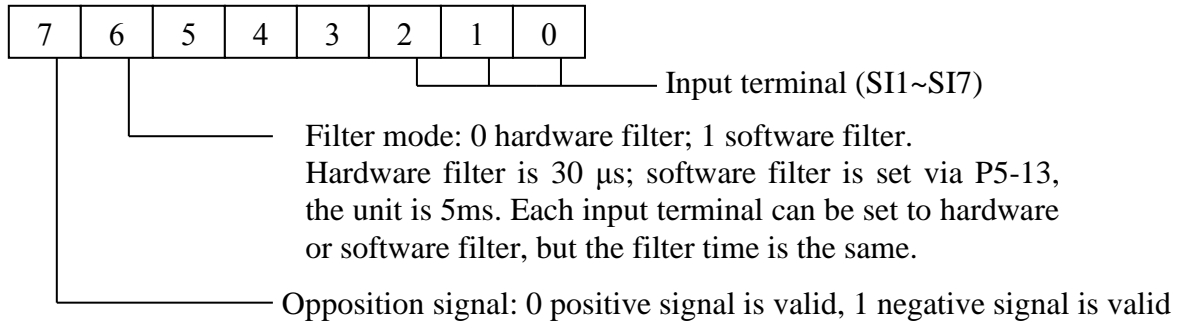
6: position control (pulse command)

The position command is external pulse input for the position control mode. Please refer to chapter 4-3-2.

7: speed control (pulse frequency command)

The speed command is external pulse input for the speed control mode. Please refer to chapter 4-3-1.

## 4-4-2．Signal settings of input circuit

8-bits can set one signal:

7	6	5	4	3	2	1	0

Input terminal (SI1~SI7)

Filter mode: 0 hardware filter; 1 software filter. Hardware filter is 30 μs; software filter is set via P5-13, the unit is 5ms. Each input terminal can be set to hardware or software filter, but the filter time is the same.

Opposition signal: 0 positive signal is valid, 1 negative signal is valid

Note:

1. P5-10.L=0, the input signal is configured to default settings, the settings of P5-10.H~P5-17.H are invalid. Filter mode is hardware filter (filter time is 30μs).

2. P5-10.L=1, user can change the input terminal distribution via P5-10.H~P5-17.H:

(1) 0x83: input negative signal to SI3, hardware filter mode (filter time is 30μs).

(2) 0x46: input positive signal to SI6, software filter mode (filter time can be set via P5-19, the unit is 5ms).

(3) 0x00: the signal is always invalid. Filter cannot work.

(4) 0x80: the signal is always valid. Filter cannot work.

3. Please don't distribute more than one function to one terminal. All the functions that distributed to the terminal will be functional.

4-4-3．Signal settings for output circuit

8-bit can set one signal:

7	6	5	4	3	2	1	0

Output terminal (SO1~SO3)

Opposition signal: 0 positive signal is valid; 1 negative signal is valid.
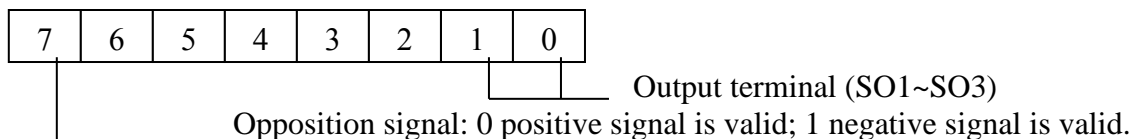
Note: if more than one signal is distributed to the same terminal, the signals will take the calculation of OR and output.

4-4-4．JOG speed

Please use this parameter when setting the motor speed via operate panel or numeric operator.

Parameter	Function	Unit	Range	Default
P3-04	JOG speed	rpm	0~1000	100

Set the motor speed by operate panel or numeric operator. The motor will run at MAX speed if the setting speed is larger than the MAX value.

4-5．Stop function

This chapter will introduce the skills of stop smoothly.

4-5-1. Dynamic brake (DB)

Please set P0-06.L when use dynamic brake. The servo will stop through mechanical friction if not use DB.

Parameter	Function	Unit	Range	Default	Control mode
P0-06.L	Motor stop mode when servo OFF or alarm occurs	—	0~2	0	Speed control, torque control, position control

Servo will be OFF in the follow situations:

servo enable signal is OFF（/S-ON）

servo alarm occurs

Power OFF

P0-06.L	Content
0	Stop through DB. Keep DB status after stop.
1	Stop through DB. Change to inertia status after stop.
2	Stop inertia motion. Motor is not power on. Stop through mechanical friction.

**Note:**

（1）servo enable signal is forced OFF when power is off or alarm occurs.

（2）the stop criterion is rotation speed P5-02 (rpm).

DB is the way to forced stop the servo. Don't stop and start the servo frequenctly through power or servo enable signal (/S-ON). Otherwise, the components inside servo will be damaged.

DB is the normal way of urgent servo stop. Stop the motor through shorting the electric circuit of motor.
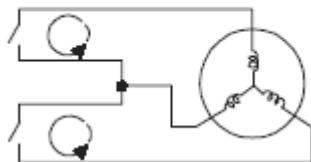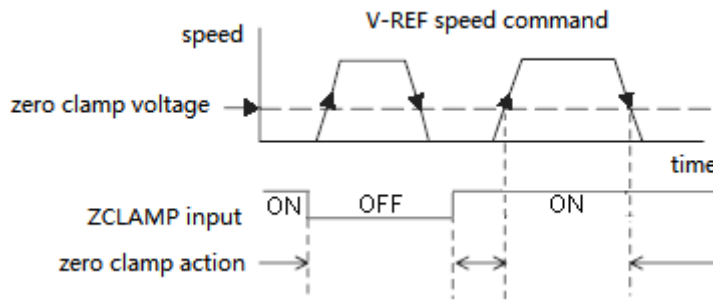

4-5-2. Zero clamp (ZCLAMP)

● **Zero clamp function**

This function can be used when host device uses speed command input without position loop function. That is mean the function can be used when V-REF (speed command) input voltage is not 0V but the servo must stop. Servo will configure the temporary position loop when set on the zero clamp function. After setting on zero clamp function, the position loop will be configured inside. The motor will clamp at this place in the range of pulse ±1. It will return to zero clamp position even it run under external force.

● **Set the parameters**

To set the following parameters to make the input signal"/ZCLAMP"enter zero clamp on/off mode.

Zero clamp will act when meet the following conditions:
speed control (submode = 3 or 4)
set on "/ZCLAMP"
speed command is lower than P5-01

Zero clamp signal:

Signal	Input	Input mode	Terminal		Description
/ZCLAMP	ON, valid	Input positive signal	CN1-9 connect 24V	SI=0V (optocoupler ON)	When the speed is lower than zero clamp speed, zero clamp is effective
		Input negative signal		SI=24V or cut off (optocoupler OFF)	
	OFF, invalid	Input positive signal		SI=24V or cut off (optocoupler OFF)	Zero clamp is ineffective
		Input negative signal		SI=0V (optocoupler ON)	

The input terminal of /ZCLAMP signal can be set through below parameter:

parameter	Function	Unit	Default value	Range	Control mode
P5-16.L	Zero clamp	—	00	00～C7	Speed control

The default value is 00, /ZCLAMP is invalid. To make the function valid, set P5-10.L to 01, distribute /ZCLAMP signal to the terminal through parameter P5-16.L. Please refer to chapter 4-4-2 for details.

4-6．Sequence control

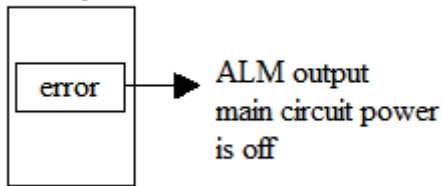## 4-6-1. Alarm output (ALM)

The alarm output signal wiring:
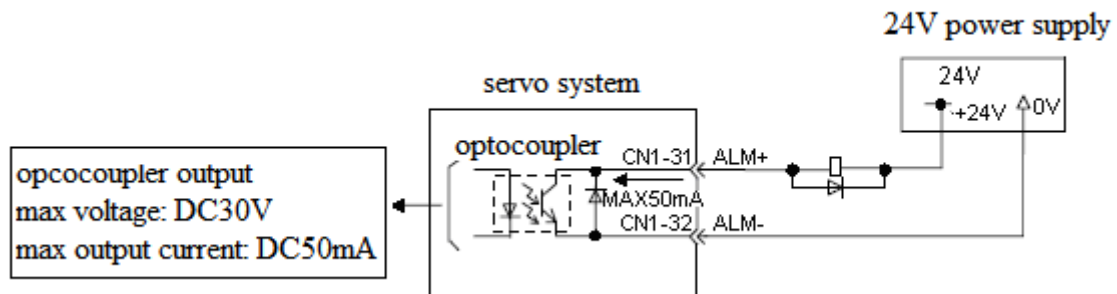
Please prepare external 24V power supply.

Output signal	Function	Control mode
ALM	Alarm output	Speed control, torque control, position control

The signal will output when servo system has error.

Please set OFF the servo enable signal when alarm signal output.

Signal	Output state	Output mode	Terminal state		Explanation
/ALM	On is valid	Positive signal	DS3	S0+ and S0- is connected	Servo alarm signal
		Negative signal		S0+ and S0- is disconnected	
	OFF is invalid	Positive signal	DS3	S0+ and S0- is disconnected	servo run well
		Negative signal		S0+ and S0- is connected	

/ALM can output from the output terminal. Choose the output terminal through the following parameter.

Parameter	Function	Unit	Range	Default value
P5-24.H	Choose output terminal for /ALM	—	00～83	02

The default value is 02, the signal will output from terminal SO2+ and SO2-. Please see chapter 4-4-3 for how to set the output signal.

When servo alarm signal output, please find out the alarm reason. Then set ON signal ALM-RST to clear the alarm. /ALM-RST can be set through P12.H.

Input signal	Function	Control mode
/ALM-RST	Clear alarm	Speed control, torque control, position control

ALM-RST can reset the alarm. The alarm reset also can be done by opertate panel. When servo alarm outputs, the servo enable signal (/S-ON) should be cut off through external circuit.
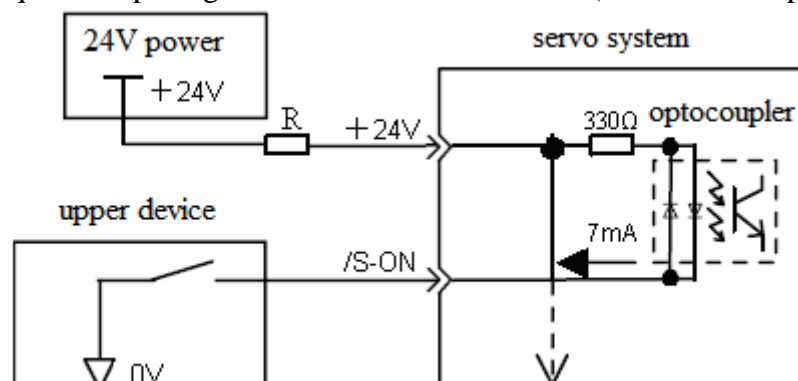
4-6-2. Servo enable（S-ON）

Servo enable has two modes:
1. Through input terminal
2. Auto-ON when servo power on

● **Through input terminal**
Sequence input signal: control the servo enable (motor start/stop) through upper device.

Input signal	Function	Control mode
/S-ON	Servo enable	Speed control, torque control, position control

Control the motor ON/OFF state.

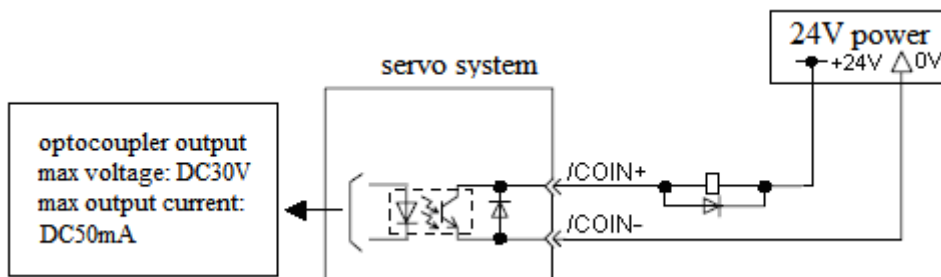| Signal	Input state	Input mode	Terminal state		Description
/S-ON	ON is effective	Positive signal	CN1-9 connect to 24V	SI=0V (optocoupler is ON)	Servo enable is ON
		Negative signal		SI=24V or disconnected (optocoupler is OFF)	
	OFF is ineffective	Positive signal		SI=24V or disconnected (optocoupler is OFF)	Servo enable is OFF
		Negative signal		SI=0V (optocoupler is ON)	

Note: please output /S-ON signal at first, then output the input command to start/stop the motor.

- **Auto-ON when servo power on (not use /S-ON signal)**

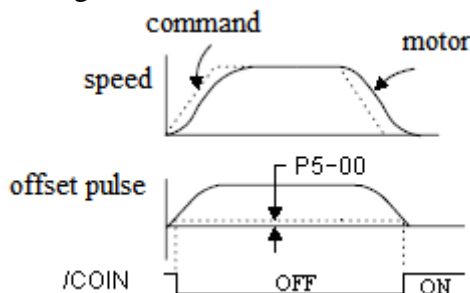Servo auto-ON when power on: please refer to chapter 4-1-6 (set P5-10 = 0x8001).

4-6-3．Output after positioning（COIN）

Optocoupler output signal: /COIN signal means the servo motor moving is finished in position control mode.

Output signal	Function	Control mode
/COIN	Positioning end	Position control

This signal can be used to interlock of positioning end in upper device.

Signal	Output state	Output mode	Terminal state		Description
/COIN	ON is effective	Positive signal	DS3	S0+ and S0- connected	Positioning end
		Negative signal		S0+ and S0- disconnected	
	OFF is ineffective	Positive signal	DS3	S0+ and S0- disconnected	In positioning
		Negative signal		S0+ and S0- disconnected	

Set the output terminal of /COIN through below parameter:

Parameter	Function	Unit	Default value	Range
P5-20.L	Output terminal distribution for /COIN	—	01	00～83

The default setting is 01, output from SO1+ and SO1-. Please see chapter 4-4-3 for details.

The signal width of /COIN can be set through below parameter.

Parameter	Function	Unit	Default	Range	Control mode
P5-00	The /COIN signal width	Command pulse	7	0～250	Speed control, torque control, position control

In position control mode, when the differences between setting position command pulse and real position is less than P5-00, set ON /COIN (positioning is finished). The default value is 7 command pulses. /COIN is always OFF in speed control and torque control mode.

4-6-4．Same speed output（V-CMP）

Optocoupler output signal: same speed output (/V-CMP) means servo motor speed is the same to command speed. It is used to interlock of upper device.
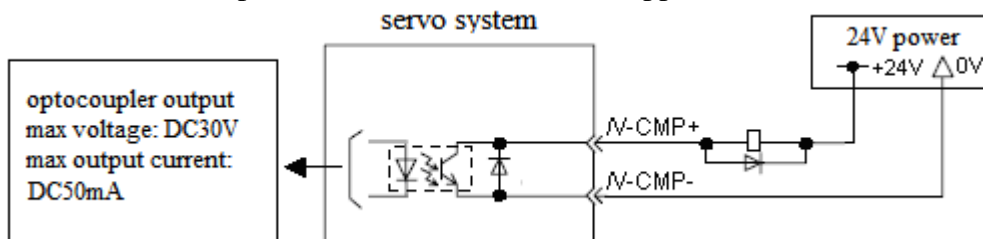
Output signal	Function	Control mode
/V-CMP	Same speed output	Speed control

Signal	Output state	Output mode	Terminal state		Description
/V-CMP	ON is effective	Positive signal	DS3	S0+ and S0- is connected	Command speed=feedback speed
		Negative signal		S0+ and S0- is disconnected	

	OFF is ineffective	Positive signal	DS3	S0+ and S0- is disconnected	Command speed≠feedback speed
		Negative signal		S0+ and S0- is connected	

Set the output terminal for /V-CMP through below parameter:

Parameter	Function	Unit	Default value	Range
P5-20.H	Output terminal distribution for /V-CMP	—	00	00～83

The default value is 00 (ineffective). Please refer to chapter 4-4-3 for details.

Set the checking width of same speed output V-CMP

Parameter	Function	Unit	Default value	Range
P5-03	V-CMP signal width	rpm	10	1～250

In speed control mode, when the difference between set speed and feedback speed is less than P5-03, /V-CMP is ON (speed reach to max value). The default value is 10rpm.

4-6-5．Rotate checking output（TGON）

Optocoupler output signal: rotate checking output /TGON means the servo motor is rotating.
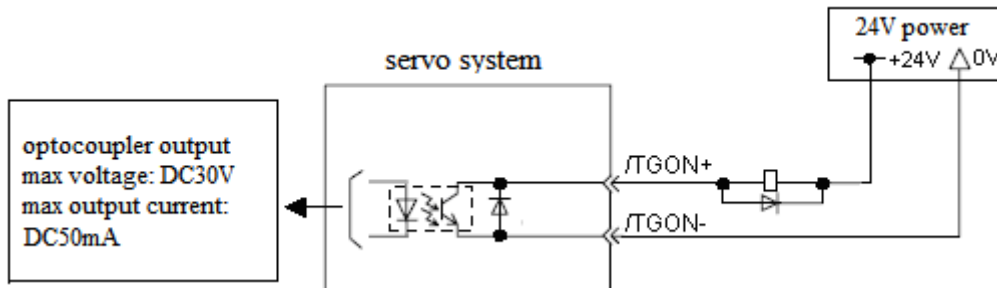
Output signal	Function	Control mode
/TGON	Rotate checking output	Speed control, torque control, position control

Signal	Output state	Output mdoe	Terminal state		Description
/TGON	ON is effective	Positive signal	DS3	S0+ and S0- is connected	Motor is rotating
		Negative signal		S0+ and S0- is disconnected	
	OFF is ineffective	Positive signal	DS3	S0+ and S0- is disconnected	Motor is not rotating
		Negative signal		S0+ and S0- is connected	

Set value: P5-02 rotating check speed

Set the output terminal for /TGON through below parameter:

Parameter	Function	Unit	Default value	Range
P5-21.L	Output terminal distribution for /TGON	—	00	00～83

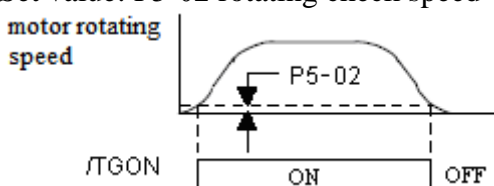The default value is 00 (ineffective). Please refer to chapter 4-4-3 for details.
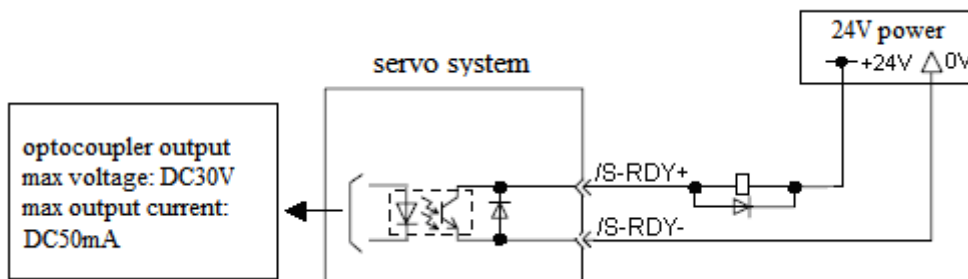
Set the rotating check speed through below parameter:

Parameter	Function	Unit	Default value	Range
P5-02	Rotating check speed	rpm	20	1～1000

When the motor speed is larger than P5-02, /TGON is ON. It means the motor is rotating.

4-6-6．Servo ready（S-RDY）

Optocoupler output signal: servo ready S-RDY means servo power on and no alarm.

Output signal	Function	Control mode
/S-RDY	Servo ready	Speed control, torque control, position control

S-RDY means the servo is ready to accept servo enable signal /S-ON.

Signal	Output state	Output mode	Terminal state		Description
/S-RDY	ON is effective	Positive signal	DS3	S0+ and S0- is connected	Servo is ready
		Negative signal		S0+ and S0- is disconnected	
	OFF is ineffective	Positive signal	DS3	S0+ and S0- is disconnected	Servo alarm
		Negative signal		S0+ and S0- is connected	

Set the output terminal for /S-RDY.

Parameter	Function	Unit	Range	Default value
P5-21.H	Output terminal distribution for /S-RDY	-	00～83	03

DS3 default value is 03, output from SO3+ and SO3-. Please refer to chapter 4-4-3 for details.

4-6-7．Near output（NEAR）

Optocoupler output: /NEAR should be used together with /COIN. It means the servo motor is near positioning end.
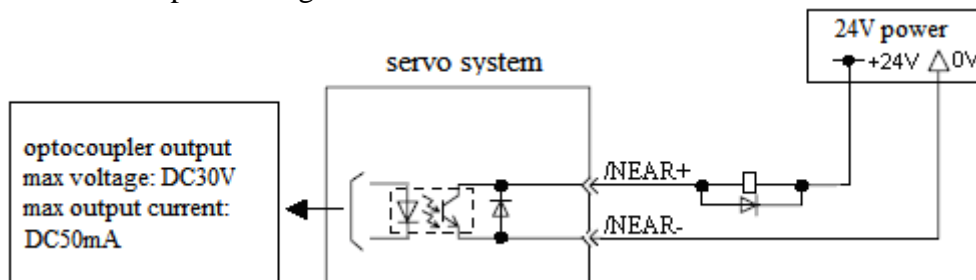
Output signal	Function	Control mode
/NEAR	Near output	Position control

In position control mode, upper device accepts /NEAR signal before positioning is finished. It leaves enough time for the system to prepare the next operation.

Signal	Output state	Output mode	Terminal state		Description
/NEAR	ON is effective	Positive signal	DS3	S0+ and S0- is connected	Near the positioning end location
		Negative signal		S0+ and S0- is disconnected	
	OFF is ineffective	Positive signal	DS3	S0+ and S0- is disconnected	Not near the positioning end location
		Negative signal		S0+ and S0- is connected	

Set the output terminal for /NEAR through below parameter:

Parameter	Function	Unit	Range	Default value
P5-24.L	Output terminal distribution for /NEAR	-	00～83	00

The default value is 00 (ineffective). Please refer to chapter 4-4-3 for details.

The output time of /NEAR can be set through below parameter:

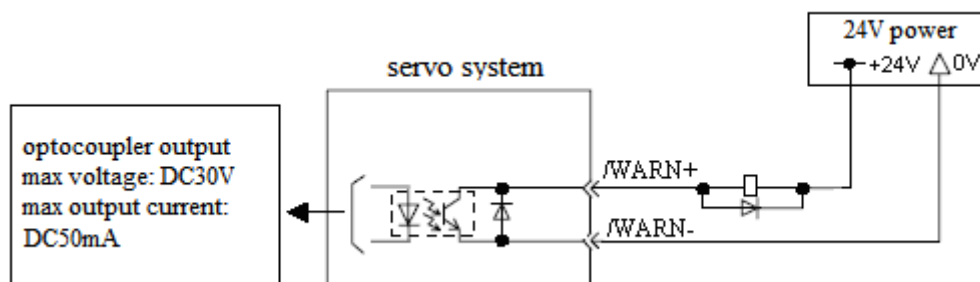| Parameter	Function	Unit	Range	Default value
P5-04	NEAR signal width	Command pulse	0～10000	50

P5-04 should be larger than the signal width of /COIN. Please refer to chapter 4-6-3 for details.
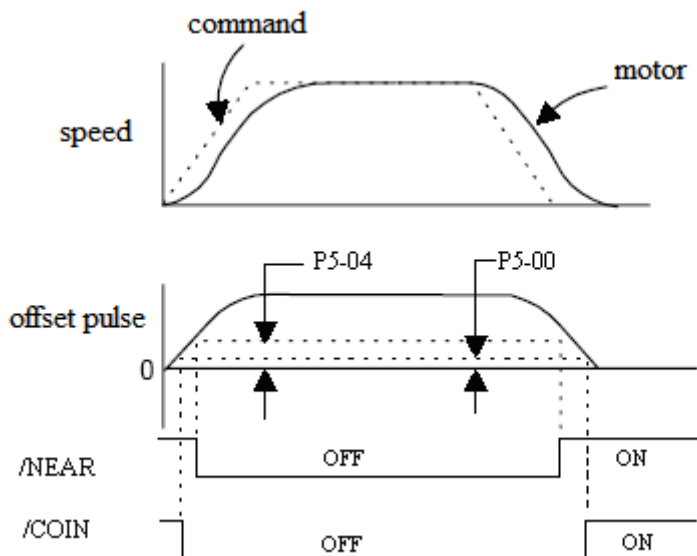
4-6-8．WARN output（WARN）

Optocoupler output: /WARN means the servo motor is overload. If the overload is not solved for a while, it will output /ALM signal.

Output signal	Function	Control mode
/WARN	Warn output	Speed control, torque control, position control

This signal output to warn the servo motor is overload.

Signal	Output state	Output mode	Terminal state	Description
/WARN	ON is effective	Positive signal	S0+ and S0- is connected	Warn the abnormal status
		Negative signal	S0+ and S0- is disconnected	
	OFF is ineffective	Positive signal	S0+ and S0- is disconnected	Normal
		Negative signal	S0+ and S0- is connected	

Set the output terminal for /WARN through below parameter:

Parameter	Function	Unit	Default value	Range
P5-23.H	Output terminal distribution for /WARN	—	00	00～83

The default value is 00 (ineffective). Please refer to chapter 4-4-3 for details.

4-7. Smooth run

This chapter will introduce the skills of making the motor running smoothly.

4-7-1．Smooth

The command pulse (certain frequency) can be filtered. Choose the filter type through below parameter:

Parameter	Function	Unit	Range	Default value	Control mode
P2-01	Choose the filter of position command	-	0, 1	0	Position control

P2-01	Choice
0	First-order inertial filter
1	Smooth filter

The filter time can be set through below parameter:

Parameter	Function	Unit	Range	Default value	Control mode
P2-04	Time of position command filter	ms	0～100	0	Position control

P2-04 is valid for external pulse speed control. When the speed is controlled by external pulse, it is limited by P2-04.

4-7-2．Soft start

Soft start means the servo speed changed with acceleration/deceleration, but not suddenly changed.

Parameter	Function	Unit	Range	Default value	Control mode
P3-05	Soft start time (acceleration time)	ms	0～65535	0	Speed control
P3-06	Soft start time (deceleration time)	ms	0～65535	0	Speed control

Set acceleration and deceleration time for speed command.
When the speed command is ladder changed or internal speed is selected, soft start function can be used. (Please set to 0 for normal case)
• P3-05: the time from stop to rate speed
• P3-06: the time from rated speed to stop
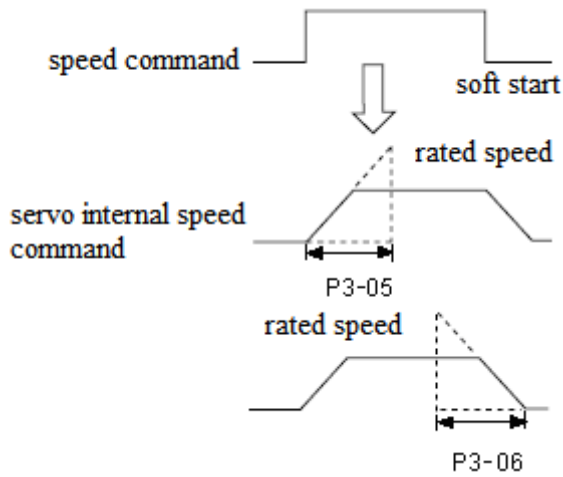
4-8. Servo gain adjustment

This chapter will introduce the skills of gain adjustment.

4-8-1. Gain setting

● **The gain of speed loop**

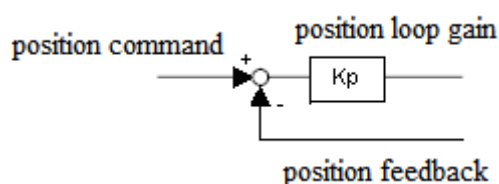| Parameter	Function	Unit	Range	Default value	Control mode
P1-00	Speed loop gain (Kp)	Hz	1～500	100	Speed, position control
P1-01	Speed loop integral time (Ki)	0.1ms	1～5000	400	Speed, position control

The larger the speed loop gain or the smaller the speed loop integral time; the higher the reponse of speed control. But it is restricted by mechanical features.
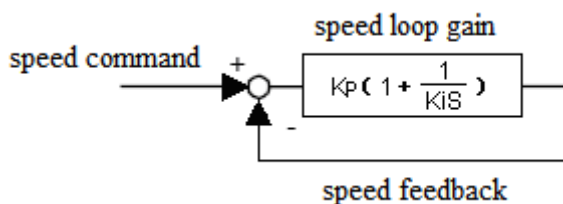
● **The gain of position loop**

Parameter	Function	Unit	Range	Default value	Control mode
P1-02	Position loop gain (Kp)	1/s	1～200	30	Position control

The larger the speed loop gain, the higher the reponse and the less the position offset. But it is restricted by mechanical features.

This gain is valid when zero clamp.

In position control mode, servo will alarm when offset pulse is over the offset pulse limit.

Parameter	Function	Unit	Range	Default value	Control mode
P5-05	Offset pulse limit	256 command pulse	0～65535	1000	Speed control

P5-05=0, it will not check the value of offset pulse.

Set the offset pulse voltage which can test the position offset pulse overflow alarm (E-10).
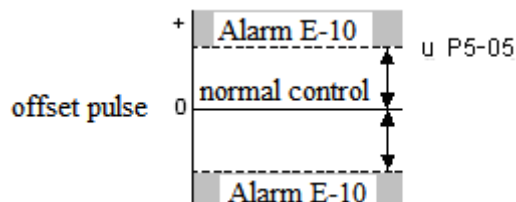
Position loop gain (P1-02) can not be set too large. E-10 will appear when the machine is running very fast. If the parameter value is too large, it is difficult to test the alarm.

4-8-2．Proportion action（P-CON）

Input signal /P-CON is the switch for P/PI of speed loop.

P: proportion control, this mode is proportion action command.

PI: proportion&integral control.

● Proportion action command

Set the input terminal for /P-CON through below parameter:

Parameter	Function	Unit	Range	Default value	Control mode
P5-11.L	Proportion action command, P/PI switch	—	00～C7	02	Speed, position control

The default value is 02, it means /P-CON will input from terminal SI2. Please refer to chapter 4-4-3 for details.

The two cases to use proportion action command:
(1) The speed command is sent from upper device and run at the same time. The upper device will choose to run in P mode in special conditions. This way can delete the over range and shorten the adjustment time.
(2) When there is command offset in speed control, the servo will not stop even getting the zero speed command in PI mode. And the servo will run at low speed. If choose P mode, servo will stop at once.

4-8-3．Gain switching（G-SEL）

G-SEL signal can switch the gain when the servo is running.
For example, the motor is running or stop, set first gain and second gain, switch to each other through G-SEL signal.

Set the input terminal for /G-SEL through below parameter:

Parameter	Function	Unit	Range	Default value	Control mode
P5-17.L	Gain switching	—	00～C7	00	Position, speed control

The default value is 00 which means /G-SEL is invalid. In order to make the signal valid, please set P5-10.L to 01, then set P5-17.L. Please refer to chapter 4-4-2 for details.
When the input terminal for /G-SEL is OFF, the first gain will be choosed (P1-00～P1-02), when it is ON, the second gain will be choosed (P1-04～P1-06).

/G-SEL input signal	Signal invalid	Signal valid
Speed loop gain	P1-00 is valid	P1-04 is valid
Integral time	P1-01 is valid	P1-05 is valid
Position loop gain	P1-02 is valid	P1-06 is valid

5 Use the operate panel

This chapter describes the basic operation of the operate panel and the features it offers. All parameter settings and motor operations can be executed by simple, convenient operations.

5-1．Basic Operation

This section provides information on the basic operation of the operate panel for setting operating conditions.

5-1-1. Functions of operate panel

The operate panel can be used for parameter settings, operating references, and status displays.

- 5-bit LED: Displaying parameter settings, status or alarm.
- Power LED POWER: The LED is on when the servo driver is powered on.
- Charge LED CHARGE: The LED is on when the main circiut is powered on. When the power of main circiut is off, electric charges remain in the capacitors, and at this time DO NOT touch the servo.

This section provides information on the keys and their functions available from the initial displays.
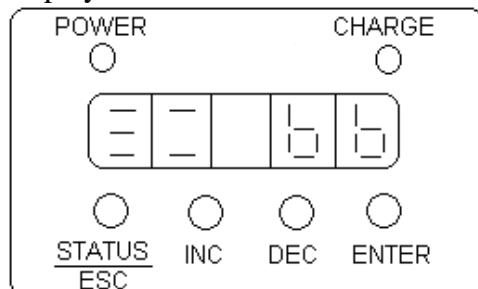
Key Name	Function
STATUS/ESC	Press: Status switch, status return
INC	Press: Increase the value; Press and hold: Increase the value continuously
DEC	Press: Decrease the value; Press and hold: Decrease the value continuously
ENTER	Press: Shift the editing digit; Press and hold: Enter a status, Enter

5-1-2. Basic Mode Switching

The operate panel can display the status, set parameter and run the command by switching the basic mode.
The running status, auxiliary function, parameter setting, and monitoring are the basic modes. The modes switch as the below diagram by pressing STATUS/ESC.
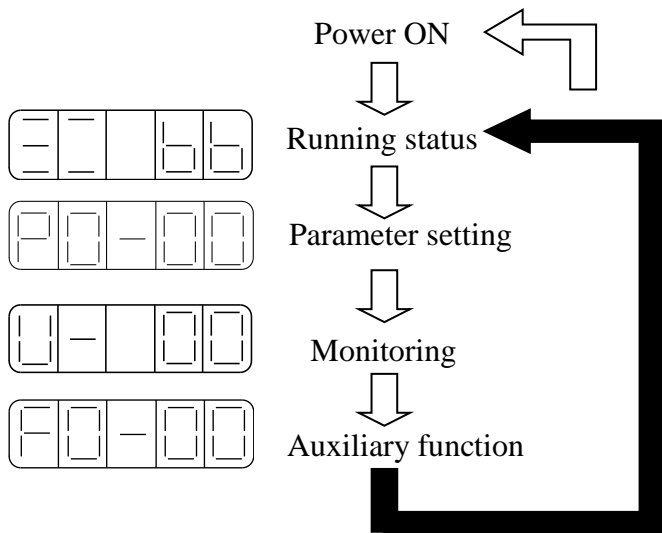
Display mode:

- Monitor Function U－ XXX: XXX means the number of the monitor function.
- Auxiliary Function FX－XX: The first X means group No., the last two X means the member No. in the group.
- Parameter Setting PX－XX: The first X means group No., the last two X means the member No. in the group.
- Alarm E－XXX: XXX means the alarm code.

5-2．Running status mode

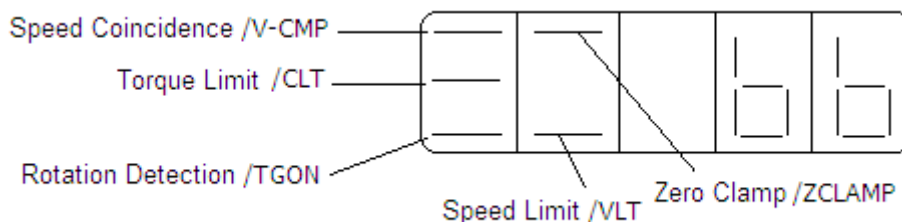In running status mode, bit data and codes indicate the status of the servo driver.

■ Select the running status mode

The servo will enter running status when power on. If not, press STATUS/ESC to enter.

■ The display content of running status mode
The display contents are different in speed, torque, position control mode.

➤ Speed and Torque Control Mode

A. Bit contents:

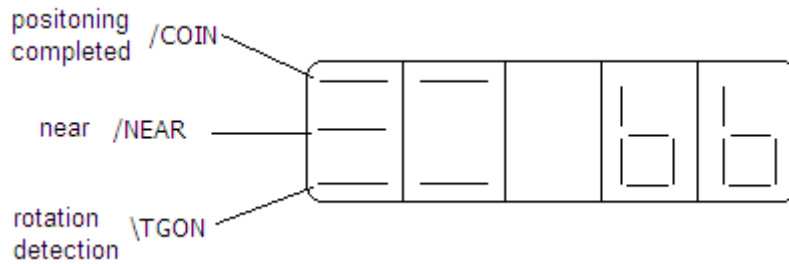| Bit Data	Description
Speed Coincidence (/V-CMP)	Light when the motor actual speed and command speed is the same. Speed coincidence signal checking width: P5-03 (unit: rpm)
Torque Limit (/CLT)	Light when actual torque exceeds preset value. Forward Torque Limit: P4-02 Reverse Torque Limit: P4-03
Rotation Detection	Light when the motor speed exeeds the rotation detection speed.

(/TGON)	Rotation Detection Speed Level: P5-02(Unit: rpm)
Zero Clamp (/ZCLAMP)	Light when zero clamp signal is ON.
Speed Limit (/VLT)	Light when actual speed exceeds preset value. Speed Limit during Torque Control: P4-07

B. The code contents:

Code	Descrption
⌷⌷⌷	Standby Servo OFF (motor power OFF)
run	Run Servo ON (motor power ON)
Pot	Forward Run Prohibited P-OT is OFF. Please refer to 4-2-2 "Overtravel Limit"
not	Reverse Run Prohibited N-OT is OFF. Please refer to 4-2-2 "Overtravel Limit"

> **Position Control Mode**

A. The bit contents:

Bit Data	Description
Positioning Completed (/COIN)	Light when set position and actual position is the same. Positioning accomplishment width: P5-00 (unit: command pulse)
Near (/NEAR)	Light when set position and actual position is the same. Near signal width: P5-04
Rotation Detection (/TGON)	Light when the motor speed exeeds the rotation detection speed. Rotation detection speed: P5-02(unit: rpm)

B. The code contents:

| Code	Descrption
⌷⌷⌷	Standby Servo OFF (motor power OFF)
run	Run Servo ON (motor power ON)
Pot	Forward Run Prohibited P-OT is OFF. Please refer to 4-2-2 "Overtravel Limit"
not	Reverse Run Prohibited N-OT is OFF. Please refer to 4-2-2 "Overtravel Limit"

5-3. Monitoring Mode

The Monitoring Mode can be used to monitor the reference values, I/O signal status, and servo driver internal status.
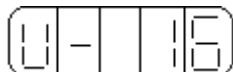The monitor mode can be set when the motor is running.

■ Using the Monitor Mode

Now we take the monitor code U-016 as an example.
1. Press the STATUS/ESC key to select the monitoring mode.
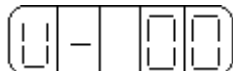
2. Press the INC or DEC key to select the monitor number U-016, and then press and hold ENTER to enter the monitor mode.

3. The value 0 is now displayed. It means the driver is normal.

4. Press ENTER, the monitor no. will increase 1.
5. Press STATUS/ESC key to return to the monitoring number switching state.

■ Display contents of Monitoring Mode

Number	Monitor Display		Unit
U-000	Actual speed of motor		Rpm
U-001	Input speed command		Rpm
U-002	Internal torque command		%
U-003	Rotate angle (mechenism angle)		0.1 °
U-004	Rotate angle (electrical angle)		0.1 °
U-005	Bus voltage		V
U-006	Module temperature		0.1℃
U-007	Input command pulse speed		Rpm
U-008	Offset command	(0000~FFFF)*1	Command
U-009	pulse	(0000~FFFF)*FFFF	pulse
U-010	Rotate angle (encoder	(0000~FFFF)*1	encoder pulse
U-011	value)	(0000~FFFF)*FFFF	
U-012	Pulse value of input	(0000~FFFF)*1	Pulse
U-013	command	(0000~FFFF)*FFFF	command
U-014	Pulse value of	(0000~FFFF)*1	Pulse
U-015	feedback command	(0000~FFFF)*FFFF	command
U-016	Current position	(0000~FFFF)*1	encoder pulse
U-017	(Accumulated)	(0000~FFFF)*FFFF	
U-018	Current, 1-bit decimal		0.1A
U-019	Analog input V-REF		0.01V
U-020	Analog input T-REF		0.01V
U-021	I/O signals status		
U-022	I/O terminals status		

■ U-021 displays I/O signals status

The following diagram describes the input and output signals status displayed in U-021.
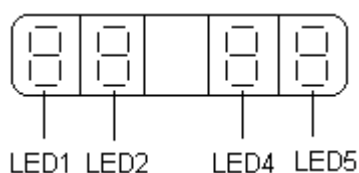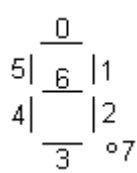
LED1 LED2   LED4 LED5
Diagram 1   Diagram 2

In diagram 1, LED4 and LED5 stand for input signals status, and LED1 and LED2 stand for output signals status. In diagram 2 there shows the segment No. of each LED.

➢ Input signals status

LED segment no.	Description	Modbus address	LED segment no.	Description	Modbus address
LED4_0	/SPD-A internal set speed selection	Ox0808	LED5_0	/S-ON servo signal	0x0800
LED4_1	/SPD-B internal set speed selection	0x0809	LED5_1	/P-CON proportion action command	0x0801
LED4_2	/C-SEL control mode selection	0x080A	LED5_2	/P-OT forward prohibit	0x0802
LED4_3	/ZCLAMP zero clamp	0x080B	LED5_3	/N-OT reverse prohibit	0x0803
LED4_4	Undefined	0x080C	LED5_4	/ALM-RST clear the alarm	0x0804
LED4_5	/G-SEL switch the gain	0x080D	LED5_5	/P-CL external torque limit at forward side	0x0805
LED4_6	/CLR clear the pulse	0x080E	LED5_6	/N-CL external torque limit at reverse side	0x0806
			LED5_7	/SPD-D internal set speed selection	0x0807

➢ Output signals status

LED segment no.	Description	Modbus address	LED segment no.	Description	Modbus address
LED1_0	/NEAR near	0x081A	LED2_0	/COIN positioning completed	0x0812
LED1_1	/ALM alarm output	0x081B	LED2_1	/V-CMP speed synchronization checking	0x0813
			LED2_2	/TGON rotate checking	0x0814
			LED2_3	/S-RDY ready	0x0815
			LED2_4	/CLT torque limit	0x0816
			LED2_5	/VLT speed limit checking	0x0817
			LED2_6	/BK brake lock	0x0818
			LED2_7	/WARN warn	0x0819

Note: the signal state read through Modbus communication: 0 is OFF, 1 is ON.

■ **U-022 displays I/O terminals status**

The following diagram describes the input and output terminals status:
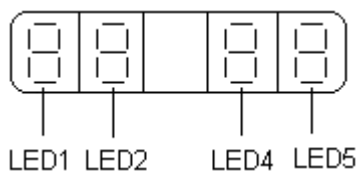

LED1 LED2   LED4 LED5
Diagram 1   Diagram 2
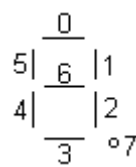
In diagram 1, LED5 stands for input signals status, and LED2 stands for output signals status. In diagram 2 there shows the segment No. of each LED.

Input terminals		Output terminals	
Segment	Description	Segment	Description
LED5_0	Input status of SI1	LED2_0	Output status of SO1
LED5_1	Input status of SI2	LED2_1	Output status of SO2

LED5_2	Input status of SI3	LED2_2	Output status of SO3
LED5_3	Input status of SI4		
LED5_4	Input status of SI5		
LED5_5	Input status of SI6		
LED5_6	Input status of SI7		

5-4．Auxiliary Function

Use the operate panel to do application in auxiliary function mode.

Group No.	Content
F0-**	Check system information, display the system code and data
F1-**	Auxiliary run mode, display the auxiliary run command and result
F2-**	Set the motor code
F3-**	Check the alarm information, clear the alarm
F4-00	Reset parameters to default
F5-00	External communication monitoring

5-4-1．Check System Infomation

Press STATUS/ESC to switch to the auxiliary function mode. Set the group No. to 0 to check system information. Press INC or DEC key to select different No., and press and hold ENTER key to check current information. Press STATUS/ESC key to return.

The following table describes the meaning of each No.

Function No.	Description	Function No.	Description
F0-00	Motor Code	F0-01	Servo Series
F0-02	Servo Model	F0-03	Produce Date: Year
F0-04	Produce Date: Month day	F0-05	Software version 1
F0-06	Software Version 2	F0-07	Hardware Version

5-4-2. Auxiliary Run Mode

Press the STATUS/ESC key to select the auxiliary function mode. Set the group No. to 1. Press INC or DEC key to select different No., and press and hold ENTER key to use current function. Press STATUS/ESC key to return.

1. Jog (F1-00)

Make sure that the motor shaft is not connected to the machine before jogging!
Press ENTER to power on the motor (servo on). Press INC for forward jogging, press DEC for reverse jogging. Press STATUS/ESC key to power off the motor (servo off), and press STATUS/ESC key again to return.

4 different states of jogging:

State	Panel Display	State	Panel Display
Idle	JoU –	Forward Jogging	JoU –P
Servo ON	JoU – –	Reverse Jogging	JoU –n

2. Test run (F1-01)

Make sure that the motor shaft is not connected to the machine before test run!

When servo driver is connected with non-original encoder line or power line, enter test run first to ensure that the encoder line or power line is connected correctly.

LED will show 0 and shine after entering the test run. User must set the voltage (unit: %). Do not set it too large, recommended value is 20. Press ENTER to start the motor. The servo system will run forward (counterclockwise at shaft side), the shaft is rotate with certain speed, voltage. If the motor doesn't rotate, please increase the voltage. If the wiring is wrong, the motor will run reverse and lock at certain angle. Please stop the servo system and find the problem.
Press STATUS/ESC to exit.

3. Current Offset Auto-Adjustment (F1-02)

When the servo driver has finsied the self-update, or the motor does not run smoothly for long time, the current offset auto-adjustment is recommended.
Select F1-02 and enter current offset auto-adjustment function, and the panel displays "rEF".
Press ENTER key to start current offset auto-adjustment, and the panel displays blinking "rEF".
About 5 seconds later auto-adjustment is finished, and the panel displays "donE" to inform that the function is already finished.
Press STATUS/ESC key to return.

4. Speed command offset auto-adjustment (F1-03)

Select F1-03 and enter speed command offset auto-adjustment function, and the panel displays "rEF_o".
Press ENTER key to start speed command offset auto-adjustment, and the panel displays blinking "rEF_o".
About 1 second later, auto-adjustment is finished, and the panel displays "donE" to inform that the function is already finished.
Press STATUS/ESC key to return.

5. Torque command offset Auto-Adjustment (F1-04)

Select F1-04 and enter torque command offset auto-adjustment function, and the panel displays "rEF_o".
Press ENTER key to start torque command offset auto-adjustment, and the panel displays blinking "rEF_o".
About 1 second later, auto-adjustment is finished, and the panel displays "donE" to inform that the function is already finished.
Press STATUS/ESC key to return.

6. Forced Servo enables (F1-05)

0: Cancel forced servo enables
1: Forced servo enables

5-4-3．Check Alarm Information

The following steps show how to check alarm information.
1. Press STATUS/ESC key to select Auxiliary Function mode.
2. Press INC or DEC key to set group No. to 3, and press ENTER.
3. Press INC, DEC or ENTER key to modify the alarm No.
4. Press ENTER key to display corresponding alarm information.

Member No.	Description	Unit	Modbus address
F3-00	Current alarm code ※1		0x0716
F3-01	Current warn code ※2		0x0717
F3-02	Alarm/warn code 1 when alarm		0x0718
F3-03	U phase current when alarm	A	0x0719
F3-04	V phase current when alarm	A	0x071A
F3-05	DC bus-voltage when alarm	V	0x071B
F3-06	IGBT module temperature when alarm	℃	0x071C
F3-07	Speed when alarm	rpm	0x071D
F3-08	Internal torque command when alarm	%	0x071E
F3-09	V-REF value when alarm	V	0x071F
F3-10	T-REF value when alarm	V	0x0720
F3-11	Alarm/warn code 2 when alarm		0x0728
F3-12	Alarm/warn code 3 when alarm		0x0729
F3-13	Alarm/warn code 4 when alarm		0x072A
F3-14	Alarm/warn code 5 when alarm		0x072B
F3-15	Alarm/warn code 6 when alarm		0x072C
F3-16	Alarm/warn code 7 when alarm		0x072D

※1: F3-00=0 indicates that there is no alarm.

※2: F3-01=0 indicates that there is no warn.

5-4-4. Reset Parameters to Default

The following steps show how to reset parameters to default.
1. Close the servo enable (S-ON is OFF)
2. Press STATUS/ESC key to select Auxiliary Function.
3. Press INC or DEC key to set group No. to 4.
4. Choose F4-00.
5. Set the value to 1, press ENTER to confirm.

5-4-5. External monitoring

Select F5-00 in auxiliary function, the panel displays "C-OUT" which means external monitoring mode, COM1 is effective, operate panel is ineffective. At this time user can debug the servo via PC.
Press STATUS/ESC to exit.

5-5. Parameter Setting

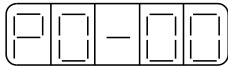Select or adjust the functions via parameter setting. Please refer to chapter 4-1 for parameters list.

The following steps show how to change a parameter.
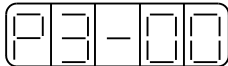Check the permitted range of the parameters in chapter 4.
The example below shows how to change parameter P3-09 from 2000 to 3000.

1. Press the STATUS/ESC key to select the parameter setting mode.

`P0-00`

2. At this time the second LED is blinking, and press INC or DEC key to set the group No. to 3. Press ENTER key to confirm.

`P3-00`

3. At this time the last two LED is blinking, and press INC or DEC key to set the member No. to 9. Press and hold ENTER key to confirm.
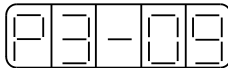
`P3-09`

4. At this time the panel displays the value in P3-09, and numbers are blinking. Press INC to modify the value to 3000, and press ENTER to confirm.
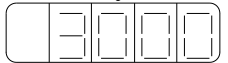
`3000`

The parameter in P3-09 in changed from 2000 to 3000.

Repeat steps 2 to 4 to change the parameter again.

5. Press STATUS/ESC key to return.

5-6. Alarm

Alarm code will pop up (E-XXX) if there is error in servo. The alarm state is invisible when there is no error in servo.

The alarm code is E-XXX or EEEEE (operate panel communication error). Press ENTER to reset the alarm. If the servo power is OFF caused by alarming, it no needs to reset the alarm.

Note: please find out the alarm reason before reset the alarm.

6 Specification and dimension

This chapter will introduce the specification and dimension of MS series servo motor and DS3 series servo drive.

6-1. Servo motor

6-1-1. Servo motor specification

Please refer to this chapter when selecting the servo drive.

Volge level		220V		
Motor MS-		80ST-M02430□□-20P7	110ST-M06030□□-21P8	130ST-M10015□□-21P5
Rated power(KW)		0.75	1.8	1.5
Rated current (A)		3.0	6.0	6.0
Rated speed (rpm)		3000	3000	1500
Rated torque (N m)		2.39	6	10
Peak torque (N m)		7.1	18	25
Back EMF constant (V/krpm)		48	60	103
Torque coefficient (N m/A)		0.8	1.0	1.67
Rotor inertia (Kg m^2)		0.24×10^{-3}	0.76×10^{-3}	1.94×10^{-3}
Winding resistor (Ω)		2.88	0.776	1.34
Winding inductance (mH)		6.4	2.68	5.07
Electrical time constant (ms)		2.22	3.45	3.78
Weight (kg)		2.86	6.7	11.5
Encoder (ppr)		2500		
Pole-pairs		4		
Motor insulated level		Class B (130℃)		
Protection level		IP65		
Ambient	Temperature	－20℃～＋50℃		
	Humidity	Related humidity <90% (no condensation)		

■ 80 series motor winding socket

Motor winding socket	Winding lead wire	U	V	W	PE
	Socket no.	1	3	2	4

■ 80 series motor encoder socket

Signal wire	5V	0V	B+	Z-	U+	Z+	U-	A+	V+	W+	V-	A-	B-	W-	PE
Socket no.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1

■ 110, 130 series motor winding socket

Motor winding socket	Winding lead wire	U	V	W	PE
	Socket no.	2	3	4	1

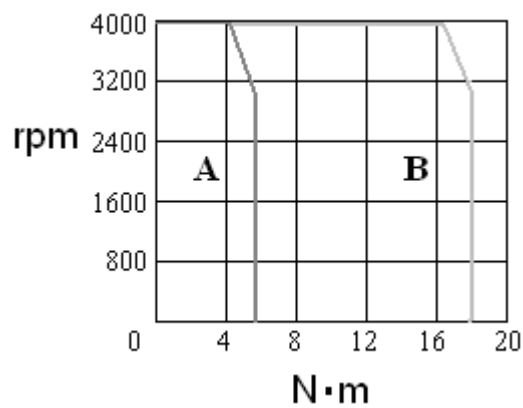| Signal wire	5V	0V	A+	B+	Z+	A-	B-	Z-	U+	V+	W+	U-	V-	W-	PE
Socket no.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1

6-1-2. Torque-Speed Feature
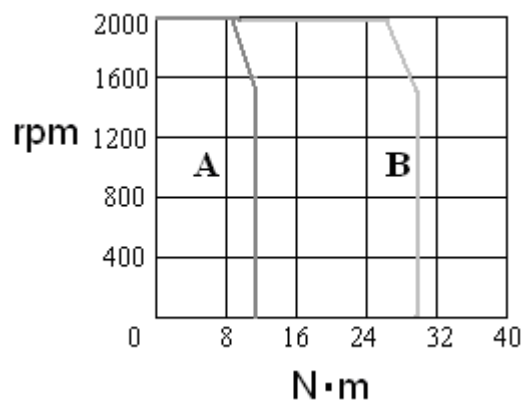
A: continuous using area
B: repeated using area
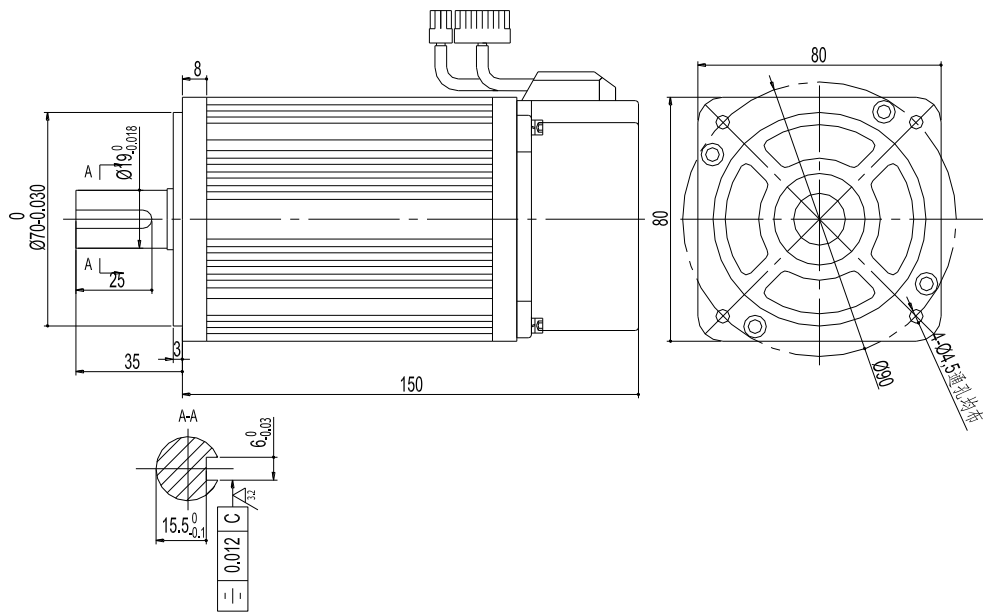
MS-80ST-M02430□□-20P7
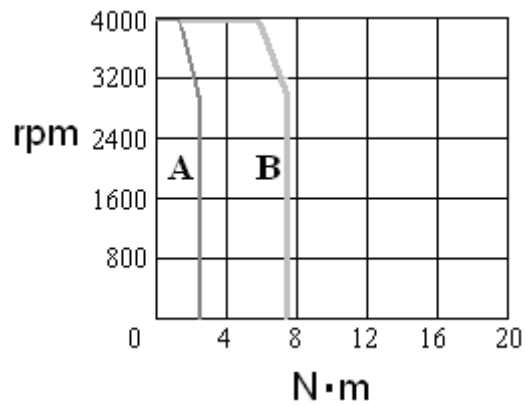
MS-110ST-M06030□□-21P8

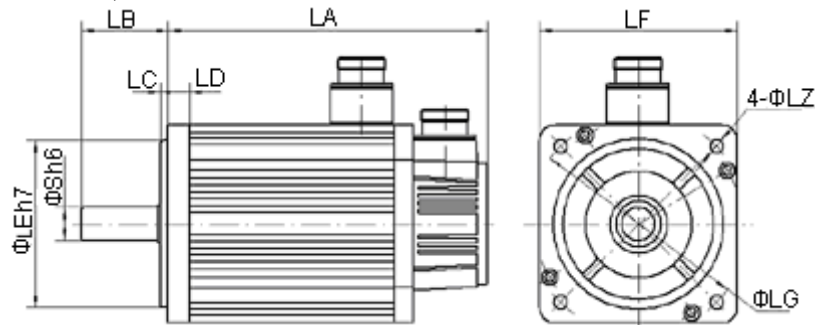**MS-130ST-M10015□□-21P5**

6-1-3. Servo motor dimensions

■ **MS-80ST-M02430□□-20P7**　　　　　　　Unit: mm

■ **110, 130 series motor**　　　　　　　Unit: mm

Type	LA	LB	LC	LD	LE	LF	LG	LZ	S
MS-110ST-M0603□□-21P8	217	55	5	12	95	110	130	9	19
MS-130ST-M1001□□-21P5	217	57	5	14	110	130	145	9	22

6-2. Servo drivers

This section introduces the specification and dimension of servo drive.

6-2-1. General specification

Servo drive type	DS3-20P7	DS3-21P8	DS3-21P5
Suitable motor	80ST-M02430□□-20P7	110ST-M06030□□-21P8	130ST-M10015□□-21P5
Speed (rpm)	Rated 3000/max 4000		Rated 1500/max 2000
Suitable encoder	Incremental encoder 2500 ppr		
Max suitable motor capacity (kW)	1.8		
Continuous output current (A rms)	6		
Max output current (A rms)	18		
Allowable regenerative frequency (time/minute)	31		

| Input power	3-phase or single phase AC200~240V, 50/60Hz
Control mode	3-phase full-wave rectifier IGBT , PWM control, sine-wave current dirve
Using Temperature	0 ~ +50 ℃/-20 ~ +85 ℃
Humidity	Below 90% RH (no condensation)
Vibration /impact resistance	4.9m/s² / 19.6m/s²
Structure	Base installation

6-2-2. Performance specification

Servo drive type				DS3-21P8, DS3-20P7, DS3-21P5
Speed torque control mode	Performance	Speed control range		1: 4000 (the lower limit of speed control range, not stop at rated load torque)
		Speed change rate	Load change rate	0~100% load: below ±0.01% (rated speed)
			Voltage change rate	Rated voltage ±10% : 0% (rated speed)
			Temperature change rate	20±25℃: below ±0.1% (rated speed)
		Frequency feature		250Hz (JL≤JM)
		Soft start time		0～65535ms (set acceleration, deceleration individually)
	Input signal	Speed command	Command voltage	DC±10V
			Input resistor	About 13KΩ
		Torque command	Command voltage	DC±10V
			Input resistor	About 13KΩ
Position control mode	Performance	Feedforward compensation		0～100% (resolution is 1%)
		Positioning finished width		0～250 command unit (resolution is 1 command unit)
	Input signal	Command pulse	Input pulse type	Sign+pulse, A/B orthogonal pulse
			Input pulse state	Line drive (+5V), collector (+5V, +12V, +24V)
			Input pulse frequency	Bus drive 500kbps, transistor open circuit 200 kbps
		Control signal		Clear signal (/CLR)
		Internal open collector power supply		+5V (internal 150Ω resistor)
I/O signal	Position output	Output mode		Phase A, B, Z: bus differential drive output Z phase transistor OC output
		Frequency division ratio		1:1
	Input signal	External input		7
		Changeable signal distribution		/S-ON, /P-CON, /P-OT, /N-OT, /ALM-RST, /PCL, /NCL, /SPD-D, /SPD-A, /SPD-B, /C-SEL, /ZCLAMP, /CLR, /G-SEL
	Output signal	External output		3
		Changeable signal distribution		/COIN, /V-CMP, /TGON, /S-RDY, /CLT, /VLT, /BK, /WARN, /NEAR, /ALM
Built-in function	Dynamic brake (DB)			Valid when power is OFF/servo alarm/servo OFF/over-range
	Regeneration			External regenerative resistor
	Over range（OT）protection			P-OT, N-OT action, DB stop, deceleration stop or inertia stop
	Electronic gear			0.01≤ B/A≤100
	Protection			Program error, parameter error, overvoltage, undervoltage, regeneration error, overtemperature, overcurrent, overspeed, analog input error, position offset overflow, output shorting, current error, encoder cut, encoder error, overload, power off when running, write parameter error…
	LED display			Charge, power supply, 7-segment LED ×5 (built-in digital operate)
	COM1	Connect device		RS232, connect to PC
		Serial		Baud rate 19200; data bit 8; stop bit 1; communication protocol:

		parameters	ModubsRTU slave; Modbus station No.1
com mun icati on		Functions	Debug online
	COM2	Connect device	RS232, RS485, connect to PLC, HMI, PC and other devices
		Serial parameters	Serial parameter can be set; communication protocol: ModbusRTU slave; Modbus station No. can be set
		Functions	State display, user constant setting, monitor display, alarm display, alarm display, special control, online debug

6-2-3. Servo drive dimensions

Unit: mm
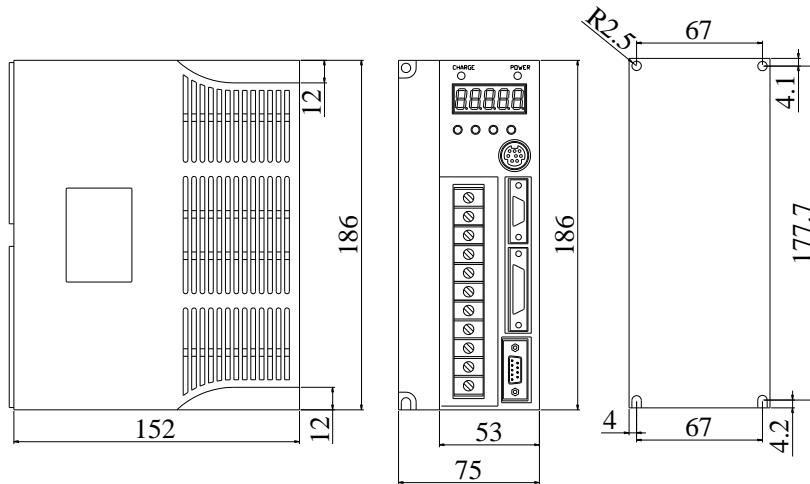
7 Alarm Information

This chapter describes the alarm information of DS3 series servo drives.

Alarm Code	Description	Reason	Solution
E-001	Program damage	program self-test failed	Re-download the program or contact Xinje or an authorized distributor
E-002	Parameter damage	Parameter self-test failed	Restart the drive to reset the parameters. If it occurs for many times please contact Xinje or an authorized distributor
E-003	Bus over-voltage	Power grid is over votage or need a regenerative resistor; the regenerative resistor damage or its value is too large	Check the power grid; connect and check the regenerative resistor
E-004	Bus under voltage	Power grid is under votage	Check the power grid
E-005	Regenerative resistor error	Regenerative resistor is ineffective	Check the connection of regenerative resistor
E-006	Module over temperature	Run with large load for long time	Reduce the load, and enhance the cooling system, or check if the fan is revolving when motor is ON; cool down the ambient temperature
E-007	Over current	UVW of drive is short circiut or the motor is error	Replace the damaged motor; check the UVW wiring.
E-008	Over speed	Motor speed is too fast, motor UVW connection is error	Check if there is other device that make motor revolve too fast; check the UVW wiring.
E-009	Analog input error	Input voltage error when 2-channe analog zero calibrating	Input correct voltage when zero calibration for analog
E-010	Position offset too large	The difference between set position and actual position exceeds the limit value	Check if the motor stalled, decrease the set position speed, increase offset pulse limit value P5-05
E-011	Motor UVW is short circiut	External is short circuit when fist self-test	Check the UVW wiring of motor, or replace the damaged motor
E-012	Motor UVW current error	Current collection circuit error	Check the UVW wiring of motor, or replace the damaged drive
E-013	Encoder UVW wire cut off	Encoder wiring error, encoder broken, encoder is not connected	Check the wiring of encoder, and re-connect the encoder after power-off, or replace the damaged encoder

E-014	Encoder ABZ wire cut off	Encoder wiring error, encoder broken, encoder is not connected	Check the wiring of encoder, and re-connect the encoder after power-off, or replace the damaged encoder
E-015	Speed changes too fast (encoder feedback error)	The encoder wiring is error, or the encoder has interference	Check the wiring of encoder, or add shield layer for the encoder wire
E-016	Overload	Run overload for long time	Reduce the overload running time, change a motor with larger rated power
E-017	Power supply is off when running	The power supply is off when running	Re-power on after the bus voltage is normal

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