

ZD210 SPINDLE SERVO DRIVER

USER'S MANUAL

ZD210 SPINDLE SERVO DRIVER

USER S MANUAL

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CNCMAKERS LIMITED

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1. Specification

1.1 General Specification

Table 1-1 General Specification

Model	ZD210	Specification
Control Characteristics	Control Mode	Position Control, Speed Control, Torque Control, Position/Speed Control
	Speed Range	1:8000
	Speed Control Precision	±0.1%
	Torque Control Precision	±5%
	Over Load Rating	200% motor rated output current
	Input Signal	KSN servo bus
	Accelerate/decelerate Characteristics	Bell shaped curve method or 'S' curve method
	Braking Mode	Use of braking resistors
	Automatic Parameters Adjustment	Automatic motor parameters adjustment, Automatic motor load inertia adjustment
Interface	Optocoupler Input	A total of 10 channel, 8 channel which can be customized
	Optocoupler Output	4 channel, can be customized
	Relay Output	2 channel, can be customized
	Control Input Interface	KSN servo bus interface
	Encoder Input Interface	2 connector, support incremental encoder, absolute encoder, and resolver
	Encoder Output Interface	None
	Computer Interface	RS232 Interface, Modbus protocol available
Spindle Functions	Speed Control	Speed range, 0 ~ 8000rpm, Servo bus control

Model ZD210		Specification
	Spindle Orientation	'S' curve rapid orientation, orientation position can be set automatically by performing 'tU5' operation. Support external encoder orientation, rapid orientation function available.
	Spindle Gear Box	8 groups of gear ratio
	Other Functions	'C' axis control, thread cutting, electronic gear
Safety Functions	Overcurrent Protection	When the output current is 2 times the rated current occurs
	Overvoltage Protection	Both software and hardware detection
	Low-voltage Protection	Both software and hardware detection
	Abnormal Protection	Abnormal braking and encoder malfunctions protection
	Power Module Overheating Protection	Two level, warning protection and fault protection
	Mechanical Brake	Users can change the brake sequence
Ambient	Running Temperature	-10°C ~ +45°C
	Humidity	90% RH or less (non-condensing)
	Storage Temperature	-20°C ~ +60°C
	Altitude	1000 m max
	Vibration	0.5G (4.9m/s ²) max, 10~60Hz (not continuously running)

1.2 Model Specification

Table 1-2 Model Specification

Model ZD210—□		42P2	43P7	45P5	47P5	4011	4015
Maximum Applicable Motor Capacity, KW		2.2	3.7	5.5	7.5	11	15
Rated Output	Output Capacity, KVA	4.2	7	11.3	13.7	18.3	24
	Rated Output Current, A	5.5	9	14	18.5	26	35
	Maximum Output Voltage	600V					
	Maximum Output Voltage Frequency	300Hz					
Power Input	Rated Voltage Rated Frequency	Three-phase AC380V 50Hz/60Hz					
	Allowable Voltage Fluctuation Range	-15% ~ +10%					
	Allowable Frequency Fluctuation Range	±5%					
Braking Resistor	W	400	800	1000	1600	2000	2000
	Ω	150	75	75	40	26	26
Circuit Breaker	A	10	16	30	30	50	60
Magnetic Contactor	A	9	16	18	20	30	50
Noise Filter	A	7.5	10	15	20	30	40
	mH	3.6	2.2	1.42	1.06	0.7	0.53

1.2.1 Nameplate

Figure 1-1 show the nameplate of a 7.5KW servodrive.

Model: model of the servodrive.

Input: power supply parameters

Output: output parameters of the servodrive.

S/N: the product serial number

SPINDLE SERVO DRIVER ZD210

MODEL: ZD210-47P5 E1 E2 E3 E4
E5 E6 E7 E8

INPUT : AC, 3 PH, 380V-440V 50Hz/60Hz

OUTPUT: AC, 3 PH, 0V-400V 13.7kVA 18.5A

Install and connect following specified manual.
Only for indoor using.

DANGER High voltage circuits are used internally. Don't touch any terminals or labels when CHARGE indicator is lit up.
Disassembly and maintenance can only be performed by professionals.

CAUTION Don't touch cooling fin to prevent scalding when servo driver is working.

Ground reliably.

S/N:

BEIJING KND CNC TECHNIQUE Co.,Ltd.

1.2.2 Servodrive Model

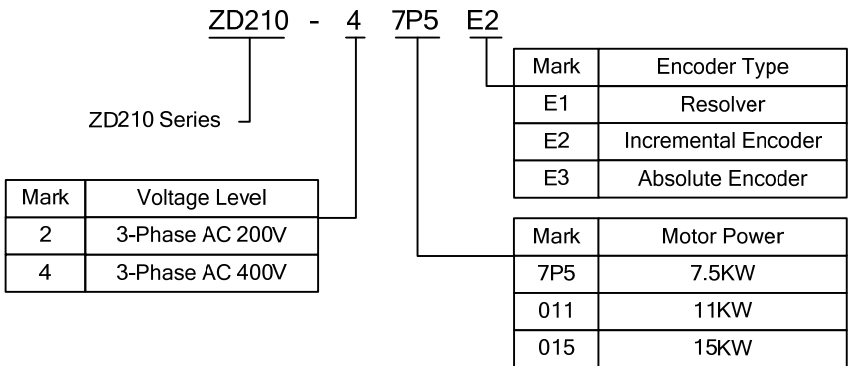


Figure 1-2 Servodrive Model

1.3 Installation Dimensions

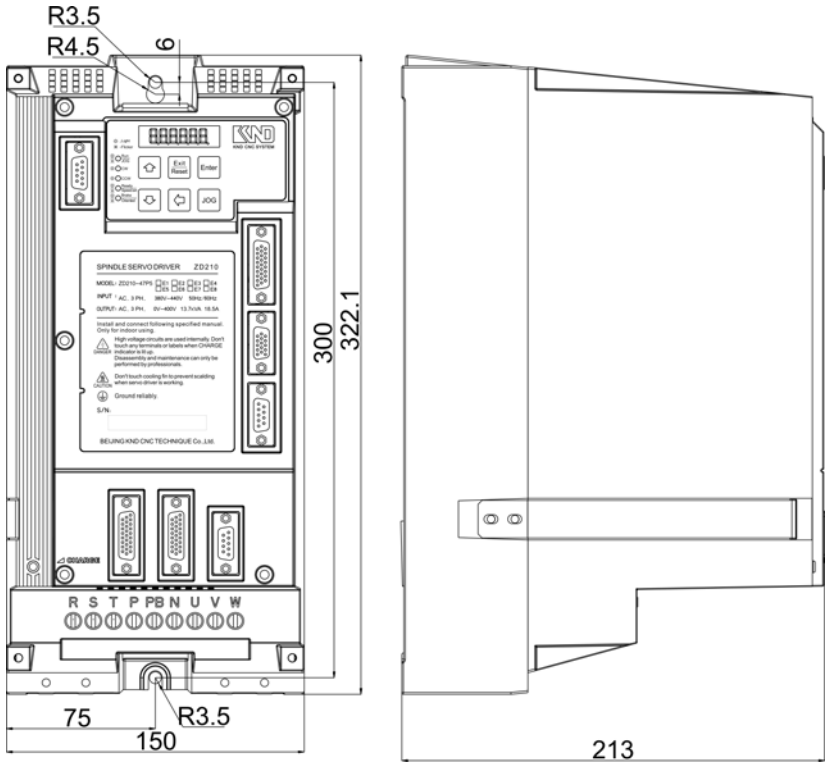


Figure 1-3 Installation Dimensions

Two M6 screws length of more than 10mm are necessary to mount the servodrive.

2. Installation and Wiring

2.1 Checking on Delivery

Check the following items when ZD210 series products are delivered.

Table 2-1 Checking on Delivery

No.	Check Items	Comments
1	Are the delivered products the ones that were ordered?	Check the labels, nameplates and appearance.
2	Are the accessories complete?	Check the packing list and the articles.
3	Are the accessories matching with the product?	Check the accessories type and appearance.
4	Is there any damage?	Check the overall appearance, and check for damage that may have occurred during shipping.
5	Are there any loose screws?	Check screws for looseness using a screwdriver.

If any of the above items are faulty or incorrect, contact your sales representative or the dealer from whom you purchased the products.

2.2 Installation Surroundings

1 **Electrical cabinet**

Generally, the temperature in electrical cabinet is higher than that of surroundings.

Working in high temperature will obviously reduce the servodrives' service life and increase the failure rate. Be careful to arrange the components in cabinet and consider the cooling for servodrives. Ensure that the temperature around these servodrives is below 55°C (below 45°C when working for long-term) and the relative humidity (RH) is less than 90%.

2 **Vibratory equipment**

Make sure that the vibrating acceleration speed is less than 0.5g (4.9m/s²).

3 **Application condition**

This servodrive is designed for ordinary application conditions. It is recommended to install them in electrical cabinet to prevent them from

corrosive gases and liquids, water or metallic particles.

To use them in these adverse conditions, please contact KND technical service center for more information.

4 **EMI**

Some interfere signals emitting from the equipment around may result in the servodrive working unexpectedly. It is recommended to install a noise filter and an insulating transformer at the power supply interface and pay attention to the leak current. Install the control signals cable carefully because they are easily to be interfered.

2.3 Installation Method

Direction

Install vertically.

Mounting

Two M6 screws are necessary to mount the servodrive.

Install distributing

Refer to figure 2-1 below to install servodrives in the cabinet. Bigger space between servodrives is recommended to ensure well elimination of heat.

Heat elimination

ZD210 servodrive adopts forced air cooling method.

Remarks

When installing, be careful to prevent iron chips, screws, mill dusts and some other objects entering inside of servodrives.

ZD210 servodrives are designed for given types of AC servo motors. Do not attempt to control not matching servo motors.

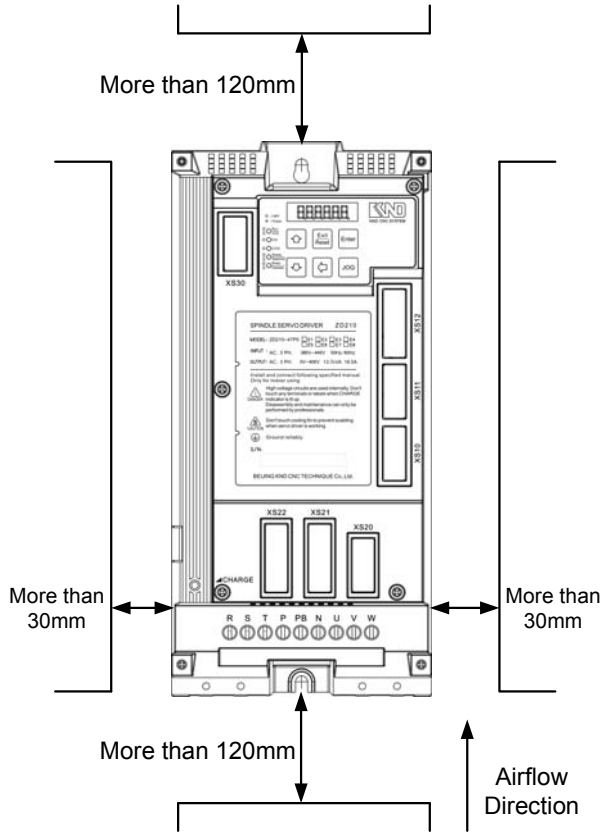


Figure 2-1 ZD210 Installation Distribution

2.3.1 Connecting to Peripheral Devices

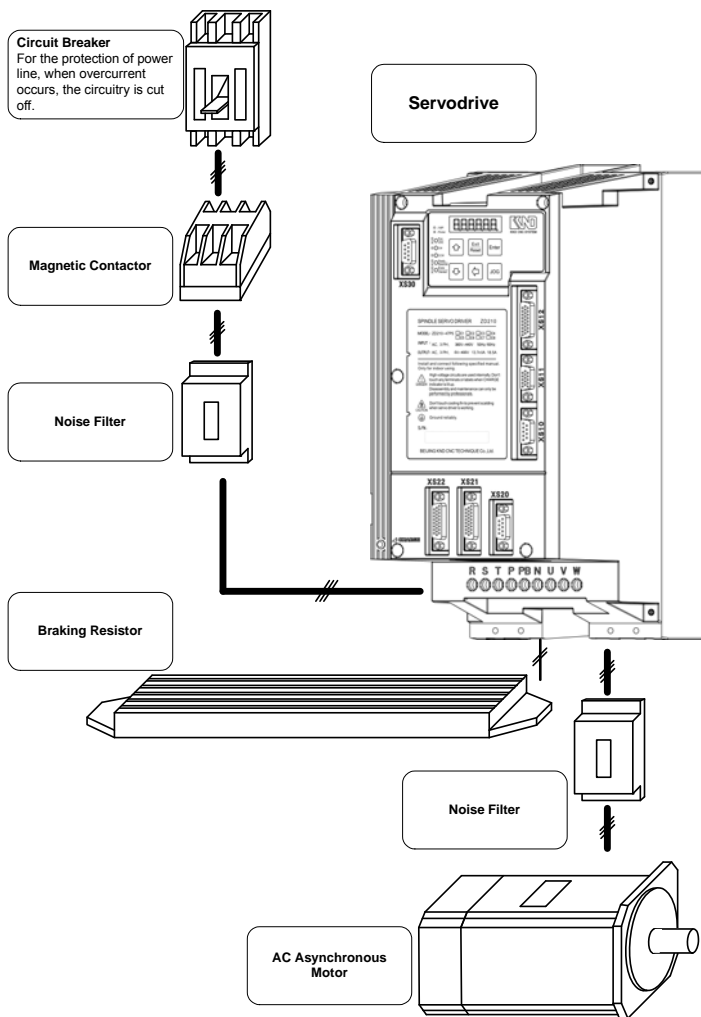


Figure 2-2 Peripheral Devices

2.3.2 Main Circuit Wiring

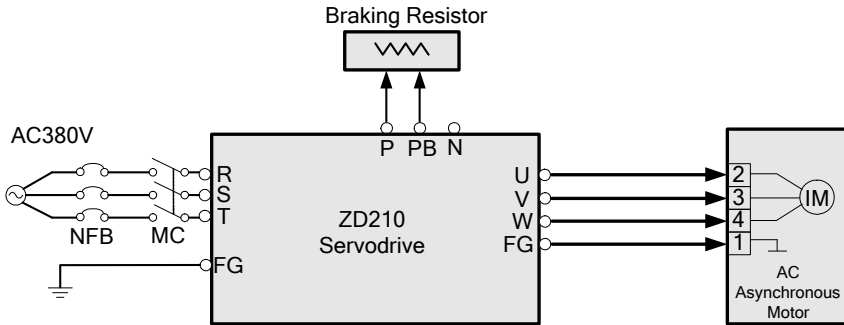


Figure 2-3 Main Circuit Wiring

- 1 The cable types of terminal R, S, T, U, V, W and FG please refer to table 2-2.
- 2 Use strong grounding lines. Connect the grounding terminals of the servo motor and the drive firmly. The ground resistance should be less than 100Ω.
- 3 Install circuit breaker to protect the servodrive when some accident happens.
- 4 Connect terminal U, V, W of the servodrive to line U, V, W of the motor.
- 5 There are high frequency switching currents inside servo motors, ensure grounding terminals of servo motors and drives are firmly grounded, to prevent electric shock accidents.
- 6 It is recommended to supply power to servodrive through three phase insulating transformers.
- 7 It is recommended to install noise filters to reduce interfere.
- 8 Install noise filters to reduce the inductive interference and radio interference.

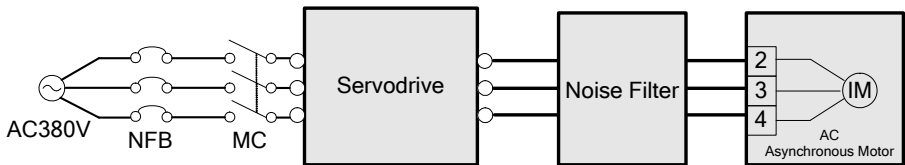


Figure 2-4 Install Noise Filter

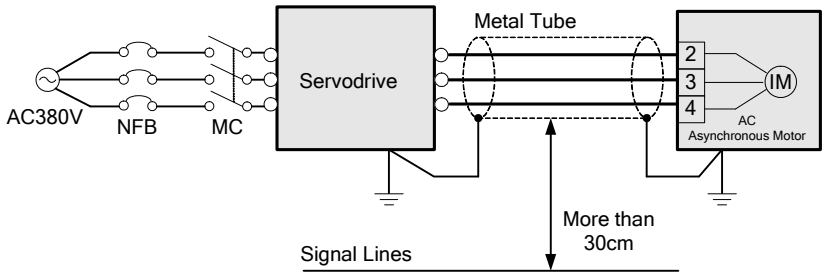


Figure 2-5 Reduce the inductive interference

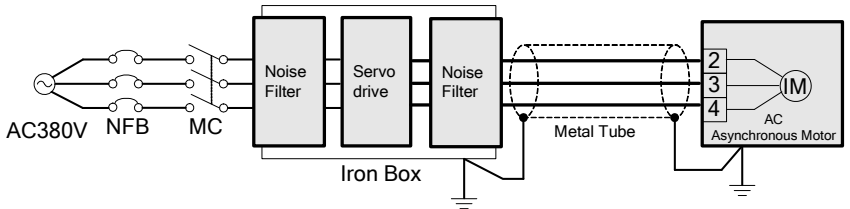


Figure 2-6 Reduce the radio interference

2.3.3 Selection of Circuit Breaker, Magnetic Contactor and Cable Type

Table 2-2 Circuit Breaker, Magnetic Contactor and Cable Type

Model	Power (KW)	Circuits Breaker (A)	Magnetic Contactor (A)	Main circuits cable (mm ²)
42P2	2.2	10	9	2.5
43P7	3.7	16	16	4
45P5	5.5	30	18	4
47P5	7.5	30	20	6
4011	11	50	30	10
4015	15	60	50	16

2.3.4 I/O Signal Connections

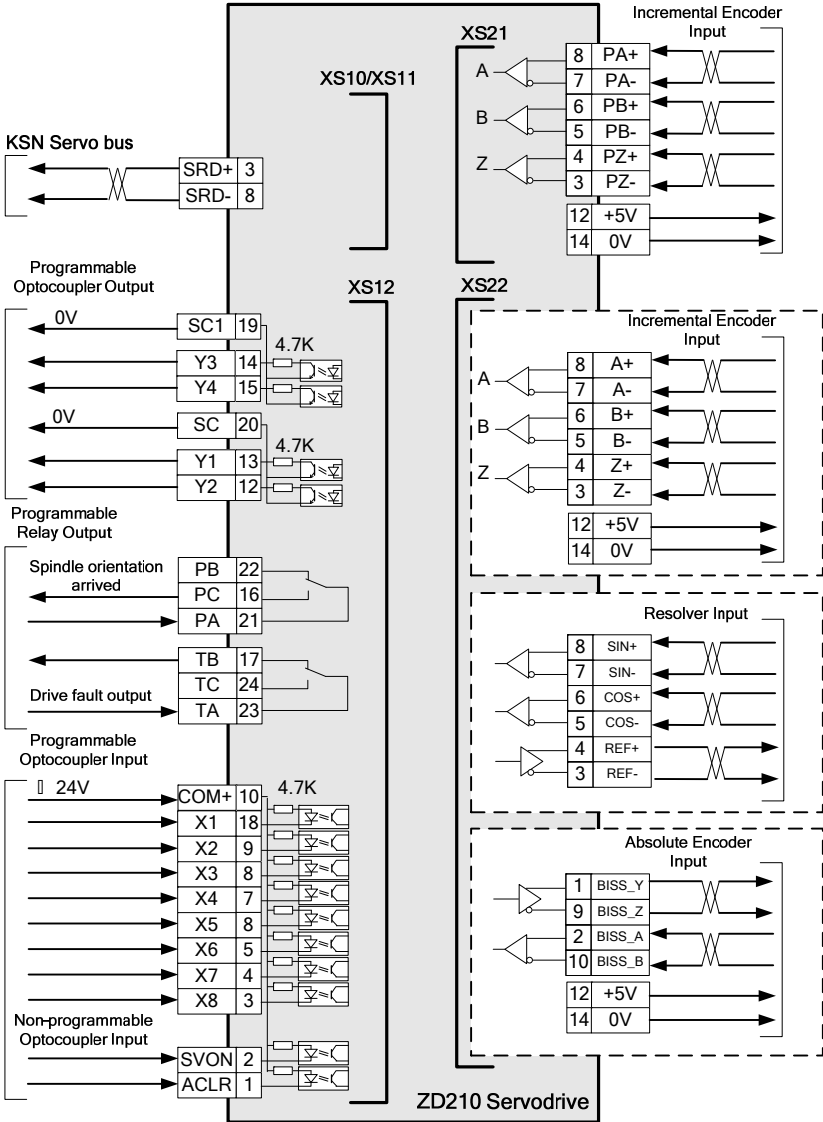


Figure 2-7 I/O Signals

2.4 Wiring Check

2.4.1 Check Items

After wiring, check the following items:

- 1 Don't connect the input terminals to the output ones.
- 2 Make sure that screws and other articles not left in the servodrive.
- 3 Make sure that screws are tightened.
- 4 Ensure no exposed wire come into contact with the adjacent terminals.

2.5 I/O Signals

2.5.1 List of XS10/XS11 Terminals

Table 2-3 List of XS10/XS11 Servo bus Terminals (DB9 Female Connector)

Pin No.	Mark	Name	Remarks
1/2/4 5/6/7/9	—	—	—
3	SRD+	Servo bus (KSN) Signal	Servo bus (KSN) Communication Signals
8	SRD-		

Note:

1. The terminals arrangement of XS10 and XS11 are the same.
2. Only SRD+ and SRD- are used for communication. Other terminals are not used and should be unconnected.

2.5.2 List of XS12 Terminals

Table 2-4 List of XS12 (DB26-3 Female Connector)

Pin No.	Name	Mark	Type	Remarks
18	Optocoupler Switching value input signals	X1	Type 3	Default: Servo motor rotates in positive direction (SFR), Can be customized
9	Optocoupler Switching value input signals	X2	Type 3	Default: Servo motor rotates in negative direction (SRV), Can be customized

Installation and Wiring

Pin No.	Name	Mark	Type	Remarks
8	Optocoupler Switching value input signals	X3	Type 3	Default: Spindle orientation (ORCM), Can be customized
7	Optocoupler Switching value input signals	X4	Type 3	Default: Zero-speed clamp (ZSPD), Can be customized
6	Optocoupler Switching value input signals	X5	Type 3	Default: Rigid tapping (TAP), Can be customized
5	Optocoupler Switching value input signals	X6	Type 3	Default: Emergency stop (EST), Can be customized
4	Optocoupler Switching value input signals	X7	Type 3	Default: Spindle swing (SWI), Can be customized
3	Optocoupler Switching value input signals	X8	Type 3	Default: Speed/Position control selection (VP), Can be customized
2	Optocoupler Switching value input signals	Q1	Type 3	Servodrive force enable (SVON)
1	Optocoupler Switching value input signals	Q2	Type 3	Alarm clearing (ACLR)
10	Positive pole for input signals	COM+	—	When using an external power supply, connected to + 24V
11				
25	Positive pole for input signal	CME	—	CME is internally connected to the power supply ground
26				
13	Optocoupler Switching value output signals	Y1	Type 1	Default: Spindle zero speed (ZEROSPD), Can be customized
12	Optocoupler Switching value output signal	Y2	Type 1	Default: Spindle orientation arrived (ORAR), Can be customized

Pin No.	Name	Mark	Type	Remarks	
20	Negative pole for output signals	SC	—	Ground terminal of Y1, Y2 Connect to external power supply ground (0V)	
14	Optocoupler Switching value output signal	Y3	Type 1	Default: Drive fault output (#DALM), Can be customized	
15	Optocoupler Switching value output signal	Y4	Type 1	Default: Velocity completed (VCMP), Can be customized	
19	Negative pole for output signals	SC1	—	Ground terminal of Y3, Y4 Connect to external power supply ground (0V)	
23	Relay	Common contact	TA	Type 2	Default: Drive fault output (#DALM), Can be customized
17		Normally closed contact	TB		
24		Normally open contact	TC		
21	Relay	Common contact	PA	Type 2	Default: Spindle orientation arrived (ORAR), Can be customized
22		Normally closed contact	PB		
16		Normally open contact	PC		

2.5.3 List of XS21 Terminals

Table 2-6 Incremental Encoder Signals (DB15 Female Connector)

Pin No.	Name	Mark	Type	Remarks
12/13	+5V power supply	+5V	—	Power supply for encoder
14/15	Power supply ground	0V	—	
8	PA+ Input	PA+	Type 5	Connect to the A+ terminal of

Pin No.	Name	Mark	Type	Remarks
				incremental encoder
7	PA- Input	PA-	Type 5	Connect to the A- terminal of incremental encoder
6	PB+ Input	PB+	Type 5	Connect to the B+ terminal of incremental encoder
5	PB- Input	PB-	Type 5	Connect to the B- terminal of incremental encoder
4	PZ+ Input	PZ+	Type 5	Connect to the Z+ terminal of incremental encoder
3	PZ- Input	PZ-	Type 5	Connect to the Z- terminal of incremental encoder

2.5.4 List of XS22 Terminals

Table 2-7 Resolver Signals (DB15 Male Connector)

Pin No.	Name	Mark	Type	Remarks
8	SIN+ Input	SIN+	—	Connect to the SIN+ terminal of Resolver
7	SIN- Input	SIN-	—	Connect to the SIN- terminal of Resolver
6	COS+ Input	COS+	—	Connect to the COS+ terminal of Resolver
5	COS- Input	COS-	—	Connect to the COS- terminal of Resolver
4	Reference+ Output	REF+	—	Reference+ for Resolver
3	Reference- Output	REF-	—	Reference- for Resolver

Table 2-8 Incremental Encoder Signals (DB15 Male Connector)

Pin No.	Name	Mark	Type	Remarks
12/13	+5V power supply	+5V	—	Power supply for encoder
14/15	Power supply ground	0V	—	
8	PA+ Input	A+	Type 5	Connect to the A+ terminal of incremental encoder
7	PA- Input	A-	Type 5	Connect to the A- terminal of incremental encoder

Pin No.	Name	Mark	Type	Remarks
6	PB+ Input	B+	Type 5	Connect to the B+ terminal of incremental encoder
5	PB- Input	B-	Type 5	Connect to the B- terminal of incremental encoder
4	PZ+ Input	Z+	Type 5	Connect to the Z+ terminal of incremental encoder
3	PZ- Input	Z-	Type 5	Connect to the Z- terminal of incremental encoder

Table 2-9 Absolute Encoder Signals (DB15 Male Connector)

Pin No.	Name	Mark	Type	Remarks
12/13	+5V power supply	+5V	—	Power supply for encoder
14/15	Power supply ground	0V	—	
1	BISS_MAY	BISS_Y	Type 6	Absolute encoder communication signal MAY
9	BISS_MAZ	BISS_Z	Type 6	Absolute encoder communication signal MAZ
2	BISS_SLA	BISS_A	Type 6	Absolute encoder communication signal SLA
10	BISS_SLB	BISS_B	Type 6	Absolute encoder communication signal SLB

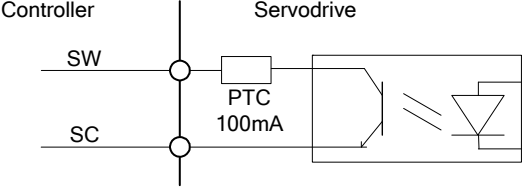
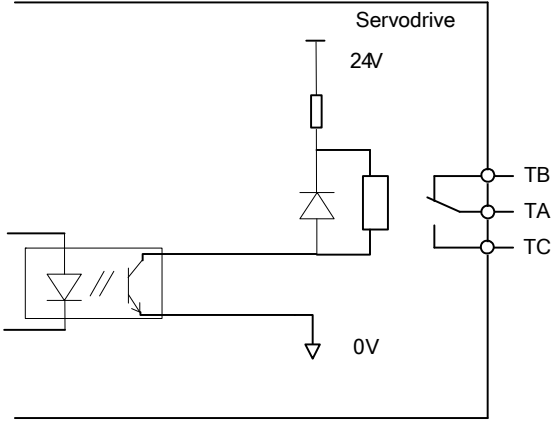
2.5.5 List of XS30 Terminals

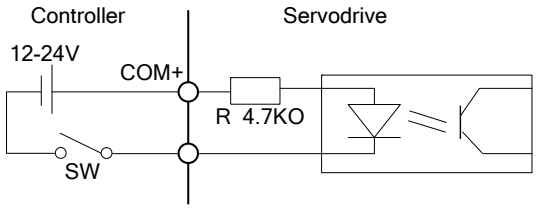
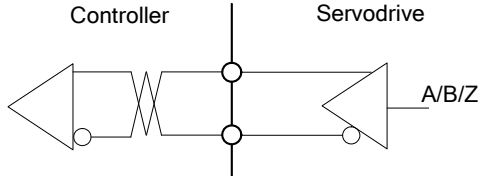
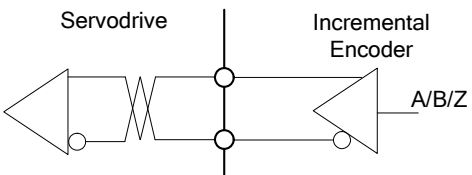
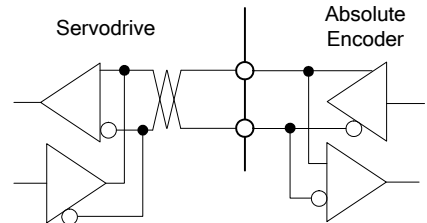
Table 2-10 Computer Interface (DB9 Male Connector)

Pin No.	Name	Mark	Type	Remarks
4	RS232 Transmit	TXD	—	RS232 Interface signal TXD
3	RS232 Receive	RXD	—	RS232 Interface signal RXD
1	GND	GND	—	RS232 Interface signal ground

2.6 I/O Signal Types

Table 2-9 I/O Signal Types

Type	Name	Remarks
1	Optocoupler, Switching value output signals	 <p>1. Provide power externally by users. Reversed power polarity may damage servodrives.</p> <p>2. Use open-collector output signals, the maximum current is 50mA, and the maximum voltage is 25V. Overload may damage servodrives.</p> <p>3. For inductive loads such as relays, install a fly-wheel diode in parallel reversely. Improper installation may damage servodrives.</p>
2	Relay, Switching value output signals	 <p>Relay contact capacity: AC250V, DC30V, 1A TA :Common contact TB: Normally closed contact TC: Normally open contact</p>

Type	Name	Remarks
3	Optocoupler, Switching value input signals	 <p>1. Power supply: DC12~24V, $\geq 100\text{mA}$ 2. Reversed power polarity or improper voltage may result in the servodrive working unexpectedly.</p>
4	Output signals from incremental encoders	 <p>Sent by AM26LS31</p>
5	Input signals from incremental encoders	 <p>Received by AM26LS32</p>
6	Absolute encoder communication interface	 <p>Send or receive using SN65HVD05</p>

3. Display and Operation

3.1 Operation Panel

The display and operation panel of ZD210 servodrive consists of the following there parts: six nixie tubes, five LEDs and six keys. Working together, the three parts support all operation and displaying applications.

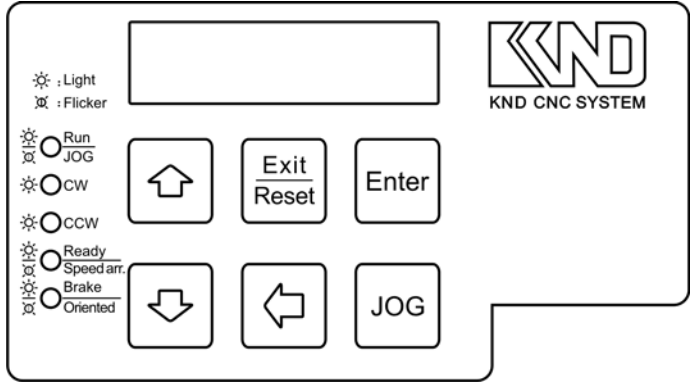







Figure 3-1 Operation Panel

3.1.1 Keys

Keys	Name	Functions
	Increase	<ol style="list-style-type: none"> 1. Cyclic switching operation pages. 2. Increase the sequence numbers or values. 3. When in JOG mode, motor rotates clockwise.
	Decrease	<ol style="list-style-type: none"> 1. Cyclic switching operation pages. 2. Decrease the sequence numbers or values. 3. When in JOG mode, motor rotates counterclockwise.
	Shift	<ol style="list-style-type: none"> 1. Cyclic selection operation numbers.
	Enter	<ol style="list-style-type: none"> 1. Enter operation pages 2. Confirm parameter changes
	Escape	<ol style="list-style-type: none"> 1. Return to the previous page or cancel one operation 2. When a warning occurs, keep pressing this key will exit from the warning status after solving the problems.
	JOG	<ol style="list-style-type: none"> 1. Enter/Exit JOG mode

3.1.2 LED Indicators

LED Indicators	Name	Description
	RUN/JOG	<p>1. LED will light up when the servo motor is in drive status, otherwise it goes off. Except that when in JOG mode</p> <p>2. When in JOG mode, LED flashing.</p>
	CW	LED will light up when the servo motor rotating in positive direction, otherwise it goes off.
	CCW	LED will light up when the servo motor rotating in negative direction, otherwise it goes off.
	Ready/VCMP	<p>1. LED will light up when the servodrive work normally, otherwise it goes off.</p> <p>2. In speed control mode or JOG mode, when the motor speed reaches the setting range, LED flashing</p>
	Brake/ORAR	<p>1. LED will light up when the braking resistor is operating, otherwise it goes off.</p> <p>2. When the spindle orientation function is complete, LED flashing</p>

3.1.3 Operation Guide Map

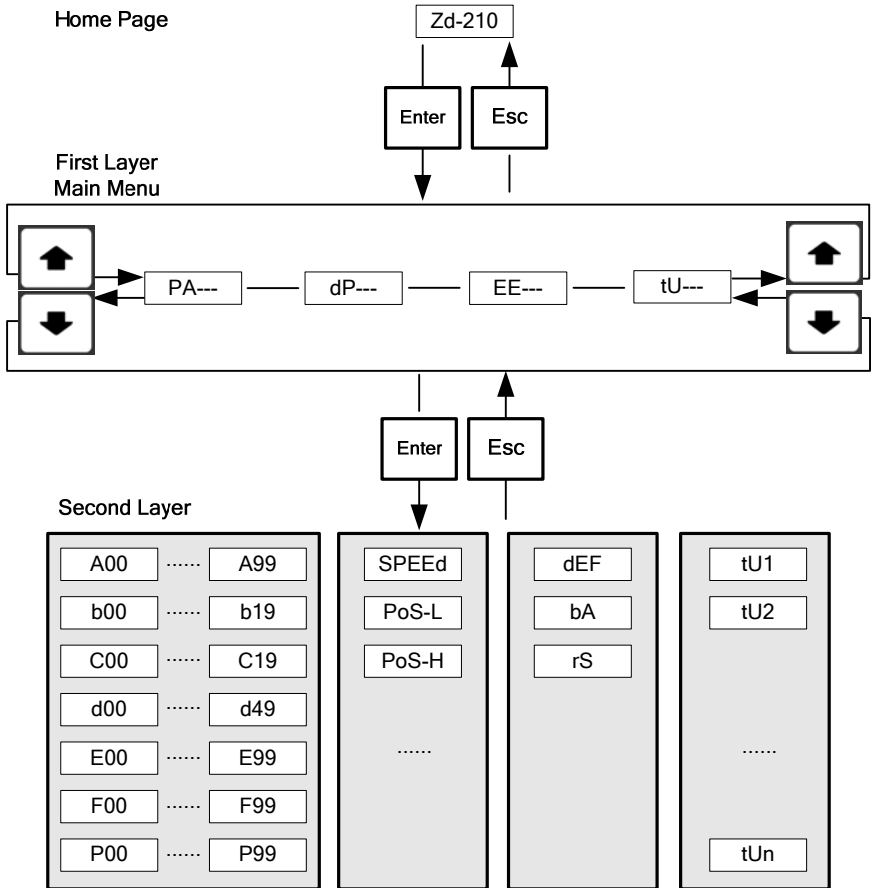
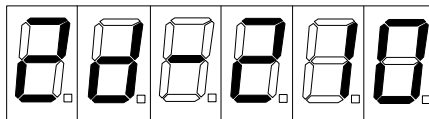


Figure 3-2 Operation Guide Map

Turn on the servodrives power, about two seconds later, it shows the default monitoring menu set by PA-A03. Press any key to enter the home page in which the characters 'Zd-210' is displayed.



3.2 First Layer

Press **Enter** in home page to enter the first layer menu which includes four sub-menus: 'tU', 'EE', 'dP' and 'PA'. Press **Enter** to enter the second layer menu. Press **Esc** to exit and enter the home page.

- Parameter menu: **PA- - -**

Parameters' displaying and setting operations are performed under this menu.

- Monitoring menu: **dP- - -**

Running status of motors and drives are displayed under this menu.

- EEPROM menu: **EE- - -**

The operations of EEPROM are performed under this menu to achieve the function of managing parameters.

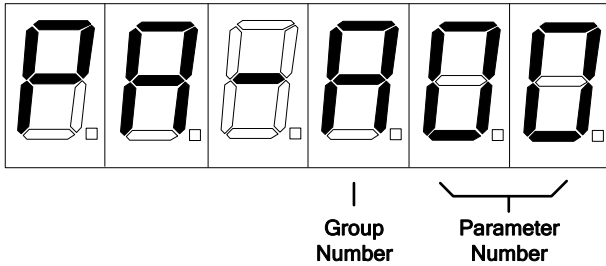
- Adjustment menu: **tU- - -**

In this menu perform the operation of adjusting the servo systems' performance such as automatic parameters' setting, absolute encoders' zero point setting, absolute encoders' multi-turn data clearing etc.

3.3 Second Layer




3.3.1 Parameter Setting (PA)


Select "PA---" in the first layer menu and press **Enter** to enter the second layer. There are 7 groups of parameters in the ZD210 servodrive, they are A, B, C, D, E, F and P. Parameters are numbered from 00 to 99 of each group. Parameter 00 of group A (PA-A00) is as follows:






Follow the below procedure to read or set parameters.

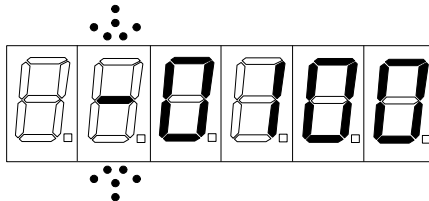
- 1 Select a parameter sequence number

When the parameter sequence number is flickering, pressing  will increase the number and select a desired parameter. For one bit, the value changes from 0 to 9, and then it changes to 0 circularly. Press  to shift to the left number. Pressing  repeatedly will select any number circularly from right to left.

- 2 Press  to display the selected parameter's value.
- 3 Modify parameters values

Like the operation in step 1, press  or  to change parameters values. Press  to confirm the new values, otherwise the parameters values won't change.

The signs of parameter values are set at the highest order digit. For example, if a parameter's value range is from -5000 to 5000, the sign should be specified in the 5th digit from right to left. If the current value is 100 but -100 is needed, users should press  until the "0100" is displayed and press  or  to select the negative sign.



4 Confirm or cancel setting operation

If parameters values set newly satisfy your application, press to confirm the setting. When “-----” stop flashing, the values set newly will be effective in control process. If the value set does not satisfy your application, press to cancel the setting and go back to step 1.

Note:

1. Parameters values meet some specified ranges; ZD210 servodrive automatically restricts the setting value in these ranges.
2. Set PA-A00 to a specific value before setting parameters; refer to section 5.1 for more information.

3.3.2 Monitoring Menu (dP)

Select “dP---” in the first layer menu and press to enter the second layer. Press the or key to select a specified monitoring menu. Press to read the desired value.

Table 3-1 Monitoring Menu

No.	Name	Symbol	Description	Unit
0	SPEEd	r	Motor rotation speed	rpm
1	PoS-L	P	Low-6-bit of current position	command unit
2	PoS-H	P	High-4-bit of current position	
3	CPo-L	C	Low-6-bit of the command position	command unit
4	CPo-H	C	High-4-bit of the command position	
5	EPo-L	E	Low-6-bit of position offset	command unit
6	EPo-H	E	High-4-bit of position offset	
7	—	—	Undefined	—
8	—	—	Undefined	
9	EnC-L	P	Low-6-bit of feedback positions from servo motor encoders	feedback unit
10	EnC-H	P	High-4-bit of feedback positions from servo motor	

No.	Name	Symbol	Description	Unit
			encoders	
11	En2-L	P	Low-6-bit of feedback positions from external encoders	feedback unit
12	En2-H	P	High-4-bit of feedback positions from external encoders	
13	IA	A	U-phase current value	A
14	Ib	b	V-phase current value	A
15	Cnt	—	Control Mode, PoS: Position Control SPd: Speed Control Tor: Torque Control oL-tor: Open-loop Control	—
16	CS	r	Speed command	rpm
17	I	I	Motor phase current RMS value	A
18	IAd	IAd	Zero-offset value of U-phase current	sampling resolution
19	Ibd	Ibd	Zero-offset value of V-phase current	sampling resolution
20	trqn	t	Current torque	Nm
21	trq	t	Percentage of current torque and the rated torque	%
22	HF	HF	Slip	Hz
23	InEr	I	The inertia value obtained by automatic motor load inertia adjustment	Kg.m ²
24	InEr-r	I	The inertia percentage obtained by automatic motor load inertia adjustment	%
25	tPon-L	—	Current time elapsed since the servodrive power on	Lower -bit Hours, Minutes, Seconds
26	tPon-H	d		Higher -bit Days
27	tSon-L	—	Current time elapsed since the	Lower -bit Hours, Minutes, Seconds

No.	Name	Symbol	Description		Unit
28	tSon-H	d	servo motor is in drive status	Higher-bit	Days
29	APon-L	—	Total power on time of the servodrive	Lower-bit	Hours, Minutes, Seconds
30	APon-H	d		Higher-bit	Days
31	ASon-L	—	Total drive status time of the servo motor	Lower-bit	Hours, Minutes, Seconds
32	ASon-H	d		Higher-bit	Days
33	ItP	C	Temperature of the internal IPM module		°C
34	GEAr	n	Group number of the gear box		—
35	SSPd	r	Spindle speed When no external encoders are used, it shows motor speed calculated through gear ratio (same symbol as motor speed). When external encoders are used, it shows external encoder speed (same symbol as external encoder speed).		rpm
36	NQ	q	Quality factor of the trap filter		—
37	SPRI	C	Elastic coefficient of servo system		Nm/rad
38	DAP	B	Damp coefficient of servo system		Nm/rad/s
39	oE	E	Spindle orientation error		0.01°
40	or	r	Spindle orientation gear ratio		0.01
41	bUS-Pd	t	Synchronizing period of servo bus		Microseconds (us)
42	bUS-Er	nO	Alarm codes about servo bus		—
43	EnC-tP	—	Encoder type		—

No.	Name	Symbol	Description	Unit
44	tAb_L	d	Low-6-bit of the swivel table per revolution	command unit
45	tAb_H	d	High-4-bit of the swivel table per revolution	
46	Enr_L	E	Low-6-bit of the absolute encoder's extended multi-turn value	revolution
47	Enr_H	E	High-4-bit of the absolute encoder's extended multi-turn value	
48	EtP	C	Internal temperature	°C
49	rEE	P	Position deviation between servo motor encoder and external encoder	command unit
50	Err	Er	Current error code	—
51	Er1	Er	1 st error code recently	—
52	Er2	Er	2 nd error code recently	—
53	Er3	Er	3 rd error code recently	—
54	Er4	Er	4 th error code recently	—
55	Er5	Er	5 th error code recently	—
56	Er6	Er	6 th error code recently	—
57	Er7	Er	7 th error code recently	—
58	Er8	Er	8 th error code recently	—
59	Er9	Er	9 th error code recently	—
60	AL	AL	Alarm code	—
61	oF-P1	F	Servo motor encoder's current position based on its 'Z' signal	feedback unit
62	oF-d1	F		degree
63	oF-P2	F	Servo motor encoder's current position per revolution, based on the orientation reference point. 1. If the orientation parameter is set to servo motor encoder, that is the	feedback unit
64	oF-d2	F		degree

No.	Name	Symbol	Description	Unit
			F00 parameter is set to 0, the value in this item is valid. 2. If the orientation reference point is set to 'Z' signal of the encoder, that is the F01 parameter is set to 0, this item displays the same as oF-P1 and oF-d1.	
65	oF-P3	F	External encoder's current position based on its 'Z' signal	feedback unit
66	oF-d3	F		degree
67	oF-P4	F	External encoder's current position per revolution, based on the orientation reference point. 1. If the orientation parameter is set to external encoder, that is the F00 parameter is set to 1, the value in this item is valid. 2. If the orientation reference point is set to 'Z' signal of the encoder, that is the F01 parameter is set to 0, this item displays the same as oF-P3 and oF-d3.	feedback unit
68	oF-d4	F		degree
69	—	—	Undefined	—
70	—	—	Undefined	—
71	In1	I	DI signal input 0 ~ 15 bits (Note 1)	—
72	In2	I	DI signal input 16 ~ 31 bits (Note 1)	—
73	In3	I	DI signal input	—

No.	Name	Symbol	Description	Unit
			32 ~ 47 bits (Note 1)	
74	In4	I	DI signal input 48 ~ 63 bits (Note 1)	—
75	oUt1	o	DO signal output 0 ~ 15 bits (Note 2)	—
76	oUt2	o	DO signal output 16 ~ 31 bits (Note 2)	—
77	UbUS	U	DC busbar voltage	V
78	FRE	F	Vibration frequency	Hz
79	d-no	—	Development version	—
80	UEr	—	Extended software version	—
81	ASIC	n	Hardware version	—
82	ASIC-S	n	Extended hardware version	—

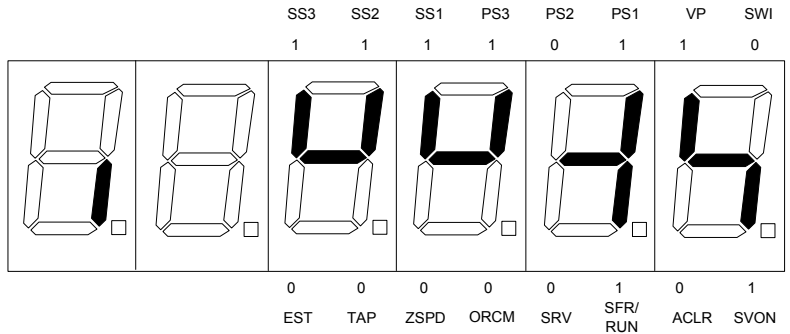
Note 1:

The DI input signals from external controllers as shown in the following table.
Please refer to section 5.2.9 for more information.

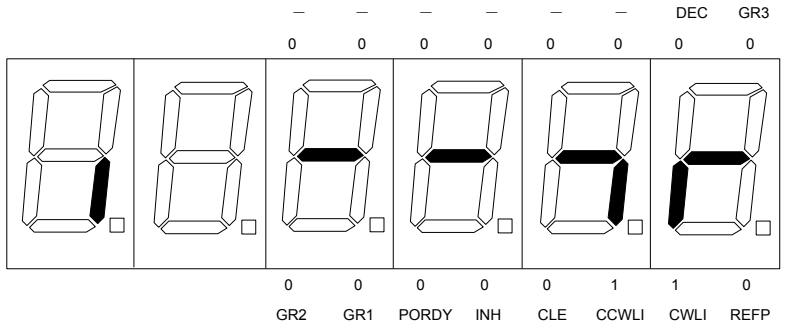
Table 3-2 DI signals

in4	63~56	—	—	—	—	—	—	—	—
	55~48	—	—	—	—	—	—	—	—
in3	47~40	—	—	—	—	—	—	—	—
	39~32	—	—	—	—	—	—	—	—
in2	31~24	—	—	—	—	—	—	DEC	GR3
	23~16	GR2	GR1	PORDY	INH	CLE	CCWLI	CWLI	REFP
in1	15~ 8	SS3	SS2	SS1	PS3	PS2	PS1	VP	SWI
	7 ~ 0	EST	TAP	ZSPD	ORCM	SRV	SFR / RUN	ACLR	SVON

in1 item displays bits 0 to 15 as shown in the following figure, bits SVON, SFR/RUN, VP, PS1, PS3, SS1, SS2 and SS3 are 1, others are 0.



in2 item displays bits 16 to 31 as shown in the following figure, bits CWLI and CCWLI are 1, others are 0.



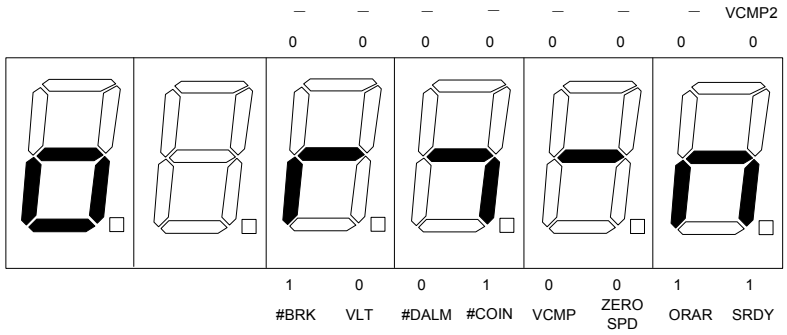
in3 item displays bits 32 to 47, in4 item displays bits 48 to 63.

Note 2:
The DO output signals to external controllers as shown in the following table. Please refer to section 5.2.9 for more information.

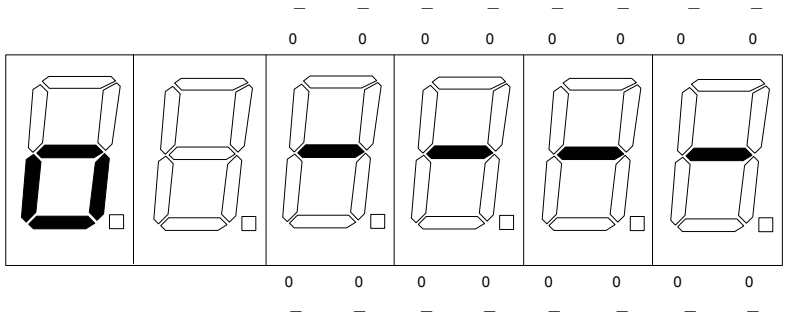
Table 3-3 DO signals

oUt2	31~24	—	—	—	—	—	—	—	—
	23~16	—	—	—	—	—	—	—	—
oUt1	15~ 8	—	—	—	—	—	—	—	VCMP2
	7 ~ 0	#BRK	VLT	#DALM	#COIN	VCMP	ZEROSPD	ORAR	SRDY

oUt1 item displays bits 0 to 15 as shown in the following figure, bits SRDY, ORAR, # COIN and # BRK are 1, others are 0.



oUt2 item displays bits 16 to 31 as shown in the following figure, all bits are 0.



3.3.3 Parameter Management (EE)

Parameters in ZD210 servodrive are saved in EEPROM. Two independent regions are used to manage parameters, the parameter region and backup region

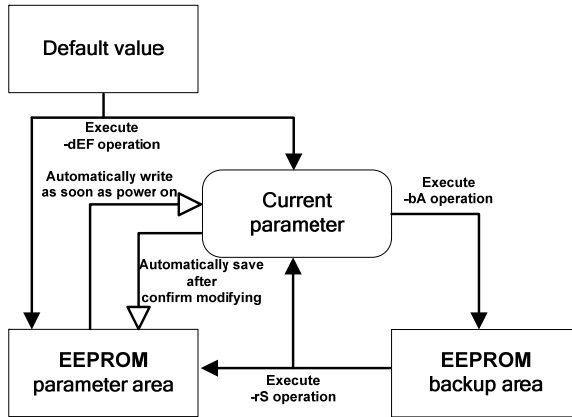


Figure 3-3 Parameter Management

■ Parameter region

It is used to save all parameters used (not including volatile parameters). When power on, ZD210 servodrive reads these parameters into memory. After modifying one or more parameters, the corresponding parameters in this region will be written with new values. Performing the ‘dEF’ operation will initialize parameter region to the factory-set values.

■ Backup region

It is used to save the current using parameters. Perform ‘bA’ or ‘rS’ operation to read or write this region.

There are three operations in parameter management.

1. **dEF** Perform the ‘dEF’ operation to initialize all parameters to factor-set values, except for the parameters shown in table 3-4.

Table 3-4 Parameters that ‘dEF’ operation won’t change

Parameters	Description
PA-A00	Operation password
PA-A01	Servo motor type
PA-A41	Servo motor encoder installation direction
PA-A63	Servo motor U,V,W phase sequence
PA-A70	KSN servo bus slave address
PA-A80	External encoder installation direction

PA-Bxx (parameters in group B)	Servo motor parameters set by users, or set by automatic motor parameters adjustment.
-----------------------------------	---

2. **bA** Save all parameters except for volatile ones in backup region. Perform the 'bA' operation when the following situations happen.
 - (1) When debugging servodrives, save the current setting of parameters which are properly match your application before trying to change some parameters to achieve better performance.
 - (2) When a set of parameters has been obtained after debugging servodrives, perform the 'bA' operation to save them. Once some parameters are changed, perform the 'rS' operation will save these parameters into memory again.
3. **rS** Load parameters except for volatile ones in backup region into memory. The current using parameters' values will lose.

Table 3-5 Volatile Parameters

Parameters	Description
PA-A00	Operation password
PA-A13	Servodrive force enable
PA-A60	Operation method when in JOG mode

Example: Save parameters in backup region

Select the 'bA' menu and keep pressing the **Enter** key until '-----' is displayed, then ZD210 servodrive save the current using parameters into backup region in EEPROM, if the saving operation succeed after several seconds later, 'FINISH' is displayed. If the saving operation fails, 'Er' code is displayed. Press the **Esc** key to return to the upper layer menu, as shown in the following figure.

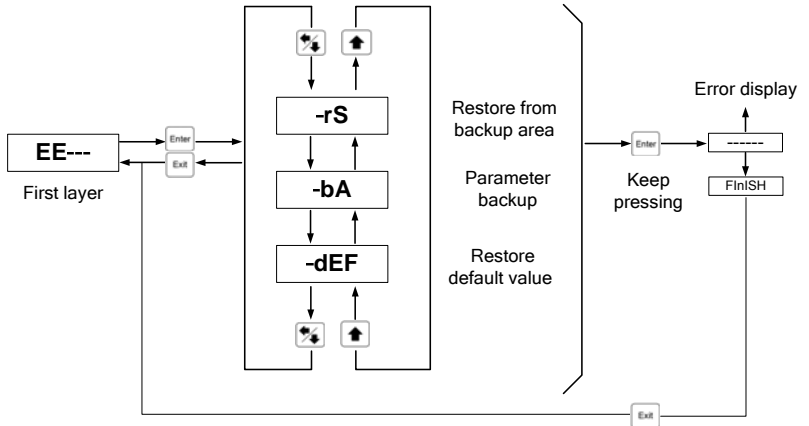


Figure 3-4 -bA Operation

Note:

- For safety, 'dEF' and 'rS' operations cannot be performed when the motor is running; 'bA' operation is not subject to this restriction. If the 'dEF' or 'rS' operation succeed, the LEDs will display 'Er 015', please restart the servodrive.

3.3.4 Adjusting menu (tU)

Select 'tU---' in the first layer menu and press the key to enter the second layer. Press the or key to select a specified adjusting menu. Press the key to perform the operation. There are 6 operations in adjusting menu.

- **tU1:** Automatically adjust parameters associated with servo system performance such as rotary inertia, sliding friction etc.
- **tU2:** Use 'tU2' to set the origin position of motor equipped with absolute encoder. After the 'tU2' operation, the current position is defined as the origin position. The position data based on the specified origin are transmitted to host controller. The origin position is nonvolatile. This function is not available when driving motor equipped with increasing encoder.
- **tU3:** Automatic motor parameters adjustment. If the servo motor you use beyond the ones that ZD210 servodrives have given, and then this operation must be performed. When this operation succeeds, the results will

automatically set in parameters PA-B10 to PA-B18.

- **tU4:** Clear the multi-turn data of absolute encoder. 'A-tU4' operation for servo motor encoder and 'b-tU4' operation for external encoder.
- **tU5:** Automatic parameters adjustment for spindle orientation.
- **Tu6:** When using external encoders, if full position closed-loop is enabled, encoder direction parameter (A80) should be set correctly and gear ratio F2x/F3x should be set relatively precise. New added TU6 operation can set these 3 parameters automatically.

Besides, to simplify machine debugging procedures, TU6 operation can check UVW phase sequence of motors automatically, and save the result to parameter A63.

When performing TU6, motor will get electrified and rotate at a speed of about 300rpm. Several seconds or dozens of seconds later, motor stops. If self-learning succeeds, A80 and F2x/F3x (selected by input signals GR3~GR1) is set and saved automatically, otherwise, Er070 alarm occurs.

【Recommended machine debugging procedures】

Basic:

- (1)Set A01 to select motor model (use built-in motor parameters)
- (2)Set A57 to select external encoder model (if there is no external encoders, this operation is unnecessary)
- (3)Perform TU6

Senior:

- (4)Perform TU1 to set load inertia ratio A56, system rigidity A55 and frequency of trap filter D03/D04/D43/D44
 - (5)Set full position closed-loop parameters C11/C12/C13
 - (6)Set gain shift parameters F64~F70
- **tU9:** Software reset. When 'Er 015' occurs, you may restart the servodrive manually or perform the 'tU9' operation.

Considerations for each operation as shown in the following table:

Table 3-6 tU Operation Considerations

Operation	Remarks		Consideration
tU1	<ol style="list-style-type: none"> 1. Servo motor must stop running. 2. Servo motor is connected with normal load. 		<ol style="list-style-type: none"> 1. Ensure that motor rotation does not result in collisions or overtravel. 2. If significant changes of the load inertia occur, or parameter A56 is set to the default value, please perform tU1 operation. 3. When the equipment debugging, set the A91.2 parameter to 0, in order to prevent vibration caused by big load inertia and low rigidity of the servo system.
tU2	Servo motor must stop running.		
tU3	b-tU3	<ol style="list-style-type: none"> 1. Set the A01 parameter to 0, and ensure the servo motor is not power-on. 2. Do not connect the servo motor to the load. 3. Input parameters B00 to B07 refer to the motor nameplate. 	<ol style="list-style-type: none"> 1. Do not connect the servo motor to the load. 2. Ensure that the servo motor is installed firmly. 3. The servo motor will rotate at high speed, reaching the rated speed, operator please stay off the motor to prevent injury. 4. Parameters B01, B02 and B03 must be set accurately.
tU4	A-tU4	Clear the multi-turn data of motor absolute encoders. Ensure that the servodrive is not in drive status.	After the tU4 operation, the absolute encoder's feedback position change. If the CNC system using absolute position, please perform zero point return operation.
	b-tU4	Clear the multi-turn data of external absolute encoders. Ensure that the servodrive is not in drive status.	
tU5	Properly set the spindle orientation parameters.		
tU6	Automatically check UVW phase sequence, external encoder direction and gear ratio		
tU9	Ensure that the servo motor is off.		

Example: Automatic motor load inertia adjustment

Select the tU1 menu and keep pressing the **Enter** key until '-----' is displayed, then ZD210 servodrives perform automatic motor load inertia adjustment, if the operation succeed after several seconds later, 'FinISH' is displayed. If the operation fails, alarm codes will display. Press the **Esc** key to return to the upper layer menu, as shown in the following figure.

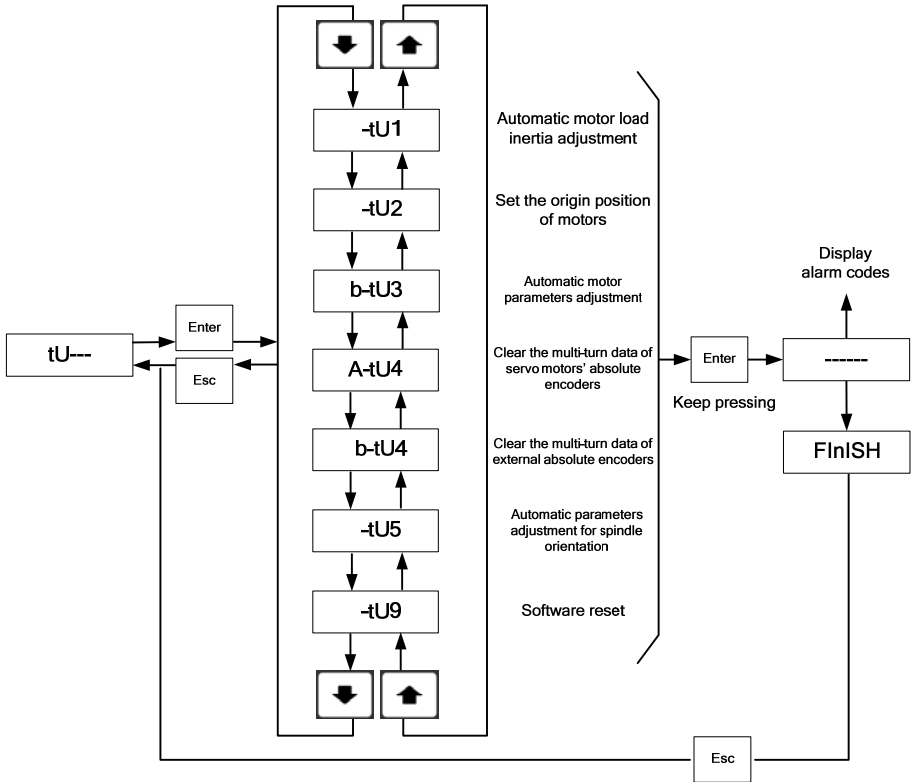
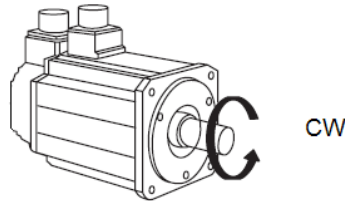


Figure 3-5 tU Operations

4. Run

Description of the motor rotation direction

Watching a motor from the axis head, the counterclockwise direction is defined as the positive direction (CW). Reversely, the clockwise direction is defined as the negative direction (CCW)



- ◆ The definition of CW and CCW rotation directions in all parts of this manual is the same as the above descriptions, regardless of the parameters settings.
- ◆ If the motor rotation direction contrary to the above definition, modify the PA-A05 parameter.

4.1 Grounding

Both servodrives and motors should be put to earth reliably. It is recommended to keep the protection grounding terminals of servodrives and those of control cabinets together to prevent electrical shocking. The PWM technology used in driving may result in interfere to the whole servo system including servodrives and cables. To meet the criterion of EMC, grounding wires should be as strong as possible and the grounding resistors should be as small as possible.

4.2 Working Sequence

4.2.1 Power On Sequence

- 1 Supply power to the servodrive through magnetic contactor.
- 2 About two seconds after power on, servo ready signal (SRDY) is ON, which means that the servodrive is ready to receive servo enable signal (SVON) from host controllers. After receiving SVON signal successfully, servodrives are in RUN status. Servodrives and servo motors will in free status if SVON signal is not received or some alarms are issued.
- 3 Frequently turning on and off circuits' power may damage the soft start

circuits and braking circuits. The turning on and off frequency should be less than 5 times per hour and 30 times per day. After clearing of a fault about overheat of servodrives or motors, turn on the power at least 30 minutes later to let them cool down.

4.3 Trial Operation

4.3.1 Check before Trial Operation




Check the following items before servodrives power on.

- Wiring is correct and firm.
- Power voltage is correct.
- Power cables to servodrives and motors have no short circuits and are put to earth correctly.
- Control signals are connected correctly.
- The polarity and level of input and output signals are correct.
- The encoders' signals are connected correctly.
- Do not drive any load in trial operation.

In trial operation, users can perform easy steps or advanced steps as described below.

Easy Steps	Advanced Steps
<ul style="list-style-type: none"> ■ Simple operation. ■ Do not check the servo motor U,V,W phase sequence. 	<ul style="list-style-type: none"> ■ More operation steps. ■ Manually or automatically check the motor U,V,W phase sequence, motor vibration won't happen. ■ If parameters in group B are used, after the trial operation is completed, servodrives can achieve good performance.

4.3.2 Easy Steps

Step	Operation and Description
1	Turn on the power supply, if the servodrive displays error codes, check the wiring.
2	Perform the 'dEF' operation in EE menu to set all parameters to factory-set values.
3	<p>Set parameter PA-A00 to 385, and then set PA-A01 to a proper motor type.</p> <p>If the servo motor you use beyond the ones that ZD210 servodrives have given, set PA-A01 to 0, and then input parameters B00 to B07 refer to the motor nameplate, B01, B02 and B03 must be set accurately.</p> <p>After you input parameter PA-B00, parameters B10 to B18 will be set automatically.</p> <p>Parameter PA-B02 is the motor pole pair, for example, 4-pole motor's pole pair is 2.</p>
4	<p>Manually rotate the motor shaft, and check the motor speed in dP menu.</p> <p>Check the encoder connection if the speed display is abnormal.</p>
5	<p>Press the  key, and then the servo motor is in drive status.</p> <p>If 'Er 006', 'Er 012', 'Er 044' or 'Er 045' alarm occurs, it shows that motor U,V,W phase sequence disorder, please inverse the value of parameter PA-A63.</p> <p>Press the  or  key, if the motor rotates stably with 50 to 100 rpm speed, the trial operation finish, otherwise please perform the advanced steps</p>

4.3.3 Advanced Steps

Sequential perform the following three parts of operations.





Part 1, Confirm the motor encoder wiring and the motor U,V,W phase sequence.
When you first use the servodrive after wiring, this part of operations must be performed.

Step	Operation and Description
1	Verify that emergency stop input signal (signal EST) in effect. Turn on the power supply, if the servodrive displays error codes, check the wiring.
2	Perform the 'dEF' operation in EE menu to set all parameters to factory-set values.
3	Set parameter PA-A00 to 385, and then set PA-A01 to a proper motor type. If the servo motor you use beyond the ones that ZD210 servodrives have given, set PA-A01 to 0, and then input parameters B00 to B07 refer to the motor nameplate, B01, B02 and B03 must be set accurately. After you input parameter PA-B00, parameters B10 to B18 will be set automatically. Parameter PA-B02 is the motor pole pair, for example, 4-pole motor's pole pair is 2. If you set PA-A01 to 0, then go to part 2, otherwise perform the following steps.
4	Set parameter PA-A60 to 'UF'. Disable the input signal EST.
5	Check the motor speed in dP menu. Press the <input type="button" value="JOG"/> key, and then the servo motor starts rotating. If the display speed is negative, press the <input type="button" value="JOG"/> key to stop the motor, and then inverse the value of parameter PA-A63. Make the motor start to rotate again. If the display speed is positive, then go to part 3.

Part 2, Automatic motor parameters adjustment

If you set PA-A01 to 0, this part of operations must be performed.

Step	Operation and Description
1	Perform b-tU3 operation, the automatic motor parameters adjustment. Please refer to section 5.2.16 for more information.

Part 3, Confirm the closed-loop servo system is operating normally	
Step	Operation and Description
1	<p>Set parameter PA-A60 to 'CON', press the  key, and then the servo motor starts rotating.</p> <p>Each time when users press the  or  key, the motor speed will change with a user-defined value, this value is set in parameter PA-D24.</p> <p>The maximum command speed is set in parameter PA-D05.</p>
2	Enter the dP menu to check if the motor speed is consistent with the setting values.
3	Press the  key to stop the motor, the trial operation finish.

4.4 Adjustment and Setting

4.4.1 Select Motor Model

ZD210 servodrive can be used to drive dozens of models of motors. Select the correct motor model and set it in PA-A01. Please refer to section 4.5 for more information.

4.4.2 Electronic Gear Ratio and Spindle Gear Box

Electronic gear ratio is used to set the proportional relationship of command pulses and actual movements, valid only when in position control mode.

When the motor shaft and the spindle transmission ratio is not 1:1, the spindle gear box function is needed.

In position/speed control mode, if you do not use the spindle gear box function, set parameter PA-A90.0 to 1.

If worktables are equipped with the following structure, the motor shaft and the spindle transmission ratio is 1:1, set the spindle gear box parameters to factory-set values, and the electronic gear ratio is calculated as follows:

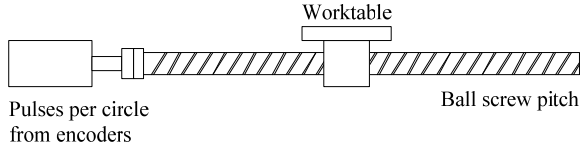


Figure 4-1 Screw Connection

$$\frac{C01}{C02} = \frac{\text{Pulse's number per revolution}}{\text{Ball screw pitch (mm) x 1000}} \times \text{The length per command pulse (um)}$$

Example 1 :

When using 1024 p/r encoders, 4096 pulses will be received per revolution. In this case, the typical electronic gear ratio is as follows:

$\frac{C01}{C02}$	Ball screw pitch				
	4 mm	5 mm	6 mm	8 mm	10 mm
1μm	$\frac{128}{125}$	$\frac{512}{625}$	$\frac{256}{375}$	$\frac{64}{125}$	$\frac{256}{625}$

Example 2:

When using 2500 p/r encoders, 10000 pulses will be received per revolution. In this case, the typical electronic gear ratio is as follows:

$\frac{C01}{C02}$	Ball screw pitch				
	4 mm	5 mm	6 mm	8 mm	10 mm
1μm	$\frac{5}{2}$	$\frac{2}{1}$	$\frac{5}{3}$	$\frac{5}{4}$	$\frac{1}{1}$

If worktables are equipped with the following structure, the motor shaft and the spindle transmission ratio is not 1:1, modify the spindle gear box parameters, set PA-F20 to K1 value, set PA-F30 to K2 value.

The electronic gear ratio is calculated as follows:

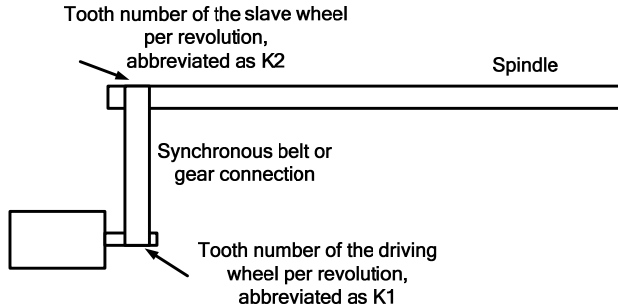


Figure 4-2 Synchronous Belt or Gear Connection

$$\frac{C01}{C02} = \frac{\text{Pulse's number per revolution}}{\text{Command pulses that spindle needs per revolution}}$$

Example:

When using 1024 p/r encoders, 4096 pulses will be received per revolution, and K1 is 50, K2 is 100, if the spindle needs 10000 command

pulses per revolution, then $\frac{C01}{C02} = \frac{256}{625}$, set PA-F20 to 50, set PA-F30 to

100, and choose group 1 of the spindle gear box.

4.4.3 Parameters related to the Performance of Servo System

- Automatic motor parameters adjustment

Parameter PA-A56 is the load inertia ratio, it significantly affect the performance of the servo system. For the adjustment of this parameter, please refer to section 5.2.17 for more information.

- Adjust the rigidity of servo system

The rigidity of the system affects the response time and anti-disturbance ability. To adjust the rigidity of servo systems please refer to section 5.2.5 for more information.

- Shorten positioning time

In position control mode, speed feedforward enables you to shorten the positioning time. The default value of parameter PA-C03 is 0; increase it to shorten the positioning time.

- Vibration adjustment

Mechanical vibration affects the performance of the servo system. In order to reduce the mechanical vibration please refers to chapter 7.6 for more information, or you can perform the following operations.

(1) If the load rigidity is low or the inertia is too big, servo systems may vibrate.

 Increase the value of parameter PA-D02 to reduce vibration.

(2) If there exist resonant points, adjust the value of parameter PA-D03 and PA-D04 to suppress resonance.

4.4.4 Start-stop Characteristic Adjustment

- Load inertia and start-stop frequency

When the start-stop frequency is relative high, the available start-stop frequency range should be confirmed which depends on motor types, load inertias, rotation speeds and some other elements.

- Motor models and start-stop frequency

The available start-stop frequency range is different from motor models which may be used in variant applications. Please refer to motors' manual for more information.

■ Adjusting method

Generally, the load inertia should be less than 20 times of the motor rotor inertia. When driving motors with too large load inertia, ZD210 servodrive may issue some errors because of the regenerative energy during deceleration process. In this cases, perform the following operations.

- (1) Reduce the motor rotation speed.
- (2) Increase the acc./dec. time of CNC.
- (3) Install external braking resistors.
- (4) Change a motor with bigger inertia.

4.5 Motors Specifications

In order to adjust parameters finely, when A98.2 is set to 1, if A01 is set to non-zero value manually, built-in motor parameters is copied to group B and saved. Hereafter, set A01 to 0, modify and apply motor parameters of group B.

This function is disabled by default (A98.2=0).

Table 4-2 Motors Specifications

No.	Model	Encoder Type
0	Other AC asynchronous servo motors (Need to modify parameters in group B)	Choose an encoder type in parameter PA-B01
1	KND-43P7ZGB15	Encoder/resolver 1024p/r
2	KND-45P5ZGB15	Encoder/resolver 1024p/r
3	KND-47P5ZGB15	Encoder/resolver 1024p/r
4	KND-ZJY-F205/F132-3.7-1500	Encoder/resolver 1024p/r
5	KND-ZJY-F205/F132-5.5-1500	Encoder/resolver 1024p/r
6	KND-ZJY-F205/F132-7.5-1500	Encoder/resolver 1024p/r
11	KND-4011ZGC10	Encoder/resolver 1024p/r
12	KND-4015ZGC15	Encoder/resolver 1024p/r
14	KND-ZJY-F270/F160-11-1500	Encoder/resolver 1024p/r
15	KND-ZJY-F270/F160-15-1500	Encoder/resolver 1024p/r
16	KND-ZJY-F270/F160-18.5-1500	Encoder/resolver 1024p/r
17	KND-ZJY-F270/F160-22-1500	Encoder/resolver 1024p/r
40	MK-DH09-1-19-3.0/3.7-4-1500	Encoder/resolver 1024p/r
41	MK-DH09-2-24-3.7/5.5-4-1500	Encoder/resolver 1024p/r
42	MK-DH10-2-35-5.5/7.5-4-1500	Encoder/resolver 1024p/r
43	MK-DH10-3-48-7.5/11-4-1500	Encoder/resolver 1024p/r
44	MK-DH10-4-71-11/15-4-1500	Encoder/resolver 1024p/r
45	MK-DH13-2-95-15/18.5-4-1500	Encoder/resolver 1024p/r
46	MK-DH13-3-117-18.5/22-4-1500	Encoder/resolver 1024p/r
60	SDS-S81-3.0/3.7-1500/8500-E-4V	Encoder/resolver 1024p/r
61	SDS-S82-3.7/5.5-1500/8500-E-4V	Encoder/resolver 1024p/r
62	SDS-S83-5.5/7.5-1500/8000-E-4V	Encoder/resolver 1024p/r
63	SDS-S84-7.5/11-1500/8000-E-4V	Encoder/resolver 1024p/r
64	SDS-S85-11/15-1500/7000-E-4V	Encoder/resolver 1024p/r
65	SDS-S86-15/18.5-1500/7000-E-4V	Encoder/resolver 1024p/r
66	SDS-S87-18.5/22-1500/6000-E-4V	Encoder/resolver 1024p/r

5. Parameters

5.1 Catalog

5.1.1 Parameter Description

ZD210 servodrive has 7 groups of parameters, they are A, B, C, D, E, F and P. Parameters are numbered from 00 to 99 of each group.

Group	Description
A	Basic parameters, including operation password, motor model, run mode, rigidity, etc.
B	User-set motor parameters. If the servo motor you use beyond the ones that ZD210 servodrives have given, set PA-A01 to 0, then input parameters B00 to B07 refer to the motor nameplate, and perform the automatic motor parameters adjustment operation.
C	Parameters used in position control mode, including position loop gain, electronic gear ratio, speed feedforward, etc.
D	Parameters used in position control mode or speed control mode, including speed loop gain, filter, 'S' curve, etc.
E	Application parameters, such as the torque servo parameters.
F	Application parameters, such as the spindle orientation and spindle gear box parameters.
P	Application parameters, such as the input/output parameters.

5.1.2 Introduction

Take parameter PA-A01 as an example:

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A01	Motor Model	Current motor model. Please refer to section 4.5 for more information.	0~ 12	1	—	× B

No.	The number of parameters
Name	Parameter name
Description	Meanings of the parameters
Setting Range	Setting range of the parameters
Factory Setting	Factory-set value of the parameters

Unit	Parameter Units
Setting	√ : Allowed to change this parameter regardless of the servo motor status.
Properties	× : Not allowed to change this parameter when the servo motor is powered on.
	— : Not allowed to change this parameter
	⊙ : Need to restart the servodrive when this parameter changed.
Operation	A: Set parameter PA-A00 to 315 or a higher authority value.
Authority	B: Set parameter PA-A00 to 385 or a higher authority value.
	C: Parameter PA-A00 need to be set to a specific value, please contact KND technical service center for more information.

5.1.3 Basic Parameters (Group A)

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A00	Operation password	A: 315 B: 385 C: Please contact KND technical service center for more information.	0~ 65535	315	—	√
A01	Motor model	Current motor model. Please refer to section 4.5 for more information.	0~ 12	1	—	× B
A02	Software version	Servodrive software version, cannot be changed. There is also an extended software version locates in the 'UER' item in dP menu.	—	—	—	— A
A03	Default display item	The default display item in dP menu when power-on.	0~ 55	0	—	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A04	Control mode	PoS: Position control SPd: Speed control tor: Torque control P-S: Position/speed control	—	P-S	—	× A
A05	Motor rotation direction	0: Positive direction 1: Negative direction	0~1	0	—	√ A
A07	Emergency stop method	The servo motor's emergency stop method when the emergency stop signal (EST) is valid. 0: Inertia stop 1: Deceleration stop	0~1	1	—	√ A
A08	Normal stop method	The servo motor's stop method when there is no fault. 0: Inertia stop 1: Deceleration stop	0~1	1	—	√ A
A10	Time to start mechanical brake	In inertia stop method, this parameter represents the time to start mechanical brake after servo motor is powered off. Parameter PA-A10 is valid when PA-A90.3 is set to 1.	0~ 5.000	0.500	s	√ A
A11	Motor speed to start mechanical brake	In inertia stop method; this parameter represents the motor speed to start mechanical brake after servo motor is powered off. Parameter PA-A11 is valid when PA-A90.3 is set to 1.	0~ 1000	100	rpm	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A12	Servo motor OFF delay time	In deceleration stop method, this parameter represents the time interval between mechanical brake start operating and servo motor is powered off. Parameter PA-A12 is valid when PA-A90.3 is set to 1.	0~ 10.000	0.500	s	√ A
A13	Servodrive force enable	Automatically set to 'oFF' when emergency stop input signal (signal EST) in effect or failure occurs. Automatically set to 'oFF' after restart.	on ~ oFF	oFF	—	√ B
A14	Overvoltage alarm value	Overvoltage alarm value of the DC busbar (software detection)	100 ~ 800	750	V	√ A
A15	Under-voltage alarm value	Under-voltage alarm value of the DC busbar (software detection)	100 ~ 800	300	V	√ A
A16	The treatment when power line open phase	The treatment when power line open phase occurs AL: display a warning Er: display an error no: ignore	AL Er no	AL	—	√ A
A17	Serial communication baud rate	Modify this parameter in serial communication	0~ 120.0	38.4	Kbps	√ A
A40	Slave address in Modbus	Slave address in Modbus protocol	1~ 247	10	—	× ⊙ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A41	Motor encoder installation direction	Motor encoder installation direction 0: Normal 1: Reverse	0~1	1	—	× A
A42	Maximum speed in 'tU1' operation	The maximum motor speed in 'tU1' operation.	500 ~ 1500	500	rpm	√ A
A43	Maximum revolution in 'tU1' operation	The maximum revolution in 'tU1' operation.	2~8	6	rev	√ A
A47	Maximum continuous operating time of the braking resistor	If the continuous operating time of the braking resistor exceeds the maximum time, 'Er 014' occurs.	500 ~ 8000	5000	ms	√ A
A48	Filter time of the DI input signals	If the input signals receive noise, increase this value.	0 ~ 1000	16	ms	√ A
A52	Motor rotation direction limit	0: Free 1: Prohibit the negative direction rotation 2: Prohibit the positive direction rotation	0~2	0	—	× A
A53	User-defined motor encoder pulse number	If PA-B01 is set to 'E-all', set the user-defined motor encoder pulse number in this parameter.	64 ~ 32768	1024	—	× A ⊙
A54	User-defined external encoder pulse number	If PA-A57 is set to 'E-all', set the user-defined external encoder pulse number in this parameter.	64 ~ 32768	1024	—	× A ⊙

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A55	System rigidity	Higher rigidity of servo system and quicker response will be obtained by increasing the value of PA-A55. It may cause vibration when the rigidity is too high.	-3~12	-1	—	√ A
A56	Load inertia ratio	The value of PA-A56 represents the ratio of loads' inertia to motors' inertia. Performing the 'tU1' operation will automatically change this value.	50 ~ 3000	600	%	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
57	External encoder type	<p>E0000: None</p> <p>E-aLL: User-defined external encoder pulse number</p> <p>E1024: Incremental encoder 1024 p/r</p> <p>E2048: Incremental encoder 2048 p/r</p> <p>E2500: Incremental encoder 2500 p/r</p> <p>E4096: Incremental encoder 4096 p/r</p> <p>A1716: 17-bit absolute encoder with 16-bit multi-turn counting</p> <p>A1712: 17-bit absolute encoder with 12-bit multi-turn counting</p> <p>A1700: 17-bit absolute encoder without multi-turn counting</p>	E0000 ~ A1700	E0000	—	<p>×</p> <p>⊙</p> <p>A</p>
A58	Continued operating time of the cooling fan	<p>Continued operating time of the cooling fan after the servo motor is powered off.</p> <p>Parameter PA-A58 is valid when PA-A91.1 is set to 0.</p>	0~ 1000	30	s	<p>√</p> <p>A</p>

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A60	Operation method in JOG mode	STSP: Start-stop operation CON: Continuous operation UF: VF debugging operation Automatically set to 'CON' after restart.	—	CON	—	√ A
A61	Output voltage in VF debugging method	When PA-A60 is set to 'UF, this parameter represents the output voltage in VF debugging method.	0~ 100	50	V	√ A
A62	Motor speed in VF debugging method	When PA-A60 is set to 'UF, this parameter represents the motor speed in VF debugging method.	0~ 1000	200	rpm	√ A
A63	Motor U,V,W phase sequence	0: Normal 1: Reverse	0~1	0	—	× A
A66	Overcurrent alarm value (software detection)	ZD210-42P2 --- 9.5A ZD210-43P7 --- 16.0A ZD210-45P5 --- 25.0A ZD210-47P5 --- 32.0A ZD210-4011 --- 48.0A ZD210-4015 --- 64.0A If the motor phase current exceeds the value in PA-A66, 'Er 012' occurs.	0~ 500.0	9.5/ 16.0/ 25.0/ 32.0/ 48.0/ 64.0	A	√ A
A70	Servo bus (KSN) node address	It specifies the node address of a servodrive in the Servo bus (KSN) system. Corresponding to the setting in host controllers.	1~16	4	—	× ⊙ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A71	Servo bus (KSN) monitoring item 1	Choose a monitoring item in servo bus communication.	0~999	517	—	√ A
A72	Servo bus (KSN) monitoring item 2	choose a monitoring item in servo bus communication	0~999	514	—	√ A
A80	External encoder installation direction	External encoder installation direction 0: Normal 1: Reverse	0~1	0	—	× A
A81	Mechanical brake release delay time	Time interval between servo motor is powered on and mechanical brake release. Parameter PA-A81 is valid when PA-A90.3 is set to 1.	0~5.000	0.400	s	√ A
A82	Speed loop continuous saturation time	If the actual motor speed is less than the command speed continuously, and the time exceeds the value in parameter PA-A82, 'Er 006' occurs. If the load is too big, at the time of acceleration and deceleration, increase this value.	0~20000	10000	ms	√ A
A83	Maximum motor speed when spindle shift	When Spindle shift, if the motor speed exceeds the value in parameter PA-A83, 'Er 049' occurs.	0~1000	100	rpm	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A90	Functional parameter 1	◆ A90.0 Spindle gear box 0: Valid 1: Invalid	0000 ~ FFFF	0110	—	× A
		◆ A90.1 Vibration frequency detection 0: Invalid 1: Valid				
		◆ A90.2				
		◆ A90.3 External brake 0: Invalid 1: Valid				
A91	Functional parameter 2	◆ A91.0 Overtravel protection 0: Invalid 1: Valid	0000 ~ FFFF	0000	—	× A
		◆ A91.1 Cooling fan operating method 0: Intermittent 1: Continuous				
		◆ A91.2 The application method of 'tU1' operation 0: Manual 1: Automatic				
		◆ A91.3				
A92	Functional parameter 3	◆ A92.0	0000 ~	1000	—	× A
		◆ A92.1				

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
		<ul style="list-style-type: none"> ◆ A92.2 Motor U,V,W phase sequence monitoring 0: Invalid 1: Valid 	FFFF			
		<ul style="list-style-type: none"> ◆ A92.3 				
A93		<ul style="list-style-type: none"> ◆ A93.2 Function switch of spindle interlock 	0 ~ 1	0	—	√ A
		<ul style="list-style-type: none"> ◆ A93.3 Position deviation detection 0: Valid 1: Invalid 	0 ~ 1	0	—	√ A
A94	Functional parameter 4	<ul style="list-style-type: none"> ◆ A94.0 	0000 ~ FFFF	2000	—	× A
		<ul style="list-style-type: none"> ◆ A94.1 				
		<ul style="list-style-type: none"> ◆ A94.2 				
		<ul style="list-style-type: none"> ◆ A94.3 Field weakening method of asynchronous motors 0: Typical method 1: Improved method 1 2: Improved method 2 				
A95	Functional parameter 5	<ul style="list-style-type: none"> ◆ A95.0 Spindle orientation method 0: Normal orientation 1: Rapid orientation 	0000 ~ FFFF	2000	—	× ⊙ A
		<ul style="list-style-type: none"> ◆ A95.1 				
		<ul style="list-style-type: none"> ◆ A95.2 				
		<ul style="list-style-type: none"> ◆ A95.3 Class of load inertia ratio (0: milling machine, 1: small-sized lathe, 2: lathe; setting range: 0~2) 				

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
A96	Functional parameter 6	◆ A96.0 Acceleration detection 0: Invalid 1: Valid	0000 ~ FFFF	0001	—	× ⊙ A
		◆ A96.1 Speed filter in speed control mode; please refer to parameter PA-D09 for more information. 0: Invalid 1: Valid				
		◆ A96.2 Setting spindle reference point with servo bus commands (0: Closed (default) 1: Open)	0~1	0	—	√A
		◆ A96.3 When external encoders are installed, to obtain the initial position by 0: The motor encoder 1: The external encoder	0~1	0	—	× ⊙ A
A97	Functional parameter 7	◆ A97.0	0000	0000	—	×
		◆ A97.1	~			⊙

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
		<p>◆ A97.2 Voltage overmodulation mode 1~3 can increase maximum output power of motor, but may cause abnormal voice when accelerating. If improving motor accelerating ability is needed, try to shift mode 1~3 gradually; when over large voice or overcurrent happens, decrease this parameter value gradually or set it to 0.</p> <p>◆ A97.3 Overcurrent detection method 0: Rapid detection 1: Filtered detection</p>	FFFF			A
A98	Functional parameter 8	<p>■ A98.0 IGBT temperature detection 0: Valid 1: Invalid</p> <p>■ A98.1 Internal temperature detection 0: Valid 1: Invalid</p> <p>■ A98.2 Function switch for opening built-in motor parameters</p>	0000 ~ FFFF	0000	—	√ A
			0 ~ 1	0	-	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
		■ A98.3 Function switch for b-tU3 inner measurement	0 ~ 1	0	-	√ A

5.1.4 User-set Motor Parameters (Group B)

The 'dEF' operation does not affect parameters in group B.

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
B00	Rated power	Refer to the motor nameplate Motor rated power After you input parameter PA-B00, parameters B10 to B18 will be set automatically.	1.0 ~ 15.0	3.7	KW	× A
B01	Motor encoder type	Refer to the motor nameplate E-aLL: User-defined motor encoder pulse number E1024: Incremental encoder 1024 p/r E2048: Incremental encoder 2048 p/r E2500: Incremental encoder 2500 p/r E4096: Incremental encoder 4096 p/r A1716: 17-bit absolute encoder with 16-bit multi-turn counting A1712: 17-bit absolute encoder with 12-bit multi-turn counting A1700: 17-bit absolute encoder without multi-turn counting	E1024 ~ A1700	E1024	—	× A
B02	Pole pair	Refer to the motor nameplate Motor pole pair = motor poles/2 For example, 4-pole motor's pole pair is 2.	1 ~ 10	2	—	× A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
B03	Rated frequency	Refer to the motor nameplate Motor rated frequency	10.0 ~ 500.0	50.0	Hz	× A
B04	Rated voltage	Refer to the motor nameplate Motor rated voltage	380	380	V	× A
B05	Rated current	Refer to the motor nameplate Motor rated current	1.0 ~ 30.0	8.0	A	× A
B06	Maximum speed	Refer to the motor nameplate Motor maximum speed	500 ~ 8000	8000	rpm	× A
B07	Rated torque	Refer to the motor nameplate Motor rated torque	1.0 ~ 100.0	23.6	Nm	× A
B10	Stator resistance	Motor stator resistance Modify it by performing the 'b-tU3' operation.	0~ 30.000	1.550	Ω	× B
B11	Rotor resistance	Motor rotor resistance Modify it by performing the 'b-tU3' operation.	0~ 30.000	1.610	Ω	× B
B12	Mutual inductance	Mutual inductance between motor stator and rotor Modify it by performing the 'b-tU3' operation.	0~ 30.000	0.215	H	× B
B13	Leakage inductance	Motor leakage inductance Modify it by performing the 'b-tU3' operation.	0~ 1.0000	0.0080	H	× B
B14	Rated excitation current	Motor rated excitation current Modify it by performing the 'b-tU3' operation.	0~ 100.00	5.42	A	× B

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
B15	Torque coefficient	Motor vector control torque coefficient Modify it by performing the 'b-tU3' operation.	0~ 10.00	2.25	Nm/A	× B
B16	Excitation time constant	Motor excitation time constant Modify it by performing the 'b-tU3' operation.	0~ 1000.0	150.0	ms	× B
B17	Field weakening starting speed	The starting speed of the motor field weakening control Modify it by performing the 'b-tU3' operation.	0~ 10000	1036	rpm	× B
B18	Moment of inertia	Motor moment of inertia Modify it by performing the 'b-tU3' operation.	0.0001 ~ 0.1000	0.0098	Kg.m ²	× B

5.1.5 Parameters Used in Position Control Mode (Group C)

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
C00	Position loop gain	Position loop gain Modify parameter PA-A55 will automatically change this value.	1~ 200	5	1/s	√ A
C01	Numerator of electronic gear ratio	Recommended set to the motor encoder pulses number per revolution.	1~ 32767	1	—	× A
C02	Denominator of electronic gear ratio	Recommended set to the command pulses number per revolution.	1~ 32767	1	—	× A
C03	Speed feedforward factor of position loop	Speed feedforward factor of position loop in position control mode.	0~ 100	0	%	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
C04	Band width of the speed feedforward filter	Band width of the speed feedforward filter in position control mode.	50~ 1000	900	Hz	√ A
C05						
C06	Position deviation alarm value	If the difference between command position and actual position exceeds the value of this parameter, 'Er 004' occurs.	0~ 20.00	10.000	rev	√ A
C07	Positioning completed range	If the difference between command position and actual position is less than the value of this parameter, the '#COIN' output signal is valid.	0~ 20000	50	0.001rev	√ A
C08	Position coordinates setting	In position/speed control mode, reset the position coordinates when switching to position control. 0: Continue to use the position coordinates 1: Set the position coordinates to zero	0~1	0	—	√ A
C09	Exponential filter time constant of the position command	Exponential filter time constant of the position command Set it to zero means do not use the exponential filter.	0~ 1000	0	ms	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
C11	Filter time of encoders	<p>1000ms: Only the motor encoder be used</p> <p>0ms: Only the external encoder be used</p> <p>Else: Filter time of the motor encode and external encoder.</p>	0 ~ 1000	0	ms	√ A ⊙
C12	Position deviation alarm value of encoders	<p>0: Do not detect position deviation of encoders</p> <p>Else: If the difference between motor encoder position and external encoder position exceeds the value of this parameter, 'Er 035' occurs.</p>	0 ~ 65535	300	0.001rev	√ A
C13	One-turn deviation coefficient of two-position feedback closed-loop (%)	One-turn deviation coefficient of two-position feedback closed-loop (%)	0 ~ 100	20	%	√A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
C14	Positioning approaching range	Positioning approaching range (NEAR) (command unit)	0 ~ 65535	100	Command	√ A

5.1.6 Parameters Used in Position Control Mode or Speed Control Mode (Group D)



No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
D00	Speed loop gain	Speed loop gain Modify parameter PA-A55 will automatically change this value.	1~200	5	Hz	√ A
D01	Speed loop integral time constant	Speed loop integral time constant Modify parameter PA-A55 will automatically change this value.	1~1000	50	ms	√ A
D02	Band width of the torque filter	Band width of the torque filter Modify parameter PA-A55 will automatically change this value.	1~500	160	Hz	√ A
D03	Frequency of trap filter 1	Frequency of trap filter 1	1~1000	900	Hz	√ A
D04	Frequency of trap filter 2	Frequency of trap filter 2	1~1000	900	Hz	√ A
D05	Maximum speed in JOG mode	The maximum motor speed in JOG mode.	0~8000	100	rpm	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
D06	Maximum acceleration in 'S' curve method	Bigger values mean quicker orientation. Should be in the motor acceleration/deceleration capacity range. Valid only when parameter PA-A95.0 is set to 1.	500 ~ 8000	4000	rpm/s	× A
D07	Jerk in 'S' curve method	Jerk in 'S' curve method Bigger values mean acceleration change quicker.	2000 ~ 12000	8000	rpm/s ²	× A
D08	Terminals SFR, SRV setting	0: SFR, enable the servodrive, SRV, motor rotation direction. 1: SFR, motor rotates in positive direction, SRV, motor rotates in negative direction.	0~1	1	—	√ A
D09	'S' curve function	Command filter setting in speed control mode 0: No filter 1: Use the 'S' curve filter 2: Use the bell-shaped curve filter If the host controllers equip with acceleration/deceleration function, set this parameter to 0.	0~2	1	—	× A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
D10	Speed command setting	Speed command setting in speed control mode Obtained the speed command from: 0: Undefined 1: Undefined 2: Internal parameters 3: Undefined 4: KSN servo bus	0~4	4	—	× A
D14	Velocity completed (VCMP) speed	If the motor speed reach the value of this parameter, the velocity completed (VCMP) output signal is valid.	0~8000	100	rpm	√ A
D15	Velocity completed range	If the difference between actual speed and setting speed is less than the value of this parameter, the 'VCMP/VCMP2' or 'ZEROSPD' output signal is valid.	0~1000	10	rpm	√ A
D16	Internal speed command 1	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '000', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	√ A
D17	Internal speed command 2	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '001', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	√ A
D18	Internal speed command 3	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '010', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
D19	Internal speed command 4	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '011', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	✓ A
D20	Internal speed command 5	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '100', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	✓ A
D21	Internal speed command 6	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '101', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	✓ A
D22	Internal speed command 7	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '110', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	✓ A
D23	Internal speed command 8	When PA-D10 is set to 2 and DI signals SS3-SS2-SS1 are '111', this parameter is used as the internal speed.	-8000 ~ 8000	0	rpm	✓ A
D24	JOG speed in JOG mode	If parameter PA-A60 is set to 'CON' in JOG mode, each time when users press the  or  key, the motor speed will change with the value of this parameter.	0~ 1000	50	rpm	✓ A
D25	Quality factor of trap filter 1	Quality factor of trap filter 1	1~ 100	47	%	✓ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
D26	Quality factor of trap filter 2	Quality factor of trap filter 2	1~ 100	47	%	√ A
D27	Speed setting when SFR and SRV valid or invalid at the same time	Parameter PA-D27 is valid when PA-D08 is set to 1 0: Maintain the original rotation direction 1: Decrease motor speed to zero	0~1	1	—	√ A
D28	Depth of trap filter 1	Depth of trap filter 1	1~ 1000	900	—	√ A
D29	Depth of trap filter 2	Depth of trap filter 2	1~ 1000	900	—	√ A
D30	Exponential filter time constant of the speed command	Exponential filter time constant of the speed command Set it to zero means do not use the exponential filter.	0~ 1000	0	ms	√ A
D32	The bell-shaped curve acceleration time of the speed command	The time for motors to accelerate to the maximum motor speed.	0.1 ~ 500.0	5.0	s	√ A
D33	The bell-shaped curve deceleration time of the speed command	The time for motors to decelerate from the maximum speed to zero.	0.1 ~ 500.0	5.0	s	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
D34	Jerk in bell-shaped curve acceleration method of the speed command	Smooth the change of acceleration in bell-shaped curve acceleration method, to avoid shocks.	2000 ~ 30000	24000	rpm/s	√ A
D43	Frequency of trap filter	Frequency of trap filter 3 (Hz)	1 ~ 1000	900	Hz	√ A
D44	Frequency of trap filter	Frequency of trap filter 4 (Hz)	1 ~ 1000	900	Hz	√ A

5.1.7 Application Parameters (Group E)

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
E02	Maximum speed in torque control mode	Maximum speed in torque control mode.	0~ 8000	500	rpm	√ A
E20	Motor field weakening characteristics	Generally do not need to change this parameter. Increase this parameter 10% each time, if motor deceleration abnormal	0~ 500	200	%	× A
E23	Motor current loop bandwidth	Motor current loop bandwidth	200 ~ 1000	600	Hz	× C
E24	Motor overload ratio	The ratio of the motor maximum current and the rated current	100 ~ 500	200	%	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
E27	Motor minimum excitation current	Motor minimum excitation current	10 ~ 100	Calculated by motor parameters	%	√ A
E28	Maximum motor slip	Maximum motor slip	1 ~ 20	10	Hz	√ A
E31	Field weakening starting speed coefficient for asynchronous motor	Field weakening starting speed coefficient for asynchronous motor (%)	50 ~ 2000	100	%	√ A
E34	Field weakening compensation coefficient 3 for asynchronous motor	Field weakening compensation coefficient 3 for asynchronous motor (%)	0 ~ 300	100	%	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
E44	Resistance value of braking resistance	Resistance value of braking resistance (ohm)	5~200	Braking resistance for different drivers 2.2KW: 150 3.7KW: 75 5.5KW: 40 7.5KW: 40 11 KW: 26 15 KW: 26 22 KW: 20	Ohm	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
E90	Function setting parameter 10	<p>E90.0 Gain shifting method</p> <p>0: Manual shift through servo bus</p> <p>1: Manual shift by DI</p> <p>2: Automatic shift</p> <p>3: Close gain shift function and gain of group 2 is fixed.</p> <p>E90.1 Automatic gain shift conditions</p> <p>0: COIN on</p> <p>1: COIN off</p> <p>2: NEAR on</p> <p>3: NEAR off</p>	0000~ FFFF	0000	-	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
E91	Function setting parameter 11	<p>E91.0 Processing mode of driver warnings 0: Check and upload alarms (default) 1: Check warnings only 2: Warnings are not checked</p> <p>E91.1</p> <p>E91.2 Driver warnings are recorded to alarm history 0: Invalid (default) 1: Valid</p> <p>E91.3 When turning on drivers, 0 is inserted to alarm history 0: Invalid (default) 1: Valid</p>	0 x0~FFxF	00x0	-	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
E93	Current loop control mode	E93.0 Current loop control mode (0~2) Current loop control mode 1 or 2 can improve current loop performance. On drivers of 11KW and above, if motor and load inertia is relatively large, abnormal voice and increasing current when motor rotates at a high speed will cause motor overheat. Try to set this parameter to 0 and confirm whether abnormal conditions get improved.	0~2	0	—	√ A

5.1.8 Application Parameters (Group F)

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
F00	Choose an encoder for spindle orientation	0: Motor encoder 1: External encoder	0~1	0	—	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
F01	Choose a reference point for spindle orientation	0: 'Z' signal of encoders 1: Zero-point switch signal	0~1	0	—	√ A
F02	Spindle orientation trigger method	0: ORCM High level trigger 1: ORCM Positive pulse trigger, the pulse width must be more than 100ms	0~1	0	—	√ A
F03	Spindle orientation speed	Motor speed when searching for the orientation reference point.	100 ~ 2000	300	rpm	√ A
F04	Choose a spindle orientation direction	0: Choose the current rotation direction 1: Choose a direction from PA-F05	0 ~ 1	1	—	√ A
F05	Spindle orientation direction	0: CCW direction 1: CW direction	0~1	1	—	√ A
F06	Spindle orientation position 1	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '000', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 1, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
F07	Spindle orientation position 2	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '001', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 2, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A
F08	Spindle orientation position 3	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '010', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 3, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A
F09	Spindle orientation position 4	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '011', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 4, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
F10	Spindle orientation position 5	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '100', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 5, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A
F11	Spindle orientation position 6	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '101', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 6, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A
F12	Spindle orientation position 7	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '110', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 7, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
F13	Spindle orientation position 8	<ul style="list-style-type: none"> ■ When PA-F14 is set to 0 and DI signals PS3-PS2-PS1 are '111', this parameter is used as the Spindle orientation position. ■ When PA-F14 is set to 1 and PA-F15 is set to 8, this parameter is used as the Spindle orientation position. 	0.0~ 360.0	0.0	degree	√ A
F14	Choose a spindle orientation position	0: Choose from DI signals PS3, PS2, PS1 1: Choose a position from PA-F15	0~1	0	—	√ A
F15	Spindle orientation position	When PA-F14 is set to 1, choose a spindle orientation position in this parameter. When perform the tU5 operation, also choose a spindle orientation position in this parameter.	1~8	1	—	√ A
F16	Spindle orientation reference signal trigger method	0: Falling edge 1: Rising edge	0~1	0	—	√ A
F17	Maximum speed in rapid orientation	Bigger values mean quicker orientation.	2000~ 12000	6000	rpm	× A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
F18	Orientation arrive delay time	Orientation arrive delay time.			s	× A
F19	Spindle orientation functional parameter	<p>◆ F19.0 When using external encoder in rapid orientation: 0: Automatically calculate the gear ratio 1: Use the spindle gear box.</p>	0000 ~ FFFF	0000	—	√ A
		<p>◆ F19.1 Installation direction of motor encoder and external encoder. This parameter is valid when PA-F19.0 is set to 1. 0: The same direction 1: Opposite direction</p>				
		<p>◆ F19.2</p>				
		<p>◆ F19.3 Choose the orientation direction in rapid orientation. 0: Automatically choose 1: Choose the orientation direction from PA-F04 and PA-F05.</p>				
F20	Tooth number of the driving wheel in gear box 1	Tooth number of the driving wheel in gear box 1	1~ 32767	1	—	× A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
F21	Tooth number of the driving wheel in gear box 2	Tooth number of the driving wheel in gear box 2	1~ 32767	1	—	× A
F22	Tooth number of the driving wheel in gear box 3	Tooth number of the driving wheel in gear box 3	1~ 32767	1	—	× A
F23	Tooth number of the driving wheel in gear box 4	Tooth number of the driving wheel in gear box 4	1~ 32767	1	—	× A
F24	Tooth number of the driving wheel in gear box 5	Tooth number of the driving wheel in gear box 5	1~ 32767	1	—	× A
F25	Tooth number of the driving wheel in gear box 6	Tooth number of the driving wheel in gear box 6	1~ 32767	1	—	× A
F26	Tooth number of the driving wheel in gear box 7	Tooth number of the driving wheel in gear box 7	1~ 32767	1	—	× A
F27	Tooth number of the driving wheel in gear box 8	Tooth number of the driving wheel in gear box 8	1~ 32767	1	—	× A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
F28	Use the DI input signals GR1, GR2, GR3 as	Use the DI input signals GR1, GR2, GR3 as: 0: Individual input signals, to choose gear box group 1 to group 3. Ensure that there is only one signal be set to 1. 1: A 3-bit binary number, to choose gear box group 1 to group 8.	0~1	0	—	√ A
F29	Choose a spindle orientation zero-point signal	◆ F29.0 0: Orientation finished position deviation alarm is invalid 1: Orientation finished position deviation alarm is valid ◆ F29.1 0: Orientation gain is not shifted when performing orientation 1: Orientation gain is shifted when performing orientation ◆ F29.3 0: DI signal 'REFP' 1: 'Z' signal of external encoders	0000 ~ FFFF	0011	—	√ A
F30	Tooth number of the slave wheel in gear box 1	Tooth number of the slave wheel in gear box 1	1~ 32767	1	—	× A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
F31	Tooth number of the slave wheel in gear box 2	Tooth number of the slave wheel in gear box 2	1~ 32767	1	—	× A
F32	Tooth number of the slave wheel in gear box 3	Tooth number of the slave wheel in gear box 3	1~ 32767	1	—	× A
F33	Tooth number of the slave wheel in gear box 4	Tooth number of the slave wheel in gear box 4	1~ 32767	1	—	× A
F34	Tooth number of the slave wheel in gear box 5	Tooth number of the slave wheel in gear box 5	1~ 32767	1	—	× A
F35	Tooth number of the slave wheel in gear box 6	Tooth number of the slave wheel in gear box 6	1~ 32767	1	—	× A
F36	Tooth number of the slave wheel in gear box 7	Tooth number of the slave wheel in gear box 7	1~ 32767	1	—	× A
F37	Tooth number of the slave wheel in gear box 8	Tooth number of the slave wheel in gear box 8	1~ 32767	1	—	× A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
F44	Delay time of spindle interlock	Delay time of spindle interlock (ms)	0 ~ 10000	0	ms	√ A
F45	Percentage of spindle interlock torque	Percentage of spindle interlock torque (%)	0 ~ 100	5	%	√ A
F50	Monitoring type of 'Z' signal of encoders	<p>◆ F50.0 Motor encoder 0: Monitoring once when powered on 1: No monitoring 2: Keep monitoring</p> <p>◆ F50.1 External encoder 0: Monitoring once when powered on 1: No monitoring 2: Keep monitoring</p>	0000 ~ FFFF	0022	—	√ A
F51	Maximum monitoring speed of motor encoder	When motor encoder speed exceeds the speed in this parameter, stop monitoring the 'Z' signal.	0~ 10000	6000	rpm	√ A
F52	Maximum monitoring speed of external encoder	When external encoder speed exceeds the speed in this parameter, stop monitoring the 'Z' signal.	0~ 10000	6000	rpm	√ A
F60	Gain shift (1→2) waiting time	Gain shift (1→2) waiting time (ms)	0 ~ 65535	0	ms	√ A
F61	Gain shifting (1→2) time	Gain shifting (1→2) time (ms)	0 ~ 65535	0	ms	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
F62	Gain shift (2→1) waiting time	Gain shift (2→1) waiting time (ms)	0 ~ 65535	0	ms	√ A
F63	Gain shifting (2→1) time	Gain shifting (2→1) time (ms)	0 ~ 65535	0	ms	√ A
F64	Gain of group 1: position loop gain	Gain of group 1: position loop gain (rad/s)	1 ~ 200	20	ms	√ A
F65	Gain of group 1: speed feed forward factor of position loop	Gain of group 1: speed feed forward factor of position loop (%)	0 ~ 100	0	%	√ A
F66	Gain of group 1: speed loop gain	Gain of group 1: speed loop gain (Hz)	1 ~ 20	20	Hz	√ A
F67	Gain of group 1: speed loop integral time constant	Gain of group 1: speed loop integral time constant (ms)	1 ~ 1000	50	ms	√ A
F68	Gain of group 1: cut-off frequency of torque filter	Gain of group 1: cut-off frequency of torque filter (Hz)	1 ~ 500	120	Hz	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
F90	Orientation speed forward percentage	Orientation speed forward percentage (%)	0 ~ 100	100	%	√ A
F91	Orientation completed range	Before orientation completed, when servodrive output the 'ORAR' signal, if the spindle position deviate from the orientation position exceeds the value of this parameter, then the 'ORAR' signal is invalid.	0.01~ 90.00	0.50	degree	√ A
F92	Valid holding time threshold value within orientation accuracy range	Valid holding time threshold value within orientation accuracy range (ms)	0 ~ 5000	100	ms	√ A
F93	Holding time threshold value beyond orientation accuracy range	Holding time threshold value beyond orientation accuracy range (ms)	0 ~ 5000	200	ms	√ A
F94	Gain of group 3:	Gain of group 3: position loop gain of orientation	0~ 200	15	rad/s	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
	position loop gain of orientation	(rad/s)				
F95	Gain of group 3: speed loop gain of orientation	Gain of group 3: speed loop gain of orientation (Hz)	1~ 200	10	Hz	√ A
F96	Gain of group 3: speed loop integral time constant of orientation	Gain of group 3: speed loop integral time constant of orientation (ms)	1~ 1000	50	ms	√A
F97	Gain of group 3: cut-off frequency of torque filter for orientation	Gain of group 3: cut-off frequency of torque filter for orientation (Hz)	1 ~ 500	160	Hz	√ A
F98	Gain of group 3 shift waiting time	Gain of group 3 shift waiting time (ms)	0 ~ 65535	0	ms	√ A
F99	Gain of group 3	Gain of group 3 shifting time (ms)	0 ~ 65535	0	ms	√A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
	shifting time					

5.1.9 Application Parameters (Group P)

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
P10	DI input signals group 1	SFR/RUN: P10.0 SRV: P10.1 ORCM: P10.2 ZSPD: P10.3	0000 ~ FFFF	4321	—	√ A
P11	DI input signals group 2	TAP: P11.0 EST: P11.1 SWI: P11.2 VP: P11.3	0000 ~ FFFF	8765	—	√ A
P12	DI input signals group 3	PS1: P12.0 PS2: P12.1 PS3: P12.2 SS1: P12.3	0000 ~ FFFF	0000	—	√ A
P13	DI input signals group 4	SS2: P13.0 SS3: P13.1 REFP: P13.2 CWL: P13.3	0000 ~ FFFF	9000	—	√ A
P14	DI input signals group 5	CCWLI: P14.0 CLE: P14.1 INH: P14.2 PORDY: P14.3	0000 ~ FFFF	0009	—	√ A
P15	DI input signals group 6	GR1: P15.0 GR2: P15.1 GR3: P15.2 DEC: P15.3	0000 ~ FFFF	0000	—	√ A

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
P16	DI input signals group 7	<ul style="list-style-type: none"> ◆ P16.0 SCLP input selection (0: Invalid, 1~8: XIn1~XIn8, Others: Valid) ◆ P16.1 GSEL input selection (0: Invalid, 1~8: XIn1~XIn8, Others: Valid) 	0000 ~ FFFF	0080	—	√ A
P17	DI input signals group 8	User-defined	0000 ~ FFFF	0000	—	√ A
P18	DI input signals group 9	User-defined	0000 ~ FFFF	0000	—	√ A
P19	DI input signals group 10	User-defined	0000 ~ FFFF	0000	—	√ A
P20	DI input signals group 11	User-defined	0000 ~ FFFF	0000	—	√ A
P21	DI input signals group 12	User-defined	0000 ~ FFFF	0000	—	√ A
P22	DI input signals group 13	User-defined	0000 ~ FFFF	0000	—	√ A
P23	DI input signals group 14	User-defined	0000 ~ FFFF	0000	—	√ A
P24	DI input signals group 15	User-defined	0000 ~ FFFF	0000	—	√ A
P25	DI input signals group 16	User-defined	0000 ~ FFFF	0000	—	√ A

Parameters

No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
P26	DO output signal 1	The 'Y1' terminal Optocoupler output Default value 3 means choose the 'ZEROSPD' signal.	0~ 32	3	—	√ A
P27	DO output signal 2	The 'Y2' terminal Optocoupler output Default value 2 means choose the 'ORAR' signal.	0~ 32	2	—	√ A
P28	DO output signal 3	The 'Y3' terminal Optocoupler output Default value 6 means choose the '#DALM' signal.	0~ 32	6	—	√ A
P29	DO output signal 4	The 'Y4' terminal Optocoupler output Default value 4 means choose the 'VCMP' signal.	0~ 32	4	—	√ A
P30	DO output signal 5	The 'TA' terminal Relay output Default value 6 means choose the '#DALM' signal	0~ 32	6	—	√ A
P31	DO output signal 6	The 'PA' terminal Relay output Default value 2 means choose the 'ORAR' signal	0~ 32	2	—	√ A
P36	DI input terminals X4 to X1 logical reverse	DI input terminals X4, X3, X2, X1 0: Normal 1: Reverse	0000 ~ 1111	0000	—	√ A
P37	DI input terminals X8 to X5 logical reverse	DI input terminals X8, X7, X6, X5 0: Normal 1: Reverse	0000 ~ 1111	0000	—	√ A

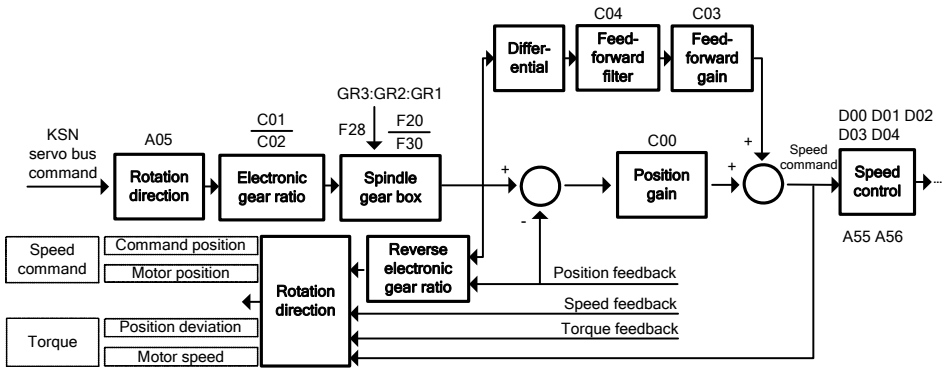
No.	Name	Description	Setting Range	Factory Setting	Unit	Authority
P38	DO output terminals Y4 to Y1 logical reverse	DO output terminals Y4, Y3, Y2, Y1 0: Normal 1: Reverse	0000 ~ 1111	0000	—	√ A
P39	DO output terminals P, T logical reverse	DO output terminals P, T 0: Normal 1: Reverse	00 ~ 11	00	—	√ A
P60	Servo bus IN1 signal setting	Servo bus IN1 signal setting (1~32:DO signal, 81~88:X1~X8 terminal, Others: 0)	0 ~ 128	0	-	√ A
P61	Servo bus IN2 signal setting	Servo bus IN2 signal setting (1~32:DO signal, 81~88:X1~X8 terminal, Others: 0)	0 ~ 128	0	-	√ A
P62	Servo bus IN3 signal setting	Servo bus IN3 signal setting (1~32:DO signal, 81~88:X1~X8 terminal, Others: 0)	0 ~ 128	0	-	√ A
P63	Servo bus IN4 signal setting	Servo bus IN4 signal setting (1~32:DO signal, 81~88:X1~X8 terminal, Others: 0)	0 ~ 128	0	-	√ A

5.2 Parameter Details

5.2.1 Position Control Mode

Position command	From KSN servo bus																										
Motor rotation direction	<p>Motor rotation direction depend on:</p> <p>(1) PA-A05 setting</p> <p>(2) The sign of position command</p> <table border="1" data-bbox="389 507 1044 722"> <tr> <td>PA-A05</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>The sign of position command</td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> <td></td> <td></td> </tr> <tr> <td>Motor rotation direction</td> <td>CW</td> <td>CCW</td> <td>CCW</td> <td>CW</td> <td></td> <td></td> </tr> </table>						PA-A05	0	0	1	1			The sign of position command	+	-	+	-			Motor rotation direction	CW	CCW	CCW	CW		
PA-A05	0	0	1	1																							
The sign of position command	+	-	+	-																							
Motor rotation direction	CW	CCW	CCW	CW																							
Motor power control signals	<p>Motor power control signals:</p> <p>(1) Input terminal 'SVON'</p> <p>(2) KSN servo bus command</p> <p>(3) PA-A13 setting</p> <table border="1" data-bbox="358 954 1044 1145"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Terminal 'SVON'</th> <th colspan="2">Command 'SVON'</th> <th colspan="2">PA-A13</th> </tr> <tr> <th>Valid</th> <th>Invalid</th> <th>Valid</th> <th>Invalid</th> <th>on</th> <th>oFF</th> </tr> </thead> <tbody> <tr> <td>Motor powered on</td> <td>√</td> <td>×</td> <td>√</td> <td>×</td> <td>√</td> <td>×</td> </tr> </tbody> </table>							Terminal 'SVON'		Command 'SVON'		PA-A13		Valid	Invalid	Valid	Invalid	on	oFF	Motor powered on	√	×	√	×	√	×	
	Terminal 'SVON'		Command 'SVON'		PA-A13																						
	Valid	Invalid	Valid	Invalid	on	oFF																					
Motor powered on	√	×	√	×	√	×																					

The associated parameters and displaying items about the position control mode are described in the following figure:



- In position control mode, the 'S' curve function is invalid, use host controllers to control the motor acceleration/deceleration.
- In position control mode, the display values of 'PoS', 'Cpo' and 'EPo' in dP menu have been converted base on the electronic gear ratio.
- Use the DI input signals ' GR3', ' GR2' and ' GR1' to choose a spindle gear box group.

The spindle gear box function is used to convert the command pulses.

For example, when spindle gear box group 3 is used, and PA-F22 is 50 (means the tooth number of the driving wheel is 50), PA-F32 is 100 (means the tooth number of the slave wheel is 100), the original command speed is 100rpm, and after the spindle gear box function, the command speed change to 200rpm.

$$100 \times F32 / F22 = 200\text{rpm.}$$

This function is valid only when PA-F00 is set to 0 and PA-F01 is set to 1, generally, this function is used in rigid tapping.

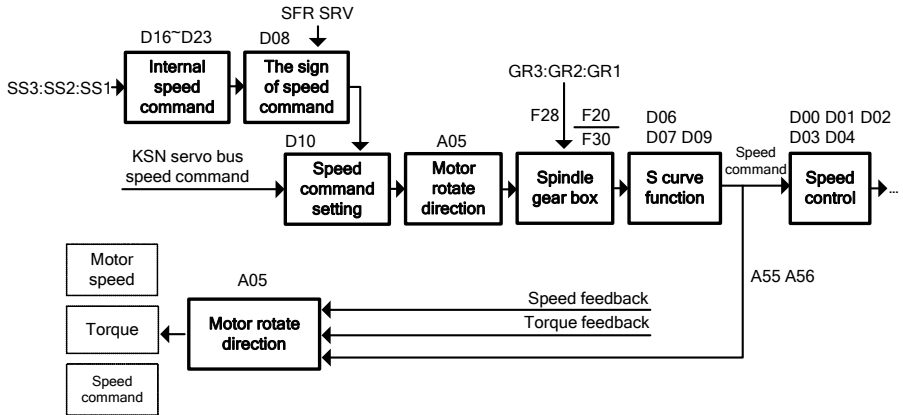
Set PA-F20 to PA-F27 and PA-F30 to PA-F37 to 1, if there is no need to use this function.

5.2.2 Speed Control Mode

Speed command	Internal speed command				
	Terminals SS3,SS2,SS1	Use internal speed	Terminals SS3,SS2,SS1	Use internal speed	
	000	D16	100	D20	
	001	D17	101	D21	
	010	D18	110	D22	
	011	D19	111	D23	
	Speed command direction				
	When PA-D08 is set to 0:				
	Terminal 'SFR'	Not matter			
	Terminal 'SRV'	Invalid	Valid	Invalid	Valid
Motor rotation direction	+	-	-	+	
When PA-D08 is set to 1:					
Terminal 'SFR'	Invalid	Invalid	Valid	Valid	
Terminal 'SRV'	Invalid	Valid	Invalid	Valid	
Motor rotation direction	Unchanged	-	+	Unchanged	
KSN servo bus speed command					
Motor speed and speed direction set by KSN servo bus.					

<p>Motor rotation direction</p>	<p>Motor rotation direction depend on:</p> <p>(1) PA-A05 setting</p> <p>(2) The sign of position command</p> <table border="1" data-bbox="331 268 1059 483"> <tr> <td>PA-A05</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>The sign of position command</td> <td>+</td> <td>-</td> <td>+</td> <td>-</td> </tr> <tr> <td>Motor rotation direction</td> <td>CW</td> <td>CCW</td> <td>CCW</td> <td>CW</td> </tr> </table>				PA-A05	0	0	1	1	The sign of position command	+	-	+	-	Motor rotation direction	CW	CCW	CCW	CW									
PA-A05	0	0	1	1																								
The sign of position command	+	-	+	-																								
Motor rotation direction	CW	CCW	CCW	CW																								
<p>Motor power control signals</p>	<p>Motor power control signals:</p> <p>(1) Input terminal 'SFR' and 'SRV'</p> <p>(2) KSN servo bus command</p> <p>(3) PA-A13 setting</p> <p>■ When PA-A13 is set to 'off'</p> <p>(1) If PA-D08 is set to 0, then motor is powered on when terminal 'SFR' is valid, motor is powered off when terminal 'SFR' is invalid.</p> <p>(2) If PA-D08 is set to 1, then motor is powered on when terminal 'SFR' or 'SRV' is valid, motor is powered off when terminal 'SFR' and 'SRV' are invalid.</p> <table border="1" data-bbox="300 930 1059 1262"> <thead> <tr> <th>PA-D08</th> <th>Terminal 'SFR'</th> <th>Terminal 'SRV'</th> <th>Motor powered on</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0</td> <td>Valid</td> <td>Not matter</td> <td>√</td> </tr> <tr> <td>Invalid</td> <td>Not matter</td> <td>×</td> </tr> <tr> <td rowspan="4">1</td> <td>Invalid</td> <td>Invalid</td> <td>×</td> </tr> <tr> <td>Invalid</td> <td>Valid</td> <td>√</td> </tr> <tr> <td>Valid</td> <td>Invalid</td> <td>√</td> </tr> <tr> <td>Valid</td> <td>Valid</td> <td>√</td> </tr> </tbody> </table> <p>■ When PA-A13 is set to 'on', motor is powered on regardless of the 'SFR' and 'SRV' status.</p>				PA-D08	Terminal 'SFR'	Terminal 'SRV'	Motor powered on	0	Valid	Not matter	√	Invalid	Not matter	×	1	Invalid	Invalid	×	Invalid	Valid	√	Valid	Invalid	√	Valid	Valid	√
PA-D08	Terminal 'SFR'	Terminal 'SRV'	Motor powered on																									
0	Valid	Not matter	√																									
	Invalid	Not matter	×																									
1	Invalid	Invalid	×																									
	Invalid	Valid	√																									
	Valid	Invalid	√																									
	Valid	Valid	√																									

The associated parameters and displaying items about the speed control mode are described in the following figure:



■ **The ‘S’ curve function**

When host controllers implement closed-loop position control , the ‘S’ curve function is invalid.

If PA-D10 is set to 2, ensure that PA-D09 is set to 1 (use the ‘S’ curve function), otherwise mechanical shocks may occur.

■ **Turn on motor power regardless of the motor speed**

In speed control mode, when the ‘S’ curve function is valid, users can turn on motor power regardless of the motor speed.

■ **The spindle gear box function**

Use the DI input signals ‘ GR3’, ‘ GR2’ and ‘ GR1’ to choose a spindle gear box group.

The spindle gear box function is used to convert the command pulses.

For example, when spindle gear box group 3 is used, and PA-F22 is 50 (means the tooth number of the driving wheel is 50), PA-F32 is 100 (means the tooth number of the slave wheel is 100), the original command speed is 100rpm, and after the spindle gear box function, the command speed change to 200rpm.

$100 \times F32 / F22 = 200\text{rpm}$.

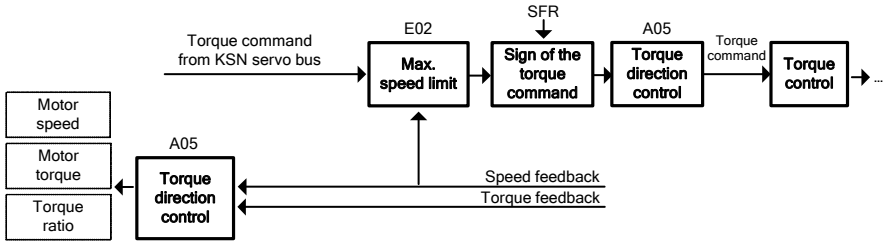
Set PA-F20 to PA-F27 and PA-F30 to PA-F37 to 1, if there is no need to use this function.

When in position/speed control mode (PA-A04 is set to 'P-S'), if you use this function in position control and do not use it in speed control, then set PA-A90.0 to 1.

5.2.3 Torque Control Mode

Torque command	From KSN servo bus						
Motor torque output direction	Motor torque output direction depend on: (1) PA-A05 setting (2) The sign of torque command						
	PA-A05	0	0	1	1		
	The sign of torque command	+	-	+	-		
	Motor torque output direction	CW	CCW	CCW	CW		
Motor power control signals	Motor power control signals: (1) Input terminal 'SVON' (2) KSN servo bus command (3) PA-A13 setting						
		Terminal 'SVON'		Command 'SVON'		PA-A13	
		Valid	Invalid	Valid	Invalid	on	oFF
	Motor powered on	√	×	√	×	√	×

The associated parameters and displaying items about the torque control mode are described in the following figure:



■ Torque displaying items

The display values of 'trqn' and 'trq' in dP menu are inaccurate when the motor speed exceeds the rated speed.

■ Maximum speed limit

The maximum speed in torque control mode is set in PA-E02. When the motor speed exceeds the maximum speed, output signal 'VLT' is valid. If the value of PA-E02 is bigger than the maximum speed of motors, before the actual rotation speed reaches the value set by PA-E02, 'Er 001' occurs.

5.2.4 Position/speed Control Mode

PA-A04 is set to 'P-S' in position/speed control mode, modify the input terminal 'VP' to select a control mode.

Terminal 'VP'	Servodrive running mode
0	Speed control mode
1	Position control mode

If the input terminal 'VP' is 0, the control characteristics are the same as the speed control mode (when PA-A04 is set to 'Spd').

If the input terminal 'VP' is 1, the control characteristics are the same as the position control mode (when PA-A04 is set to 'PoS').

Modify input terminal 'VP'	Servodrive operating sequence
0 change to 1	1. Stop the motor according to the 'S' curve function. 2. Set the position coordinates to zero if PA-C08 is set to 1. 3. Running in position control mode.
1 change to 0	1. Running in speed control mode immediately.

- The pulse width of terminal 'VP' must be more than 100ms.
- When the servodrive is about to switch to position control mode, users may perform the spindle orientation operation, refer to the following table:

Step	Operation
1	Set PA-C08 to 1.
2	When input terminal 'VP' is 0, make the input terminal 'ORCM' in effect to perform the spindle orientation operation.
3	When orientation completed, set the input terminal 'VP' to 1 before the end of the spindle orientation function.
4	Stop the spindle orientation function, then the servodrive is in position control mode, and the current position is as the zero position.

5.2.5 Servo System Rigidity Setting

A servo system consists of servodrives, servo motors and mechanical components. The rigidity of the servo system affects the response time and anti-disturbance ability. Higher rigidity means quicker response and higher anti-disturbance ability.

The rigidity of servo system is decided by two factors:

- (1) Mechanical connection rigidity, which is the mechanical time constant.
- (2) Closed-loop controller bandwidth of servo system.

Modify PA-A55 will change the closed-loop controller bandwidth. Set PA-A55 to 0 or 1 in low rigidity system, set it to 2 to 5 in medium rigidity system, set it to 6 to 12 in high rigidity system. Higher rigidity of servo system and quicker response will be obtained by increasing the value of PA-A55.

It may cause vibration when the rigidity is too high.

The values of PA-C00, PA-D00, PA-D01 and PA-D02 will be changed

according to the value of PA-A55, refer to the following table:

A55	C00(rad/s)	D00(Hz)	D01(ms)	D02(Hz)
-3	1	1	200	160
-2	3	3	100	160
-1	5	5	50	160
0	10	10	100	160
1	15	15	70	160
2	20	20	50	160
3	30	30	40	160
4	40	40	25	160
5	50	50	22	200
6	60	60	20	230
7	80	80	18	300
8	100	100	15	400
9	120	120	10	450
10	140	140	9	550
11	160	160	8	650
12	200	200	6	800

Properly set PA-A56, otherwise parameters PA-C00, PA-D00, PA-D01 and PA-D02 is meaningless.

When the following situations occur, users may modify PA-C00, PA-D00, PA-D01 and PA-D02 manually, but do not change them in a wide range.

- PA-A55 is set to a value when the performance of the servo system is not up to the requirements, but increases the value in PA-A55 result in servo system vibration.
- No matter how to set PA-A55, servo system is still in vibration.

Change the value of PA-C00, PA-D00, PA-D01 and PA-D02 will not affect the value of PA-A55.

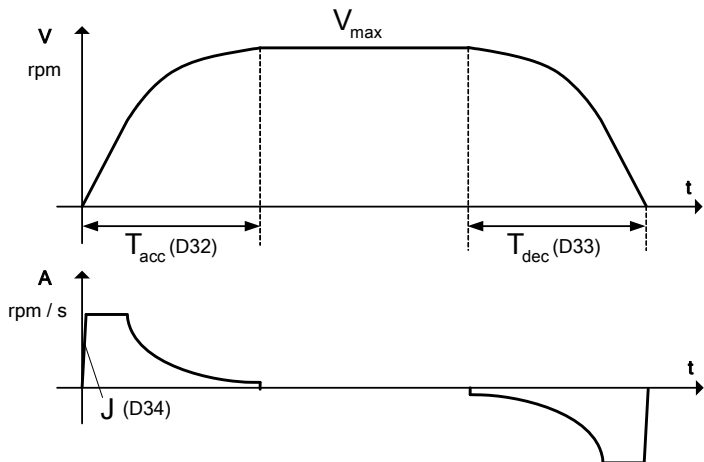
5.2.6 The Bell-shaped Curve and 'S' Curve Function

Smooth the change of acceleration in bell-shaped curve or 'S' curve

acceleration function, to avoid shocks.

Curve type	Perform the acceleration/deceleration function	
Use the 'S' curve	Spindle orientation	
	b-tU3	
	In JOG mode and PA-A60 is not set to 'UF'	
Choose a curve type in PA-D09	When the motor is stopping	D09 = 0 or 1: The 'S' curve D09 = 2: The bell-shaped curve
	Running in speed control mode	D09 = 0: None D09 = 1: The 'S' curve D09 = 2: The bell-shaped curve
	In position/speed control mode, and is about to switch to position control	D09 = 0 or 1: The 'S' curve D09 = 2: The bell-shaped curve

(1) The bell-shaped curve characteristics

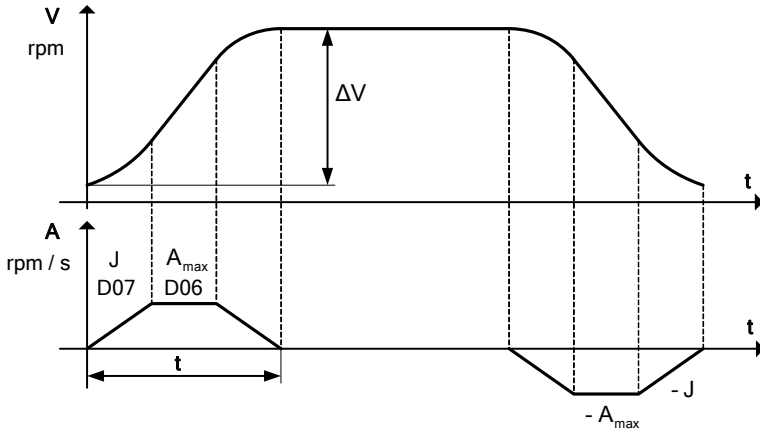


Bell-shape curve acceleration as shown in the figure above. PA-D32 is the time for motors to accelerate to the maximum motor speed, PA-D33 is the time for motors to decelerate from the maximum speed to zero, PA-D34 is the jerk in bell-shaped curve acceleration.

If the system load inertia and damping are too big, 'Er 044', 'Er 017' and

some other alarms may occur, in this case, increase PA-D32 and PA-D33.

(2) The 'S' curve characteristics



(1) When speed increment $\Delta V < \frac{A_{max}^2}{J}$, Acceleration time: $t = 2\sqrt{\frac{\Delta V}{J}}$

(2) When speed increment $\Delta V \geq \frac{A_{max}^2}{J}$, Acceleration time: $t = \frac{\Delta V}{A_{max}} + \frac{A_{max}}{J}$

Note: ΔV 槩 Speed increment(rpm)
 A_{max} 槩 Maximum acceleration (D06)(rpm/s)
 J 槩 Jerk (D07)(rpm/s²)
 t 槩 Acceleration time(s)

When PA-D06 is set to 4000rpm/s, the time needed to run to the following speed is as follow.

Speed increment ΔV (rpm)	Acceleration time t (s)	
	D07 = 4000 rpm/s ²	D07 = 8000 rpm/s ²
1000	1.000	0.707
2000	1.414	1.000
3000	1.732	1.250
4000	2.000	1.500
5000	2.250	1.750
6000	2.500	2.000

PA-D07 is the jerk in 'S' curve acceleration. Bigger values mean acceleration

change quicker.

5.2.7 Deceleration Stop

There are two motor stop methods in ZD210 servodrive:

Motor stop method	Description
Inertia stop	Motor is powered off immediately, stop the motor by mechanical brake, or coast the motor to a stop. If PA-A90.3 is set to 1, the mechanical brake will start operating when the following situations occur: (1) After the motor is powered off, time elapse more than the value of PA-A10. (2) The motor speed is lower than the value of PA-A11.
Deceleration stop	Motor is still powered on, perform the 'S' curve function to stop the motor. If alarms occur during the stop process, servodrives will switch to inertia stop method. If PA-A90.3 is set to 1, when deceleration stop completed, the mechanical brake start operating, and the motor is still powered on for some time that set in PA-A12.

There are three motor stop types in ZD210 servodrive:

Motor stop type	Description
Normal stop	If there is no alarm occurs; servodrive stops the motor according to user operation. Choose a motor stop method in PA-A08.
Emergency stop	When the emergency stop signal (EST) is valid, servodrives perform the emergency stop operation. Choose a motor stop method in PA-A07.
Fault stop	When alarms occur, servodrives perform the fault stop operation; the motor is powered off immediately. Inertia stop method is used in fault stop operation.

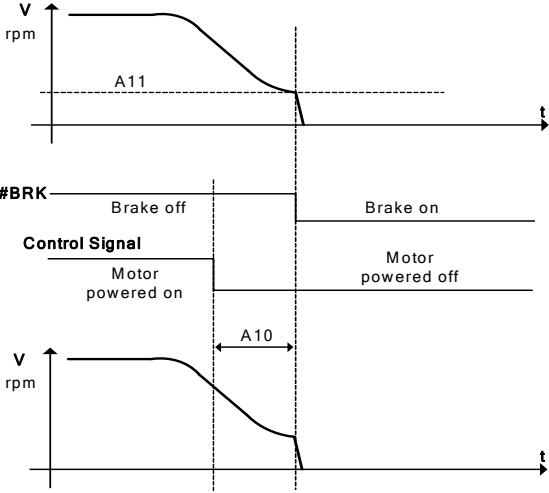
In torque control mode, inertia stop method will be used regardless of the settings of PA-A07 and PA-A08.

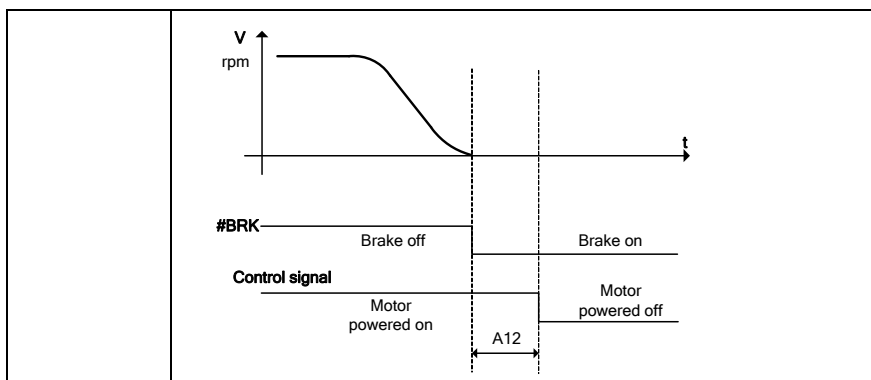
5.2.8 Mechanical Protection

■ Mechanical brake

Use servo motors with mechanical brakes for vertical shaft applications or when external force is applied to the shaft to prevent the shaft from rotating due to gravity or external force when powered off. ZD210 servodrives can control the mechanical brakes, set PA-A90.3 to 1 to use mechanical brakes.

The timing of mechanical brakes is described in the following table:

Motor stop method	Mechanical brake timing
Inertia stop	<p>Mechanical brakes will start operating when the following situations occur:</p> <p>(1) After the motor is powered off, time elapse more than the value of PA-A10.</p> <p>(2) The motor speed is lower than the value of PA-A11.</p> 
Deceleration stop	<p>When deceleration stop completed, mechanical brakes start operating, and the motor is still powered on for some time that set in PA-A12.</p>



- Motor rotation direction limit

Modify PA-A52 if there is only one rotation direction of the motor be allowed. If the positive rotation direction (CW) is not allowed and a CW rotate command is received, 'AL 140' warning occurs. If the negative rotation direction (CCW) is not allowed and a CCW rotate command is received, 'AL 141' warning occurs.

In torque control mode, this function is invalid.

- Overtravel protection

When PA-A91.0 is set to 1, which means the overtravel protection function is valid, if the input terminal 'CWLI' is valid and a CW rotate command is received, or the input terminal 'CCWLI' is valid and a CCW rotate command is received, 'Er 038' alarm occurs.

In torque control mode, this function is invalid.

- Overheat protection

If the temperature of the internal IPM module exceeds 90°C, 'AL 142' warning occurs. If the temperature of the internal IPM module exceeds 100°C, 'Er 031' alarm occurs.

- Maximum continuous operating time of the braking resistor

If the braking resistor operating continuously, it may overheat and damage, set the maximum continuous operating time of the braking resistor in PA-A47.

If the continuous operating time of the braking resistor exceeds the value of PA-A47, 'Er 014' occurs.

- Enhance the cooling effect

The default setting of the cooling fan is start operating when motor is powered on and stop operating when motor is powered off. Set PA-A91.1 to 1, the cooling fan will operate continuously, and it may enhance the cooling effect.

5.2.9 Define the I/O Terminals

ZD210 Servodrive provides input and output terminals.

- Digital input terminals (DI)

ZD210 Servodrive provides ten digital input terminals:

Fixed input		User-defined input	
Terminal	Application	Terminal	Default application
SVON	Servodrive enable	X1	SFR/RUN: CW/RUN
ACLR	Alarm clearing	X2	SRV: CCW
		X3	ORCM: Spindle orientation
		X4	ZSPD: Zero-speed clamp
		X5	TAP: Rigid tapping
		X6	EST: Emergency stop
		X7	SW: Spindle swing
		X8	VP: Choose position or speed control in Position/speed control mode

In addition to the fixed input signals 'SVON' and 'ACLR', ZD210 servodrive can also receive 62 signals from the input terminals X1 to X8. Modify PA-P10 to PA-P25 to assign input terminals. Different signals can be assigned to a single terminal.

No.	Name	Parameter	Remarks
1	SFR/RUN	P10	P10.0 CW/RUN
2	SRV		P10.1 CCW
3	ORCM		P10.2 Spindle orientation trigger
4	ZSPD		P10.3 Zero-speed clamp
5	TAP	P11	P11.0 Rigid tapping
6	EST		P11.1 Emergency stop
7	SWI		P11.2 Spindle swing
8	VP		P11.3 Choose position or speed control in Position/speed control mode
9	PS1	P12	P12.0 Position selection signal 1
10	PS2		P12.1 Position selection signal 2
11	PS3		P12.2 Position selection signal 3
12	SS1		P12.3 Speed selection signal 1
13	SS2	P13	P13.0 Speed selection signal 2
14	SS3		P13.1 Speed selection signal 3
15	REFP		P13.2 Reference point
16	CWLI		P13.3 CW allow
17	CCWLI	P14	P14.0 CCW allow
18	CLE		P14.1 Clear position deviation counter
19	INH		P14.2 Prohibit position command input
20	PORDY		P14.3 Positioning ready
21	GR1	P15	P15.0 Spindle gear box group 1
22	GR2		P15.1 Spindle gear box group 2
23	GR3		P15.2 Spindle gear box group 3
24	DEC		P15.3 Deceleration signal
25	—	P16	Pxx.0 —
	—		Pxx.1 —
60	—	P24	Pxx.2 —
	—		Pxx.3 —
61	—	P25	P25.0 —
62	—		P25.1 —

If PA-P10 to PA-P25 is set to 0, then the corresponding signal is also 0. If the parameter is set to 9 to 'F', then the corresponding signal is 1. If the parameter is set to 1 to 8, then the signal is assigned to the corresponding terminal.

Example:

PA-P10 is set to '4321', which means 'ZSPD' assigned to terminal X4, 'ORCM' assigned to terminal X3, 'SRV' assigned to terminal X2, 'SFR/RUN' assigned to terminal X1.

PA-P12 is set to '9057', which means 'SS1' is 1, 'PS3' is 0, 'PS2' assigned to terminal X5, 'PS1' assigned to terminal X7.

■ Digital output terminals (DO)

ZD210 Servodrive provides six digital output terminals:

User-defined optocoupler output		User-defined relay output	
Terminal	Default application	Terminal	Default application
Y1	ZEROSPD: Zero-speed output	T	#DALM: Servodrive failure
Y2	ORAR: Spindle orientation arrived	P	ORAR: Spindle orientation arrived
Y3	#DALM: Servodrive failure		
Y4	VCMP: Velocity completed		

ZD210 Servodrive provides 32 output signals, modify PA-P26 to PA-P31 to assign output terminals.

No.	Name	Remarks
0	—	Output '0'
1	SRDY	Servodrive ready
2	ORAR	Spindle orientation arrived
3	ZEROSPD	Zero-speed output
4	VCMP	Motor speed matches the value of PA-D14
5	#COIN	Positioning completed
6	#DALM	Servodrive failure
7	VLT	Torque limit
8	#BRK	External brake valid
9	VCMP2	Motor speed matches the command speed

No.	Name	Remarks
10		
—	—	—
32		

Input the output signals number to PA-P26 to PA-P31 to assign signals to the corresponding terminal.

Example:

PA-P26 is set to 1, which means 'SRDY' assigned to terminal Y1.

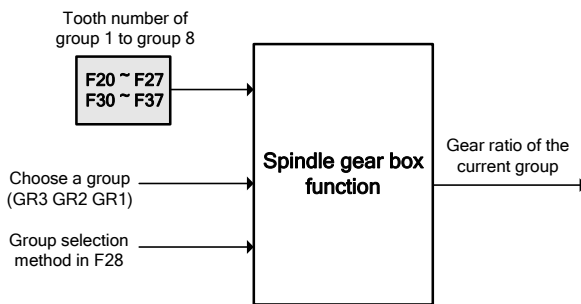
PA-P31 is set to 0, which means there is no output signal assigned to terminal P.

5.2.10 Spindle Gear Box

When the motor shaft and the spindle transmission ratio is not 1:1, the spindle gear box function is needed. This function allows the command speed equals to the spindle speed regardless of the transmission ratio.

Set PA-F20 to PA-F27 and PA-F30 to PA-F37 to 1 if the transmission ratio is 1:1.

The spindle gear box function chart is as follows:



This function is valid only when PA-F00 is set to 0 and PA-F01 is set to 1, generally, this function is used in spindle orientation and rigid tapping.

Example 1: Spindle orientation

When there are three spindle gear box groups, which the transmission ratio are 1:1, 1:2 and 1:3. DI input signals GR1, GR2 and GR3 are used as individual input signals. Then set PA-F28 to 0, set PA-F20, PA-F21 and

PA-F22 to 1, set PA-F30 to 1, set PA-F31 to 2, set PA-F32 to 3, set PA-F00 to 0, and set PA-F01 to 1.

To perform 60 degree indexing spindle orientation, set PA-F06 to PA-F13 to '0.0','60.0', '120.0', '180.0', '240.0' and '300.0'.

The above settings allow the command speed equals to the spindle speed regardless of the transmission ratio.

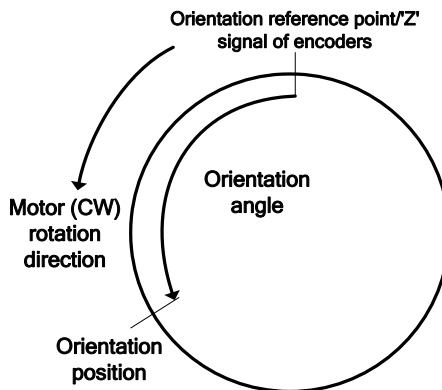
Example 2: Rigid tapping

When there are two spindle gear box groups, which the transmission ratio are 1:1 and 1:5. DI input signals GR1, GR2 and GR3 are used as a 3-bit binary number. Then set PA-F28 to 1, set PA-F20 and PA-F21 to 1, set PA-F30 to 1, set PA-F31 to 5 and set PA-A04 to 'PoS'.

To perform rigid tapping, set the command speed to 500rpm or some other values, the spindle speed will be equal to the command speed regardless of the transmission ratio.

5.2.11 Spindle Orientation

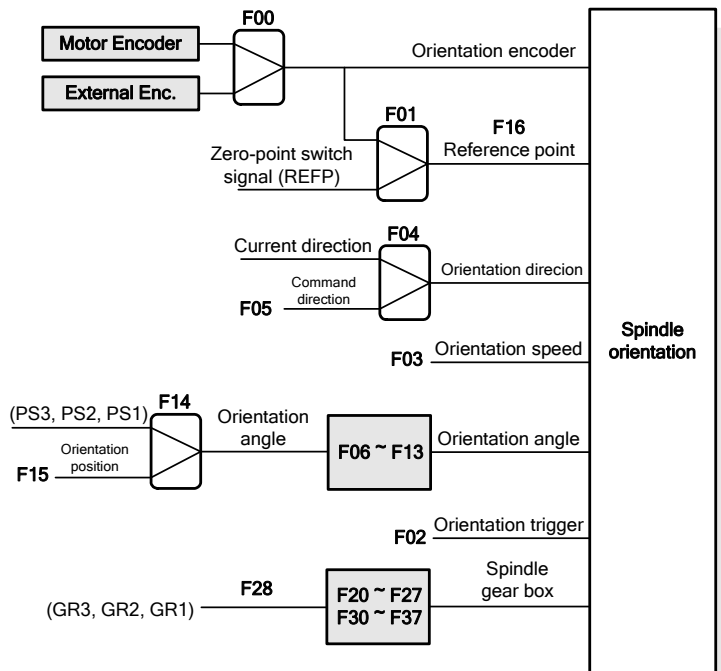
Spindle orientation will make the spindle stops at the orientation position based on orientation reference point, refer to the following figure:



The orientation angle is the motor turning angle in positive rotation direction. The setting range is '0.0' degree to '360.0' degree.

Description	
■	Support external encoder orientation and motor encoder orientation.
■	Support 8-point orientation, orientation angle is optional.
■	Orientation rotation direction and orientation speed are optional.
■	Reference point for spindle orientation is optional; choose the ' Z ' signal of encoders or the zero-point switch signal.
■	Support level trigger and pulse trigger.
■	Support 360 degree spindle orientation.
■	Automatically set the orientation angle by performing tU5 operation.

The setting of spindle orientation refers to the following figure:



Description	
Choose an encoder for spindle orientation	PA-F00: Choose an encoder for spindle orientation 0: Motor encoder 1: External encoder

Parameters

	Description																																								
Choose a reference point for spindle orientation	PA-F01: Choose a reference point for spindle orientation 0: 'Z' signal of encoders 1: Zero-point switch signal 'REFP' PA-F16: Spindle orientation reference signal trigger method 0: Falling edge 1: Rising edge																																								
Choose a spindle orientation direction	When PA-F04 is set to 0, choose the current rotation direction, else when PA-F04 is set to 1, choose a direction from PA-F05. If PA-F95.0 is set to 1 and PA-F19.3 is set to 0, ZD210 servodrive automatically choose a spindle orientation direction regardless of the setting of PA-F04 and PA-F05.																																								
Spindle orientation speed	PA-F03: Motor speed when searching for the orientation reference point. Invalid when PA-A95.0 is set to 1.																																								
Spindle orientation angle	<p>There are eight spindle orientation angle that set in PA-F06 to PA-F13. When PA-F14 is set to 0, choose a spindle orientation position from DI signals PS3, PS2, PS1.</p> <table border="1"> <thead> <tr> <th>PS3, PS2, PS1</th> <th>Orientation angle</th> <th>PS3, PS2, PS1</th> <th>Orientation angle</th> </tr> </thead> <tbody> <tr> <td>000</td> <td>F06</td> <td>100</td> <td>F10</td> </tr> <tr> <td>001</td> <td>F07</td> <td>101</td> <td>F11</td> </tr> <tr> <td>010</td> <td>F08</td> <td>110</td> <td>F12</td> </tr> <tr> <td>011</td> <td>F09</td> <td>111</td> <td>F13</td> </tr> </tbody> </table> <p>When PA-F14 is set to 1, choose a spindle orientation position from PA-F15.</p> <table border="1"> <thead> <tr> <th>PA-F15</th> <th>Orientation angle</th> <th>PA-F15</th> <th>Orientation angle</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>F06</td> <td>5</td> <td>F10</td> </tr> <tr> <td>2</td> <td>F07</td> <td>6</td> <td>F11</td> </tr> <tr> <td>3</td> <td>F08</td> <td>7</td> <td>F12</td> </tr> <tr> <td>4</td> <td>F09</td> <td>8</td> <td>F13</td> </tr> </tbody> </table>	PS3, PS2, PS1	Orientation angle	PS3, PS2, PS1	Orientation angle	000	F06	100	F10	001	F07	101	F11	010	F08	110	F12	011	F09	111	F13	PA-F15	Orientation angle	PA-F15	Orientation angle	1	F06	5	F10	2	F07	6	F11	3	F08	7	F12	4	F09	8	F13
PS3, PS2, PS1	Orientation angle	PS3, PS2, PS1	Orientation angle																																						
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PA-F15	Orientation angle	PA-F15	Orientation angle																																						
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2	F07	6	F11																																						
3	F08	7	F12																																						
4	F09	8	F13																																						

	Description
Spindle orientation trigger method	PA-F02: Spindle orientation trigger method 0: Input signal 'ORCM' high level trigger 1: Input signal 'ORCM' positive pulse trigger, the pulse width must be more than 100ms.
Spindle gear box	Valid only when PA-F00 is set to 0 and PA-F01 is set to 1. Support 360 degree spindle orientation. Choose a spindle gear box from DI input signals 'GR1', 'GR2', 'GR3'. Choose a coding method of 'GR1', 'GR2' and 'GR3' in PA-F28. 0: Individual input signals, to choose gear box group 1 to group 3. Ensure that there is only one signal be set to 1. 1: A 3-bit binary number, to choose gear box group 1 to group 8. Modify PA-F20 to PA-F27 to specify the tooth number of the driving wheels, modify PA-F30 to PA-F37 to specify the tooth number of the slave wheels. Set PA-F20 to PA-F27 and PA-F30 to PA-F37 to 1 if the transmission ratio is 1:1.
Orientation arrive delay time	When the motor arrives the orientation position, ZD210 servodrive delay for some time that set in PA-F18, and then output the 'ORAR' signal.
Orientation completed range	Before orientation completed, when servodrives output the 'ORAR' signal, if the spindle position deviate from the orientation position exceeds the value of PA-F91, then the 'ORAR' signal is invalid and 'Er 053' occurs.
Orientation position gain	When orientation completed, if bigger holding torque is needed, increase this parameter.

Modify PA-F00 and PA-F01 as follows:

PA-F00,PA-F01	Applicable configuration
'00':Motor Enc. + 'Z' signal of motor Enc.	No external encoder, no external zero-point switch. The transmission ratio is 1:1. Support 360 degree motor shaft orientation.

Parameters

PA-F00,PA-F01	Applicable configuration
'10': External Enc. + 'Z' signal of external Enc.	No external zero-point switch. Equipped with external encoder. Support gear shifting of spindle. Support 360 degree spindle orientation.
'01': Motor Enc. + Zero-point switch signal	No external encoder. Equipped with external zero-point switch. Support gear shifting of spindle. Support 360 degree spindle orientation.
'11': External Enc. + Zero-point switch signal	Equipped with external encoder and external zero-point switch. Support gear shifting of spindle. Support 360 degree spindle orientation.

Perform the spindle orientation operation as follows:

Step	Description
1	Ensure that PA-A04 is set to 'SPd'. Or PA-A04 is set to 'P-S' and in speed control. Not in JOG mode.
2	Ensure that the settings of PA-F00 to PA-F16, PA-F20 to PA-F28 and PA-F30 to PA-F37 meet the spindle orientation requirements.
3	Start spindle orientation regardless of the motor status. Modify the input terminal 'ORCM' to perform the operation.
4	Motor runs to the orientation speed according to the 'S' curve function, and waits for the reference point signal.
5	When the reference point signal is active, the motor runs to the orientation position and stops according to the 'S' curve function. The output signal 'ORAR' is valid and the 'ORAR' LED starts flashing, the motor maintains in the orientation position.
6	If the input signal 'ORCM' is high level triggered, when motor arrives the orientation position and 'ORCM' is in low level, spindle orientation completes. If the input signal 'ORCM' is positive pulse triggered, when motor arrives the orientation position and input signal 'SFR'/'SRV' is valid, spindle orientation completes.
7	When spindle orientation completed, ZD210 servodrive returns to the previous operating state, the output signal 'ORAR' is invalid and the 'ORAR' LED stops flashing.

Modify PA-F06 to PA-F13 manually or by performing the 'tU5' operation as follows:

Manually input	<ol style="list-style-type: none"> 1. Move the spindle to the orientation position. 2. When PA-F00 is set to 0, check the 'oF-D2' item in dP menu, when PA-F00 is set to 1, check the 'oF-D4' item in dP menu. 3. If the displaying value is '-1.0', which means the spindle hasn't arrived the reference point since the servodrive powered on, keep moving the spindle until the displaying value is not '-1.0'. If the displaying value is not '-1.0', input this value in PA-F06 to PA-F13. 4. Repeat step 1 to step 3 until all the orientation positions are set.
Performing the 'tU5' operation	<ol style="list-style-type: none"> 1. Modify PA-F14 and PA-F15 to choose an orientation position saving number, which is one of PA-F06 to PA-F13. 2. Move the spindle to the orientation position. 3. Perform the 'tU5' operation, when finished, the orientation positions will automatically be saved. If a warning occurs, which means the spindle hasn't arrived the reference point since the servodrive powered on, keep moving the spindle until no warning occurs. 4. Repeat step 1 to step 3 until all the orientation positions are set.

- The 'VP', 'SFR', 'SRV' input signals and 'JOG', 'tU' operations are invalid when the spindle orientation operation is performing.
- This operation will not be interrupted unless alarms occur or the 'EST' input signal is valid.

5.2.12 Spindle Rapid Orientation

When PA-A95.0 is set to 1, rapid orientation function is valid.

Rapid orientation function realizes quicker orientation, when PA-F19.3 is set to 0, ZD210 servodrive will automatically choose an optimal orientation direction.

Parameters setting

(1) Parameters that are shared with spindle orientation

F00: Choose an encoder for spindle orientation

- F01: Choose a reference point for spindle orientation
- F02: Spindle orientation trigger method
- F04: Choose a spindle orientation direction
- F05: Spindle orientation direction (CW or CCW)
- F06-F13: Spindle orientation position
- F14: Choose a spindle orientation position
- F15: Spindle orientation position (1 to 8)
- F16: Spindle orientation reference signal trigger method
- F18: Spindle orientation arrive delay time
- F91: Spindle orientation completed range
- F92: Spindle orientation position gain

(2) Parameters that are used in spindle rapid orientation

F17 Maximum speed in rapid orientation

Maximum speed in rapid orientation, bigger values mean quicker orientation.

F19 Spindle orientation functional parameter 0

F19.0: When using external encoder in rapid orientation:

0: Automatically calculate the gear ratio

1: Use the spindle gear box.

F19.1: Installation direction of motor encoder and external encoder.

This parameter is valid when PA-F19.0 is set to 1.

0: The same direction

1: Opposite direction

F19.3: Choose the orientation direction in rapid orientation.

0: Automatically choose

1: Choose the orientation direction from PA-F04 and PA-F05.

D07 Jerk in 'S' curve method (rpm/s²)

Valid only when PA-A95.0 is set to 1, bigger values mean acceleration change quicker.

5.2.13 Set Spindle Orientation Parameters Automatically When Using External Encoders

【Function description】

- (1)When modifying parameter A57, parameter F00/F01 is set automatically;
- (2)When A96.2 = 1, parameter F01 is altered by system commands;
- (3)When modifying parameter C11 (default: 0), parameter F00 is set automatically;
- (4)Parameter F00/F01 can be modified and saved manually (Normally, it is used only when using external one-turn switch);
- (5)Automatically check collision of orientation parameter setting. The following conditions belong to collision status:
 - ◆ When F01 = 1(signal REFP used), P13.2 = 0 (this signal is not distributed to terminals)
 - ◆ A57 = 0 (external encoders not used), F00 = 1 (use external encoders for orientation);

A96.2	A57	C11	F00	F01	Remarks
= 0	= 0	≠ 1000	0	0	Motor encoder + Z signal of motor encoder
		= 1000	0	0	Motor encoder + Z signal of motor encoder
	≠ 0	≠ 1000	1	0	External encoder + Z signal of external encoder
		= 1000	0	0	Motor encoder + Z signal of motor encoder
≠ 0	= 0	≠ 1000	0	-	Motor encoder + system setting (Z signal or REFP)
		= 1000	0	-	Motor encoder + system setting (Z signal or REFP)
	≠ 0	≠ 1000	1	-	External encoder + system setting (Z signal or REFP)
		= 1000	0	-	Motor encoder + system setting (Z signal or REFP)

【Parameter setting】

A96.2: Setting spindle reference point by servo bus commands (0: invalid, 1: valid, default: 0)

A57: External encoder type (0: unused, 1~11: specified encoder, default: 0)

C11: Filter time of encoders (0: Only the external encoder be used 1~999: Filter time of the motor encode and external encoder, 1000: Only the motor encoder be used, default: 0), this parameter is invalid until external encoder is used.

F00: Choose an encoder for spindle orientation (0: Motor encoder,1: External encoder, default: 0)

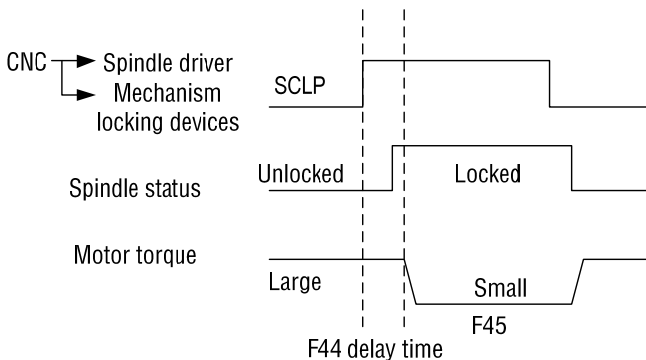
F01: Choose a reference point for spindle orientation (0: Z signal of encoders,1: external zero point signal, default: 0)

5.2.14 Spindle Interlock Function

【Function description】

In turning and milling composite machine tools, after spindle graduation, spindle is locked by mechanism. Then milling or tapping operations is performed. To avoid collision between motor drive force and mechanism locking force, which causes abnormal voice, overcurrent of drivers, spindle driver decreases drive force at this point.

This function is closed by default (A93.2=0).



【Parameter setting】

A93.2: Function switch (0: OFF 1: ON) Default:0

F44: Delay time of spindle interlock (ms), Default:0

F45: Percentage of spindle interlock torque (%), Default:5

P16.0: Input channel selection of signal SCLP, Default:0 (unused)

5.2.15 Monitoring Type of 'Z' Signal of Encoders

When PA-F50.0 and PA-F50.1 are set to 2, ZD210 servodrive will keep monitoring the 'Z' signal of encoders.

If a disturbance causes an error 'Z' signal input, alarms will occur to avoid spindle orientation fault and thread turning fault. 'Er 046' or 'Er 052' will occur when the following situations happen:

- (1) The encoder pulse number between two 'Z' signals is incorrect.
- (2) The pulse number exceeds the encoder pulse number per revolution from the last 'Z' signal.

Modify PA-F50 to choose the monitoring type of 'Z' signal of encoders.

Modify PA-F51 to set the maximum monitoring speed of motor encoder. When motor encoder speed exceeds the speed in this parameter, stop monitoring the 'Z' signal.

Modify PA-F52 to set the maximum monitoring speed of external encoder. When external encoder speed exceeds the speed in this parameter, stop monitoring the 'Z' signal.

5.2.16 Full Position Closed-loop

When external encoders are installed, ZD210 servodrive supports full position closed-loop. If there is displacement between spindle and motor shaft during operation, ZD210 servodrive can still perform the spindle orientation operation using external encoders.

The default setting is not using the full position closed-loop function.

Modify PA-F57 to choose the external encoder type.

Modify PA-C11 to set the filter time of encoders. '1000ms' means only the motor encoder be used (not using the full position closed-loop function), '0ms' means

only the external encoder be used.

Modify PA-C12 to set the position deviation alarm value of encoders. '0' means do not detect position deviation of encoders.

If the difference between motor encoder position and external encoder position exceeds the value of this parameter, 'Er 035' occurs.

The 'rEE' item in dP menu displays the position deviation between motor encoder and external encoder.



Modify PA- A96.3 to choose the encoder to obtain the initial position.


Properly set the transmission ratio in PA-F20, PA-F30 and some other parameters when using the full position closed-loop function. Modify PA-C01 and PA-C02 as follows:




$$\frac{C01}{C02} = \frac{\text{Pulse's number per revolution}}{\text{Command pulses that spindle needs per revolution}}$$

5.2.17 JOG Mode










JOG mode is used in trial operation.

Before the motor is powered on, keep pressing the  key until the JOG LED starts flashing, then ZD210 servodrive is running in JOG mode. Press the  key again to exit JOG mode, and the JOG LED stops flashing.

When the motor is already powered on, press the  key will have no effect.

In JOG mode, only the ,  and  key are effective, and parameter PA-A05 is invalid.

There are three operation methods in JOG mode, please refer to the following table:

Operation method	PA-A60 Setting	Description
Start-stop operation	STSP	<p>Press the  key, the JOG LED starts flashing, the motor stops, and then the servodrive is running in start-stop method. Keep pressing the  key, the motor will rotate in CW direction with the speed that set in PA-D05. Keep pressing the  key, the motor will rotate in CCW direction with the speed that set in PA-D05. Release the keys, the motor stops.</p>
Continuous operation	CON	<p>Press the  key, the JOG LED starts flashing, the motor stops, and then the servodrive is running in continuous method. Each time when users press the  or  key, the motor speed will change with a user-defined value that is set in PA-D24. The maximum command speed is set in PA-D05.</p>
VF debugging operation	UF	<p>Press the  key, the JOG LED starts flashing, and then the servodrive is running in VF debugging method. The motor output voltage is set in PA-A61; the motor speed is set in PA-A62. Press the  and  keys will have no effect.</p> <p>When you first use a servo motor, perform the VF debugging operation to check whether the motor U,V,W phase sequence matches the motor encoder installation direction.</p>

- If the servodrive is running in start-stop method or continuous method, and users press the JOG key when the motor is still rotating, the servodrive will perform the 'S' curve function to stop the motor, then the servodrive is ready for the next operation.
- When alarms occur or the emergency stop input terminal 'EST' is valid, the servodrive will exit JOG mode automatically.

5.2.18 Automatic Motor Parameters Adjustment

Perform the tU3 operation to implement automatic motor parameters adjustment, including motor U,V,W phase sequence, stator resistance, rotor resistance, mutual inductance, leakage inductance, excitation time constant, field weakening starting speed and moment of inertia, etc.

Operation	Description	Servodrive operation sequence
b-tU3	Automatic motor parameters adjustment. If the servo motor you use beyond the ones that ZD210 servodrives have given, perform this operation.	(1) Motor is powered on and stays still for about five second. (2) Motor rotates with low speed for about five seconds. (3) Perform the 'S' curve function to accelerate to the rated speed for about five seconds. (4) Perform the 'S' curve function to decelerate to a low speed for about 25 seconds. (5) Perform the 'S' curve function to stop, and the motor stays still for about 40 seconds. (6) Motor rotates forward and reverse for about five seconds.

The LEDs will display the operation progress, and display 'Finish' when the operation completed, the results will automatically save in PA-B10 to PA-B18, and PA-A63 will be modified according to the motor U,V,W phase sequence.

If the servo motor you use beyond the ones that ZD210 servodrives have given, follow the steps shown in the following table.

Step	Operation
1	Input PA-B00 to PA-B07 refers to the motor nameplate. Parameters B01, B02 and B03 must be set accurately. After users input parameter B00, parameters B10 to B18 will be set automatically. Parameter B02 is the motor pole pair, for example, 4-pole motor's pole pair is 2.
2	Set PA-A01 to 0, ensure the motor is powered off, and then perform the b-tU3 operation.
3	When step 2 finished, parameters in B10 to B18 will be automatically updated.

Possible faults or warnings and corresponding countermeasures as shown in the following table:

Code	Type	Description	Countermeasure
Er 028	Fault	Cannot perform the 'tU3' operation. The motor may have been powered on.	Ensure that the motor is powered off.
Er 044	Fault	Motor overcurrent.	Decrease parameter PA-D06.
AL 139	Warning	The result of the 'tU3' operation is incorrect.	(1) Properly input PA-B00 to PA-B07 refer to the motor nameplate, and perform the 'tU3' operation again. (2) If the above countermeasures cannot solve this problem, that means ZD210 servodrive does not support this type of motors, use another motor.

Warning	
1.2.1	Do not connect the servo motor to the load when performing the 'b-tU3' operation.
1.2.2	Ensure that the servo motor is installed firmly.
1.2.3	The servo motor will rotate at high speed, reaching the rated speed, operator please stay off the motor to prevent injury.

- This operation will not be interrupted unless alarms occur or the 'EST' input signal is valid.

5.2.19 Automatic Motor Load Inertia Adjustment

The motor load inertia ratio is set in parameter PA-A56, it is an important parameter in servo system, perform the 'tU1' operation to implement automatic motor load inertia adjustment. Please refer to the following table.

Step	Operation
1	<ol style="list-style-type: none"> 1. Ensure that motor rotation does not result in collisions or overtravel. Properly set parameter PA-A43. 2. Properly set the maximum motor speed in tU1 operation, which is parameter PA-A42. 3. When in trial operation, set the A91.2 parameter to 0, in order to prevent vibration caused by big load inertia and low rigidity of the servo system.
2	Perform the 'tU1' operation when the motor is stopping. Choose the 'tU1' item in tU menu, keep pressing the <input type="button" value="Enter"/> key until "-----" is displayed, and then the motor start rotating with a speed that set in PA-A43.
3	When the 'tU1' operation finished, the motor load inertia ratio will be displayed. If PA-A91.2 is set to 1, the result will be saved in PA-A56, otherwise PA-A56 remain the same.
4	When the 'tU1' operation finished, the motor will automatically return to the previous position.

Parameters that used in this operation are as follows:

Parameter	Name	Description	Setting Range	Factory Setting	Unit	Auth- ority
A42	Maximum speed in 'tU1' operation	The maximum motor speed in 'tU1' operation.	500~1500	1000	rpm	√ A
A43	Maximum revolution in 'tU1'	If this value is too small, 'AL 129' warning	2~8	4	rev	√ A

Parameter	Name	Description	Setting Range	Factory Setting	Unit	Authority
	operation	may occur. Else if this value is too big, it may result in collisions or overtravel.				
A91.2	The application method of 'tU1' operation	The application method of 'tU1' operation. 0: Manual 1: Automatic	0~1	0	—	× A
A56	Motor load inertia ratio	The ratio of loads' inertia to motors' inertia.	50~5000	100	%	√ A

Possible faults or warnings and corresponding countermeasures as shown in the following table:

Code	Type	Description	Countermeasure
Er 029	Fault	Cannot perform the 'tU1' operation. The motor is running in spindle orientation operation.	Perform 'tU1' operation after the spindle orientation operation is finished.
AL 129	Warning	The motor acceleration is too high in 'tU1' operation.	(1) Decrease PA-A42. (2) Increase PA-A43
AL 131	Warning	The motor load inertia ratio varies too much in 'tU1' operation, exceeds 20%.	(1) Eliminate the disturbance on motor shaft. (2) If there is no disturbance, properly increase PA-A42.
AL 132	Warning	The result of the 'tU1' operation is incorrect.	(1) Reduce the load inertia, or use another motor with bigger inertia. (2) Properly set PA-A01.

- Ensure that motor rotation does not result in collisions or overtravel. Properly set parameter PA-A43.
- Ensure that the servo motor is connected to the load when performing the 'tU1' operation.
- If significant changes of the load inertia occur, or parameter A56 is set to the default value, please perform tU1 operation.
- Properly set PA-A56, otherwise parameters PA-C00, PA-D00, PA-D01 and PA-D02 is meaningless.
- This operation will not be interrupted unless alarms occur or the 'EST' input signal is valid

5.2.20 Two Sets of Parameters for Lathe/milling Machine

【Function description】

Usually, load inertia ratio of a lathe is relatively large, driving belt is relatively long and rigidity is relatively low; load inertia ratio of a milling machine is relatively small, driving belt is relatively short and rigidity is relatively high. For the differences between lathe and milling machine, there are two sets of parameters built in drivers, which can be selected for different application conditions.

【Parameter setting】

A95.3: Set lathe /milling machine mode (0: Milling machine; 1: Small-sized lathe; 2: Lathe). Normally, it is set to 2 for lathe, and set to 0 for milling machine.

A95.3	A56 %	A55 —	F70 —	F94 rad/s	F95 Hz	F96 ms	F97 Hz
0	200	0	2	30	20	50	160
1	400	-1	0	15	10	50	160
2	600	-1	0	15	10	50	160

5.2.21 Gain Shift Function

【Function description】

There are two sets of gain parameters, which can be shifted dynamically.
Function switch: E90.0, servo bus manual shift is valid by default.

Gain parameters of group 1 are F70/F64~F68, and gain parameters of group 2 are A55/C00/C03/D00/D01/D02.

Drivers use gain parameters of group 2 at power-on by default. In speed control mode, gain parameters of group 2 are used; while in position control mode, gain parameters of group 1 are used.

Current gain can be displayed in monitoring item DP-EAS:

1: Gain of group 1

2: Gain of group 2

102: Shifting from gain of group 1 to group 2

201: Shifting from gain of group 2 to group 1

◆ Manual shift:

(1)Select gain parameters of group 1 or group 2 by servo bus (E90.0);

(2)Select gain parameters of group 1 or group 2 by DI signal GSEL (E90.0=1);

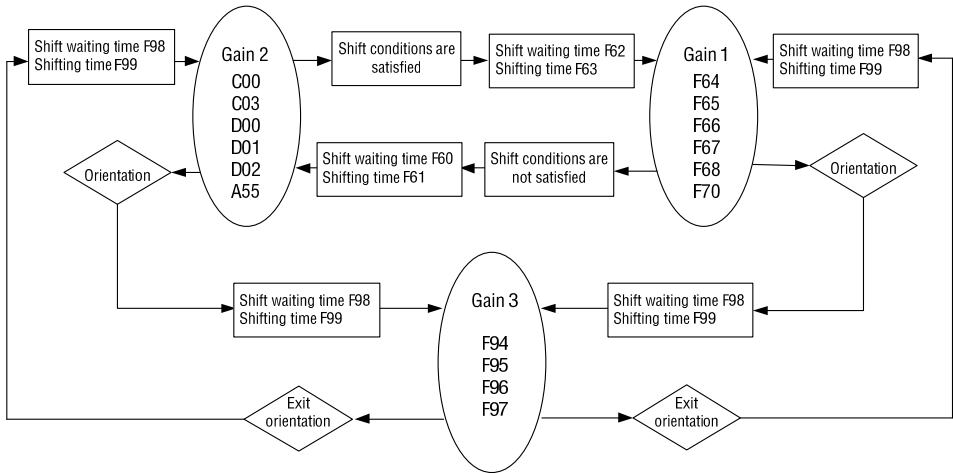
◆ Automatic shift:

Shift between two sets of gain parameters according to conditions selected by E90.1:

E90.1	Shift conditions	
	Position running mode	Other running modes
0	COIN on	Fixed to be gain 2
1	COIN off	Fixed to be gain 1
2	NEAR on	Fixed to be gain 2
3	NEAR off	Fixed to be gain 1

When shift conditions are satisfied, gain parameters of group 2 is shifted to gain parameters of group 1;

When shift conditions can not be satisfied, gain parameters of group 1 is shifted to gain parameters of group 2;



Schematic diagram of gain shift

◆ Gain of orientation (gain of group 3)

When spindle drivers perform orientation, in order to shorten orientation time and promote position keeping rigidity, a set of gain parameters F94~F97 for orientation is added.

When a spindle driver is performing orientation, motor decreases speed approaching to 0 first, then shifts from current gain status to orientation gain status; after exiting orientation, spindle driver shifts from orientation gain status to current gain status.

Orientation gain can be shifted only when a spindle driver is performing orientation, that is, when orientation is triggered by input signal ORCM.

【Parameter setting】

E90.0: Shifting methods (0: Shifted by servo bus 1: Shifted by DI signal 2: Automatically shifted 3: Function closed)

E90.1: Automatic shifting conditions (0: COIN on 1: COIN off 2: NEAR on 3: NEAR off)

F60: Gain shift (1→2) waiting time, default: 0ms

F61: Gain shifting (1→2) time, default: 0ms

F62: Gain shift (2→1) waiting time, default: 0ms

F63: Gain shifting (2→1) time, default: 0ms

F64: Gain of group 1: position loop gain, default: 10rad/s (corresponding to C00)

F65: Gain of group 1: speed feedforward factor of position loop, default: 0 (corresponding to C03)

F66: Gain of group 1: speed loop gain, default: 10Hz (corresponding to D00)

F67: Gain of group 1: speed loop integral time constant, default: 100ms (corresponding to D01)

F68: Gain of group 1: cut-off frequency of torque filter, default: 160Hz (corresponding to D02)

F71: Gain of group 1: system rigidity, default: 0 (corresponding to A55)

P16.1: Input channel selection of signal GSEL, default: 8 (input from X8 as same as signal VP)

Gain parameters of orientation

F94: Gain of group 3: position loop gain of orientation, default: 15rad/s (corresponding to C00)

F95: Gain of group 3: speed loop gain of orientation, default: 10Hz (corresponding to D00)

F96: Gain of group 3: speed loop integral time constant of orientation, default: 50ms (corresponding to D01)

F97: Gain of group 3: cut-off frequency of torque filter for orientation, default: 160Hz (corresponding to D02)

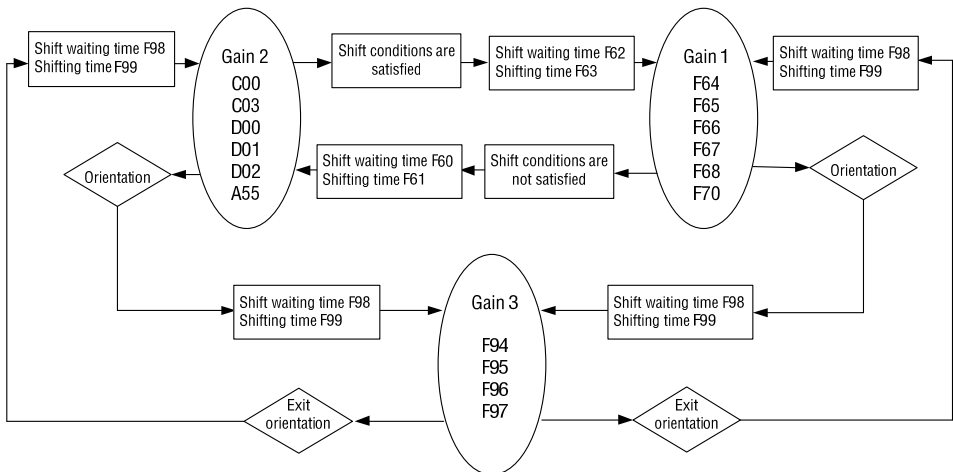
F98: Gain shift waiting time (shift to gain of group 3), default: 0ms

F99: Gain shifting time (shift to gain of group 3), default: 0ms

5.2.22 Gain shift Function for Spindle Orientation

When spindle drivers perform orientation, in order to shorten orientation time and promote position keeping rigidity, a set of gain parameters F94~F97 for orientation is added.

When a spindle driver is performing orientation, motor decreases speed approaching to 0 first, then shifts from current gain status to orientation gain status; after exiting orientation, spindle driver shifts from orientation gain status to current gain status.



【Parameter setting】

F29.1: Gain shift function for orientation, default:1 (enabled)

F94: Gain of group 3: position loop gain of orientation, default: 15rad/s (corresponding to C00)

F95: Gain of group 3: speed loop gain of orientation, default: 10Hz (corresponding to D00)

F96: Gain of group 3: speed loop integral time constant of orientation, default: 50ms (corresponding to D01)

F97: Gain of group 3: cut-off frequency of torque filter for orientation, default: 160Hz (corresponding to D02)

F98: Gain shift waiting time (shift to gain of group 3), default: 0ms

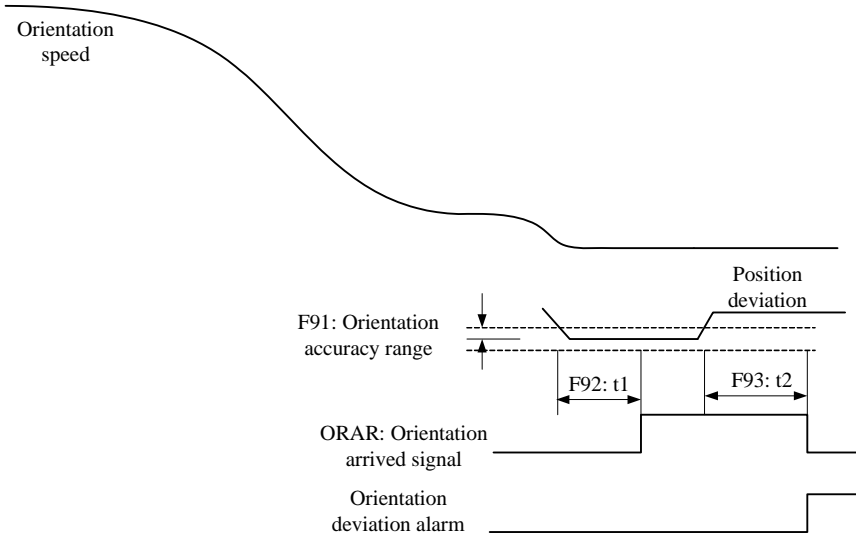
F99: Gain shifting time (shift to gain of group 3), default: 0ms

5.2.23 Monitor Function for Spindle Orientation Deviation Alarm

【Function description】

During spindle orientation, when motor decelerates close to zero, if position deviation is less than setting value of F91 and holding time exceeds setting value of F92, then orientation arrived signal (ORAR) is output; if under external forces, position deviation is greater than setting value of F91 and holding time exceeds setting value of F93, excessive orientation deviation alarm (Er053) will occur, and orientation arrived signal (ORAR) won't be output.

Monitor function of orientation deviation alarm can be closed by setting parameter F29.0.



【Parameter setting】

F29.0: Monitor function of orientation deviation alarm, enabled by default setting 1

F91: Orientation accuracy range (degree), default: 0.5 degrees

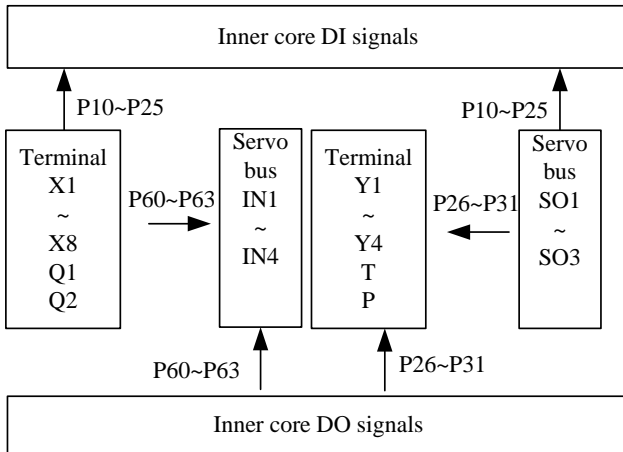
F92: Valid holding time threshold value within orientation accuracy range (ms), default: 100ms

F93: Holding time threshold value beyond orientation accuracy range (ms), default: 200ms

5.2.24 Servo Bus Input&output Function of IN1~IN4 and SO1~SO3

【Function description】

By servo bus commands, system can send drivers output signals (SO1~SO3), and receive input signals (IN1~IN4) feedback from drivers at the same time. Signals SO1~SO4 not only can be distributed to inner DI signals of drivers, but also can be output to output terminals (Y1~Y4, T, P) of drivers; signals IN1~IN4 not only can be distributed from inner DO signals of drivers, but also from input terminals (X1~X8) of drivers.



【Parameter setting】

P10~P25: Configuration of input DI signals (1~8: X1~X8 9~B: SO1~SO3)

P26~P31: Configuration of terminal output (1~32: DO1~32 81~83: SO1~SO3)

P60~P63: Configuration of servo bus IN signal source (1~8: X1~X8 9~B: SO1~SO3)

6. Protection Function

6.1 Error/warning List

Code		Type	Description
Dec.	Hex.		
000	00H	Normal	No error or warning
001 ~ 127			
001	01H	Error	Rotation speed exceeds the maximum speed.
002	02H	Error	Main circuit overvoltage (hardware detection)
003	03H	Error	Main circuit low-voltage (hardware detection)
004	04H	Error	Positioning deviation is out of tolerance.
005	05H	Error	External encoder error
006	06H	Error	Speed saturates for long time
007	07H	Error	Positive and negative limitation switches error.
008	08H	Error	Servodrive hardware error
009	09H	Error	Motor encoder error
010	0AH	Error	Power line open phase
012	0CH	Error	Motor overcurrent (software detection)
014	0EH	Error	Braking resistor is working for a long time
015	0FH	Error	Need to restart the servodrive
016	10H	Error	Software and hardware are not match
017	11H	Error	Main circuit overvoltage (software detection)
019	13H	Error	Command speed exceeds the maximum speed.
020	14H	Error	EEPROM error when reading or writing.
021	15H	Error	No data is in the EEPROM parameter backup area or data has been damaged.
022	16H	Error	Data in the EEPROM parameter storage area has been damaged.
023	17H	Error	Value of parameters in the EEPROM exceeds the specified range.
024	18H	Error	Position command after gear ratio exceeds the maximum speed of motors.
025	19H	Error	Servodrive software error
026	1AH	Error	Main circuit low-voltage (software detection)
027	1BH	Error	User-set motor parameters (Group B) error


Code		Type	Description
Dec.	Hex.		
028	1CH	Error	'tU3' operation error
029	1DH	Error	'tU1' operation error
031	1FH	Error	IPM module overheat, exceeds 100°C
033	21H	Error	Error encoder type
034	22H	Error	Motor absolute encoder communication error
035	23H	Error	Position deviation between motor encoder and external encoder exceeds the specified range.
037	25H	Error	Modbus initialization error
038	26H	Error	Command position exceeds the maximum range specified in software.
040	28H	Error	PA-F01 is set to 1, but the 'REFP' input signal is not assigned to any DI input terminals.
041	29H	Error	Low voltage of absolute encoder batteries causes multi-circle data lost
042	2AH	Error	Multi-circle data error for battery type absolute encoders
043	2BH	Error	Cannot perform the spindle orientation operation.
044	2CH	Error	Motor overcurrent (hardware detection)
045	2DH	Error	Motor U,V,W phase sequence disorder.
046	2EH	Error	Error 'Z' signal input of the motor encoder.
047	2FH	Error	PA-F00 is set to 1, but external encoder type is not specified.
048	30H	Error	External encoder is not working properly when performing the spindle orientation operation.
049	31H	Error	Error spindle shift signal input of the spindle gear box.
050	32H	Error	The gear ratio of the spindle gear box exceeds the specified limitation.
052	34H	Error	Error 'Z' signal input of the external encoder.
053	35H	Error	Spindle position deviate from the orientation position exceeds the specified range.
054	36H	Error	Counting error for absolute encoders
056	38H	Error	Spindle orientation error
058	3AH	Error	External absolute encoder communication error
060	3CH	Error	Absolute encoder multi-turn data error

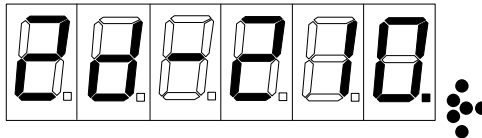
Protection Function


Code		Type	Description
Dec.	Hex.		
061	3DH	Error	Error motor type
062	3EH	Error	Motor encoder speed exceeds the specified range.
063	3FH	Error	Motor encoder acceleration exceeds the specified range.
064	40H	Error	External encoder speed exceeds the specified range.
065	41H	Error	External encoder acceleration exceeds the specified range.
066	42H	Error	Power supply error
068	44H	Error	DI input signals error
069	45H	Error	Current zero drift detecting circuit error
070	46H	Error	Self-learning gear ratio (TU6) overtime
128 ~ 191			
128	80H	Warning	The operations are not allowed when the motor is running.
129	81H	Warning	The motor acceleration is too high in 'tU1' operation.
130	82H	Warning	EEPROM parameters region is not initialized
131	83H	Warning	The motor load inertia ratio varies too much in 'tU1' operation, exceeds 20%.
132	84H	Warning	The result of the 'tU1' operation is incorrect.
133	85H	Warning	Some parameters have been changed through servo bus (KSN).
134	86H	Warning	Prohibitive to change this parameter through servo bus (KSN).
135	87H	Warning	Not allowed to change parameters through servo bus (KSN) at the current authority.
136	88H	Warning	Zero position has been changed.
137	89H	Warning	Power line open phase.
138	8AH	Warning	Improper 'S' curve parameters settings.
139	8BH	Warning	Invalid user-set motor parameters (Group B).
140	8CH	Warning	The positive rotation direction (CW) is not allowed and a CW rotate command is received.
141	8DH	Warning	The negative rotation direction (CCW) is not allowed and a CCW rotate command is received.
142	8EH	Warning	IPM module overheat, exceeds 90°C
143	8FH	Warning	Servodrive internal overheat, exceeds 75°C

Code		Type	Description
Dec.	Hex.		
148	94H	Warning	Illegal servo bus (KSN) command or data.
149	95H	Warning	PA-A01 is not set to 0 in 'tU3' operation.
150	96H	Warning	The voltage of the battery used for absolute encoders is low
151	97H	Warning	Unsupported motor model is specified through servo bus.
153	99H	Warning	Parameter modification is invalid.
154	9AH	Warning	Parameter value exceeds permitted range
160	A0H	Warning	Servodrive is not ready.
192 ~ 255			
228	E4H	Error	Servo bus (KSN) overrun
229	E5H	Error	Servo bus (KSN) position interpolation error
230	E6H	Error	Servo bus (KSN) communication error
231	E7H	Error	Unsupported synchronizing period
232	E8H	Error	Servo bus (KSN) WDT error
233	E9H	Error	Servo bus (KSN) synchronizing error
234	EAH	Error	Servo bus (KSN) initialization error

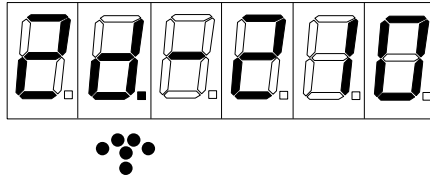
Explanations:

1. Error code will twinkle when one or more errors occur. Keep pressing the  key can stop the twinkle status, but the decimal point at the right bottom corner will twinkle simultaneity, which indicates the servodrive is in error status. The current error code can be read in the 'Err' item of the dP monitor menu. When some errors happen, the 'RUN' LED will off immediately, the motor is put in free status or braking status (equipped with mechanical brake and wiring correctly).



2. Warning code will twinkle when one or more alarms occur. Keep pressing the  key can stop the twinkle status, but the decimal point at second LED

right bottom corner will twinkle simultaneity, which indicates the servodrive is in alarm status. The current alarm code can be read in the 'AL' item of the dP monitor menu.



- Keep pressing the **Esc** key will exit from the warning status after solving the problems and the decimal point will stop twinkle.

6.2 Error/warning

6.2.1 Error

Er 001	Motor rotation speed exceeds the maximum speed	
Status	Cause	Remedy
When servodrive is powered on.	<ol style="list-style-type: none"> 1. Motor encoder malfunction. 2. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Check the motor encoder wiring. 2. Replace motor encoder. 3. Replace motor. 4. Replace servodrive.
When motor is running	Motor rotation speed exceeds the maximum speed.	Reduce the command speed.

Er 002	Main circuit overvoltage (hardware detection)	
Status	Cause	Remedy
When servodrive is powered on	Servodrive malfunction.	Replace servodrive.
When motor deceleration	Regenerative energy exceeds braking resistor capacity.	<ol style="list-style-type: none"> 1. Increase deceleration time constant. 2. Reduce load. 3. Use a lower ohm braking resistor. 4. Increase braking resistor capacity.

Er 003	Main circuit low-voltage (hardware detection)	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Low power supply voltage. 2. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Check the power supply. 2. Replace servodrive.

Er 004	Positioning deviation is out of tolerance.	
Status	Cause	Remedy
When in position control mode	The difference between command position and actual position exceeds the value of PA-C06.	<ol style="list-style-type: none"> 1. Increase PA-C06. 2. Increase PA-A55. 3. Set PA-C05 to 1, prohibit position deviation detection

Er 005	External encoder error	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. The setting of PA-A57 is to use an external encoder, but no external encoder is installed. 2. External encoder is damaged. 3. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Modify PA-A57, do not use the external encoder. 2. Replace external encoder. 3. Replace servodrive.
When motor is running	<ol style="list-style-type: none"> 1. Improper external encoder wiring. 2. External encoder is damaged. 	<ol style="list-style-type: none"> 1. Check the external encoder wiring. 2. Replace external encoder.

Er 006	The actual motor speed is less than the command speed for a long time.	
Status	Cause	Remedy
When in trial operation	Motor U,V,W phase sequence disorder.	Inverse the value of PA-A63.
When motor is running	<ol style="list-style-type: none"> 1. Under heavy load. 2. The value of PA-E24 is too small. 3. The value of PA-A82 is too small. 	<ol style="list-style-type: none"> 1. Reduce load. 2. Increase PA-E24. 3. Increase PA-A82.

Er 007		
Positive and negative limitation switches error.		
Status	Cause	Remedy
When servodrive is powered on	When PA-A91.0 is set to 1, the 'CWLI' and 'CCWLI' input signals are effective at the same time.	<ol style="list-style-type: none"> 1. Check the 'CWLI' and 'CCWLI' input signals. 2. Set PA-A91.0 to 0.

Er 008		
Servodrive hardware error		
Status	Cause	Remedy
When servodrive is powered on	Servodrive malfunction.	Restart the servodrive, if 'Er 008' still occurs, replace the servodrive.
When motor is running	<ol style="list-style-type: none"> 1. Motor U,V,W phase short circuit. 2. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Check the motor U,V,W phase wiring. 2. Restart the servodrive, if 'Er 008' still occurs, replace the servodrive.

Er 009		
Motor encoder error		
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Improper motor encoder wiring. 2. Motor encoder is damaged. 3. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Check the motor encoder wiring. 2. Replace motor encoder. 3. Replace servodrive.

Er 010		
Power line open phase		
Status	Cause	Remedy
When servodrives boot.	<ol style="list-style-type: none"> 1. Power line open phase. 2. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Check the power line wiring. 2. Replace servodrive.
When servodrives shutdown.	PA-A16 is set to 'Er'.	No operation is needed.

Er 012 Motor overcurrent (software detection)		
Status	Cause	Remedy
When servodrives boot	Servodrive malfunction.	Replace servodrive.
When in trial operation	Motor U,V,W phase sequence disorder.	Inverse the value of PA-A63.
When motor is running	<ol style="list-style-type: none"> 1. Under heavy load. 2. There is disturbance on the servo system. 3. Improper user-set motor parameters (Group B). 4. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Reduce load. 2. Increase PA-A66. 3. Properly set parameters in group B. 4. Replace servodrive.

Er 014 Braking resistor is working for a long time		
Status	Cause	Remedy
When the motor is off	Servodrive malfunction.	Replace servodrive.
When motor deceleration	Regenerative energy exceeds braking resistor capacity.	<ol style="list-style-type: none"> 1. Increase deceleration time constant. 2. Reduce load. 3. Use a lower ohm braking resistor. 4. Increase braking resistor capacity. 5. Increase PA-A47.

Er 015 Need to restart the servodrive		
Status	Cause	Remedy
A relevant parameter has been set	Need to restart the servodrive	Perform 'tU9' operation to restart, or manual restart.

Er 016 Software and hardware are not match		
Status	Cause	Remedy
When servodrive is powered on	Servodrive malfunction.	Replace servodrive.

Er 017 Main circuit overvoltage (software detection)		
Status	Cause	Remedy
When motor deceleration	Regenerative energy exceeds braking resistor capacity.	<ol style="list-style-type: none"> 1. Increase deceleration time constant. 2. Reduce load. 3. Use a lower ohm braking resistor. 4. Increase braking resistor capacity. 5. Increase PA-A14.

Er 019 Command speed exceeds the maximum speed.		
Status	Cause	Remedy
In speed control mode	<ol style="list-style-type: none"> 1. Command speed exceeds the maximum motor speed. 2. Improper user-set motor parameters (Group B) when PA-A01 is set to 0. 	<ol style="list-style-type: none"> 1. Reduce the command speed. 2. Properly set parameters in group B.

Er 020 EEPROM error when reading or writing.		
Status	Cause	Remedy
When servodrives boot or a relevant parameter is set	EEPROM error when reading or writing.	Replace servodrive.

Er 021 No data is in the EEPROM parameter backup area or data has been damaged.		
Status	Cause	Remedy
When performing the 'rS' operation in EE menu	<ol style="list-style-type: none"> 1. Need to perform 'bA' operation. 2. EEPROM error. 	<ol style="list-style-type: none"> 1. Perform the 'bA' operation. 2. Replace servodrive.

Er 022	Data in the EEPROM parameter storage area has been damaged.	
Status	Cause	Remedy
When servodrives boot or performing operations in EE menu	<ol style="list-style-type: none"> 1. The servodrive software has been upgraded. 2. EEPROM error. 	<ol style="list-style-type: none"> 1. Perform the 'dEF' operation in EE menu, and then restart. 2. Replace servodrive.

Er 023	Value of parameters in the EEPROM exceeds the specified range.	
Status	Cause	Remedy
When servodrives boot or performing operations in EE menu	The servodrive software has been upgraded.	Perform the 'dEF' operation in EE menu, and then restart.

Er 024	Position command after gear ratio exceeds the maximum speed of motors.	
Status	Cause	Remedy
In position control mode	<ol style="list-style-type: none"> 1. Position command frequency is too high. 2. Improper gear ratio setting. 3. Improper user-set motor parameters (Group B) when PA-A01 is set to 0. 	<ol style="list-style-type: none"> 1. Reduce the position command frequency. 2. Check the values of PA-C01 and PA-C02. 3. Properly set parameters in group B.

Er 025	Servodrive software error	
Status	Cause	Remedy
When servodrive is powered on	Servodrive malfunction.	Replace servodrive or contact KND technical service center for more information.

Er 026	Main circuit low-voltage (software detection)	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Low power supply voltage. 2. Improper setting of PA-A15. 3. Servodrive malfunction. 	<ol style="list-style-type: none"> 1. Check the power supply. 2. Decrease PA-A15. 3. Replace servodrive

ER 027		
User-set motor parameters (Group B) error		
Status	Cause	Remedy
When servodrive is powered on or PA-A01 has been changed	PA-A01 is set to 0 and 'tU3' operation is needed.	Perform 'tU3' operation or do not set PA-A01 to 0.

Er 028		
'tU3' operation error		
Status	Cause	Remedy
When performing the 'tU3' operation	<ol style="list-style-type: none"> 1. The motor is on when performing the 'tU3' operation. 2. 'tU3' operation failed. 	<ol style="list-style-type: none"> 1. Perform 'tU3' operation when the motor is off. 2. Perform 'tU3' operation again.

Er 029		
'tU1' operation error		
Status	Cause	Remedy
When performing the 'tU1' operation	<ol style="list-style-type: none"> 1. Start to perform the 'tU1' operation when the motor speed is more than 30rpm. 2. Spindle orientation operation is still in progress. 3. JOG operation is still in progress. 	<ol style="list-style-type: none"> 1. Perform 'tU1' operation when the motor speed is below 30rpm. 2. Perform 'tU1' operation when spindle orientation finished. 3. Exit JOG mode and perform 'tU1' operation again.

Er 031		
IPM module overheat, exceeds 100°C		
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Ambient temperature is too high. 2. Under heavy load. 3. The IPM module is damaged. 	<ol style="list-style-type: none"> 1. Enhance heat dissipation. 2. Reduce load. 3. Set PA-A98.1 to 1. 4. Replace servodrive.

Er 033	Error encoder type	
Status	Cause	Remedy
When servodrive is powered on	Improper user-set motor parameters (Group B).	Properly set parameters in group B, modify PA-B01 to choose a proper encoder type.

Er 034	Motor absolute encoder communication error.	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Improper motor model. 2. Improper encoder wiring. 3. Shield grounding is not connected. 4. Encoder malfunction. 	<ol style="list-style-type: none"> 1. Properly set PA-A01. 2. Check the motor encoder wiring. 3. Replace motor encoder.

Er 035	Position deviation between motor encoder and external encoder exceeds the specified range.	
Status	Cause	Remedy
When servodrive is powered on	Position deviation between motor encoder and external encoder exceeds the specified range.	<ol style="list-style-type: none"> 1. Check the 'rEE' item in dP menu. 2. Increase PA-C12 or set PA-C12 to 0.

Er 037	Modbus initialization error	
Status	Cause	Remedy
When servodrives boot.	Servodrive malfunction.	Restart the servodrive, if 'Er 037' still occurs, replace the servodrive.

Er 038	Command position exceeds the maximum range specified in software.	
Status	Cause	Remedy
When servodrive is powered on	The 'CWLI' or 'CCWLI' input signal is effective.	<ol style="list-style-type: none"> 1. Check the 'CWLI' and 'CCWLI' input signals. 2. Set PA-A91.0 to 0.

Er 040	PA-F01 is set to 1, but the 'REFP' input signal is not assigned to any DI input terminals.	
Status	Cause	Remedy
When servodrives boot or performing the spindle orientation operation	PA-F01 is set to 1, but the 'REFP' input signal is not assigned to any DI input terminals.	<ol style="list-style-type: none"> 1. Set PA-F01 to 0. 2. Modify PA-P13 to assign the 'REFP' input signal to one of the DI input terminals.

Er 041	Low voltage of absolute encoder batteries causes multi-circle data lost	
Status	Cause	Remedy
Occurs when turning on the power or running	<ol style="list-style-type: none"> 1 Drive a motor with an absolute encoder at the first time 2 Battery voltage is low 3 Batteries are not installed 4 The encoder is damaged 	Perform the –tU4 operation

Er 042	Multi-circle data error for battery type absolute encoders	
Status	Cause	Remedy
Occurs when turning on the power or running	<ol style="list-style-type: none"> 1 Abnormal malfunction 2 The encoder is damaged 	Perform the –tU4 operation If it occurs frequently, replace a motor encoder

Er 043	Cannot perform the spindle orientation operation.	
Status	Cause	Remedy
When start to perform the spindle orientation operation.	Cannot perform the spindle orientation operation.	Please refer to section 5.2.11 for more information.

Er 044	Motor overcurrent (hardware detection)	
Status	Cause	Remedy
When servodrives boot	Servodrive malfunction.	Replace servodrive.
When in trial operation	Motor U,V,W phase sequence disorder.	Inverse the value of PA-A63.
When motor is running	<ol style="list-style-type: none"> 1. Under heavy load. 2. There is disturbance on the servo system. 3. Servodrive malfunction 	<ol style="list-style-type: none"> 1. Reduce load or replace with a higher capacity servodrive. 2. Enhanced electromagnetic shielding. 3. Replace servodrive.

Er 045	Motor U,V,W phase sequence disorder.	
Status	Cause	Remedy
When in trial operation	Motor U,V,W phase sequence disorder.	Inverse the value of PA-A63.
When motor is running with load	<ol style="list-style-type: none"> 1. Improper detection. 2. Improper setting of PA-A55. 	<ol style="list-style-type: none"> 1. Set PA-A92.2 to 0. 2. Decrease PA-A55.

Er 046	Error 'Z' signal input of the motor encoder.	
Status	Cause	Remedy
When motor is running	<ol style="list-style-type: none"> 1. Improper user-set motor parameters (Group B). 2. Error 'Z' signal input of the motor encoder. 	<ol style="list-style-type: none"> 1. Properly set parameters in group B, modify PA-B01 to choose a proper encoder type. 2. Set PA-F50.0 to 1.

Er 047	PA-F00 is set to 1, but external encoder type is not specified.	
Status	Cause	Remedy
When servodrives boot or start to perform the spindle orientation operation or 'tU5' operation.	PA-F00 is set to 1, but external encoder type is not specified.	Properly set PA-A57.

Er 048	External encoder is not working properly when performing the spindle orientation operation.	
Status	Cause	Remedy
When performing the spindle orientation operation	External encoder is not working properly when performing the spindle orientation operation.	Check the external encoder wiring.

Er 049	Error spindle shift signal input of the spindle gear box.	
Status	Cause	Remedy
When servodrive is powered on	Receives the spindle shift signal when motor speed exceeds the value in PA-A83.	<ol style="list-style-type: none"> 1. Properly increase PA-A83. 2. Check the spindle shift signal. 3. Perform spindle shift when motor speed is below the value in PA-A83.

Er 050	The gear ratio of the spindle gear box exceeds the specified limitation.	
Status	Cause	Remedy
When servodrives boot or parameters PA-F20 to PA-F27 and PA-F30 to PA-F37 have been changed	Improper settings of PA-F20 to PA-F27 and PA-F30 to PA-F37, gear ratio of the spindle gear box exceeds 1:1000.	Properly set PA-F20 to PA-F27 and PA-F30 to PA-F37.

Er 052	Error 'Z' signal input of the external encoder.	
Status	Cause	Remedy
When motor is running	<ol style="list-style-type: none"> 1. Improper setting of PA-A57. 2. Error 'Z' signal input of the external encoder. 	<ol style="list-style-type: none"> 1. Properly set PA-A57. 2. Set PA-F50.1 to 1.

Er 053	Spindle position deviate from the orientation position exceeds the specified range.	
Status	Cause	Remedy
When spindle orientation finished	When servodrive outputs the 'ORAR' signal, if the spindle position deviate from the orientation position exceeds the value of PA-F91, then the 'ORAR' signal is invalid and 'Er 053' occurs.	<ol style="list-style-type: none"> 1. Check the mechanical conditions of the servo system. 2. Properly increase PA-F92. 3. Increase PA-F91.

Er 054	Counting error for absolute encoders	
Status	Cause	Remedy
Occurs when turning on the power or running	Encoder malfunction	Replace a motor encoder

Er 056	Spindle orientation error	
Status	Cause	Remedy
When performing the spindle orientation operation	Orientation reference point signal is abnormal, results in the orientation time exceeds 10 seconds.	Check the orientation reference point signal.

Er 058	External absolute encoder communication error	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Improper external encoder type. 2. Improper external encoder wiring. 3. Shield grounding is not connected. 4. External encoder malfunction. 	<ol style="list-style-type: none"> 1. Properly set PA-A57. 2. Check the external encoder wiring. 3. Replace external absolute encoder.

Er 060	Absolute encoder multi-turn data error	
Status	Cause	Remedy
When servodrive is powered on	Absolute encoder multi-turn data error.	Replace servodrive or contact KND technical service center for more information.

Er 061	Error motor type	
Status	Cause	Remedy
When PA-A01 has been changed	Improper setting of PA-A01.	Properly set PA-A01.

Er 062	Motor encoder speed exceeds the specified range.	
Status	Cause	Remedy
When motor is running	<ol style="list-style-type: none"> 1. Motor encoder speed exceeds the specified range. 2. Motor encoder malfunction. 	<ol style="list-style-type: none"> 1. Check the motor speed. 2. Replace motor encoder.

Er 063	Motor encoder acceleration exceeds the specified range.	
Status	Cause	Remedy
When motor is running	<ol style="list-style-type: none"> 1. Motor encoder acceleration exceeds the specified range. 2. Motor encoder malfunction. 	<ol style="list-style-type: none"> 1. Check the motor speed. 2. Replace motor encoder. 3. Set PA-A96.0 to 0.

Er 064	External encoder speed exceeds the specified range.	
Status	Cause	Remedy
When motor is running	<ol style="list-style-type: none"> 1. External encoder speed exceeds the specified range. 2. External encoder malfunction. 	<ol style="list-style-type: none"> 1. Check the motor speed. 2. Replace external encoder.

Er 065	External encoder acceleration exceeds the specified range.	
Status	Cause	Remedy
When motor is running	<ol style="list-style-type: none"> 1. External encoder acceleration exceeds the specified range. 2. External encoder malfunction. 	<ol style="list-style-type: none"> 1. Check the motor speed. 2. Replace external encoder. 3. Set PA-A96.0 to 0.

Er 066	Power supply error	
Status	Cause	Remedy
When servodrives boot	Servodrive malfunction.	Replace servodrive.

Er 068	DI input signals error	
Status	Cause	Remedy
When servodrives boot	DI input signals are abnormal.	Check DI input signals.

Er 069	Current zero drift detecting circuit error	
Status	Cause	Remedy
Occurs at power-on	Current feedback sample circuit abnormal	Driver needs repair if it alarms at power-on everytime

Er 070	Self-learning gear ratio (TU6) overtime	
Status	Cause	Remedy
Occurs when performing TU6	Mechanical connection abnormal or gear ratio excessive (more than 10) or too small (less than 0.1)	Confirm mechanical connection normal;

AI 150	The voltage of the battery used for absolute encoders is low	
Status	Cause	Status
After power-on	1 The voltage is low or no battery is installed 2 Cable malfunction 3 The encoder is damaged	After power-on

AI 154	Parameter value exceeds permitted range	
Status	Cause	Remedy
Occurs when altering driver parameters	Parameter value exceeds permitted range when altering driver parameters	Confirm parameter setting range

Er 228	Servo bus (KSN) overrun	
Status	Cause	Remedy
When servodrive is powered on	Servo bus (KSN) overrun.	Restart the servodrive, if 'Er 228' still occurs, replace the servodrive.

Er 229	Servo bus (KSN) position interpolation error	
Status	Cause	Remedy
When servodrive is powered on	Servo bus (KSN) position interpolation error.	Restart the servodrive, if 'Er 229' still occurs, replace the servodrive.

Er 230	Servo bus (KSN) communication error	
Status	Cause	Remedy
When servodrive is powered on	Servo bus (KSN) communication error.	<ol style="list-style-type: none"> 1. Check the servo bus interface wiring. 2. Restart the servodrive, if 'Er 230' still occurs, replace the servodrive.

Er 231	Unsupported synchronizing period	
Status	Cause	Remedy
When servodrive is powered on	Unsupported synchronizing period of servo bus (KSN).	Check the host controller settings.

Er 232	Servo bus (KSN) WDT error	
Status	Cause	Remedy
When servodrive is powered on	Servo bus (KSN) WDT error.	<ol style="list-style-type: none"> 1. Check the servo bus interface wiring. 2. Check the host controller settings. 3. Restart the servodrive, if 'Er 232' still occurs, replace the servodrive.

Er 233	Servo bus (KSN) synchronizing error	
Status	Cause	Remedy
When servodrive is powered on	Servo bus (KSN) synchronizing error.	Check the host controller working conditions.

Er 234	Servo bus (KSN) initialization error	
Status	Cause	Remedy
When servodrive is powered on	Servo bus (KSN) initialization error.	Restart the servodrive, if 'Er 234' still occurs, replace the servodrive.

6.2.2 Warning

AL 128	The operations are not allowed when the motor is running.	
Status	Cause	Remedy
When performing 'tU' or 'EE' operation	The operations are not allowed when the motor is running.	Perform the operation when the motor is powered off.

AL 129	The motor acceleration is too high in 'tU1' operation.	
Status	Cause	Remedy
When performing 'tU1' operation	The motor acceleration is too high in 'tU1' operation.	Decrease PA-A42 or increase PA-A43.

AL 130	EEPROM parameters region is not initialized.	
Status	Cause	Remedy
When servodrive boot	EEPROM parameters region is not initialized.	No operation is needed. System will initialize the space when the warning occurs.

AL 131	The motor load inertia ratio varies too much in 'tU1' operation, exceeds 20%.	
Status	Cause	Remedy
When performing 'tU1' operation	The motor load inertia ratio varies too much in 'tU1' operation, exceeds 20%.	(1) Eliminate the disturbance on motor shaft. (2) If there is no disturbance, properly increase PA-A42.

AL 132	The result of the 'tU1' operation is incorrect.	
Status	Cause	Remedy
When performing 'tU1' operation	The result of the 'tU1' operation is incorrect.	(1) Reduce the load inertia, or use another motor with bigger inertia. (2) Properly set PA-A01.

AL 133	Some parameters have been changed through servo bus (KSN).	
Status	Cause	Remedy
When a relevant parameter is set	A relevant parameter is set through the servo bus	System note. No operation is needed.

AL 134	Prohibitive to change this parameter through servo bus (KSN).	
Status	Cause	Remedy
When users modify parameters	Prohibitive to change this parameter through servo bus (KSN).	Try another way too set the parameter.

AL 135	Not allowed to change parameters through Servo bus (KSN) at the current authority.	
Status	Cause	Remedy
When users modify parameters	Not allowed to change parameters through Servo bus (KSN) at the current authority.	Set PA-A00 to obtain higher authority and change the parameter again.

AL 136	Zero position has been changed.	
Status	Cause	Remedy
When zero position has been changed	The reason may be one of the following: 1. Electronic gear ratio is changed 2. Rotation direction is changed 3. Spindle gear box is changed	No operation is needed.

AL 137		
Status	Cause	Remedy
When servodrives boot	1. Power line open phase. 2. Servodrive power supply circuit fault.	1. Check the power line wiring. 2. Replace servodrive.
When servodrives shutdown	PA-A16 is set to 'AL'.	No operation is needed.

AL 138		
Status	Cause	Remedy
When users modify parameters	Improper 'S' curve parameters settings.	Properly set PA-D06 and PA-D07.

AL 139		
Status	Cause	Remedy
When PA-A01 is set to 0	'tU3' operation is needed.	Perform the 'tU3' operation.
When 'tU3' operation finished	'tU3' operation failed.	Perform the 'tU3' operation again. If 'AL 139' still occurs, that means servodrive does not support this type of motor.

AL 140		
Status	Cause	Remedy
When motor is running	The positive rotation direction (CW) is not allowed and a CW rotate command is received.	Modify PA-A52.

Protection Function

AL 141	The negative rotation direction (CCW) is not allowed and a CCW rotate command is received.	
Status	Cause	Remedy
When motor is running	The negative rotation direction (CCW) is not allowed and a CCW rotate command is received.	Modify PA-A52.

AL 142	IPM module overheat, exceeds 90°C	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Under heavy load. 2. The IPM module is damaged. 	<ol style="list-style-type: none"> 1. Reduce load. 2. Set PA-A98.0 to 1. 3. Replace servodrive.

AL 143	Servodrive internal overheat, exceeds 75°C	
Status	Cause	Remedy
When servodrive is powered on	<ol style="list-style-type: none"> 1. Ambient temperature is too high. 2. The internal temperature sensor is damaged. 	<ol style="list-style-type: none"> 1. Enhance heat dissipation. 2. Set PA-A98.1 to 1. 3. Replace servodrive.

AL 148	Illegal servo bus (KSN) command or data.	
Status	Cause	Remedy
When servo bus is communicating	Unsupported commands or data from host controllers are received.	No operation is needed.

AL 149	PA-A01 is not set to 0 in 'tU3' operation.	
Status	Cause	Remedy
When performing 'b-tU3' operation	PA-A01 is not set to 0 in 'tU3' operation.	Set PA-A01 to 0 and perform 'b-tU3' operation again.

AL 151	Unsupported motor model is specified through servo bus.	
Status	Cause	Remedy
When unsupported motor model is specified	Unsupported motor model is specified through servo bus.	No operation is needed.

AL 153	Parameter modification is invalid.	
Status	Cause	Remedy
When users modify parameters	Modify the parameters dozens of times within a few seconds.	Slowly modify the parameters.

AL 160	Servodrive is not ready.	
Status	Cause	Remedy
When servodrive is powered on	Driving command is received from the servo bus when servodrive is not ready	Find out the reason that cause the servodrive not ready and solve it.

7. Troubleshooting

7.1 Unable to Change Parameters

■ Unable to change parameters.

- (1) Refer to the parameters introduction, the authority '—' means not allowed to change this parameter.
- (2) Without operating authority, please set PA-A00 to a specific value. Higher authority is needed when users change some parameters, please contact KND technical service center for more information.
- (3) Refer to the parameters introduction, the authority '×' means not allowed to change this parameter when the servo motor is powered on.

7.2 Motor Cannot Rotate

■ Motor cannot rotate in JOG mode, when users press the or key.

- (1) Check the 'JOG' LED, if it stops flashing, which means the servodrive is not in JOG mode.
- (2) The setting of PA-A60 is 'STSP' or 'CON'.
- (3) Check the settings of PA-D05 and PA-D24.
- (4) Check the 'EST' emergency stop input signal.

■ Motor cannot rotate when received external control signals.

- (1) Check the setting of PA-A04. Ensure that the servodrive is not in JOG mode or spindle orientation operation.
- (2) Check the 'EST' and 'ORCM' input signals. In speed control mode, check the 'SFR/RUN' and 'SRV' input signals. In position control mode, check the 'SVON' input signal.
- (3) The input signals are not valid. In speed control mode, check the setting of PA-D10.

- **The motor stops when acceleration.**

- (1) Under heavy load. Please increase the acceleration time or reduce the load.
- (2) Modify PA-D06 and PA-D07.

- **The motor can only rotate in a single direction.**

If PA-A52 is set to 1, then the negative rotation direction (CCW) is not allowed.

If PA-A52 is set to 2, then the positive rotation direction (CW) is not allowed.

If PA-A52 is set to 0, then there is no limitation.

7.3 The Motor Rotates in the Opposite Direction

Please check the setting of PA-A05 and refer to section 5.2 for more information.

7.4 Poor Performance of Motor Acceleration/deceleration

- **Poor performance of motor acceleration/deceleration.**

- (1) Check the settings of PA-D06, PA-D07 and PA-D09.
- (2) Under heavy load, the motor torque is insufficient, replace with a higher capacity motor.

- **Poor performance of deceleration stop method.**

- (1) Coast the motor to a stop when in inertia stop method, the deceleration time will be long-lasting.
- (2) Perform the 'S' curve function to stop the motor when in deceleration stop method. Check the settings of PA-A07, PA-A08, and also check the settings of PA-D06, PA-D07, PA-D09.

- **Poor performance of motor acceleration (exceeds 3000rpm) when under heavy load.**

- (1) Set PA-A97.2 to 1, the output voltage over-modulation function is valid. But some motors may vibrate.

- (2) Change the setting of PA-E27, the reference value is 10 to 20 (the factory setting value is 50). But the motor speed may fluctuate.

7.5 Unable to Clear Alarm or Warning

■ Unable to clear alarm or warning

- (1) When 'Er 015' occurs, restart the servodrive manually or perform the 'tU9' operation.
- (2) Find out the reason that cause the servodrive alarm and solve it.
- (3) Servodrive malfunction, please contact your sales representative.

7.6 Mechanical Vibration

■ The rigidity setting of servo system is too high.

It may cause vibration when the rigidity is too high. When parameter settings meet the system performance requirements, properly reduce the value of PA-A55.

■ Modify the speed gain and position gain parameters.

Modify PA-C00, PA-D00, PA-D01 and PA-D02 manually, but do not change them in a wide range.

If there exist resonant points, adjust the value of parameter PA-D03 and PA-D04 to suppress resonance.

■ Mechanical vibration still occurs.

If mechanical vibration still occurs after parameters adjustment, please improve the mechanical rigidity of the servo system.

8. Inspection and Maintenance

8.1 Note

Affected by environmental factors such as temperature, humidity, pH, dust and vibration, the servodrive may malfunction in some ways. Daily inspection and maintenance is necessary for the servo system.

Warning

- ◆ Securely fasten the power supply terminal screws and motor output screws, not doing so may result in fire.
- ◆ Never use the servodrive in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
- ◆ Never touch any rotating motor parts when the motor is running.
- ◆ Do not touch the heat sinks during operation.

Caution

- ◆ Do not touch terminals for five minutes after the power is turned off, residual voltage may cause electric shock.
- ◆ Do not remove the panel cover when the power is on.
- ◆ Do not attempt to change wiring when the power is on.

Caution

- ◆ Never touch the inside of the servodrive.
- ◆ Only authorized professional staff can repair the servodrive.
- ◆ Maintenance personnel must remove watches and other metal items before work, and equipped with proper clothing and tools. Not doing so may result in injury.

8.2 Daily Inspection

Perform daily maintenance, ensure the normal operation of the equipment, and prolong the service life of the servodrive. Follow the daily inspection procedures in the following table.

Table 8-1 Daily Inspection

	Item	Method	Requirement
Operating ambient	<ol style="list-style-type: none"> 1. Temperature and humidity 2. Dust, water vapor and dew 3. Gases 	<ol style="list-style-type: none"> 1. Thermometer and hygrometer 2. Observation 3. Smell 	<ol style="list-style-type: none"> 1. Running temperature less than 45°C, humidity less than 90% RH 2. No dust, non-condensing 3. No abnormal color, no peculiar smell
Servodrive	<ol style="list-style-type: none"> 1. Vibration 2. Heating 3. Noise 	<ol style="list-style-type: none"> 1. Observation 2. Thermometer 3. Listening 	<ol style="list-style-type: none"> 1. No abnormal vibration 2. Cooling fan is working properly, no abnormal heating 3. No abnormal noise
Motor	<ol style="list-style-type: none"> 1. Vibration 2. Heating 3. Noise 	<ol style="list-style-type: none"> 1. Observation 2. Thermometer 3. Listening 	<ol style="list-style-type: none"> 1. No abnormal vibration 2. Cooling fan is working properly, no abnormal heating 3. No abnormal noise
Operating conditions	<ol style="list-style-type: none"> 1. Input voltage 2. Output voltage 3. Output current 4. Internal temperature. 	<ol style="list-style-type: none"> 1. Multimeter 2. Voltmeter 3. Ammeter 4. Thermometer 	Meet the specification requirements

8.3 Regular Inspection

Perform regular inspection every 3 to 6 months according to the using environment. The regular inspection is as follows:

1. Securely fasten the power supply terminal screws.
2. Check whether there are signs of overheating.
3. Check whether the cable skin is damaged.

4. Check whether the cable bandage is detached.
5. Clean up the dust of the servo system.
6. Check the insulation of the servodrive. Firstly, removed all connecting lines and shorted all the power line terminals.
7. Check the insulation of the servo motor. Firstly, removed all connecting lines and shorted all the power line terminals.

Warning	
◆	Please use 500V megohmmeter.
◆	Do not attempt to check the insulation of a single power line terminal.
◆	Do not attempt to check the insulation of the control signals.
◆	Remove all the short wiring after the insulation test.

8.4 Servodrive Inspection

The servodrive wearing parts include cooling fans and electrolytic capacitors. Generally, the cooling fan service life is 30000 to 40000 hours; the electrolytic capacitor service life is 40000 to 50000 hours. If the inspection found abnormal, it should be replaced immediately.

Table 8-2 Wearing parts list

No.	Item	Aging Causes	Criterion
1	Cooling fan	Bearing wear, fan blade aging.	When the servodrive is powered on, check the cooling fan operating conditions, whether there is abnormal vibration, noise etc.
2	Electrolytic capacitor	High working temperature, high ripple current, electrolyte aging.	Overcurrent or overvoltage fault occurs frequently when the servodrive is running with load.

8.5 Servodrive Storage

No.	Item	Requirement
1	Temperature	-40°C ~ +70°C <30°C and non-condensing for long-term storage.
2	Humidity	5~95%RH Use desiccant when necessary.
3	Other	Avoid direct sunlight, facilitates inspection and cleaning, well-ventilated and free of dust and moisture, free of corrosive or explosive gases
4	Long-term unused	Power up the servodrive once every six months, more than half an hour each time.

8.6 Servodrive Warranty

In the event of damage or malfunction, the servodrive warranty period is 12 months after delivery, if the servodrive has already delivered more than 12 months, will charge a reasonable cost of repair. Even within 12 months, if the following occurs, certain repair costs will be charged:

1. The servodrive damage caused by wrong wiring and faulty operation.
2. The servodrive damage caused by fire, flood and abnormal power supply.
3. The servodrive damage caused by unauthorized modifications.

9. Connect to Host Controllers and Motors

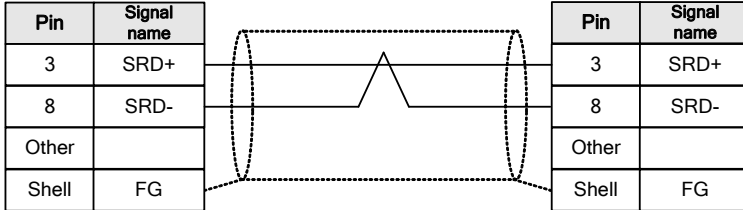
9.1 Connect to KND Controllers

Servodrive side XS10/XS11:

DB9 female

Host controller side:

DB9 female



9.2 Connect to the Resolver of Servo Motors

■ KND-ZJY-F205-3.7-1500

■ KND-ZJY-F205-5.5-1500

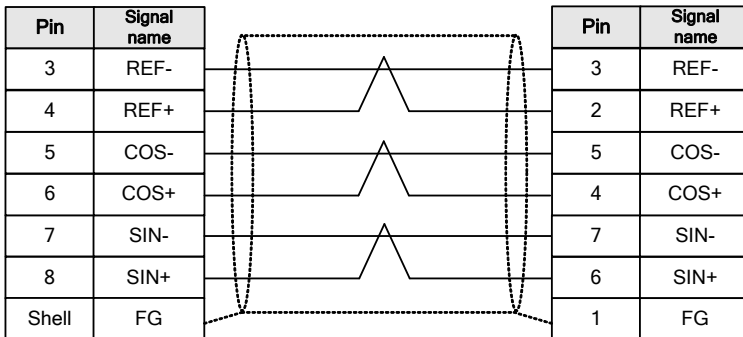
■ KND-ZJY-F205-7.5-1500

Servodrive side XS22:

DB15-2 female

Motor side:

E socket (7 pins)

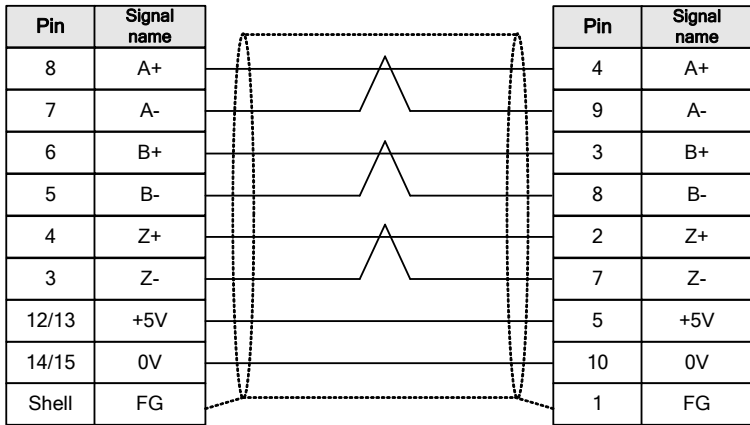


9.3 Connect to the Incremental Encoder of Servo Motors

- KND-43P7ZGB15
- KND-45P5ZGB15
- KND-47P5ZGB15
- KND-4011ZGC10
- KND-4015ZGC15

Servodrive side XS22:
DB15-2 female

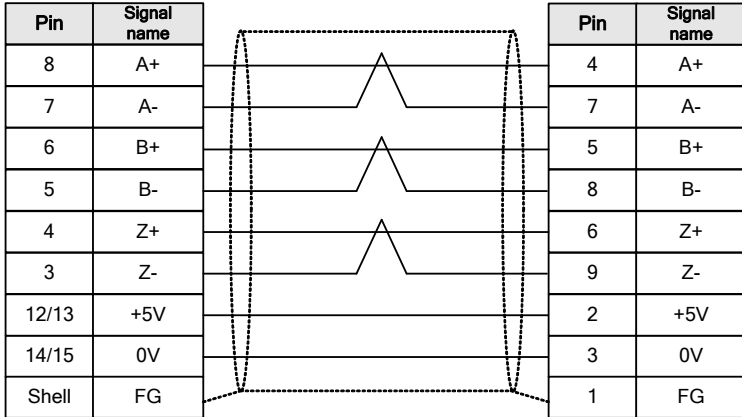
Motor side:
IDC-10 socket



- **KND-ZJY-F205-3.7-1500**
- **KND-ZJY-F205-5.5-1500**
- **KND-ZJY-F205-7.5-1500**

Servodrive side XS22:
DB15-2 female

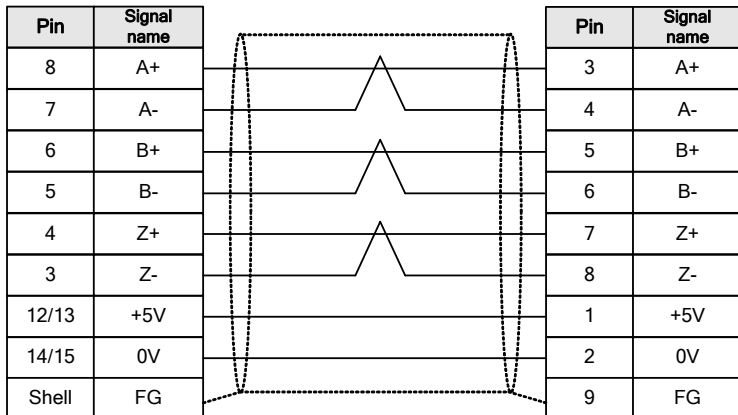
Motor side:
AYD28K15TS



- **MK-DH09-2-24-3.7/5.5-4-1500**

Servodrive side XS22:
DB15-2 female

Motor side:
ZJPT-12 female



9.4 Connect to the Absolute Encoder of Servo Motors

17-bit absolute encoder with 12-bit multi-turn counting

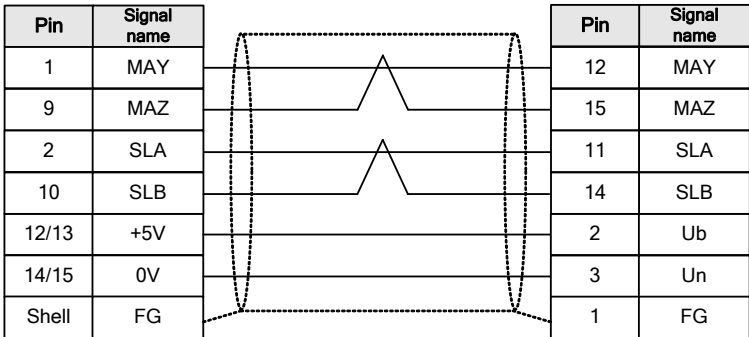
- **KND-ZJY-F205-3.7-1500**
- **KND-ZJY-F205-5.5-1500**
- **KND-ZJY-F205-7.5-1500**

Servodrive side XS22:

DB15-2 female

Motor side:

AYD28K15TS



9.5 Parameters Settings after the Connection of the Servo System

9.5.1 Basic Parameters Settings

Part 1: Modify the parameters associated with motor
To make the motor run well and smooth.
Please refer to section 4.3 for more information.

Part 2: Modify the parameters associated with host controller	
To make the host controller can control the motor operates normally.	
1. Servodrive position control	
Step	Operation

1	<p>Check the wiring between servodrive and KND controller.</p> <p>Ensure that no warning or alarm occurs.</p>
2	<p>Modify parameters of the servodrive.</p> <p>PA-A70: Servo bus (KSN) node address, ensure that it is corresponding with the KND controller settings.</p> <p>PA-A05: Motor rotation direction.</p>
3	<p>Modify parameters of the KND controller.</p> <p>Set the servodrive node address (2230).</p> <p>Set the servodrive alarm level (1105).</p> <p>Set the servodrive control method to 0 (1120).</p> <p>Set the maximum speed of servo motor (D40).</p> <p>Set the spindle type.</p> <p>Set the zero point return method.</p>
4	<p>Servodrive trial operation in position control mode.</p> <p>(1) Check the motor speed.</p> <p>The controller outputs a 100rpm motor rotation command, if the motor speed is abnormal, check the parameters settings of step 2 and step 3.</p> <p>(2) Check the spindle zero point return operation.</p>
2. Host controller position control	
1	<p>Check the wiring between servodrive and KND controller.</p> <p>Ensure that no warning or alarm occurs.</p>
2	<p>Modify parameters of the servodrive.</p> <p>PA-A70: Servo bus (KSN) node address, ensure that it is corresponding with the KND controller settings.</p> <p>PA-A05: Motor rotation direction.</p>

3	<p>Modify parameters of the KND controller.</p> <p>Set the servodrive node address (2230).</p> <p>Set the servodrive alarm level (1105).</p> <p>Set the servodrive control method to 1 or 2 (1120).</p> <p>Set the position loop gain (1121), set it to 0 when in open-loop position control.</p> <p>Set the maximum speed of servo motor (D40).</p> <p>Set the spindle type.</p> <p>Set the zero point return method.</p>
4	<p>Controller trial operation in position control mode.</p> <p>(1) Check the motor speed.</p> <p>The controller outputs a 100rpm motor rotation command, if the motor speed is abnormal, check the parameters settings of step 2 and step 3.</p> <p>(2) Check the spindle zero point return operation.</p>

9.5.2 Advanced Parameters Settings

Modify the parameters associated with servodrive performance					
To make the servodrive to achieve better performance.					
Step	Operation				
1	<p>Modify the load inertia ratio.</p> <p>Set PA-A55 to a small value before perform the motor load inertia adjustment, the factory setting value of PA-A55 is 2.</p> <p>Please refer to section 5.2.17 for more information.</p>				
2	<p>Modify the closed-loop gain.</p> <p>Easy step: Power up the motor and gradually increase PA-A55 from 0 until the motor vibrates, and then decrease PA-A55 by 1. If the motor still vibrates, decrease PA-A55 again until there is no vibration. Modify PA-A55 refer to the following table:</p> <table border="1" data-bbox="295 1378 1060 1457"> <tr> <td data-bbox="295 1378 445 1457">Mechanical rigidity</td> <td data-bbox="445 1378 919 1457">Machines connection type</td> <td data-bbox="919 1378 1060 1457">Reference values</td> </tr> </table>		Mechanical rigidity	Machines connection type	Reference values
Mechanical rigidity	Machines connection type	Reference values			

	High rigidity	Machines that are directly connected to ball screws.	6 to 12
	Medium rigidity	Machines that are driven by ball screws through speed reducers or long-length machines directly driven by screws.	3 to 5
	Low rigidity	Machines that are driven by timing belts or chains	0 to 2
	<p>Advanced step: If the easy step is not up to the requirements, modify PA-C00, PA-D00, PA-D01 and PA-D02 manually. Modify the speed loop parameters firstly, and then modify the position loop parameters. Minimize the speed loop response time.</p> <p>(1) Set PA-C00 to a small value, and then gradually increase PA-D00, ensure that there is no vibration.</p> <p>(2) Decrease PA-D00 a bit, and then gradually increase PA-C00, ensure that there is no vibration.</p> <p>(3) Modify PA-D01 as follows:</p> $PA-D01 = \frac{1000}{PA-D00}$ <p>(4) Properly decrease PA-D02 if there is no vibration, otherwise increase PA-D02.</p> <p>(5) Manually fine-tune PA-C00, PA-D00, PA-D01 and PA-D02 again, to obtain better performance.</p> <p>(6) When in host controller position control method, the position loop gain is set in controller parameters.</p>		
3	<p>Modify the acceleration/deceleration parameters.</p> <p>If overcurrent, overvoltage and 'Er 006' occur, modify the acceleration/deceleration parameters.</p>		

Revision History

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1	December 2014	First edition

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