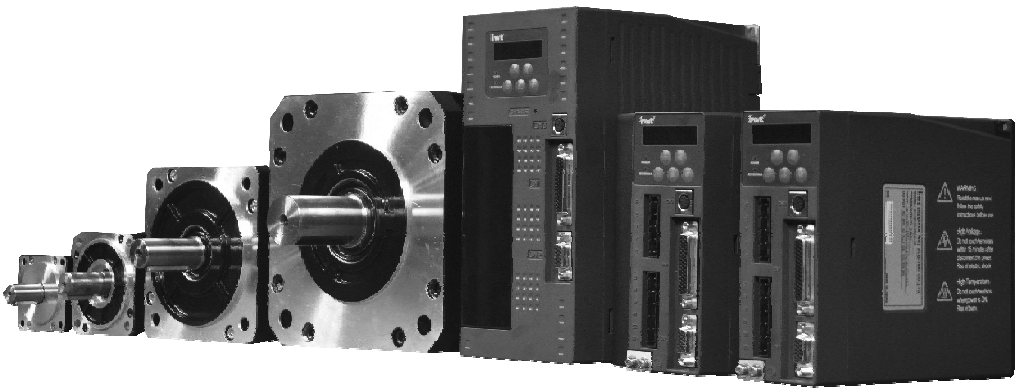
Operation Manual

SV-DB100

AC servo drives



SHENZHEN INVT ELECTRIC CO., LTD.

Preface

Thanks for using AC servo drive of the permanent magnet synchronous motor (hereinafter called "servo drive") from Shenzhen INVT Electric Co., Ltd. Please carefully read and master the user's manual before proper use. Improper use may cause abnormal running or shorten its service life or even directly damage the drive.

Please keep this manual carefully for later reference.

Safety precautions

The precautions related to safe operation are classified into "Warnings" and "Notes".


Warning

Point out potential danger which, if not avoided, may cause physical injury or death.


Note

Point out potential danger which, if not avoided, may result in mild or moderate physical injury and damage to the equipment. It's also available to warn about unsafe operations.

In some cases, even the content described in "Note" may also cause serious accidents. So please follow these important precautions in any situations.

Warning signs are presented on the sides of the servo drive. Please follow these instructions when using the servo drive.

Warning signs:


Danger

Read the manual and follow the safety instructions before use.

Touch current may be over 3.5mA,Must be grounded before operation.


High Voltage

Do not touch terminals within 15 minutes after disconnecting the power. Risk of electric shock.


High Temperature

Do not touch heat sink when power is ON. Risk of burn.

Please pay attention to the following safety precautions during installation, wiring, operation, maintenance and inspection.

Installation:


Warning

Please use the servo drive and servo motor with the instructed combination mode. Otherwise it may cause malfunction or even fire of the equipment.

Never expose the product to an environment containing moisture, corrosive gas, or flammable gas. Otherwise it may cause electrical shock or fire.

Wiring:


Warning

Only qualified electricians are allowed to carry out the wiring. Otherwise there is danger of electrical shock or fire.

The grounding terminals of the drive and motor must be grounded with proper techniques. Otherwise there is danger of electrical shock.

Do not touch the conductive components directly. Do not connect the output lines of the drive with the enclosure. Avoid short circuit of the output lines. Otherwise there is the danger of electrical shock or short-circuit.

Ensure the installation of available overcurrent protector, leakage protector and E-stop devices after distribution. Otherwise there may be danger of electrical shock, injury and fire.

Redistribute the drive in at least 15 minutes after disconnecting the power supply. Ground with correct techniques if the pick-up current is more than 3.5mA.

Make sure the voltage of the AC power supply equals to the rated voltage of the servo drive. Otherwise there is danger of injury, fire and damage to the drive.


Note

Never connect the input power lines to the output terminals as this will damage the drive.

Never conduct voltage withstand test on the drive or its connection wires as this will cause damage to the drive.

Connect the drive and motor with correct phase sequence. Otherwise it may cause malfunction or damage the drive.

Operation:

Please de-coupled the load from the drive before the trial operation for the avoidance of accidents.

Check that the supply power of the drive can be disconnected with the E-stop switch all the time before running.


Note

Verify and adjust all parameters before running. Otherwise the drive may run abnormally or act unexpectedly due to the load.

Do not touch the radiator or the external braking resistor during running. They may become very hot and burn fingers.

Maintenance and inspection:


Warning

Before doing any inspection and maintenance, be sure to disconnect the power supply, wait for 15 minutes and then confirm with a multimeter. Otherwise electric shock may occur.

Only qualified electricians are allowed to inspect the servo drive. Otherwise electric shock may occur.

Contents

1 General

1.1 General technical specifications

The standard specifications of the AC permanent magnet synchronous servo drive are listed in the table below:

Table 1-1 Standard specifications of servo drive

Servo drive		Specifications		
		200W~1.0kW	1.5kW~2.0kW	1.0kW~5.5kW
Power supply for the main circuit	Voltage degree	Single/3-phase 230V/50Hz	3-phase 230V/50Hz	3-phase 400V/50Hz
	Input voltage range	AC 230V±15%		AC 400V±15%
	Input frequency range	47Hz~63Hz		47Hz~63Hz
Power supply for the control circuit	Voltage degree	Single phase 230V/50Hz		Single phase 400V/50Hz
	Input voltage range	AC 230V±15%		AC 400V±15%
	Input frequency range	47Hz~63Hz		47Hz~63Hz
Power supply for interfaces	Voltage	DC 12V~24V		
	Allowable voltage fluctuation	±10%		
	Power capacity	Above 500mA (the local 24V can only provide 100mA current)		
Control method		Vector control, SVPWM		
Control mode		Position control mode, speed control mode and torque control mode		
Dynamic brake		Yes		

Servo drive		Specifications		
		200W~1.0kW	1.5kW~2.0kW	1.0kW~5.5kW
Regenerative braking unit		Built-in braking resistor, as well as the external braking resistor can be connected		
AC reactor		None		
Switch signal	Input	13 optical coupling isolation input		
	Output	7 open-collector output		
Analog	Input	2, range: DC -10V~+10V		
	Output	2, range: DC 0V~+10V		
Pulse	Input	2, differential input or open-collector input		
	Output	4 frequency division output,3 differential output of encoder A/B/Z pulses 1 open-collector output of encoder Z pulse		
Protection functions		Protection from overcurrent, overvoltage, overload, overheating, encoder fault, regeneration fault, undervoltage, overspeed and high tracking error and so on		
Position control	Input pulse frequency	500kHz (differential input) 200kHz (open-collector input)		
	Positioning feedback pulse	A/B orthogonal pulse Resolution: 10000 pulses/rev		
	Pulse amplification range	Electronic gear A/B:A=1~65535 and B=1~65535 1/50<A/B<500		
	Positioning accuracy	±1 pulse		
	Setting the range for reaching the designated position	±10 pulses		
	Range of fault	set within the range of ±5 revs		
	Torque control range	Set via the parameter or external analog input of DC 0~±10V		

Servo drive		Specifications		
		200W~1.0kW	1.5kW~2.0kW	1.0kW~5.5kW
		Max torque: 300% of rated torque		
Speed control	Frequency response	1000Hz		
	Speed control range	The Max speed is 5000r/min, the Min speed is 0.1r/min, and the speed regulation range is 1:50000		
	Analog speed command input	DC 0~±10V/Max rotation speed 12bit and 16bit A/D optional		
	Speed fluctuation rate	±0.03%		
	Torque control range	Set via the parameter or external analog input of DC 0~±10V Max torque: 300% of rated torque		
Torque control	Analog torque command input	DC 0~±10V/Max torque 12bit A/D		
	Torque linearity	Below ±10%		
	Speed control range	Set via the parameter or external analog input of DC 0~±10V (Max rotation speed)		
Allowable Max inertia		30 times		
Communication	RS232	Host 1: 1 communication		
	RS485	Host 1: n communication, n≤32		
Structure		IP20, natural cooling for the drive≤400W and air cooling for the drive >400W		
Environment	Operating temperature	0~45℃		
	Storage temperature	-20~80℃(without freezing)		
	Humidity	Operating/storage: ≤90%RH (non-condensation)		

Servo drive		Specifications		
		200W~1.0kW	1.5kW~2.0kW	1.0kW~5.5kW
	Other environmental conditions	Indoor (without direct sunshine), free from corrosive, flammable gasses, oil mist, dust		
	Allowable operating altitude	Should be derated if the altitude is higher than 1000m		
	Vibration	≤5.88m/s^2, 10~60Hz (not allowed to run at the resonant point)		

1.2 Name plate of the servo drive

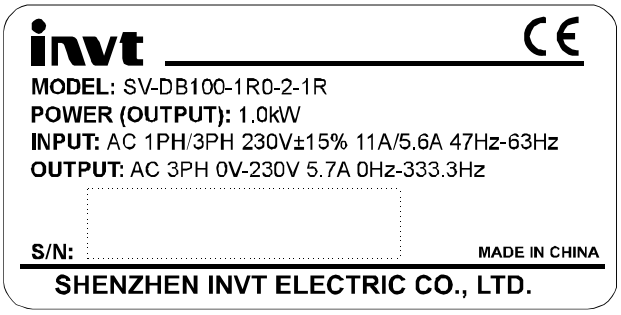


Fig. 1-1 Name plate of the servo drive

1.3 Illustration of the nameplate

SV-DB100 -XXX -X-1 R□

A B C D E F G

Fig. 1-2 Meanings of the model

Field	Meaning			
A	SV: (INVT) Servo system products			
B	DB100: products series			
C	Power degree:			
	0R2: 200W	0R4: 400W	0R7: 750W	1R0: 1.0kW
	1R5: 1.5kW	2R0: 2.0kW	3R0: 3.0kW	4R4: 4.4kW
	5R5: 5.5kW			
D	Input voltage degree:			
	05: 48VDC	08: 80VDC	D1: 110VDC	1: 110VAC

Field	Meaning			
	2: 230VAC	4: 400VAC	6: 660VAC	
E	Encoder type:			
	1: 15-wire 2500 pulses per circle increment mode	2: 9-wire 2500 pulses per circle increment mode	3: 17-bit one-loop absolute value	4: 17-bit multiple-loop absolute value
	5: Rotary transformer			
F	Communication:			
	R: RS485	C: CANOPEN	P: PROFIBUS-DP	
G	Reserved space			
	Products for special use and specific OEM product with protection Default: standard product			

1.4 Power specification

The power of each model is listed in the table below:

Table 1-2 Power specification of every model

Models	Input		Output	
	Capacity (kV/A)	Voltage (V)	Power (kW)	Rated current (A)
SV-DB100-0R2-2-1R	0.5	Single /3-phase 230	0.2	1.8
SV-DB100-0R4-2-1R	0.9	Single /3-phase 230	0.4	2.8
SV-DB100-0R7-2-1R	1.3	Single /3-phase 230	0.75	4.5
SV-DB100-1R0-2-1R	1.7	Single /3-phase 230	1.0	5.7
SV-DB100-1R5-2-1R	2.5	3-phase 230	1.5	8.0
SV-DB100-2R0-2-1R	3.5	3-phase 230	2.0	10.0
SV-DB100-1R0-4-1R	1.9	3-phase 400	1.0	3.0
SV-DB100-2R0-4-1R	3.9	3-phase 400	2.0	4.5
SV-DB100-3R0-4-1R	4.8	3-phase 400	3.0	8.0
SV-DB100-4R4-4-1R	6.2	3-phase 400	4.4	11.0
SV-DB100-5R5-4-1R	7.5	3-phase 400	5.5	14.0

1.5 Illustrations of every parts of the servo drive

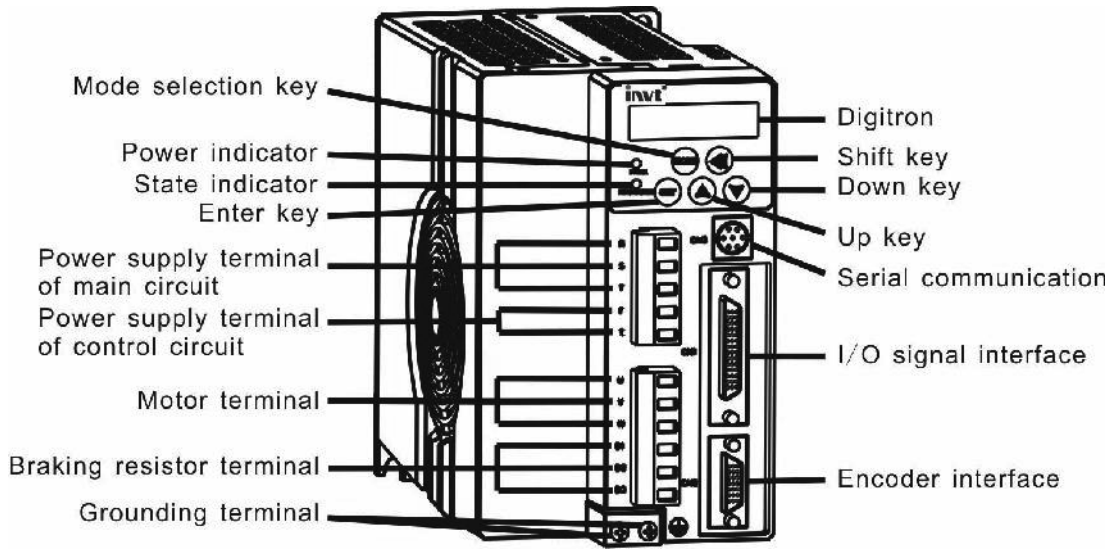


Fig. 1-3 Illustrations of every parts of 200W~5.5kW servo drives

1.6 External dimensions and installations sizes of the servo drive

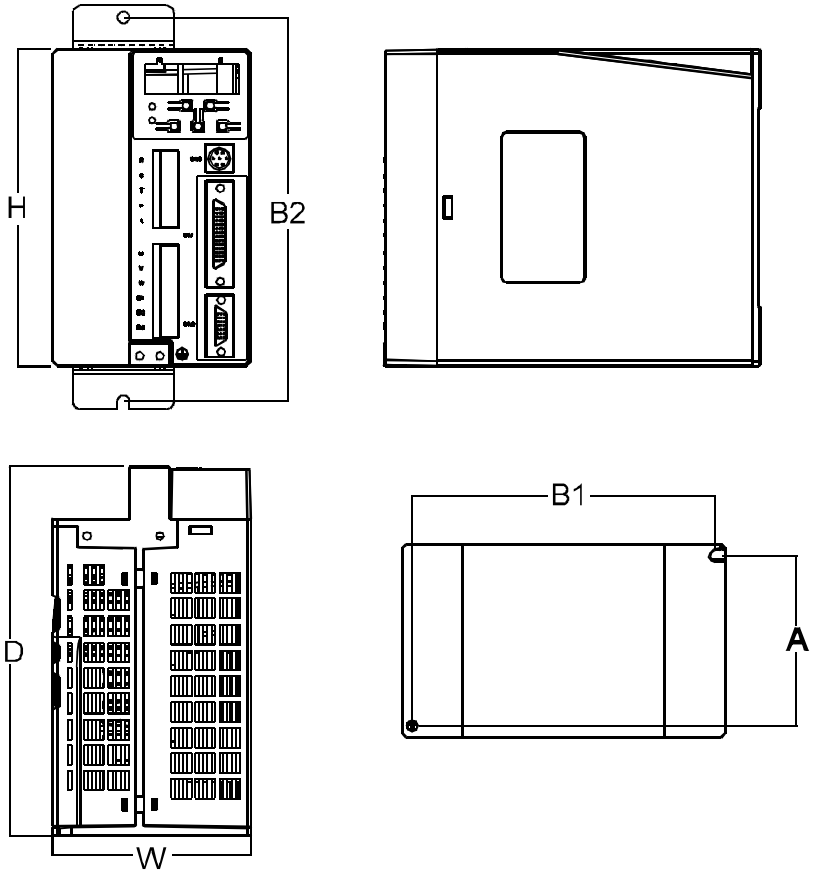


Fig. 1-4 External dimensions of 0.2KW~5.5KW servo drive

Table 1-3 **External dimensions and installations sizes**

Models	External dimensions			Installation sizes			Installation hole (mm)
	H (mm)	W (mm)	D (mm)	A (mm)	B1 (mm)	B2 (mm)	
SV-DB100-0R2-2-1R	160	68	186	56	150	194	5
SV-DB100-0R4-2-1R							
SV-DB100-0R7-2-1R	160	98	186	86	150	194	5
SV-DB100-1R0-2-1R							
SV-DB100-1R5-2-1R							
SV-DB100-2R0-2-1R							
SV-DB100-1R0-4-1R							
SV-DB100-2R0-4-1R							
SV-DB100-3R0-4-1R	230	110	186	98	219	264	5
SV-DB100-4R4-4-1R							
SV-DB100-5R5-4-1R							

2 Unpacking inspection


Note

• **Don't install or use any servo drive that is damaged or has fault parts, otherwise physical injury may occur**.

Check the following items after unpacking the servo drive and servo motor.

1. Inspect the entire exterior of the servo drive and servo motor to ensure there are no scratches or other damage caused by the transportation.
2. Ensure there is operational manual in the packing box.
3. Inspect the nameplate and ensure it is the right product.
4. Ensure the optional parts are the ordered ones.

Please contact the local agent if there is any damage to the servo drive and servo motor or optional parts.

3 Installation

Warning

- Only qualified electricians are allowed to operate on the drive device/system. Ignoring the instructions in "warning" may cause serious physical injury or death or property loss. Only qualified electricians are permitted to design, install, commission and operate on the device/system.
- Connect the input power lines tightly and permanently. And ground the device with proper techniques.
- Even when the servo drive is stopped, dangerous voltage is present at the terminals:

- Power Terminals: R, S, T, r and t;
- Motor Connection Terminals: U, V and W;
- Regenerative Braking Resistor Connection Terminals: B1, B2 and B3.

- Stop the drive and disconnect it from the power line. Wait for 15 minutes to let the drive discharge and then begin the installation.

Note

- Install the servo drive on the non-flammable materials (such as metal) to prevent fire.
- Install a cooling fan to ensure the air temperature is lower than 45°C when two drives are needed in one cabinet. Otherwise fire or damage to the devices may occur.

3.1 Environmental Requirement

3.1.1 Temperature and relative humidity

Environment temperature range: 0°C ~ +45°C

RH≤ 90%

No condensation is allowed

3.1.2 Altitude

The servo drive can run at the rated power if the installation site is less than 1000m (including 1000m) above the sea level. But it has to derate if the altitude exceeds 1000m. See the following figure for details:

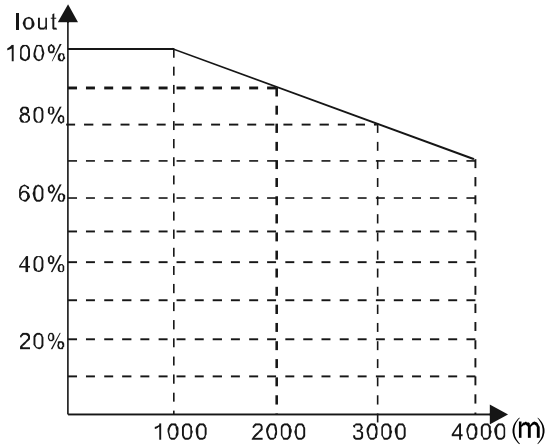


Figure 3.1 Relationship between output current and altitude

3.1.3 Other environment requirements

The servo drive can not bear fierce impact or shock. So the oscillation range should be less than 5.88m/s^2 (0.6g), 10Hz~60Hz.

The servo drive should keep away from the electromagnetic radiation source.

The servo drive should keep away from water and condensation.

The servo drive should keep away from contaminative air, such as corrosive gas, oil mist and conductive dust.

The servo drive should keep away from direct sunlight, oil mist, and steam and vibration environment.

3.2 Installation of the servo drive

3.2.1 Installation

The drive can be rack mounted. On the rear panel of the drive, there are two M5 mounting holes in the bottom left corner and top right corner to fix the drive tightly on a vertical plane.

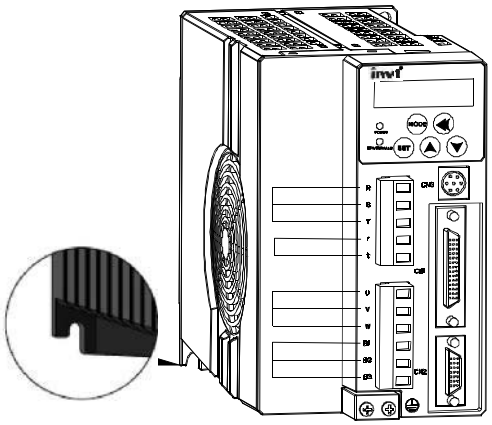


Fig. 3-2 Mounting holes of the servo drive

The servo drive can be shelf mountable by mounting bracket.

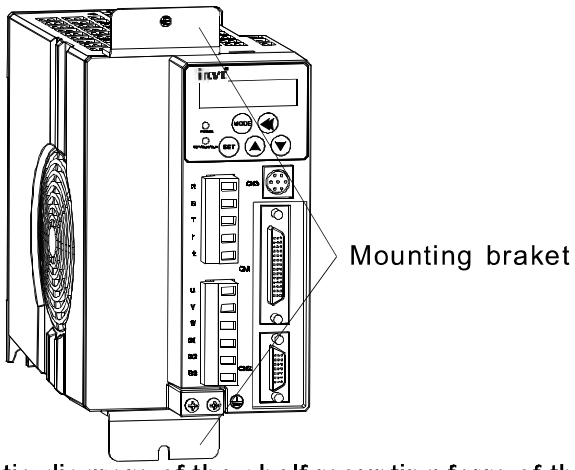


Fig. 3-3 Schematic diagram of the shelf mounting form of the servo drive

3.2.2 Installation direction and spacing

Please install the servo drive vertically and keep sufficient space around it for ventilation. If necessary, please fit a fan to control the temperature in the cabinet below 45℃.

1) To install only one set:

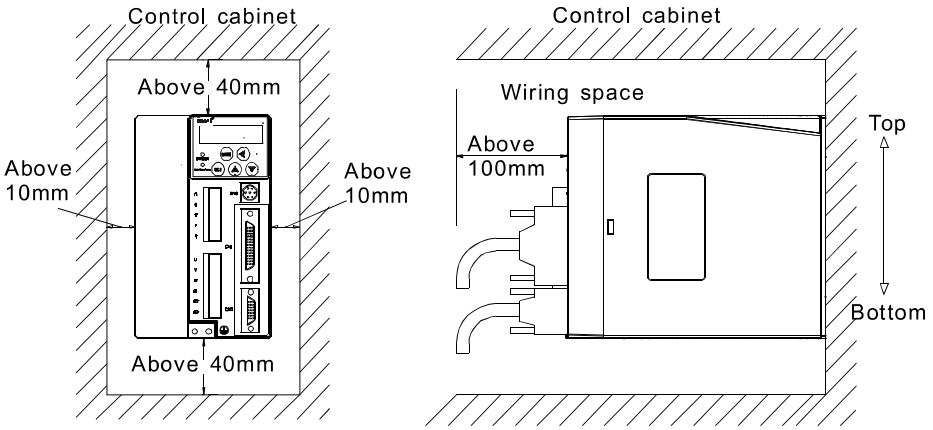


Fig. 3-4 Installation of single servo drive

2) To install several sets:

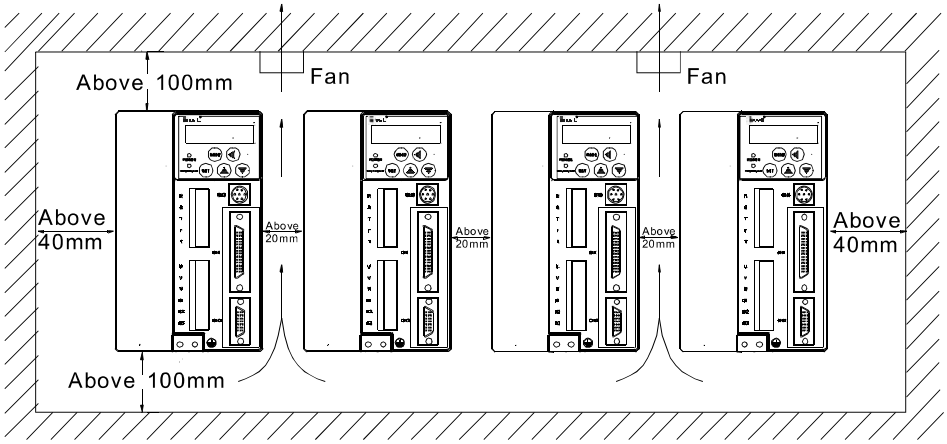


Fig. 3-5 Installation of several servo drives

3.2.3 Avoid intrusion of foreign objects

1. When assembling the control cabinet, do not allow metal chips to intrude into the servo drive.
2. Do not allow oil, water, metal chips and other foreign objects drop into the servo drive through the gaps between the control cabinet or the fan.
3. When the control cabinet is installed in a place with harmful gas or dust, ventilation is confirmedly required (to blow clean air into the control cabinet and keep the pressure inside is higher than outside) to avoid these matters coming into the control cabinet.

4 Signal and wiring

 Warning
• Only qualified electricians are allowed to operate on the drive for the insurance of a safe running of the servo drive. • Never carry out any insulation or voltage withstand tests on the cables connecting with the servo drive. • Even if the servo drive is stopped, dangerous voltage is present at the input power lines, DC circuit terminals and motor terminals. Wait for 15 minutes even when the drive is switched off until is discharge before operation. • Ground the grounding terminals of the drive with proper techniques. Otherwise there is danger of electrical shock and fire. • Never do wiring or other operations on the servo drive with wet hands. Otherwise there is danger of electric shock
 Note
• Verify that the rated voltage of the servo drive equals to the voltage of the AC power supply. • The power wires and motor wires must be permanently fastened and connected.

4.1 System configuration

4.1.1 Connection diagram of the servo drive and external equipment

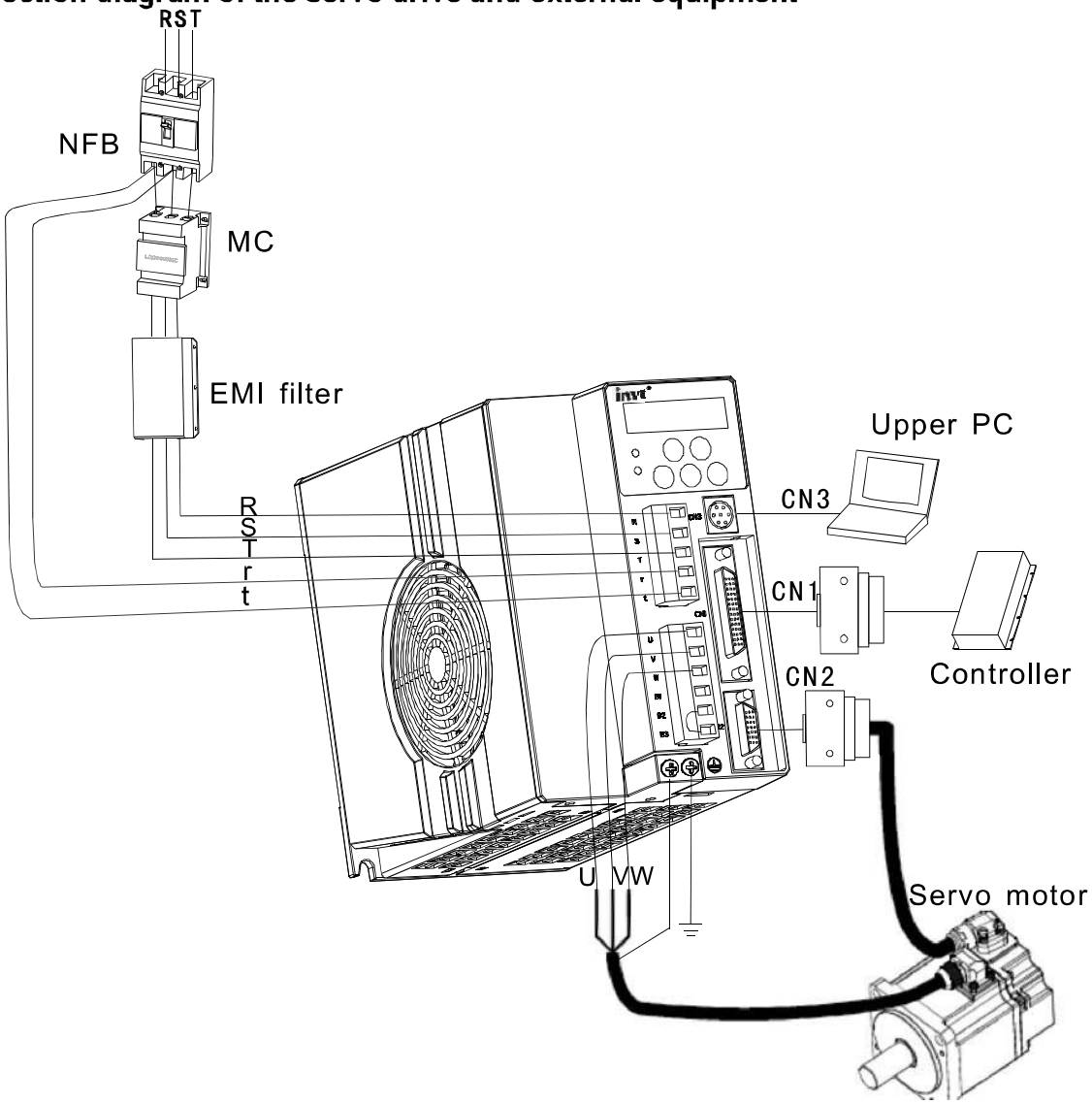


Fig. 4-1 Connection diagram of the servo drive and external equipment

- Check to ensure the input power supply indicated on the nameplate is the same as the grid before connecting the power supply of the drive.
- The electromagnetic contactor is used to switch on/off the power supply of the main circuit of the servo drive. Do not use it to start/stop the servo drive.
- In the figure above, the built-in regenerative braking resistor is used as default. If an external regenerative braking resistor is used, please refer to relevant wiring diagram. The regenerative braking resistor must be mounted on non-flammable materials, such as metal.

4.1.2 Cable diameter selection

Table 4-1 Cable diameter selection

Model	Cable diameter of the main circuit
SV-DB100-0R2-2-1R	0.75~2.0mm^2 AWG14 to AWG18
SV-DB100-0R4-2-1R	
SV-DB100-0R7-2-1R	2.0mm^2 AWG14
SV-DB100-1R0-2-1R	
SV-DB100-1R5-2-1R	
SV-DB100-2R0-2-1R	
SV-DB100-1R0-4-1R	
SV-DB100-2R0-4-1R	
SV-DB100-3R0-4-1R	3.5mm^2 AWG12
SV-DB100-4R4-4-1R	
SV-DB100-5R5-4-1R	

Note:

1. Cable diameter is the diameter of copper cables.

2. The diameter of the protective grounding wire: not less than 2.0mm^2(AWG14) for 200W~2.0kW models; not less than 3.5mm^2(AWG12) for 3.0kW~4.4kW models; not less than 5.3mm^2(AWG10) for 5.5 kW model.

4.1.3 EMI filter selection

Table 4-2 EMI filter selection

Drives	EMI filters
SV-DB100-0R2-2-1R	FLT-P04016L-B
SV-DB100-0R4-2-1R	
SV-DB100-0R7-2-1R	
SV-DB100-1R0-2-1R	
SV-DB100-1R5-2-1R	
SV-DB100-2R0-2-1R	
SV-DB100-1R0-4-1R	
SV-DB100-2R0-4-1R	
SV-DB100-3R0-4-1R	
SV-DB100-4R4-4-1R	
SV-DB100-5R5-4-1R	

Note: The EMI filter modules in the table means the filter product modules of INVT.

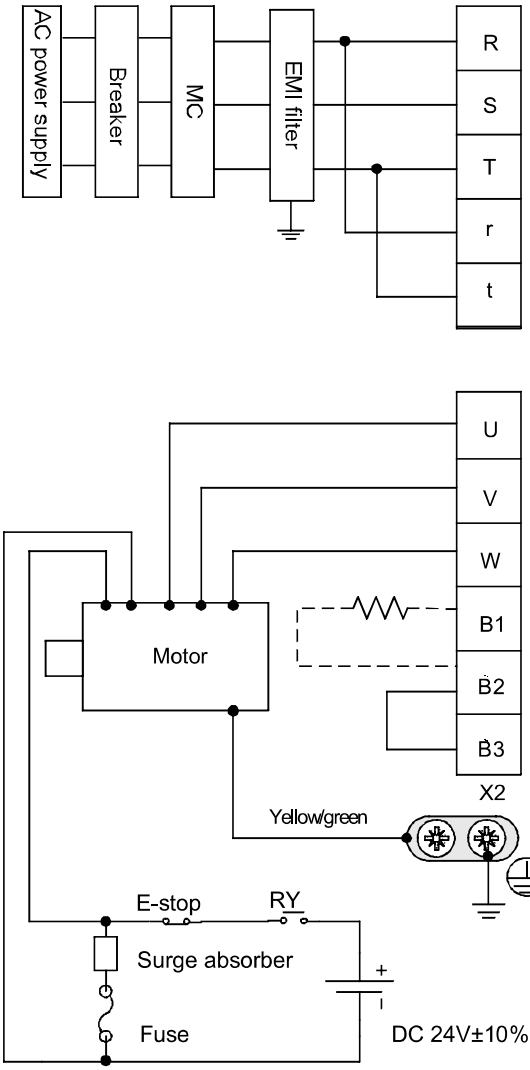
4.1.4 Braking resistor selection

Table 4-3 Braking resistor selection

Drives	Internal braking resistors	Recommended external braking resistors	The allowed external Minimum braking resistors
SV-DB100-0R2-2-1R	47Ω 80W	60Ω 200W	40Ω
SV-DB100-0R4-2-1R	47Ω 80W	60Ω 400W	40Ω
SV-DB100-0R7-2-1R	47Ω 80W	40Ω 750W	40Ω
SV-DB100-1R0-2-1R	47Ω 80W	30Ω 1.0kW	25Ω
SV-DB100-1R5-2-1R	20Ω 80W	20Ω 1.0kW	15Ω
SV-DB100-2R0-2-1R	20Ω 80W	20Ω 1.0kW	15Ω
SV-DB100-1R0-4-1R	80Ω 80W	80Ω 1KW	80Ω
SV-DB100-2R0-4-1R	47Ω 80W	50Ω 1KW	47Ω
SV-DB100-3R0-4-1R	47Ω 80W	40Ω 2.0kW	30Ω
SV-DB100-4R4-4-1R	47Ω 80W	40Ω 2.0kW	30Ω
SV-DB100-5R5-4-1R	47Ω 80W	40Ω 2.0kW	30Ω

4.2 Wiring of the main circuit (Plug X1 and X2)

4.2.1 Overview



Check whether the phase number/voltage grade of the AC power supply are consistent with those identification on the nameplate of the drive.

Non-fuse breaker or leakage switch.

Do not use this electromagnetic contactor to start/stop the servo drive.

Correctly connect to output U, V, and W of the drive according to the phase sequence of the motor cable of the servo motor. Wrong phase sequence will cause drive fault.

Do not disconnect the short circuit wire between B2 and B3 unless an external regenerative braking resistor is used.
When an external regenerative braking resistor is used, disconnect the short circuit wire between B2 and B3, and connect it according to the dashed in the figure.

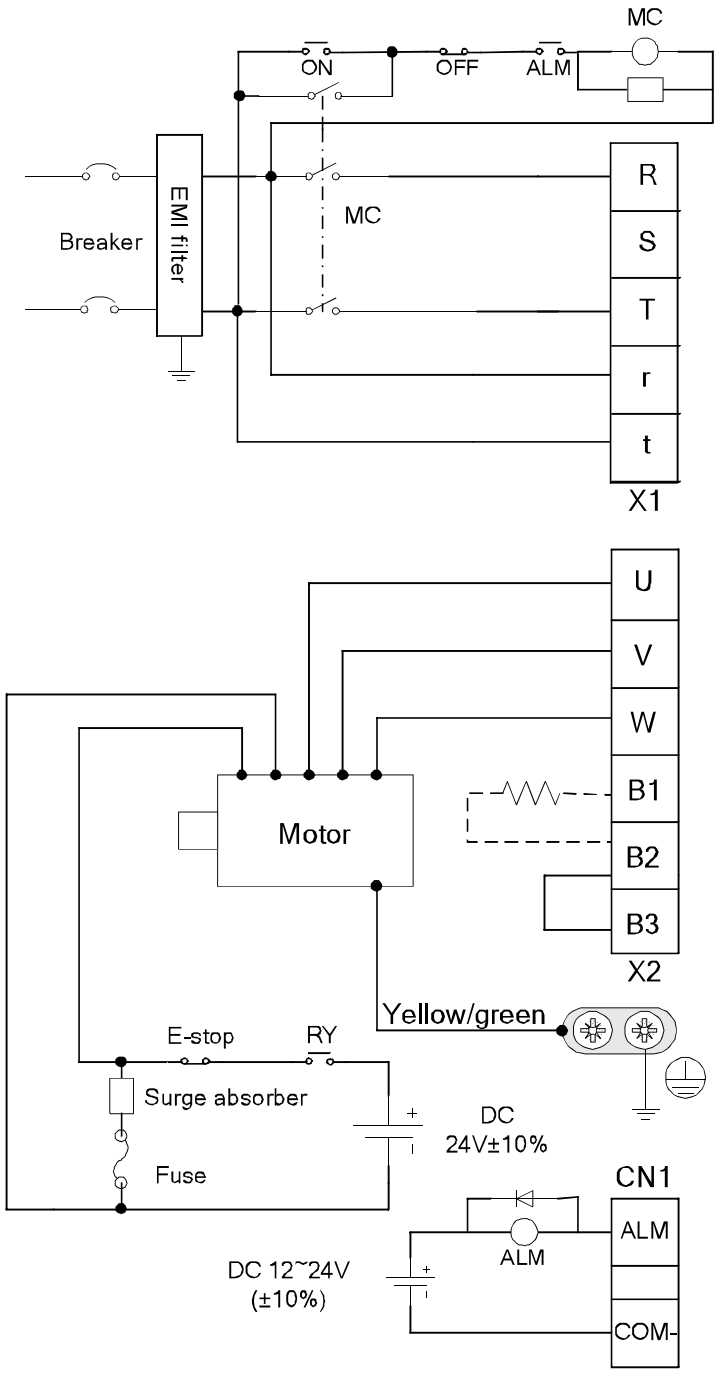
Be sure to ground the servo drive with proper techniques to avoid the accident of electrical shock.

Please set a circuit which can activate the electromagnetic brake not only through the servo drive but also through the external emergency stop device. Please refer to section 4.6.
The electromagnetic brake uses 24V power supply which should be provided by the user. Do not share it with the control signal power supply. pow

The distance between the servo motor and the servo drive should not exceed 20m. Keep a distance of at least 30cm between the encoder wire, motor cable and power cable.

Fig. 4-2 Wiring diagram of the main circuit

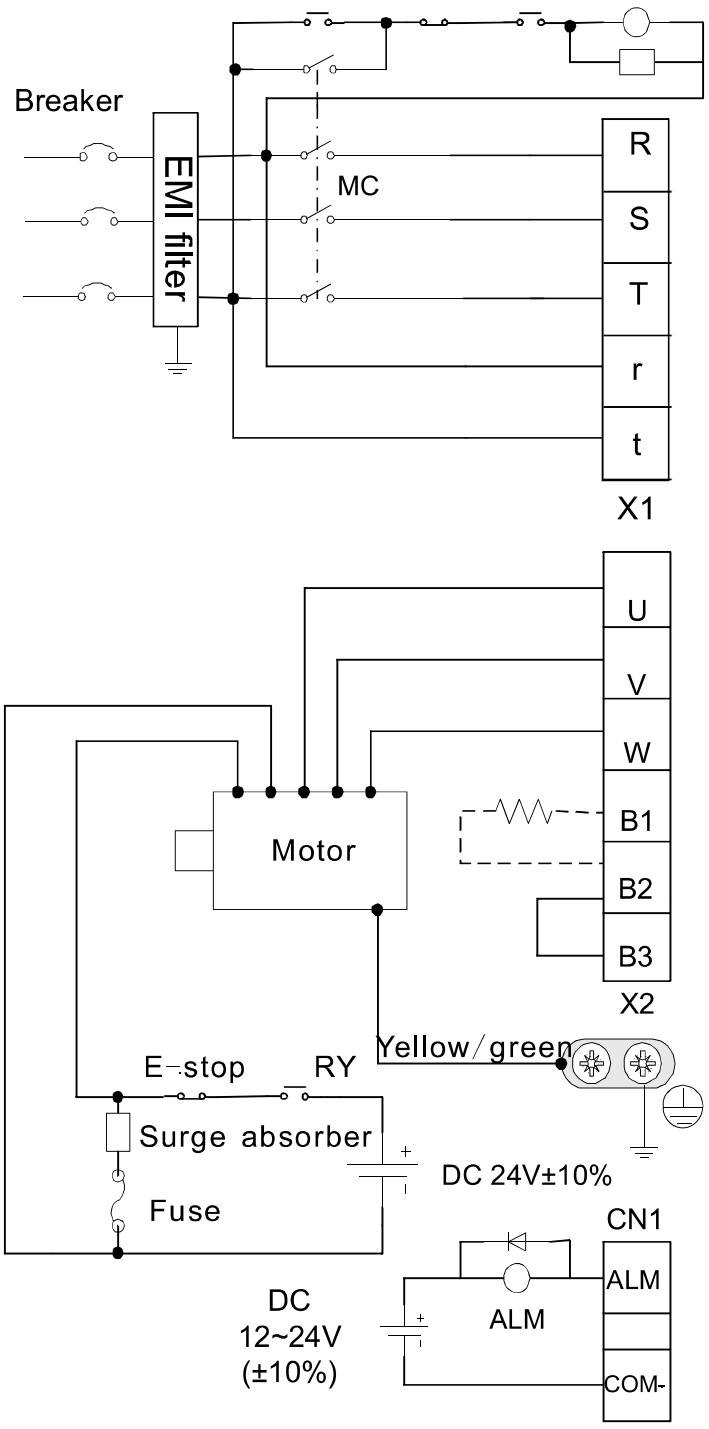
4.2.2 Wiring diagram of single phase 230V power input



- The user is required to make this emergency stop protection circuit.
- Fit surge absorbing devices on both ends of the electromagnetic contactor winding.
- The input voltage range of main circuit and control circuit is 230V±15%
- Please connect terminal R with terminal T.
- Connect the output U, V, and W of the drive to the servo motor correctly according to the phase sequence of the motor cable of the servo motor. Wrong phase sequence will cause drive fault.
- Do not disconnect the short circuit wire between B2 and B3 unless an external regenerative braking resistor is used.
- When an external regenerative braking resistor is used, disconnect the short circuit wire between B2 and B3, and connect it according to the dashed in the figure.
- Be sure to ground the servo drive to avoid accident of electrical shock.
- Please refer to section 4.6 for connection of the electromagnetic brake.
- The electromagnetic brake uses 24V power supply which should be provided by the user. Moreover, it must be isolated with the 12-24V power supply which is used for the control signal.
- Pay attention to the connection of the freewheeling diode. Reversed polarity may damage the drive.

Fig. 4-3 Wiring diagram of single phase 230V power input

4.2.3 Wiring diagram of three-phase 230V power input



The user is required to make this emergency stop protection circuit.
Fit surge absorbing devices on both ends of the electromagnetic contactor winding.

The input voltage range of main circuit and control circuit is 230V±15%

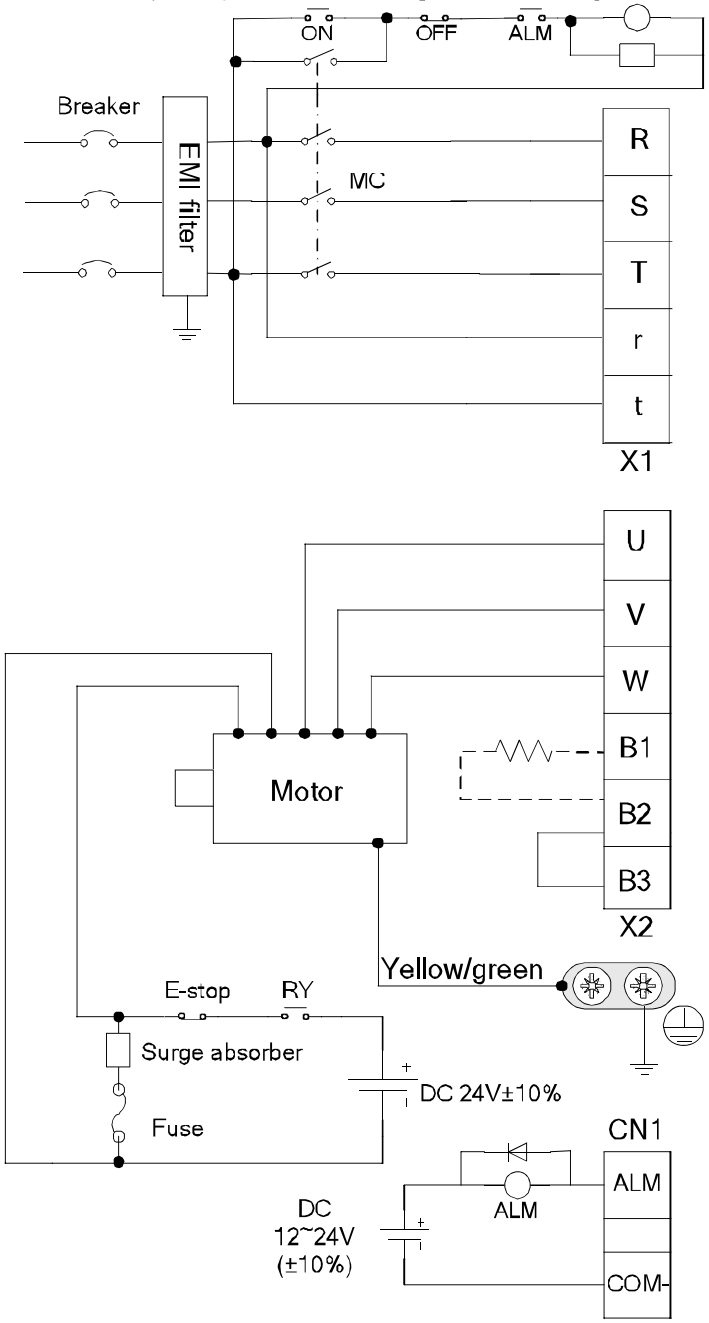
Correctly connect to output U, V, and W of the drive according to the phase sequence of the motor cable of the servo motor. Wrong phase sequence will cause drive fault.
Do not disconnect the short circuit wire between B2 and B3 unless an external regenerative braking resistor is used.
When and external regenerative braking resistor is used, disconnect the short circuit wire between B2 and B3, and connect it according to the dashed in the figure.

Be sure to ground the servo drive to avoid accident of electrical shock.

Please refer to section 4.6 for connection of the electromagnetic brake.
The electromagnetic brake uses 24V power supply which should be provided by the user. Moreover, it must be isolated with the 12-24V power supply which is used for the control signal.
Pay attention to the connection method of the freewheeling diode. Reversed polarity may damage the drive.

Fig. 4-4 Wiring diagram of three-phase 230V power input

4.2.4 Wiring diagram of three-phase 400V power input

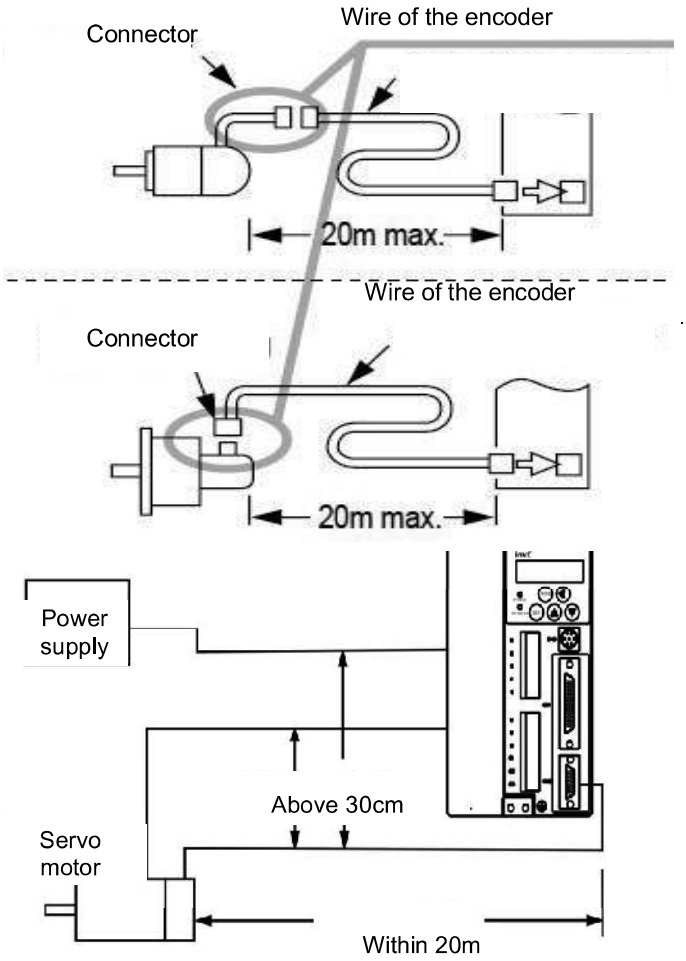


- The user is required to make this emergency stop protection circuit.
- Fit surge absorbing devices on both ends of the electromagnetic contactor winding.
- The input voltage range of main circuit and control circuit is 400V±15%
- Correctly connect to output U, V, and W of the drive according to the phase sequence of the motor cable of the servo motor. Wrong phase sequence will cause drive fault.
- Do not disconnect the short circuit wire between B2 and B3 unless an external regenerative braking resistor is used.
- When and external regenerative braking resistor is used, disconnect the short circuit wire between B2 and B3, and connect it according to the dashed in the figure.
- Be sure to ground the servo drive to avoid accident of electrical shock.
- Please refer to section 4.6 for connection of the electromagnetic brake.
- The electromagnetic brake uses 24V power supply which should be provided by the user. Moreover, it must be isolated with the 12-24V power supply which is used for the control signal.
- Pay attention to the connection method of the freewheeling diode. Reversed polarity may damage the drive.

Fig. 4-5 Wiring diagram of three-phase 400V power input

4.3 Wiring of the encoder (plug CN2)

4.3.1 Overview



The plug of the encoder is subject to the motor type. There are: cannon plugs and aviation plugs.

If it is necessary to select shields with good flexural strength and the diameter should be above 0.18mm2 (AWG24). Please refer to the connection below.

The distance between the servo motor and the servo drive should not be longer than 20m.
Keep a distance of at least 30cm between the encoder wire, motor cable and power cable. Neither laying them in one conduit nor binding them together.

Fig. 4-6 Wiring of the encoder signal

4.3.2 CN2 pin arrangement and signal definition of the servo drive

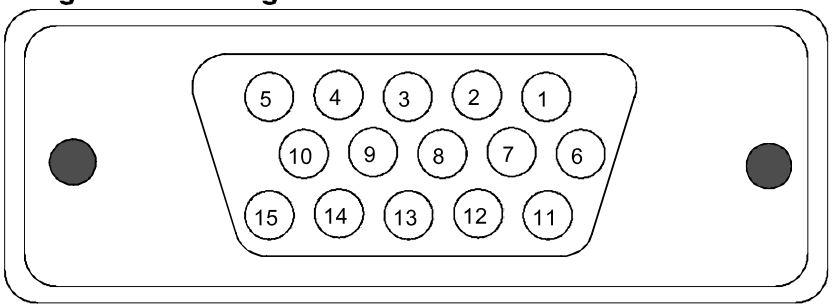


Fig. 4-7 CN2 pin arrangement

Table 4-4 CN2 signal definition table

CN2 pin No.	Definition	Cable color
1	V+	Black
2	W+	Brown
3	A+	Red
4	A-	Red and white

CN2 pin No.	Definition	Cable color
5	5V	Purple
6	U+	Orange
7	V-	Black and white
8	W-	Brown and white
9	B-	Blue
10	B+	Blue and white
11	U-	Orange and white
12	GND	Purple and white
13	Z-	Green
14	Z+	Green and white
15	/	/

4.4 Connection with the PC or HOST (CN3 plug)

The servo drive provides two kinds of communication interface: RS232 and RS485, both are drawn out via the plug CN3.

CN3 pin arrangement and signal definition:

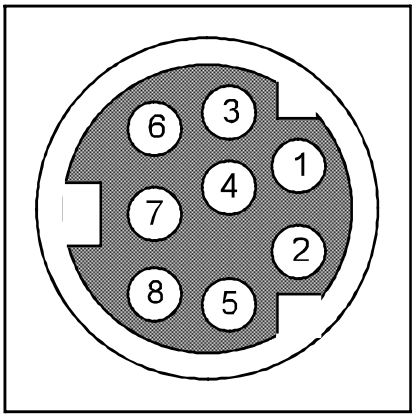


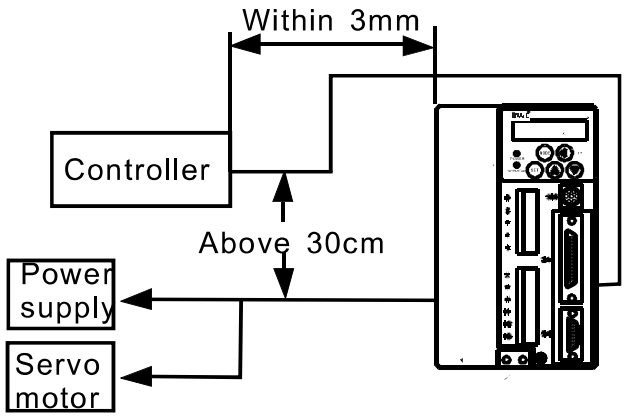
Fig. 4-8 CN3 pin arrangement

Table 4-5 CN3 signal definition table

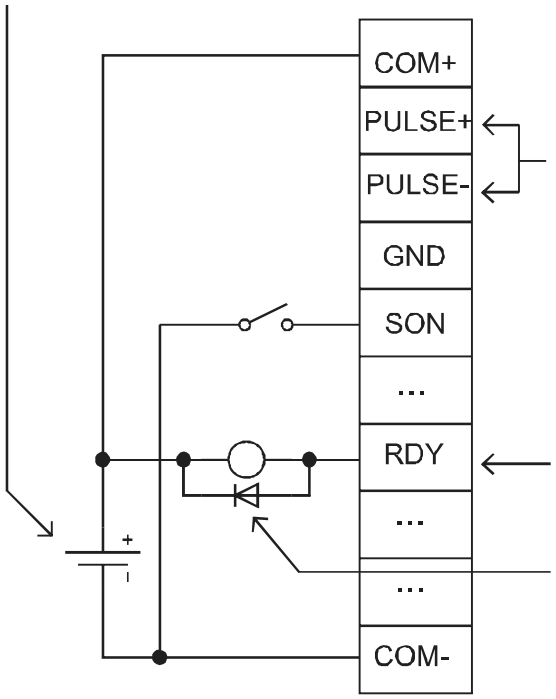
CN3 pin No.	1	2	3	4	5	6	7	8
Definition	RXD	GND	TXD	CANL	/	CANH	RS485-	RS485+

4.5 I/O signal wiring (CN1 connector)

4.5.1 Overview



The peripheral equipment such as the controller must be within 3m from the servo drive.
The controller cable must be kept at least 30cm away from the power cable and motor cable. Do not bind them together or lay them in one cable duct.



The user is recommended to prepare the 12-24V DC power supply of 500mA or more capacity used for control signal.
The local 24V power supply of the drive can only provide 100mA current.
The signal wires for pulse command input and encoder output should adopt shielded twisted pairs.

Do not apply a voltage higher than 30V or a load over 50mA on the digital output terminal. The digital outptu signals drive inductive loads directly such as relay, etc. Be sure to fit a freewheeling diode on each end of the load.

Fig. 4-9 Input/output signal connection

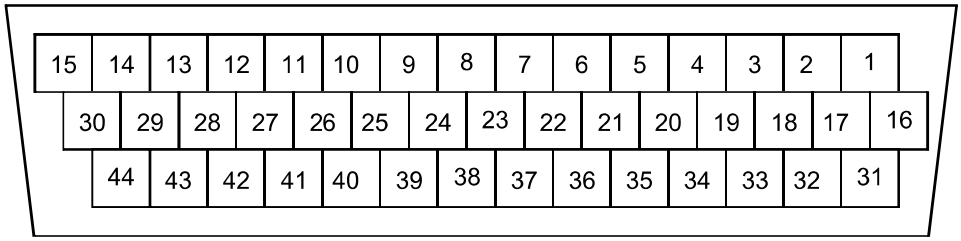
4.5.2 CN1 pin arrangement and signal explanation

4.5.2.1 CN1 terminal definition

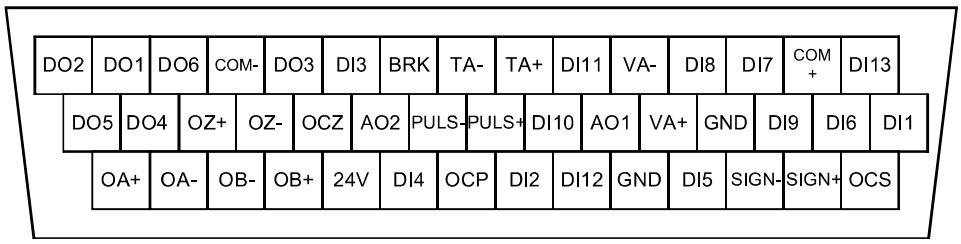
			16	DI1	Port definition 1 of digital input			
1	DI13	Port definition 13 of digital input 13	17	DI6	Port definition 6 of digital input	31	OCS	Command pulse input 1 (optional)
2	COM+(-)	Control signal power +	18	DI9	Port definition 9 of digital input	32	SIGN+	Command pulse input 2
3	DI7	Port definition 7 of digital input	19	GND	Signal ground	33	SIGN-	Command pulse input 2
4	DI8	Port definition 8 of digital input	20	VA+	Analog input 1	34	DI5	Port definition 5 of digital input
5	VA-	Analog input 1	21	AO1	Analog output 1	35	GND	Signal ground
6	DI11	Port definition 11 of digital input	22	DI10	Port definition 10 of digital input	36	DI12	Port definition 12 of digital input
7	TA+	Analog input 2	23	PULSE+	Command pulse input 1	37	DI2	Port definition 2 of digital input
8	TA-	Analog input 2	24	PULSE-	Command pulse input 1	38	OCP	Command pulse input 2 (optional)
9	BRK	Brake release	25	AO2	Analog output 2	39	DI4	Port definition 4

								of digital input
10	DI3	Port definition 3 of digital input	26	OCZ	Z phase open collector output	40	24V	Internal 24V power
11	DO3	Port definition 3 of digital output	27	OZ-	Z phase output	41	OB+	B phase output
12	COM-	Contorl signal power-	28	OZ+	Z phase output	42	OB-	B phase output
13	DO6	Port definition 6 of digital output	29	DO4	Port definition 4 of digital output	43	OA-	A phase output
14	DO1	Port definition 1 of digital output	30	DO5	Port definition 5 of digital output	44	OA+	A phase output
15	DO2	Port definition 2 of digital output						

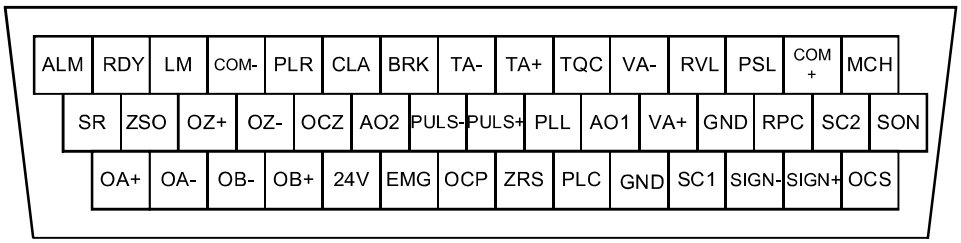
4.5.2.2 CN1 See the figure below for CN1 pin signals:



Pin arrangement of connector CN1



Signal arrangement of connector CN1



Default signal arrangement of connector CN1

Fig. 4-10 CN1 pin signal diagram

4.5.2.3 Power signal

Table 4-6 Power signal table

Symbol	Pin No.	Name	Function
24V	40	24V power supply	COM- is the ground terminal of the 24V power. Its capacity is 100mA. If the actual load is higher than this value, the user shall provide the power supply by themselves.
GND	19, 35	Signal ground	The ground of the internal power supply (except the 24V power supply) of the servo drive, it is also the ground of the phase Z open-collector signal of the encoder and the analog output signal. It is isolated with COM-.
COM+	2	Positive pole of external DC power	If the DC power supply is provided by the user, the positive pole of the DC power supply must be connected to this terminal. If the 24V power supply of the drive is used, the 24V

Symbol	Pin No.	Name	Function
		12V~24V	terminal (pin 40) must be connected on this terminal.
COM-	12	Negative pole of the power	Local 24V; Negative pole of the external power 12V~24V
FG	Cassie	Cassie ground	The cassis of CN1 terminal is connected with that of the drive.

4.5.2.4 Digital input signals and their functions

The digital input signal of P3.01~P3.13 can be configured according to the settings in table 4-7.

Table 4-7 Function table of digital input signals

Symbol	Setting	Name	Function	Mode
SON	0	Servo enabling	External servo enabling can be conducted by this terminal: the drive is in servo enabling state after this terminal is short-circuited with COM-. After switching on the power, the motor will run according to the command of the drive. After this terminal is disconnected with COM-, the drive will disconnect the output and the motor will stop. This terminal signal takes effect when receiving a pulse. When this terminal is disconnected with COM-, internal servo enabling can be conducted through parameter P0.04. See the explanation of parameter P0.04 for details. Note: After SON is short-circuited with COM-, please wait for at least 100ms before entering any command pulse; When SON is disconnected with COM-, the position deviation counter is cleared off. Try best to avoid to starting/stopping the servo drive with this terminal continually. The drive can be started/stopped with the zero speed clamp terminal (ZRS). See function description of terminal ZRS for details.	P.S.T

Symbol	Setting	Name	Function	Mode
ZRS	1	Zero speed	● After the terminal is short-connected with COM-, the servo motor will stop and in the locking state. If the terminal is disconnected with COM-, the motor will continue to work. ● In the speed mode, the stoping mode of servo motor can be set through P0.58, after connection, the servo motor stops in the position and torque mode. Note: the terminal signal is valid in electric level.	P.S.T
CAL	2	Alarm clear	When a fault alarm occurs, this terminal can be short-connected with COM-. If the fault condition is removed, the fault alarm display will be cleared. If the fault condition is not removed, the fault will be reported again. Please remove the fault and short connect this terminal with COM- again. In this way the fault alarm display will be cleared. Note: This terminal signal takes effect when receiving a pulse.	P.S.T

Symbol	Setting	Name	Function	Mode
EMG	3	Emergency stop	When parameter P3.41 (E-stop masking) is set as 1, i.e. Emergency stop terminal signal is active, this terminal can be used to execute emergency stop function: after disconnecting this terminal with COM-, the servo drive cuts off the output, the servo motor coast to stop and Emergency stop warning will occur. After emergency stopping, even if this terminal recovers short-circuit with COM-, it needs to enable the servo to run the drive. If internal servo enabling is used, it needs to switch on the control power again and then activate the internal servo enabling. This terminal signal takes effect when receiving a pulse. When parameter P3.41 is set as 0, Emergency stop terminal signal is invalid. Note: This terminal signal takes effect when receiving a pulse.	P.S.T

<table>
<tr><th>Symbol</th><th>Setting</th><th>Name</th><th>Function</th><th>Mode</th></tr>
<tr><td>SC1</td><td>4</td><td>Speed option 1/electronic gear option 1</td><td rowspan="2">Internal speed command (speed mode)/speed limit (torque mode) or electronic gear (position mode) is selected by combination of these two terminal signals as listed in the table below (ON indicates SCX is short-circuited with COM-, OFF indicates SCX is open-circuited with COM- (X=1 or 2)):
<table>
<tr><th>SC2</th><th>SC1</th><th>Speed/torque mode</th><th>Position mode</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Internal speed/speed limit 1</td><td>Electronic gear 1</td></tr>
<tr><td>OFF</td><td>ON</td><td>Internal speed/speed limit 2</td><td>Electronic gear 2</td></tr>
<tr><td>ON</td><td>OFF</td><td>Internal speed/speed limit 3</td><td>Electronic gear 3</td></tr>
<tr><td>ON</td><td>ON</td><td>Internal speed/speed limit 4</td><td>Electronic gear 4</td></tr>
</table></td><td rowspan="2">P.S.T</td></tr>
<tr><td>SC2</td><td>5</td><td>Speed option 2/electronic gear option 2</td></tr>
</table>

Symbol	Setting	Name	Function	Mode
PSL	6	Forward travel limitation	When parameter P3.40 is set as 1, i.e. the signal of travel limitation terminal is active, this terminal can be used to execute forward travel limitation function: When this terminal is disconnected with COM-, the forward speed will return to zero immediately and a forward travel limitation alarm will occur until the forward travel limitation terminal recovers short-circuit with COM-. In the forward travel limitation, the drive can automatically respond to the reverse speed command. This terminal signal takes effect when receiving a pulse. In the speed mode and torque mode, the servo is in zero speed clamp state. In the position mode, the servo is in locked state. When parameter P3.40 is set as 0, this travel limitation terminal signal is invalid.	P.S.T

Symbol	Setting	Name	Function	Mode
RVL	7	Reverse travel limitation	When parameter P3.40 (Travel limit switch masking) is set as 1, i.e. the travel limitation terminal signal is active, this terminal can be used to execute reverse travel limitation function: When this terminal is disconnected with COM-, the reverse speed will return to zero immediately and a reverse travel limitation alarm will occur until the forward travel limitation terminal recovers short-circuit with COM-. In reverse travel limitation, the drive can automatically respond to the positive speed command. This terminal signal takes effect when receiving a pulse. In the speed mode and torque mode, the servo is in zero speed clamp state. In the position mode, the servo is in locked state. When parameter P3.40 is set as 0, this travel limit terminal signal is invalid.	P.S.T

Symbol	Setting	Name	Function	Mode
RPC	8	Speed reversing/ retention pulse clearing	In the speed mode, short connecting this terminal with COM- can reverse the direction of the internal speed command and analog speed command. In the position mode, short connecting this terminal with COM- can clear the position command pulse counter, the position feedback pulse counter, and the position deviation pulse counter. In the torque mode, if P0.61=1, the terminal is short-connected with COM-, the motor operation direction is CWW, if disconnected, the motor operation direction is CW. This terminal signal takes effect when receiving a pulse.	P.S.T
PLL	9	Pulse input disabling	In position control mode, this terminal can be used to disable input of position pulse signal, i.e. the inputted position pulse signal is invalid. When this terminal is short-circuited with COM-, pulse input is disabled, and the servo is in locked state. When this terminal is disconnected with COM-, pulse input is allowed, and the servo can run. Note: This terminal signal takes effect when receiving a pulse.	P

<table>
<tr><th>Symbol</th><th>Setting</th><th>Name</th><th>Function</th><th>Mode</th></tr>
<tr><td>TQC</td><td>10</td><td>Torque limit selection</td><td>In the speed or position mode, if parameter P0.04=0, when this terminal is short-circuited with COM-, the torque limit command is external analog torque limit, when this terminal is disconnected with COM-, the torque limit command is internal torque limit, and the value is given by parameter P0.12. If parameter P0.04=1, the torque limit command is internal torque limit, this terminal signal is inactive.</td><td>P.S</td></tr>
<tr><td>PLC</td><td>11</td><td>Gain switching</td><td>When parameter P2.22 (gain switching condition) is set as 0, i.e. manual gain switching, this terminal can be used to switch gain. Parameter P2.21 is used to select the type of gain switching. See the explanation of P2.21 and P2.22 for details.</td><td>P.S.T</td></tr>
<tr><td>MCH</td><td>12</td><td>Control mode switching</td><td>When parameter P0.03 (control mode selection) is set as 3~5, this terminal can be used to switch between different controls modes. The corresponding relationships of this terminal's state and the control modes are listed in the table below:
<table>
<tr><th>Value of parameter P0.03</th><th>MCH is disconnected with COM-</th><th>MCH is connected with COM-</th></tr>
<tr><td>3</td><td>Position control mode</td><td>Speed control mode</td></tr>
<tr><td>4</td><td>peed control mode</td><td>Torque control mode</td></tr>
<tr><td>5</td><td>Position control mode</td><td>Torque control mode</td></tr>
</table></td><td>P.S.T</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Setting</th><th>Name</th><th>Function</th><th>Mode</th></tr>
<tr><td>SHOME</td><td>13</td><td>Origin returning start</td><td>The origin returning is started through this terminal. Refer to P4.11 for the setting.
Note: The signal is link valid</td><td>P</td></tr>
<tr><td>ORGP</td><td>14</td><td>Origin sensor</td><td>The origin returning is started through this terminal. Refer to P4.11 for the setting.
Note: The signal is link valid</td><td>P</td></tr>
<tr><td>CTRG</td><td>15</td><td>Route trigger</td><td>1. In the PT control mode, P4.22=0, this signal is connected with COM-, the selected route by POS0~POS2 is triggered. Refer to POS0~POS2.
2. P4.22=1, this signal is connected with COM-, the selected route by POS0~POS2 is triggered: disconnected with COM-; pause the operation; connected with COM-, the operation continues
Note: before the operation is finished, the trigger route will not be impacted.</td><td>P</td></tr>
<tr><td>POS0</td><td>16</td><td>Route selection 0</td><td>The command route will be selected through the three terminals before the signal triggering. It is invalid during the operation.
<table>
<tr><th>POS2</th><th>POS1</th><th>POS0</th><th>Route selection</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>3</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>5</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>6</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>7</td></tr>
</table>
Note:
0:OFF
1:ON</td><td>P</td></tr>
</table>

Symbol	Setting	Name	Function	Mode
POS1	17	Route selection 1		
POS2	18	Route selection 2		
PR_STOP	20	PT stop	In the PT control mode, if the port is valid, stop the executing items and retreat from the cycle	P
VS-SEL	21	Vibration control switch	Switch the frequency 0:OFF: the 1st vibration frequency 1: ON: the 2nd vibration frequency Note: The parameter is valid if P1.35=1	P
Custom In 0	22	User definition input 0	If the user needs to read the state through the communication, it is necessary to define the ports. The communication address is 1100H, the returned value is designated by 4-bit hex numbers and the default port value is 1,	P.S.T
Custom In 1	23	User definition input 1	Please refer to Custom In 0	P.S.T
Custom In 2	24	User definition input 2	Please refer to Custom In 0	P.S.T
Custom In 3	25	User definition input 3	Please refer to Custom In 0	P.S.T
Custom In 4	26	User definition input 4	Please refer to Custom In 0	P.S.T
Custom In 5	27	User definition input 5	Please refer to Custom In 0	P.S.T

Symbol	Setting	Name	Function	Mode
Custom In 6	28	User definition input 6	Please refer to Custom In 0	P.S.T
Custom In 7	29	User definition input 7	Please refer to Custom In 0	P.S.T
Custom In 8	30	User definition input 8	Please refer to Custom In 0	P.S.T
Custom In 9	31	User definition input 9	Please refer to Custom In 0	P.S.T

Remark: The pole of SON, ZRS, CLA, PLL, RPC can be reversed by setting parameter P3.00. See the explanation of P3.00. The pole of PR, STOP, ORGP, POS2, POS1, POS0 can be reversed by setting parameter P4.24. See the explanation of P4.24.

4.5.2.5 Pulse input signals and their functions

Table 4-8 Function table of pulse input signals

Symbol	Pin No.	Name	Function
OCP	38	Position command pulse input 1	In the position control mode, they are used as the input terminals of the position command; In other control modes, this group of terminals is inactive; Allowed Max. input pulse frequency: 500kHz in differential mode, 200kHz in open-collector mode.
PULSE+	23		
PULSE-	24		
OCS	31	Position command pulse input 2	
SIGN+	32		
SIGN-	33		

4.5.2.6 Pulse input signals and their functions

Table 4-9 Function table of analog input signals

Symbol	Pin No.	Name	Function
VA+	20	Position command pulse input 1	External analog input terminals. The input impedance is 10kΩ. The input voltage range is -10V~+10V. A voltage exceeding ±11V may damage the drive. Refer to parameters of P0.42, P0.62 and P3.20, P3.23.
VA-	5		
TA+	7	Position command pulse input 2	
TA-	8		

4.5.2.7 Digital output signals and their functions

Except BRK signal, P3.14~P3.19 can be congifured with digital input signal according to the

information in the table below.

Table 4-10 Function table of digital output signals

Symbol	Setting	Name	Function	Symbol
RDY	0	Servo ready	When the control power and main power are applied normally and the drive is not in alarm state, this signal output transistor is breakover, it means the drive can be started.	P.S.T
ALM	1	Servo alarm	When the servo drive is in normal state, this signal output transistor is breakover. When the power supply is disconnected or the servo drive is in alarm state, this signal output transistor switches off.	P.S.T
PLR	2	Position reaching	When the position reaches to the command range, this signal output transistor is breakover.	P.S.T
ZSO	3	Zero speed	When the speed reaches the range of zero speed, this signal output transistor is breakover.	P.S.T
SR	4	Speed reaching	When the speed reaches the range of speed setting, this signal output transistor is breakover.	P.S.T
LM	5	Torque limit	When the servo system is in torque limit, this signal output transistor is breakover.	P.S.T
HOME	6	Origin arrived	The signal output transistor conduction if the original is arrived.	P
CMD_OK	7	Command finished	The signal output transistor conduction if the command is finished. The signal does not mean that the positioning is finished.	P
MC_OK	8	Task finished	The signal output transistor conduction if the command and positioning is finished. Output ransistor conduction if CMD_OK signal is arrived at the 1st position.	P
Custom Out 0	9	User definition output 0	If the user needs to read/write the state through the communication, it is necessary to define the ports. The communication address is 1101H, the returned value is designated by 4-bit hex numbers and the default port value is 0	P.S.T
Custom Out 1	10	User definition output 1	Please refer to Custom Out 0	P.S.T
Custom Out 2	11	User definition	Please refer to Custom Out 0	P.S.T

		output 2		
Custom Out 3	12	User definition output 3	Please refer to Custom Out 0	P.S.T
Custom Out 4	13	User definition output 4	Please refer to Custom Out 0	P.S.T
Custom Out 5	14	User definition output 5	Please refer to Custom Out 0	P.S.T
Custom Out 6	15	User definition output 6	Please refer to Custom Out 0	P.S.T
Symbol	**Pin No.**	**Name**	**Function**	**Symbol**
BRK	9	Brake release	When the control brake releases, this signal output transistor conduction.	P.S.T

4.5.2.8 Digital output signals and their functions

Table 4-11 Function table of encoder output signals

Symbol	Pin No.	Name	Function
OA+	44	Phase A output	• Output the frequency divided encoder signal, comply with the standard of TIA/EIA-422-B; • The output phase A pulse and phase B pulse is still orthogonal. When it rotates forward, phase B leads phase A by 90º. When it rotates in reverse, phase A leads phase B by 90º. • The frequency division coefficient of phase A and phase B can be set through parameter P0.06 and P0.07. Frequency division with any integer and decimal fraction is allowable but frequency multiplication is not allowed; • The output signals have no isolation.
OA-	43		
OB+	41	Phase B output	
OB-	42		
OZ+	28	Phase Z output	
OZ-	27		
OCZ	26		Output the open-collector signal of phase Z, without isolation.

4.5.2.9 Analog output signals and their functions

Table 4-12 Function table of analog output signals

Symbol	Pin No.	Name	Function
AO1	21	Analog output 1	Its output function can be defined by setting parameter of P3.30. The range and deviation can be set via parameters P3.31 and P3.34.
AO2	25	Analog output 2	Its output function can be defined by setting parameter of P3.32. The range and deviation can be set via parameters P3.33 and P3.35.

4.5.3 Standard wiring of the position control mode

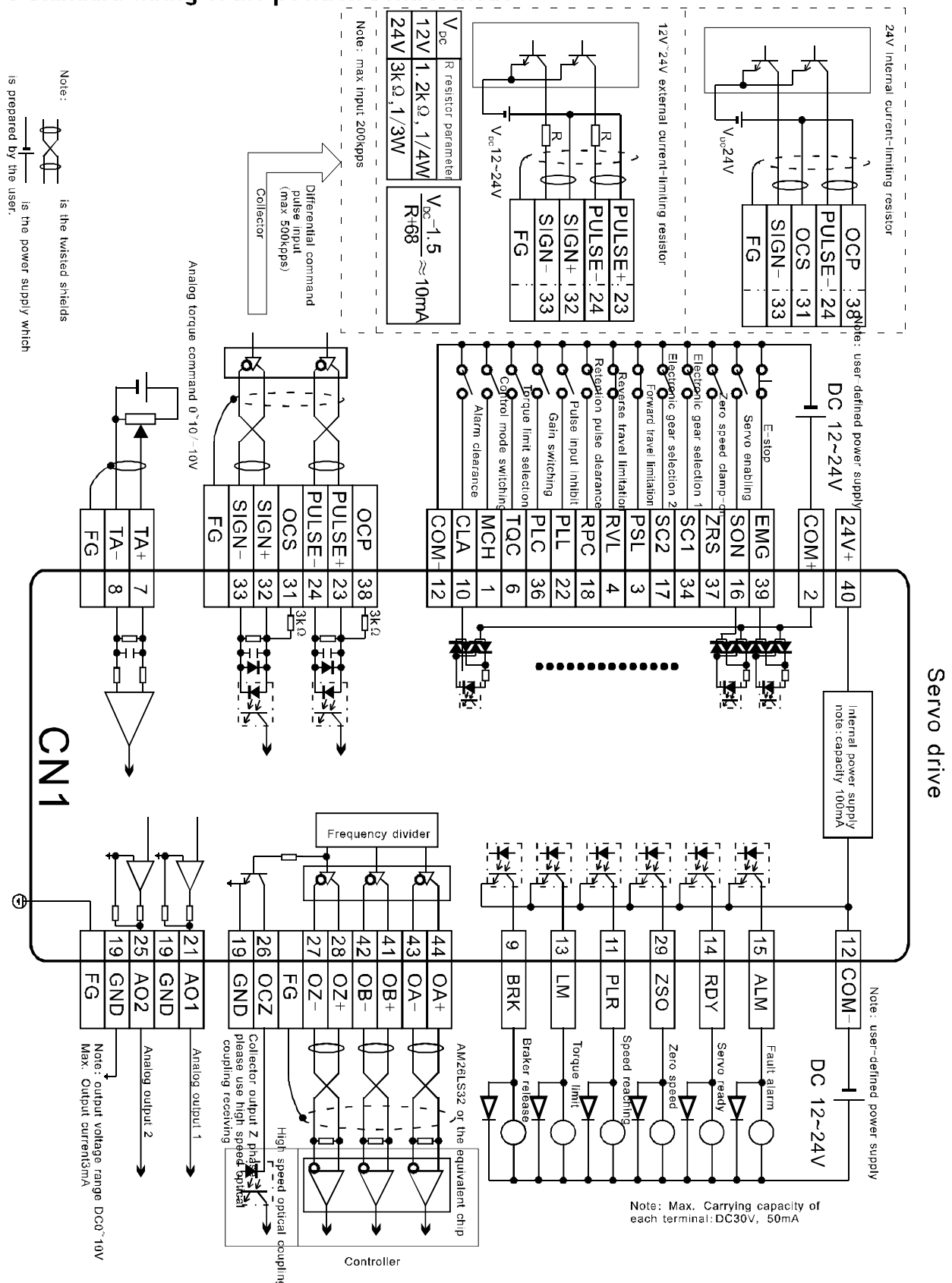


Fig. 4-11 Standard wiring of the position control mode

4.5.4 Standard wiring of the speed control mode

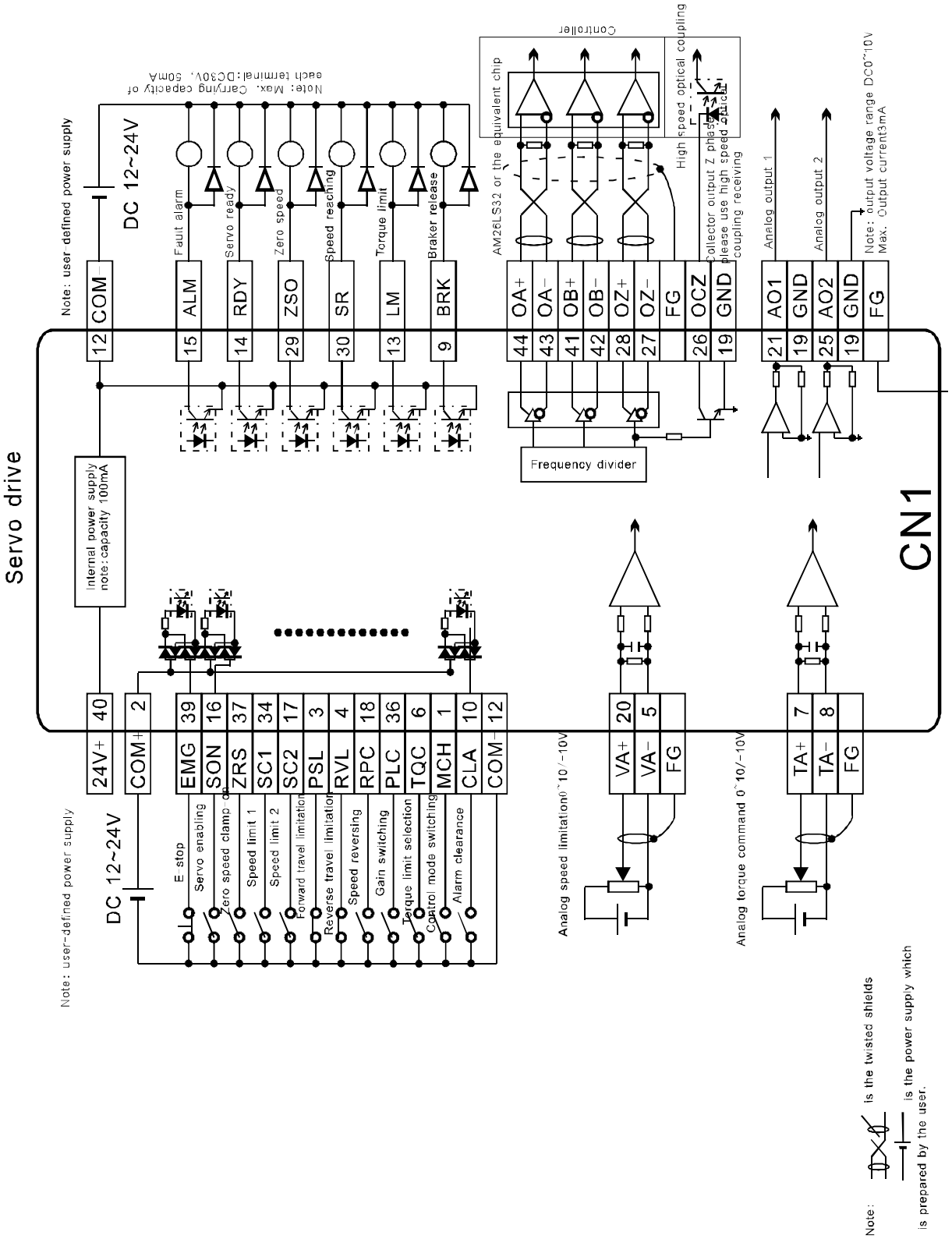


Fig. 4-12 Standard wiring of the speed control mode

4.5.5 Standard wiring of the torque control mode

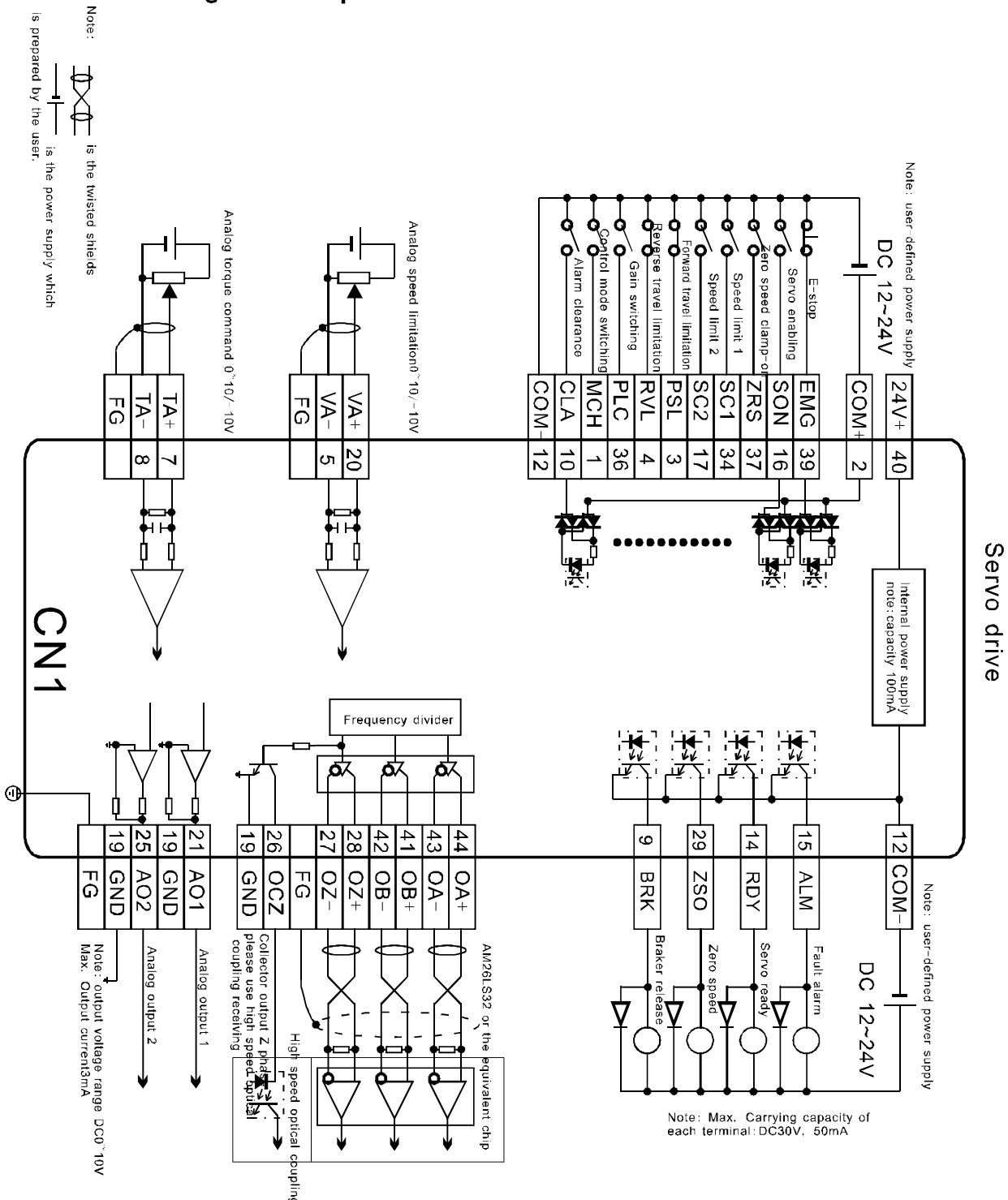


Fig. 4-13 Standard wiring of the torque control mode

4.5.6 Detailed instruction of the input and output of CN1

4.5.6.1 Wiring of ON-OFF input circuit

Connection diagram when the power supply is self-provided by user:

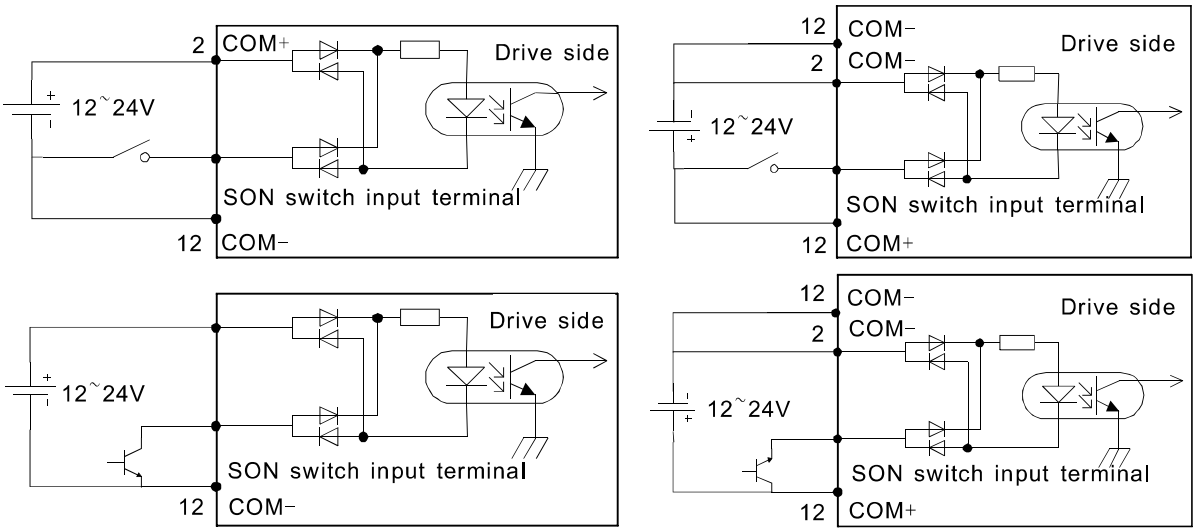


Fig. 4-14 Wiring diagram of ON-OFF input circuit (power supply is self-provided by user)

Connection diagram when the local power supply is used:

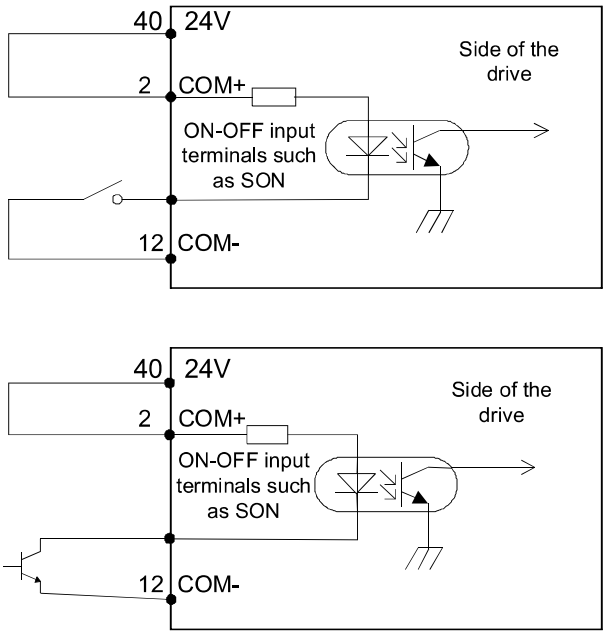


Fig. 4-15 Wiring diagram of ON-OFF input circuit (local power supply)

- The ON-OFF input circuit can be connected with mechanical switch connection and the open-collector connection of audion shown in the figure.
- The user can use either the 24V power supply (it only can provide 100mA current) of the servo drive or 12V~24V power supply provided by the user.

4.5.6.2 Wiring of the pulse input circuit

Connect method 1: the differential connection

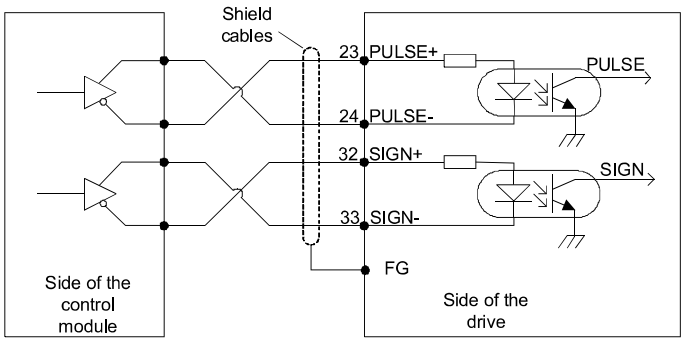


Fig. 4-16 Wiring diagram of differential pulse input circuit

◆ The maximum frequency of input pulse is 500kHz and the input signal voltage is ±5v;

◆ With the best anti-noise capability, this signal transmit method is recommended as the preferred.

Connection method 2: the open collector circuit 1

The control module is NPN (the common negative pole):

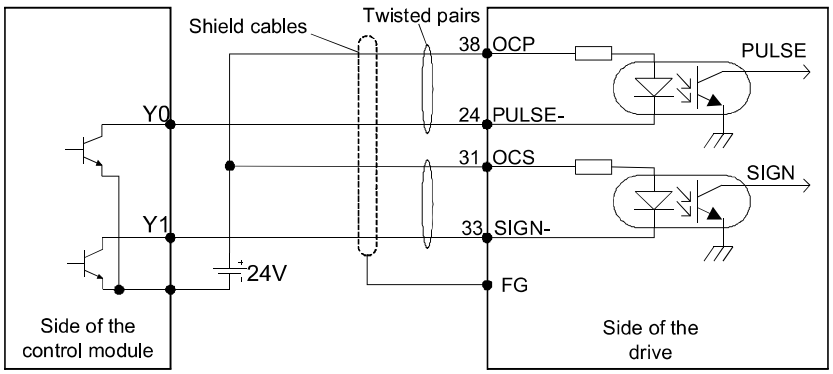


Fig. 4-17 Wiring diagram of the open collector circuit 1(NPN)

The control module is PNP module (the common positive pole):

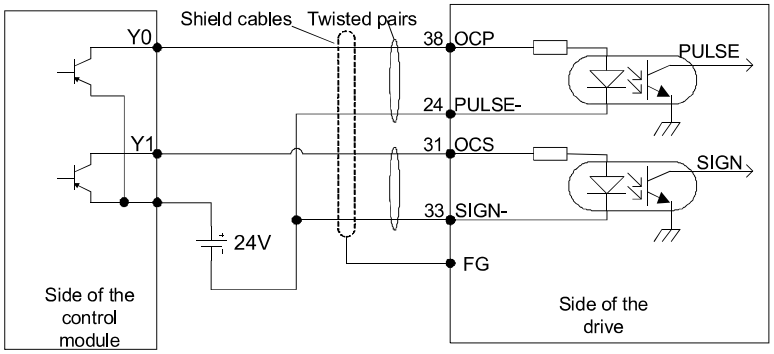


Fig. 4-18 Wiring diagram of the open collector circuit 1(PNP)

◆ The Max. input pulse frequency is 200kHz; apply the local 24v power supply((it only can provide 100mA current)) or the user-provided 24v power supply without the current-limiting resistor. Generally, most of Japanese PLC (such as Mitsubishi, Panasonics

and OMRON) is NPN module, while most of European PLC (such as Siemens) is PNP module. The above figure is external 24V power supply connection. If the internal power supply is needed, connect the pin of the positive terminal of 24V power supply and the pin of 24V power supply (the 40 pins of CN1)of the drive and connect the pin of the negative terminal of 24V power supply and COM-(the 12 pins of CN1).

Connection method 3: the open collector circuit 2

The control module is NPN (the common negative pole):

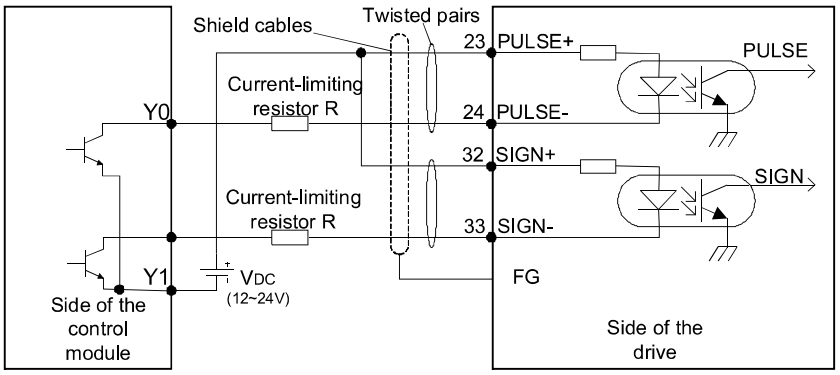


Fig. 4-19 Wiring diagram of the open collector circuit 2(NPN)

The control module is PNP (the common positive pole):

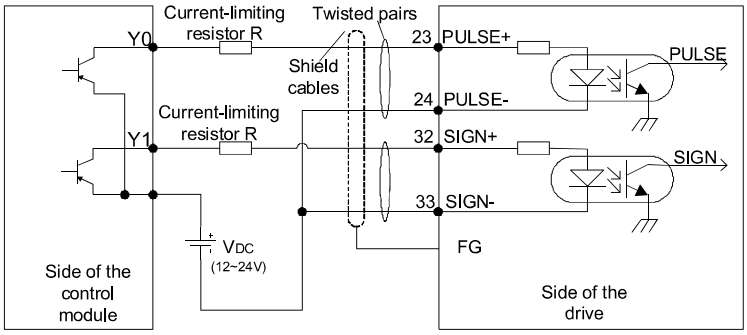


Fig. 4-20 Wiring diagram of the open collector circuit 2(PNP)

◆ The Max. input pulse frequency is 200kHz; apply the local 24v power supply((it only can provide 100mA current)) or the user-provided 24v power supply with the current-limiting resistor(the resistance is selected as the below table). Generally, most of Japanese PLC (such as Mitsubishi, Panasonics and OMRON)is NPN module, while most of European PLC (such as Siemens)is PNP module. The above figure is external 24V power supply connection. If the internal power supply is needed, connect the pin of the positive terminal of 24V power supply and the pin of 24V power supply (the 40 pins of CN1)of the drive and connect the pin of the negative terminal of 24V power supply and COM-(the 12 pins of CN1).

VDC	Resistor parameters
12V	1000Ohm ,1/4W
24V	2000Ohm ,1/3W

$$\frac{V_{DC} - 1.5}{R + 68} \approx 10\ (mA)$$

For all the 3 methods, shielded twisted-pair must be used and the length must be less than 3m.

4.5.6.3 Wiring of the analog input circuit

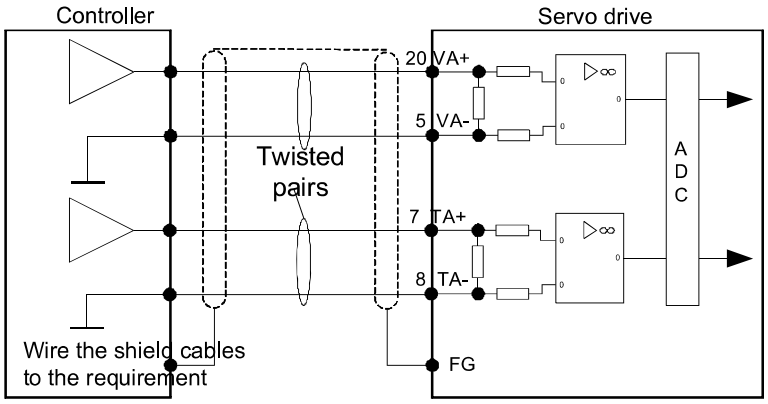


Fig. 4-21 Wiring diagram of the analog input circuit

- There are two analog input circuits VA and TA. The input impedance is 10kΩ. The input voltage range is -10V~+10V. If the voltage is higher than ±11V, the circuits may damage.

4.5.6.4 Wiring of ON-OFF output circuit

Connection diagram when the power supply is self-provided by user:

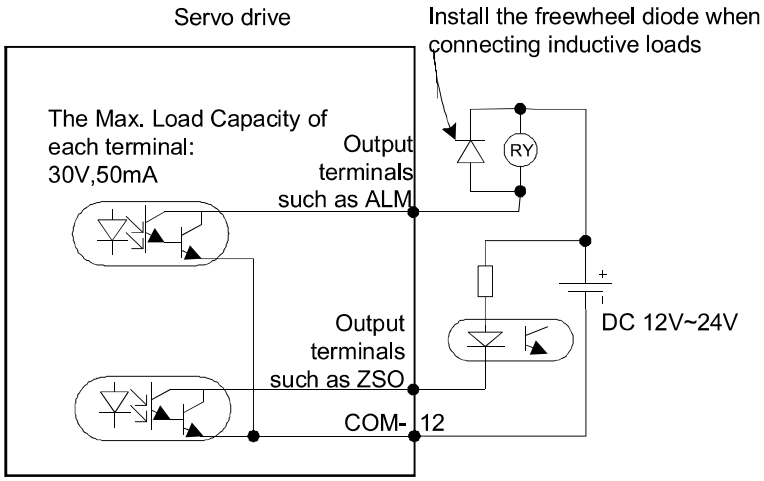


Fig. 4-22 Wiring diagram of ON-OFF output circuit (power supply is self-provided by user)

Connection method when the local power supply is used:

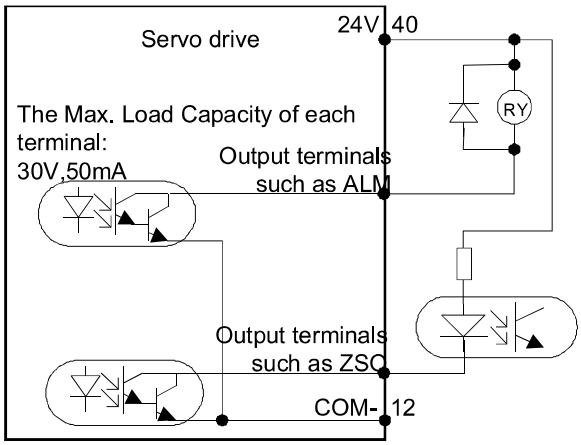


Fig. 4-23 Wiring diagram of ON-OFF output circuit (local power supply)

- There are 7 digital output circuits in total and all of them adopt the open-collector output as shown in the figure. They can be used to drive the relay coil or optical coupled load. The loading capacity is as shown in the figure.
- When inductive loads such as relay coil are connected, a free wheel diode must be fitted as shown in the figure. Otherwise the drive will be damaged.
- The local 24V power supply only can provide 100mA current. If the actual load current is larger than 100mA, the user should provide the power supply by themselves. The recommended capacity is greater than 500mA.

4.5.6.5 Wiring of the frequency division output circuit of the encoder feedback signal:

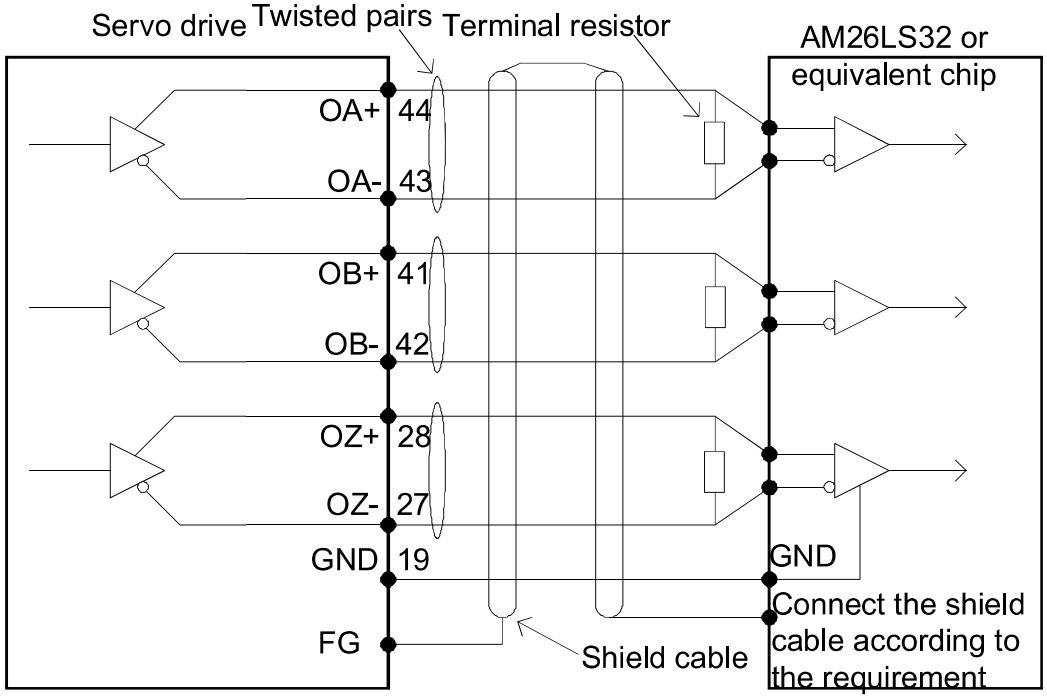


Fig. 4-24 Wiring diagram of the frequency division output circuit of the differential encoder feedback signal

Open-collector mode:

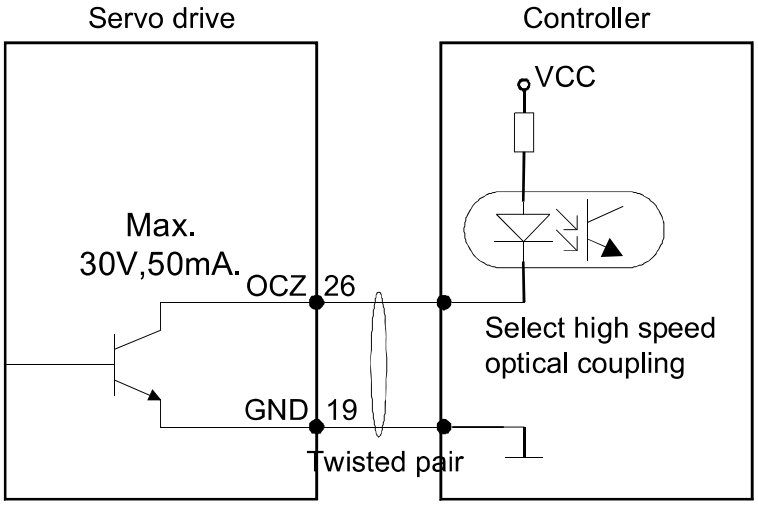


Fig. 4-25 Wiring diagram of the frequency division output circuit of the open-collector encoder feedback signal

- Phase A and B of the encoder only provides differential output signal, phase Z provides differential output and open-collector output signals.
- For differential output signal, to use AM26C32 or equivalent differential receiving chip and be sure to fit a terminal matching resistor of about 220Ω is recommended .
- For the phase Z signal of open-collector output, as the signal pulse width is very narrow, the user shall use high speed optical coupler to receive this signal.
- Both kinds of output circuits have no isolation.

4.5.6.6 Wiring of the analog output circuit

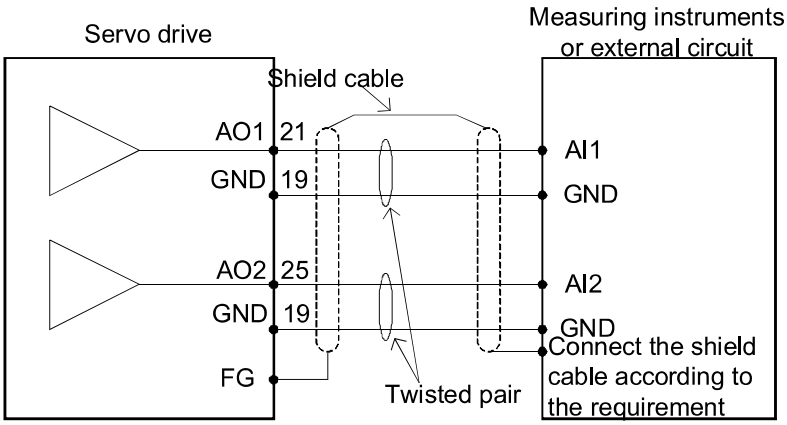


Fig. 4-26 Wiring diagram of the analog output circuit

There are two analog output circuits in all. The output voltage range is 0 – 10V. The Max output current is 3mA.

4.5.7 Wiring of the electromagnetic brake

If the servo drive is used in the vertical drop applications, the electromagnetic brake can be used to stop and keep the dropping speed. The wiring diagram is:

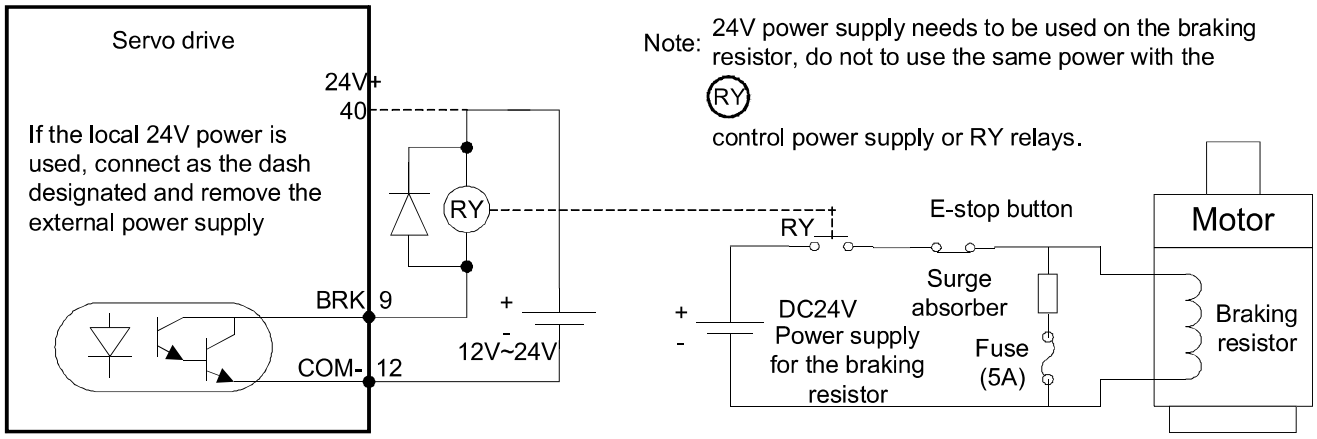


Figure 4-27 Wiring diagram of the electromagnetic brake

- 24V power supply special for the electromagnetic brake can not be used with the contorl signal;
- RY is the relay wires, please pay attention to the direction of the diode;
- The electromagnetic brake is used to keep the speed, other than stop;
- Please intall the external braking devides besides the electromagnetic brake;
- BRK signal acts when the power is connected, the drive is switched off or fault occurs. Please refer to chapter 5.1.10.

BRK signal can be switched off in the delay time through P3.57. Please refer to P3.57.

5 Running and operation

5.1 Running

5.1.1 First powering on

Check followings before powering on:

1) Wiring

- The power supply of the servo drive (R, S, T, r and t) should be connect with proper techniques;
- The output phase of the servo drive (U, V and W) should be the same as that of the cables of the servo drive;
- There is no short circuit between the output of the servo drive (U, V and W) and the input power supply (R, S and T);
- All wiring comply with the standard wiring shown in section 4.5.3~4.5.5;
- Ensure the external terminal (SON) for servo enabling is set to OFF;
- Ensure the servo drive and the servo motor are grounded to the earth properly;
- When using external braking resistor, the short circuit wire between B2-B3 on X2 terminal should be removed;
- Do not put voltage above DC24V on CN1;
- The press threshold is among the designated range.。

2) Environment

- There are no foreign objections, such as metal and other wire lead which can cause short circuit of signal and power wires.

3) Mechanical parts

- The installation of the servo drive and the connection of the bear are reliable;
- The servo motor and the machines are available to run;
- Do not run the motor at negative load (the direction of the output torque of the motor reverses to the speed direction).

If all above items are checked OK, switch on the power supply:

5.1.1.1 Sequence of powering ON/OFF

The control circuit and the main circuit of the drive are supplied separately. In principle, when powering on, switch on the power supply of the control circuit (terminals r, t) first and then switch on the power supply of the main circuit (terminals R, S, T). When powering off, switch off the power supply of the main circuit first and then switch off the power supply of the control circuit.

After switching on the control circuit power supply and before switching on the main circuit

power supply, "AL-PoF" will display on the front panel as the main circuit power-off alarm. it means the bus voltage of the main circuit is 0 or too low.


Warning

After switching on the power supply of the main circuit, do not touch the motor line terminals even if the servo is not started as this may cause electrical shock.

After switching on the power supply, do not touch the electriferous parts as this may cause electric shock.

5.1.1.2 Checking after powering-on

After switching on both of the control circuit and main circuit power supplies, if the power supply is OK, the Power indicator lamp on the front panel will illuminate in red and the servo drive and servo motor will not generate abnormal noise. If there is no fault alarm of the servo drive, the LED on the front panel displays the current speed of the servo motor as default. The default parameter can be set through parameter P0.15. The 3-color indicator lamp on the front panel illuminates as blue. If there is a fault of the servo drive, the LED displays current alarm sign and the 3-color indicator lamp on the front panel illuminates as red. Please fix the fault by referring to chapter 9.1.

5.1.2 Self-test before running of the servo

The self-test before running the servo is very essential, it includes the following items:

1) Whether there are disconnecting of the motor encoder

Rotate the motor shaft with hands at least one cycle to see if it reports an encoder line break fault (Er-EC1 or Er-EC2).

2) Whether there is abnormality of current detection

Verify whether the motor shaft is rotating while switching on the power, whether it reports a current detection fault (Er-iTE) during power-on.

5.1.3 Parameter setting before running the servo

Parameter setting must be conducted before running the servo. You can set relevant parameters via the front panel or communication to meet the function and performance requirements of the site application. See chapter 5.2.4 for the detailed description of all parameters of the servo drive. Some of these parameters need to be set according to the site application demand. For examples, pulse input mode, electronic gear, frequency division coefficient of encoder output, upper/lower limit of analog input, etc. Some of these parameters need to be set according to the site debugging. For example, the parameters of the regulator loop which affect the system performance and other similar parameters. For most parameters the factory default values are appropriate.

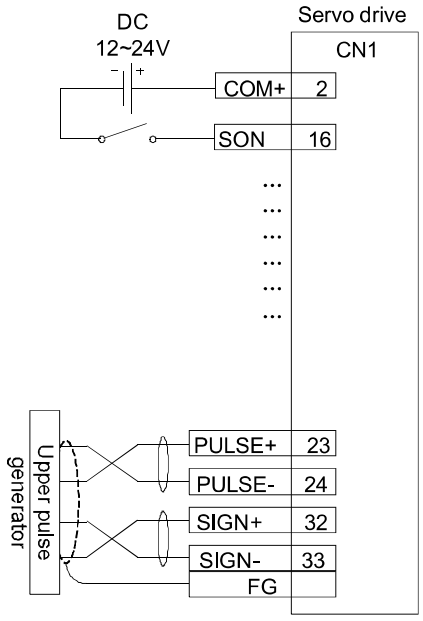
5.1.3 Trial jogging

Trial jogging can check whether the servo drive and the servo motor are intact and conduct preliminary debugging of the system including the servo drive, servo motor and peripheral equipments. Run the servo motor by JOG operation after ensuring that the wiring is correct and there is no fault alarm and no abnormal running, See chapter 5.2.4 for detailed instructions. Before jog running, ensure:

- The motor isn't in running state. If the motor is running, JOG operation is invalid;
- The load inertia shouldn't exceed 15 times of the motor inertia. Otherwise it may cause serious mechanical vibration;
- The jog speed can be set via parameterP0.05.
- The accelerating/decelerating time during jogging can be set via parameters P0.54, P0.55 and P0.56, P0.57.

5.1.4 Running at the position control mode

Simple connection:



Parameter	Function	Setting value
P0.03[1]	Mode selection	0
P0.23[1]	Pulse input	Set according to the requirement
P0.24[1]	Pulse input direction reverse	0
P0.25	The first electrical gear numerator	1
P0.26	The first electrical gear denominator	1

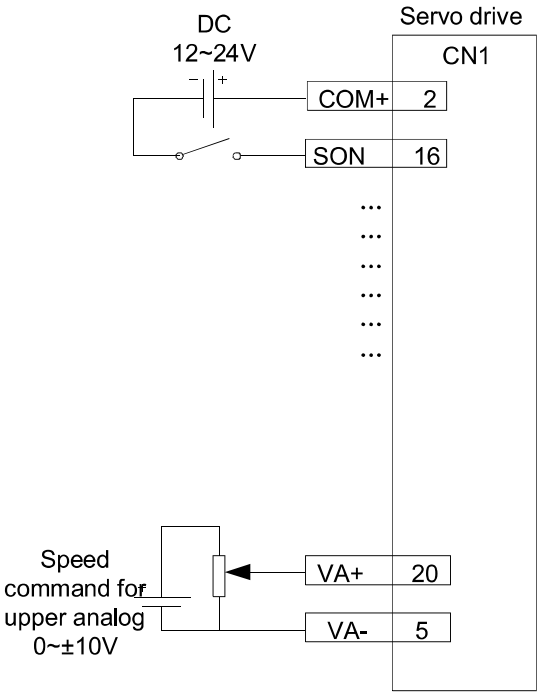
Figure 5-1 Simple connection of the position control mode

Steps:

1. Complete the connection between the drive and the servo motor.
2. Set P0.03 to "0", the position control mode.
3. Ensure the pulse output of the upper controller and adjust P0.23. Keep the pulse type is the same as that of the upper controller. Please refer to the instruction of P0.23.
4. After modifying P0.03 and P0.23, it will be valid only when disconnecting the control power and repower on.
5. Connect the corresponding terminal of CN1 and ensure the pulse wires (differential output and open collector output)
6. Connect CN1 to the drive and apply the power supply. Control the connection between SON and COM-. And then, the servo enters into the locking state.
7. Send the low frequency pulse command from the upper controller and rotate the motor at low speed.
8. Ensure the rotating direction of the motor is as the designated. The direction can be modified through the upper controller or operate on P0.24.
9. Ensure the pulse number is as the designated. Please refer to the instruction of P0.25 and P0.26.

5.1.5 Running at the speed control mode

Simple connection



Parameter	Function	Setting value
P0.03[1]	Mode selection	1

P0.40	Speed command selection	1
P0.42	Speed command input gain	500
P3.20	Bias voltage of analog input 1	Set according to the requirement

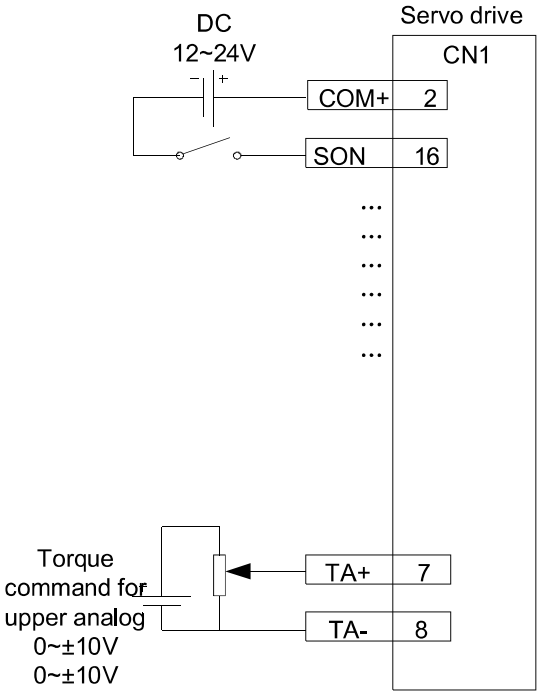
Figure 5-2 Simple connection of the speed control mode

Steps:

1. Complete the connection between the drive and the servo motor.
2. Set P0.03 to "1", the speed control mode.
3. It is necessary to disconnect the control power supply after saving the modified value of P0.03. And it will be valid after repowering on.
4. Set P0.40 to "1", external analog speed command mode.
5. Set P0.42 to the required value. Please refer to the instruction of P0.42.
6. Connect the corresponding terminals of CN1.
7. Connect the CN1 to the drive and power on. Control the connection between SON and COM-. Then the servo enters into the locking state.
8. The motor shaft may rotate at a low speed if there is no upper command voltage. It needs to adjust P3.20. Please refer to the detailed instruction of P3.20.

5.1.6 Running at the torque control mode

Simple connection:



Parameters	Function	Setting value
P0.03[1]	Mode selection	2
P0.60	Torque command selection	1
P0.61	Torque command direction selection	To the need
P0.62	Torque command input gain	10
P3.23	Bias voltage of analog input 2	Set according to the requirement
P0.46	Speed limit 1	100

Figure 5-3 Simple connection of the pulse control mode

Steps:

1. Complete the connection between the drive and the servo motor.
2. Set P0.03 to "2", the torque control mode.
3. It is necessary to disconnect the control power supply after saving the modified value of P0.03. And it will be valid after repowering on.
4. Set P0.61 to the required value. Please refer to the instruction of P0.61.
5. Set P0.62 to the required value. Please refer to the instruction of P0.62.
6. Connect the corresponding terminals of CN1.
7. Connect the CN1 to the drive and power on. Control the connection between SON and COM-. Then the servo enters into the locking state.
8. The motor shaft may rotate at a low speed if there is no upper command voltage. It needs to adjust P3.23. Please refer to the detailed instruction of P3.23.
9. In the torque mode, please adjust the speed limit and set P0.46 to the required value. Please refer to the detailed instruction of P0.46.

5.1.7 Parameter setting before running the servo

Parameter setting must be conducted before running the servo. You can set relevant parameters via the front panel or communication to meet the function and performance requirements of the site application. See chapter 6 for the detailed description of all parameters of the servo drive. Some of these parameters need to be set according to the site application demand. For examples, pulse input mode, electronic gear, frequency division coefficient of encoder output, upper/lower limit of analog input, etc. Some of these parameters need to be set according to the site debugging. For example, the parameters of the regulator loop which affect the system performance and other similar parameters. For most parameters the factory default values are appropriate.

Hereunder only some necessary parameters are listed:

1) Mode setting

The control mode (position mode, speed mode, torque mode) can be set through setting

parameter P0.03 according to the control requirements on the site. The mode will be valid after repowering on.

2) Command input

Set or enter relevant commands to control the position, speed or torque of the servo motor's shaft according to the setting of parameter P0.03.

- In the position mode: pulse command (3 kinds of input mode), internal torque limit command or external analog torque limit command;
- In the speed mode: internal speed command or external analog speed command, internal torque limit command or external analog torque limit command;
- In the torque mode: internal torque command or external analog torque command, internal speed limit command or external analog speed limit command;

5.1.8 Servo enabling


Warning

Do not operate the switches with wet hand as this may cause electric shock.


Note

Please confirm the parameter setting before running. Otherwise unexpected running state of the machinery may occur;

The radiator, regenerative braking resistor, servo motor and other components may become very hot in a period after they are powered on and powered off. Don't touch them!

Enable the servo via the external servo enabling terminal (SON) or internal servo enabling parameter (P0.04). See the function description of terminal SON and detailed explanation of parameter P0.04 in chapter 4.5.2.4.

When servo enabling:

- If no alarm occurs, the state indicator of servo will turn to green;
- When the dynamic braking is triggering, light clatter can be heart;
- The fan starts to run;
- In the position mode, if there is no pulse command input, the servo is in locked state;
- In the speed mode, the servo motor runs at the given speed;
- In the torque mode, if no torque is applied externally, the servo motor accelerates from zero speed to the limit speed. If the external torque is larger than the internal setting one, the servo motor maintains the state of zero speed output;
- If a servo alarm occurs, the servo status indicator will turn to red and the

servo motor will get into the inertia running state.

5.1.9 Coast to Stop / DEC to Stop of the servo

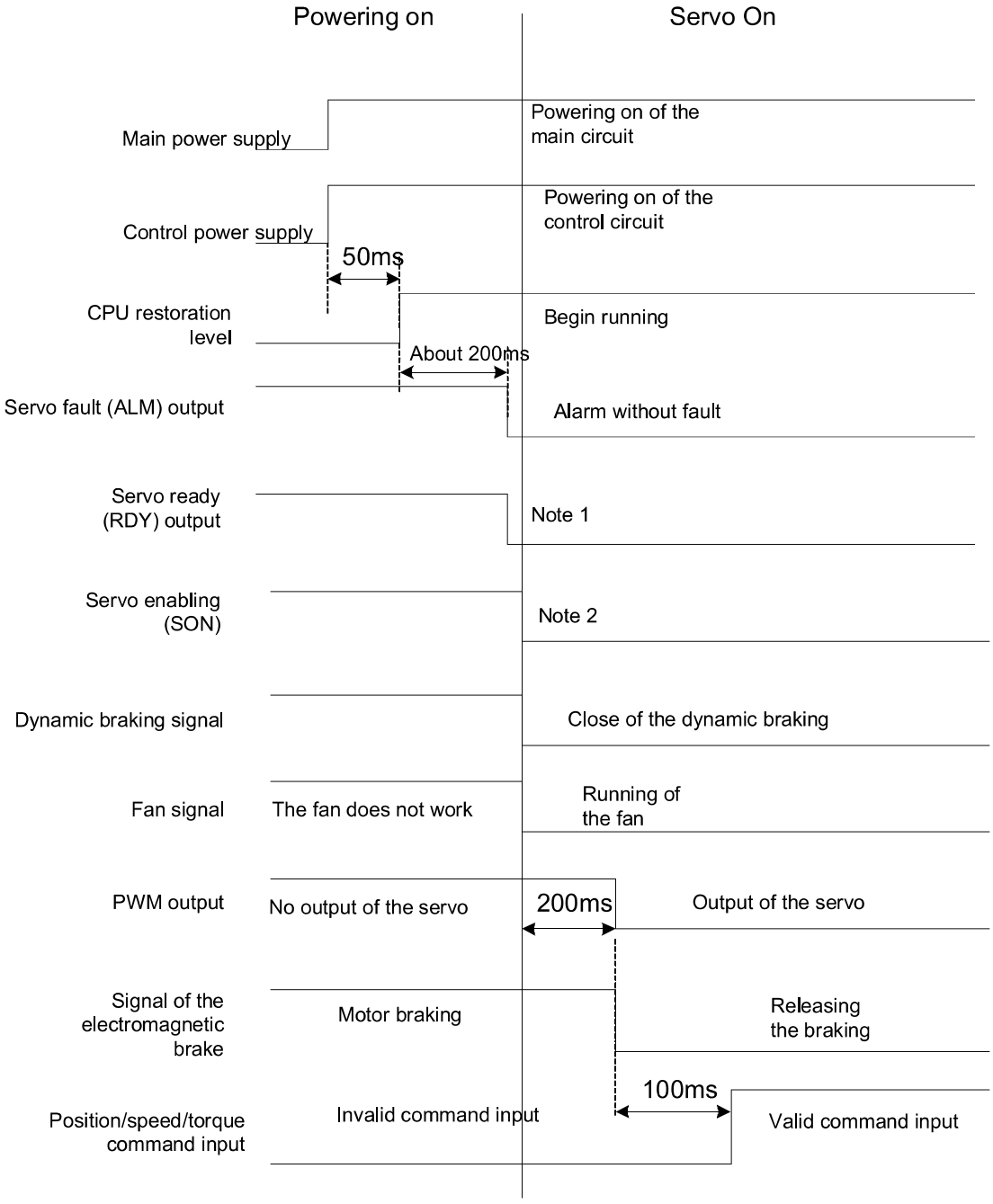
If the servo drive is in the following conditions, the servo motor will coast to a stop or stop normally. Coasting to Stop means the drive cuts off output immediately, the motor coasts to rest under the action of inertia, and does not keep in locked state after that. DEC to Stop means the drive outputs reverse torque to make the motor to decelerate to zero speed and, after that, the motor is in a locked state.

- When the servo enabling terminal (SON) signal is set to OFF, the servo motor will stop. Select the stopping method through setting parameter P4.30. See description of P4.30 for details. This process will not cause regenerative braking.
- When a fault alarm occurs, the servo motor will stop. Select the stopping method of the servo motor when an alarm occurs through setting parameter P4.30. See description of P4.30 for details. This process will not cause regenerative braking.
- When the zero speed clamp terminal (ZRS) signal is set to ON, the servo motor will stop. In the position mode and torque mode, the servo motor will stop immediately. In the speed mode, set parameter P0.58 to select whether the servo motor stops immediately or decelerates to stop according to the settings of parameter P0.56 and P0.57. After stop the servo is in a locked state. This stop process may cause regenerative braking. If a braking overload fault alarm occurs, please install an external braking resistor.
- If the travel limit terminal signal is valid (parameter P3.40=1), and the travel limit terminal (PSL/RVL) signal is set to OFF, the servo motor will immediately decelerate to a stop and get into a locked state. After it stops running, if a reverse running command is valid, the motor can run in reverse direction.

If the emergency stop terminal signal is valid (parameter P3.41=1), and the emergency stop terminal (EMG) signal is set to OFF, the servo motor will coast to stop.

5.1.10 Sequence diagram

5.1.10.1 Sequence diagram of power-on and servo ON

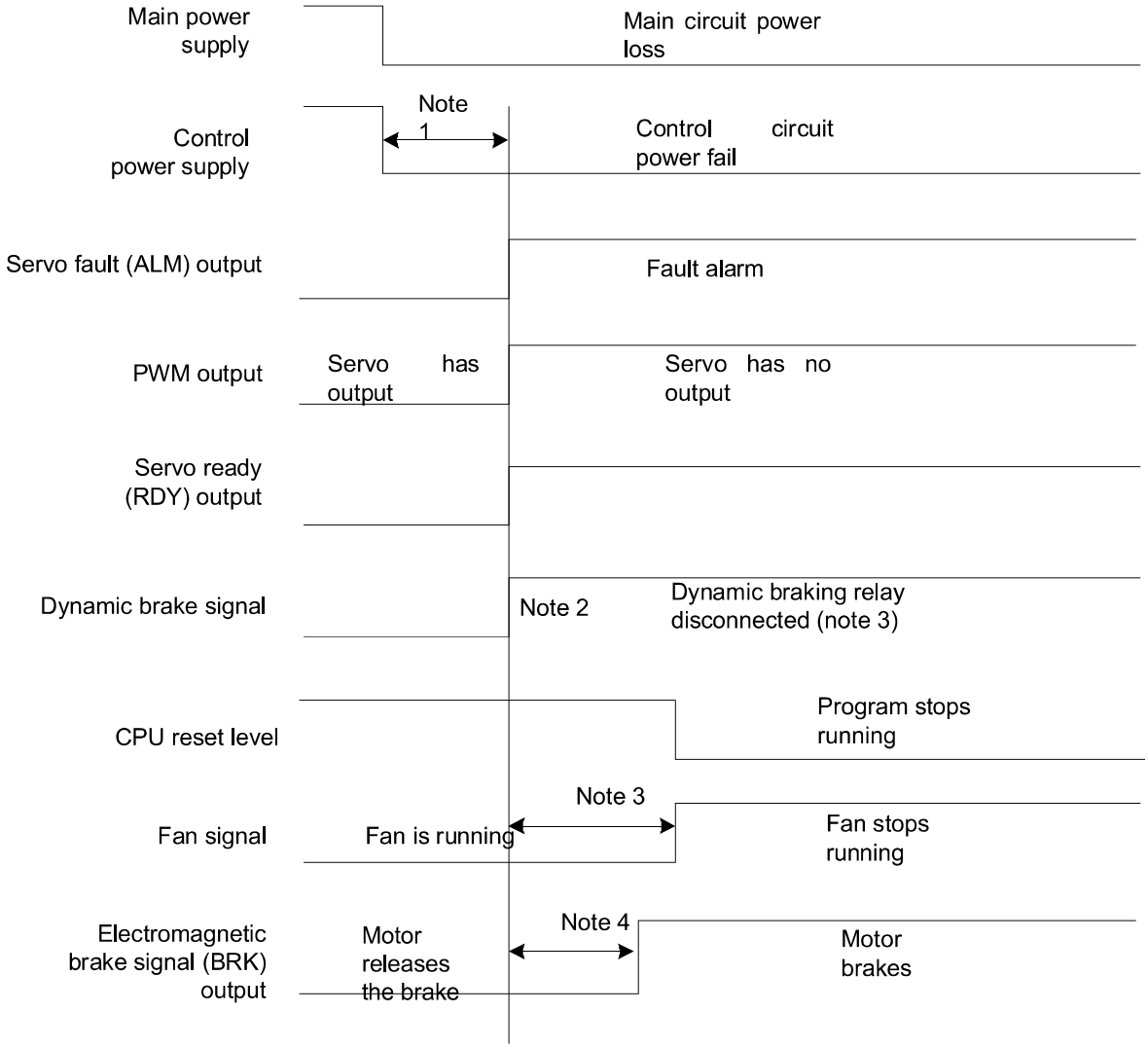


Note 1: the RDY output signal of becomes low when there is no fault to the servo and the bus voltage has been established (the bus voltage is above 230V. If the bus voltage is below 230V, there is AL-PoF alarm);

Note 2: the servo enabling signal is valid when the the RDY output signal of becomes low.

Fig. 5-4 Sequence diagram of Power-on and servo ON

5.1.10.2 Sequence diagram of power loss during running



Note 1: When the bus voltage of the control circuit drops below 200V, an undervoltage fault will occur. At this time the servo fault (ALM) output becomes high level;

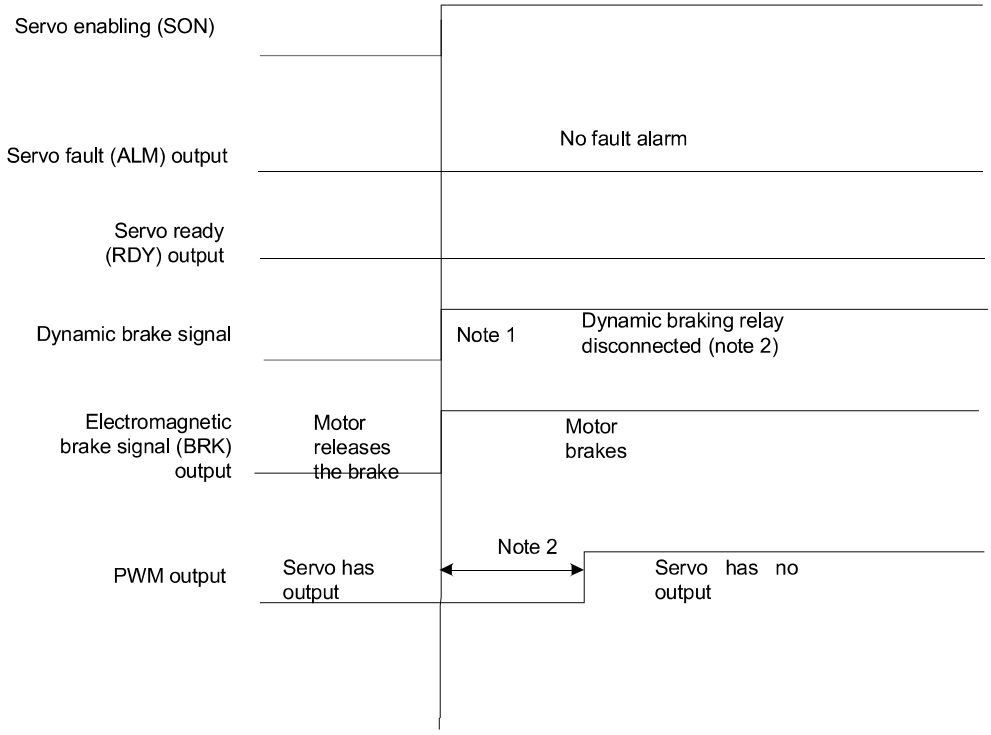
Note 2: P4.30 can set the function of immediate disconnection of the dynamic braking relay at undervoltage fault

Note 3: When the module temperature is less than 45℃, the fan will stop. If the module temperature is higher than 45℃, the fan stops running after the CPU reset level becomes lower;

Note 4: The output delay time of the electromagnetic brake signal can be set by the function code P3.57.At the same time, if the speed drops below 30r/min within the time set of P3.57, the electromagnetic brake signal (BRK) will also become stronger.

Fig. 5-5 Sequence diagram of power loss during running

5.1.10.3 Servo OFF sequence in a locked state

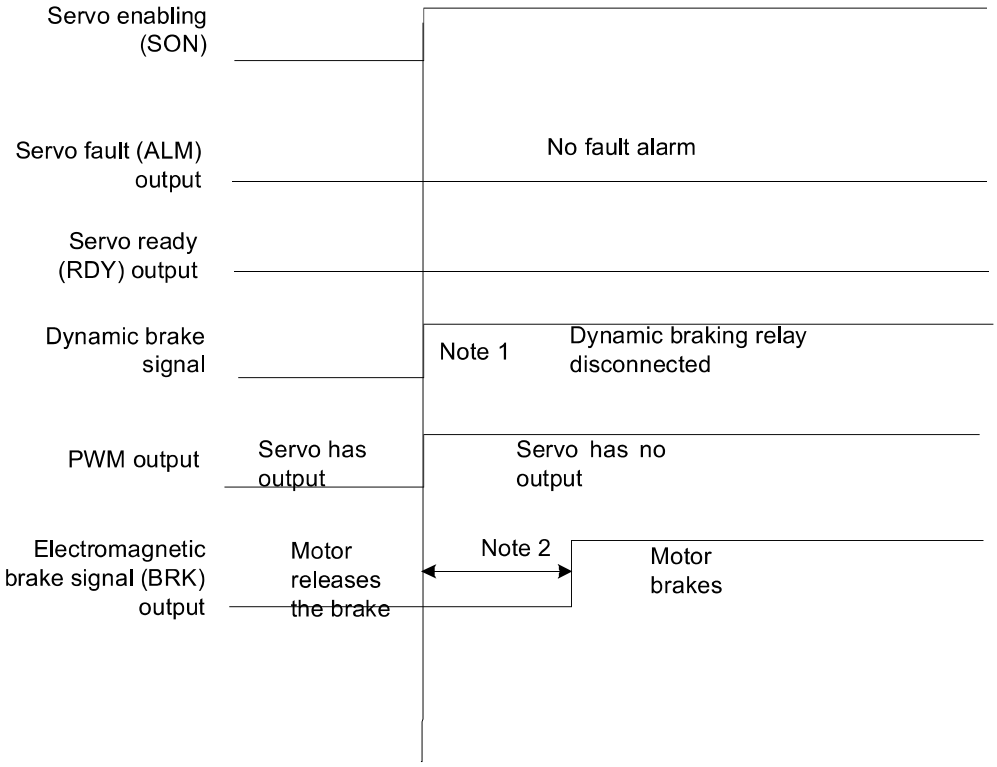


Note 1: P4.30 can set the function of immediate disconnection of the dynamic braking relay at undervoltage fault

Note 2: The motor power-off delay time can be set by function code P3.56.

Fig. 5-6 Servo OFF sequence diagram in a locked state

5.1.10.4 Servo OFF sequence in running state

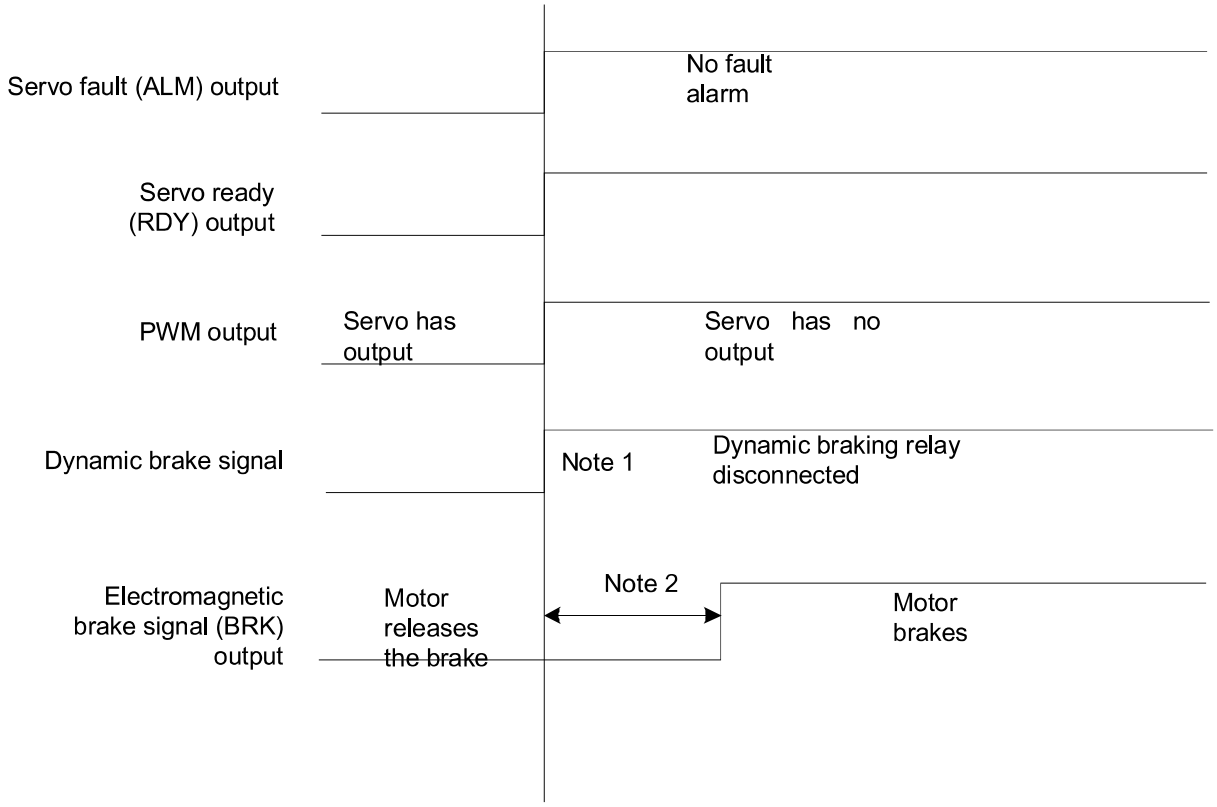


Note 1: P4.30 can set the function of immediate disconnection of the dynamic braking relay at undervoltage fault

Note 2: The output delay time of the electromagnetic brake signal can be set by function code P3.57. At the same if the speed drops below 30r/min within the time set of P3.57, the electromagnetic brake signal (BRK) will also become stronger

Fig. 5-7 Servo OFF sequence diagram in running state

5.1.10.5 Sequence of fault alarm



Note 1: P4.30 can set the function of immediate disconnection of the dynamic braking relay at undervoltage fault

Note 2: The output delay time of the electromagnetic brake signal can be set by function code P3.57. At the same, if the speed drops below 30r/min within the time set of P3.57, the electromagnetic brake signal (BRK) will also become stronger.

Fig. 5-8 Sequence diagram of fault alarm

5.2 Display and operation

5.2.1 Display

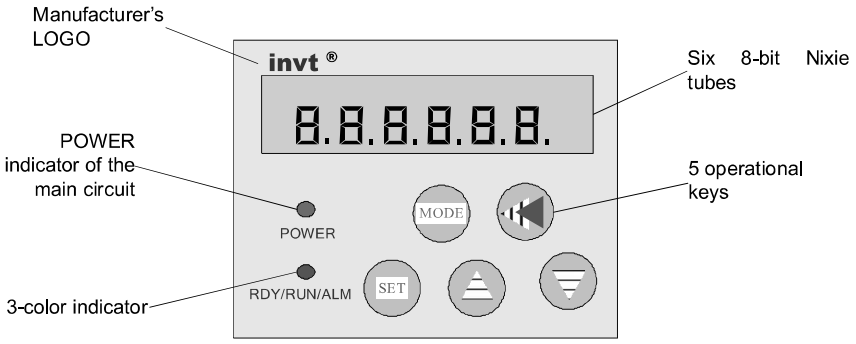


Fig 5-9 Schematic diagram of the keypad

Table 5-1 State of the 3-color indicator

Color	Function
Green	Normal running state
Red	Fault alarm state
Blue	The control board is powering on but the servo is not started

Table 5-2 Key function definition

Key	Key name	Function
	MODE key	Used to switch between different modes or return to previous menu
	SET key	Used to enter next menu or execute setting command
	UP key	Used to select parameter upwards or increase value
	DOWN key	Used to select parameter downwards or decrease value
	SHIFT key	When setting a parameter, it is used to select the position of the current digit

There are 5 operation modes in total, which can be switched with key.

a) Status monitoring mode: used to display the values of the status parameters;

b) Basic parameter setting mode: used to set the basic parameters;

c) Gain and filtering parameter setting mode: used to set gain or filtering parameters;

d) Expansion parameter setting mode: used to set the expansion parameters;

e) Auxiliary function mode: used for JOG control and to restore parameters to default value.

Operation flowchart:

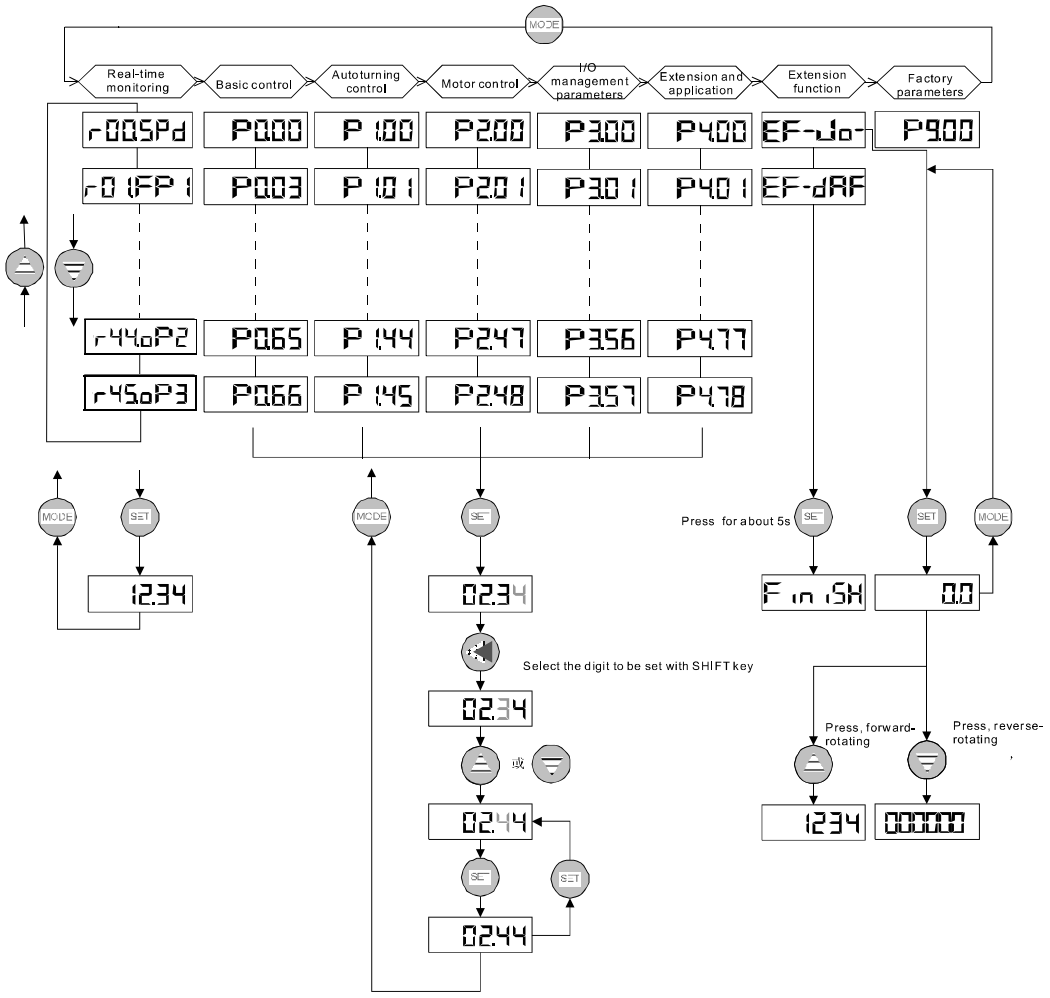


Fig.5-10 Flow chart of front panel operation

5.2.2 State monitoring mode

5.2.2.1 Operation flowchart

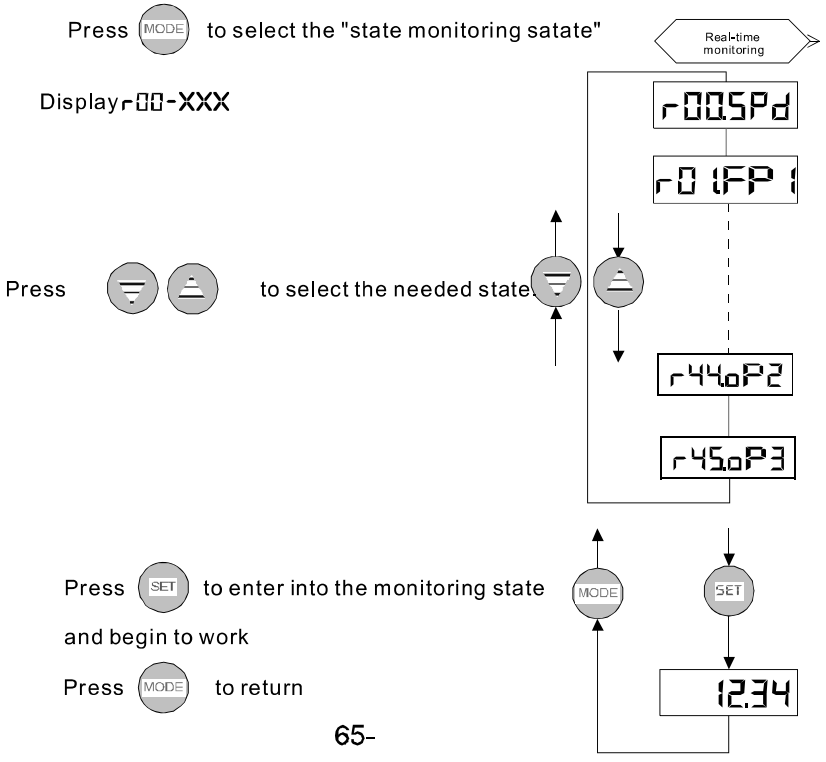


Fig.5-11 Flow chart of state monitoring operation

5.2.2.2 The meaning of state sign

The meanings are shown as below:

Table 5-3 Function meaning

Sign	Name	Unit	Accuracy
r00SPd	Motor speed	r/min	0.1
r01FP1	Lower 5 digits of feedback pulse accumulation	pulse	1
r02FP2	Medium 5 digits of feedback pulse accumulation	pulse	1
r03FP3	Higher 5 digits of feedback pulse accumulation	pulse	1
r04rP1	Lower 5 digits of command pulse accumulation	pulse	1
r05rP2	Medium 5 digits of command pulse accumulation	pulse	1
r06rP3	Higher 5 digits of command pulse accumulation	pulse	1
r07EP	Detention pulse	pulse	1
r08An1	Analog speed command voltage	V	0.001
r09An2	Analog torque command voltage	V	0.001
r10ud1	Bus voltage of main circuit power	V	0.1
r11ud2	Bus voltage of control circuit power	V	0.1
r12cur	RMS value of current output current	A	0.01
r13rG	Current torque	%	1
r14rn	Module temperature	℃	0.1
r15Ld	Ratio of average load	%	1
r16PoS	Position of the rotor relative to Z pulse	pulse	1
r17inE	Ratio of load inertia	time	1
r18oAL	Third latest fault alarm code	-	-
r19AL	Second latest fault alarm code	-	-
r20ALc	Latest fault alarm code	-	-
r21in	Digital input state	-	-
r22ou	Digital output state	-	-
r23rT	Motor temperature	℃	0.1
r24uE1	DSP software version	-	0.01

Sign	Name	Unit	Accuracy
r25.uE2	FPGA software version	-	0.01
r26.uuu	Encoder feedback value	-	-
r27.iA	Instantaneous value of U phase output current	A	0.01
r28.ib	Instantaneous value of V phase output current	A	0.01
r29.iAF	Instantaneous value of U phase output current when a fault occurs	A	0.01
r30.ibF	Instantaneous value of phase V output current when a fault occurs	A	0.01
r31.udF	Bus voltage when a fault occurs	V	0.1
r32.Sn1	Drive serial No. 1	-	-
r33.Sn2	Drive serial No. 2	-	-
r34.Sn3	Drive serial No. 3	-	-
r35.Sn4	Drive serial No. 4	-	-
r36.Sn5	Drive serial No. 5	-	-
r37.Sn6	Drive serial No. 6	-	-
r38.Pr	Carrier cycle	us	0.01
r39.oLc	Load ratio	%	0.01
r40.rT	Operation time	h	1
r41.PrS	Execution route	-	-
r42.SPE	Speed standard deviation	r/min	0.001
r43.oP1	Low 5 bit of the origin	pulse	1
r44.oP2	Medium 5 bit of the origin	pulse	1
r45.oP3	High 5 bit of the origin	pulse	1

5.2.3 Parameter setting

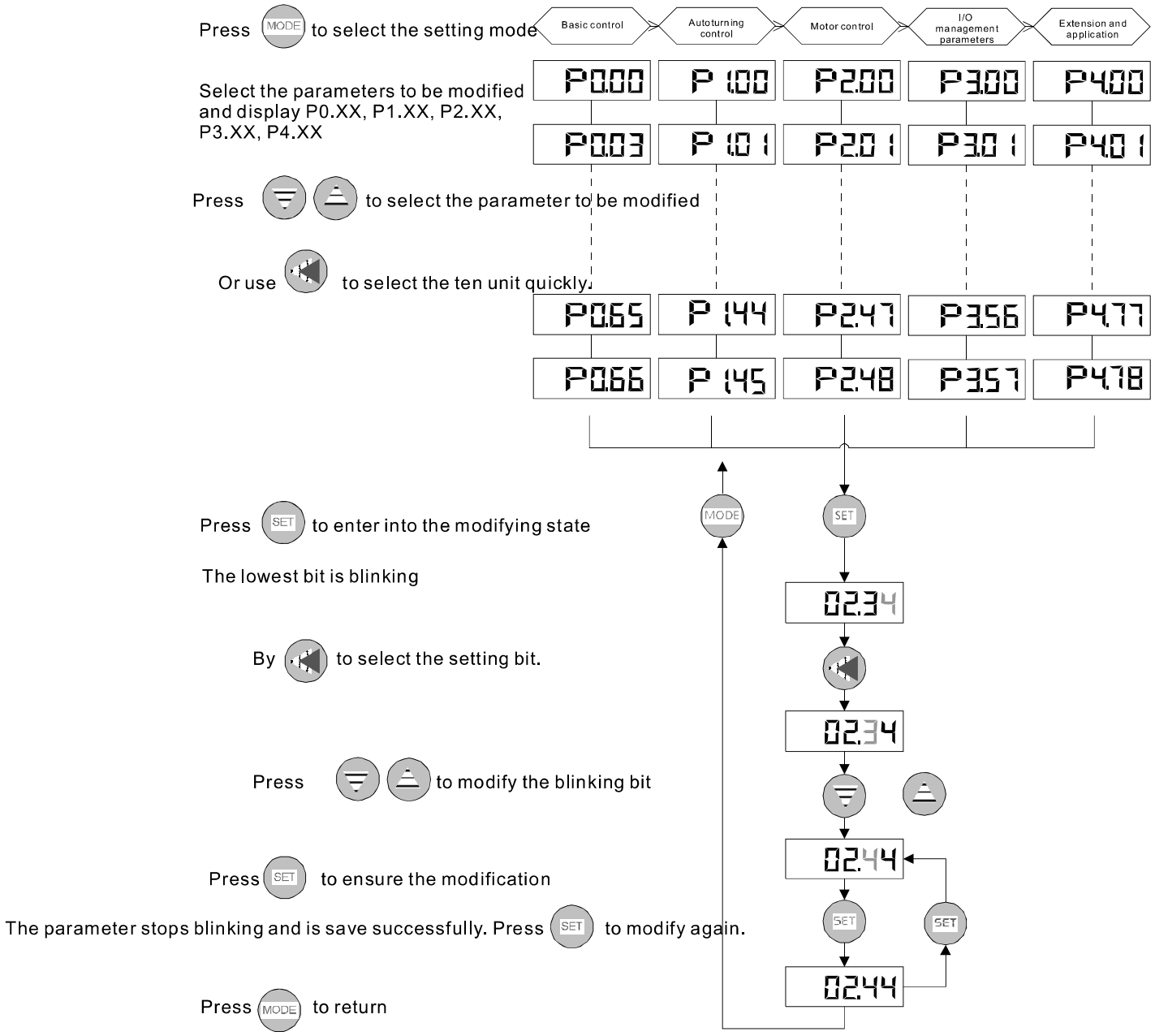


Fig.5-12 Flow chart of parameter setting operation

5.2.4 Auxiliary functions

There are two auxiliary functions: 1. Jogging trial function EF-Jo-

2. Function of parameters restoration EF-dAF

These functions can be selected by pressing or .

5.2.4.1 Operation flowchart for jogging trial

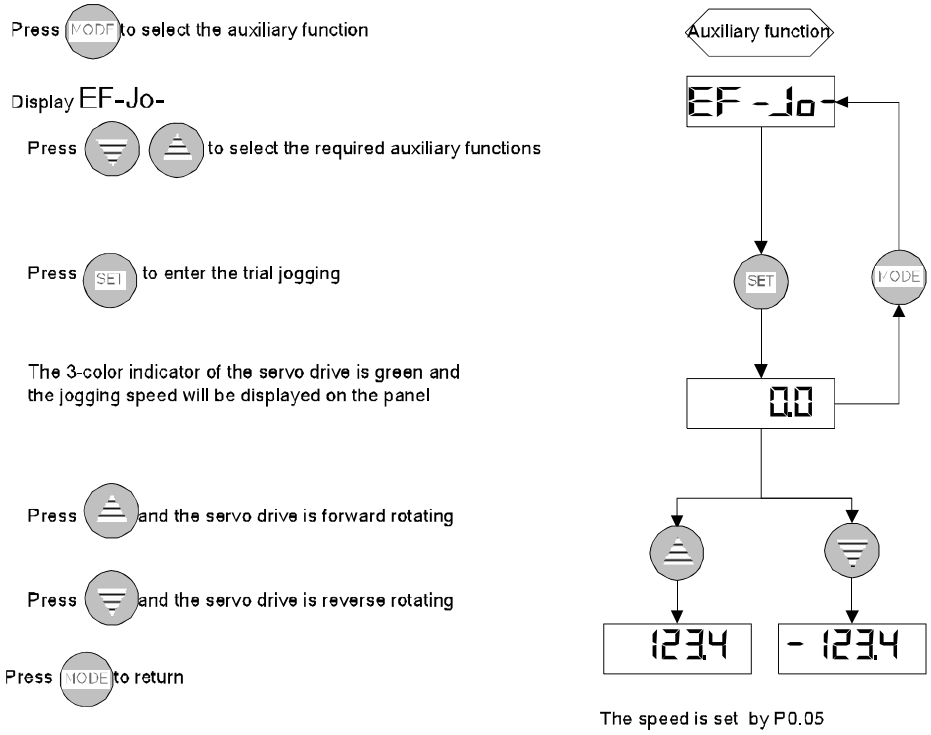


Fig.5-13 Flow chart of jogging trial operation

5.2.4.2 Operation flowchart for function parameters restoration

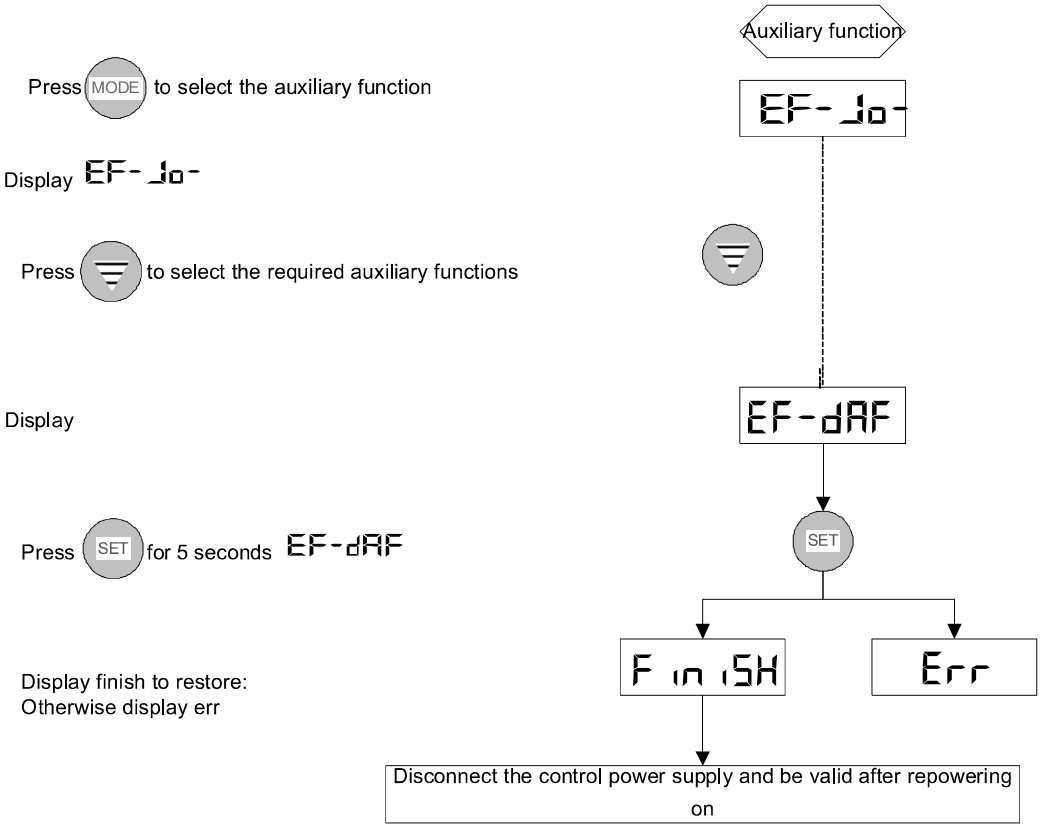


Fig.5-14 Flow chart of default parameter function restoration operation

5.2.5 Alarm display

When the servo drive runs abnormally, it will perform fault alarm or warning protection. At this

time the panel will display the fault alarm or warning identifier.

The meanings of the alarm or warning identifiers are listed in the table below:

Table 5-4 Comparison table of faults or warning identifier

Sign	Name
Er-EEP	EEPROM fault
Er-Ec1	Encoder line break fault 1
Er-Ec2	Encoder line break fault 2
Er-iFE	Current test fault
Er-oc1	Hardware overcurrent fault
Er-oc2	Line-to-ground short circuit fault
Er-bcE	Brake overload fault
Er-ou	Overvoltage fault
Er-uu	Undervoltage fault
Er-oL	Overload fault
Er-LnE	Ground abnormality fault
Er-oS	Overspeed fault
Er-oH1	Drive overtemperature fault
Er-uu1	Undervoltage fault
Er-iPo	IPM module fault
Er-dP	The power input phase loss fault
Er-oE	Over-pulse fault
Er-cFE	Communication fault
Er-oF	Write/read overtime fault
Er-inE	Inertia identification fault
Er-drE	Motor parameters matching fault
AL-LF1	Forward travel limit warning
AL-LF2	Reverse travel limit warning
AL-ESr	Emergency stop warning
AL-PoF	Main circuit power-down warning
AL-cFE	Communication abnormality warning

5.2.6 Alarm clearance

For fault alarms, if the fault condition is removed, the fault alarm display can be removed by short connecting the alarm clear terminal CLA with COM-. If the servo is still in enabled state at this time, the drive will recover running automatically. Please note that when EC2 fault or OC2 fault is reported, even if the fault is removed, it can be cleared only after the control circuit is powered off and re-on. For warnings, if it is the travel limit warning, once the warning condition is removed, the drive will clear the warning display automatically. If the servo is still in enabled state at this time, the drive will recover running automatically. If it is the emergency stop warning, if the warning condition is removed, the warning display can be removed by short connecting the alarm clear terminal CLA with COM-. But the servo must be enabled again to allow the drive to continue running.

If parameters need to be set when a fault alarm or warning occurs but they are not removed, press and hold  for about 3 seconds while the panel displays the fault alarm or warning identifier to enter the parameter setting mode. After the parameters are set, press and hold down  for about 3 seconds to exit the parameter setting mode and the panel recovers displaying of the fault alarm or warning identifier.

6 Detailed parameter description

P – position mode; S – speed mode; T – torque mode.

The definition of direction: in line with the direction of motor shaft, the counter clockwise direction which is short for CW is the forward direction; the clockwise direction which is short for CCW is the reverse direction. For the speed and torque reference, the positive value is the forward direction and the negative value is the reverse direction.

The function codes with the superscript of "1" indicate that these parameters can be valid only when the system is reset and restarted or repowered after disconnection.

The function codes with the superscript of "2" indicate that these parameters are valid when the servo drive stops. The modification during operation is invalid. The function codes with the superscript of "*" indicate that these parameters are not saved after power off.

6.1 Basic parameters (P0 group parameters)

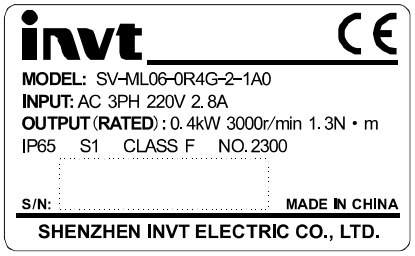
6.1.1 Basic control

	P0.00[1]	Matching motor selection	Setting range	Default	Unit	Available mode		
			0~9999	-	-	P	S	T

Detailed instruction: Right motor parameters are set in factory. Refer to the name plate. For example, the name plate of 400W motor is :

of which, No.: 2300 is the set value of the parameter.

Note: Wrong setting may cause abnormal running or damage to the drive and motor.

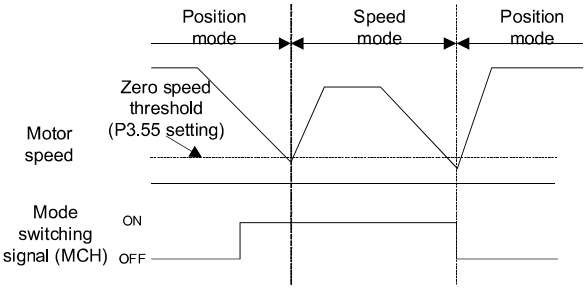


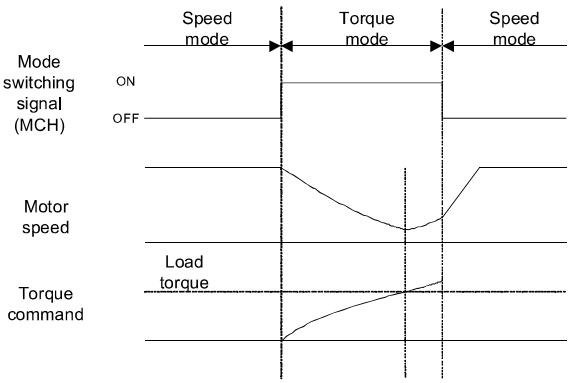
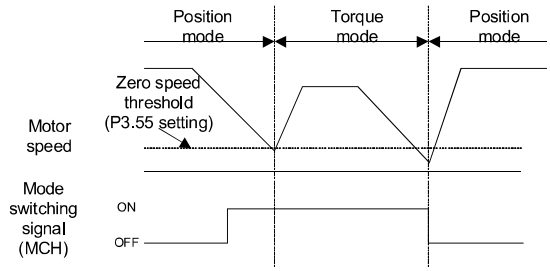
	P0.03[1]	Mode selection	Setting range	Default	Unit	Available mode		
			0~6	0	-	P	S	T

Detailed instruction:

This parameter can be used to set the operating mode of the system:

Setting value	1st working mode	2nd working mode	Instruction
0	P	/	Position mode: In the position mode, it can control the angular displacement of the servo motor with the pulse command and thus achieve the goal to control the displacement of the mechanical

			movement.
1	S	/	Speed mode: The mode can control the rotation speed of the servo motor with the internal speed command or external analog speed command
2	T	/	Torque mode: The mode can control the output torque of the servo motor with the internal torque command or external analog torque command.
3	P	S	Position/speed mode: The position mode and speed mode can be switched with the control mode switching terminal (MCH pin "1").  Note: For safety, after changing the MCH terminal input status, the switching between position mode and speed mode can be performed only when the motor speed becomes lower than the value of zero speed range (P3.55).

4	S	T	Speed/torque mode: The speed mode and torque mode can be switched with control mode switching terminal (MCH pin "1").  Note: The mode can not be limited by the current working condition.
5	P	T	Position/torque mode: The position mode and torque mode can be switched with the control mode switching terminal (MCH pin "1").  Note: For safety, after changing the MCH terminal input status, the switching between position mode and torque mode can be performed only when the motor speed becomes lower than the value of zero speed range (P3.55).
6	Reserved	Reserved	Factory reserved mode. Setting by the user is prohibited.

Remarks:

MCH terminal state	Current working mode
0	1st working mode
1	2nd working mode

Note: MCH is the connecting terminal of CN1. The corresponding relationships between pin "1" and COM-:
0:OFF (the terminal is disconnected with COM-);
1:ON (the terminal is connected with COM-).

	P0.04*	Internal enabling command	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T

Detailed instruction:
Control the running state through modifying the parameters:

Setting value of P0.04	External terminal command state	Working state of the servo drive
0	0(the terminal is disconnected with COM-)	Stand-by (OFF)
0	1(the terminal is connected with COM-)	Enabling running (ON)
1	0(the terminal is disconnected with COM-)	Enabling running (ON)
1	1(the terminal is connected with COM-)	Enabling running (ON)

Note: For safety, this parameter will automatically become 0 when fault alarm occurs and after the control circuit is powered on and the system is reset. If you want to run the servo drive, this parameter must be reset.
Warning: If the servo drive is controlled by the external, please ensure there is no system fault and disconnect the terminal with COM-.

	P0.05	Jog speed (JOG)	Setting range	Default	Unit	Available mode		
			0~1000.0	200.0	r/min	P	S	T

Detailed instruction:
This parameter can be used to set the jog speed. For jogging, please refer to chapter 5.1.3. During jogging, the ACC/DEC time parameters (P0.54, P0.56, P0.55, P0.57) are active. The motor will accelerate, decelerate, start and stop according to the settings.

	P0.06[2]	Numerator of the frequency division	Setting range	Default	Unit	Available mode

		coefficient of encoder pulse output	0~30000	10000	-	P	S	T
	P0.07[2]	Denominator of the frequency division coefficient of encoder pulse output	Setting range	Default	Unit	Available mode		
			0~30000	0	-	P	S	T

Detailed instruction:

By setting the numerator and denominator of the frequency division coefficient of encoder pulse output, the phase A and phase B signals of the encoder can be frequency divided by any integer or decimal fraction and then outputted through the encoder's pulse output signal terminals(OA+, OA-, OB+ and OB- pin 44, 43, 41 and 42)

Output pulse number of the drive = $\frac{P0.06}{P0.07}$ ×Resolution of the encoder

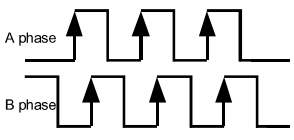
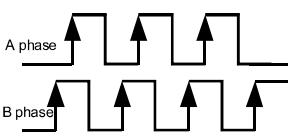
Note:

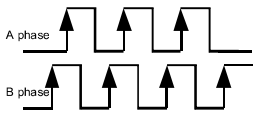
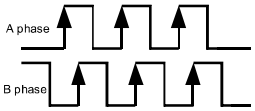
1. In the position control mode, if the encoder output signal of the preceding stage servo motor is used as the position pulse command input of the succeeding stage servo drive, i.e. as start/stop type master-slave follow-up, in order to ensure high positioning accuracy of the succeeding stage servo drive, the frequency division coefficient must be 1:1. Otherwise the accuracy of master-slave position follow-up will be affected in this case.
2. In factory setting, P0.07 is 0, P0.06 is 10000, which means the output terminal of the encoder will output 1000 pulse signal when the motor rotates a circle.
3. If the denominator is a non-zero value, the value of molecule can not be set larger than the value of denominator.
4. If the denominator is 0, the maximum value of molecule is 10000.

	P0.08[1]	Logic invert of pulse output	Setting range	Default	Unit	Available mode		
			0~1	1	-	P	S	T

Detailed instruction:

The invert of B phase can be carried out through this parameter and the relationship between A phase and B phase can be changed:

P0.08	Logic of B phase	CW	CCW
0	The invert		

1	Negation			

	P0.11	Max torque limit	Setting range	Default	Unit	Available mode		
			0~300	300	%	P	S	T

Detailed instruction:

This parameter can be used to set the maximum torque of the servo motor can output. Taking the rated torque of the servo motor as 100%, the setting is the percentage of the rated torque of the servo motor. If the absolute value of the torque command is larger than the value of this parameter, then the actual output torque will be limited by the parameter.

	P0.12	Internal torque limit	Setting range	Default	Unit	Available mode		
			0~300.0	-	%	P	S	

Detailed instruction:

In the speed and position modes, this parameter is used to set the value of internal torque limit. Taking the rated torque of the servo motor as 100%, this setting is the percentage of the rated torque of the servo motor.

Control mode	Setting value of P0.60	TQC	Torque limit state
Position mode or speed mode	0	0	Setting value of P0.12 internal torque limit
		1	External analog torque limit
	1	Invalid	External analog torque limit

Note:

1. TQC is the selection terminal of torque limit (TQC:10). Below is the relationship between TQC and COM-:

0:OFF (the terminal is disconnected with COM-);

1: ON (the terminal is connected with COM-).

2. The default value and setting range of the parameter are relative to the power grade of the drive.

	P0.13	Power of the external	Setting	Default	Unit	Available

		braking resistor	range			mode		
			0~1500	0	W	P	S	T
	P0.14	Resistance of the external braking resistor	Setting range	Default	Unit	Available mode		
			1~100	1	Ω	P	S	T

Detailed instruction:

When an external braking resistor is connected, this group of parameters should be set with the values equal to the resistance and power of the external braking resistor. Please set this group of parameters correctly. Otherwise if the values of this group of parameters are not matched with the parameters of the external braking resistor, it may report a braking overload fault (Er-bCE) by mistake or cause burnout of the braking resistor. The regenerative braking overload protection time is proportional to these two parameters. When P0.13=0, the internal braking resistor is active.

	P0.15[1]	Default monitored parameters	Setting range	Default	Unit	Available mode		
			0~45	0	-	P	S	T

Detailed instruction:

This parameter is used to set the parameters which can be monitored while powering-on of the system:

Setting value	Parameter meaning	Accuracy	Unit
00	Current motor rotation speed	0.1	r/min
01	Lower 5 digits of feedback pulse accumulation	1	pulse
02	Medium 5 digits of feedback pulse accumulation	1	pulse
03	Higher 5 digits of feedback pulse accumulation	1	pulse
04	Lower 5 digits of command pulse accumulation	1	pulse
05	Medium 5 digits of command pulse accumulation	1	pulse
06	Higher 5 digits of command pulse accumulation	1	pulse
07	Retention pulse	1	pulse

	08	Analog speed command voltage	0.001	V
	09	Analog torque command voltage	0.001	V
	10	Main circuit power bus voltage	0.1	V
	11	Control circuit power bus voltage	0.1	V
	12	Effective value of current output current	0.01	A
	13	Current torque	1	%
	14	Drive module temperature	0.1	℃
	15	Average load rate	1	%
	16	Position of the rotor relative to Z pulse	1	pulse
	17	Inertia ratio of load	1	time
	18	The two previous fault alarm code	/	/
	19	The previous fault alarm code	/	/
	20	Current fault alarm code	/	/
	21	Digital input state	/	/
	22	Digital output state	/	/
	23	Motor temperature	0.1	℃
	24	DSP software version	/	/
	25	FPGA software version	/	/
	26	Encoder UVW feedback value	/	/
	27	Instantaneous value of phase U output current	0.01	A
	28	Instantaneous value of phase V output current	0.01	A
	29	Instantaneous value of U phase output current when a fault occurs	0.01	A

30	Instantaneous value of phase V output current when a fault occurs	0.01	A
31	Bus voltage when a fault occurs	0.1	V
32	Drive serial No. 1	/	/
33	Drive serial No. 2	/	/
34	Drive serial No. 3	/	/
35	Drive serial No. 4	/	/
36	Drive serial No. 5	/	/
37	Drive serial No. 6	/	/
38	Carrier cycle	0.01	us
39	Overload ratio	0.01	%
40	Operation time	1	h
41	Execution route	-	-
42	Speed standard deviation	0.001	r/min
43	Low 5 bit of the origin position	1	pulse
44	Medium 5 bit of the origin position	1	pulse
45	High 5 bit of the origin position	1	pulse

P0.16	Parameter modification operation locking	Setting range	Default	Unit	Available mode		
		0~1	0	-	P	S	T

Detailed instruction:

This parameter is used to mask the parameter setting function and thus to avoid incorrect modification of the parameters by the user:

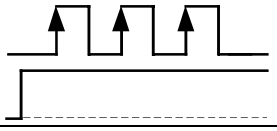
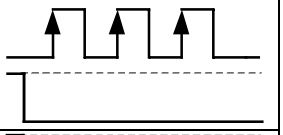
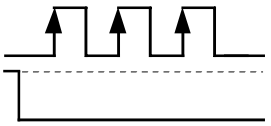
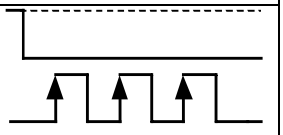
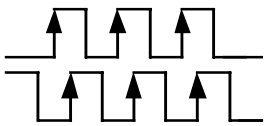
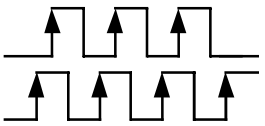
Setting value	Operation	Communication operation
0	Parameter modification valid	Parameter modification valid
1	Parameter modification invalid	Parameter modification valid

6.1.2 Position control

	P0.23[1]	Pulse input form	Setting range	Default	Unit	Available mode		
			0~2	0	-	P	-	-

Detailed instruction:

This parameter is used to set the manner of pulse input. There are 3 types of pulse input manners:

P0.23	Pulse input form	Signal form	Shown in the picture	
			FWD(CW)	REV(CCW)
0	Pulse + sign	pulse sign		
1	FWD/REV pulse train	pulse sign		
2	Orthogonal encoder pulse	pulse sign		

Remark: The pulse direction of the parameter can be reversed by P0.24[1]. Please refer to P0.24[1] for detailed information.

	P0.24[1]	Pulse input direction reversing	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	-	-

Detailed instruction:

By setting this parameter, the direction of the input pulse can be reversed. At this time the actual output speed direction of the servo drive is opposite to the direction indicated by the pulse input form in P0.23.

0: Pulse input direction does not change;

1: Pulse input direction is opposite to the original input direction.

	P0.25	Numerator of the 1st electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-
	P0.26	Denominator of the 1st electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-

	P0.27	Numerator of the 2nd electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-
	P0.28	Numerator of the 3rd electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-
	P0.29	Numerator of the 4th electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-
	P0.30	Denominator of the 2nd electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-
	P0.31	Denominator of the 3rd electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-
	P0.32	Denominator of the 4th electronic gear	Setting range	Default	Unit	Available mode		
			1~65535	1	-	P	-	-

Detailed instruction:

Concept of the electronic gears: for discretional pulse input, the number and frequency of the pulse actually received by the drive can be changed by multiplying a certain coefficient. It can be shown separately with two parts: numerator and denominator:

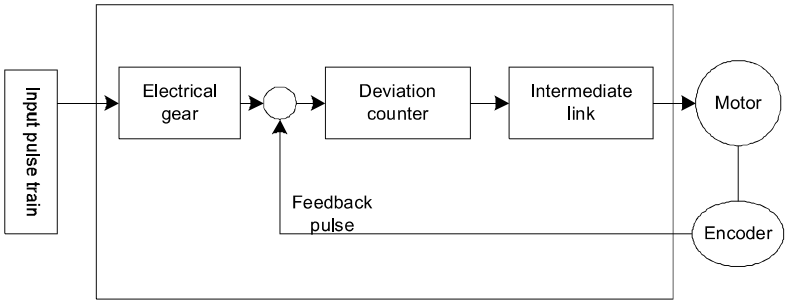
Electronic gear = g^1 / g^2

Of which

$g1$:The numerator of the electronic gear;

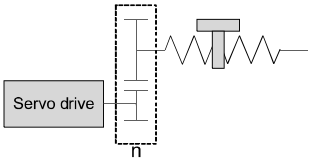
$g2$: The denominator of the electronic gear;

Below is the schematic diagram of the electronic gear in the system:



Example:

Below is a case where 1 pulse is equivalent to a feed rate of 10 μm



Mechanical specifications:

Feed of the ball screw Pb =10mm;

Reduction ratio n =3/5;

Resolution of the servo motor encoder =10000;

At this time calculate the electronic gear:

$$\frac{g1}{g2} = \Delta l_0 \bullet \frac{Pt}{\Delta S} = \Delta l_0 \bullet \frac{Pt}{n \cdot Pb} = 10 \times 10^{-3} \bullet \frac{10000}{(3/5) \cdot 10} = \frac{50}{3}$$

In the formula :

Δl_0 :Feed rate corresponding to per pulse (mm/pulse);

ΔS :Feed rate corresponding to per revolution of the motor (mm/rev).

i.e. in this example, $g1$ =50, $g2$ =3.

Set P0.25 to 50 and P0.26 to 3.

The servo drive supplied 4 groups of electronic gear: P0.25, P0.26, P0.27, P0.30, P0.28, P0.31, P0.29 and P0.32. Select the digital input (DI1~DI13) terminal of the electronic gear of CN1 (SC1:4, SC2:5) to determine the parameter. The corresponding relationships are listed in the table below:

SC1	SC2	**Position mode**

0	0	Electronic gear 1
1	0	Electronic gear 2
0	1	Electronic gear 3
1	1	Electronic gear 4

Note: The relationship between SC1, SC2 and COM-:

0:OFF (the terminal is disconnected with COM-);

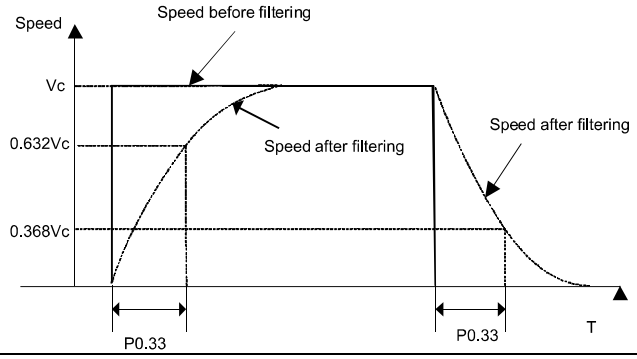
1:ON (the terminal is connected with COM-).

	P0.33	Position command filter time	Setting range	Default	Unit	Available mode		
			0~6000	0	512μs	P	-	-

Detailed instruction:

This parameter is used to set the time constant of the 1st order low-pass filter corresponding to the position command. By setting this parameter, mechanical shock can be reduced in cases when the input pulse command frequency changes abruptly.

See the figure below:



6.1.3 Speed and torque control

	P0.40	Speed command selection/speed limit selection	Setting range	Default	Unit	Available mode		
			0~1	0	-	-	S	T

Detailed instruction:

Control mode	Function name	Setting value of P0.40	Input method	Instruction
Speed mode	Speed command selection	0	Internal speed command manner	SC2 / SC1 / Parameter / Speed mode: 0 / 0 / P0.46 / Internal. Select the internal multi-stage speed by the speed selection terminal of CN1(SC1:4, SC2:5).

<table>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>speed 1</td></tr>
<tr><td>0</td><td>1</td><td>P0.47</td><td>Internal speed 2</td></tr>
<tr><td>1</td><td>0</td><td>P0.48</td><td>Internal speed 3</td></tr>
<tr><td>1</td><td>1</td><td>P0.49</td><td>Internal speed 4</td></tr>
</table>
Please refer to the detailed instruction of P0.46, P0.47, P0.48 and P0.49.
</td></tr>
<tr><td></td><td></td><td>1</td><td>External analog speed command manner</td><td>The speed of the servo motor can be controlled by applying a voltage between -10V and 10V on the analog speed input terminals (VA+, VA- and pin 20 and 5). According to the factory default, positive value means forward direction and negative value means reverse direction. But it can be changed by setting parameters.
Please refer to the detailed instruction of P0.42.</td></tr>
<tr><td>Torque mode</td><td>Speed limit selection</td><td>0</td><td>Internal speed limit</td><td>Select the internal multi-stage speed limit by the speed selection terminal of CN1 (SC1:4, SC2:5).
<table>
<tr><th>SC2</th><th>SC1</th><th>Parameter</th><th>Speed mode</th></tr>
<tr><td>0</td><td>0</td><td>P0.46</td><td>Speed limit 1</td></tr>
<tr><td>0</td><td>1</td><td>P0.47</td><td>Speed limit 2</td></tr>
<tr><td>1</td><td>0</td><td>P0.48</td><td>Speed limit 3</td></tr>
<tr><td>1</td><td>1</td><td>P0.49</td><td>Speed limit 4</td></tr>
</table>
Please refer to the detailed instruction of</td></tr>
</table>

				of the torque command.
		1	External analog speed limit manner	The motor speed can be limited by applying a voltage between -10V and 10V on the analog speed limit terminals (VA+, VA- and pin 20 and 5). The magnitude of the speed limit value is the absolute value of the analog input, the direction of it is the same as that of the torque command. The speed limit can be modified. Note: The speed limit depends on the absolute value of the corresponding parameter. The direction is the same as that of the torque command.

Note: Please note that in the torque mode; do not allow the motor to run under the condition of negative load.

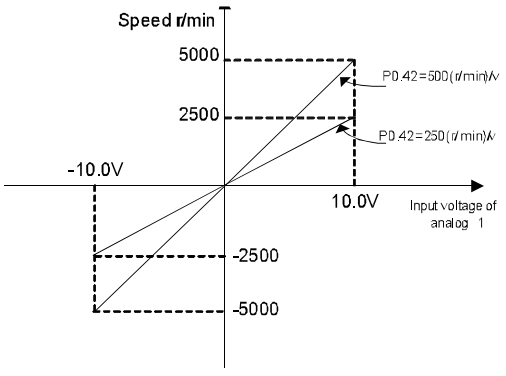
	P0.42	Speed command input gain	Setting range	Default	Unit	Available mode		
			10~2000	500	(r/min)/v	-	S	T

Detailed instruction:

1. The voltage of set analog inputVA corresponds to the switching gain of command speed.

2.The relationship between analog VA input coltage and speed is default as each 1V: 500r/min。

P0.40	Speed command/speed limit
0	P0.46, P0.47, P0.48, P0.49
1	Input voltage x P0.42



Note:

1. Analog input VA is the input signal from analog speed/speed limit terminal of CN1.

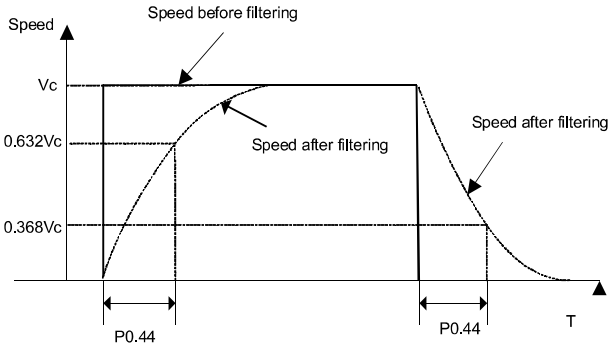
2. The parameter is valid when P0.40 is set to “1”.

3. Set right parameter after ensure the running. Big setting value may cause big fluctuation of motor speed.
4. Large voltage between VA+ and VA- may cause damage to the drive. (-10~10V)

	P0.44	Speed command filter time	Setting range	Default	Unit	Available mode		
			0.0~1000.0	0.0	ms	-	S	-

Detailed instruction:

This parameter is used to set the time constant of the 1st order low-pass filter corresponding to the analog speed command. By setting this parameter, the change of the speed will be more gently in cases the speed analog input changes largely. See the figure below:



	P0.45	Dead zone of analog VA	Setting range	Default	Unit	Available mode		
			0.000~2.000	0.000	V	-	S	T

	P0.46	Internal speed/speed limit 1	Setting range	Default	Unit	Available mode		
			-6000.0~6000.0	100.0	r/min	-	S	T
	P0.47	Internal speed/speed limit 2	Setting range	Default	Unit	Available mode		
			-6000.0~6000.0	200.0	r/min	-	S	T

Detailed instruction:

The servo drive provides 4 stages of internal speed command/internal speed limit:

Control mode	Setting value of P0.40	SC1	SC2	Relative parameters and setting
Speed mode	0	0	0	Setting value of P0.46 Internal speed 1
		1	0	Setting value of P0.47 Internal speed 2

		0	1	Setting value of P0.48 Internal speed 3
		1	1	Setting value of P0.49 Internal speed 4
Torque mode	0	0	0	Setting value of P0.46 internal speed limit 1
		1	0	Setting value of P0.47 internal speed limit 2
		0	1	Setting value of P0.48 internal speed limit 3
		1	1	Setting value of P0.49 internal speed limit 4

Note:

1. SC1 and SC2 are the wiring terminals for CN1. The corresponding relationships between SC1, SC2 and COM-:

0: OFF (the terminal is disconnected with COM-);

1: ON (the terminal is connected with COM-).

2. The speed limit depends on the absolute value of the corresponding parameter. The directions the same as that of the torque command.

3. The setting range of the parameter is subject to the power grade of the drive.

	P0.48	Internal speed/speed limit 3	Setting range	Default	Unit	Available mode		
			-6000.0~6000.0	500.0	r/min	-	S	T
	P0.49	Internal speed/speed limit 3	Setting range	Default	Unit	Available mode		
			-6000.0~6000.0	1000.0	r/min	-	S	T

Detailed instruction:

The function of the parameters is the same as that of P0.46 and P0.47.

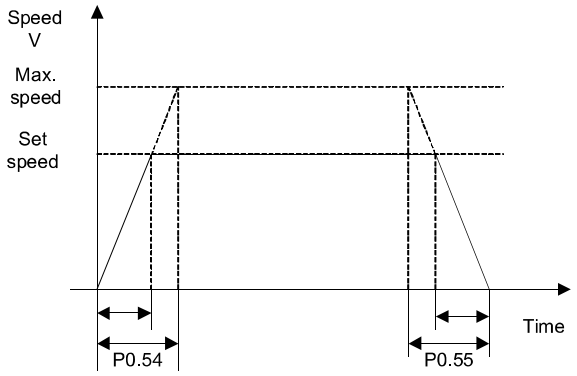
	P0.54	ACC time	Setting range	Default	Unit	Available mode		
			0~20000	0	ms	-	S	-
	P0.55	DEC time	Setting range	Default	Unit	Available mode		
			0~20000	0	ms	-	S	-

Detailed instruction:

ACC/DEC time means that in the case of internal reference speed command, the time required for the speed setting to increase from 0r/min to 3000r/min. When the speed setting is quicker or slower than 3000r/min, the actual ACC/DEC time is calculated at the proportion. If the speed command is a negative value, the ACC/DEC time is calculated with its absolute value.

For example, assuming that the reference speed is 2000r/min and the ACC/DEC time (P0.54 and P0.55) is set as 1500 and 1500, at this time the actual ACC time of the speed command is 1500×(2000/3000)=1000(ms) and the DEC time is 1500×(2000/3000)=1000ms.

The meaning of the ACC/DEC time is shown in the figure as below:



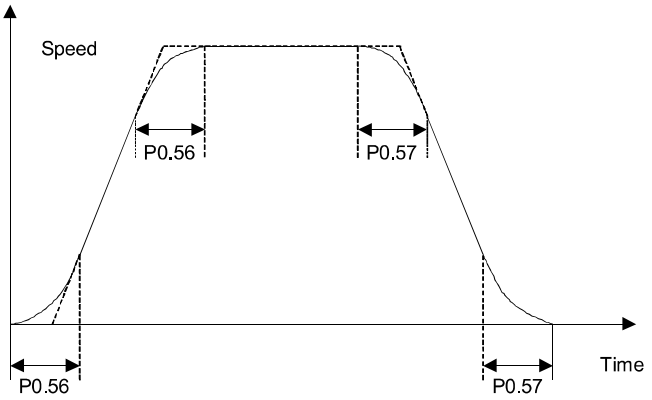
Note:

1. ACC/DEC time can only be used in the speed mode, and it is only valid when P0.40 is set to 0.
2. ACC/DEC time is valid when using jogging function.

	P0.56	S curve ACC time	Setting range	Default	Unit	Available mode			
			0~1000	0	ms	-	S	-	
	P0.57	S curve DEC time	Setting range	Default	Unit	Available mode			
			0~1000	0	ms	-	S	-	

Detailed instruction:

In a case of internal reference speed command, this parameter is used to set the duration of the circular arc segment during S curve decelerating and thus to achieve the goal of smoothly stopping. The ACC/DEC time of S curve is shown in the figure below:



Note:

1. The ACC/DEC time of S curve can only be used in the speed mode and it is valid when P0.40 is set to 0.

2. The ACC/DEC time of S curve is valid when using jogging function.

	P0.58	Stopping method	Setting range	Default	Unit	Available mode		
			0~1	0	-	-	S	-

Detailed instruction:

This parameter is used to set how the servo motor stops running when the zero speed clamp terminal (ZRS :1) signal is set to ON in the speed mode:

0: Decelerate to stop. The DEC time is the setting values of parameter P0.55 and P0.57;

1: Instant stop. The DEC time is 0.

	P0.60	Torque command/torque limit selection	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T

Detailed instruction:

Control mode	Function name	Setting value of P0.04	Input method	Instruction
Torque	Torque	0	Internal	Set the required torque by setting

mode	command		torque command	P0.66. Please refer to the detailed instruction of P0.66.
		1	External analog torque command	The output torque can be controlled by applying a voltage between -10V and 10V on the analog torque input terminals (TA+, TA- and pin 7 and 8). By factory default, the positive value means forward and negative value means reverse. But it can be changed by setting parameters. Please refer to the detailed instruction.
Speed mode or position mode	Torque limit selection	0	Internal torque limit	The output torque can be limited by setting the internal torque limit parameter (P0.12) or the internal and external torque limit can be switched by changing the state of TQC (TQC: 10) and COM-. The direction of the torque limit is the same as that of the speed command. Please refer to the detailed instruction.
		1	External analog torque limit	The output torque can be limited by applying a voltage between -10V and 10V on the analog torque limit terminals (TA+, TA- and pin 7 and 8). The magnitude of the torque limit is the absolute value of the analog input, the direction of it is the same as that of the torque command. But it can be changed by setting parameters. Please refer to the detailed instruction.

Note: Please note that in the torque mode; do not allow the motor to run under the condition of negative load.

	P0.61	Torque command direction selection	Setting range	Default	Unit	Available mode		
			0~1	0	--	-	-	T

Detailed instruction:

Under the torque mode, set this parameter to specify the motor running direction.

P0.61	The motor running direction
0	The positive and negative torque instruction
1	RPC is short-connected with COM-, CWW RPC is disconnected form COM- CW

Note: under the torque mode, this parameter is valid.

	P0.62	Torque command input gain	Setting range	Default	Unit	Available mode		
			10~300	10	%/v	P	S	T

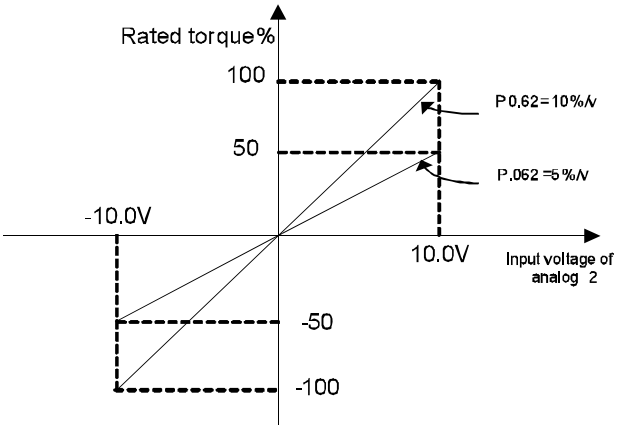
Detailed instruction:

1. The voltage of set analog input TA corresponds to the switching gain of torque command.

2. The parameter is valid when P0.60 is set to "1";

3. The relationship between analog TA input coltage and speed is default as each 1V: 10% of the rated torque.

Running mode	P0.60	Torque command/torque limit
Position/speed mode	0	P0.12
	1	Input voltage X P0.62
Torque mode	0	P0.66
	1	Input voltage X P0.62



Note:

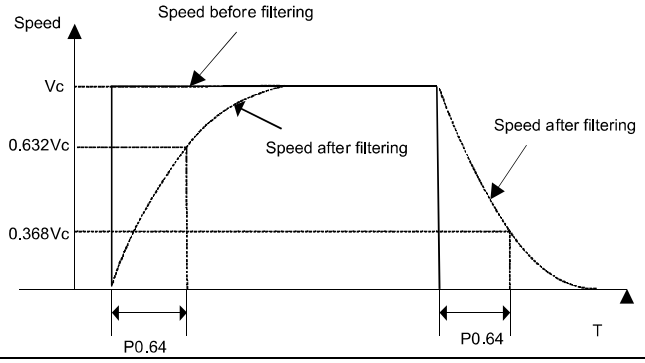
1. Analog input TA is the input signal from analog speed/speed limit terminal.

2. Set right parameter after ensure the running. Big setting value may cause big fluctuation of motor speed.

	P0.64	Torque command filter time	Setting range	Default	Unit	Available mode		
			0~6000	0	256μs	-	-	T

Detailed instruction:

This parameter is used to set the time constant of the 1st order low-pass filter corresponding to the torque command. By setting this parameter, the actual output torque changes more gently in cases the torque command changes largely. See the figure below:



	P0.65	Dead zone of analog TA	Setting range	Default	Unit	Available mode		
			0.000~2.000	0.000	V	P	S	T

	P0.66	Internal torque command	Setting range	Default	Unit	Available mode		
			-250.0~250.0	10.0	%	-	-	T

Detailed instruction:

This parameter is used to set the internal torque setting. Taking the rated torque of the servo motor as 100%, this setting is the percentage of the rated torque of the servo motor.

Note:

1. If the absolute value of this parameter is larger than P0.11, then the output torque is the value of P0.11 and the direction is the same as that of the parameter.
2. In the torque mode, the parameter is valid if P0.04 is set to 0.

6.2 Autoturning control parameters (P1 group parameters)

6.2.1 Inertia identification(Automatic gain)

	P1.00	Online inertia identification switch	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T

Detailed instruction:

The parameter is used to select whether the function is valid or not.

Setting value	Function	Meaning
0	Invalid	Online adjustment invalid
1	Valid	Basic mode

	P1.01	Speed of online inertia identification release	Setting range	Default	Unit	Available mode		
			0~3	1	-	P	S	T

Detailed instruction: This parameter is used to select the speed of online inertia identification.

This parameter is valid when the online adjustment is valid. The larger the setting value, the faster tracking speed of the load change and larger fluctuation of the value. The result is saved every 30 minutes.

Setting value	Function	Meaning
0	No change	Release stop
1	Basic no change	Basic no change of the load
2	Slow change	Slow change of the load
3	Rapid change	Rapid change of the load

	P1.02	Rotational inertia ratio	Setting range	Default	Unit	Available mode		
			0~10000	200	%	P	S	T

Detailed instruction:

This parameter is used to set the ratio of the load inertia converted into the rotor shaft to the inertia of the servo motor.

$$\text{Setting value of P1.02} = \frac{\text{Load rotational inertia on the rotor shaft } (J_L)}{\text{Rational inertia of the rotator of the servo drive}(J_M):}$$

	P1.03	Machine rigidity setting	Setting range	Default	Unit	Available mode		
			0~31	13	–	P	S	T

Detailed instruction:

The bigger the value is, the faster response and higer rigidty and easier vibration. In stable system, higer rigidity setting makes fast response.

Mechanical structure	Rigid set
Big handling, transmission equipment	0~13
Belt drive mechanism	5~16
Manipulator	10~20
Ball screw + Belt drive	13~25
Direct ball screw or rigid bodies	18~31

	P1.04	Inertia identification switch	Setting range	Default	Unit	Available mode		
			0~1	0	--	P		

Detailed instruction:

0: Inertia identification switch off

1: Inertia identification switch on

Note:

1. The parameter is valid in position mode;
2. The bigger value of P1.06 and P1.07, the faster the motor speed;
3. Refer to chapter 10.1 if the drive report Er-INE;
4. The parameter is invalid in the enabling state.

	P1.05	Inertia identification operation	Setting range	Default	Unit	Available mode		
			0~3	0	--	P		

Detailed instruction:

In position mode, if P1.04=1, the motor will:

0: Forward rotate and then reverse rotate

1: Forward rotate

2: Reverse rotate

3: Reverse rotate and then forward rotate

	P1.06	Mechanical movement	Setting range	Default	Unit	Available mode		
			0.5~10	1.5	r	P		

Detailed instruction: In position mode, if the inertia identification is valid, the parameter can limit the maximum running revolutions in each cycle.

	P1.07	Identification of inertia acceleration time constant	Setting range	Default	Unit	Available mode		
			2~200	2	ms	P		
Detailed instruction: The setting of this parameter is the command of ACC time constant of the motor, other than the actual ACC time. the bigger the value, the longer the ACC time. if the load inertia is big enough, ACC time can be set as a long time to ensure the speed of the motor exceeds 150r/min.								

	P1.08	For factory	Setting range	Default	Unit	Available mode		
			0~3	-	--	P	S	T
Detailed instruction: only for the factory setting.								

	P1.09	Reserved	Setting range	Default	Unit	Available mode		
			-	-	--	P	S	T
Detailed instruction: Reserved.								

6.2.2 Adaptive vibration control

	P1.19	Valid bit of resonance detection	Setting range	Default	Unit	Available mode		
			1.0~100.0	5.0	%	P	S	T
Detailed instruction: This parameter is used to set the sensitivity of the automatic test for the mechanical resonance frequency. The smaller the value is the higher sensitivity to the resonance. Note: When the setting value of P1.19 is increasing, the senility to the resonance is reducing.								

	P1.20	Resonance test mode	Setting range	Default	Unit	Available mode		
			0~4	0	--	P	S	T
Detailed instruction:								

This parameter is used to set the resonance test mode and the resonance number and action after signal releasing.

If the function is valid (1, 2, 3), the system will analyze automatic gathering data for the mechanical resonance frequency and the result is saved in P1.21 and P1.22. The user can set the frequency of notch filter according to P1.21 and P1.22 to eliminate the mechanical resonance.

Note: The setting value is invalid after the adjustment.

Setting value	Function	Meaning
0	Invalid	All relative parameters keep no change
1	1 notch filter valid	The relative parameters of the 3rd notch filter will be updated according to the autotuning result.
2	2 notch filters valid	The relative parameters of the 3rd and 4th notch filters will be updated according to the autotuning result.
3	Resonance frequency test mode	No relative parameters
4	Parameters clear	Restore to the default values

	P1.21	1st mechanical resonance frequency	Setting range	Default	Unit	Available mode		
			0~1500	0	Hz	P	S	T
	P1.22	2nd mechanical resonance frequency	Setting range	Default	Unit	Available mode		
			0~1500	0	Hz	P	S	T

Detailed instruction:

This parameter is used to display the resonance frequency. When P1.20 is set to "1, 2, 3", the system will detect the frequency on the Max. resonance and display it by the function codes.

Note:

1. When the speed reaches above 30r/min, the measuring value will be correct.
2. This function is only for read and can not be set. The user can set the frequency of the notch filter according to the function code to remove the resonance.

	P1.23	1st trap wave center frequency	Setting range	Default	Unit	Available mode		
			50.0~3000.0	3000.0	Hz	P	S	T
Detailed instruction: This parameter is used to set the frequency of the 1st trap wave filter for suppressing resonance. The trap wave filters can simulate the mechanical resonant frequency and thus suppress the resonant frequency. 50~2999: trap wave frequency; 3000: invalid.								

	P1.24	1st trap wave width	Setting range	Default	Unit	Available mode		
			1.0~1000.0	50.0	Hz	P	S	T
Detailed instruction: This parameter is used to set the trap wave width of the 1st trap wave filter for suppressing resonant. A larger trap wave width can be obtained with a larger setting.								

	P1.25	1st trap wave depth	Setting range	Default	Unit	Available mode		
			0.00~1.00	0.00	%	P	S	T
Detailed instruction: This parameter is used to set the trap wave depth of the 1st trap wave filter for suppressing resonant. A larger trap wave depth can be less with a larger setting.								

	P1.26	2nd trap wave center frequency	Setting range	Default	Unit	Available mode		
			50.0~3000.0	3000.0	Hz	P	S	T
	P1.27	2nd trap wave width	Setting range	Default	Unit	Available mode		
			1.0~1000.0	50.0	Hz	P	S	T
	P1.28	2nd trap wave depth	Setting range	Default	Unit	Available mode		
			0.00~1.00	0.00	%	P	S	T
Detailed instruction:Please refer to P1.23, P1.24 and P1.25.								

	P1.29	3rd trap wave center	Setting	Default	Unit	Available

		frequency	range			mode		
			50.0~3000.0	3000.0	Hz	P	S	T
	P1.30	3rd trap wave width	Setting range	Default	Unit	Available mode		
			1.0~1000.0	50.0	Hz	P	S	T
	P1.31	3rd trap wave depth	Setting range	Default	Unit	Available mode		
			0.00~1.00	0.00	%	P	S	T
Detailed instruction:Please refer to P1.23, P1.24 and P1.25.								

	P1.32	4th trap wave center frequency	Setting range	Default	Unit	Available mode		
			50.0~3000.0	3000.0	Hz	P	S	T
	P1.33	4th trap wave width	Setting range	Default	Unit	Available mode		
			1.0~1000.0	50.0	Hz	P	S	T
	P1.34	4th trap wave depth	Setting range	Default	Unit	Available mode		
			0.00~1.00	0.00	%	P	S	T
Detailed instruction:Please refer to P1.23, P1.24 and P1.25.								

	P1.35	Vibration control selection	Setting range	Default	Unit	Available mode		
			0~2	0	-	P	-	-
Detailed instruction: This parameter is used to set the switching mode. 0: The 1st vibration control is valid 1: Switch according to VS-SEL 2:Automatic Note: The relationship between VS-SEL and COM-: 0:OFF 1:ON								

	P1.36	The 1st vibration control frequency	Setting range	Default	Unit	Available mode		
			0.0~200.0	0.0	Hz	P	-	-

Detailed instruction:

It is used to set the frequency reducing ratio of the control load and the frequency at the peak of the load.

Note: Invalid if the setting value is below 1.0Hz.

	P1.37	The 1st vibration control factor	Setting range	Default	Unit	Available mode		
			0.00~1.00	1.00	-	P	-	-

Detailed instruction:

This parameter is used to set the filter factor.

	P1.38	The 2nd vibration control frequency	Setting range	Default	Unit	Available mode		
			0.0~200.0	0.0	Hz	P	-	-

Detailed instruction:

It is used to set the frequency reducing ratio of the control load and the frequency at the peak of the load.

Note: Invalid if the setting value is below 1.0Hz.

	P1.39	The 2nd vibration control factor	Setting range	Default	Unit	Available mode		
			0.00~1.00	1.00	-	P	-	-

Detailed instruction:

This parameter is used to set the filter factor.

	P1.40	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-
	P1.41	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-
	P1.42	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-
	P1.43	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-

	P1.44	Reserved	Setting range	Default	Unit	Available mode			
			-	-	-	-	-	-	
	P1.45	Reserved	Setting range	Default	Unit	Available mode			
			-	-	-	-	-	-	
Detailed instruction: Reserved									

6.3 Motor control parameters (P2 group parameters)

6.3.1 Gain

	P2.00	1st speed gain	Setting range	Default	Unit	Available mode			
			0.1~3000.0	27.0	Hz	P	S	T	
Detailed instruction: This parameter is used to set the gain of the speed loop. When the setting is increased, the speed response will be improved, but it may easily cause vibration and noise.									

	P2.01	1st speed integration time constant	Setting range	Default	Unit	Available mode			
			0.1~1000.0	21.0	ms	P	S	T	
Detailed instruction: This parameter is used to set the integration time constant of the speed loop. The response may be improved by decreasing the setting, but this parameter may easily cause vibration and noise. It should be noted particularly that when this parameter is set as 5000, it means the integral action is invalid.									

	P2.02	1st position gain	Setting range	Default	Unit	Available mode			
			0.1~3000	48.0	1/s	P	-	-	
Detailed instruction: This parameter is used to set the gain of the position loop. When the setting is increased, the position response will be improved, but it may easily cause vibration and noise.									

	P2.03	1st speed detection filter time	Setting range	Default	Unit	Available mode

			0.00~100.00	0.00	ms	P	S	T
Detailed instruction: This parameter is used to set the time constant of the speed detect filter.								

	P2.04	1st torque filter	Setting range	Default	Unit	Available mode		
			0.00~25.00	0.84	ms	P	S	T
Detailed instruction: This parameter is used to set the time constant of torque filter. Refer to 7.1.2.								

	P2.07	2nd position gain	Setting range	Default	Unit	Available mode		
			0.1~3000.0	57.0	1/s	P	-	-
	P2.05	2nd speed gain	Setting range	Default	Unit	Available mode		
			0.1~3000.0	27.0	Hz	P	S	T
	P2.06	2nd speed integration time constant	Setting range	Default	Unit	Available mode		
			0.1~1000.0	1000.0	ms	P	S	T
	P2.08	2nd speed detection filter time	Setting range	Default	Unit	Available mode		
			0.00~100.00	0.00	ms	P	S	T
	P2.09	2nd torque filter	Setting range	Default	Unit	Available mode		
			0.00~25.00	0.84	ms	P	S	T
Detailed instruction: There are two groups of parameters for position gain, speed gain and speed integration time constant. The definition of the function and content are the same as those of 1st group. The user can select or switch between 1st gain and 2nd gain according to the requirement. Please refer to the detailed information of P2.21 and P2.22.								

	P2.10	Speed feed-forward gain	Setting range	Default	Unit	Available mode		
			0.0~100.0	30.0	%	P	-	-
Detailed instruction:								

This parameter is used to set the speed feed-forward gain.

	P2.11	Speed feed-forward filter time constant	Setting range	Default	Unit	Available mode		
			0.00~60.00	0.50	ms	P	-	-

Detailed instruction:

This parameter is used to set the speed feed-forward filter time constant.

	P2.12	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	P	S	-

Detailed instruction: Reserved.

6.3.2 Gain switching

	P2.21	Gain switching selection	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T
	P2.22	Gain switching condition	Setting range	Default	Unit	Available mode		
			0~5	0	-	P	S	T

Detailed instruction:

Setting value of P2.22	Function
0	Manual gain switching

When P2.22 is set to 0, P2.21 can set to gain switching selection. Carry out manual gain switching according to the relationship between the gain switching terminal (PLC :11) and COM-.

Setting value of P2.21	Function name	PLC	Content
0	Speed loop gain switching	0	Speed loop adjustor ——PI adjustment
		1	Speed loop adjustor ——P adjustment
1	Switching	0	1st gain

			to 2nd gain		

Note:

Below is the relationship between COM- and PLC:

0: OFF(the terminal is disconnected with COM-);

1: ON (the terminal is connected with COM-).

1	Fix to the 2nd gain
2	When the retention pulse is too large, select the 2nd gain, otherwise select the 1st gain and the threshold of the retention pulse is set with P2.25
3	When the speed command is too large, select the 2nd gain, otherwise select the 1st gain and the threshold of the speed command is set with P2.25
4	When the speed command is relatively small, select the 2nd gain, otherwise select the 1st gain and the threshold of the speed command is set with P2.25
5	Position command + speed gain switching mode. In the position mode, when no position command pulse is inputted, it will select the 1st gain. When a position command pulse is inputted, it will select the 2nd gain. After the position command pulse stops input for 3ms and the motor speed falls below the speed threshold set with P2.25, it will switch to the 1st gain.

		Setting range	Default	Unit	Available mode		
P2.23	Gain switching time constant	0~1000	0	ms	P	S	T

Detailed instruction::

This parameter is used to set the time constant of the transition process when switching between the 1st gain and 2nd gain. This parameter is active only for the proportional parameters. By setting this parameter we can lighten the mechanical shock caused by gain switching. See chapter 7.3 for details.

		Setting range	Default	Unit	Available mode		
P2.25	Gain switching threshold	0~5000	100	pluse	P	S	T
		0~500.0	10.0	r/min			

Detailed instruction:

The setting content of this parameter is relative to the setting value of P2.22:

	Setting value of P2.22	The setting content of P2.25 during gain switching	
	2	Retention pulse threshold	
	3	Speed threshold	
	4		
	5		

6.3.3 Special motor control

	P2.40	The speed observer switch	Setting range	Default	Unit	Available mode		
			0~2	0	-	P	S	T

Detailed instruction:

This parameter is used to set whether the observer is valid or not.

0: Invalid

1: MT method is valid

2: Direct differential speed observer is valid

	P2.41[2]	The speed observer gain	Setting range	Default	Unit	Available mode		
			0~500	100	Hz	P	S	T

Detailed instruction:

Set the speed observer gain, after setting, the response speed will be rapid, but vibration and noise may occur.

	P2.42[2]	Phase comparator gain	Setting range	Default	Unit	Available mode		
			0~1000	100	%	P	S	T

Detailed instruction:

Phase comparator gain of the speed observer is used to adjust the identification error caused by inaccurate inertia setting.

P1.02 is correct, the value is 100.

	P2.43	Time constant of torque filtering	Setting range	Default	Unit	Available mode		
			0~65535	20	0.01ms	P	S	T

Detailed instruction:

This parameter is used to set the time constant of torque filtering for the speed observer.

	P2.47	Compensation tuning switch of slot effect	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T
Detailed instruction: This parameter is used to set the compensation tuning switch of slot effect. 0: OFF 1: ON								

	P2.48	Compensation gain of slot effect	Setting range	Default	Unit	Available mode		
			0.0~100.0	0.0	%	P	S	T
Detailed instruction: After the turning, the compensation gain of slot effect will be set. Increasing the gain can improve the inhibition effect of the cogging effect.								

6.4 I/O management parameters (P3 group parameters)

6.4.1Digital input

	P3.00	Configuration 1 of digital input	Setting range	Default	Unit	Available mode		
			00000~11111	00000	-	P	S	T

Detailed instruction:

This parameter is used to reverse the polarity of the digital quantities. It is a binary number. Each bit corresponds to a digital input. 0 indicates that the polarity does not change. 1 indicates to reverse the polarity of the digital quantity corresponding to this bit. The corresponding relationships between each bit and the digital quantity are:

BIT4	BIT3	BIT2	BIT1	BIT0
RPC	PLL	CLA	ZRS	SON

Details (Refer to chapter 4.5.2.4 for detailed description of the signs of the digital quantities) :

BIT	ON-OFF signs of CN1	Function name	Available mode		
BIT0	SON	Servo enabling	P	S	T
BIT1	ZRS	Zero speed clamp-on	P	S	T
BIT2	CLA	Alarm clearance	P	S	T
BIT3	PLL	Pulse input inhibit	P	-	-
BIT4	RPC	Retention pulse clearance	P	-	-
		Speed reversing	-	S	-
		Torque command direction	-	-	T

	P3.01	Definition 1 of digital input port (DI1)	Setting range	Default	Unit	Available mode		
			0~31	0	-	P	S	T
	P3.02	Definition 2 of digital input port (DI2)	Setting range	Default	Unit	Available mode		
			0~31	1	-	P	S	T
	P3.03	Definition 3 of digital input port (DI3)	Setting range	Default	Unit	Available mode		
			0~31	2	-	P	S	T
	P3.04	Definition 4 of digital input port (DI4)	Setting range	Default	Unit	Available mode		
			0~31	3	-	P	S	T
	P3.05	Definition 5 of digital input port (DI5)	Setting range	Default	Unit	Available mode		
			0~31	4	-	P	S	T
	P3.06	Definition 6 of digital	Setting	Default	Unit	Available		

		input port (DI6)	range			mode		
			0~31	5	-	P	S	T
	P3.07	Definition 7 of digital input port (DI7)	Setting range	Default	Unit	Available mode		
			0~31	6	-	P	S	T
	P3.08	Definition 8 of digital input port (DI8)	Setting range	Default	Unit	Available mode		
			0~31	7	-	P	S	T
	P3.09	Definition 9 of digital input port (DI9)	Setting range	Default	Unit	Available mode		
			0~31	8	-	P	S	T
	P3.10	Definition 10 of digital input port (DI10)	Setting range	Default	Unit	Available mode		
			0~31	9	-	P	S	T
	P3.11	Definition 11 of digital input port (DI11)	Setting range	Default	Unit	Available mode		
			0~31	10	-	P	S	T
	P3.12	Definition 12 of digital input port (DI12)	Setting range	Default	Unit	Available mode		
			0~31	11	-	P	S	T
	P3.13	Definition 13 of digital input port (DI13)	Setting range	Default	Unit	Available mode		
			0~31	12	-	P	S	T

Detailed instruction:

The setting value corresponds to the function, so it is necessary to mark the setting value on the input port definition. For example, if P3.01 is "1", then the definition of the input port is the function of zero speed.

Relationship:

Digital input port	CN1	Parameter	Digital input port	CN1	Parameter
DI1	16	P3.01	DI8	4	P3.08
DI2	37	P3.02	DI9	18	P3.09
DI3	10	P3.03	DI10	22	P3.10
DI4	39	P3.04	DI11	6	P3.11
DI5	34	P3.05	DI12	36	P3.12
DI6	17	P3.06	DI13	1	P3.13
DI7	3	P3.07			

Function list:

Setting value	Function	Setting value	Function
0	SON servo enable	16	POS0 route selection 0
1	ZRS zero speed	17	POS1 route selection 1
2	CAL alarm clear	18	POS2 route selection 2
3	EMG emergency stop	19	Factory setting
4	SC1 speed selection 1/electronic gear 1	20	PR_STOP point stop
5	SC2 speed selection 2/ electronic gear 2	21	VS-SEL vibration control switch
6	PSL forward limit	22	Custom In 0 input definition 0
7	RVL reverse limit	23	Custom In 1 input definition 1
8	RPC pulse clear/speed reverse/ torque command direction	24	Custom In 2 input definition 2
9	PLL pulse input prohibition	25	Custom In 3 input definition 3
10	TQC torque limit	26	Custom In 4 input definition 4
11	PLC gain switch	27	Custom In 5 input definition 5
12	MCH control mode switch	28	Custom In 6 input definition 6
13	SHOME origin returning start	29	Custom In 7 input definition 7
14	ORGP origin sensor	30	Custom In 8 input definition 8
15	CTRG route trigger	31	Custom In 9 input definition 9

	P3.14	Definition 1 of digital output port (DO1)	Setting range	Default	Unit	Available mode		
			0~15	0	-	P	S	T
	P3.15	Definition 2 of digital output port (DO2)	Setting range	Default	Unit	Available mode		
			0~15	1	-	P	S	T
	P3.16	Definition 3 of digital output port (DO3)	Setting range	Default	Unit	Available mode		
			0~15	2	-	P	S	T
	P3.17	Definition 4 of digital	Setting	Defaul	Unit	Available		

		output port (DO4)	range	t		mode		
			0~15	3	-	P	S	T
	P3.18	Definition 5 of digital output port (DO5)	Setting range	Defaul t	Unit	Available mode		
			0~15	4	-	P	S	T
	P3.19	Definition 6 of digital output port (DO6)	Setting range	Defaul t	Unit	Available mode		
			0~15	5	-	P	S	T

Detailed instruction:

The setting value corresponds to the function, so it is necessary to mark the setting value on the output port definition. For example, if P3.01 is "1", then the definition of the output port is the function of zero speed.

Relationship:

Digital output port	CN1	Parameter	Digital output port	CN1	Parameter
DO1	14	P3.14	DO4	29	P3.17
DO2	15	P3.15	DO5	30	P3.18
DO3	11	P3.16	DO6	13	P3.19

Function list:

Setting value	Function	Setting value	Function
0	RDY servo ready	8	MC_OK finished
1	ALM servo alarm	9	Custom Out 0 output definition 0
2	PLR position arrived	10	Custom Out 1 output definition 1
3	ZSO zero speed	11	Custom Out 2 output definition 2
4	SR speed arrived	12	Custom Out 3 output definition 3
5	LM torque limit	13	Custom Out 4 output definition 4
6	HOME origin arrived	14	Custom Out 5 output definition 5
7	CMD_OK finished	15	Custom Out 6 output definition 6

6.4.2 Analog input / output adjustment

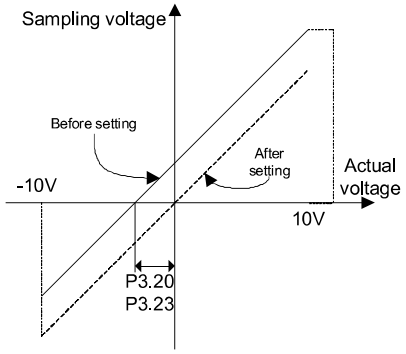
	P3.20	Offset voltage of AI VA	Setting range	Default	Unit	Available mode		
			-2.000~2.000	0.000	V	-	S	T
	P3.23	Offset voltage of AI TA	Setting range	Default	Unit	Available mode		
			-2.000~2.000	0.000	V	P	S	T

Detailed instruction:

This parameter can be used to adjust the AI1 and AI2 to improve the effective accuracy for the analog input.

Due to zero drift of the AI devices and other reasons, the actual AI corresponding value may deviate from the expected value. At this time it can be eliminated by setting the offset of AI. Similarly, the deviation of the actual AO value from the expected corresponding value caused by zero drift of AO devices and other reasons can be eliminated by setting the offset of AO.

The meaning of the analog offset voltage is shown in the figure as below:



For example, after the analog setting signal is connected into the AI terminal (VA) of the drive, even though the analog setting signal is 0, the front panel displays the analog speed command voltage (dp-An1) is 0.02V. On this condition, parameter P3.20 should be set as 0.02. The drive will automatically subtract 0.02V from the AI value received. If the front panel displays the analog speed command voltage is -0.02V, parameter P3.20 should be set as -0.02. The drive will automatically add 0.02V to the AI value received.

	P3.30	AO 1 selection	Setting range	Default	Unit	Available mode		
			0~7	0	-	P	S	T
	P3.32	AO 2 selection	Setting range	Default	Unit	Available mode		
			0~7	0	-	P	S	T

Detailed instruction:

This group of parameters is used to select the monitoring parameters to be outputted in analog form.

Parameter	Setting value	Definition	Relative parameters
P3.30 AO 1 selection	0	Motor speed	Adjust P3.31 to set the corresponding analog output signal.
	1	Output torque	
	2	Output	

			current	
		3	Bus voltage	
		4	Speed setting	
		5	Torque given	
		6~7	Reserved	
	P3.32 AO 2 selection	0	Motor speed	Adjust P3.33 to set the corresponding analog output signal.
		1	Output torque	
		2	Output current	
		3	Bus voltage	
		4	Speed setting	
		5	Torque given	
		6~7	Reserve	

	P3.31	Voltage gain of AO 1	Setting range	Default	Unit	Available mode		
			0~1000	500	-	P	S	T
	P3.33	Voltage gain of AO 2	Setting range	Default	Unit	Available mode		
			0~1000	500	-	P	S	T

Detailed instruction:

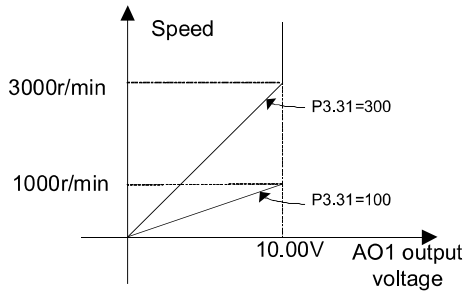
This group of parameters defines the relationships between the analog output voltage and its corresponding setting. When the analog output voltage exceeds the set upper limit or lower limit range, the part beyond will be calculated with the upper limit or lower limit.

Detailed meaning of the analog output is selected by P3.30 and P3.32. Corresponding setting of the lower and upper limit are expressed by percentages. The maximum is taken as 100% and the determination of the maximum is listed in the table below:

P3.30 and P3.32	Outputs	Maximum
0	Motor speed	500rpm corresponds to 1V of AO

1	Output torque	500x 0.1% rated torque corresponds to 1V of AO
2	Output current	500 x 0.1% rated current corresponds to 1V of AO
3	Bus voltage	Bus voltage 500V corresponds to 10V of AO
4	Speed setting	500rpm corresponds to 1V of AO
5	Torque setting	00 x 0.1% rated current corresponds to 1V of AO

Take a 400W servo drive as an example. Output the actual speed from the analog output 1 terminal (AO1) to observe, so 10V corresponds to 3000r/min and 0V corresponds to 0r/min. On this condition, set P3.30=0, Pc.36=0.00, Pc.38=8.00, P3.30=0, P3.31=300, the relationship between the actual speed setting and the output voltage is shown in the figure as below:



Note:

1. AO1 means the signal output from the AO1 terminal (AO1 pin21) and AO1 means the signal output from the AO2 terminal (AO2 pin25). The output signal has no directional properties and stands for the absolute value of the setting signal.
2. The maximum value of the motor speed, speed setting and bus voltage depends on the power grade of the drive.

	P3.34	Offset voltage of AO1	Setting range	Default	Unit	Available mode		
			-2.00~2.00	0.00	V	P	S	T
	P3.35	Offset voltage of AO2	Setting range	Default value	Unit	Available mode		
			-2.00~2.00	0.00	V	P	S	T

Detailed instruction:

This parameter can be used to adjust the AO1 and AO2 to improve the effective accuracy for the analog input. Due to zero drift of the AI devices and other reasons,

the actual AO corresponding value may deviate from the expected value. At this time it can be eliminated by setting the offset of AO. Similarly, the deviation of the actual AO value from the expected corresponding value caused by zero drift of AO devices and other reasons can be eliminated by setting the offset of AO.

6.4.3 Switch input / output settings

	P3.40	Travel limit switch shield	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T

Detailed instruction:

This parameter is used to set the input signals of the forward travel limit terminal (PSL:6) and reverse travel limit terminal (RVL:7) of CN1 are active or inactive. If the function of the travel limit switch needs to be shielded, set this parameter.

0: Signals of the travel limit terminals are inactive;

1: Signals of the travel limit terminals are active.

If PSL and RVL are connected with COM-, the state is normal and if they are disconnected with COM-, alarm will occurs.

Wiring terminal of CN1	State (with COM-)	State of the drive
PSL	Connecting	Normal working
RVL	Connecting	
PSL	Disconnecting	Forward travel limit alarm AL-LT1
RVL	Disconnecting	Reverse travel limit alarm AL-LT2

Note:

1. If AL-LT1 or AL-LT2 occurs, the servo drive will stop at the stopping mode set by P4.30.

2. The clearance of AL-LT1 or AL-LT2: If the travel limit alarm takes effective, the reverse command will be sent to the drive, and then the motor will be out of the travel limit zone and report the automatic clearance of the alarm.

	P3.41	E-stop shield	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T

Detailed instruction:

This parameter is used to set the input signal of the emergency stop terminal (EMG:3) is active or inactive. If the function of the E-stop needs to be shielded, set this

parameter.

0: Signal of the emergency stop terminal is inactive;

1: Signal of the emergency stop terminal is active.

If EMG is connected with COM-(NC), the state is normal; if the terminal is disconnected with COM-, then AL-EST will occur.

Note:

1. If AL-EST occurs, the servo drive will stop at the stopping mode set by P4.30.

2. The clearance of AL-EST: Please ensure there is no danger, and then clear the alarm signal (i.e. connecting EMG with COM). If the alarm is displayed to be cleared (CLA function), it is necessary to enable the servo drive again, and the system will work normally.

	P3.50	Range of position reaching	Setting range	Default	Unit	Available mode		
			0~20000	100	pulse	P	-	-

Detailed instruction:

This parameter is used to set the range of position reaching. When the deviation between the position feedback pulse and position command pulse are in this range, it is considered that it has reached the position and the output transistor of the position reaching terminal (PLR:2) signal comes into conduction.

	P3.54	Range of speed reaching	Setting range	Default	Unit	Available mode		
			0~1000.0	30.0	r/min	-	S	-

Detailed instruction:

This parameter is used to set the range of speed reaching. When the deviation between the speed feedback pulse and speed command pulse are in this range, it is considered that it has reached the speed and the output transistor of the speed reaching terminal (SR:4) signal comes into conduction.

	P3.55	Zero speed range	Setting range	Default	Unit	Available mode		
			0~1000.0	50.0	r/min	P	S	T

Detailed instruction:

This parameter is used to set the zero speed range. When the absolute value of the speed feedback is in this range, it is considered as zero speed and the output transistor of the zero speed terminal (ZSO:3) signal comes into conduction.

	P3.56	Locked time of servo	Setting	Default	Unit	Available

			range			mode		
		after braking	100~5000	100	ms	P	S	T

Detailed instruction:

This parameter is used to set the locked time of the servo after braking in the locked state. The servo is OFF in the locked state, the output transistor of the brake releasing terminal (BRK pin 9) signal turns off. At this time, the servo will continue to be locked for a period of time so that the motor will not rotate during the action of the relay. Refer to chapter 5.1.10 for the sequence relationship.

Note: The parameter is valid if P4.30=4.

	P3.57	Braking delay time of the electromagnetic brake	Setting range	Default	Unit	Available mode		
			0~5000	1000	ms	P	S	T

Detailed instruction:

This parameter is used to set the braking delay time of the electromagnetic brake. The servo is OFF or an alarm occurs in the running state, in this condition, the speed may be relatively high, so the output transistor of the brake releasing terminal (BRK:9) signal can be turned off after a delay time. If the speed falls below 30r/min within the delay time, the output transistor of the BRK signal will be turned off ahead of time. Please refer to chapter 5.1.10 for its sequence relationship.

6.5 Extension and application (P4 group parameters)

6.5.1 Communication setting

	P4.00[1]	Communication mode	Setting range	Default	Unit	Available mode		
			0~1	1	-	P	S	T

Detailed instruction:

This parameter is used to select the communication mode. The communication modes are:

0: RS232;

1: RS485.

	P4.01	Local communication address	Setting range	Default	Unit	Available mode		
			0~31	01	-	P	S	T

Detailed instruction:

This parameter is used to set the communication address of the local drive for RS485 serial communication.

	P4.02[1]	Communication baud rate selection	Setting range	Default	Unit	Available mode		
			0~4	0	-	P	S	T

Detailed instruction:

This parameter is used to select the communication baud rate. Available baudrate are as follow:

0:9600bps;

1:19200bps;

2:38400bps;

3:57600bps;

4:115200bps.

	P4.04	Communication parity mode	Setting range	Default	Unit	Available mode		
			0~17	0	-	P	S	T

Detailed instruction:

0: None (8, N, 1) for RTU;

1: Even (E, 8, 1) for RTU;

2: Odd (8, O, 1) for RTU;

3: None (8, N, 2) for RTU;

4: Even (E, 8, 2) for RTU;

5: Odd (O, 8, 2) for RTU;

6: None (N, 7, 1) for ASCII;

7: Even (E, 7, 1) for ASCII;

8: Odd (O, 7, 1) for ASCII;

9: None (N, 7, 2) for ASCII;

10: Even (E, 7, 2) for ASCII;

11: Odd (O, 7, 2) for ASCII;

12: None (N, 8, 1) for ASCII;

13: Even (E, 8, 1) for ASCII;

14: Odd (O, 8, 1) for ASCII;

15: None (N, 8, 2) for ASCII;

16: Even (E, 8, 2) for ASCII;

17: Odd (O, 8, 2) for ASCII;

	P4.05	Communication response delay time	Setting range	Default	Unit	Available mode

			0~200	0	ms	P	S	T

Detailed instruction:

Communication response delay time means the interval between the time when the subordinate machine receives the response data (the machine means servo drives) and the time when sending response data to the upper PC. If the response delay time is longer than the processing time of the system, after completion of data processing, the system will wait until the response delay time is over before transmitting data to the upper PC.

	P4.06	Communication overtime fault time	Setting range	Default	Unit	Available mode		
			0~60.0	0.0	s	P	S	T

Detailed instruction:

When this parameter is set as 0.0s, it does not perform communication overtime detection.

When it is set as other valid values, if the interval time between one communication and the next communication exceeds the setting of the communication overtime fault time, the servo drive will report a communication fault alarm (Er-cTE).

In general, the communication overtime detection is set as inactive. In a system that communicates continuously, the communication state can be monitored instantaneously by setting this parameter.

	P4.07	Communication fault processing method	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	S	T

Detailed instruction:

This parameter is used to select the action of the servo drive when a communication fault alarm occurs:

0: Alarms and stops (with the stopping mode set by parameter P4.30);

1: Do not alarm and continue to run.

	P4.08	Communication response enabling	Setting range	Default	Unit	Available mode		
			0~1	1	-	P	S	T

Detailed instruction:

This parameter is used to select whether a response is required when a parameter is written through communication:

0: Response is unnecessary;

1: Response is necessary.

	P4.09	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	P	S	T

6.5.2 Bit and origin returning setting

	P4.10[1]	Position control mode	Setting range	Default	Unit	Available mode		
			0~2	0	-	P	-	-

Detailed instruction:

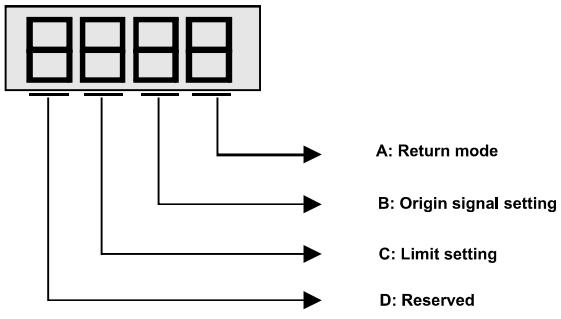
This parameter is used to set the operation mode of the system:

Setting value	Operation mode	Instruction
0	Pulse control	Control the mechanical movement displacement through the control of angular displacement of the pulse input command
1	Bit control	Control the servo motor through internal register:8-step internal register which is selected through POS0~POS2 or triggered by P4.21
2	Analog control	Control the mechanical movement displacement through the control of angular displacement which is: the voltage of VA X P4.78

	P4.11	Origin returning	Setting range	Default	Unit	Available mode		
			0000~0126	0000	-	P	-	-

Displaying mode: Hex

Detailed instruction:



Select the returning mode, and then the required origin signal setting and limit setting.

Definition:

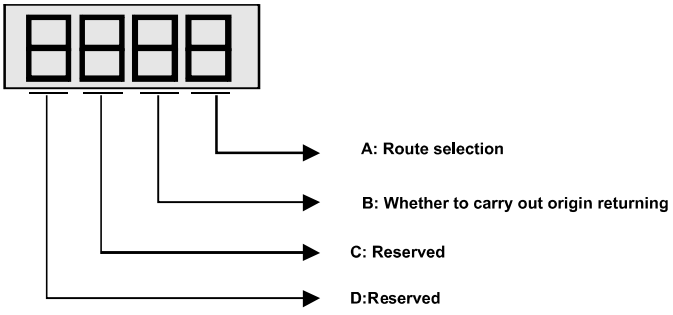
A	B	C	D
Return mode	Origin signal setting	Limit setting	Reserved

A=0: forward Z signal is the returning origin	Invalid	If there is limiting signal: C=0: display error C=1: direction reverse	-	
A=1: reverse Z signal is the returning origin				
A=2: forward PSL signal is the returning origin	B=0: find Z signal from the previous B=1: not find Z signal B=2: not find Z signal	Invalid		
A=3: reverse RVL signal is the returning origin				
A=4: forward origin returning ORGP is the returning origin	B=0: find Z signal from the latter B=1: find Z signal from the previous B=2: not find Z signal	If there is limiting signal: C=0: display error C=1: direction reverse		
A=5: reverse origin returning ORGP is the returning				
6: the current position is the origin	Invalid	Invalid		

	P4.12	Origin returning definition	Setting range	Default	Unit	Available mode		
			0000~0017	0000	-	P	-	-

Displaying mode: Hex

Detailed instruction:



A: Route selection:

0: Returning finished, stop

1 ~ 7: Returning finished, carry out at the designated route

B:Whether to carry out the origin returning :

0: Carry out

1: Not carry out

	P4.13	High 16 bit of the origin definition	Setting range	Default	Unit	Available mode		
			-32767~32767	0	pulse	P	-	-

	P4.14	Low 16 bit of the origin definition	Setting range	Default	Unit	Available mode		
			-9999~9999	0	pulse	P	-	-
Detailed instruction: Origin offset. The two groups of parameters can be combined to set the offset position, and the detailed is: Origin offset =high 16 bit of the origin definition *10000+ low 16 bit of the origin definition								

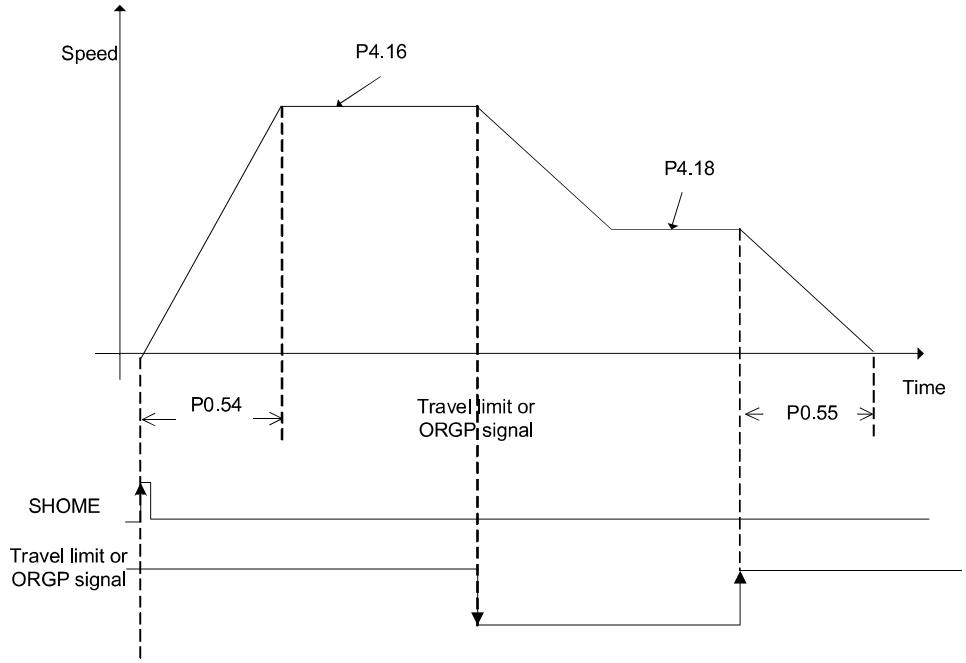
	P4.15	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	P	-	-

	P4.16	High returning speed	Setting range	Default	Unit	Available mode		
			1~2000	100	r/min	P	-	-
	P4.18	Low returning speed	Setting range	Default	Unit	Available mode		
			1~500	20	r/min	P	-	-

Detailed instruction:

The returning speed is determined by the absolute value of the parameter. In the returning g mode (the mode is 2, 3, 4, 5), if there is no travel limit or ORGP, it will run at the high speed; if there is travel limit or ORGP, it will run at the low speed.

The picture:



	P4.17	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	P	-	-

	P4.19	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	P	-	-

	P4.20	Delay after returning	Setting range	Default	Unit	Available mode		
			0~60000	1000	ms	P	-	-

Detailed instruction:

Count the time after returning until the delay is finished. Only after delay, the next command can be carried out.

	P4.21	Command route	Setting range	Default	Unit	Available mode

			0000~0007	0000	-	P	-	-

Displaying mode: Hex

Detailed instruction:

The function is triggered by the parameters.

	P4.22	Route trigger selection	Setting range	Default	Unit	Available mode		
			0~1	0	-	P	-	-

Detailed instruction:

In the bit control mode, CTRG and ZRS can be integrated on the same I/O port to set the parameters.

0: CTRG can only trigger the signal, if the program is carried out, the signal is invalid

1: When the program is finished, and the signal is route trigger; when the program is carried out, the signal is zero speed signal.

	P4.24	Configuration 2 of digital input	Setting range	Default	Unit	Available mode		
			00000~11111	00000	-	P	S	T

Detailed instruction:

Negate the digital pole through this parameter. The parameter is binary and each bit corresponds to one digital input. 0 means no negation and 1 means negation. And the relationship is:

BIT4	BIT3	BIT2	BIT1	BIT0
PR_STOP	ORGP	POS2	POS1	POS0

Detailed:

BIT	CN1	Function	Mode		
BIT0	POS0	Route selection 0	P	-	-
BIT1	POS1	Route selection 1	P	-	-
BIT2	POS2	Route selection 2	P	-	-
BIT3	ORGP	Origin sensor	P	-	-
BIT4	PR_STOP	Point stop	P	-	-

	P4.25	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-
	P4.26	Reserved						

			range			mode		
			-	-	-	-	-	-
	P4.27	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-
	P4.28	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-
	P4.29	Reserved	Setting range	Default	Unit	Available mode		
			-	-	-	-	-	-

6.5.3 Alarm threshold setting

	P4.30	Stopping mode selection	Setting range	Default	Unit	Available mode		
			0~4	3	-	P	S	T

Detailed instruction:

When the servo is turned OFF and when an fault alarm occurs, this parameter is used to set whether the dynamic brake works or not as well as the state selection of the servo motor after stop:

Setting value of P4.30	Action	
	During deceleration	After stopping
0	Coast to stop	Keep the dynamic braking state
1	Dynamic brake to stop	Keep the dynamic braking state
2	Dynamic brake to stop	Keep the inertia running state
3	Coast to stop	Keep the inertia running state
4	The drive locks the time set by P3.56 and coast to stop	Keep the inertia running state

Note: If the servo motor exceeds the rated speed and runs at high speed, please do not activate the dynamic brake. If the servo motor runs at higher speed with a load which has large inertia, please be prudent in activating the dynamic brake. Avoid by all means activating the dynamic brake too frequently as this may damage the servo

drive.

	P4.31	Max speed limit	Setting range	Default	Unit	Available mode		
			0~6500	-	r/min	P	S	T

Detailed instruction:

This parameter can be used to set the highest speed the servo motor can run. If the absolute value of the speed command is larger than the value of this parameter, the magnitude of the actual speed setting will be limited by this parameter; the direction is the same as that of the original speed command. This parameter is active in all modes.

Note: The default value of this parameter is related to the power level of the drive. The default value of drives below 750W (including) is 5000.0 and above is2500.0. The setting range of drives below 2.0kW is 0~5000.0 and above 2.0kW is 0~3000.0.

	P4.32	Overspeed level	Setting range	Default	Unit	Available mode		
			0~6553.5	-	r/min	P	S	T

Detailed instruction:

This parameter is used to set the overspeed level of the servo motor. When the rotation speed of the motor exceeds this speed setting, an overspeed fault alarm will be reported.

Note: The default of this parameter is related to the power level of the drive.

	P4.33	Pulse range for over-position	Setting range	Default	Unit	Available mode		
			0~50000	2000	10pulse	P	-	-

Detailed instruction:

This parameter is used to set the alarm threshold for the over-position fault (Er-oE). In the position mode, when the number of retention pulses exceeds this setting, an over-position fault alarm will be reported

	P4.34	Brake overload detection enabling signal	Setting range	Default	Unit	Available mode		
			0~1	1	-	P	S	T

Detailed instruction:

This parameter is used to shield the brake overload protection function.

0: Invalid; 1: Valid.

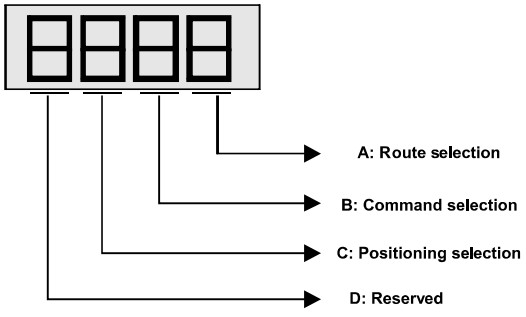
	P4.35	Reserved	Setting range	Default	Unit	Available mode		
			0~1	1	-	P	S	T
Detailed instruction: Reserved								

6.5.4 Route setting

	P4.36	1st route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-
	P4.42	2nd route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-
	P4.48	3rd route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-
	P4.54	4th route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-
	P4.60	5th route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-
	P4.66	6th route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-
	P4.72	7th route definition	Setting range	Default	Unit	Available mode		
			0000~0117	0000	-	P	-	-

Displaying:Hex

Detailed instruction:



Definition:

A: route selection :

0~7: the next route

B: command selection:

0: stop

1: the next route

C: positioning selection:

0: absolute positioning command 1: relative positioning command

	P4.37	High bit of 1st route	Setting range	Default	Unit	Available mode		
			-32767~32767	0	pulse	P	-	-
	P4.38	Low bit of 1st route	Setting range	Default	Unit	Available mode		
			-9999~9999	2000	pulse	P	-	-
	P4.43	High bit of 2nd route	Setting range	Default	Unit	Available mode		
			-32767~32767	0	pulse	P	-	-
	P4.44	Low bit of 2nd route	Setting range	Default	Unit	Available mode		
			-9999~9999	2000	pulse	P	-	-
	P4.49	High bit of 3rd route	Setting range	Default	Unit	Available mode		
			-32767~32767	0	pulse	P	-	-
	P4.50	Low bit of 3rd route	Setting range	Default	Unit	Available mode		
			-9999~9999	2000	pulse	P	-	-
	P4.55	High bit of 4th route	Setting range	Default	Unit	Available mode		
			-32767~32767	0	pulse	P	-	-
	P4.56	Low bit of 4th route	Setting range	Default	Unit	Available mode		
			-9999~9999	2000	pulse	P	-	-
	P4.61	High bit of 5th route	Setting	Default	Unit	Available		

			range			mode		
			-32767~32767	0	pulse	P	-	-
	P4.62	Low bit of 5th route	Setting range	Default	Unit	Available mode		
			-9999~9999	2000	pulse	P	-	-
	P4.67	High bit of 6th route	Setting range	Default	Unit	Available mode		
			-32767~32767	0	pulse	P	-	-
	P4.68	Low bit of 6th route	Setting range	Default	Unit	Available mode		
			-9999~9999	2000	pulse	P	-	-
Detailed instruction: Target position. The two groups of parameters can be combined to set the offset position, and the detailed is: Origin offset =high bit of the origin definition *10000+ low bit of the origin definition.								

	P4.39	ACC/DEC time of 1st route	Setting range	Default	Unit	Available mode		
			0~60000	200	ms	P	-	-
	P4.45	ACC/DEC time of 2nd route	Setting range	Default	Unit	Available mode		
			0~60000	200	ms	P	-	-
	P4.51	ACC/DEC time of 3rd route	Setting range	Default	Unit	Available mode		
			0~60000	200	ms	P	-	-
	P4.57	ACC/DEC time of 4th route	Setting range	Default	Unit	Available mode		
			0~60000	200	ms	P	-	-
	P4.63	ACC/DEC time of 5th route	Setting range	Default	Unit	Available mode		
			0~60000	200	ms	P	-	-
	P4.69	ACC/DEC time of 6th route	Setting range	Default	Unit	Available mode		

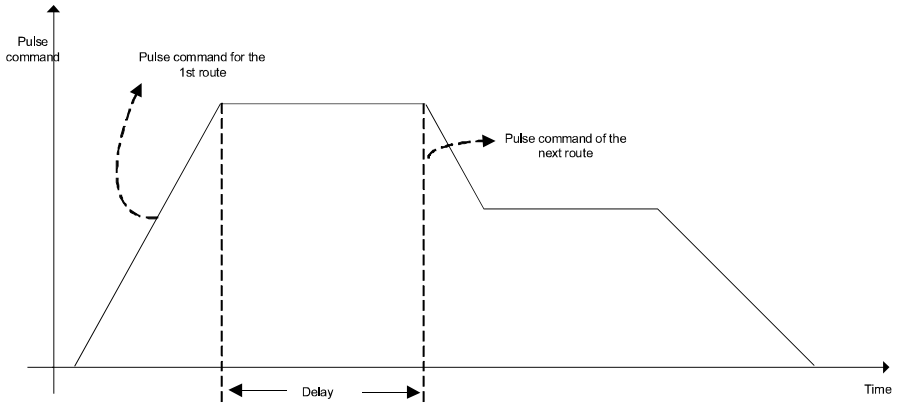
			0~60000	200	ms	P	-	-
	P4.75	ACC/DEC time of 7th route	Setting range	Default	Unit	Available mode		
			0~60000	200	ms	P	-	-
Detailed instruction: The ACC/DEC time is the needed time from 0r/min to 3000r/min. when the reference speed is more than or less than 3000r/min, the actual ACC/DEC time is counted.								

	P4.40	Operation speed of 1st route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
	P4.46	Operation speed of 2nd route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
	P4.52	Operation speed of 3rd route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
	P4.58	Operation speed of 4th route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
	P4.64	Operation speed of 5th route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
	P4.70	Operation speed of 6th route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
	P4.76	Operation speed of 7th route	Setting range	Default	Unit	Available mode		
			1~6000	100	r/min	P	-	-
Detailed instruction: Speed command setting Note: the range is relative to the power ratings of the drive.								

	P4.41	Delay of 1st route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-

	P4.47	Delay of 2nd route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-
	P4.53	Delay of 3rd route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-
	P4.59	Delay of 4th route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-
	P4.65	Delay of 5th route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-
	P4.71	Delay of 6th route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-
	P4.77	Delay of 7th route	Setting range	Default	Unit	Available mode		
			0~60000	100	ms	P	-	-

Detailed instruction: no command trigger during the interval time until the delay is finished.



	P4.78	Analog position gain	Setting range	Default	Unit	Available mode		
			0~60000	100	pulse/ 0.1v	P	-	-

Detailed instruction:

1. the voltage of VA corresponds to the changing gain

2.the relationship between VA input voltage and pulse number, the default is: each 0.1V corresponds to 100pulse

Note:

1. VA is the analog speed/speed limit terminal of CN1 (VA+、VA- "20", "5")
2. the parameter is valid if P0.40 is "1"
3. set the parameter correctly after making sure the motor situation. If the parameter is large, the motor fluctuation is large
4.large voltage may cause drive damage

6.6 Factory parameters (P9 group parameters)

	P9.00[2]	Factory password	Setting range	Default	Unit	Available mode		
			0~65535	00000	-	P	S	T
Detailed instruction: This parameter is the factory parameter password. The factory parameters are not open to the user. The user is advised not to try to get into this group of factory parameters. Otherwise it may cause malfunction or damage to the drive.								

6.7 State monitoring

	r00-SPd	Motor speed	**Symbol**	**Accuracy**	**Unit**
			r00-SPd	0.1	r/min
Detailed instruction: Display the actual rotation speed of the motor.					

	r01-FP1	Lower 5 bits of feedback pulse accumulation	**Symbol**	**Accuracy**	**Unit**
			r01-FP1	1	pulse
Detailed instruction:: Count and display the lower 5 bits of accumulated pulse fed back from the encoder of the servo motor, with sign bit.					

	r02-FP2	Medium 5 bits of feedback pulse accumulation	**Symbol**	**Accuracy**	**Unit**
			r02-FP2	1	pulse
Detailed instruction:: Count and display the medium 5 bits of accumulated pulse fed back from the encoder of the servo motor, with sign bit.					

	r03-FP3	Higher 5 bits of feedback pulse accumulation	**Symbol**	**Accuracy**	**Unit**
			r03-FP3	1	pulse
Detailed instruction: Count and display the higher 5 bits of accumulated pulse fed back from the encoder of the servo motor, with a sign bit.					

	r04-rP1	Lower 5 bits of command pulse accumulation	**Symbol**	**Accuracy**	**Unit**
			r04-rP1	1	pulse
Detailed instruction: Count and display the lower 5 bits of the number of the accumulated input pulses. The displayed number is the pulse number before being amplified by the electronic gear. The displayed content may not be consistent with the accumulated number of the feedback pulses, with a sign bit.					

	r05-rP2	Medium 5 bits of command pulse accumulation	**Symbol**	**Accuracy**	**Unit**
			r05-rP2	1	pulse
Detailed instruction: Count and display the medium 5 bits of the number of the accumulated input pulses. The displayed number is the pulse number before being amplified by the electronic gear. The displayed content may not be consistent with the accumulated number of the feedback pulses, with a sign bit.					

	r06-rP3	Higher 5 bits of command pulse accumulation	**Symbol**	**Accuracy**	**Unit**
			r06-rP3	1	pulse
Detailed instruction: Count and display the higher 5 bits of the number of the accumulated input pulses. The displayed number is the pulse number before being amplified by the electronic gear. The display content may not be consistent with the accumulated number of the feedback pulses, with a sign bit.					

	r07-EP	Retention pulse	**Symbol**	**Accuracy**	**Unit**
			r07-EP	1	pulse
Detailed instruction:					

Display the number of retention pulses of the position deviation counter. The 6th bit is the sign bit.

	r08-An1	Analog speed command voltage	**Symbol**	**Accuracy**	**Unit**
			r08-An1	0.001	V
Detailed instruction: In the speed mode: display the voltage value of the analog speed command. In the torque mode: display the voltage value of the analog speed limit.					

	r09-An2	Analog torque command voltage	**Symbol**	**Accuracy**	**Unit**
			r09-An2	0.001	V
Detailed instruction: In the torque mode: display the voltage value of the analog torque command. In the speed mode: display the voltage value of the analog torque limit.					

	r10-ud1	Bus voltage of main circuit	**Symbol**	**Accuracy**	**Unit**
			r10-ud1	0.1	V
Detailed instruction: Display the bus voltage value of the main circuit.					

	r11-ud2	Bus voltage of control circuit	**Symbol**	**Accuracy**	**Unit**
			r11-ud2	0.1	V
Detailed instruction: Display the bus voltage value of the control circuit.					

	r12-cur	RMS value of current output current	**Symbol**	**Accuracy**	**Unit**
			r12-cur	0.01	A
Detailed instruction: Display the RMS value of motor.					

	r13-Tq	Current torque	**Symbol**	**Accuracy**	**Unit**
			r13-Tq	0.1	%
Detailed instruction: Display the RMS value of motor.					

	r14-Tn	Drive module	**Symbol**	**Accuracy**	**Unit**

		temperature	r14-Tn	0.1	℃
Detailed instruction: Display the current temperature of IGBT module of the drive.					

	r15-Ld	Average load rate	**Symbol**	**Accuracy**	**Unit**
			r15-Ld	1	%
Detailed instruction: Display the continuous actual load. Taking the rated power of the servo motor as 100%, convert the actual value into a percentage to display.					

	r16-PoS	Position relative to Z pulse	**Symbol**	**Accuracy**	**Unit**
			r16-PoS	1	pulse
Detailed instruction: Display the position of the rotor relative to Z pulse in one revolution. The unit is pulse.					

	r17-inE	Inertia ratio of load	**Symbol**	**Accuracy**	**Unit**
			r17-inE	1	%
Detailed instruction: Display the predicted value of the ratio of rotational inertia of the servo motor to that of the load converted onto the servo motor's shaft in real-time.					

	r18-oAL	Third latest fault alarm code	**Symbol**	**Accuracy**	**Unit**
			r18-oAL	-	-
	r19-AL	Second latest fault alarm code	**Symbol**	**Accuracy**	**Unit**
			r19-AL	-	-
	r20-ALc	Latest fault alarm code	**Symbol**	**Accuracy**	**Unit**
			r20-ALC	-	-
Detailed instruction: Display the latest, second latest and third latest fault alarm codes.					

	r21-in	Digital input state	**Symbol**	**Accuracy**	**Unit**
			r21-in	-	-
	r22-ou	Digital output state	**Symbol**	**Accuracy**	**Unit**
			r22-ou	-	-
Detailed instruction: This value is a hexadecimal number arranged in the sequence of the digital quantities to indicate the state of all digital quantities. When a terminal is in ON state, its					

corresponding bit is denoted as 1. When a terminal is in OFF state, its corresponding bit is denoted as 0. Then, this binary number is converted into a hexadecimal number. For example, 000000001011 is denoted as 00B.

The digital input state is denoted with 4 digits of hexadecimal number. The arrangement sequence of the digital input is: (the digits not listed are filled with 0)

BIT12	BIT11	BIT10	BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
DI13	DI12	DI11	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1

The digital output state is denoted with 2 digits of hexadecimal number. The arrangement sequence of the digital output is:

BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
DO6	BRK	DO5	DO4	DO3	DO2	DO1

	r23-tt	Motor temperature	Symbol	Accuracy	Unit
			r23-tt	0.1	℃

Detailed instruction:

Display the current temperature of motor.

	r24-uE1	DSP software version	Symbol	Accuracy	Unit
			r24-uE1	-	-

Detailed instruction:

Display the version number of current DSP software.

	r25-uE2	FPGA software version	Symbol	Accuracy	Unit
			r25-uE2	-	-

Detailed instruction:

Display the version number of current FPGA software.

	r26-uuu	Encoder feedback	Symbol	Accuracy	Unit
			r26-uuu	-	-

Detailed instruction:

Display current value of encoder (U, V and W) feedback.

	r27-iA	Instantaneous value of phase U output current	Symbol	Accuracy	Unit
			r27-iA	0.01	A

Detailed instruction:

Display the instantaneous value of current phase U output current.

r28-ib	Instantaneous value of phase V output current	**Symbol**	**Accuracy**	**Unit**
		r28-ib	0.01	A
Detailed instruction: Display the instantaneous value of current phase V output current.				

r29-iAF	Instantaneous value of phase U output current when an fault occurs	**Symbol**	**Accuracy**	**Unit**
		r29-iAF	0.01	A
Detailed instruction: Display the instantaneous value of phase U output current when a fault occurs.				

r30-ibF	Instantaneous value of phase V output current when an fault occurs	**Symbol**	**Accuracy**	**Unit**
		r30-ibF	0.01	A
Detailed instruction: Display the instantaneous value of phase V output current when a fault occurs.				

r31-udF	Value of bus voltage when an fault occurs	**Symbol**	**Accuracy**	**Unit**
		r31-udF	0.1	V
Detailed instruction:Display the value of bus voltage when an fault occurs.				

r32-Sn1	Drive serial No.1	**Symbol**	**Accuracy**	**Unit**
		r32-Sn1	-	-
Detailed instruction:Display the drive serial No.1				

r33-Sn2	Drive serial No.2	**Symbol**	**Accuracy**	**Unit**
		r33-Sn2	-	-
Detailed instruction:Display the drive serial No.2				

r34-Sn3	Drive serial No.3	**Symbol**	**Accuracy**	**Unit**
		r34-Sn3	-	-
Detailed instruction:Display the drive serial No.3				

r35-Sn4	Drive serial No.4	**Symbol**	**Accuracy**	**Unit**
		r35-Sn4	-	-
Detailed instruction:Display the drive serial No.4				

	r36-Sn5	Drive serial No.5	Symbol	Accuracy	Unit
			r36-Sn5	-	-
Detailed instruction:Display the drive serial No.5					

	r37-Sn6	Drive serial No.6	Symbol	Accuracy	Unit
			r37-Sn6	-	-
Detailed instruction:Display the drive serial No.6					

	r38-Pr	Carrier cycle	Symbol	Accuracy	Unit
			r38-Pr	0.01	us
Detailed instruction: Display the carrier cycle					

	r39-oLc	Load ratio	Symbol	Accuracy	Unit
			r39-oLc	0.1	%
Detailed instruction: Display the load ratio					

	r40-rT	Operation time	Symbol	Accuracy	Unit
			r40-rT	1	h
Detailed instruction: Display the total operation time					

	r41-PrS	Execution route	Symbol	Accuracy	Unit
			r41-PrS	1	-
Detailed instruction: Display the current action step. Note: If the command is sent by the route is not excited, display 1000+ route number, after the route is excited, display 2000+ route number.					

	r42-SPE	Speed standard deviation	Symbol	Accuracy	Unit
			r42-SPE	0.001	r/min
Detailed instruction: Display the speed standard deviation.					

	r43-oP1	Low 5 bit of the origin	Symbol	Accuracy	Unit
			r43-oP1	1	pulse
Detailed instruction: Display low 5 bit of the origin, with sign bit					

	r44-oP2	Medium 5 bit of the origin	Symbol	Accuracy	Unit
			r44-oP2	1	pulse
Detailed instruction: Display medium 5 bit of the origin, with sign bit					

	r45-oP3	High 5 bit of the origin	Symbol	Accuracy	Unit
			r45-oP3	1	pulse

Detailed instruction: Display high 5 bit of the origin, with sign bit

7 Gain adjustment

7.1 General method for parameters adjusting

When the servo system oscillates or the control performance becomes not sound, you can improve the system performance or eliminate the oscillation by adjusting the parameters of the speed loop and position loop. Hereunder we describe the general principle and method for the adjustment:

Gain of the speed loop: mainly used to determine the response speed of the speed loop. Under the precondition the mechanical system does not vibrate, the larger the setting of this parameter, the higher the response speed.

Speed loop integration time constant: the speed loop has an integrator which can reflect minor input. This integrator can delay the operation of the servo system. Therefore, when the time constant increases, the response becomes slower, and the required positioning setting time is longer. When the load inertia is larger or the mechanical system is likely to vibrate, the loop integration time parameter must be large enough to avoid the vibration of the mechanical system.

Torque command filter: in some cases the mechanical system may resonate, generating vibration noise of sharp tone. At this time trap wave filtering must be performed to eliminate resonance.

Gain of the position loop: the reaction of the servo system is determined by the gain of the position loop. When the gain of the position loop is set higher, the reaction speed will increase and the time required for positioning will be shortened. If you want to set the gain of the position loop to a high value, the rigidity and natural frequency of the mechanical system must be very high.

In general case the gain of the speed loop should be ensured higher than the gain of the position loop whenever possible. When the position gain is much higher than the speed gain, the system may overshoot under the action of the step signal. This will seriously damage the system performance. Various parameters of the system always limit each other. If only the gain of the position loop increases, the command outputted by the position loop may become unstable. This may cause the reaction of the entire servo system to become unstable. In general cases, we can adjust the system by referring to the follow procedures:

1) First set the gain of the position loop at a lower value, then, under the precondition that abnormal sound and vibration are not generated, gradually increase the gain of the speed loop to the maximum.

2) Gradually decrease the gain of the speed loop while increasing the gain of the position loop.

Under the precondition that the whole response is free from overshoot and vibration, set the gain of the position loop to the maximum.

3) Speed loop integration time constant depends on the length of the positioning time. Please decrease this value as small as possible under the precondition that the mechanical system does not vibrate.

4) After that, finely adjust the gain of the position loop, speed loop and the integration time constant to find their optimal values.

Hereunder we illustrate several typical cases (in each case, only one parameter is changed relative to a case when the parameters are appropriate):

- Parameters are appropriate

In this case the parameters are set relatively appropriate. The motor speed can closely follow the position command, the speed has basically no overshoot, and the positioning time is relatively short.

- Speed loop integration time constant is relatively small

The speed loop of the servo drive must have high reaction speed. When the speed fluctuates, it indicates that the stability of the speed loop is damaged due to the shorting integration time of the speed loop. This causes the servo motor to run unstably at fluctuating speed.

- Speed loop integration time constant is relatively large

In this case, there is no apparent difference with the case when the parameters are appropriate. The influence of the speed loop integration on the speed follow-up position command is not very high, but too large speed loop integration time will delay the reaction time of the speed loop.

- Gain of the speed loop is relatively high

In this case, the motor speed will fluctuate. The influence is the same as the case when the speed loop integration time is too short. Both of them must keep coordinated. While increasing the gain of the speed loop, the speed loop integration time must also be increased. Otherwise the servo system will oscillate.

- Gain of the speed loop is too low

Decreasing the gain of the speed loop will cause fluctuation of the motor speed to fluctuate. By comparing with the case when the speed gain is too high we can know that the fluctuation frequency of the motor speed is lower in this case which fully indicates that increasing the gain of the speed loop can heighten the operating frequency of the system, improve the quick response performance of the system, and effectively overcome the influence of the interference.

- Gain of the position loop is excessively low

In the servo system, the operating frequency of the position loop is much lower than the speed loop. When the gain of the position loop is too low, the system is difficult to eliminate the position deviation formed during speed response. This can cause prolongation of the time interval of the motor speed follow-up position command.

◆ Gain of the position loop is excessively high

In the position servo system, the gain of the position loop also affects the stability. At this time, as the gain of the position loop is excessively high, it makes the motor speed to fluctuate. Additionally, comparing with the case when the gain of the position loop is too low we can know that the pure time delay of the response to the position command of the motor speed is decreased.

◆ Gain of the position loop is too low

When we adjust the gain of the position loop to a low value, the motor speed follow-up position command represents obvious lag and the positioning time is prolonged largely. The high accuracy and high response performance of the positioning system are seriously affected.

7.1.1 Adjustment of the gain of the position loop

The position control block diagram of the SV-DB100 series servo drive is shown in the figure below. The gain parameters that can be adjusted in the position mode are marked out on the block diagram.

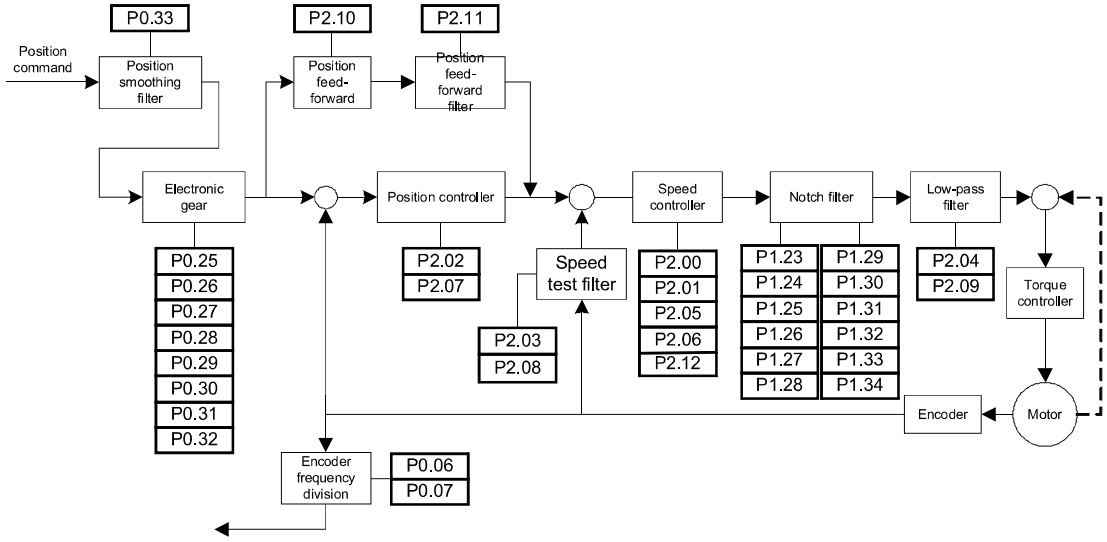


Fig. 7-1 Block diagram of position control

The general procedures for parameter adjustment in the position mode are:

1) Initial setting of the parameters

The defaults of the parameters can be recovered by the default parameter recovering operation (see chapter 5.2.4 for details).

2) Adjustment of the gain of the position loop

When the servo motor is running with default parameters, if the system oscillation occurs with buzz, the position gain should be adjusted smaller. If the system rigidity is relatively small, the position gain should be adjusted larger.

3) Adjustment of the position smoothing filter

During position control, if the position pulse commands input frequency varies largely, it may be caused by a larger impulse. At this time the position smoothing filters time constant should be adjusted to moderate the impulse.

4) Adjustment of the electronic gear

If the pulse transmission frequency of the pulse generator is restricted, or the transmission frequency does not meet the mechanical requirements, we can change the pulse input frequency by adjusting the value of the electronic gear parameters to meet the requirements for position control.

5) Adjustment of position feed-forward

In the case the retention pulse is large or fault-free follow-up is required, we can improve the position follow-up performance by adjusting the speed feed-forward gain parameter and speed feed-forward gain filter parameter. However, it should be noted that if the speed feed-forward gain is too large, it may cause system oscillation.

6) Frequency division of the feedback pulse output

If the feedback pulse needs to be outputted, the frequency division coefficient of pulse output can be used to change the frequency of the output pulse.

7.1.2 Adjustment of the gain of the speed loop

The speed control block diagram of the SV-DB100 series servo drive is shown in the figure below. The gain parameters that can be adjusted in the speed mode are marked on the block diagram.

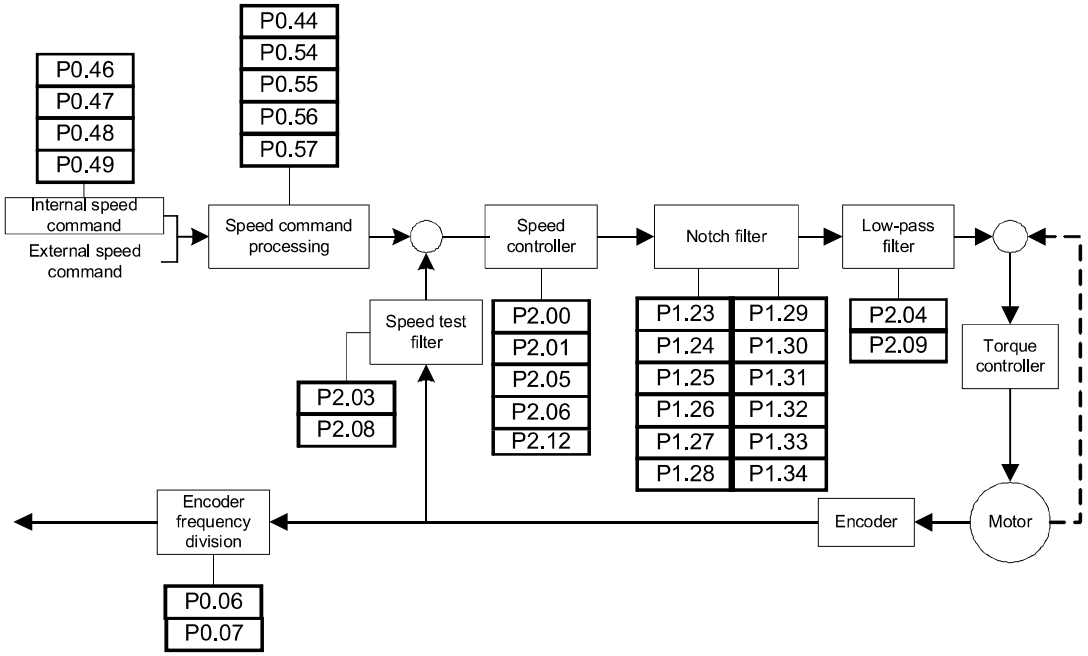


Fig. 7-2 Block diagram of speed control

The general procedures for parameter adjustment in the speed mode are:

1) Initial setting of the parameters

The defaults of the parameters can be recovered by the default parameter recovering operation (see chapter 5.2.4 for details).

2) Adjustment of the gain of the speed loop

When the servo motor is running with default parameters, if the system oscillation occurs with buzz, the speed gain should be adjusted smaller. If the system rigidity is relatively small or the speed fluctuates largely, the speed gain should be adjusted larger.

3) Adjustment of the speed integration time constant

When the gain of the speed loop is increased, the speed integration time constant should be increased at the same time. Similarly, when the gain of the speed loop is decreased, the speed integration time constant should be decreased at the same time.

4) Adjustment of the ACC/DEC time

If the speed varies violently during starting, it may cause large impulse or even overcurrent. At this time we adjust the ACC time to smoothen the speed rise. Similarly, we can adjust the DEC time to smoothen the speed fall during stopping.

5) S curve ACC/DEC adjustment

If the requirement for smooth variation of speed can not be met by adjusting the ACC/DEC time, we can adjust the S curve ACC/DEC time to make it change more smoothly.

6) Adjustment of the speed smoothing filter

In the case where the analog speed command is inputted, we can adjust the speed smoothing

filter time constant to make the speed change smoothly.

7) Adjustment of speed feed-forward

If the speed follow-up performance is still poor after above parameter adjustment, we can adjust the torque feed-forward gain to improve the speed follow-up performance. It should be noted however that too large torque feed-forward gain may affect the stability of the system.

8) Adjustment of speed filter

The performance of the speed loop can be improved by adjusting P2.04/P2.09 and P2.03/P2.08.

9) Adjustment of trap wave filtering

See chapter 7.2.

10) Frequency division of the feedback pulse output

If the feedback pulse of the encoder needs to be outputted, the frequency division coefficient of pulse output can be used to change the frequency of the output pulse.

7.1.3 Adjustment of the gain of the torque loop

The torque control block diagram of the SV-DB100series servo drive is shown in the figure below. The gain parameters that can be adjusted in the torque mode are marked out on the block diagram.

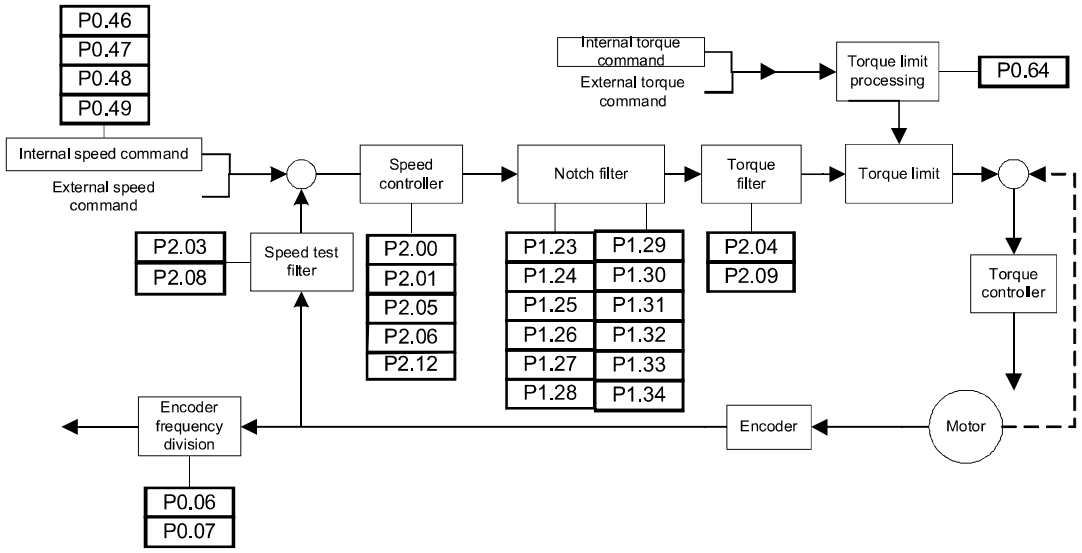


Fig. 7-3 Block diagram of torque control

The general procedures for parameter adjustment in the torque mode are:

1) Initial setting of the parameters

The defaults of the parameters can be recovered by the default parameter recovering operation (see chapter 5.2.4 for details).

2) Adjustment of the torque smoothing filter

In the case the analog torque command is inputted, we can adjust the torque smoothing filter time constant to make the torque change smoothly.

3) Frequency division of the feedback pulse output

If the feedback pulse of the encoder needs to be outputted, the frequency division coefficient of pulse output can be used to change the frequency of the output pulse.

7.2 Suppression of mechanical resonance

The mechanical system has a certain resonant frequency. If the response speed of the servo is improved, the system may resonate (oscillation and abnormal noise) near the mechanical resonant frequency. The resonance of the mechanical system can be effectively suppressed by setting the parameters of the trap wave filters.

The trap wave filters achieve the goal of suppressing mechanical resonance by decreasing the gain of certain frequency. We can set the frequency to be suppressed as well as the suppression extent with relevant parameters.

The notch filter is as figure 7-2, the servo drive has four notch filters, of which, and the 3rd and 4th notch filters can be set automatically.

Parameter	Setting value	Function	Meaning
P1.20	0	Invalid	All relative parameters keep no change
Test mode	1	1 notch filter	The relative parameters of the 3rd notch filter will be updated according to the auto tuning result.
	2	2 notch filters valid	The relative parameters of the 3rd and 4th notch filters will be updated according to the auto tuning result.
	3	Resonance frequency test mode	No relative parameters
	4	Parameters clear	Restore to the default values

If P1.20 is 1, 2, 3, the system will set following parameters as below:

Parameter	Name	Function
P1.29	3rd trap wave center frequency	If no resonance point, the setting is 3000.0, if the notch filter is valid, it will be set automatically
P1.30	3rd trap wave width	

P1.31	3rd trap wave depth	If resonance frequency, correspond to the width and depth setting
P1.32	4th trap wave center frequency	If no resonance point, the setting is 3000.0, if the 2 notch filters are valid, it will be set automatically
P1.33	4th trap wave width	If resonance frequency, correspond to the width and depth setting
P1.34	4th trap wave depth	

Note:

1. The notch filter is the lag factor for the servo system, so, if the center frequency of control width is large, the vibration may be strengthened. It is recommended to increase the width unit it meets the requirements.

2. If the notch filter is valid, the abnormality or vibration occurs, the relative parameters of 3rd and 4th notch filter may be the limit value, clear the parameters and start.

If the width of the notch is 0, the width of the filter is the deviation between two frequencies when the power of the center frequency drops to -3dB.

The width of the filter means the ratio of input and output, and the intensity attenuation 20log (P1.25, P1.28, P1.31, P1.34)dB.

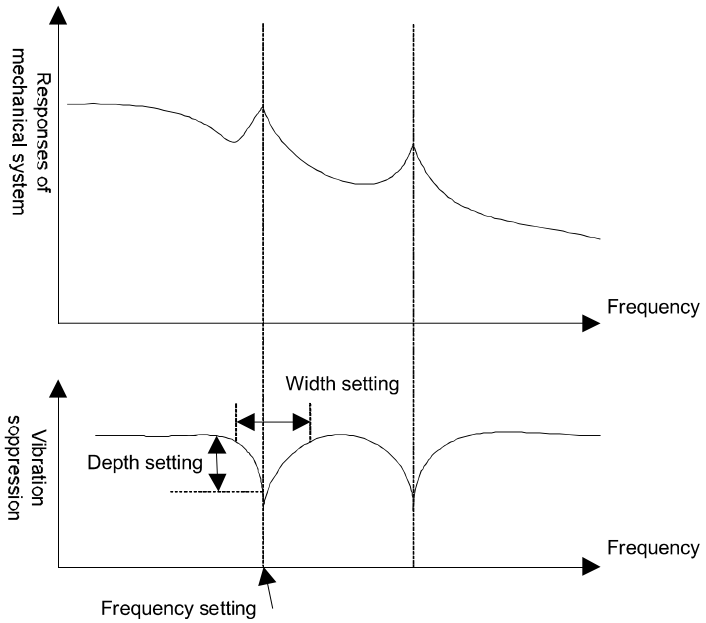


Fig. 7-4 Schematic diagram of setting of the trap wave filters

7.3 Gain switching function

Gain switching operation is performed through internal data or external signal:

1) Can switch to lower gain to suppress vibration in the state when the motor is stopped (the servo is locked);

2) Can switch to higher gain to shorten the positioning time in the state the motor is stop;

3) Can switch to high gain to obtain better command follow-up performance in the state when the motor is running.

4) Can switch between different gain settings through external signal according to the conditions of load, equipment and so on.

Here demonstrating how to improve the response performance in the position control mode by the gain switching function: in order to get better response performance and make the servo motor position quickly, we set P2.21=1, P2.22=5, P2.25=30.0. At this time, when no pulse is inputted, the system uses the 1st gain for adjustment. After the pulse command is inputted, it smoothly switches to the 2nd gain. After the command input stops, in 2ms, if the speed falls below the setting of P2.25, it will switch to the 1st gain. The whole process is shown in the figure below:

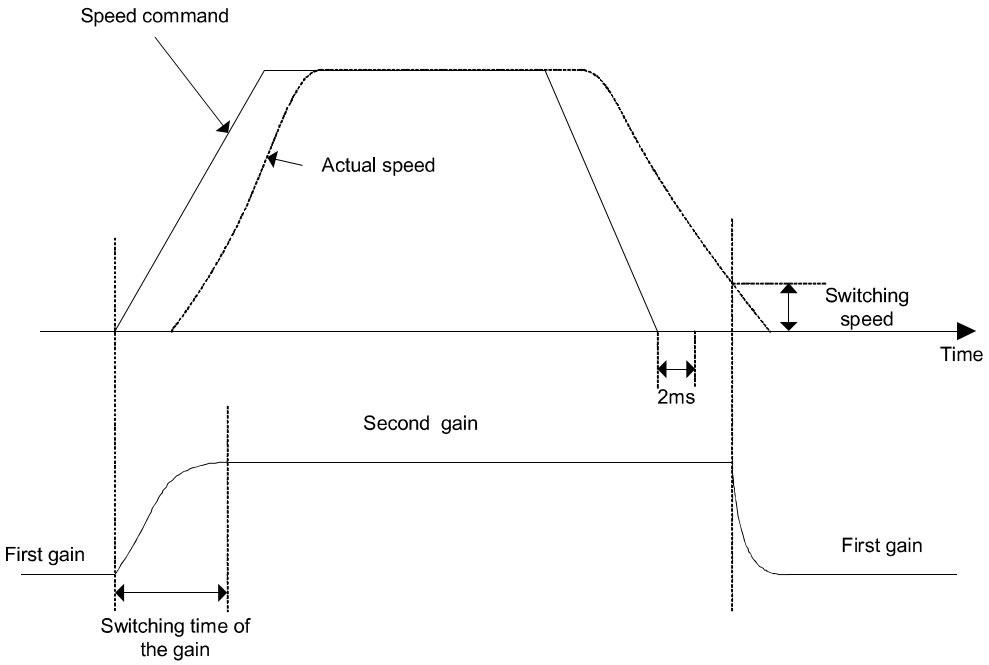
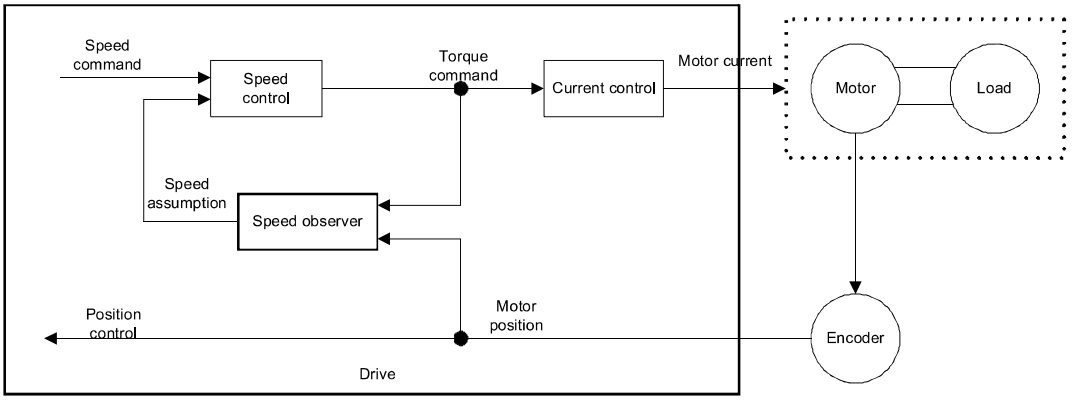


Fig. 7-5 Schematic diagram of gain switching

During positioning, generally, the speed integration function in running state of the motor can be deactivated to raise the gain and thus improve the response performance.

While after it has stopped, the gain to suppress the motor vibration can be decreased.

7.4 Speed observer



The motor speed will be assumed for following functions:

1. Improve the test precision
2. Rapid response
3. Reduce the vibration

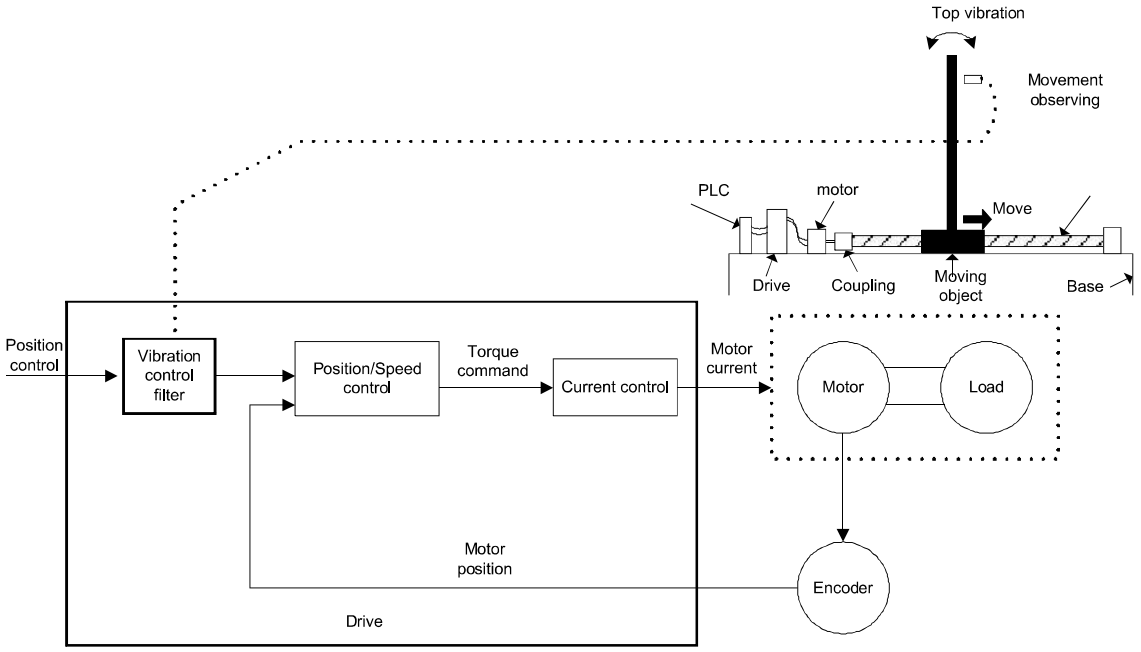
Relative parameters

Parameter	Name	Function
P2.40	The speed observer switch	to set whether the observer is valid or not
P2.41[2]	The speed observer gain	after setting, the response speed will be rapid, but vibration and noise may occur
P2.42[2]	Phase comparator gain	to adjust the identification error caused by inaccurate inertia setting
P2.43	Time constant of torque filtering	to set the time constant of torque filtering for the speed observer

Note:

1. Try to set P1.02 correctly
2. Readjust the relative parameters of position loop gain and speed loop gain if the observer is valid
3. Adjust P2.42 or P1.02 to get the least vibration.

7.5 Vibration control



In the position mode, the vibration frequency can be emanated for the position control.

Relative parameters

Parameter	Name	Function
P1.35	Vibration control selection	to set the switching mode
P1.36	The 1st vibration control frequency	set the frequency reducing ratio of the control load and the frequency at the peak of the load
P1.37	The 1st vibration control factor	to set the filter factor
P1.38	The 2nd vibration control frequency	to set the frequency reducing ratio of the control load and the frequency at the peak of the load
P1.39	The 2nd vibration control factor	to set the filter factor

1. Vibration control frequency

- Read the vibration frequency through the external tester and then set the value of P1.36/1.38
- If no external tester, watch the frequency through [ServoPlorer]—— and then set the value of P1.36/1.38

2. Setting of the vibration filter factor

If the setting value is bigger, the position adjustment time will be reduced. But large factor may cause

increasing torque fluctuation and mechanical noise.

Note:

1. If the vibration frequency exceeds 1.0~200.0HZ, the function will be disabled

2. If the vibration is caused by other reasons, the function will be disabled

3. If the factor is large, torque saturation will be lead and impact the control effect

During the switching, if the positioning range is increasing, the motor speed may be larger than the command speed to return to the original position.

8 Communication function

8.1 General

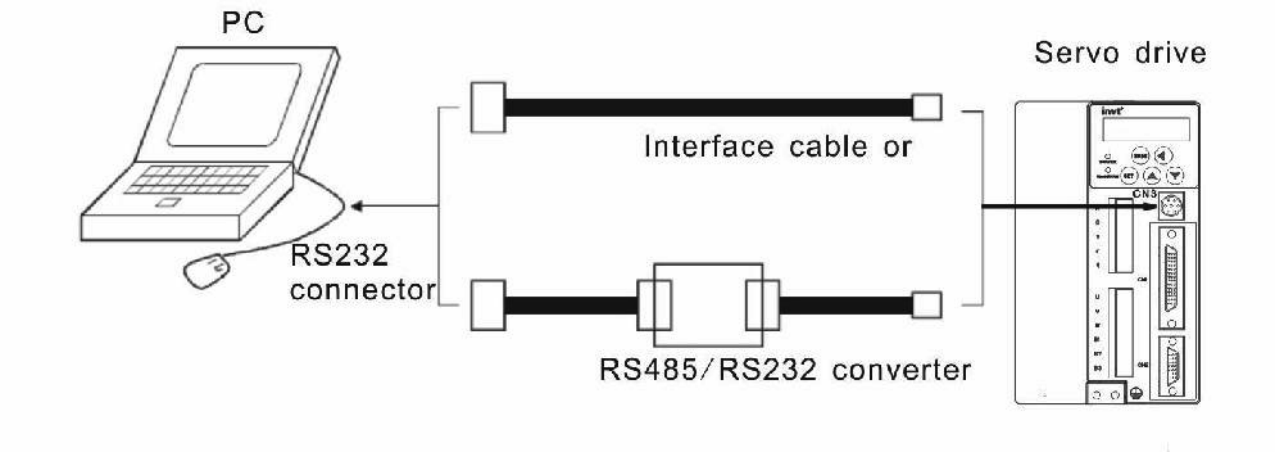
The servo drive is provided with two types of communication interfaces: RS485 and RS232. The PC or NC can realize asynchronous serial semiduplex communication with 32 servo drives simultaneously through RS485 interface. The communication function has realized the following functions:

- Read/write the function parameters of the servo drives
- Monitor the operating state of the servo drives
- Form a multi-axis control system

8.2 Topological structure

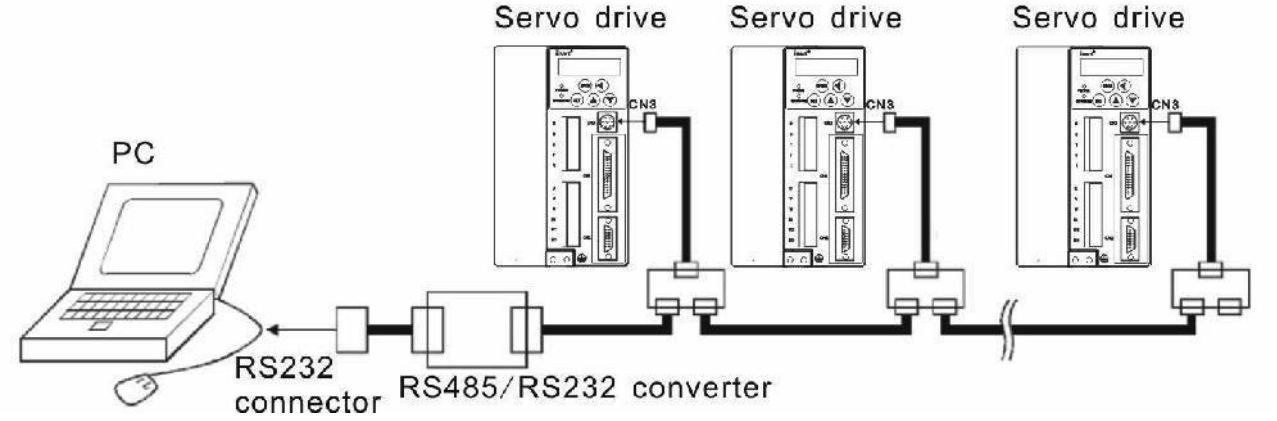
SV-DB100 series servo drive is connected in the "Single Master Multi-slave" control network with RS232/RS485 bus.

8.2.1 Communication with single set



8.2.2 Communication with multiple sets

Can run and operate 32 servo drives on one bus.



8.3 Communication protocol

The SV-DB100 series servo drive is provided with two types of communication interfaces: RS485 and RS232. It adopts international standard Modbus communication protocol to perform master-slave communication. The user can realize centralized control through PC/PLC, upper control PC, etc. (set the control command, running frequency of the servo drives, modify relevant function codes, monitor and control the operating state and fault information of the servo drives and so on) to adapt specific application requirements.

8.3.1 Protocol content

The Modbus serial communication protocol defines the frame content and usage format in asynchronous transmission which includes: master polling, and the format of the broadcast frame and the slave answering frame. The frame of the master includes: the slave address (or the broadcast frame), commands, digit and error checkout. The slave answering also applies the same structure: action confirmation, digit returning and error checkout. If there is a mistake during the frame receiving of the slave or the slave can not finish the action which the master requires, it will respond an error frame to the master as a response.

8.3.2 Protocol instructions

The communication protocol of the SV-DB100 series servo drives is an asynchronous serial Master-Slave communication protocol. The master is the only device in the network to build up the protocol (named as inquiry/command), while the other devices (the slaves) can respond to or do action to the inquiry/command of the master through providing digits. The master in this manual means PC, industrial control devices and PLC. The slaves mean the servo drives and other control devices with the same communication protocol. The master can communicate with a certain salve, as well as, send broadcast message to all slaves. For the

separately-visiting inquiry/command of the master, the slave should return a message as the response. While for the broadcast message, the salve needs not to do so.

8.3.3 Communication protocol format

Modbus protocol supports both RTU and ASCII mode. The user can select whatever they prefer as well as the serial communication parameters, such as, the baud rate and the checkout means. All the devices on the same Modbus network should select the same transmission mode and serial parameters during configuring each control devices.

8.3.3.1 ASCII mode

When the control device is set as ASCII communication mode on the Modbus network, every 8bit byte in the message is sent as two ASCII characters. The advantage of this mode is the time interval of byte sending can achieve 1 second without mistakes.

Table 8-1: The message frame in ASCII mode

The start bit	Device address	Command code	Data	LRC checkout	The tailed
1 character	2 characters	2 characters	n characters	2 characters	2 characters

As table 1 showed, in the message of ASCII mode, the start bit is ":" (ASCII code 3AH) and the tailed is the line break (ASCII code 0DH, 0AH). The device on the network is detecting ":" during the transmission. Each device decodes the next address field when receiving a ":" to estimate the owner. The device corresponds to the address field continues to receive other field until the line break appears. Except for the start bit and the tailed, the transmitting characters used in other fields are 0.....9, A.....F (hex) and the ASCII codes are also used to express characters. In the ASCII mode, LRC is used in the message to check the error.

8.3.3.2 RTU mode

When the control device is set as RTU mode, every 8bit byte in the message frame includes two 4bit hex characters.

Table 8-2: The message frame in RTU mode

The start bit	Device address	Command code	Data	LRC checkout	The tailed
T1-T2-T3-T4	8Bit	8Bit	n 8Bit(s)	16Bit	T1-T2-T3-T4

The Modbus minimum idle time between frames should be no less than 3.5 bytes. The network device is detecting, even during the interval time, the network bus. When the first field (the address field) is received, the corresponding device decodes next transmitting character. When the interval time is at least 3.5 byte, the message ends.

The whole message frame in RTU mode is a continuous transmitting flow. If there is an interval

time (more than 1.5 bytes) before the completion of the frame, the receiving device will renew the uncompleted message and suppose the next byte as the address field of the new message. As such, if the new message follows the previous one within the interval time of 3.5 bytes, the receiving device will deal with it as the same with the previous message. If these two phenomena all happen during the transmission, the CRC will generate a fault message to respond to the sending devices.

When the control device is set as RTU communication mode (remote terminal unit), every 8bit byte in the message includes two 4Bit hex characters. Compared with ACSII mode, this mode can send more data at the same baud rate.

8.3.4 Command code and the communication data instructions

8.3.4.1 Command code: 03H

Function: read N words (can read no more than16 words continously).

For example, the servo drive with the salve address of 01H, if its starting address is 0601H, read 2 words continuously, and then the structure of the frame is:

Table 8-3 The RTU master device request command

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
High byte of start address	06H
Low byte of start address	01H
High byte of data number	00H
Low byte of data number	02H
Low byte of CRC CHK	95H
High byte of CRC CHK	43H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Table 8-4 The RTU slave device reply

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
Returned byte number	04H
Higher byte of 0004H	00H
Low byte of 0004H	00H
High byte of 0005H	00H
Low byte of 0005H	00H

Low byte of CRC CHK	FAH
High byte of CRC CHK	33H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Table 8-5 The ASCII master device request command

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'3'
High byte of start address	'0'
	'6'
Low byte of start address	'0'
	'1'
High byte of data number	'0'
	'0'
Low byte of data number	'0'
	'2'
LRC CHK Hi	'F'
LRC CHK Lo	'3'
END Lo	CR
END Hi	LF

Table 8-6 The ASCII slave master device reply

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'3'
Returned byte number	'0'
	'4'
Higher byte of 0401H	'0'
	'0'
Low byte of 0401H	'0'
	'0'
High byte of 0402H	'0'

	'0'
Low byte of 0402H	'0'
	'0'
LRC CHK Lo	'8'
LRC CHK Hi	'F'
END Lo	CR
END Hi	LF

8.3.4.2 Command code: 06H

Function: write one word (word)

For example, write 5000(1388H) into address 002EH, slave device address 02H. And then the structure of the frame is:

Table 8-7 The RTU master device request command

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
High byte of data address	00H
Low byte of data address	2EH
High byte of write content	13H
Low byte of write content	88H
Low byte of CRC CHK	E4H
High byte of CRC CHK	A6H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Table 8-8 The RTU slave device reply command

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
High byte of data address	00H
Low byte of data address	2EH
High byte of write content	13H
Low byte of write content	88H
Low byte of CRC CHK	E4H
High byte of CRC CHK	A6H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Table 8-9 The ASCII master device request command

START	':'
ADDR	'0'
	'2'
CMD	'0'
	'6'
High byte of data address	'0'
	'0'
Low byte of data address	'2'
	'E'
High byte of write content	'1'
	'3'
Low byte of write content	'8'
	'8'
LRC CHK Hi	'2'
LRC CHK Lo	'F'
END Lo	CR
END Hi	LF

Table 8-10 The ASCII slave master device reply

START	':'
ADDR	'0'
	'2'
CMD	'0'
	'6'
High byte of data address	'0'
	'0'
Low byte of data address	'2'
	'E'
High byte of write content	'1'
	'3'
Low byte of write content	'8'
	'8'
LRC CHK Hi	'2'
LRC CHK Lo	'F'
END Hi	CR

END Lo	LF

8.3.4.3 Command code: 08H

Function: diagnosis

Table 8-11 Meaning of sub-function codes

Sub-function Code	Description
0000	Return to inquire information data

For example: The inquiry information string is same as the response information string when the loop detection to address 01H of driver is carried out.

Table 8-12 The RTU request command

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
High byte of sub-function code	00H
Low byte of sub-function code	00H
High byte of data content	12H
Low byte of data content	ABH
Low byte of CRC	ADH
High byte of CRC	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Table 8-13 The RTU reply command

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
High byte of sub-function code	00H
Low byte of sub-function code	00H
High byte of data content	12H
Low byte of data	ABH

content	
Low byte of CRC	ADH
High byte of CRC	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Table 8-14 The ASCII request command

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'8'
High byte of sub-function code	'0'
	'0'
Low byte of sub-function code	'0'
	'0'
High byte of data content	'1'
	'2'
Low byte of data content	'A'
	'B'
LRC CHK Hi	'3'
LRC CHK Lo	'A'
END Hi	CR
END Lo	LF

Table 8-15 The ASCII reply command

START	':'
ADDR	'0'
	'1'
CMD	'0'
	'8'
High byte of sub-function code	'0'
	'0'
Low byte of sub-function code	'0'
	'0'
High byte of data content	'1'
	'2'

Low byte of data content	'A'
	'B'
LRC CHK Hi	'3'
LRC CHK Lo	'A'
END Hi	CR
END Lo	LF

8.3.5 Error checkout of the communication frame

The error checkout of the frame can be divided into two parts: the bit checkout of the byte and the whole data checkout of the frame (CRC check or LRC check).

8.3.5.1 Bit checkout of the byte

The user can select different bit checkouts or non-checkout, which impacts the check bit setting of each byte.

The definition of even checkout: add an even check bit before the data transmission to illustrate the number of "1" in the data transmission is odd number or even number. When it is even, the check byte is "0", otherwise, the check byte is"1". This method is used to stabilize the parity of the data.

The definition of odd checkout: add an odd check bit before the data transmission to illustrate the number of "1" in the data transmission is odd number or even number. When it is odd, the check byte is "0", otherwise, the check byte is"1". This method is used to stabilize the parity of the data.

For example, when transmitting "11001110", there are five "1" in the data. If the even checkout is applied, the even check bit is "1"; if the odd checkout is applied; the odd check bit is "0". The even and odd check bit is calculated on the check bit position of the frame. And the receiving devices also carry out even and odd checkout. If the parity of the receiving data is different from the setting value, there is an error in the communication.

8.3.5.2 CRC CRC check

The checkout uses RTU frame format. The frame includes the frame error detection field which is based on the CRC calculation method. The CRC field is two bytes, including 16 figure binary values. It is added into the frame after calculated by transmitting device. The receiving device recalculates the CRC of the received frame and compares them with the value in the received CRC field. If the two CRC values are different, there is an error in the communication.

During CRC, 0*FFFF will be stored. And then, deal with the continuous 6-above bytes in the frame and the value in the register. Only the 8Bit data in every character is effective to CRC, while the start bit, the tailed and the odd and even check bit is ineffective.

The calculation of CRC applies the international standard CRC checkout principles. When the

user is editing CRC calculation, he can refer to the relative standard CRC calculation to write the required CRC calculation program.

Here provided a simple function of CRC calculation for the reference (programmed with C language):

```
unsigned int crc_cal_value(unsigned char *data_value,unsigned char data_length)
{
int i;
unsigned int crc_value=0xffff;
while(data_length--)
{    crc_value^=*data_value++;
            for(i=0;i<8;i++)
            {
if(crc_value&0x0001)crc_value=(crc_value>>1)^0xa001;
            else crc_value=crc_value>>1;
            }       }
return(crc_value);
}
```

In ladder logic, CKSM calculated the CRC value according to the frame with the table inquiry. The method is advanced with easy program and quick calculation speed. But the ROM space the program occupied is huge. So use it with caution according to the program required space.

8.3.5.3 LRC check

The LRC check is the value adding from Address to Date Content. For example, the LRC check of the 8.3.4.2 communication information is 0×02+0×06+0×01+0×09+0×13+088=0AD, and then complementary code=0×53.

8.3.6 Address definition of communication data

This chapter is the address definition of communication data used to control the running of the servo drives, acquire the state information of the servo drives and set relevant function parameters of the servo drives and so on.

The servo drive has 4 groups of function codes: P0.XX, P1.XX, P2.XX, P3.XX, P4.XX, P9.00 and rXX.XXX. The first 3 groups of function codes are not only readable but also can be modified through communication. rXX.XXX is readable. The writing is invalid.

The address of the function codes are composed of two 8-bit, expressed with the hexadecimal system. The first 8-bit indicates the group number of the function codes: P0 group is 00H, P1 group is 01H, P2 group is 02H, P3 group is 03H, P4 group is 04H, P9 group is 05H, rXX group is 06H. The last 16-bit indicates the hexadecimal expression of the serial number of the

function code. For examples, the address of function code of P0.25 is 0019H and the address of P4.31 is 041FH, the address of function code of r07.EP is 0607H.

Table 8-16 Special function codes

Function description	Address definition	Explanation of data meaning	R/W characteristics
Communication control command	1000H	0000H: Jog end	W
		0001H: Jog start	
		0002H: FWD jog start	
		0003H: REV jog start	
		0004H FWD jog end	
		0005H: REV jog end	
		0006H: Alarm clear	
Servo state	1001H	0001H: FWD running	R
		0002H: REV running	
		0003H: Servo drive standby	
		0004H: in fault	
EERPROM writing	1002H	0002H: parameter default recovering	W
Control quantity	1003H	See description of Pd.18 for the arrangement sequence of the digital quantities. In which, 3 signals – EMG, PSL and RVL – cannot be controlled through communication. Bit 13 is the communication control enabling bit.	W/R
	1100H	Read the state of the input port	R
	1101H	Read the state of the output port	W/R
Particular address	0700H	Internal speed/speed limit 1 (P0.46) higher 16 bits	W/R
	0701H	Internal speed/speed limit 2 (P0.47) Higher 16 bits	W/R

Function description	Address definition	Explanation of data meaning	R/W characteristics
	0702H	Internal speed/speed limit 3 (P0.48) Higher 16 bits	W/R
	0703H	Internal speed/speed limit 4 (P0.49) Higher 16 bits	W/R
	0704H	Lower 16 bits of speed feedback	R
	0705H	Higher 16 bits of speed feedback	R

8.3.7 Fault Responses

The slave uses functional code fields and fault addresses to indicate it is a normal response or some error occurs (named as objection response). For normal responses, the slave shows corresponding function codes, digital address or sub-function codes as the response. For objection responses, the slave returns a code which equals the normal code, but the first byte is logic 1.

For example: when the master sends a message to the slave, requiring it to read a group of address data of servo device function codes, there will be following function codes:

0 0 0 0 0 0 1 1 (Hex 03H)

For normal responses, the slave responds the same codes, while for objection responses, it will return:

1 0 0 0 0 0 1 1 (Hex 83H)

Besides the function codes modification for the objection fault, the slave will respond a byte of abnormal code which defines the error reason.

When the master receives the response for the objection, in a typical processing, it will send the message again or modify the corresponding order.

Table 8-17 Meaning of error code

Modbus abnormal code		
Code	**Name**	**Meaning**
01H	Illegal function	Receiving function codes from the upper devices is not allowable. This may because these function codes can only be applied to new devices or the slave device is dealing with this requirement in a wrong situation.
02H	Illegal digital address	For servo drives, the requirement digital address is not allowable; especially the mix of the register address and transmitting byte numbers is invalid.
03H	Illegal	The digital value received is beyond the range of address

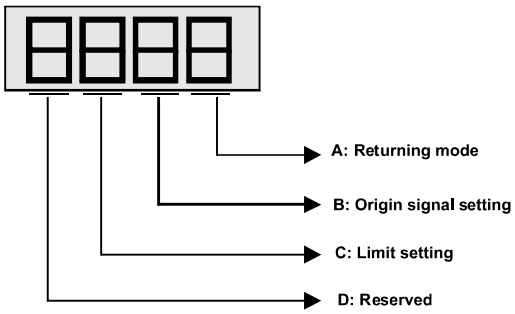
Modbus abnormal code		
Code	**Name**	**Meaning**
	digital value	parameters, leading the parameter modification invalid.
11H	Check error	In the frame message sent by the upper devices, if the CRC check bit of RTU format or the LRC check bit of ASCII format is different from the check number calculated by the below devise, an check error will be reported.

9 Point control

9.1Detailed instruction of the origin returning

The needed functions are set through the returning mode and then various returning methods can be found.

Parameters functions of P4.11:



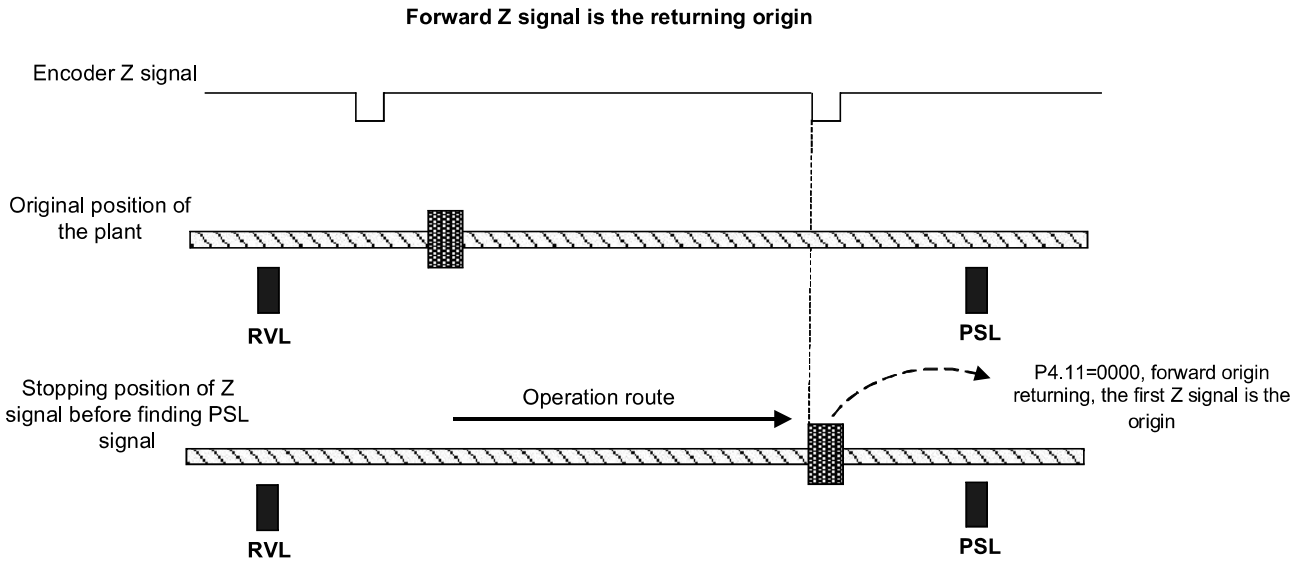
Setting definition:

A	B	C	D
Returning mode	Origin signal setting	Limit setting	Reserved
A=0: forward Z signal is the returning origin	Invalid	If there is limiting signal: C=0: display error C=1: direction reverse	-
A=1: reverse Z signal is the returning origin			
A=2: forward PSL signal is the returning origin	B=0: find Z signal from the previous B=1: not find Z signal B=2: not find Z signal	Invalid	
A=3: reverse RVL signal is the returning origin			
A=4: forward origin returning ORGP is the returning origin	B=0: find Z signal from the latter B=1: find Z signal from the previous B=2: not find Z signal	If there is limiting signal: C=0: display error C=1: direction reverse	
A=5: reverse origin returning ORGP is the returning			
6: the current position is	Invalid	Invalid	

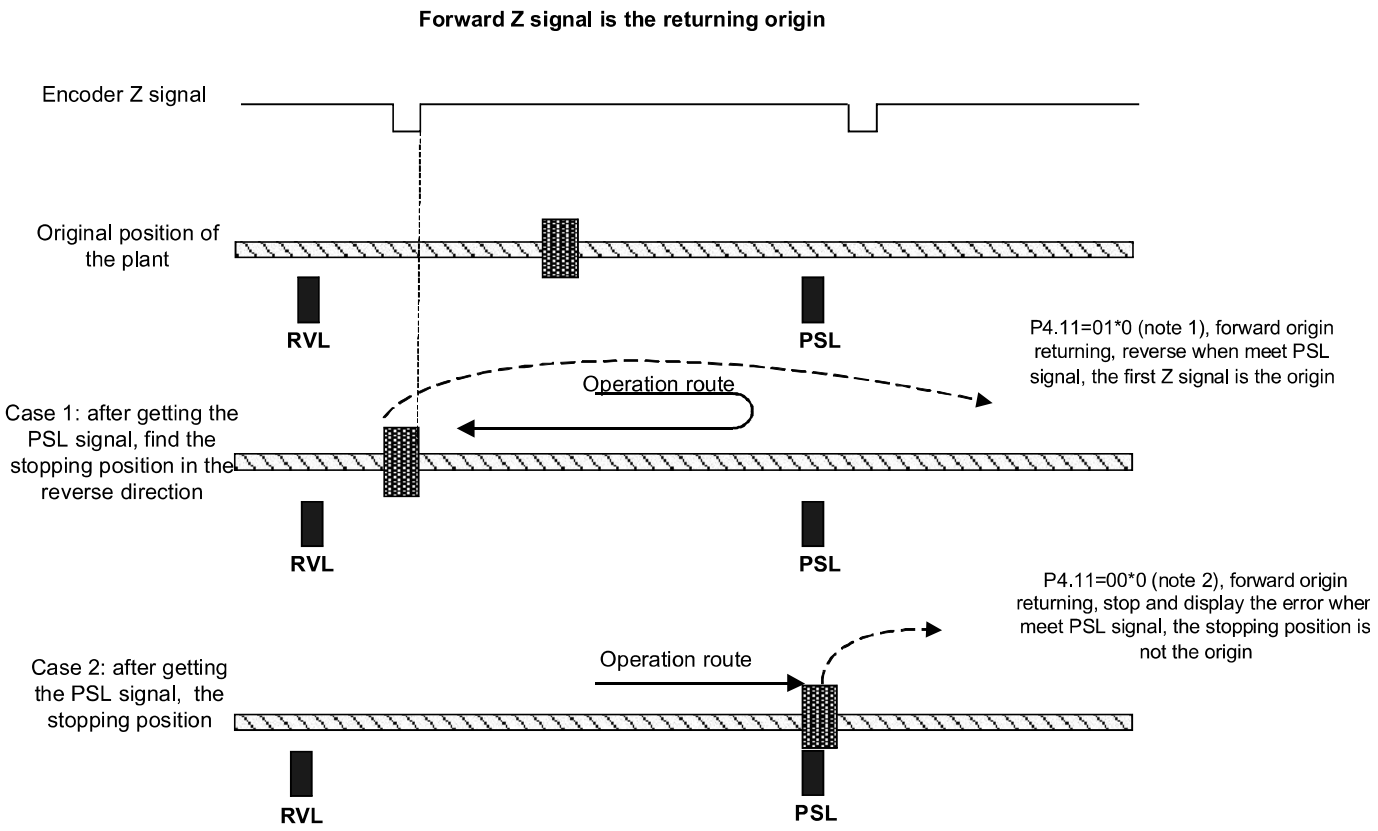
A	B	C	D
the origin			

9.1.1 Forward Z signal is the returning origin

1. Find Z signal before PSL signal:



2. Find Z signal after PSL signal:

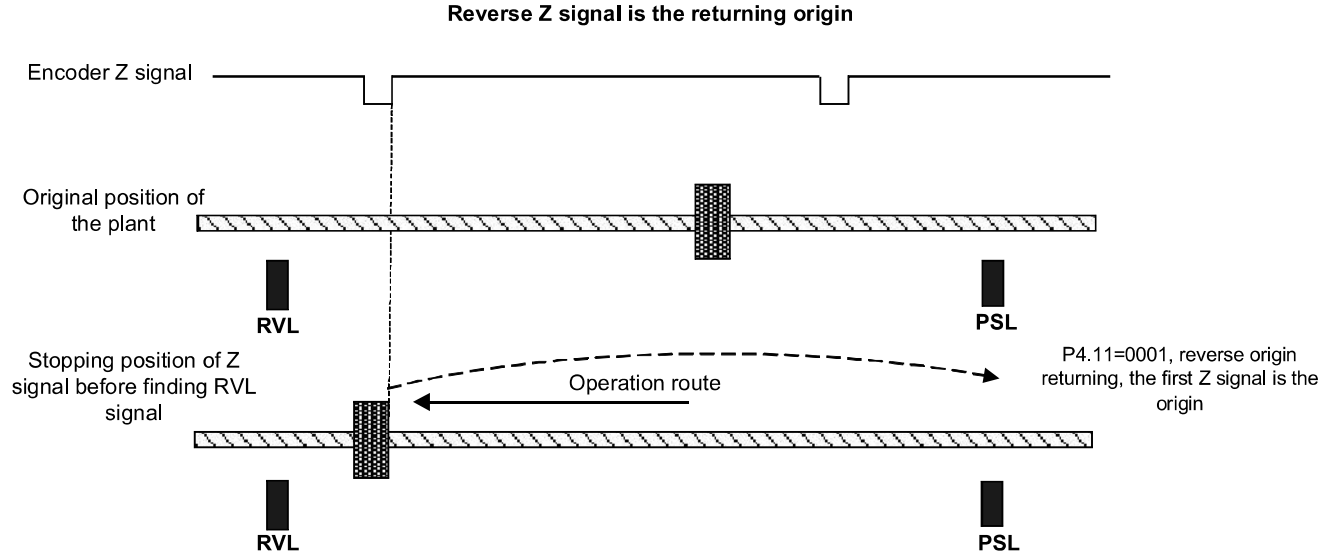


Note 1: "01*0" is 0100/0110/0120, * means it can be set as any value in the range. Please refer to P4.11

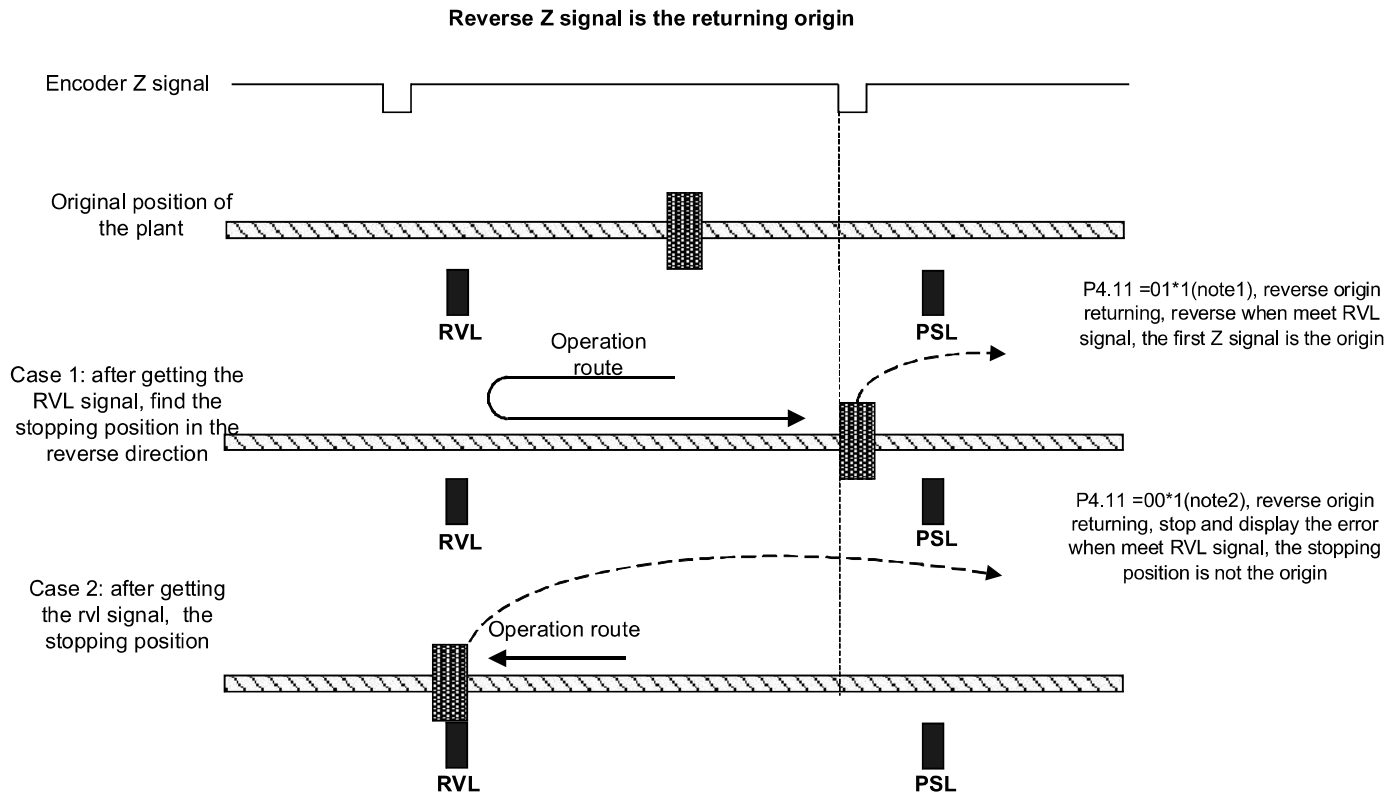
Note 2: "00*0" is 0000/0010/0020, * means it can be set as any value in the range. Please refer to P4.11

9.1.2 Reverse Z signal is the returning origin

1. Find Z signal before RVL signal:



2. Find RVL signal after PSL signal:

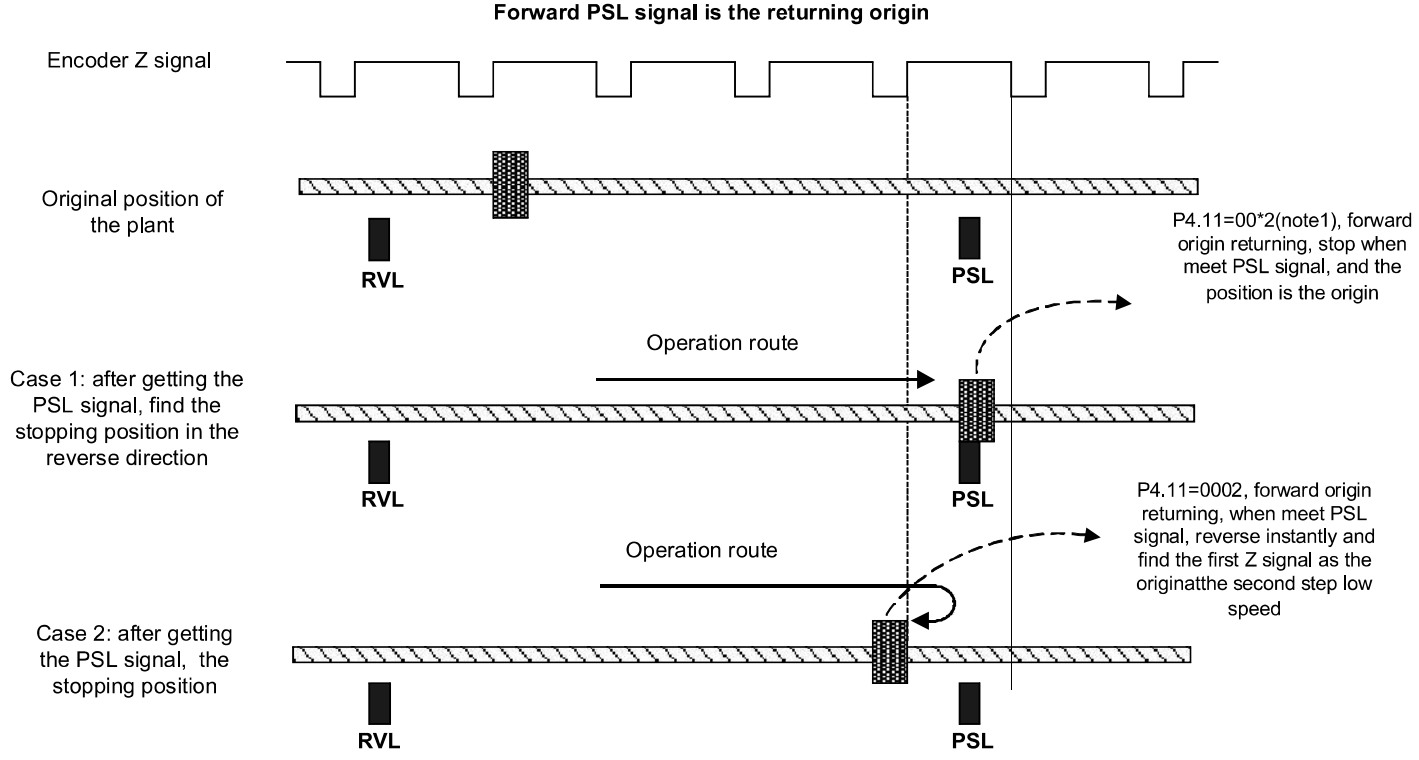


Note 1: “01*1” is 0101/0111/0121, * means it can be set as any value in the range. Please refer to P4.11

Note 2: “00*1” is 0001/0011/0021, * means it can be set as any value in the range. Please refer to P4.11

9.1.3 Forward PSL signal is the returning origin

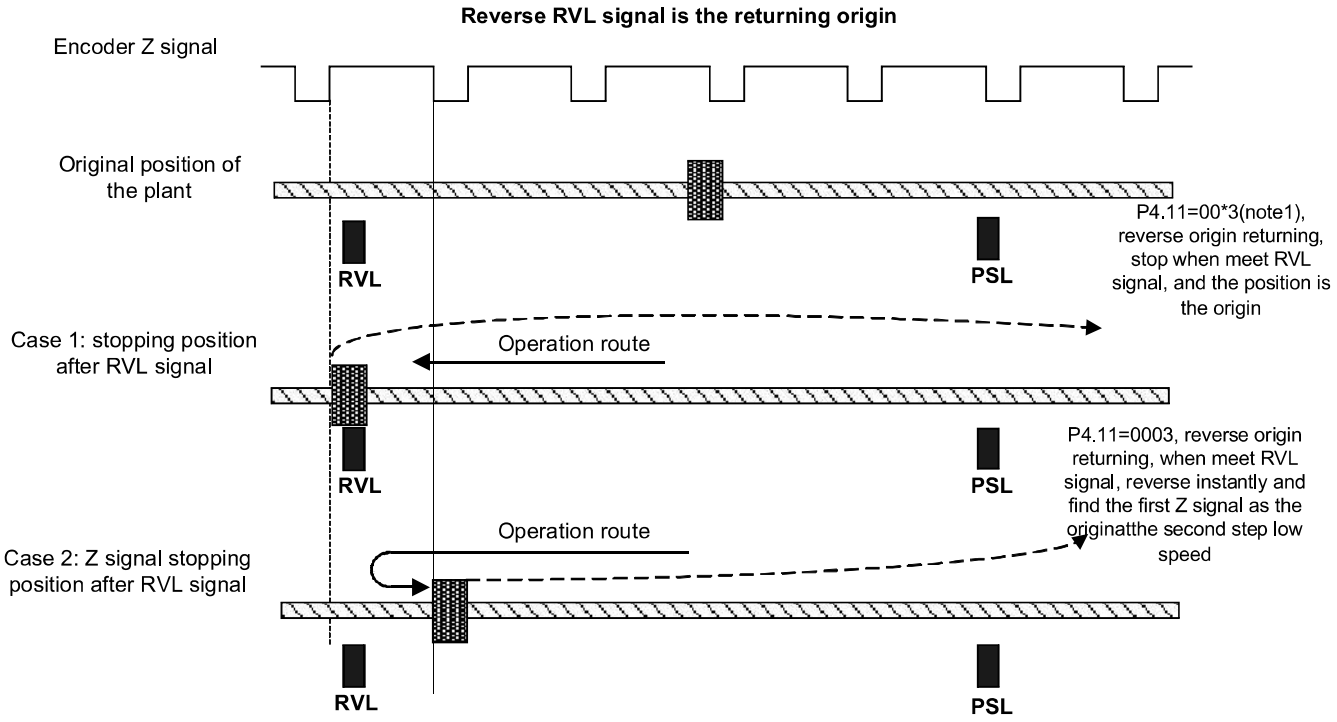
Get PSL signal:



Note 1: “00*2” is 0012/0022, * means it can be set as any value in the range. Please refer to P4.11

9.1.4 Reverse RVL signal is the returning origin

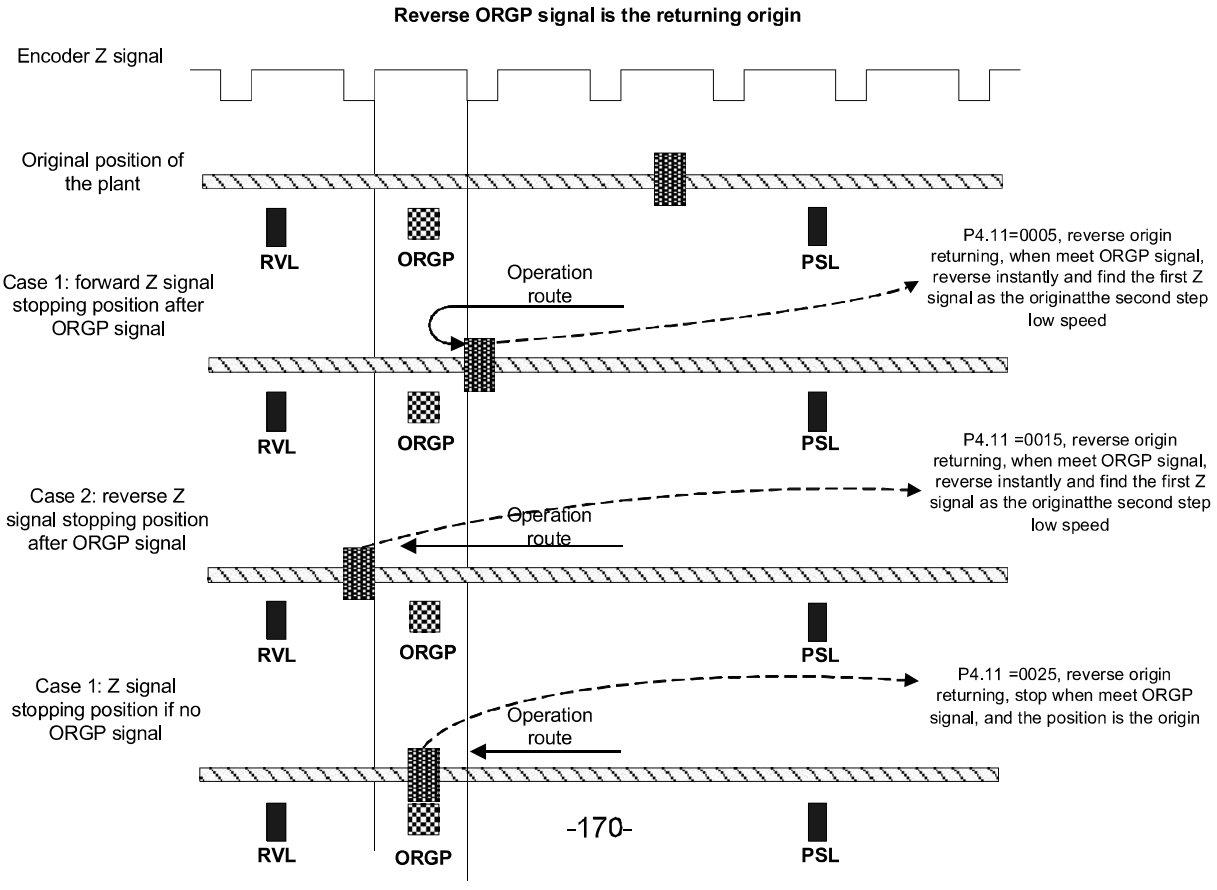
Get RVL signal:



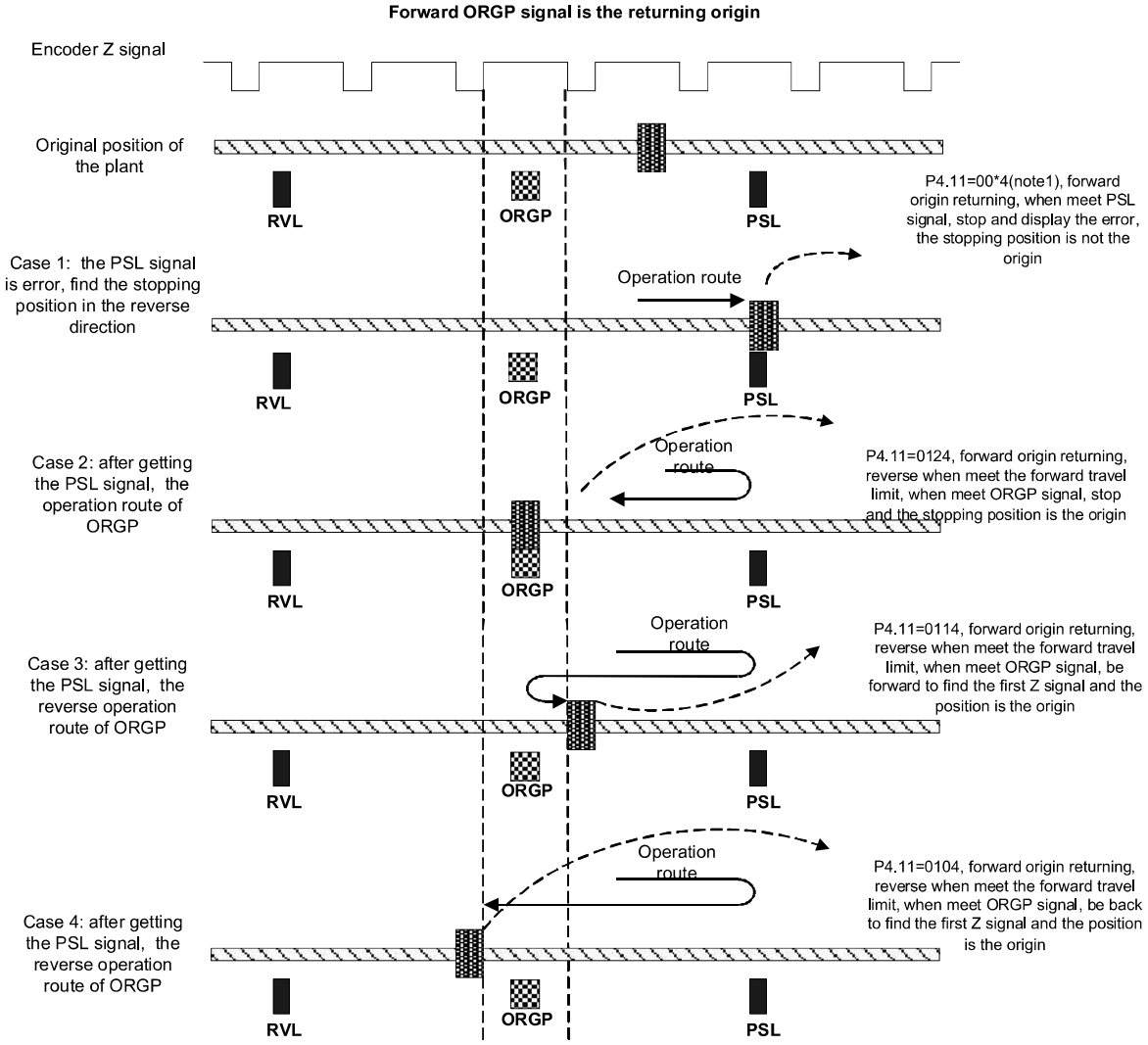
Note 2: "00*3" is 0013/0023, * means it can be set as any value in the range. Please refer to P4.11

9.1.5 Forward ORGP signal is the returning origin

1. Get ORGP signal:



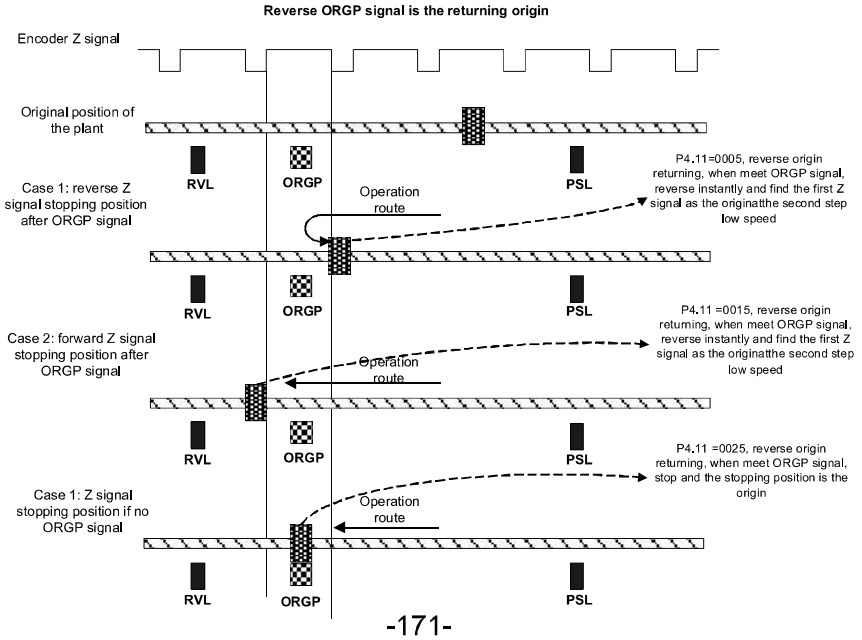
2. Get SRL signal:



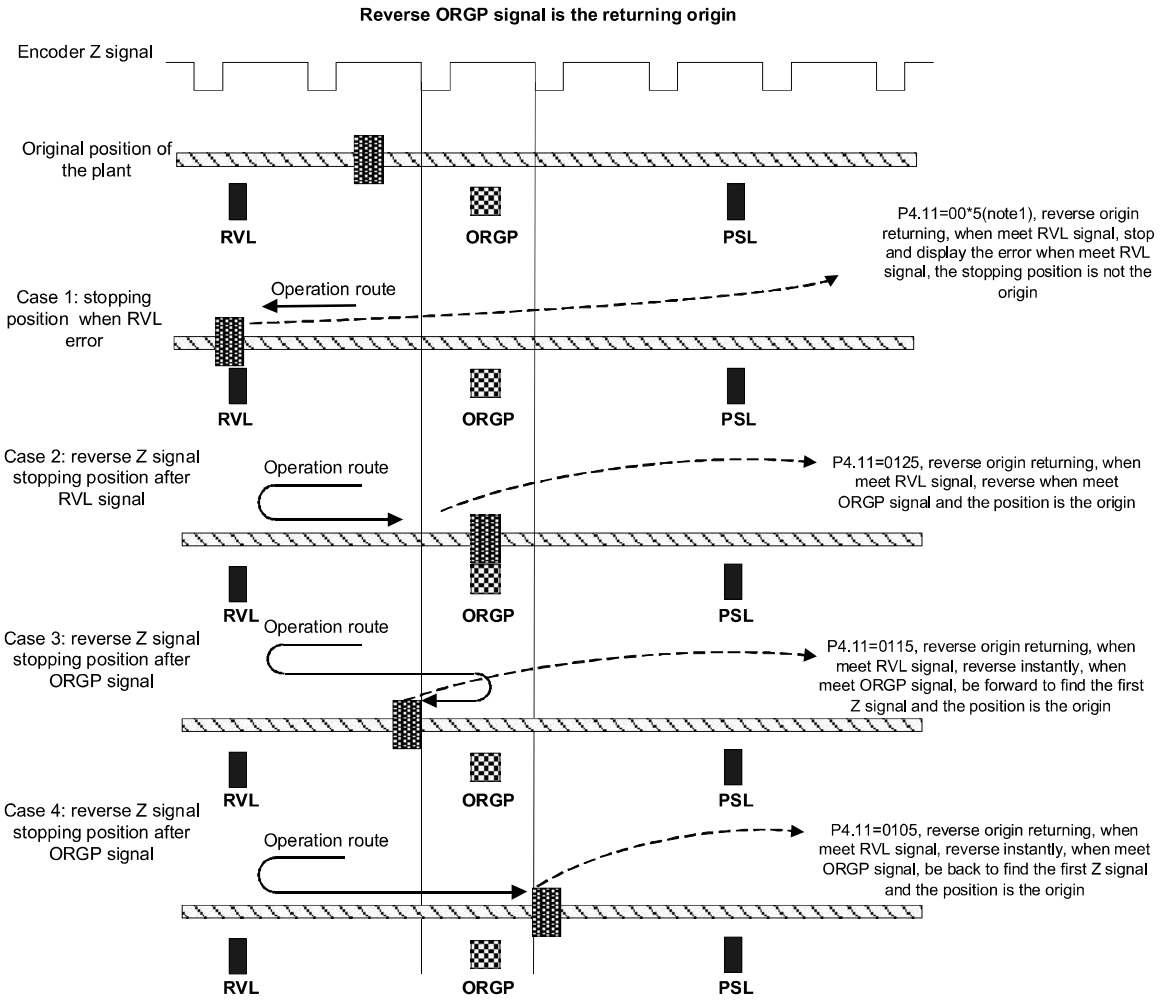
Note 1: "00*4" is 0004/0014/0024, * means it can be set as any value in the range. Please refer to P4.11

9.1.6 Reverse ORGP signal is the returning origin

1. Get EVL singal and the ORGP signal:



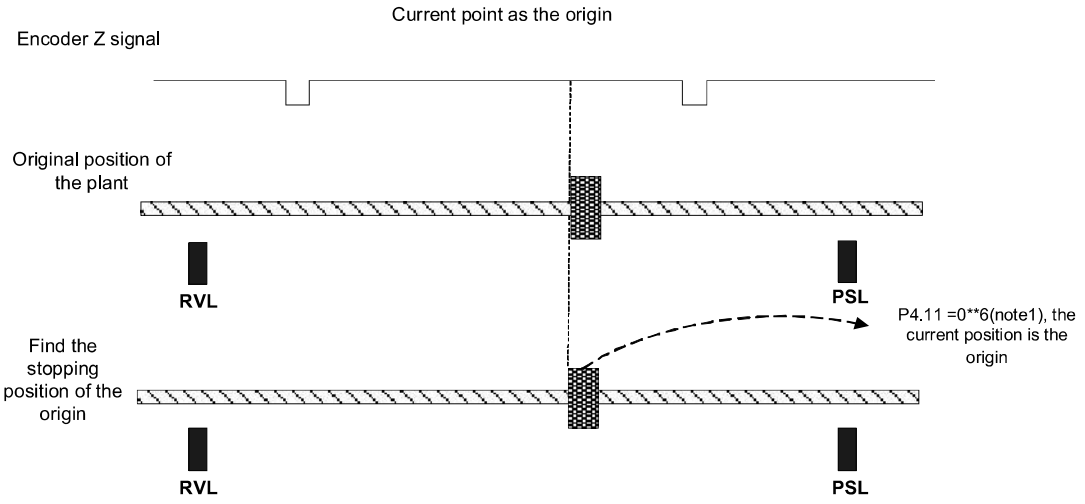
2. Get EVL singal but not the ORGP signal:



Note 2: “00*5” is 0005/0015/0025, * means it can be set as any value in the range. Please refer to P4.11

9.1.7 Current point as the origin

The current point is the origin:



Note 1: “0**6” is 0006/0016/0026/0106/0116/0126,*means it can be set as any value in the range. Please refer to P4.11.

9.2 Usage instruction

9.2.1Returning steps:

1) Connect the drive and the motor

2) Adjust P0.03 to"0" for the position contorl mode(repower)

3) Adjust P4.10 to "1" for the bit control (repower)

4) Set P4.11.

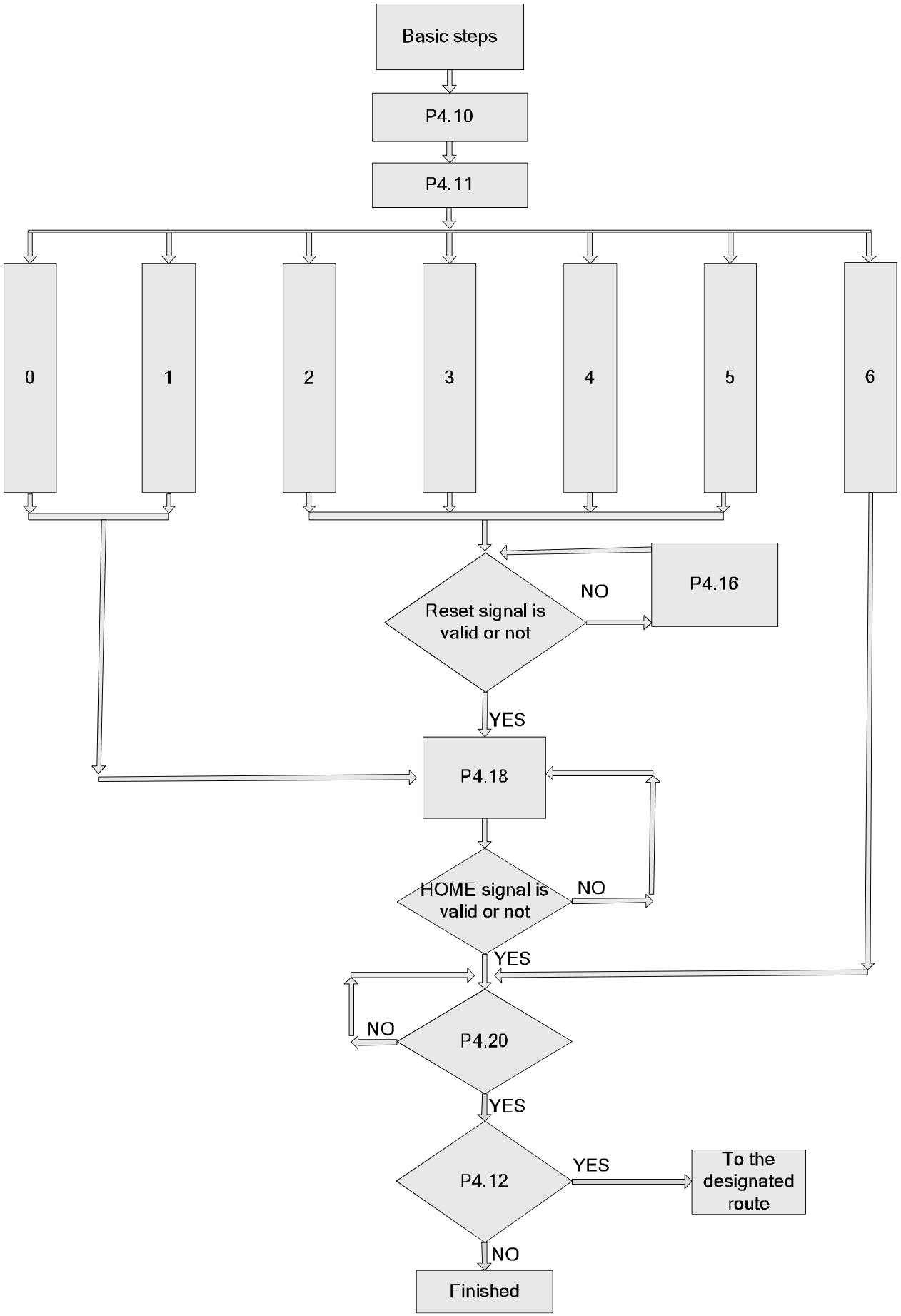
5) Set the origin returning definition, the origin position, the frist and second returning speed. Refer to P4.12~ P4.20

6) Please refer to P0.54~ P0.57 for the detailed information

7) Set the dgital input and output and refer to the "I/O port parameters"(P3.01~ P3.19)

8) Enable the signal and short connect the signal with COM-. After the trigger of SHOME, the drive begins to find the origin

9) If the signal changes from low electirc level to high level, the origin is found. If the signal is not valid and there is a emergency signal, the stopping position is not the position of origin. Refer to the detailed instruction for information


Basic steps
P4.10
P4.11
0
1
2
3
4
5
6
Reset signal is valid or not
NO
P4.16
YES
P4.18
HOME signal is valid or not
NO
YES
NO
P4.20
YES
P4.12
YES
To the designated route
NO
Finished

9.2.2 Steps:

Because the 2nd to 7th route are the same as the 1st one, now take the situation of 1st as the example.

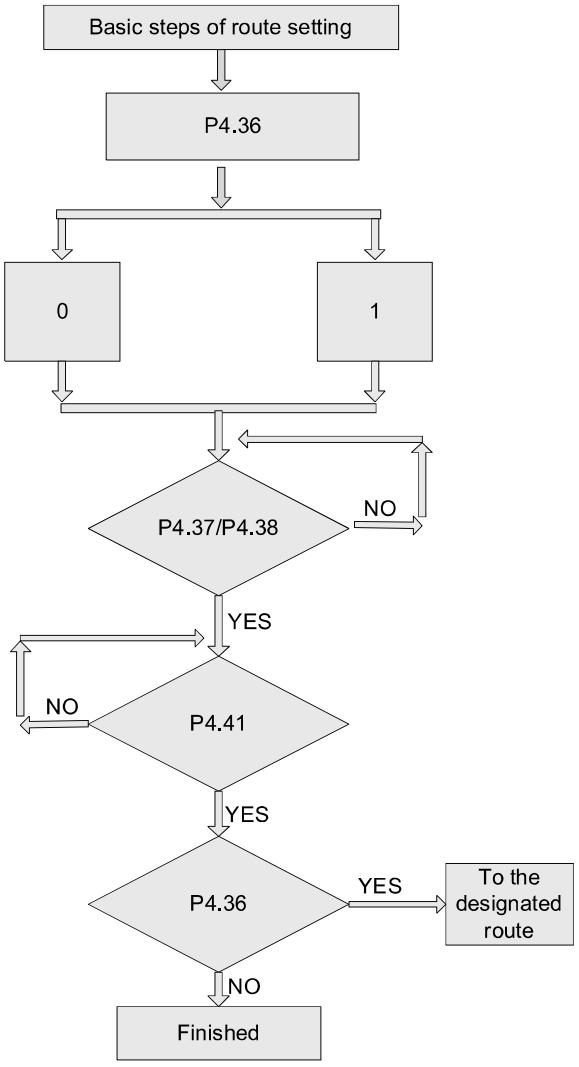
1.After finding the origin, slect the 1st route through P4.36. It is necessary to set the positioning mode is absolute or relative one.

2.Set the route position through P4.37/P4.38 and the operation direction is relative to the negative andpositive position.

3. Set the operation speed, ACC/DEC time and delay and so on. Refer to P4.39~P4.41.

4. In the route setting, the second and third position of P4.36 can be used to set the next operaiton. If the next route is set, after finishing, it will return to the designated route (0~7). If all the route setting is a cycle, the program will keep on working. Refer to P4.36.

Diagram:



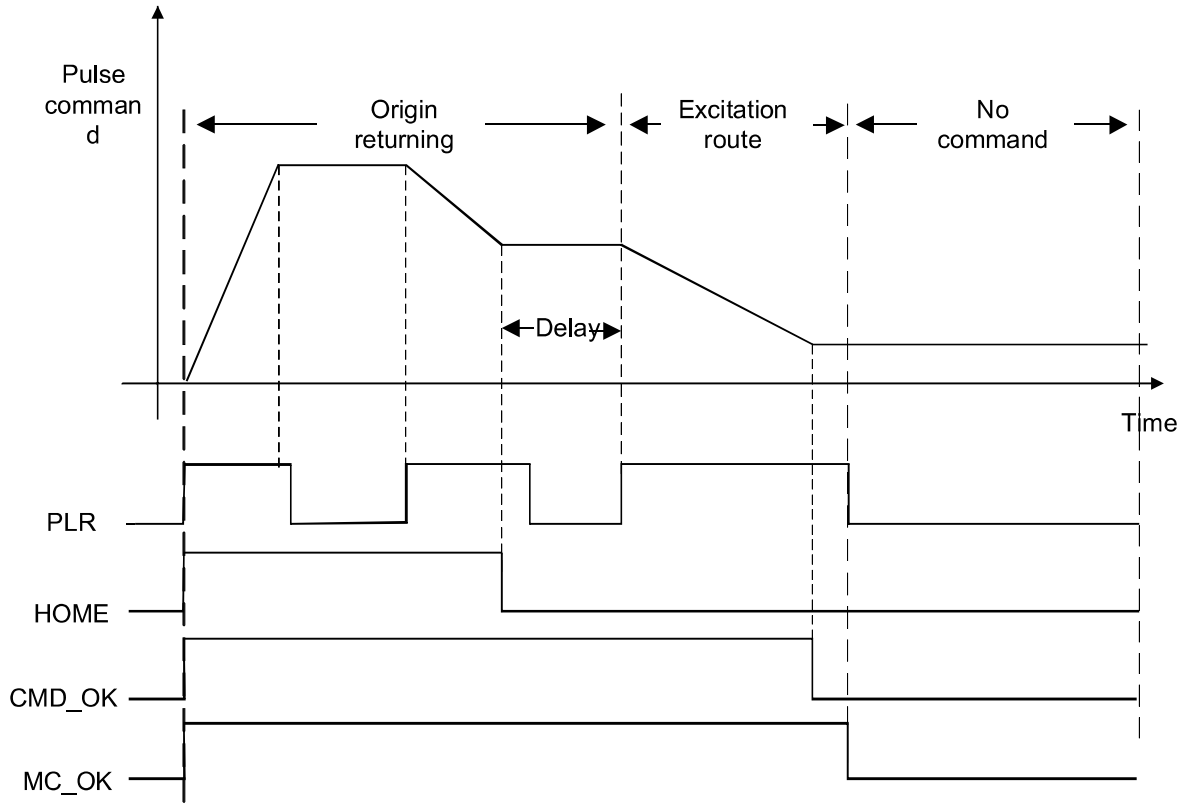
9.2.3 Route selection:

1. Set POS0~POS2 through the defined I/O port and CTRG is valid. Refer to the instruciton.

2. Set the route through POS0~POS2. Refer to the instruciton.

3. P4.21 can be used to set the route.

9.2.4 Output signal



PLR signal is the the delay time after pulse sending. And the load, speed and rigidity will affect the delay time.

HOME signal is only used in origin finding. After sending the pulse signal, the command will be the low electric level.

CMD _OK signal, after all commands are carried out, the signal output transistor conduction. The signal means the command is finished does not mean the motor positioning is finished.

MC _OK signal, after all commands are carried out, the signal output transistor conduction. The signal means the command is finished and the motor positioning is finished.

10 Fault processing

10.1 Meanings of the fault alarm codes and countermeasures

No.	Code	Name	Causes	Countermeasures
1	Er-EEP	EEPROM fault	1. EEPROM is damaged	1. Replace the drive
2	Er-Ec1	Encoder line break fault 1	1. The encoder is not connected 2. The encoder connector becomes loose 3. The line of one of the U, V, W phases of the encoder signal cable is broken	1. Connect the encoder 2. Check the encoder connector or replace the encoder cable 3. Replace the encoder cable
3	Er-Ec2	Encoder fault 2	1. Reversed A/B phase of the encoder 2. The line of one of the A, B, Z phases of the encoder signal cable is broken	1. Check that the phases of the encoder are wired correctly 2. Replace the encode cable
4	Er-iTE	Current test fault	1. The current sensor or test circuit is abnormal 2. Powered on when the motor shaft is in a non-stationary state	1. Replace the drive 2. Never power on when the motor shaft is rotating
5	Er-oc1	Hardware overcurrent fault	1. U, V, W phases of the motor are connected reversely 2. Inappropriate parameters cause system divergence 3. Too short ACC/DEC time during starting/stopping 4. Too large instant load	1. Check that the phases of the motor cable are connected correctly 2. Adjust the loop parameters to stabilize the system. Adjust the value of P0.12 smaller 3. Set the ACC/DEC time appropriately longer 4. Replace with a drive of higher power

No.	Code	Name	Causes	Countermeasures
6	Er-oc2	Line-to-ground short circuit fault	1. One of U, V, W phases of the motor cable is shorted to the ground	Replace the motor cable or test if the motor insulation is aged
7	Er-ou	Overvoltage fault	1. The grid voltage is high 2. The braking resistor is not connected 3. The braking transistor is damaged 4. Too short ACC/DEC time during starting/stopping	1. Test the input voltage of the grid 2. Check if the built-in braking resistor shorting wiring becomes loose, or check if the built-in braking resistor is damaged 3. Replace the drive 4. Set the ACC/DEC time longer
8	Er-uu	Undervoltage fault of the main bus	1. The grid voltage is low 2. The powering-up snubber relay has not picked up	1. Test the input voltage of the grid 2. Replace the drive
9	Er-uu1	Undervoltage fault of the control bus	1. The grid voltage is low 2. The powering-up snubber relay has not picked up	1. Test the input voltage of the grid 2. Replace the drive
10	Er-oL	Overload fault	1. Run overload for a long period of time 2. The load is too heavy in a short period of time	1. Replace with the drive and motor of higher power 2. Replace with the drive and motor of higher power
11	Er-LnE	Line abnormality fault	1. U, V, W phases of the motor are connected reversely	1. Check that the phases of the motor cable are connected correctly
12	Er-oS	Overspeed fault	1. The motor speed is too high 2. Overspeed of the motor.	1. Replace with a motor of higher speed or check the parameter settings

No.	Code	Name	Causes	Countermeasures
			U, V, W phases of the motor are connected reversely	2. Check that the phases of the motor cable are connected correctly
13	Er-oH1	Drive overtemperature fault	1. The temperature of the IGBT module of the drive is too high	1. Improve the ventilation or replace with a servo drive of higher power
14	Er-oE	Over-pulse fault	1. Number of the retention pulses is too large 2.The motor load is too heavy	1. Set the gain parameters of the position loop higher or set the position feed-forward gain higher 2. Check the conveyor belt or the operation plant is not wide or there is a barrier.
15	Er-cTE	Communication fault	1. Too high communication fault rate 2. Communication disconnecting	1. Try to decrease the communication interference 2. Check the connection of the communication cable
16	Er-oT	Write/read overtime fault	1. Overtime when reading/writing EEPROM 2. Damaged EEPROM	1. Replace the drive 2. Replace the drive
17	Er-bcE	Brake overload fault	1. The power of the built-in braking resistor is relatively low 2. The power of the external braking resistor is relatively low	1. Connect an external braking resistor of higher power 2. Replace with a braking resistor of higher power
18	Er-iPo	IPM module fault	1. IPM module detects out overcurrent or undercurrent	1. Adjust P0.12 smaller to decrease the maximum output torque

No.	Code	Name	Causes	Countermeasures
				or replace with a drive of higher power
19	Er-dP	Power supply input phase loss	3-phase input power supply is phase loss or seriously uneven.	Check the input voltage or the wire is loose or disconnected.
20	Er-INE	Inertia identification fault	1.Vibration in stopping exceeds 3.5s 2. Too short ACC time 3. The identification speed is below 150r/min	1.Improve the mechanical rigidity 2.Prolong P1.07 3.Increase P1.06
21	Er-DrE	Motor parameters matching fault	Wrong P0.00 setting	Ensure the motor model and the drive model

10.2 Meanings of the warning codes

No.	Warning	Name	Description
1	AL-LT1	Forward travel limit warning	This warning signal is generated when forward travel is limited (PSL terminal disconnects)
2	AL-LT2	Reverse travel limit warning	This warning signal is generated when reverse travel is limited (RVL terminal disconnects)
3	AL-EST	Emergency stop warning	This warning signal is generated when the emergency stop button acts (EMG terminal disconnects)
4	AL-Pof	Low voltage of the main circuit warning	This warning signal is generated when the bus voltage is too low.
5	AL-cTE	Communication abnormality warning	In the case of communication overtime or abnormal, if P4.07=1, this warning signal is generated.

See chapter 5.2.6 for the detailed method to clear the alarm or warning display when a fault alarm or warning occurs.

Appendix A List of function parameters

P – position mode; S – speed mode; T – torque mode.

The function codes with the superscript of "1" indicate that these parameters can be valid only when the system is reset and restarted or repowered after disconnection.

The function codes with the superscript of "2" indicate that these parameters are valid when the servo drive stops. The modification during operation is invalid. The function codes with the superscript of "*" indicate that these parameters are not saved after power off.

Function code	Name	Unit	Range	Default	Mode
P0 Basic control					
P0.00[1]	Matching motor selection	-	0~9999	-	PST
P0.03[1]	Mode selection	-	0~6	0	PST
P0.04*	Internal servo enabling	-	0~1	0	PST
P0.05	Jog speed	r/min	0.0~1000.0	200.0	PST
P0.06[2]	Numerator of the frequency division coefficient of encoder pulse output	-	0~30000	10000	PST
P0.07[2]	Denominator of the frequency division coefficient of encoder pulse output	-	0~30000	0	PST
P0.08[1]	Output logic reverse	-	0~1	1	PST
P0.11	Max. torque limit	%	0.0~300.0	300.0	PST
P0.12	Internal torque limit	%	0.0~300.0	-	PS
P0.13	Power of the external braking resistor	W	0~1500	0	PST
P0.14	Resistance of the external braking resistor	Ω	1~100	1	PST
P0.15[1]	Default monitoring parameters	-	0~45	0	PST
P0.16	Parameter modification operation locking	-	0~1	0	PST

Function code	Name	Unit	Range	Default	Mode
P0.17	Communication EEPROM write selection	-	0~1	0	PST
P0.23[1]	Pulse input	-	0~2	0	P
P0.24[1]	Pulse input direction reversing	-	0~1	0	P
P0.25	Numerator of the 1st electronic gear	-	1~65535	1	P
P0.26	Denominator of the 1st electronic gear	-	1~65535	1	P
P0.27	Numerator of the 2nd electronic gear	-	1~65535	1	P
P0.28	Numerator of the 3rd electronic gear	-	1~65535	1	P
P0.29	Numerator of the 4th electronic gear	-	1~65535	1	P
P0.30	Denominator of the 2nd electronic gear	-	1~65535	1	P
P0.31	Denominator of the 3rd electronic gear	-	1~65535	1	P
P0.32	Denominator of the 4th electronic gear	-	1~65535	1	P
P0.33	Position command filter time	ms	0.0~1000.0	0.0	P
P0.40	Speed command/speed limit selection	-	0~1	0	ST
P0.42	Speed command input gain	(r/min)/v	10~1000	500	ST
P0.44	Speed command filter time	ms	0.0~1000.0	0.0	S
P0.45	Dead zone of analog VA	V	0.000~2.000	0.000	ST
P0.46	Internal speed/speed limit 1	r/min	-6000.0~6000.0	100.0	ST
P0.47	Internal speed/speed limit 2	r/min	-6000.0~6000.0	200.0	ST
P0.48	Internal	r/min	-6000.0~6000.0	500.0	ST

Function code	Name	Unit	Range	Default	Mode
	speed/speed limit 3				
P0.49	Internal speed/speed limit 4	r/min	-6000.0~6000.0	1000.0	ST
P0.54	ACC time	ms	0~20000	0	S
P0.55	DEC time	ms	0~20000	0	S
P0.56	S curve ACC time	ms	0~1000	0	S
P0.57	S curve DEC time	ms	0~1000	0	S
P0.58	Stopping method	-	0~1	0	S
P0.60	Torque command/torque limit selection	-	0~1	0	PST
P0.61	Torque command direction selection	0~1	0	--	T
P0.62	Torque command input gain	%/V	10~300	10	PST
P0.64	Torque command filter time	ms	0.0~1000.0	0.0	T
P0.65	Dead zone of analog TA	V	0.000~2.000	0.000	PST
P0.66	Internal torque command	%	-250.0~250.0	10.0	T
P1 Autoturning control					
P1.00	Online inertia identification switch	-	0~1	0	PST
P1.01	Speed of online inertia identification release	-	0~3	1	PST
P1.02	Rotational inertia ratio	%	0~10000	200	PST
P1.03	Machine rigidity setting	-	0~31	13	PST
P1.04	Inertia identification switch	-	0~1	0	P
P1.05	Inertia identification operation	-	0~3	0	P
P1.06	Mechanical movement	r	0.5~10.0	1.5	P
P1.07	Identification of	ms	2~200	2	P

Function code	Name	Unit	Range	Default	Mode
	inertia acceleration time constan				
P1.08	For factory	--	0~3	-	PST
P1.09	Reserved	--	-	-	PST
P1.19	Valid bit of resonance detection	%	1.0~100.0	5.0	PST
P1.20	Resonance test mode	-	0~4	0	PST
P1.21	1st mechanical resonance frequency	Hz	0.0~3000.0	0.0	PST
P1.22	2nd mechanical resonance frequency	Hz	0.0~3000.0	0.0	PST
P1.23	1st trap wave center frequency	Hz	50.0~3000.0	3000.0	PST
P1.24	1st trap wave width	Hz	1.0~1000.0	50.0	PST
P1.25	1st trap wave depth	%	0.00~1.00	0.00	PST
P1.26	2nd trap wave center frequency	Hz	50.0~3000.0	3000.0	PST
P1.27	2nd trap wave width	Hz	1.0~1000.0	50.0	PST
P1.28	2nd trap wave depth	%	0.00~1.00	0.00	PST
P1.29	3rd trap wave center frequency	Hz	50.0~3000.0	3000.0	PST
P1.30	3rd trap wave width	Hz	1.0~1000.0	50.0	PST
P1.31	3rd trap wave depth	%	0.00~1.00	0.00	PST
P1.32	4th trap wave center frequency	Hz	50.0~3000.0	3000.0	PST
P1.33	4th trap wave width	Hz	1.0~1000.0	50.0	PST
P1.34	4th trap wave depth	%	0.00~1.00	0.00	PST
P1.35	Vibration control selection	-	0~2	0	P
P1.36	The 1st vibration control frequency	Hz	0.0~200.0	0.0	P
P1.37	The 1st vibration control factor	-	0.00~1.00	1.00	P
P1.38	The 2nd vibration control frequency	Hz	0.0~200.0	0.0	P
P1.39	The 2nd vibration control factor	-	0.00~1.00	1.00	P

Function code	Name	Unit	Range	Default	Mode
P1.40	Reserved	-	-	-	-
P1.41	Reserved	-	-	-	-
P1.42	Reserved	-	-	-	-
P1.43	Reserved	-	-	-	-
P1.44	Reserved	-	-	-	-
P1.45	Reserved	-	-	-	-
P2 Motor control					
P2.00	1st speed gain	Hz	0.1~3000.0	27.0	PST
P2.01	1st speed integration time constant	ms	0.1~1000.0	21.0	PST
P2.02	1st position gain	1/s	0.1~3000.0	48.0	P
P2.03	1st speed detection filter time	ms	0.00~100.00	0.00	PST
P2.04	1st torque filter	ms	0.00~25.00	0.84	PST
P2.05	2nd speed gain	Hz	0.1~3000.0	27.0	PST
P2.06	2nd speed integration time constant	ms	0.1~1000.0	1000.0	PST
P2.07	2nd position gain	1/s	0.1~3000.0	57.0	P
P2.08	2nd speed detection filter time	ms	0.00~100.00	0.00	PST
P2.09	2nd torque filter	ms	0.00~25.00	0.84	PST
P2.10	Speed feed-forward	%	0.0~100.0	30.0	P
P2.11	Speed feed-forward filter time	ms	0.00~60.00	0.50	P
P2.12	Reserved				PST
P2.21	Gain switching selection	-	0~1	1	PST
P2.22	Gain switching condition	-	0~5	0	PST
P2.23	Gain switching time constant	ms	0~100	0	PST
P2.25	Gain switching threshold	Pulse or r/min	0~5000/0~500.0	100/10.0	PST
P2.40	The speed observer switch	-	0~2	0	PST
P2.41[2]	The speed observer gain	Hz	0~500	100	PST
P2.42[2]	Phase comparator	%	0~1000	100	PST

Function code	Name	Unit	Range	Default	Mode
	gain				
P2.43	Time constant of torque filtering	0.01ms	0~65535	20	PST
P2.47	Compensation tuning switch of slot effect	-	0~1	0	PST
P2.48	Compensation gain of slot effect	%	0.0~100.0	0.0	PST
P3 I/O management					
P3.00	Digital 1 input	-	0~11111	0	PST
P3.01	Definition 1 of digital input port	-	0~31	0	PST
P3.02	Definition 2 of digital input port	-	0~31	1	PST
P3.03	Definition 3 of digital input port	-	0~31	2	PST
P3.04	Definition 4 of digital input port	-	0~31	3	PST
P3.05	Definition 5 of digital input port	-	0~31	4	PST
P3.06	Definition 6 of digital input port	-	0~31	5	PST
P3.07	Definition 7 of digital input port	-	0~31	6	PST
P3.08	Definition 8 of digital input port	-	0~31	7	PST
P3.09	Definition 9 of digital input port	-	0~31	8	PST
P3.10	Definition 10 of digital input port	-	0~31	9	PST
P3.11	Definition 11 of digital input port	-	0~31	10	PST
P3.12	Definition 12 of digital input port	-	0~31	11	PST
P3.13	Definition 13 of digital input port	-	0~31	12	PST
P3.14	Definition 1 of digital output port	-	0~15	0	PST
P3.15	Definition 2 of digital	-	0~15	1	PST

Function code	Name	Unit	Range	Default	Mode
	output port				
P3.16	Definition 3 of digital output port	-	0~15	2	PST
P3.17	Definition 4 of digital output port	-	0~15	3	PST
P3.18	Definition 5 of digital output port	-	0~15	4	PST
P3.19	Definition 6 of digital output port	-	0~15	5	PST
P3.20	Offset of AI VA	V	-2.000~2.000	0.000	ST
P3.23	Offset of AI TA	V	-2.000~2.000	0.000	PST
P3.30	AO 1 selection	-	0~7	0	PST
P3.31	Voltage gain of analog output 1	-	0~1000	500	PST
P3.32	AO 2 selection	-	0~7	0	PST
P3.33	Voltage gain of analog output 2	-	0~1000	500	PST
P3.34	Offset of AO1	V	-2.00~2.00	0.00	PST
P3.35	Offset of AO 2	V	-2.00~2.00	0.00	PST
P3.40	Travel limit switch masking	-	0~1	0	PST
P3.41	E-stop masking	-	0~1	0	PST
P3.50	Range of position reaching	pulse	0~20000	100	P
P3.54	Range of speed reaching	r/min	0.0~1000.0	30.0	S
P3.55	Zero speed range	r/min	0.0~1000.0	50.0	PST
P3.56	Locked time of servo after braking	ms	100~5000	100	PST
P3.57	Braking delay time of the electromagnetic brake	ms	0~5000	1000	PST
P4 Extension and application					
P4.00[1]	Communication mode	-	0~1	1	PST
P4.01	Local communication address	-	0~31	1	PST
P4.02[1]	Communication	-	0~4	0	PST

Function code	Name	Unit	Range	Default	Mode
	baudrate selection				
P4.04	Communication parity mode	-	0~17	0	PST
P4.05	Communication response delay time	ms	0~200	0	PST
P4.06	Communication overtime fault time	s	0.0~60.0	0.0	PST
P4.07	Communication fault processing method	-	0~1	0	PST
P4.08	Communication response enabling	-	0~1	1	PST
P4.09	Reserved	-	-	-	PST
P4.10[1]	Position control mode	-	0~2	0	P
P4.11	Origin returning	-	0000~0126	0000	P
P4.12	Origin returning definition	-	0000~0017	0000	P
P4.13	High 16 bit of the origin definition	-	-32767~32767	0	P
P4.14	Low 16 bit of the origin definition	-	-9999~9999	0	P
P4.15	Reserved	-	-	-	-
P4.16	High returning speed	r/min	1~2000	100	P
P4.17	Reserved	-	-	-	-
P4.18	Low returning speed	r/min	1~500-	20	P
P4.19	Reserved	-	-	-	-
P4.20	Delay after returning	ms	0~60000	1000	P
P4.21	Command route	-	0000~0007	0000	P
P4.22	Route trigger selection	-	0~1	0	P
P4.23	Reserved	-	-	-	-
P4.24	Congifuration 2 of digital input	-	00000~1111	00000	P
P4.25	Reserved	-	-	-	-
P4.26	Reserved	-	-	-	-
P4.27	Reserved	-	-	-	-
P4.28	Reserved	-	-	-	-
P4.29	Reserved	-	-	-	-

Function code	Name	Unit	Range	Default	Mode
P4.30	Stopping mode selection	-	0~4	3	PST
P4.31	Max. speed limit	r/min	0~6500.0	-	PST
P4.32	Overspeed level	r/min	0~6553.5	-	PST
P4.33	Pulse range for over position	10pulse	0~50000	2000	P
P4.34	Brake overload detection enabling signal	-	0~1	1	PST
P4.35	Reserved		0~1	0	PST
P4.36	1st route definition	-	0000-0117	0	P
P4.37	High bit of 1st route	pulse	-32767~32767	0	P
P4.38	Low bit of 1st route	pulse	-9999~9999	2000	P
P4.39	ACC/DEC time of 1st route	ms	0~60000	200	P
P4.40	Operation speed of 1st route	r/min	1~6000	100	P
P4.41	Delay of 1st route	ms	0~60000	100	P
P4.42	2nd route definition	-	0000-0117	0000	P
P4.43	High bit of 2nd route	pulse	-32767~32767	0	P
P4.44	Low bit of 2nd route	pulse	-9999~9999	2000	P
P4.45	ACC/DEC time of 2nd route	ms	0~60000	200	P
P4.46	Operation speed of 2nd route	r/min	1~6000	100	P
P4.47	Delay of 2nd route	ms	0~60000	100	P
P4.48	3rd route definition	-	0000-0117	0000	P
P4.49	High bit of 3rd route	pulse	-32767~32767	0	P
P4.50	Low bit of 3rd route	pulse	-9999~9999	2000	P
P4.51	ACC/DEC time of 3rd route	ms	0~60000	200	P
P4.52	Operation speed of 3rd route	r/min	1~6000	100	P
P4.53	Delay of 3rd route	ms	0~60000	100	P
P4.54	4th route definition	-	0000-0117	0000	P
P4.55	High bit of 4th route	pulse	-32767~32767	0	P
P4.56	Low bit of 4th route	pulse	-9999~9999	2000	P
P4.57	ACC/DEC time of 4th	ms	0~60000	200	P

Function code	Name	Unit	Range	Default	Mode
	route				
P4.58	Operation speed of 4th route	r/min	1~6000	100	P
P4.59	Delay of 4th route	ms	0~60000	100	P
P4.60	5th route definition	-	0000-0117	0000	P
P4.61	High bit of 5th route	pulse	-32767~32767	0	P
P4.62	Low bit of 5th route	pulse	-9999~9999	2000	P
P4.63	ACC/DEC time of 5th route	ms	0~60000	200	P
P4.64	Operation speed of 5th route	r/min	1~6000	100	P
P4.65	Delay of 5th route	ms	0~60000	100	P
P4.66	6th route definition	-	0000-0117	0000	P
P4.67	High bit of 6th route	pulse	-32767~32767	0	P
P4.68	Low bit of 6th route	pulse	-9999~9999	2000	P
P4.69	ACC/DEC time of 6th route	ms	0~60000	200	P
P4.70	Operation speed of 6th route	r/min	1~6000	100	P
P4.71	Delay of 6th route	-	0000-0117	0000	P
P4.72	7th route definition	-	0000-0117	0000	P
P4.73	Delay of 3rd route	pulse	-32767~32767	0	P
P4.74	Delay of 4th route	pulse	-9999~9999	2000	P
P4.75	ACC/DEC time of 7th route	ms	0~60000	200	P
P4.76	Operation speed of 7th route	r/min	1~6000	100	P
P4.77	Delay of 7th route	ms	0~60000	100	P
P4.78	Analog position gain	pulse/0.1 V	0~60000	100	P
P9 Factory parameters					
P9.00[2]	Factory password	-	0~65535	00000	PST

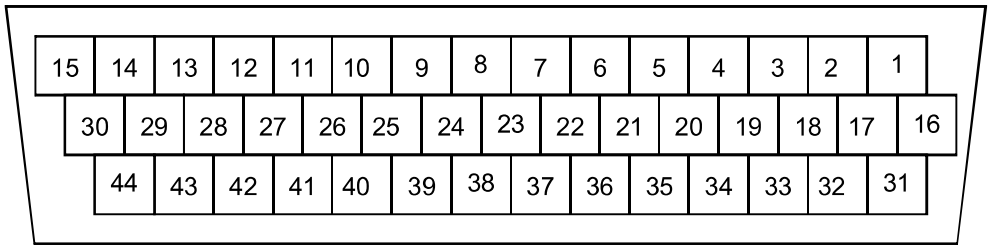
Function code	Name	Unit	Accuracy
r005Pd	Motor speed	r/min	0.1
r01FP1	Lower 5 digits of feedback pulse accumulation	pulse	1

Function code	Name	Unit	Accuracy
r02.FP2	Medium 5 digits of feedback pulse accumulation	pulse	1
r03.FP3	Higher 5 digits of feedback pulse accumulation	pulse	1
r04.rP1	Lower 5 digits of command pulse accumulation	pulse	1
r05.rP2	Medium 5 digits of command pulse accumulation	pulse	1
r06.rP3	Higher 5 digits of command pulse accumulation	pulse	1
r07.EP	Retention pulse	pulse	1
r08.An1	Analog speed command voltage	V	0.001
r09.An2	Analog torque command voltage	V	0.001
r10.ud1	Main circuit power bus voltage	V	0.1
r11.ud2	Control circuit power bus voltage	V	0.1
r12.cur	Effective value of current output current	A	0.01
r13.rG	Current torque	%	0.1
r14.Tn	Drive module temperature	℃	0.1
r15.Ld	Average load rate	%	1
r16.PoS	Position of the rotor relative to Z pulse	pulse	1
r17.inE	Inertia ratio of load	%	1
r18.oAL	The two previous fault alarm code	-	-
r19.AL	The previous fault alarm code	-	-
r20.ALc	Current fault alarm code	-	-
r21.in	Digital input state	-	-
r22.ou	Digital output state	-	-
r23.rT	Motor temperature	℃	0.1
r24.uE1	DSP software version	-	0.01
r25.uE2	FPGA software version	-	0.01
r26.uuu	Encoder UVW feedback value	-	-
r27.iA	Instantaneous value of phase U output current	A	0.01
r28.ib	Instantaneous value of phase V output current	A	0.01
r29.iAF	Instantaneous value of U phase output current	A	0.01

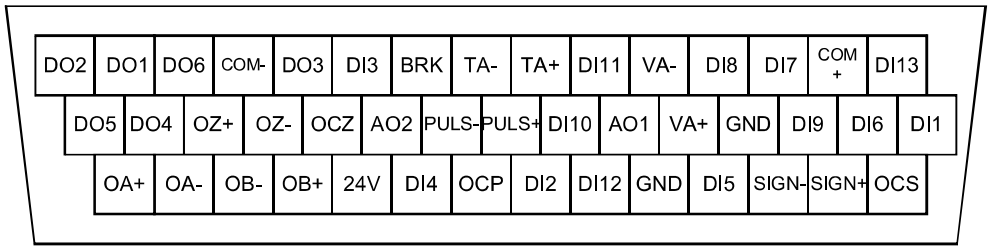
Function code	Name	Unit	Accuracy
	when a fault occurs		
r30.bF	Instantaneous value of phase V output current when a fault occurs	A	0.01
r31udF	Bus voltage when a fault occurs	V	0.1
r32.Sn1	Drive serial No. 1	-	-
r33.Sn2	Drive serial No. 2	-	-
r34.Sn3	Drive serial No. 3	-	-
r35.Sn4	Drive serial No. 4	-	-
r36.Sn5	Drive serial No. 5	-	-
r37.Sn6	Drive serial No. 6	-	-
r38.Pr	Carrier cycle	us	0.01
r39.oLc	Load ratio	%	0.01
r40.rF	Operation time	h	1
r41.PrS	Execution route	-	-
r42.SPE	Speed standard deviation	r/min	0.001
r43.oP1	Low 5 bit of the origin	pulse	1
r44.oP2	Medium 5 bit of the origin	pulse	1
r45.oP3	High 5 bit of the origin	pulse	1

Appendix B Signal arrangement diagram

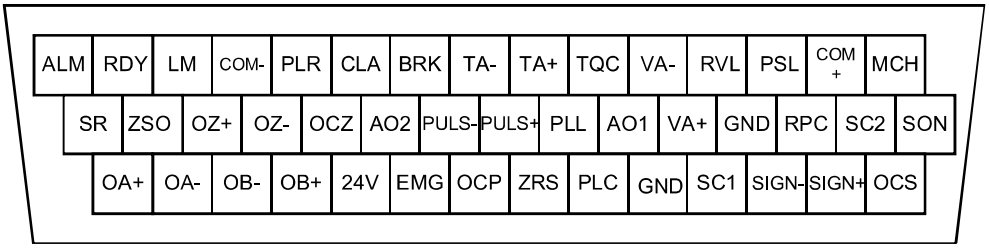
B.1 CN1 pin signal arrangement:



Pin arrangement of connector CN1

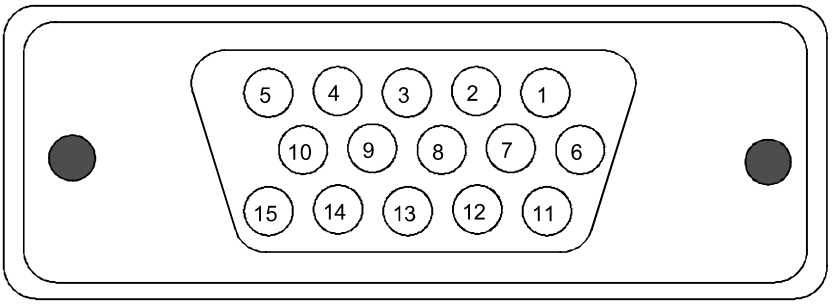


Signal arrangement of connector CN1



Default signal arrangement of connector CN1

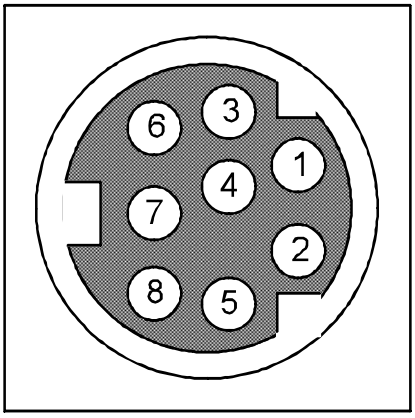
B.2 CN2 pin signal arrangement:



CN2 pin No.	Definition	Color
1	V+	Black
2	W+	Brown
3	A+	Red
4	A-	Red and white
5	5V	Purple
6	U+	Orange
7	V-	Black and white

CN2 pin No.	Definition	Color
8	W-	Brown and white
9	B-	Blue
10	B+	Blue and white
11	U-	Orange and white
12	GND	Purple and white
13	Z-	Green
14	Z+	Green and white
15	/	/

B.3 CN3 pin signal arrangement:

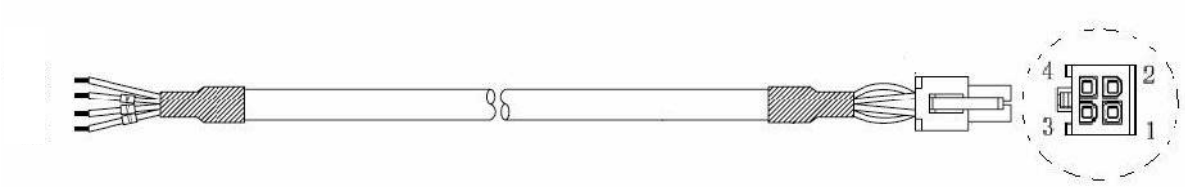


CN3 pin No.	1	2	3	4	5	6	7	8
Definition	RXD	GND	TXD	CANL	/	CANH	RS485-	RS485+

Appendix C Plug signal of servo motor

C.1 Plug of the motor

C.1.1 Below and including 750W:



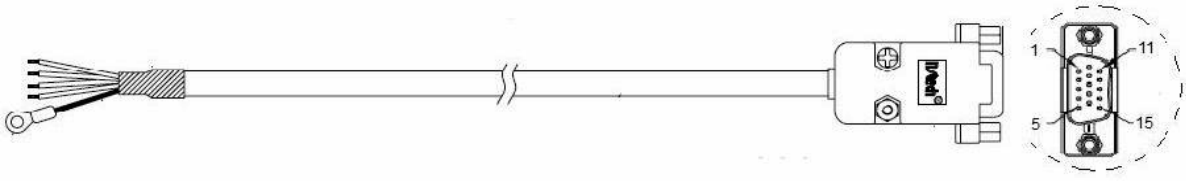
Wire sequence of the motor				
No.	1	2	3	4
Color	Brown	Yellow and green	Black	Blue
Signal	W	PE	V	U

C.1.2 Above 750W:

Wire sequence of the motor				
No.	1	2	3	4
Color	Yellow and green	Blue	Black	Brown
Signal	PE	U	V	W

C.2 Plug of encoder wire

C.2.1 Below and including 750W:



No.	Color	Signal
1	V+	Black
2	W+	Brown
3	A+	Red
4	A-	Red and white
5	5V	Purple
6	U+	Orange
7	V-	Black and white
8	W-	Brown and white
9	B-	Blue
10	B+	Blue and white
11	U-	Orange and white
12	GND	Purple and white
13	Z-	Green
14	Z+	Green and white
15	/	/

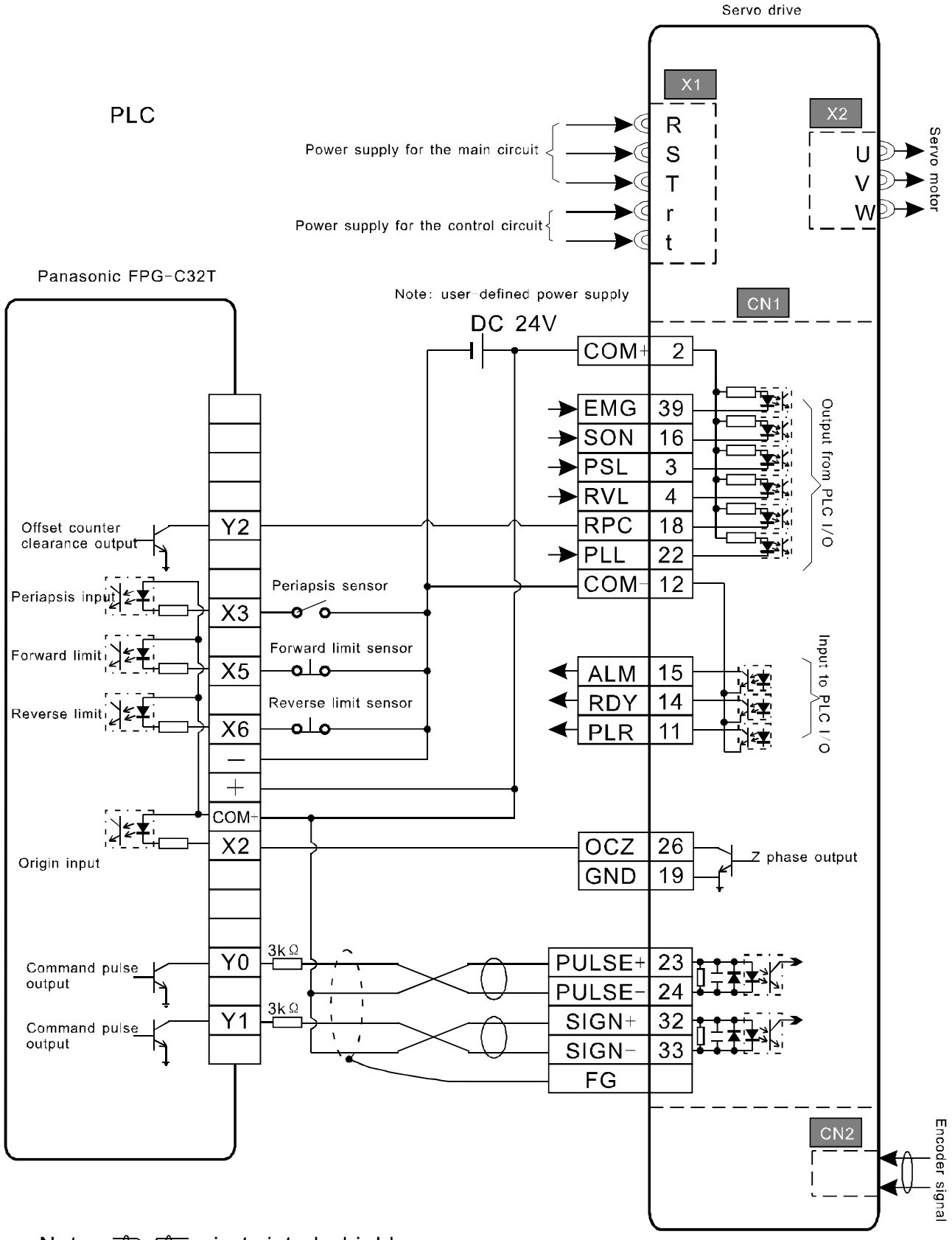
C.2.2 Above 750W:

No.	Signal	Color
1	PE	Shield wires
2	5V	Purple
3	GND	Purple and white
4	A-	Red and white
5	B+	Blue and white
6	C+	Green and white
7	A+	Red
8	B-	Blue
9	C-	Green

No.	Signal	Color
10	U+	Orange
11	V+	Black
12	W+	Brown
13	U-	Orange and white
14	V-	Black and white
15	W-	Brown and white

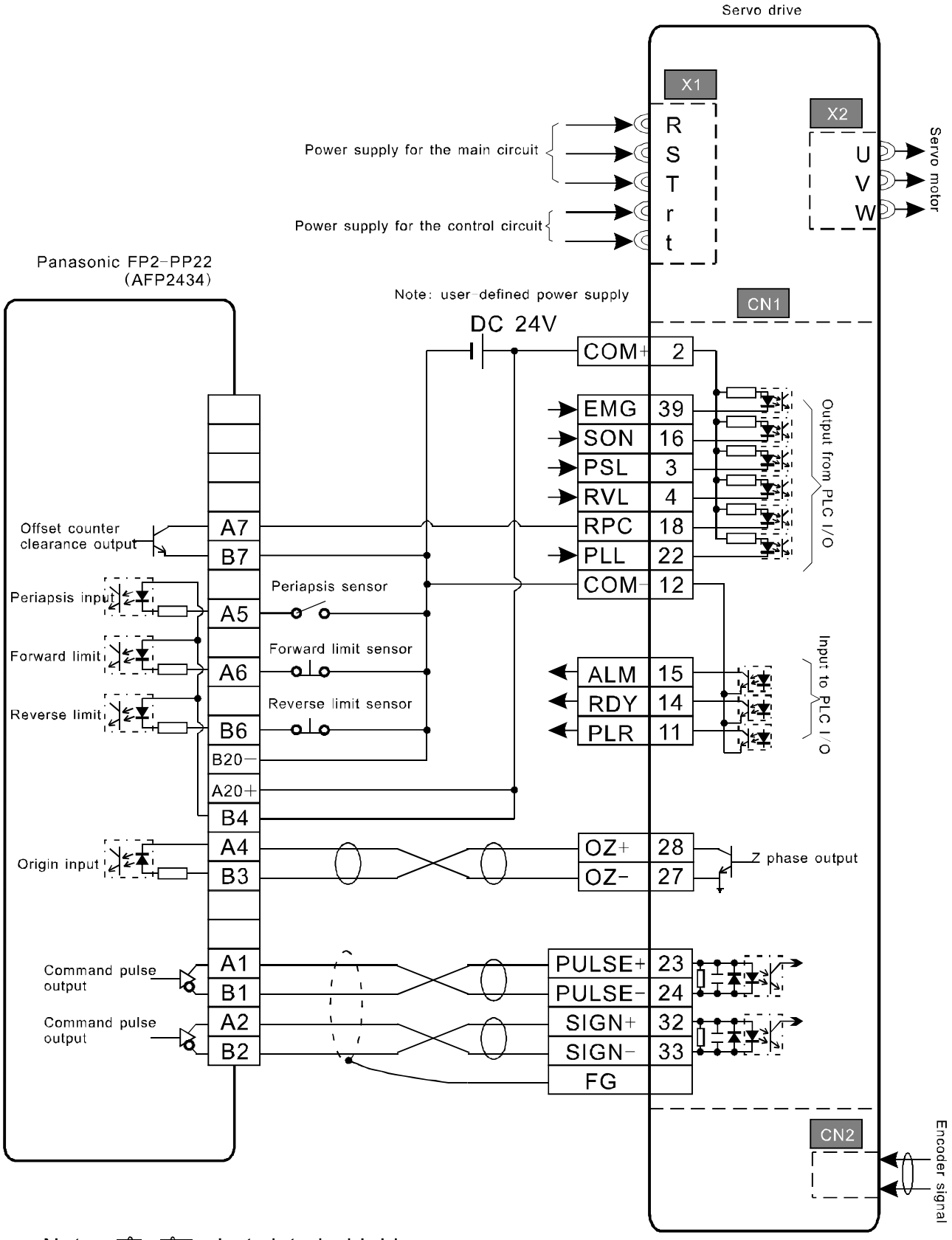
Appendix D Wiring examples

D.1 Connection with Panasonic FPG-C32T



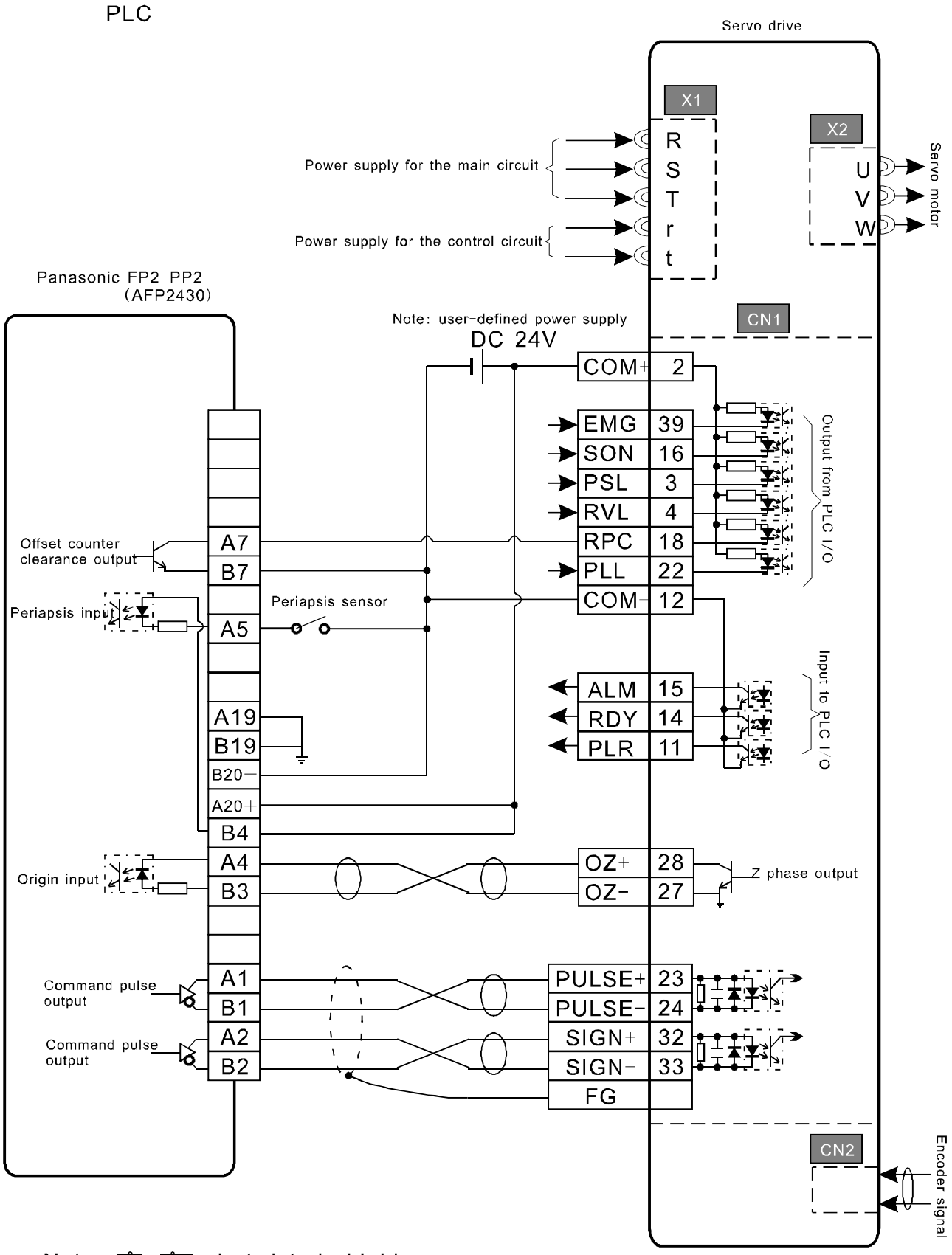
Note: is twisted shields.

D.2 Connection with Panasonic FP2-PP22 (AFP2434)



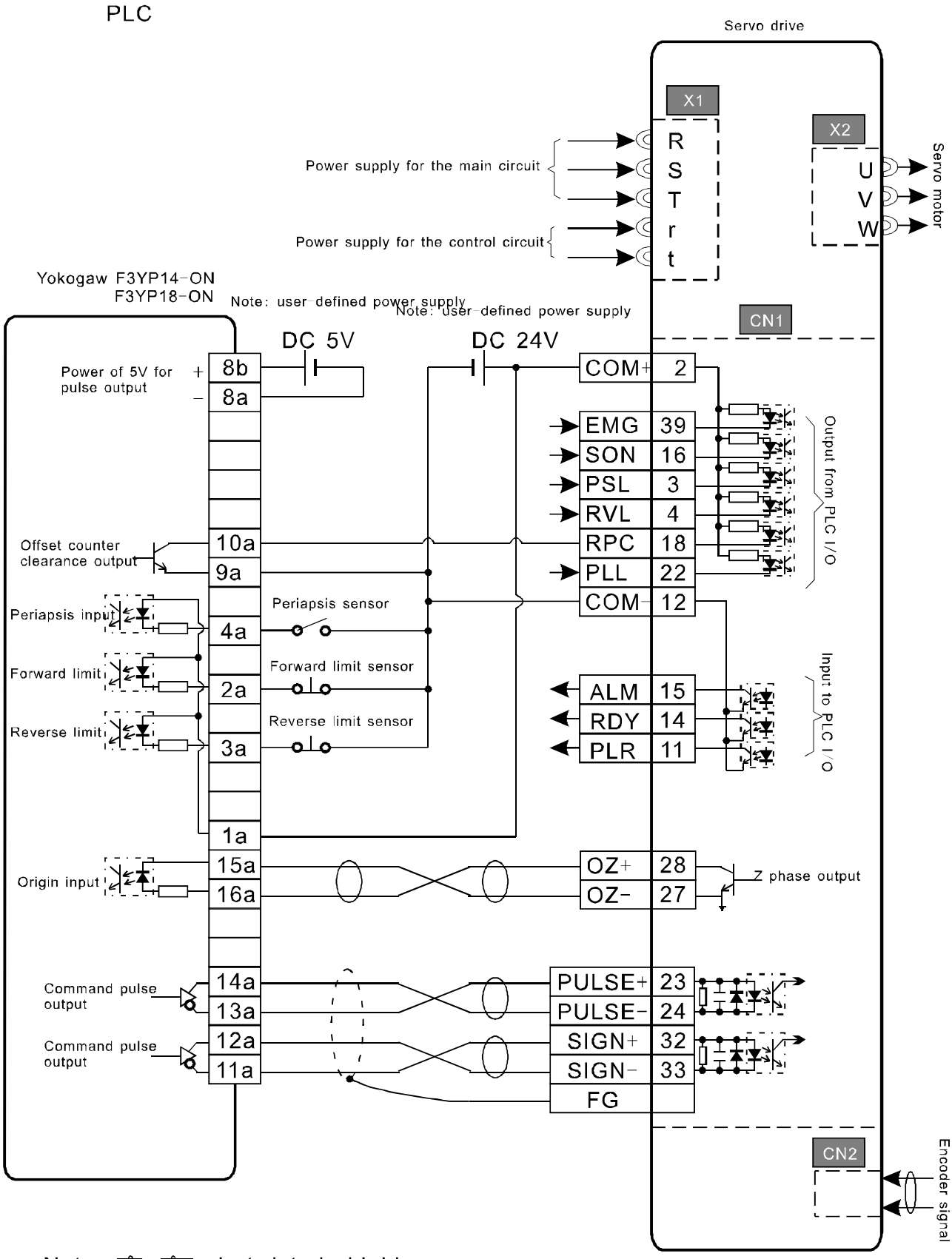
Note: is twisted shields.

D.3 Connection with Panasonic FP2-PP2 (AFP2430)



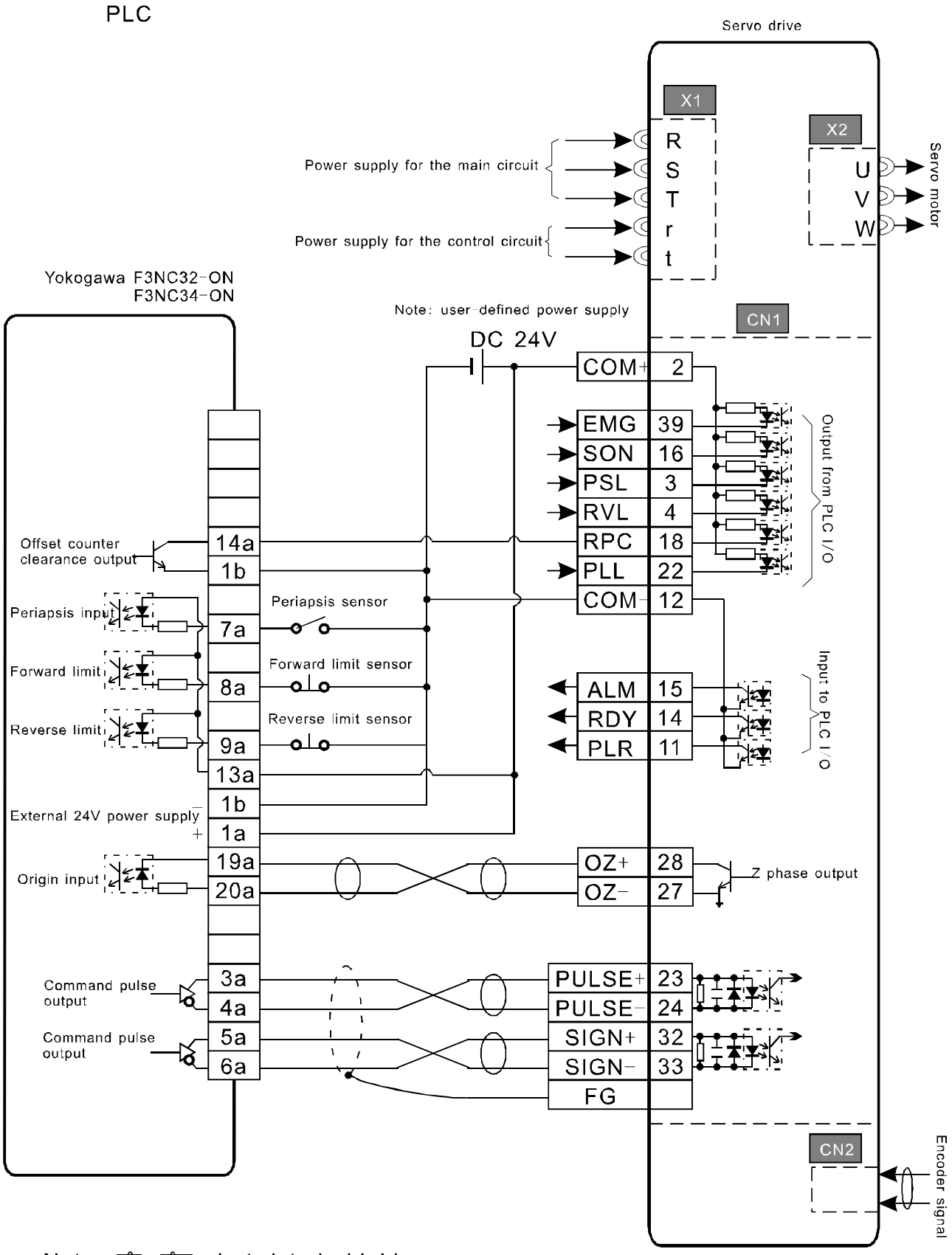
Note: is twisted shields.

D.4 Connection with Yokogawa PLC F3YP14-ON/F3YP18-ON



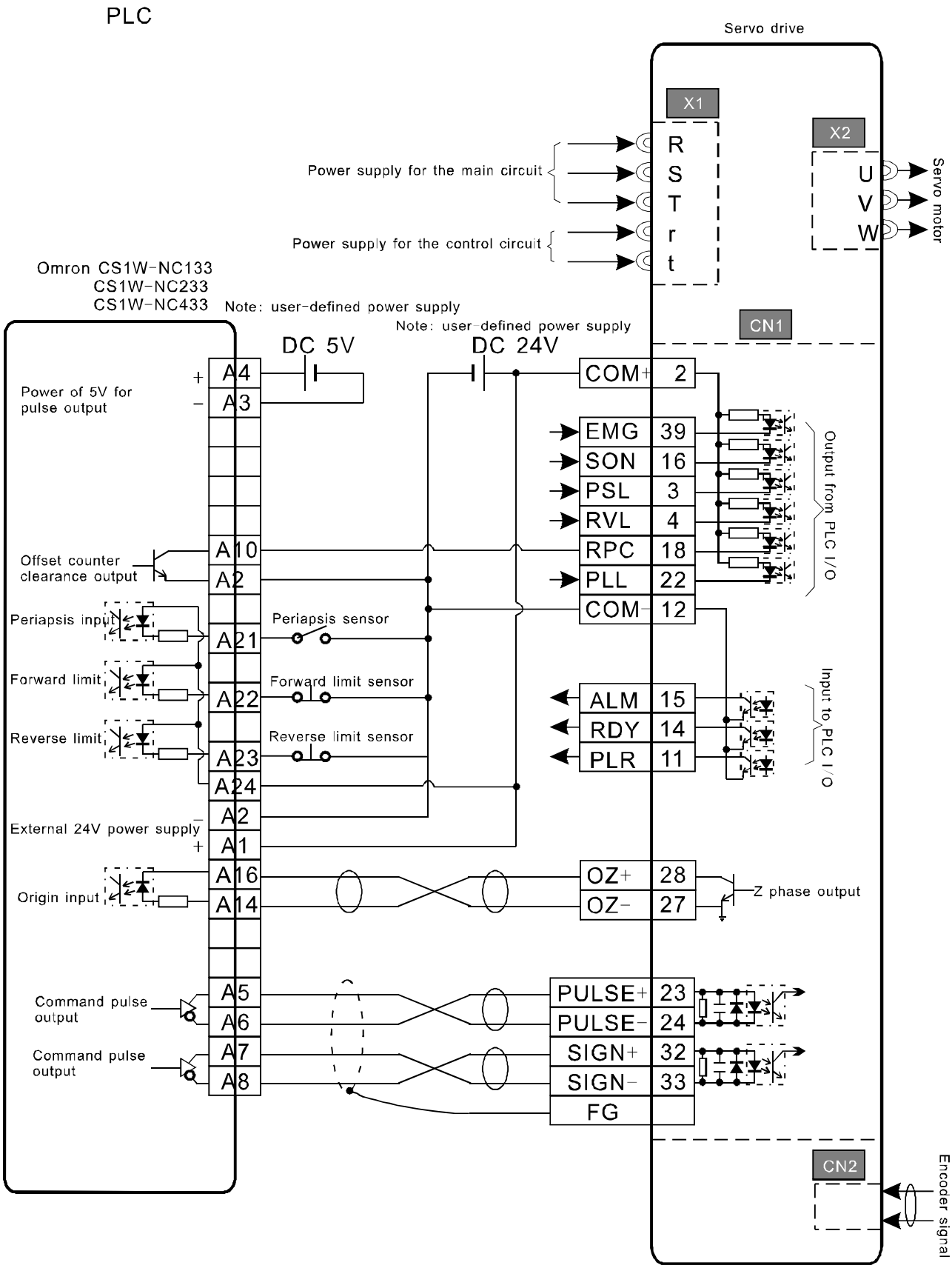
Note: is twisted shields.

D.5 Connection with Yokogawa PLC F3NC32-ON/F3NC34-ON



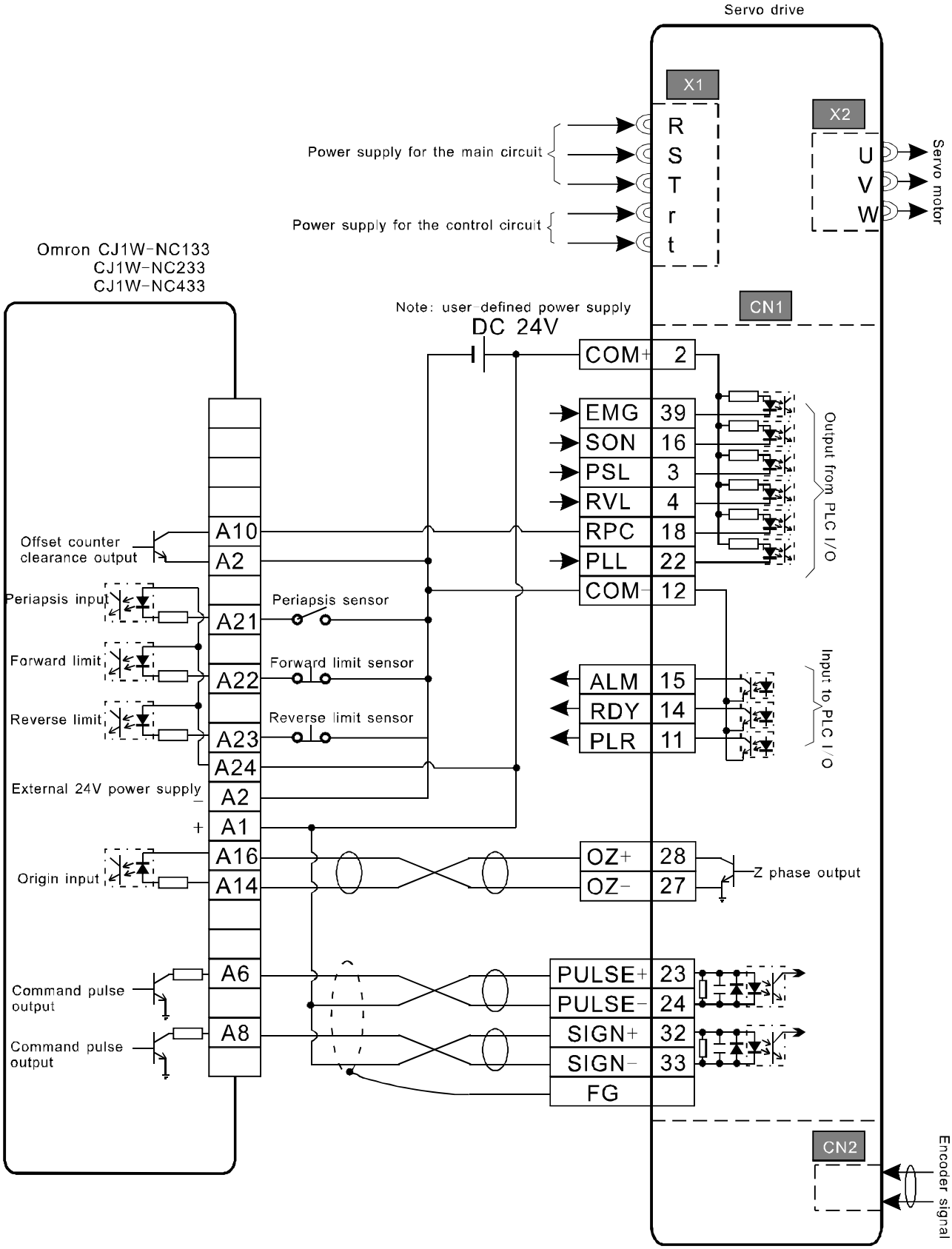
Note: is twisted shields.

D.6 Connection with Omron CS1W-NC133/233/433



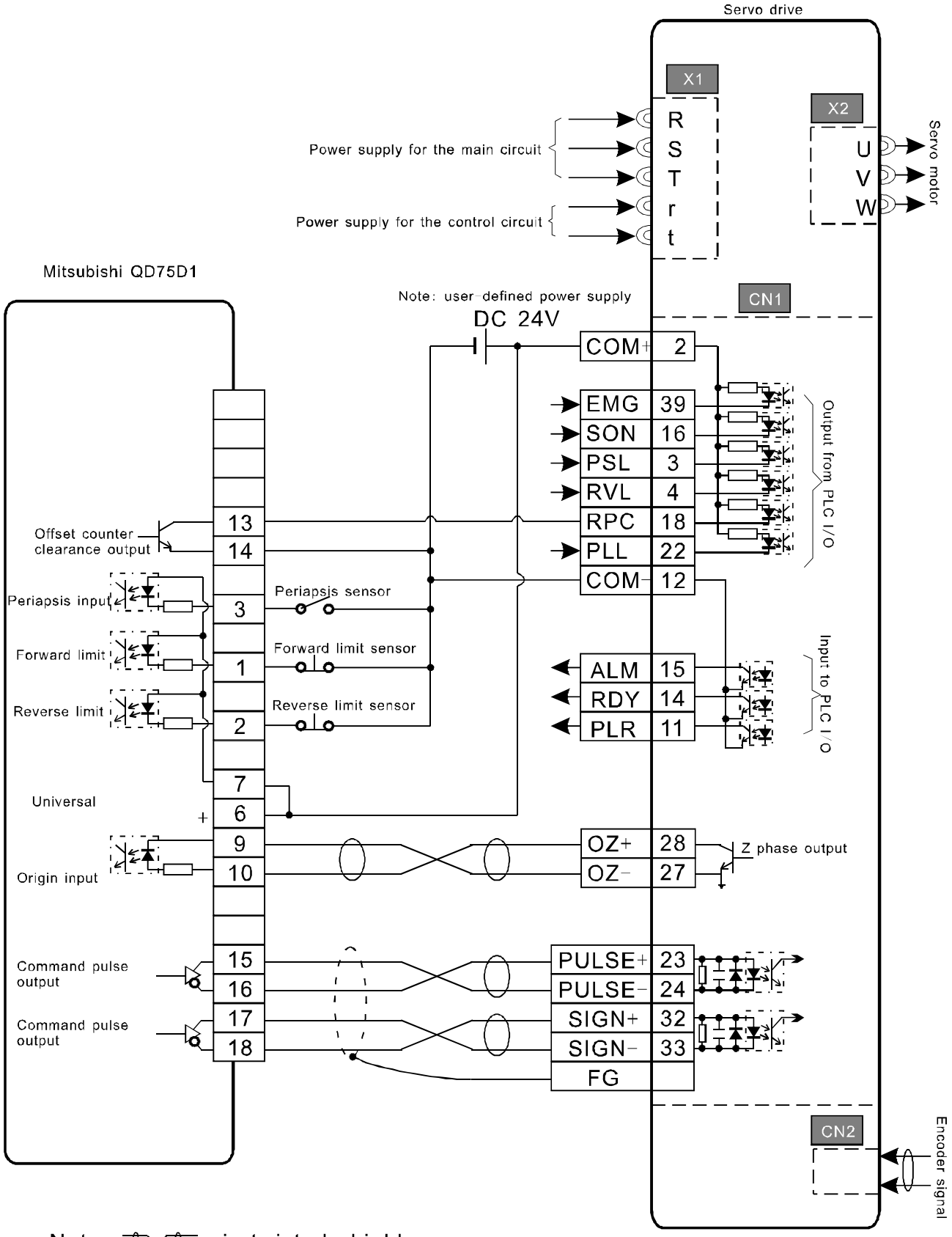
Note: is twisted shields.

D.7 Connection with Omron CJ1W-NC133/233/433



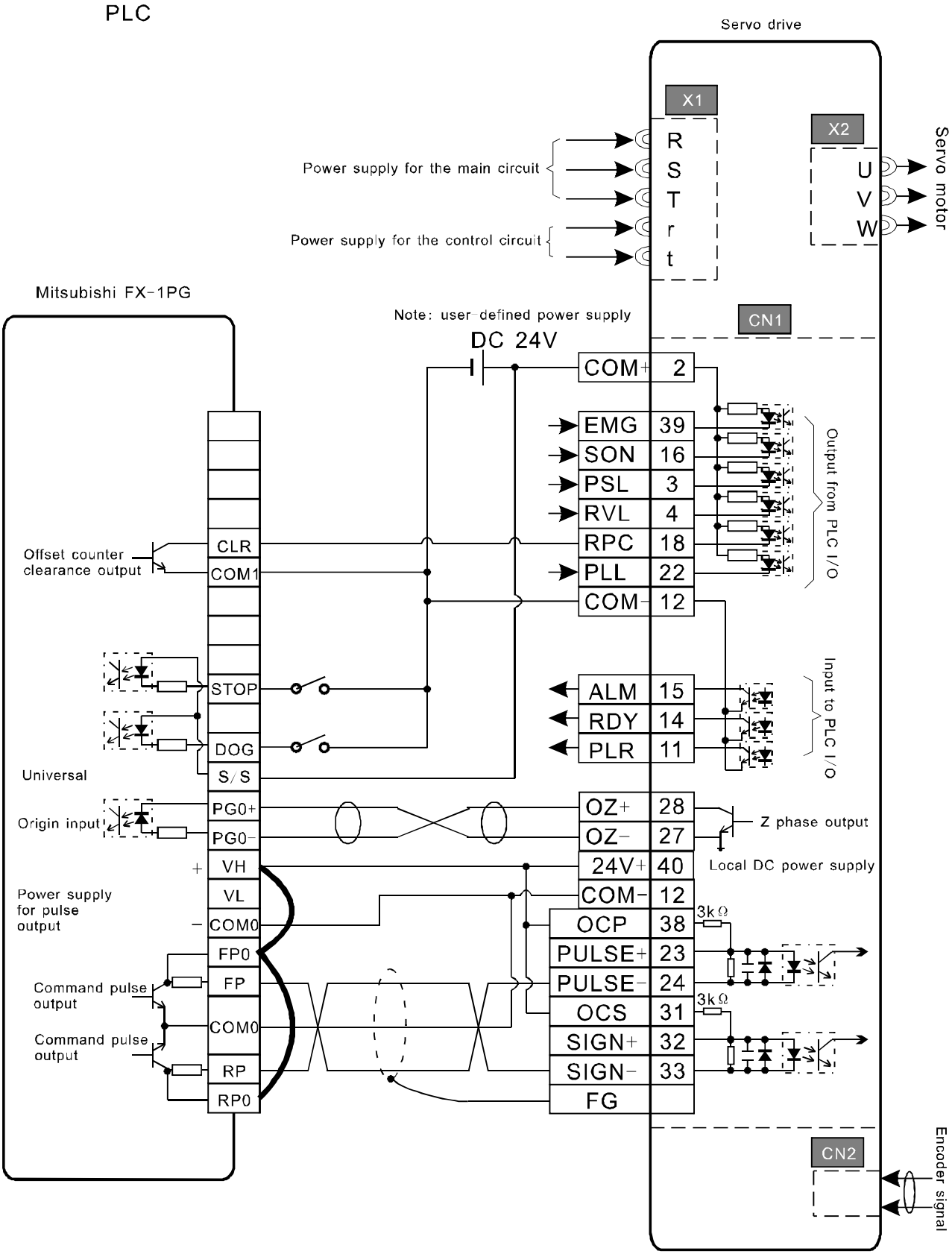
Note: is twisted shields.

D.8 Connection with Mitsubishi QD75D1



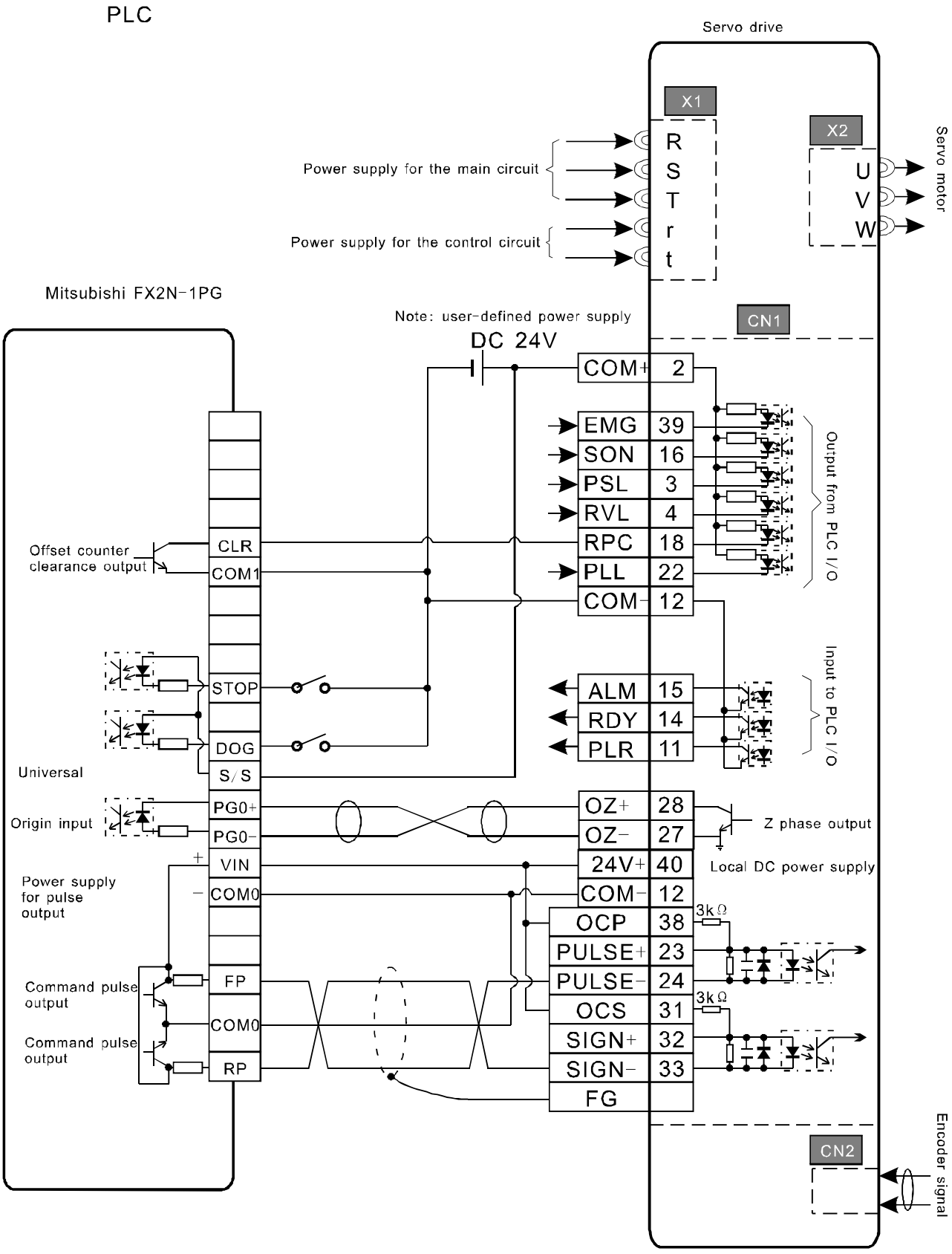
Note: is twisted shields.

D.9 Connection with Mitsubishi FX-1PG



Note: ⋈ is twisted shields.

D.10 Connection with Mitsubishi FX2N-1PG



Note: is twisted shields.

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