SD300 SERVO DRIVER

USER'S MANUAL

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CONTENT

1 Specification

1.1 Specification

Table 1.1-1 Specification of SD300

Model		KND AC Permanent-magnet Synchronous Servo Drivers SD300-30 SD300-50 SD300-75 SD300-100
Power supply	Main circuit	Three-phase(Single-phase) AC220V -15%～+10% 50Hz
	Control circuit	Single-phase: AC220V -15%～+10% 50Hz
Ambient	Temperature	Running: 0～55℃ Storage: -20～+80℃
	Humidity	90% RH or less (free from dew)
	Vibration	0.5g(4.9 m/s²) or less, 10～60Hz (not continuously running)
Control Method		Position control Velocity control Pilot running control Torque control Single-axis positioning control
Dynamic Braking		Internal or external
Position Control	Command Style	Pulses and direction signal Double direction pulses(CCW & CW) AB phases pulses
	Electronic gear ratio	1～32767/1～32767 0.01<Gear ratio value<100

	Feedback equipment	Incremental encoder (2500 pulses/r) 17-bit absolute encoder (Battery or mechanical)
	Max. pulses frequency	≤2Mpps
	Absolute position signal	Manchester's code Continuously output (Absolute encoder)
Velocity control	Input signal type	±10V differential analog voltage Parameter setting with input signals
	Frequency Character	200Hz
	Velocity Variations	Compared with rated velocity <±0.03(Load fluctuation: 0～100％); <±0.02(Power fluctuation: -15％～+10％)
	Velocity Range	1~5000 rpm
Pilot running control	Signal	Set the pilot running speed to PA21
Single-axis positioning		Command source: parameters Positioning points: PA49~PA52 Positioning speed: PA29~PA32 Range: ±16000 cycles Unit setting: PA77.2 (1~0.001 cycle) Acceleration speed: PA25 (1~500 r/s^2) Delay time after positioning: PA18 (0~1000 second) POSI_RDY is used to start positioning operation.

Input signals	Servo driver enabled Clear alarms Enable CCW control Enable CW control Clear offset counter/Speed clamp/Speed selection 1 Disable command pulses/Speed selection 2 Note: These signals can also be controlled by parameters PA54 & PA59.
Output signals	Servo ready Servo alarm Positioning finished/Speed arrived/Torque limited Enable external brake Note: These signals can be set by parameter PA57.
Accelerate/Decelerate Function	In both velocity control mode and pilot running control mode, exponential accelerate/decelerate control is available. The time constants used are set by parameters PA40 & PA41 and the ranges are both 1~1000ms.
Revolving table control	When driving a motor installed multiple cycle absolute encoder, which is used to control a revolving table, servo driver is able to calculate the actual angle of the revolving table and the angle can be rebuild after power-on again. The function is controlled by parameter PA73.3 and is disabled in factory setting.

Monitor Function	Rotation speed Current position Command position Offset between the command and actual positions Torque load ratio Phase current Control mode Speed specified IO signals Current torque Some other monitor functions
Protection Function	Feedback speed exceeds the limitation Command speed exceeds the limitation Overvoltage or low-voltage happens in main circuit Transient overcurrent Long term overload Abnormal braking Encoder working abnormally Position deviation is out-of-tolerance Limit switches malfunction Some other protection functions
Travel limitation	Travel limitation can be achieved by input signals (CCWI and CWI) and parameters. Deceleration process is available when travel limitation is activated.
Applicable Load Inertia	7 times of servo motor inertia or less

1.2 Dimensions

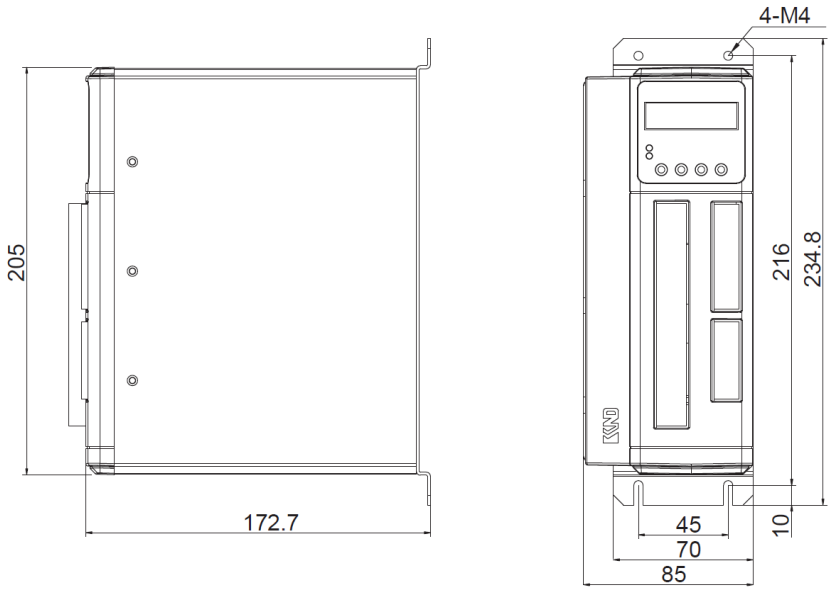


Figure 1-1 SD300-30 installation dimensions

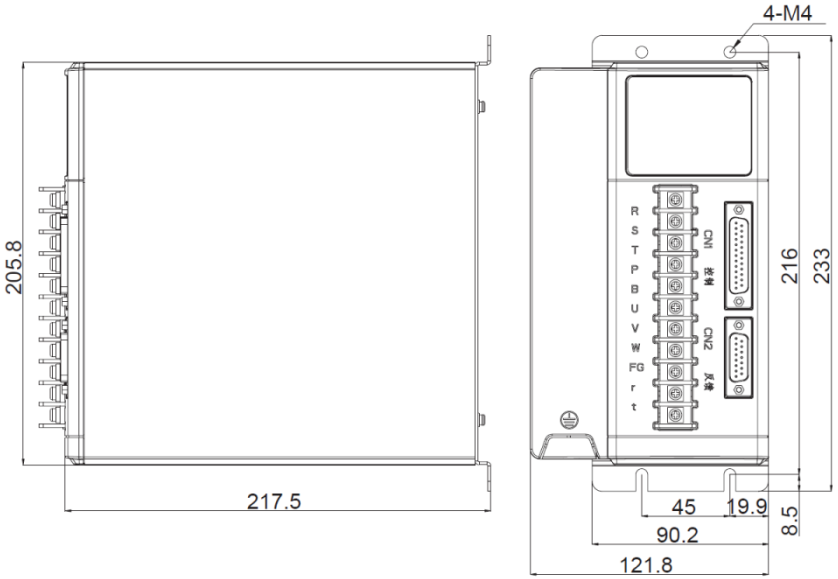


Figure 1-2 SD300-50 installation dimensions

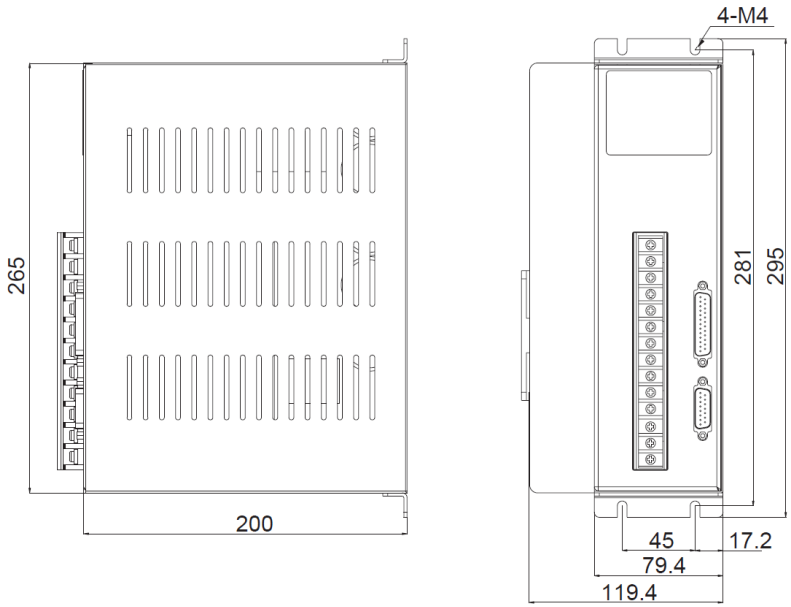


Figure 1-3 SD300-75 & SD300-100 installation dimensions

1.3 Configuration

Figure 1-4 Configuration diagram

Version

Software version

Model

SD300 drivers are available for both general applications and special applications.

Absolute encoders' type

The following types of motors are available when using battery encoders:

1. Motors with incremental encoders (Cell box is not necessary)
2. Motors with 17-bit single-cycle or 0-bit multi-cycle absolute encoders (Cell box is not necessary)
3. Motors with 17-bit single-cycle or 16-bit multi-cycle absolute encoders (Need cell box)

The following types of motors are available when using mechanical encoders:

1. Motors with incremental encoders (Cell box is not necessary)

2. Motors with 17-bit single-cycle or 12-bit multi-cycle absolute encoders (Cell box is not necessary)

2 Installation and Wiring

2.1 Installation Surroundings

Electrical cabinet

Generally, the temperature in the electrical cabinet is relatively higher than that of surroundings. Working in high temperature surroundings will obviously reduce the servo drivers' service life and increase their failure rate. Be careful to arrange the components in the cabinet and consider the cooling method. The temperature around these drivers shall be below 55℃, and for long-term working applications, it shall be below 45℃. The relative humility (RH) shall be less than 90%.

Vibratory equipment

Ensure that the vibrate acceleration speed is less than 0.5g (4.9m/s^2)

Application condition

SD300 is designed for ordinary applications. It is recommended to install them in electrical cabinet to keep them away from corrosive gases and liquids, water or metallic particles. To use them in these adverse conditions, please contact KND company.

EMI

Some interference signals emitting from the equipment around may result in the servo driver working unexpectedly. It is recommended to install noise filters and insulating transformers at the power supply interface, and pay attention to the leak current at the same time. Install the control signal's cable carefully because they are easily to be interfered.

2.2 Installation Method

Direction

Install vertically.

Mounting

Four M5 screws are necessary to mount the servo driver.

Install distributing

Refer to the Figure 2-1 below to install servo drivers in the cabinet. Bigger space between servo drivers is recommended to ensure better elimination of heat.

Heat elimination

SD300 adopts natural cooling method. Installing a fan in the cabinet is necessary for cooling.

Remarks

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

SD300 are designed for given types of AC permasyn motors. Do not attempt to control not matching servo motors.

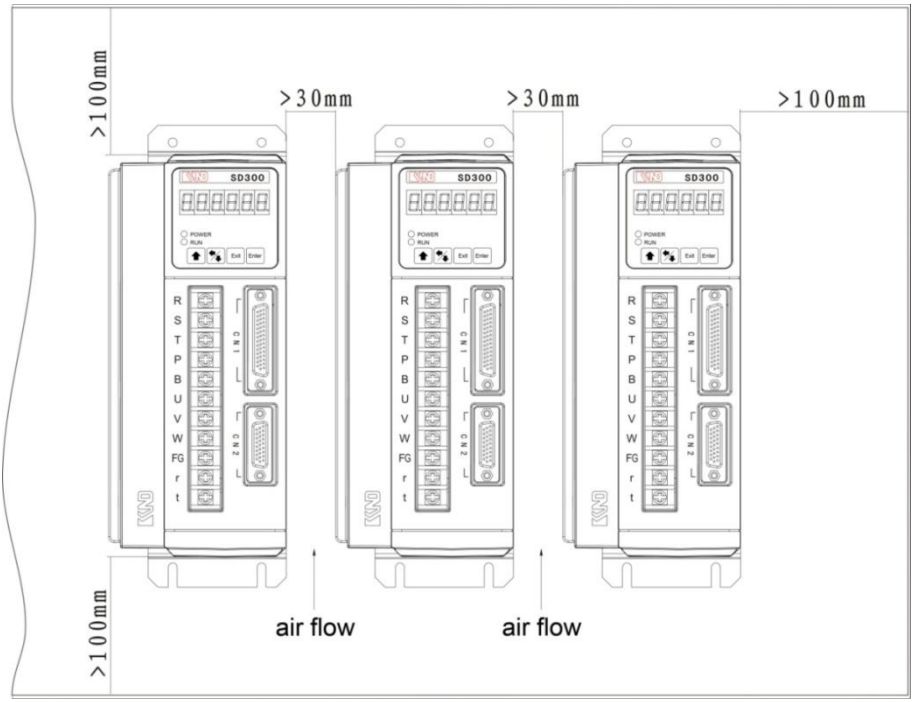


Figure 2-1 Installation distribution

2.3 Wiring

2.3.1 Position control

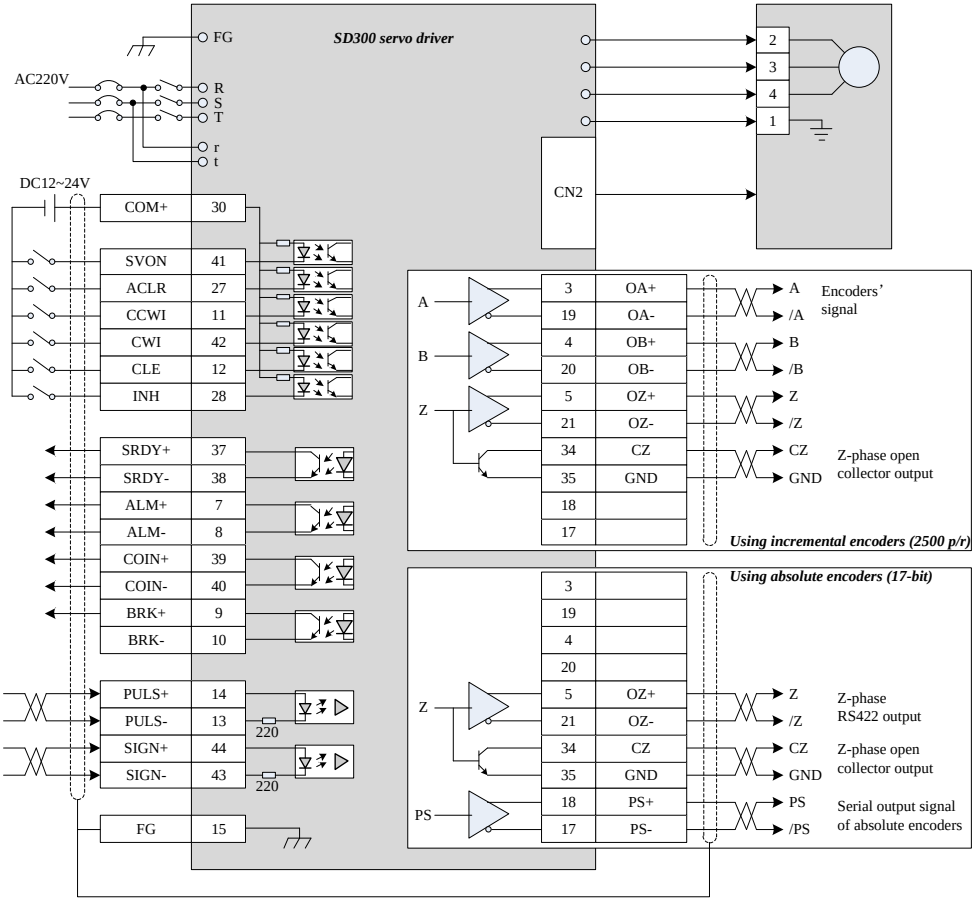


Figure 2-2 Wiring for position control

2.3.2 Velocity Control

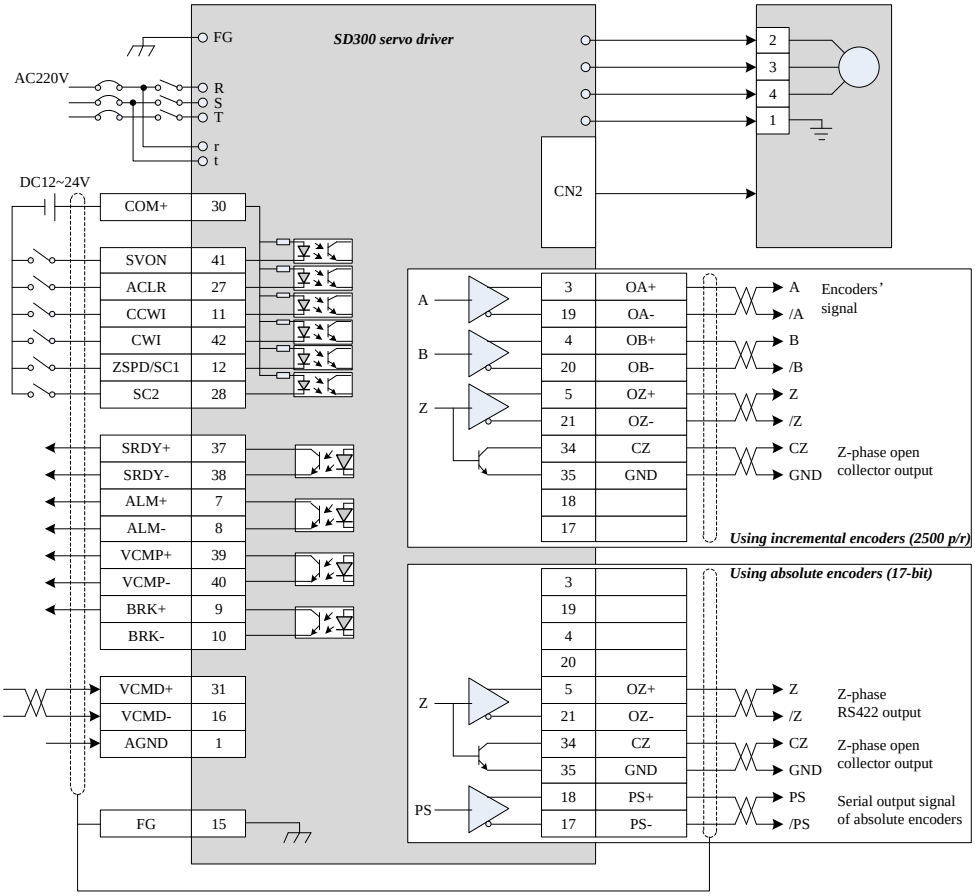


Figure 2-3 Wiring for velocity control

2.3.3 Torque control

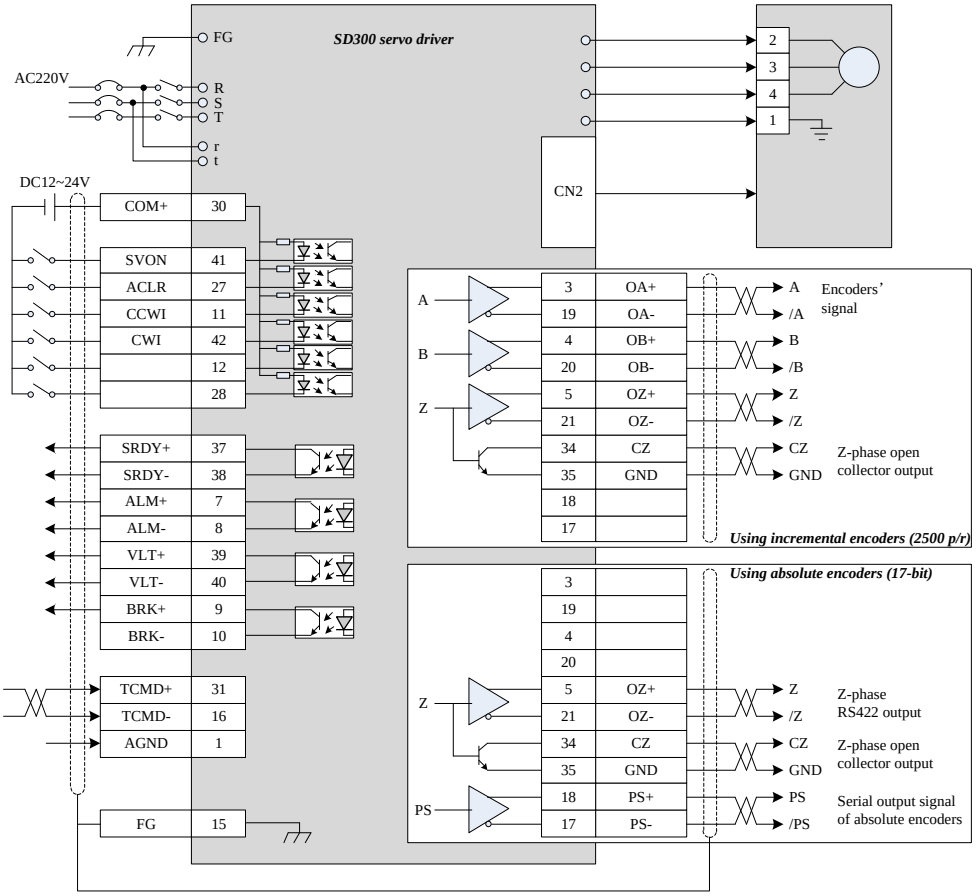


Figure 2-4 Wiring for torque control

2.3.4 Specification of Cable

Power Supply Terminals

1. Recommended line width of R, S, T, U, V, W and FG are listed in Table 2.3-1
2. Use JUT-1.5-4 chill-pressing terminals and connect tightly.
3. Use safe grounding cables. Connect the grounding terminals of the

servo motor and the driver tightly. The ground resistance shall be less than 100Ω.

4. Supply power through three phase insulating transformers.
5. Install noise filter to reduce the interfere risk.
6. Install circuit breaker to protect the servo driver when some accident happens.

Table 2.3-1 Power supply cables' specification

SD300	Circuit breaker (A)	Contactor (A)	Main circuit cable (mm^2)
30	25	16	1.5/2.5
50	40	32	2.5/4.0
75	63	40	4.0/6.0
100	63	40	6.0

Control signals' cable

1. Use shielded cable (twisted pair line is recommended) to transmit control signals and the line width should be bigger than 0.12 mm^2
2. Cable should be as short as possible. Command signals' cable should be 15m or less and encoder feedback cable should be 20m or less.
3. Control signals' cables and power cables shall be installed separately as far as possible.

2.4 Cautions

1. Connect the UVW terminals of a driver with those of a servo motor correspondingly. Do not attempt to change the servo motor's revolution direction by exchanging U, V, W terminals' order, which is totally different from the method for step motors and asynchronous motors.
2. High frequency switching current, which is essential to control servo motors, will lead to relatively high level leakage current. Connect the grounding terminals (FG) of servo drivers and motors together and put it to earth, which is necessary to prevent electric shocking and malfunctions.
3. Large value capacitors are used inside of SD300. In short time after

turning off the power, high voltage still exists in the circuits and some terminals. To prevent electric shocking, wait at least 5 minutes to touch servo drivers or motors after turning off the power.

4. Only those personnel who have received safety and maintenance training can operate servo drivers and motors. Ordinary operators should keep away from them when the power is turned on.
5. Do turn off the power when servo drivers are not used for a long time.

3 Interface

3.1 Power Supply Terminals

Table 3.1-1 Power supply terminals of SD300

No.	Mark	Name	Function
1	R	Main circuit power supply	Single phase or three phase AC220V 50Hz Note: Do not connect them to UVW terminals on a servo motor.
2	S		
3	T		
4	P	External braking resistor	Consume the regenerative energy inside of servo drivers when servo motors are braking
5	B		
6	U	Power supply for servo motors	Connect them to UVW terminals of a servo motor correspondingly
7	V		
8	W		
9	FG	Grounding terminal	Connect it to shell ground and protective ground of a servo motor
10	r	Control circuit power supply	Single phase AC220V 50Hz
11	t		

Generally, it is not necessary to connect an external braking resistor on P and B terminals. In deceleration process, if the regenerative energy is too large to be consumed by the internal braking resistor, alarm Er.002 or Er.014 may be issued. In this case, try increasing the deceleration time. If the alarm still occurs, an external braking resistor is needed to improve the braking effect.

The allowable resistance range of the braking resistor is from 40Ω to 200Ω and its allowable power is from 100W to 50W. The smaller resistance, the bigger braking current and the bigger power consumed. Note that too small resistance may result in damage of the servo driver. It is recommended to select an appropriate resistance in the method of changing braking resistance from big to small until the alarm is not issued any more. External

braking resistor can be installed in parallel with internal ones. Note that wait at least 5 minutes to touch servo drivers after turning off its power.

P and B terminals connect with internal high voltage circuit. To prevent electric shocking, do not touch P and B terminals when servo driver is working or in 5 minutes when its power is turned off. Keep P and B terminals away from other terminals to prevent short-circuit or damage to servo drivers.

3.2 IO Interface CN1

Table 3.2-1 IO interface CN1

No.	Function	Name	I/O type	Remarks
29 30	Positive pole for input signals	COM+	—	DC12~24V, ≥100mA Drive the light electric coupler of input signals
41	Servo On	SVON	Type1	Input signals to enable servo drivers SVON ON: enable servo driver SVON OFF: disable servo driver, motor is in free status. Note1: Change SVON from OFF to ON when servo motor is in stop status. Note2: Wait at least 500ms before inputting any command
27	Alarm Clear (Note1)	ACLR	Type1	Input signals to clear driver alarms ACLR ON: clear alarms ACLR should keep ON at least 400ms to clear an alarm.
11	CCW Enable (Note1)	CCWI	Type1	Input signal to enable CCW rotation CCWI ON: enable CCWI OFF: disable Note1: Used by over-travel limitation function. In OFF status, CCW rotation is disabled.

				Note2: Set PA20 to 1 to mask the function.
42	CW Enable (Note1)	CWI	Type1	Input signal to enable CW rotation CWI ON: enable CWI OFF: disable Note1: Used by over-travel limitation function. In OFF status, CW rotation is disabled. Note2: Sett PA20 to 1 to mask the function.
12	Position offset counter clear (Note1)	CLE	Type1	Effective in position control mode CLE ON: clear CLE OFF: hold
	Zero speed clamp (Note1)	ZSPD	Type1	Effective when: In velocity control mode, motor speed is controlled by external signal, and it is smaller than PA28. ZSPD ON: Valid ZSPD OFF: Invalid
	Internal speed selection (Note1)	SC1	Type1	Effective when: In velocity control modem, motor speed is controlled by SC1 and SC2. SC1SC2=00 PA29 SC1SC2=01 PA30 SC1SC2=10 PA31 SC1SC2=11 PA32
28	Command pulse disable (Note1)	INH	Type1	Effective in position control mode INH ON: command pulse disabled INH OFF: command pulse enabled

	Internal speed selection (Note1)	SC2	Type1	Effective when: In velocity control modem, motor speed is controlled by SC1 and SC2. SC1SC2=00 PA29 SC1SC2=01 PA30 SC1SC2=10 PA31 SC1SC2=11 PA32
37	Servo Ready (Note2)	SRDY+	Type2	ON: Circuit power is turned on and no alarm happens. OFF No power supply or some alarm happens
38		SRDY-		
7	Servo Alarm (Note2)	ALM+	Type2	ON: No alarms OFF: An alarm occurs
8		ALM-		
39	Positioning finished (Note2)	COIN+	Type2	Effective in position control mode ON: Position offset exceeds the specified range. OFF: Position offset is less than specified value.
40		COIN-		
39	Speed arrived (Note2)	VCMP+	Type2	Effective in velocity control mode ON: Rotation speed is in specified range OFF: Rotation speed is not in specified range
40		VCMP-		
39	Torque limited (Note2)	VLT+	Type2	Effective in torque control mode ON: Torque limited state OFF: Normal state
40		VLT-		
9	Mechanical brake release (Note2)	BRK+	Type2	This single is used to control brake on servo motor. ON: Disable braking, motor is free OFF: Enable braking, motor is
10		BRK-		

				clamped
14	Command pulse input	PULS+	Type3	Command pulses from host controllers
13		PULS-		
44	Command Pulse SIGN Input	SIGN+	Type3	Direction signal from host controllers
43		SIGN-		
3	Incremental Encoder A-phase signal	OA+	Type4	1. Incremental encoder signals(differential signals) 2. non-isolation signals
19		OA-		
4	Incremental Encoder B-phase signal	OB+	Type4	
20		OB-		
5	Incremental Encoder Z-phase signal	OZ+	Type4	
21		OZ-		
2	Position signal from absolute encoder	PS-	Type4	When using absolute encoders, use this serial port to transmit current position to host controllers. Adopt Manchester's code and the transfer rate is 4 kbps. Connect with KND CNC system.
18		PS+		
34	Z-phase open-collector signal from encoders	CZ	Type5	Turn on when Z-phase signal comes from incremental encoders Non-insulating output signal It is a narrow pulse, use high-rate optical coupling to receive it.
35 36	Ground of Z-phase signal from encoder	GND	—	Grounding line of encoders

31	Differential voltage signal	VCMD+ TCMD+	Type8	Differential voltage signal to control speed (VCMD) or torque (TCMD). Valid range: ±10V Input impedance: 10k ohm When using single level signals, connect VCMD-/TCMD- to AGND.
16		VCMD- TCMD-		
1	Ground of differential voltage signals	AGND	—	Do connect this terminal when using differential voltage signals.
15	Shielded Grounding	FG	—	Shielded grounding terminal

Note:

1. Polarity of these signals can be set conveniently by PA59. The descriptions above use the default setting of PA59 (00000). PA54 can be used to simulate these input signals when no line is connected to these terminals.
2. Polarity of these signals can be set by PA57. The descriptions above use the default setting of PA57 (0000)

3.3 Encoder Signal Interface CN2

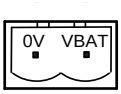
Table 3.3-1 Encoder signal interface CN2

No.	Function	Name	I/O type	Remarks
8/17/18	Power supply	+5V	—	Power supply for encoders. To reduce line voltage drop, use multiply wires to connect these signals when the cable is too long.
10～16	Power Supply Grounding	0V	—	
1	A+ Input	A+	Type6	Connect to the A+ terminal on incremental encoder
2	A- Input	A-		Connect to the A- terminal on

No.	Function	Name	I/O type	Remarks
				incremental encoder
3	B+ Input	B+	Type6	Connect to the B+ terminal on incremental encoder
4	B- Input	B-		Connect to the B- terminal on incremental encoder
5	Z+ Input	Z+	Type6	Connect to the Z+ terminal on incremental encoder
6	Z- Input	Z-		Connect to the Z- terminal on incremental encoder
19	U+ Input	U+	Type6	Connect to the U+ terminal on incremental encoder
20	U- Input	U-		Connect to the U- terminal on incremental encoder
21	V+ Input	V+	Type6	Connect to the V+ terminal on incremental encoder
22	V- Input	V-		Connect to the V- terminal on incremental encoder
23	W+ Input	W+	Type6	Connect to the W+ terminal on incremental encoder
	D+	D+	Type7	Absolute encoder communication signal D+
	BISS_MAY	BISS_Y		Absolute encoder communication signal MAY
24	W- Input	W-	Type6	Connect to the W- terminal on incremental encoder
	D-	D-	Type7	Absolute encoder communication signal D-
	BISS_MAZ	BISS_Z		Absolute encoder communication signal MAZ
7	Power	VBAT	—	Power supply for battery used by

No.	Function	Name	I/O type	Remarks
	supply for battery			absolute encoder
25	BISS_SLA	BISS_A	Type7	Absolute encoder communication signal SLA
26	BISS_SLB	BISS_B		Absolute encoder communication signal SLB
Shell	Shielded line	FG	—	Shielded grounding terminal

3.4 Battery Interface CN3A/CN3B

No.	Function	Name	I/O type	Remarks
1	Positive	VBAT	—	
2	Negative	0V	—	

3.5 Interface Terminals Arrangement

Interface CN1 use DB44-3 female socket, CN2 use DB26-3 female socket.

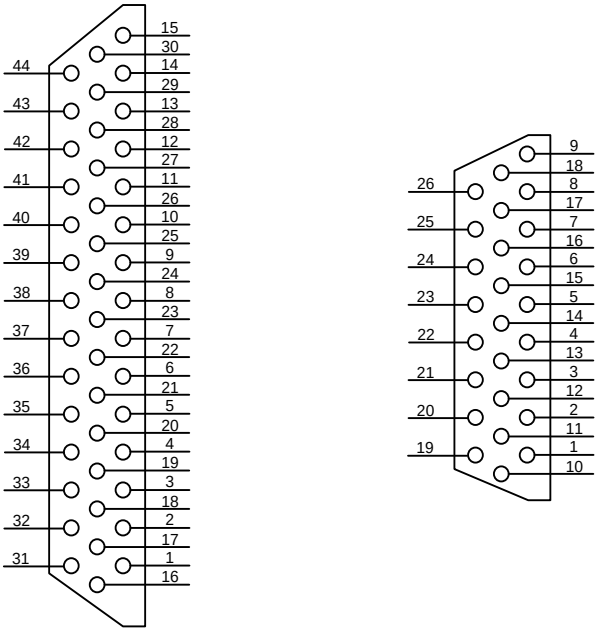
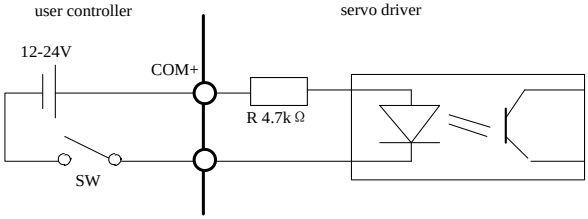
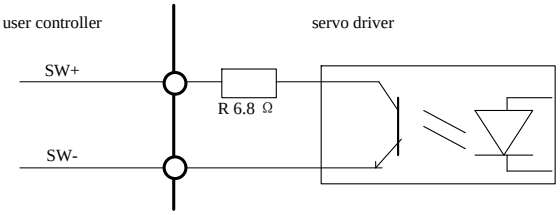


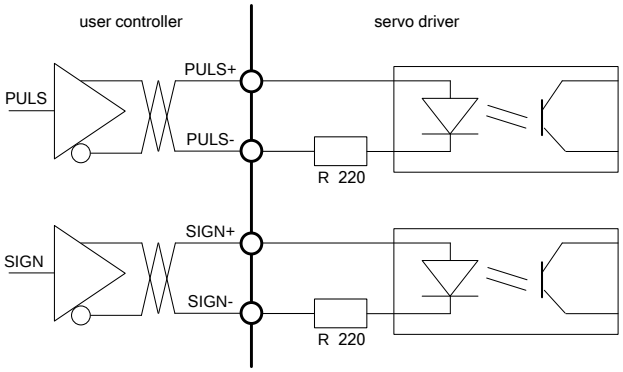
Figure 3-1 CN1 & CN2 terminals arrangement

3.6 I/O Interface Type

Table 3.6-1 I/O interface type

Type	Name	Remarks
Type 1	Switching value input signals	 Power supply: DC12~24V, ≥100mA Reversed power polarity or improper voltage may result in the servo driver working unexpectedly.

<table>
<tr>
<td>Type 2</td>
<td>Switching value output signals</td>
<td colspan="3"> 

Provide power externally by users. Reversed power polarity may damage the servo driver.
Use open-collector output signals, the maximum current is 50mA and the maximum voltage is 25V. Overload may damage the servo driver.
For inductive loads such as relays, install a fly-wheel diode in parallel reversely. Improper installation may damage the servo driver.</td>
</tr>
<tr>
<td rowspan="3">Type 3</td>
<td rowspan="3">Pulse Interface</td>
<td colspan="3"> 
</td>
</tr>
<tr>
<td>Command type</td>
<td>Pulse shape</td>
<td>PA14</td>
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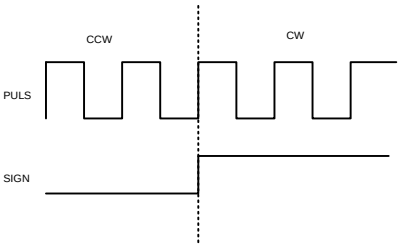
<tr>
<td>Pulse + Sign</td>
<td> 
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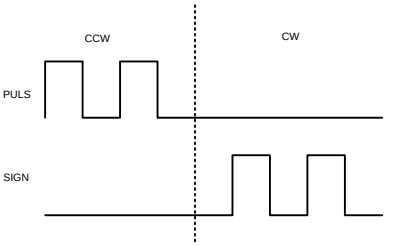
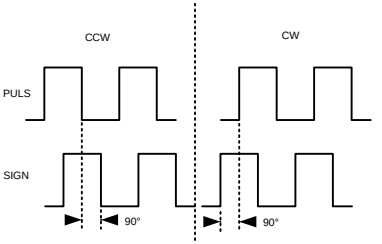
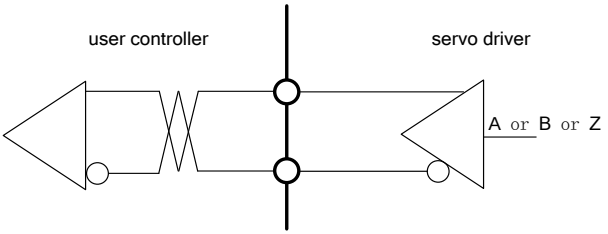
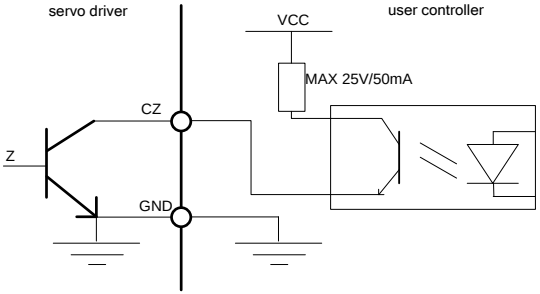
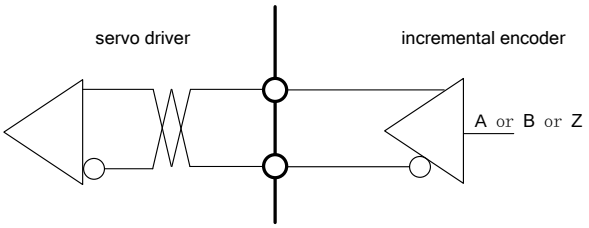
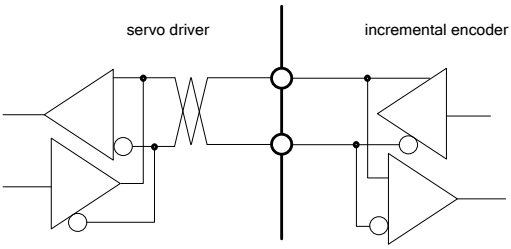
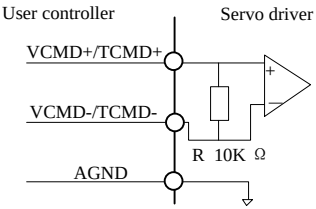
		Double pulse		1
		A/B-phases		2
Type 4	Encoder signals	 Differential signals output from 26LS31.		
Type 5	Z-phase open-collector signal from encoders	 Turn on when Z-phase signal comes from incremental encoders Non-insulating output signal It's a narrow pulse, use high-rate optical coupling to		

		receive it.
Type 6	Input signals from incremental encoders	 Received by 26LS32.
Type 7	Absolute encoder communicati on interface	 Send or receive using SN65HVD05.
Type 8	Differential voltage signals	 When using single-ended voltage signals instead of differential ones, connect VCMD-/TCMD- to AGND. Do connect AGND.

4 Parameter

4.1 Parameters Catalog

Table 4.1-1 Parameters catalog

No.	Function	Def.	Min.	Max.	Unit
00	Operation password Refer to the description note 2 below for details. Setting of PA00 is kept when the driver is turned off.	315	0	65535	—
01	Motor model selection Set PA01 following the description in the section 9.1. Note： Set PA00 to 385 or higher authority password before setting PA01 If Er.05 occurs after setting, restart the servo driver to activate the setting. If no error occurs, the setting will be effective immediately. Motor models supported are different from the servo drivers' models. When using motors with saving-line encoders, set PA36 to 1 to mask Er.032.	—	—	—	—
02	Software Version（read only）	—	—	—	—
03	Default status displayed when turning on the power Name: Function SPEED: Motor's rotation speed POS_L: Low-6-bit of the motor position POS_H: High-4-bit of the motor position	—	—	—	—

No.	Function		Def.	Min.	Max.	Unit
	CPO_L	Low-6-bit of command position				
	CPO_H	High-4-bit of command position				
	EPO_L	Low-6-bit of the position offset				
	EPO_H	High-4-bit of the position offset				
	PLS_L	Low-6-bit of the pulses counter				
	PLS_H	High-4-bit of the pulses counter				
	TRQ	Torque ratio of the motor				
	IA	Current of U-phase				
	IB	Current of W-phase				
	CNT	Control mode				
	CS	Speed command				
	APO	Electric angle of the motor				
	IN	Input logical signal				
	OUT	Output logical signal				
	COD	UVW code of the encoder				
	ERR	Error code				
	IAD	Zero-offset value of U-phase current				
	IBD	Zero-offset value of U-phase current				
	LOAD	CPU load ratio				
	TRQN	Torque output				
04	Control Mode Selection POS: Position control mode SPD: Velocity control mode TOR: Torque control mode D-SPD: Pilot running control mode A-POS: Single axis positioning mode Note: Do not change this parameter when motors are running.		—	—	—	—
05	Gain of velocity loop		40	1	200	Hz

No.	Function	Def.	Min.	Max.	Unit
06	Integration time of velocity loop	25	1	1000	ms
07	Band width of the torque filter	160	1	4000	Hz
08	bit0: switch of the closed-loop monitoring function 0: disabled 1: enabled bit1: — bit2: — bit3: —	0001	—	—	—
09	Gain of position loop	40	1	200	1/s
10	Position loop feed forward quotient	0	0	100	%
11	Band width of the position loop feed forward filter	1000	50	1000	Hz
12	Numerator of the electronic gear ratio	1	1	32767	—
13	Denominator of the electronic gear ratio	1	1	32767	—
14	Input mode of the command pulses 0: Pulse + Sign 1: CCW/CW pulses 2: A/B phases pulses Note：Do not change PA14 when motors are running. Er.05 will be issued after setting PA14, restarting the driver will activate the setting.	0	0	2	—
15	Select the rotary direction of motors 0: Current direction 1: Reverse the current direction Refer to the note 8 below for more information.	0	0	1	—
16	Specify the range used to check whether the positioning operation is finished. When the position offset value is smaller than PA16 value, COIN signal is effective.	1	0	20000	1/1000R

No.	Function	Def.	Min.	Max.	Unit
17	Limitation of the position offset. Er.04 will be issued when the position offset exceeds the limitation.	2000	0	20000	1/1000R
18	Delay time after single axis positioning operation	1.0	0.0	1000.0	Second
19	Filter time of position commands 0: No filtering Other value: filter time	0	0	1000	ms
20	Upper percentage limitation of maximum speed to rated speed.	120	50	300	%
21	The speed specified by key panel manually when the driver is working in pilot running control mode. The value is not kept when the driver is turned off.	0	0	Max. speed	RPM
22	Reserved	—	—	—	—
23	Select the data source used to specify motor speed in velocity control mode(SPD). 0: Specified by the analog voltage VCMD 1: Specified by PA29~PA32	0	0	1	—
24	Gain of the VCMD signal PA24 is used to specify the scaling relationship between the VCMD signal and the actual rotation speed. The default value is 100, which means that 1Volt corresponds to 100RPM. Setting PA24 to -100 means 1Volt corresponds to -100RPM.	100	-5000	+5000	RPM/V
25	Acceleration speed used in single axis positioning mode	10	1	500	r/s^2
26	Zero value of encoders Note：	Related to	0	65535	—

No.	Function	Def.	Min.	Max.	Unit
	Set PA00 to 385 before setting PA26. Er.05 will be issued after setting PA14, restarting the driver to activate the setting.	motor			
27	Zero offset compensation of the analog voltage specifying rotation speed in SPD mode. When specifying stationary analog voltage which corresponds to zero speed, read the value of SPEED in dP menu and set the value (including the sign) in PA27. Refer to the Figure 7-5 for more details.	0	-5000	5000	—
28	Threshold value of the zero speed clamping function in SPD mode. Free of rotation direction. When the analog voltage is smaller than PA28 and ZSPD input signal is also effective at the same time, servo driver enter zero speed clamping status.	10	0	500	RPM
29	1st internal speed value SC2SC1 = 00	0	-5000	5000	RPM
30	2nd internal speed value SC2SC1 = 01	0	-5000	5000	RPM
31	3rd internal speed value SC2SC1 = 10	0	-5000	5000	RPM
32	4th internal speed value SC2SC1 = 11	0	-5000	5000	RPM
33	Force the SVON signal to be enabled Note： Use PA33 to test drivers without host controllers. It is volatile after turning off the power.	0	0	1	—

No.	Function	Def.	Min.	Max.	Unit
	Set PA00 to 385 or higher authority password before setting PA33.				
34	Torque limitation value (CW)	300	0	300	%
35	Torque limitation value (CCW)	300	0	300	%
36	Select the function of monitoring incremental encoders 0: Monitoring 1: Not monitoring When using motors with saving-line encoders, set PA36 to 1 to mask Er.32.	0	0	1	—
37	Speed when the VCMD signal is valid Note: It is independent of the rotation direction	0	0	5000	RPM
38	Speed fluctuation range when the VCMD signal is valid	10	0	5000	RPM
39	Gain of the TCMD signal PA39 is used to specify the scaling relationship of the TCMD signal and the actual outputting torque. The default value is 1000, which means that 1Volt corresponds to 1Nm.	1000	-5000	5000	0.001Nm/V
40	Acceleration time in velocity control mode and pilot running control mode 0: No filtering Other value: Filtering time Set PA40 to 0 when using SD300 with external position loop.	0	0	1000	ms
41	Deceleration time in velocity control mode and pilot running control mode 0: No filtering Other value: Filtering time	0	0	1000	ms

No.	Function	Def.	Min.	Max.	Unit
	Set PA41 to 0 when using SD300 with external position loop.				
42	Zero offset compensation of the analog voltage specifying torque in TOR mode. When specifying stationary analog voltage which corresponds to zero torque, read the value of TRQN in dP menu and set the value (including the sign) in PA42. Refer to the Figure 7-6 for more details.	0	-5000	5000	0.001Nm
43	Upper speed limitation in TOR mode. If motors' rotation speed reaches the specified value, SD300 will automatically reduce torque output and keep the rotation speed less than the specified value.	500	0	5000	RPM
44	Software overtravel limitation in the positive direction	30000	-30000	30000	PA82.2
45	Software overtravel limitation in the negative direction	-30000	-30000	30000	PA82.2
46	Reserved				
47					
48	Velocity monitoring coefficient	150	100	1000	%
49	1st position used in single axis positioning mode	0	-30000	30000	PA77.2
50	2nd position used in single axis positioning mode	0	-30000	30000	PA77.2
51	3rd position used in single axis positioning mode	0	-30000	30000	PA77.2
52	4th position used in single axis positioning mode	0	-30000	30000	PA77.2
53	Time of the low band filter of the analog signals	1	0	1000	ms

No.	Function	Def.	Min.	Max.	Unit
	0: No filtering Other value: Filtering time				
54	Simulating of input signals Bit 4: ACLR Bit 3: INH/SC2/POSI_RDY Bit 2: CLE/SC1/ZSPD Bit 1: CCWI Bit 0: CWI 0: Not simulating 1: Simulating Using PA54 is able to test input signals conveniently without connecting any lines.	00000	00000	11111	—
55	Rigidity of servo system	4	0	12	—
56	Inertia ratio Generally, don't change this parameter manually. It is recommended to set it automatically by performing the TU1 operation.	100	50	800	%
57	Change the polarity of the output signals reversely. Bit 3: BRK Bit 2: COIN/VCMP/VLT Bit 1: ALM Bit 0: SRDY 0: Normal 1: Change polarity	0000	0000	1111	—
58	Delay time from the beginning of external brake working to cutting of the controlling of motors. If redundant movement exists when cutting off the power, increase the value of PA58 will eliminate it.	0	0	500	10ms

No.	Function	Def.	Min.	Max.	Unit
59	Change the polarity of the input signals reversely. Bit 4: ACLR Bit 3: INH/SC2/POSI_RDY Bit 2: CLE/SC1/ZSPD Bit 1: CCWI Bit 0: CWI 0: Normal 1: Change polarity When PA59 is set to 00000, the signals from input terminals without connecting any lines are regarded as 0, while they are regarded as 1 after changing their polarity. The input signals' states read from IN item in dP menu are internally used, which have been processed by PA59. For the drivers, effective polarity of input signals is 1.	00000	00000	11111	—
60	Gain of friction compensation	100	10	600	%
61	Ratio of friction compeasation	0	0	100	%
62	Gain correction of friction compensation	0	0	100	%
63					
64					
65	Numerator of the speed ratio of motor to machine	1	1	32767	—
66	Denominator of the speed ratio of motor to machine	1	1	32767	—
67					
68					
69					
70					

No.	Function	Def.	Min.	Max.	Unit
71					
72					
73	Bit0: — Bit1: — Bit2: It is used to select the method for searching Z signal when performing the TU3 operation for incremental encoders. 0: searching automatically 1: searching manually Bit3: Revolving table function is 0: Disable 1: Enable	0000	—	—	—
74					
75					
76	Average filtering time for position commands 0: no filtering operation Other value: filtering time Note: Set PA19 to 0 first when using this filtering time.	0	0	64	ms
77	Bit0: Phase lost detection (Er010) 0: Enable 1: Disable Bit1: Speed monitoring function is 0: Closed 1: Opened Bit2: Single axis positioning operation unit 0: 1 cycle 1: 0.1 cycle 2: 0.01 cycle 3: 0.001 cycle	0000	—	—	—

No.	Function	Def.	Min.	Max.	Unit
	Bit3: Position error detection (Er004) 0: Enable 1: Disable				
78	The distance in which motor decelerates and stops when over travel happens.	5.00	0.00	100.00	cycle
79	Bit0: Select the work mode when over travel happens 0: Turn off the power to motor after stop 1: Don't turn off the power to motor after stop 2: Turn off the power to motor immediately 3: Host controller deals with it Bit1: — Bit2: — Bit3: The meanings of CCWI and CWI 0: Exchanges 1: don't exchange	0100	—	—	—
80	Frequency of 1st notch filter	4000	100	4000	Hz
81					
82	Bit0: Software over travel protection function is 0: Disabled 1: Enabled Bit1: Hardware over travel protection function is 0: Disabled 1: Enabled Bit2: The unit of software over travel limitation is 0: 1000 command increment	0000	—	—	—

No.	Function	Def.	Min.	Max.	Unit
	1: 10000 command increment Bit3: —				
83	Frequency of 2nd notch filter	4000	100	4000	Hz
84					
85					
86					
87					
88					
89					
90	Maximum speed of tU1 Ensure that the mechanical equipment has the ability to run at this speed.	1500	500	2000	RPM
91	Maximum circle of tU1 Make sure that the mechanical equipment will not crash in the specified range.	4	1	9	R
92	Gain of acceleration speed feedback	0	0	1000	%
93	Gain of torque feedforward	0	0	600	%
94	Band width of torque feedforward	1000	50	2000	Hz
95	Reserved				
96	Reserved				
97	Reserved				
98	Reserved				
99	Reserved				

Note:

1. Reserved parameters
   The reversed parameters in the list are used for special purpose. Changing their values may result in some unexpected malfunctions.
2. Operation password
   (1) Set PA00 to 315 to get the authority to change modifiable parameters except for PA01, PA33, PA26 and reversed parameters.

(2) Set PA00 to 385 to get the authority to change modifiable parameters except for reversed parameters.

(3) When setting PA00 to other values, all parameters except for PA00 are read only.

(4) PA00 is free from the restriction of operation password.

3. Nonvolatile parameters

PA00, PA21 and PA33 are volatile parameters. Their values are always the default ones when turning on the power. The other parameters are nonvolatile ones. Their value are kept even when turning off the drivers' power.

4. Relevance parameters

If you change the values of a relevance parameter, some other parameters may change automatically. SD300 supports two relevance parameters: PA55 and PA01.

(1) PA55

After setting the value of PA55, the values of PA05, PA06, PA07 and PA09 are also changed automatically. See the rigidity table for more information.

(2) PA01

The value of PA26 will change after setting PA01.

The relevance between these parameters is non-reversing, which means that setting PA05 will not affect the value of PA55.

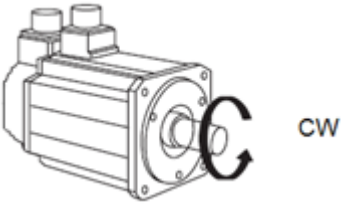
5. Procedure of setting PA01

(1) Ensure that PA00 is set to 385 or the super password and motors are not running.

(2) If Er.05 occurs after setting, restart servo drivers to activate the setting. If no error occurs, the setting will be effective immediately.

6. Motors' 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).



(1) When PA15 is set to 0, if positioning command is positive or VCMD/TCMD is a positive value, motors rotate in the positive direction (CW).

(2) When PA15 is set to 1, if positioning command is positive or VCMD/TCMD is a positive value, motors rotate in the negative direction (CCW).

The rotation direction of motors depends on two elements:

(1) The value of PA15

(2) The sign of commands' values. The sign of commands' values can be controlled by host controllers. In addition, in speed or torque control mode, the sign can also be controlled by the signs of PA24 and PA39.

4.2 Method for adjusting servo systems

The parameters related to the performance of servo systems are set to a set of suitable values. The table below lists some modifiable parameters.

No.	Function	Default value	Minimum	Maximum	Unit
05	Gain of velocity loop	40	1	200	Hz
06	Integration time of velocity loop	25	1	1000	ms
07	Band width of the torque filter	160	1	4000	Hz
09	Gain of position loop	40	1	200	1/s
10	Position loop feed forward quotient	0	0	100	%
11	Band width of the position loop feed forward filter	1000	50	1000	Hz
55	Rigidity of machine tools	4	0	12	—

56	Inertia ratio	100	50	600	%

Generally, it is not necessary to set these parameters above except for PA56. On the other hand, if the performance of servo systems does not satisfy your request, set these parameters according to your actual mechanical characteristics.

After the operation of –dEF in EE menu or the load inertial is changed obviously, set PA56 again.

SD300 supports two methods for setting PA56:

1. Estimate the load inertia and set it in PA56 manually. (Not recommended)
2. Perform the automatically setting operation. (Recommended)

Please follow the procedures below to adjust these parameters:

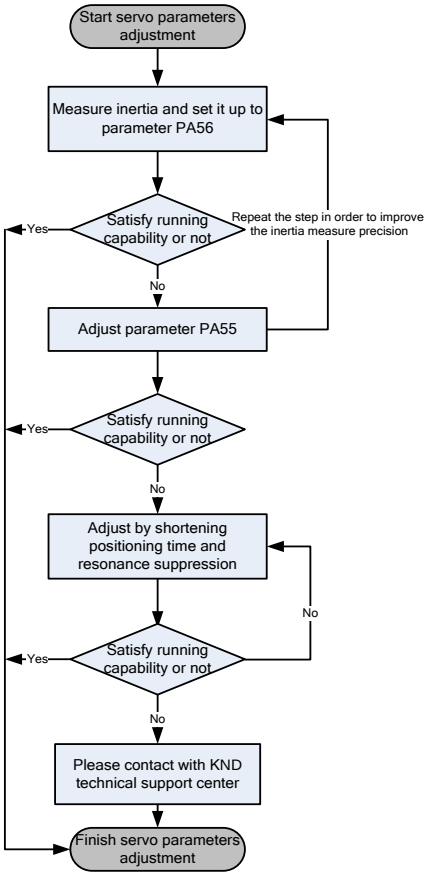


Figure 4-1 Procedures of adjusting parameters

4.2.1 Automatic parameters' adjustment

These parameters consist of PA56 and some other invisible related parameters.

Among the parameters related to the performance of servo systems, PA56 is the most important one. It obviously affects the capability of the velocity loop. In addition, slide friction, static friction, asymmetry load and some other elements also affect the performance of the whole servo systems. SD300 provides the function of measuring these elements automatically. Follow the procedures below:

1. Ensure that servo axis has enough distance to travel (Bigger than the value of PA91).
2. Set PA04 to POS mode.
3. Enable the servo driver. (Use host controllers or set PA33)
4. Set PA90 and PA91 correctly. Generally, use the default values.
5. Enter the adjustment menu and select –tU. Keep pressing Enter until "------" is displayed. If the zero point of a motor using incremental encoder is not established, zero point positioning operation should be performed first. Then the motor rotates by the circles specified in PA91 in both the positive and negative directions.
6. Display the inertial ratio or some warning.

Related parameters associated with automatic adjustment are listed below:

No.	Function	Default value	Unit	Meaning
90	Maximum speed of tU1	1500	RPM	Specify the maximum speed of tU1. Too small speed may decresease the measurement precision. Set it to a value less than the rated speed.
91	Maximum circles of tU1	4	R	Specify the maximum circles of tU1. Small value leads to a great acceleration speed which may result in the adjustment process failure (AL.129). Large value may decrease the adjustment precision and result in colliding.

After adjustment is finished, all the related parameters including PA56 are set automatically.

Note:

Ensure that enough movement distances are provided for each axis to prevent colliding when performing the –tU1 operation.

4.2.2 Rigidity adjustment

Set PA55 to adjust rigidity. The maximum rigidity is restricted by the rigidity of drive system.

No.	Function	Default value	Minimum	Maximum

55	Rigidity of servo system	4	0	12

Generally, the rigidity of a servo system could be classified into the following types:

1. Low rigidity system: 0～3
2. Middle rigidity system: 4～6
3. High rigidity system: bigger than 6

The smaller rigidity, more slowly system responses, and the lower ability system has. Small rigidity brings slow response ability and worse anti-interference ability. Too big rigidity may result in servo system vibration.

The values of PA05, PA06, PA07 and PA09 will be changed automatically after changing to the value of PA55. The relationship is as follows:

Rigidity	**Position gain**	**Speed gain**	**Integral time**	**Band width of the torque filter**
PA55	**PA09(rad/s)**	**PA05(Hz)**	**PA06(ms)**	**PA07(Hz)**
0	10	10	100	70
1	15	15	70	80
2	20	20	50	90
3	30	30	40	120
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	520
10	140	140	9	670
11	160	160	8	800
12	200	200	6	1060

After setting PA55, the values of PA05, PA06, PA07 and PA09 are set to the default values listed above. Changing these parameters slightly may obtain better performance, but do not change them in a wide range.

If the current rigidity level doesn’t satisfy your request and the next

rigidity level leads to vibration, try adjusting PA05~PA07 and PA09 to obtain a proper rigidity level between the two ones above.

Modifying one or more of PA05, PA06, PA07 and PA09 doesn't affect the value of PA55.

Automatic parameters' adjustment and rigidity adjustment are the two basic procedures of adjusting servo systems. The following sections are provided for some special applications.

4.2.3 Shorten positioning time

PA10 are used to change the feed forward quotient of the position loop. Increase its value to shorten the positioning time.

Set PA77.1 and PA48 to activate the velocity monitoring function which increases the gain of velocity loop and shortens the positioning time indirectly. Ensure that PA56 is specified correctly.

Set PA93 to change the gain of torque feedforward.

Note:

Set PA56 properly before activating the velocity monitoring function.

4.2.4 Vibration adjustment

If the load rigidity is low or the inertia is too big, servo systems may vibrate easily. In this case, try increasing the value of PA07 to reduce vibration.

If there exist resonant points, adjust the value of PA80 and PA83 to suppress resonance.

If there exists a fixed resonant point in servo system, please adjust PA80 and PA83 to suppress the resonant point. The resonant point frequency can be read by the FrE item in DP menu.

If the load inertia is too big, TU1 operation may fail because no value is suitable for PA56. In this case, try setting PA56 manually and observing the FrE item in DP menu. Use the trap filter to to suppress the resonant point. Repeat the procedures to increase the value of PA56 step by step and ensure that no vibration happens.

Set the gain of acceleration speed feedback(PA92) to suppress vibration.

5 Protection Function

5.1 Error/Alarm List

No.	Type	Description	
000	Normal	No error or warning	
001 ~ 127			
001	Error	Rotation speed exceeds the limitation	◆
002	Error	Overvoltage of the main circuit	◆
003	Error	Low-voltage of the main circuit	
004	Error	Positioning deviation is out of tolerance	
006	Error	Velocity loop saturates for a long time	
007	Error	Malfunction of limitation switches in positive/negative directions	◆
009	Error	Malfunction of encoders (Hardware error of UVW or ABZ signals from incremental encoders)	◆
010	Error	Phase lost in the main circuit	
011	Error	IPM error	◆
012	Error	Motor's instant current exceeds the limitation	◆
013	Error	Long time overload of servo drivers and motors	
014	Error	Braking resistor has been working for a long time	◆
015	Error	Restart the driver	
016	Error	Software doesn't match with the hardware	
017	Error	Overvoltage in the main circuits (detected by software)	◆
018	Error	Torque commanded exceeds the limitation	◆
019	Error	Speed commanded exceeds the limitation	◆
020	Error	EEPROM access error	
021	Error	No data or incorrect data is found in the EEPROM backup area	
022	Error	Damaged data is found in the EEPROM parameter area	
023	Error	Parameter value in EEPROM exceeds the specified range.	
024	Error	Positioning command after electronic gear ratio exceeds the limitation.	◆

025	Error	Core error	◆
026	Error	Low-voltage in the main circuits (detected by software)	
030	Error	Malfunction of Z-phase signal from an incremental encoder	◆
031	Error	Overhead of the power circuits	◆
032	Error	Illegal code of UVW signals from an incremental encoder	◆
033	Error	Error encoder type	◆
034	Error	Absolute encoder communication error	◆
038	Error	Position commanded exceeds the maximum range specified in software.	
039	Error	Using unsuitable parameters in single axis positioning mode	
041	Error	Multi-circle information of the absolute encoder is lost because of the battery voltage is too low	
042	Error	Multi-circle information error of the absolute encoder	◆
050	Error	The speed ratio of motor to machine exceeds the limitation	
054	Error	Miscount of the absolute encoder feedback	◆
060	Error	Multiple cycle error of absolute encoder	◆
062	Error	The feedback speed of encoder is too big	◆
067	Error	Voltage of control power is too low	◆
128 ~ 191			
128	Warn	The operation is forbidden in RUN status	
129	Warn	Acceleration speed of the servo motor is too big when performing the automatic parameter adjusting operation	
130	Warn	EEPROM parameter region is not initialized	
131	Warn	Load inertia ratio varies too much(±20%) when performing the parameter adjusting operation	
132	Warn	Load inertia ratio got from parameter automatic adjusting operation exceeds the drivers' applicable range	
144	Warn	Temperature warning of encoder	
150	Warn	The voltage of battery used by absolute encoders is tool low	
152	Warn	Zero point error of absolute encoder. Need TU3 operation	
153	Warn	Invalid adjustment of parameters, operate again	
154	Warn	Parameter value is out of allowable range.	

155	Warn	Perform tU1 in RUN state	
156	Warn	Internal error when executing tU1 operation	
157	Warn	Perform tU3 in READY state	
158	Warn	It is not allowable to perform tU3 operation in RUN state	
159	Warn	Internal error when executing tU3 operation	
161	Warn	Value of PA90 exceeds the upper limite speed of the motor	

Note:

1. "Er" and error code flicker when one or more errors occur. Press EXIT key continuously to exit from the flicker page, but the decimal point at the right bottom corner flickers continuously, which indicates that the driver is in error status. The current error code can be read in the monitor menu "Err". When some error happens, the RUN indicator goes out immediately and motors are put in free status or braking status (with mechanical brake and wiring correctly).
2. "AL" and warning code flicker when one or more warnings occur. Press EXIT key continuously to exit from the flicker page, but the decimal point at the right bottom corner of the second LED flickers continuously, which indicates that the driver is in warning status. The current warning code can be read in the monitor menu "AL". Press EXIT to exit from the warning status after solving the problem and the decimal point stops flickering. Warnings are used to indicate some minor troubles which may not affect motors running seriously, and motors running status won't be interrupted.
3. After solving the error or warning, keep pressing EXIT key until "------" is displayed, which will make servo driver enter READY status.
4. According to the difference whether motors can be controlled, errors are classified into two types: emergency errors and non-emergency errors. For non-emergency errors, if the current speed of the motor is lower than 100r/m, servo driver activates external brake and cuts off power supply to the motor after delaying the time specified by PA58. For emergency errors or non-emergency errors while motor speed is bigger than 100r/m, servo driver cuts off power supply to the motor immediately and activates the external brake at the same time.

5.2 Error/alarm remedy

No.	Name	Status	cause	remedy
001	Over speed	Occurs at the power-on of control circuits	Control circuit fault Encoder fault	Replace servo driver Replace motor
		Occurs when motor is running	Command frequency is too high	Check the command frequency
			Acceleration time is short and the speed overshoot is big	Increase acceleration time
			Electronic gear ratio is too big	Set the electronic gear ratio correctly
			Encoder fault	Replace servo motor
			Encoder cable fault	Replace encoder cable
			Overshoot of servo system is too big	Reduce the valued of PA55
		Occurs at the beginning of motor startup	Load inertia is too big	Reduce load inertia Replace by more powerful driver and motor
			Encoder zero-point fault	Replace servo motor Modify encoder zero-point by manufacturer
			Wrong UVW wiring Wrong encoder cable wiring	Check the wiring
002	Over voltage	Occurs at the power-on of control circuits	PCB fault	Replace servo motor

No.	Name	Status	cause	remedy
		Occurs at the power-on of main circuits	High voltage of the power Abnormal waveform of the power	Check the power source
		Occurs when motor is running	Connection error of the brake resistor	Check the wiring
			Damage of brake transistor Damage of the inner brake resistor	Replace servo driver
			Capacity of the brake circuit is low	Reduce reboot frequency Increase acceleration time Reduce torque limitation Reduce load inertia Replace by more powerful driver and motor
003	Low-voltage	Occurs at the power-on of control circuits	PCB fault Power fuse damage Soft startup circuit fault Rectifier damage	Replace servo driver
			Low-voltage of power Instant power off	Check the power source
		Occurs when motor is running	Power capacity is low Instant power off	Check load
			Radiator over-heat	Check load
004	Position deviation exceeds the limitation	Occurs at the power-on of control circuits	PCB fault	Replace servo driver
		Supply power to the main circuits, motor	Wrong wiring of U/V/W Wrong wiring of encoder feedback cable	Check wiring

No.	Name	Status	cause	remedy
		does not rotates when inputting command pulses.	Encoder fault	Replace servo motor
		Occurs when motor is running	Position deviation limitation is tool small	Increase the limitation value
			Gain of position loop is too small	Increase the gain
			Insufficient torque	Check the torque limitation value Reduce load Replace by more powerful driver and motor
			Frequency of command pulses is too high	Reduce the frequency
			Wrong zero point of the motor equipped with an absolute encoder	Perform the –tU3 operation
			Reaches the hardware over-travel limitation	Check the CWI and CCWI signal
006	Velocity loop is saturated	Occurs when a motor starts running	Motor is clamped	Check the motor and load
		Occurs when motor is running	Overload	Reduce the load Replace by more powerful driver and motor
			Connector fault Switch power fault Chip is damaged	Check connectors Check the switch power Replace servo driver

No.	Name	Status	cause	remedy
007	Limitation switches malfunction	Occurs at the power-on of control circuits Occurs when motor is running	CCWI and CWI signals are ineffective	Check wiring and input signals Set PA20 to mask the alarm
009	Signal malfunction of encoders	Occurs at the power-on of control circuits Occurs when motor is running	Wrong motor model	Set PA01 correctly
			Wrong wiring of encoder cable	Check the wiring
			Encoder cable fault	Replace the cable
			Cable is too long to supply enough power voltage to encoders	Use shorter cable Supply power to encoder with multiple lines
			Encoder damage	Replace the motor
			Connector fault Switch power fault Chip is damaged	Check connectors Check the switch power Replace servo driver
010	Phase lost	Occurs at the power-on of motor	Power source looses one or more phases	Check the RST terminals
011	IPM malfunction	Occurs at the power-on of control circuits	PCB fault	Replace the servo driver
		Occurs when motor is running	Low-voltage Over-heat	Check the servo driver Reboot Replace the servo driver
			Short circuits of U, V, W terminals	Check wiring
			Grounding fault	Ground correctly
			Damage of motor insulation	Replace the motor

No.	Name	Status	cause	remedy
			Interfered	Add filters Keep away from interference source
012	Overcurrent	Occurs at the power-on of control circuits Occurs when motor is running	Short circuits of U, V, W terminals	Check wiring
			Grounding fault	Ground correctly
			Damage of motor insulation	Replace the motor
			Damage of driver	Replace the servo driver
			Wrong zero point of the motor equipped with an absolute encoder	Perform the –tU3 operation
013	Overload	Occurs at the power-on of control circuits	PCB fault	replace servo driver
		Occurs when motor is running	Output torque exceeds the rated torque.	Check load Reduce start-stop frequency Reduce torque limitation value Replace by more powerful driver and motor
			Brake shuts down	Check the brake
			Motor vibration	Adjust the gain Increase acceleration time Reduce load inertia
			One phase of U, V, W breaks Encoder wiring fault	Check wiring

No.	Name	Status	cause	remedy
014	Brake malfunction	Occurs at the power-on of control circuits	PCB fault	Replace the servo driver
		Occurs at the power-on of main circuits	Overvoltage of the main circuits Abnormal waveform of the power source	Check the power source
		Occurs when motor is running	brake resistor wire break	wire again
			brake transistor damage inner brake resistor damage	replace servo driver
			brake circuit capacity is too small	① reduce start-stop frequency ② increase acc/dec time constant ③ reduce torque limitation value ④reduce load inertia ⑤ replace by bigger power driver and motor
			main circuit power voltage is too high	check main power
015	Power on again	occur at parameters setup	the setup parameters will be valid after power on again	power on again
016	Software doesn't match with hardware	Occurs at power-on of control circuits	Software doesn't match with the hardware	Connect machine tool builder

No.	Name	Status	cause	remedy
017	Overvoltage of main circuits	Follow the same procedures of Er002		
018	Value of torque command is big.	Occur at motor run in the torque mode	torque command exceeds the motor maximum torque in torque mode	reduce the setup value of torque command
019	Value of speed command is big.	Occur at motor run in the speed mode	speed command exceeds the motor maximum speed in speed mode	reduce the setup value of speed command
020	Save fault	occur at power on or motor run	chip or PCB fault	replace servo driver
021	Save fault	occur at executing "-rS" operation	No data is in the EEPROM parameter backup area or data has been damaged.	Using "-BA" operation to reset up data in the parameter backup area.
022	Save fault	occur at power on or motor run	Data has been damaged in the EEPROM parameter storage area.	Initialize parameters to the default value automatically, please check whether they satisfy requirements.
023	Save fault	occur at power on or motor run	The value of parameters in the EEPROM exceed the specified value.	Initialize parameters to the default value automatically, please check whether they satisfy requirements.
024	Command Pulse Frequency too High	occur at motor run	PA12 and PA13 setting incorrect command pulse frequency input too high	check parameter value of PA12 and PA13 reduce command pulse frequency

No.	Name	Status	cause	remedy
025	Kernel fault	occur at motor run	inside fault	power on again, please replace servo driver if the error is continuous.
026	Low-voltage of main circuits	Follow the same procedures of Er003		
030	Encoder Z-phase pulse fault	occur at power on or motor run	① Z-phase pulse do not exist and encoder is damaged ②encoder Z-phase signal damage ③encoder cable fault ④cable shield fault ⑤ shielded grounding connect fault ⑥encoder interface circuit fault	① check encoder interface circuit ②replace servo driver ③replace servo motor
031	Over heat of IPM module	At power-on or running	Ambient temperature is too high Load is too big IPM damaged	Improve cooling method Decrease load Chang servo driver
032	Encoder U, V and W signal coding fault	occur at power on or motor run	①cable fault ②cable shield fault ③ shielded grounding connect fault ④ encoder U, V and W signal damage ⑤encoder interface circuit fault	① check encoder interface circuit ②correct grounding ③replace cable ④replace servo driver ⑤replace servo motor
033	Encoder classification fault	occur at power on	motor model fault	correct setup of PA01

No.	Name	Status	cause	remedy
034	Absolute encoder fault	occur at power on or motor run	①motor model setup fault ②cable fault ③ shielded grounding connect fault ④encoder interface circuit fault ⑤cable shield fault	①correct setup of PA01 ②replace cable ③ check encoder interface circuit replace servo motor
038	Software overtravel	Occurs when tuning on the power or motors are running.	Servo drivers position exceeds the software limitation range.	Set PA08 to 0 to mask the overtravel protection function. Get out of the forbidden range and enable the function again. Set PA44 and PA45 correctly. Perform TU2 operation to set the current position as the zero position.
039	A-POS error	At running process	Unsuitable parameters	Check PA29~PA32, PA49~PA52, PA25 & PA77
041	Absolute encoders error	Occurs when tuning on the power or motors are running.	Using absolute encoders firstly Battery voltage is low No battery Encoders are broken down	Perform TU4 operation
042	Absolute encoders error	Occurs when tuning on the power or motors are running.	Encoders are broken down	Perform TU4 operation Change motors if the error happens frequently,
050	Drive ratio error	At power-on or setting	Unsuitable driver ratio parameters	Check parameters

No.	Name	Status	cause	remedy
		parameters		
054	Absolut encoder Miscount	At power-on or running	Encoder malfunction	Chand encoder
060	Absolute encoder error	At power-on	Multiple cycle error when using revolving table	Restart driver or change servo driver
062	Feedback speed exceeds limit	At power-on or running	Motor rotates tool fast Encoder is damaged	Check the actual speed Change motor
067	Low-voltage of control circuits	At power-on or running	Voltage of control circuits is too low.	Change driver

No.	Error name	Cause	Remedy
128	Prohibit execute operations under running	execute the forbidden operations in running status(motor enable), e.g. setting up parameters	Execute operations needed until run indicator light turns off.
129	tU1 alarm	acceleration is big while executing “tU1” operation	①reduce the setup value of PA90 ②increase the setup value of PA91
130	no data in the EEPROM parameter area	EEPROM data area hasn’t been initialized.	Parameters have already been initialized to the default value automatically
131	Automatic parameters	Load inertia ratio varies too much when performing	Increase the value of PA90 properly

	adjusting	parameters adjusting. (±20%)	
132	Automatic parameters adjusting	Load inertia ratio got from automatic adjusting operation exceeds the drivers' range Select the wrong motor model	Reduce inertia ratio or replace a motor with higher inertia. Confirm the value of PA01.
144	Temperature warning of absolute encoder	Ambient temperature is too high	Improve cooling method
150	Battery voltage is low	Battery voltage is low Feedback cable malfunction Encoder is broken down	Replace a new battery Confirm the feedback cable is well Change a new motor
152	Zero point of absolute encoder warning	Zero point of absolute encoder is not established yet.	Perform the TU3 operation
153	Invalid adjustment of parameters	Too quick to change parameters	Operate again
154	Parameter value is out of allowable range.	Parameter value is out of allowable range.	Confirm the allowable range and set again.
155	tU1 failure	Perform tU1 in RUN state	Perform tU1 in RUN state
156	tU1 failure	Internal error when executing tU1 operation	Operate again
157	tU3 failure	Perform tU3 in READY state	Operate again
158	tU3 failure	It is not allowable to perform tU3 operation in RUN state	Operate again
159	tU3 failure	Internal error when executing	Operate again

		tU3 operation	
161	Invalid adjustment of parameters	Value of PA90 exceeds the upper limite speed of the motor	Confirm the allowable range and set again.

6 Display and Operation

Display and operation panel of SD300 consists of the following there parts: six nixie tubes, two indicators and four keys. It supports all operations and displaying requirement.

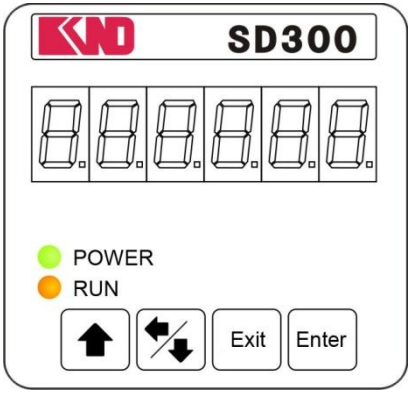


Figure 6-1 Display and operation panel

Keys

: Increase sequence number or value

: Reduce sequence number or value/Shift to the left

Exit: Return to the previous menu or cancel the current operation

Enter: Enter the next layer menu or confirm the operation

Keep pressing or , sequence number or value will continuously increase or reduce.

POWER indicator

POWER indicator will be lit up after 800 ms from turning on the power of main circuits, and it goes out when the power of main circuits is turned off.

Note:

High capacities in SD300 bring the risk of electric shocking even when the POWER indictor goes out. Do not touch any part of the driver in five minutes after turning off the power.

RUN indicator

RUN indicator will be lit up when the servo motor is active. Reversely, if it goes out, the servo motor is in free status or in braking status (with external

mechanical brake).

After turning on the power of control circuits, drivers display the default monitoring menu set by PA03. Press any key to enter the main interface in which "Sd-300" is displayed.

The operation guide map is as follows:

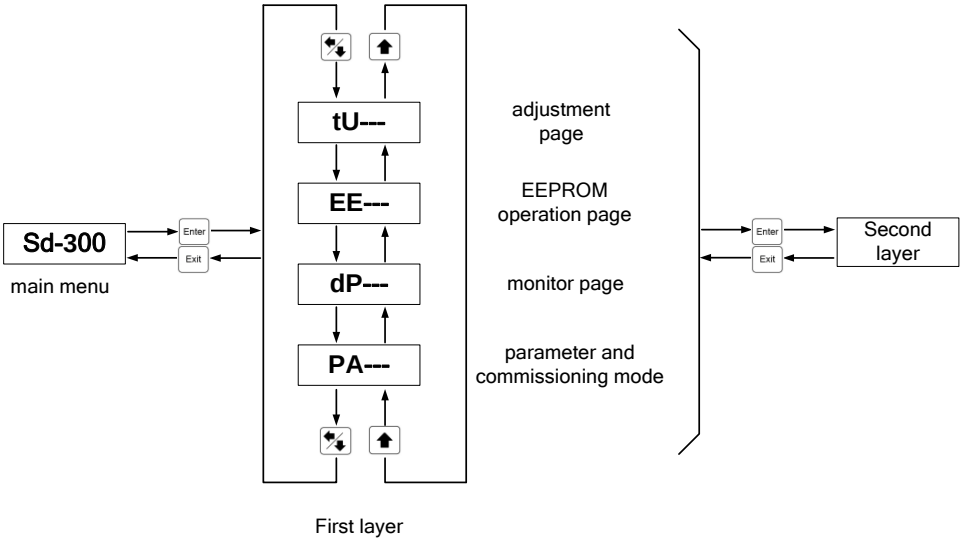


Figure 6-2 Operation guide map

6.1 First Layer

Press [Enter] in the main interface to enter the first layer menu which includes four sub-menus: PA, dP, EE and tU. Press [▲] or [◄/▼] to switch among the four sub-menus described in Fig. 6.2. Select one sub-menu and press [Enter] to enter the second layer menu. Press [Exit] to exit from a sub-menu.

1. PA- - - (Parameter menu)
   Parameters' displaying and setting operations are performed in this menu.
2. dP- - - (Monitoring menu)
   Running status of motors and drivers are displayed in this menu.
3. EE- - - (EEPROM menu)
   The operations of EEPROM are performed in this menu to achieve the

function of managing parameters.

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

6.2 Second Layer

6.2.1 Parameter Setting (PA)

Select "PA - - - " in the first layer menu and press Enter to enter the second layer menu. Follow the procedures below to read or set parameters.

1. Select parameter sequence number
   When parameter sequence number is flickering, press ↑ to increase the sequence number. 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 Enter to display selected parameter's value.
3. Modify parameters' values
   Like the operation in step 1, press ↑ or ↑/→ to change parameters' values. Parameters' values meet some specified ranges. SD300 will automatically restrict the setting value in these ranges. A parameter value set newly will not be effective in control process immediately.
4. Confirm or cancel setting operation
   If parameters' values set newly satisfy your application, press Enter to confirm the values. When "------" stops flickering, the values will be effective in control process. Press Exit to cancel setting operation and go back to step 1.
   Press Exit to return to the first layer sub-menu "PA - - - ".

Note:

1. Set PA00 to specified value before setting parameters. Refer to chapter 4 for more information.
2. The signs of parameters' values are set at the highest order digit.

6.2.2 Monitoring menu (dP)

Select "dP - - - " in the first layer menu and press Enter to enter the second layer. Press ↔ or ↑ to select a specified monitoring item. Press Enter to read the desired value.

Name	Symbol	Function	Unit
SPEED	R	Motor's rotation speed	RPM
POS_L	P	Low-6-bit of current position	command pulses
POS_H	P	High-4-bit of current position	command pulses
CPO_L	C	Low-6-bit of the command position	command pulses
CPO_H	C	High-4-bit of the command position	command pulses
EPO_L	E	Low-6-bit of position offset	command pulses
EPO_H	E	High-4-bit of position offset	command pulses
PLS_L	P	High-4-bit of command pulses counter	command pulses
PLS_H	P	Low-6-bit of command pulses counter	command pulses
TRQ	T	Motor torque load ratio	%
IA	I	U-phase current value	mA
IB	I	W-phase current value	mA
CNT	—	Current control mode POS: Position control mode SPD: Velocity control mode D-SPD: Pilot running control mode TOR: Torque control mode Note: CNT value indicates the current control mode, which may be different from the setting of PA04.	—
CS	R	Seed command	RPM

<table>
<tr><td>Name</td><td>Symbol</td><td colspan="5">Function</td><td>Unit</td></tr>
<tr><td>APO</td><td>A</td><td colspan="5">Electrical angle of motors</td><td>$2\pi \times 2^{-15}$ rad</td></tr>
<tr><td rowspan="5">IN</td><td rowspan="5">I</td><td colspan="5">Input signal from host controllers</td><td rowspan="5"></td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Signal</td><td></td><td></td><td>ACLR</td><td>INH/SC2</td></tr>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Signal</td><td>ZSP</td><td>CCWL</td><td>CWL</td><td>SVON</td></tr>
<tr><td rowspan="5">OUT</td><td rowspan="5">O</td><td colspan="5">output signal to host controller</td><td rowspan="5"></td></tr>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Signal</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Signal</td><td>BRK</td><td>COIN</td><td>ALM</td><td>SRDY</td></tr>
<tr><td>COD</td><td>COd</td><td colspan="5">UVW code from encoders</td><td>—</td></tr>
<tr><td>ERR</td><td>Er</td><td colspan="5">Error code</td><td>—</td></tr>
<tr><td>ER1</td><td>Er</td><td colspan="5">Latest 1st error code</td><td>—</td></tr>
<tr><td>ER2</td><td>Er</td><td colspan="5">Latest 2nd error code</td><td>—</td></tr>
<tr><td>ER3</td><td>Er</td><td colspan="5">Latest 3rd error code</td><td>—</td></tr>
<tr><td>ER4</td><td>Er</td><td colspan="5">Latest 4th error code</td><td>—</td></tr>
<tr><td>ER5</td><td>Er</td><td colspan="5">Latest 5th error code</td><td>—</td></tr>
<tr><td>ER6</td><td>Er</td><td colspan="5">Latest 6th error code</td><td>—</td></tr>
<tr><td>ER7</td><td>Er</td><td colspan="5">Latest 7th error code</td><td>—</td></tr>
<tr><td>ER8</td><td>Er</td><td colspan="5">Latest 8th error code</td><td>—</td></tr>
<tr><td>ER9</td><td>Er</td><td colspan="5">Latest 9th error code</td><td>—</td></tr>
</table>

Name	Symbol	Function	Unit
IAD	IAd	Zero-offset value of U-phase current	—
IBD	Ibd	Zero-offset value of W-phase current	—
LOAD	L	CPU load ratio	%
TRQN	T	Current torque	1/1000Nm
AL	AL	Warning code	—
AI	U	Input analog voltage command	—
BUS-PD	t	—	—
BUS-ER	nO	—	—
ENC_L	P	Low-6-bit of feedback position from endcoder	Feedback unit
ENC_H	P	High-4-bit of feedback position from endcoder	Feedback unit
RAS_L	P	—	—
RAS_H	P	—	—
REE	P	—	—
ENC_TP	—	Encoder type: D-C-17: 17-bit single cycle/16-bit multiple cycle absolute encoder INC-25: 2500 pulses incremental encoder HSL-17: 17-bit single cycle/12-bit multiple cycle absolute encoder D-C017: 17-bit single cycle/0-bit multiple cycle absolute encoder	—
PCOR	C	Target position in A-POS mode	PA77.2
FRE	F	Vibration frequency	Hz
NQ	q	Q-factor of trap filter	—
SPRI	C	Elastic coefficient of servo system	Nm/rad
DAP	b	Damp coefficient of servo system	Nm/rad/s
UBUS	U	Main circuits' voltage	V
TAB_L	D	Low-6-bit of the revolving table angle	Command pulse

Name	Symbol	Function	Unit
TAB_H	D	High-4-bit of the revolving table angle	Command pulse
ENR_L	E	Low-6-bit of the extended multi-cycle of an absolute encoder	R
ENR_H	E	High-4-bit of the extended multi-cycle of an absolute encoder	R
D-NO	—	Development version	—
UER	—	Extended software version	—
ASIC	n	Hardware version	—
ASIC-S	n	Hardware sub-version	—

Note:

1. Checking monitoring state is free of any authority (PA00).
2. The unit of motor position, command position, position offset and command pulses counter is the same as that of host controllers. These values are decimal base numbers.
3. Motor position:
   (1) Motors position is countered by command pulses. The zero position can be specified by the operation of TU2.
   (2) Motors position is the upper transmitted data from absolute encoders when using the absolute encoders' upper transmission function. If the electronic gear ratio or the value of PA15 is changed when drivers are running, the zero position of motors will shift, but the motors position displayed will not change. In this case, zero position returning operation should be performed immediately, otherwise sliding or overtravel may happen. Refer to chapter 7.7.5 for more information.
4. When a motors is in free status (the RUN indicator goes out), the command position changes with the motor's actual position. The number of pulses received from a host controller can be read in PLS_L/PLS/H.
5. When the digit number reaches up to 6, symbols will not be displayed. (E.g. -12345)
6. Output signal status without considering the control of PA57 are read in OUT. The active level of BRK, COIN and ALM is 0, while the active level of SRDY,

VCMP and VLT is 1.

7. Input signals considering the control of PA54 and PA59 are read in IN. The active level of INH/SC2, CLE/SC1/ZSPD, CCWI, CWI and SVON is 1. The rising edge of ACLR is effective signal.
8. The monitoring status of IN and OUT are shown as follows:

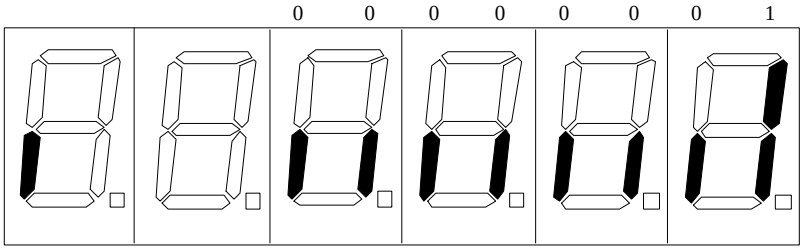


Figure 6-3 Monitoring status in IN item

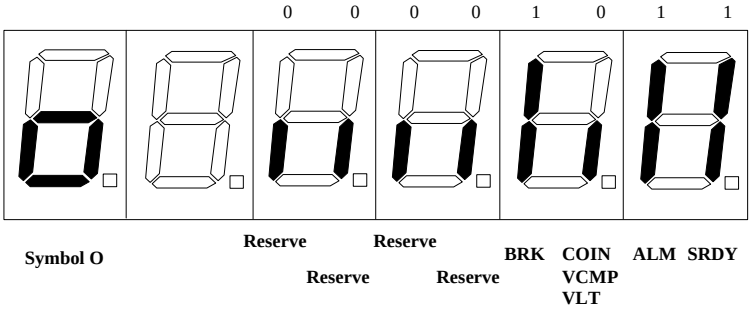


Figure 6-4 Monitoring status in OUT item

6.2.3 Parameter Management (EE)

Parameters in SD300 are saved in EEPROM. Two independent regions are used to manage parameters: Parameter region and Backup region.

Parameter region

This region is used to save all parameters except for volatile parameters. When the power is turned on, SD300 reads these parameters into memory.

After modifying one or more parameters, the corresponding parameters in this region will be written with newly set values. Performing the –dEF operation will initialize parameters' values in this region to the factory-set values.

Backup region

This region is used to save the current using parameters. Perform –bA or –rS operations to write or read this region.

Parameter management operations are shown as follows:

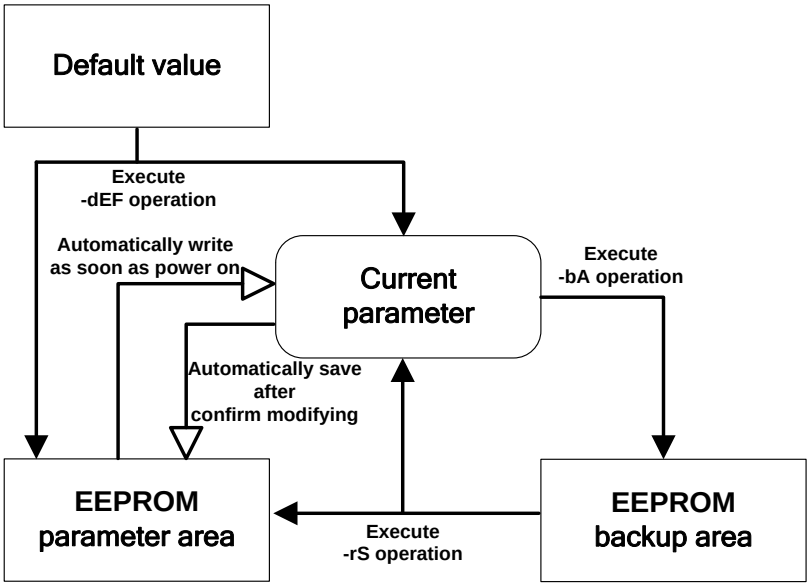


Figure 6-5 Parameter management operation diagram

Select "EE- - -" and press Enter to enter parameter management menu.SD300 supports three parameter management functions:

There are three kinds of parameter management modes: -dEF, -bA and -rS.

1. –dEF

   Perform the –dEF operation to initialize all parameters except for PA00 and PA01 to factor-set values. Some parameters' default values are different from the motor models specified by PA01. Ensure that the value of PA01 is correct before performing the –dEF operation.

2. –bA

   Save all parameters expert for volatile ones in backup region. Perform –bA in the following cases:

   When debugging drivers, save the current set of parameters which satisfy your applications before trying to change some parameters to achieve better performance.

   When a set of parameters have been obtained after debugging drivers, perform –bA to save it. Once some parameters are changed, perform –bS to load these parameters into memory again.

3. –rS

   Load parameters from backup region into memory. The current using parameters' values will be lost.

   Press [◄/▼] or [▲] to select the three operations above and press [Enter] to confirm your operations. The example of saving parameters is as follows:

   Select –bA menu and keep pressing [Enter] until "------" is displayed, then SD300 saves the current using parameters into backup region. One or two seconds later, the string "FInISH" is displayed, which means that save operation is sucessful. If the saving operation fails, "Er" code is displayed. Press [Exit] to return to the upper layer menu.

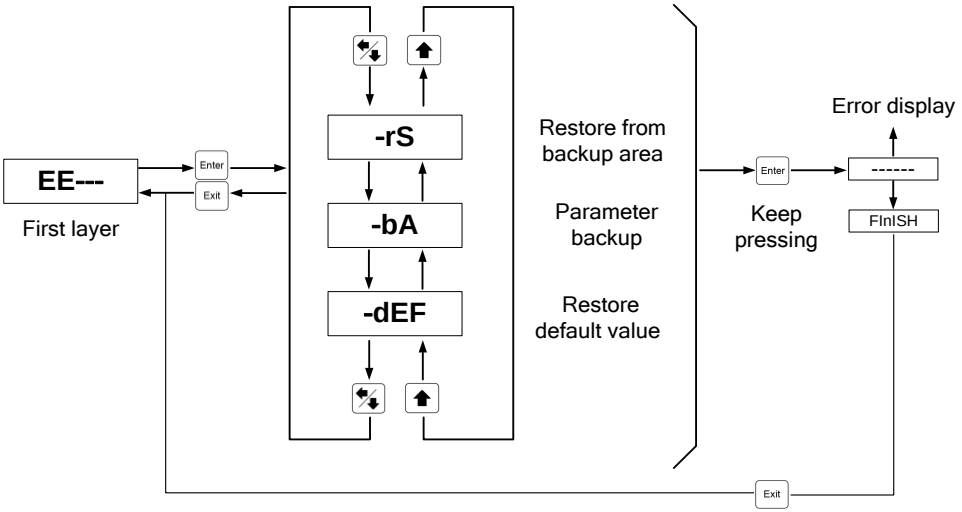


Figure 6-6 EEPROM management operation map

Note:

1. Set PA00 to 315 or higher authority password before performing parameter management operation.
2. Do not perform –dEF and –rS operation when the motor is running.
3. Setting operation in PA menu will save parameters into EEPROM in real time, and the –bA operation is not necessary in this case.
4. After changing the value of PA01, the values of parameters associated with servo system controlling such as PA05, PA06, PA07, PA09, PA55, PA56 and so on keep unchanged, but SD300 controls motors following the newly style which is determined by PA01. Perform –dEF operation according to your application after changing the value of PA01.

6.2.4 Adjusting menu (tU)

Select "PA - - - " and press Enter to enter tU menu.

SD300 supports four adjusting functions:

1. -tU1

   Automatically adjust servo system parameters such as rotary inertia, sliding friction etc. Please refer to chapter 4.2 for more information.

2. -tU2

   Use –tU2 to set the origin position of motors equipped with absolute encoders. After –tU2 operation, the current position is defined as the origin position. Position information based on the specified origin when running are transmitted to host controllers. This origin position is nonvolatile. This function is not available when driving motors equipped with incremental encoders.

3. -tU3

   Establish the zero point of absolute encoders and incremental encoders.

   When motors with absolute encoders are firstly driven, do perform this operation firstly. Ensure that the following conditions are satisfied before performing –tU3 operation:

   (1) The power of control circuits and main circuits are turned on.

(2) Servo driver is not enabled (the RUN indicate is not lit up)

(3) Stop motor and connect no loads.

(4) Release the brake if motors are equipped with mechanical brake.

After –tU3 operation, the zero point of electrical angle is saved in absolute encoders. Set PA00 to 385 or higher authority password before performing this operation. Make sure that the above conditions are satisfied before –tU3 operation. The zero points of electrical angle are saved in motors. So generally the -tU3 operation is performed only once.

4. -tU4

   Clear the multi-circle data of absolute encoders. If servo drivers issue Er041 or Er042 alarm when driving motors with absolute encoders, the –tU4 operation should be performed. Ensure that the following conditions are satisfied before performing –tU4 operation:

   (1) The power of control circuits (from r and t terminals) is turned on.

   (2) Servo driver is not enabled (the RUN indicate is not lit up).

   After –tU4 operation, the position of absolute encoders are changed. The position data transmitted to host controllers are not correct any more. Reference position returning operation should be performed in this case.

5. -tU9

   Performing the –tU9 operation will restart servo driver forcibly, no matter servo motor is power-on or not. Generally, -tU9 is used when Er015 is generated, in which case servo driver should be restarted.

The operation method is similar to that in EE menu.

Note:

Set PA00 to 315 or higher authority password before above operations.

7 Run

7.1 Grounding

Both servo drivers and motors should be connected to earth reliably. It is recommended to keep the protection grounding terminals of servo drivers 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 servo drivers 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.

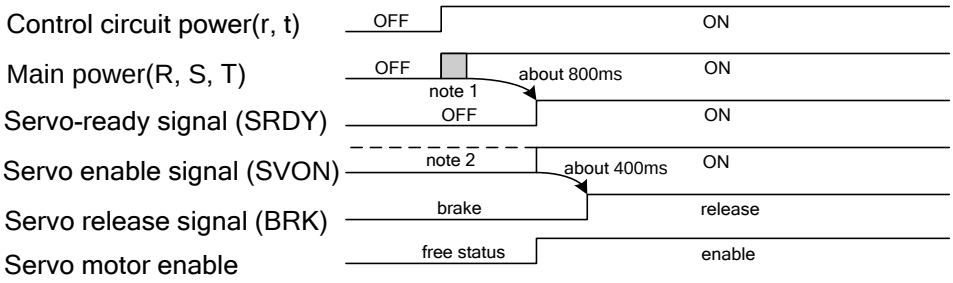
7.2 Working Sequence

7.2.1 Power on sequence

1. Supply power to the main circuits through electromagnetic connectors. Connect R, S and T for three phase applications and connect R, S for single phase applications.
2. Turn on the power of control circuits at the same time of turning on that of main circuits or after it. If only the power of control circuits is turned on, servo ready signal (SRDY) is OFF.
3. Servo ready signal(SRDY) is turned on about 800 ms after the main circuits' power is turned on, which means that the servo driver is ready to receive servo enable signals (SVON) from host controllers. When SVON is received successfully, servo motor is activated immediately. When SVON signal is disabled, any alarm is generated or main circuits' power is turned off, servo motor enters free status.
4. When SVON signals and circuits power are turn on at the same time, the base circuits will be switched on after 800 ms.
5. Frequently turning on and off circuits' power may damage the soft start circuits and braking circuits. The frequency of turning on and off circuits' power should be less than 5 times per hour and 30 times per day. After clearing of a fault about overheat of servo drivers or motors,

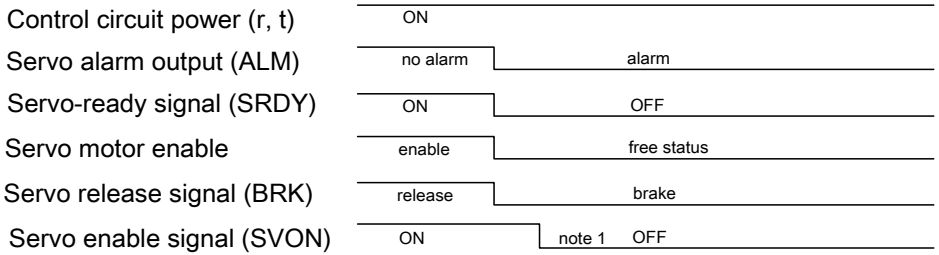
turn on the power again at lease 30 minutes later to let it cool down.

7.2.2 Time Sequence Diagram



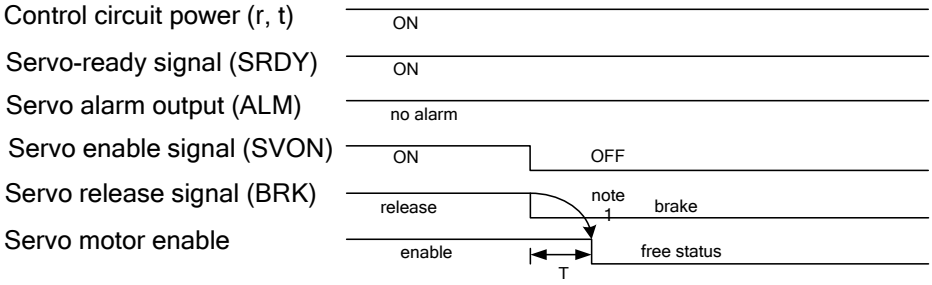
Note1：The main circuit power on after the control circuit power on or the main circuit and the control circuit power on simultaneously.
Note2：Even if servo enable signal (SVON) input already, driver do not accept SVON signal until SRDY signal turn on.

Figure 7-1 Power on sequence



Note1：Considering safe operation, it is necessary that turn off SVON signal from supervisory controller reliably after alarm occurs.

Figure 7-2 Alarm sequence



Note1: Servo motor enable will hold T(ms) time after brake release signal close, then servo motor is in free status, T= PA58 setting value×10ms.

Figure 7-3 Brake sequence in normal run status

7.3 Adjustment and setting

7.3.1 Select motor model

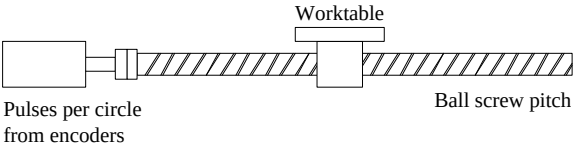
SD300 can be used to drive many models of motors. Select the correct motor model and set it in PA01.

7.3.2 Electronic gear ratio

Electronic gear ratio is used to set the proportional relationship between command pulses and actual movements.

If worktables are installed using the following structure, electronic gear ratio is calculated as follows:

$$\frac{PA12}{PA13} = \frac{Pulse's\ number\ per\ revolution}{Ball\ screw\ pitch(mm) \times 1000} \times Length\ per\ command\ pulse(\mu m)$$



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

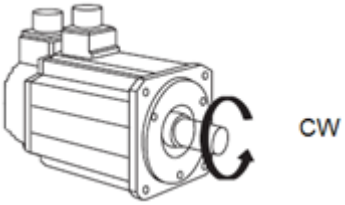
PA12/PA13	Lead screw pitch (mm)				
	4	5	6	8	10
1μm	5/2	2/1	5/3	5/4	1/1
0.1μm	1/4	1/5	1/6	1/8	1/10

When using 17-bit absolute encoders, 131072 pulses will be received per revolution. In this case, the typical electronic gear ratio is as follows:

PA12/PA13	Lead screw pitch (mm)				
	4	5	6	8	10
1μm	4096/125	16384/625	8192/375	2048/125	8192/625
0.1μm	2048/625	8192/3125	4096/1875	1024/625	4096/3125

7.3.3 Motors' 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).



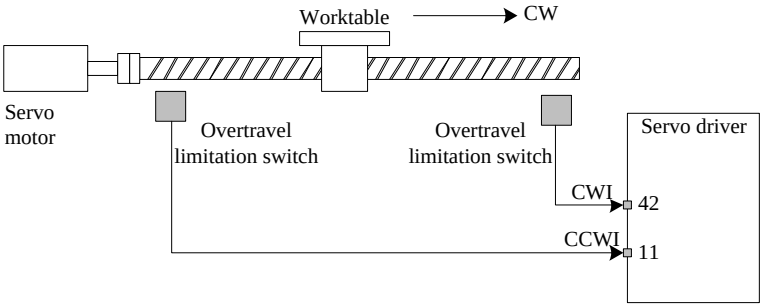
When PA15 is set to 1, if positioning commands are positive, motors rotate in the negative direction (CCW).

Note:

1. Setting PA15 changes the rotation direction of motors, but has no relationship with the definition of CW and the sign of feedback position values.
2. The rotation direction setting in SPD mode and TOR mode are the same.

7.3.4 Hardware overtravel protection

Drivers provide the hardware over travel protection function when using over travel limitation switches on machine tools.



Set PA82.1 to 1 to enable the function. When the limitation switch signal in CW direction is received, the torque outputted in CW direction is zero. When the limitation switch signal in CCW direction is received, the torque outputted in CCW direction is zero.

The default state of CWI and CCWI are normal open. If the active states of limitation switches are normal closed, using PA59 to change the active level of CWI and CCWI.

When overtravel happens, the stopping style described below can be specified by setting PA79.0.

1. Motor is stopped after a deceleration process. The maximum distance in deceleration process is specified by PA78.
2. Motor is stopped freely.
3. Weather Er.038 is issued or not after the motor is stopped.

When the over travel protection is active, drive motors in the opposite direction to exit from the over travel position.

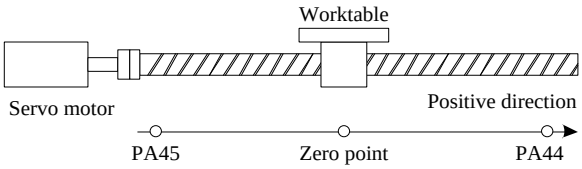
Overtravel protection function is available for every control mode as follows:

PA04	Phenomenon	Processing method
POS A-POS	Movement is forbidden in the direction of overtravel. Er004 is issued.	Drive motors in the opposite direction to exit from the overtravel position.
SPD D-SPD	Movement is forbidden in the direction of overtravel.	Drive motors in the opposite direction to exit from the overtravel position.
TOR	Outputting torque is forbidden in the direction of overtravel.	Drive motors in the opposite direction to exit from the overtravel position.

7.3.5 Software overtravel protection

When using grating rules or driving a motor with an absolute encoder in POS mode, software overtravel protection function is available by setting PA82.0 to 1. The function is useful to save some limitation switches to achieve the same application effect.

Set PA44 and PA45 correctly when using this function.



Explanations

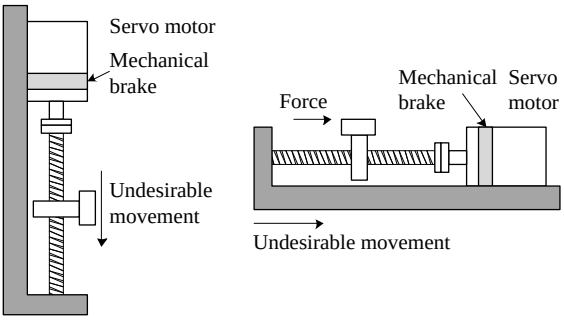
1. This function is available only for the POS mode.
2. If the zero point is changed, ensure that the values of PA44 and PA45 are changed correspondingly. The following operations may change the zero point position.

No.	Operation	Warning
1	1 The electronic gear ration is changed (PA12/PA13) 2 The rotation direction a motor is changed (PA15)	AL136
2	Perform the tU2 operation	–
3	Perform the tU4 operation	–
4	Mechanical devices are changed	–

3. The process methods for the software overtravel protection function is the same as those for hardware overtravel protection function except for the two notes above.

7.3.6 Mechanical brakes of motors

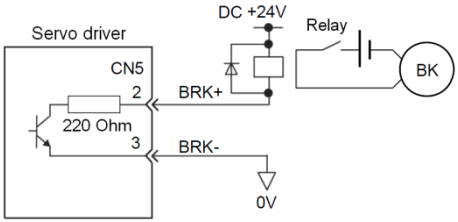
When driving a vertical axis or a axis subjected to some external forces, a mechanical brake is needed to clamp the motor to prevent some unexpected movement when the power to the motor is cut off.



The BRK+ and BRK- signals in CN5 socket are used to control a mechanical brake.

Example

For a mechanical brake using DC power source, its typical application diagram is as follows:



7.3.7 Performance of servo systems

The load inertia ratio (PA56) should be set correctly when adjusting servo systems. To achieve better performance, the related parameters should be adjusted properly according to the mechanical attributes.

7.3.8 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. When the load inertia is m times of that of motor inertia, the available start-stop frequency range and recommended acceleration/deceleration time are as follows:

m	Available start-stop frequency	Acc./dec. time
m≤3	>100 time/minute	60ms or less
m≤5	60~100 time/minute	150ms or less
m＞5	<60 time/minute	150ms or more

When using KND series CNC systems to control SD300, the acceleration/deceleration times of CNC can be set following the table above. If the cases described above can't satisfy your applications, try reducing the internal torque limitation specified by PA34 and PA35 or decreasing the rotation speed of motors.

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, load inertia should be 1~3 times of that of motors. When driving motors with too large load inertia, SD300 may issue some errors because of the regenerative energy during deceleration process. In this cases, follow the below procedures:

1. Reduce the internal torque limitation specified by PA34 and PA35.
2. Reduce the rotation speed of motors.
3. Increase the acc./dec. time of CNC.
4. Install external braking resistors.
5. Change a motor with bigger inertia.

7.3.9 Transmit position data up to host controller

This function is available when using KND CNC as host controllers.

Rotation direction

Connect servo driver and KND CNC unit correctly and select motor model. Enable servo driver. Move motor slowly in JOG mode and observe the coordinates on CNC screen. Follow the procedures below to adjust some parameters.

1. If the coordinates on CNC screen increase while the data transmitted to host controller decreases, reverse the pulse direction on CNC unit.
2. After the setting in step 1, if the coordinates on CNC screen increase while the tool doesn't move in the desired direction, try changing the value of PA15 on servo driver.

Note

The position data transimited upto host controller represnets the servo motor's actual position, which can be read in the POS item in dP menu or on CNC unit.

Return to the reference position of the system

The system here represents the servo system including CNC unit, servo driver and mechanical parts on machine tool. Follow the procedures below to return to the reference position.

1. Perform the reference position return operation on CNC unit, and clear the coordinate values to 0. The position data transmitted from servo driver may be not zero.
2. Perform the tU2 operation on servo driver. After this operation, the

position data transmitted up to CNC unit will be zero.

If the reference position return operation is finished successfully, the reference position will be remembered even when the power to the whole servo system is cut off.

In the following cases, reference position return operation should be performed immediately, otherwise collision or over travel may happen.

1. After changing PA12 or PA13(electronic gear ratio parameters)
2. After changing PA15
3. After the tU4 operation

7.3.10 Battery installation and replacement

When driving motors with multi-circle absolute encoders using batteries, the absolute position is remembered with the help of batteries when drivers' power is turned off. SD300 provides a battery box on the top of its body in which three #5 batteries are installed. These batteries can be replaced conveniently by users. Battery replacement operation can be performed when drivers are supplied power or not.

When drivers' power is turned on, replacing batteries will not lose the absolute position information, but AL150 will be issued. When drivers' power is turned off, replacing batteries operation will lose the absolute position information, which will result in issuing Er.041 at the moment of restarting the driver.

Note

It is not necessary to reboot the driver after replacing batteries when the power is on. Press Exit continuously will clear the AL.150 alarm.

7.4 Commissioning

7.4.1 Check before pilot running

Check the following conditions before turning on the power of servo drivers and motors:

1. Whether wiring is correct and firm or not?

2. Whether the voltage is correct or not?
3. Whether short circuit or grounding exists or not?
4. Whether control signals are connected correctly or not?
5. Whether the polarity and level of input and output signals are suitable or not?
6. Whether the encoders' signals are connected correctly or not?
7. Do not connect any load in pilot running mode.

7.4.2 Pilot running in velocity control mode

1. Ensure that the servo ready signal is OFF.
2. Turn on the power of control circuits, while the main circuits' power is not turned on. If some error is issued, please check the wiring.
3. Select the correct motors' model in PA01.
4. Turn on the power of main circuits.
5. Set PA04 to D-SPD mode.
6. Send servo enable signal from host controllers after confirming that no malfunctions and abnormalities happen. Motor will rotates at the speed specified in PA21.
7. The rotation direction of motors can be changed by setting PA15.
8. The rotation speed of motors can be specified by setting PA21.

7.5 Position control mode

Follow the below procedures before running in position control mode.

1. Ensure that the servo enable signal is turned off.
2. Turn on the power of control circuits and main circuits.
3. Select the correct motor model and set PA01.
4. Set PA04 to POS. Set P14 according to the style of command pulses from host controllers. Calculate electronic gear ratio according to the mechanical equipment and set PA12 and PA13 correctly. Confirm the value of PA15 is correct.
5. If no abnormality or malfunction happens, host controllers can send servo enable signal to drive motors.
6. Send low frequency command pulses from host controllers.

General view of position control mode is as follows:

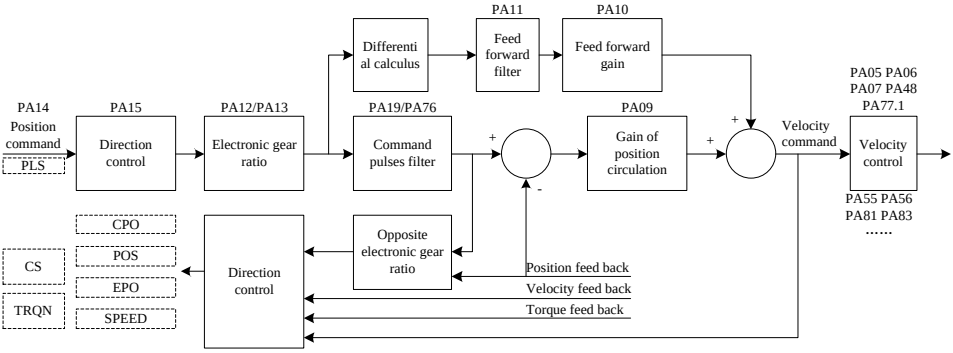


Figure 7-4 General view of position control mode

When the input signal INH is effective, servo drivers stop responding command pulses. When INH becomes ineffective, servo drivers can continuously respond command pulses again.

In position control mode, if the absolute value of deviation is less than PA16, COIN signal is output, while if the value is bigger than PA17, Er.04 will be issued.

7.6 Velocity control mode

Follow the below procedures before running in velocity control mode.

1. Ensure that the servo enable signal is turned off.
2. Turn on the power of control circuits and main circuits.
3. Select the correct motor model and set PA01.
4. Set PA04 to SPD.
   (1) Using external speed command

   Set PA23 to 0. Confirm the values of PA53, PA24, PA27, PA28, PA40 and PA41 are proper. Confirm the input signals ZSPD and VCMD are valid.

   (2) Using internal speed command

   Set PA23 to 1. Confirm the values of PA29, PA30, PA31, PA32, PA40 and PA41 are proper. Confirm the input signals SC2 and SC1 are valid.

5. If no abnormality or malfunction happens, host controllers can send servo enable signal to drive motors.
6. Send low frequency command pulses from host controllers.

General view of velocity control mode is as follows:

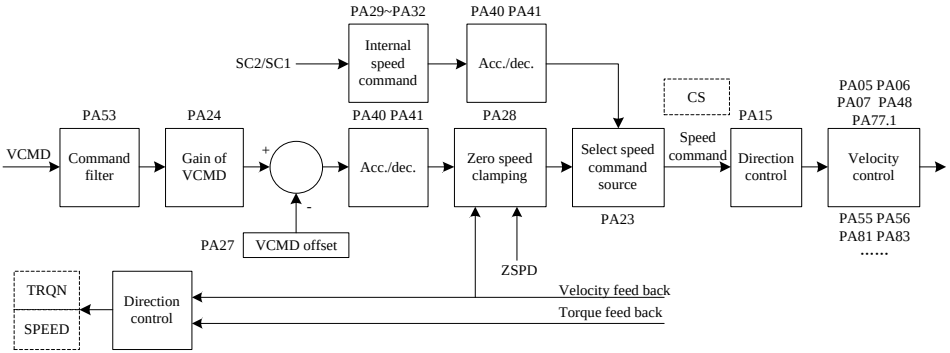


Figure 7-5 General view of velocity control mode

When the absolute value of external analog speed command is less than the value of PA28 and the input signal of ZSPD is effective at the same time, servo drivers enter the zero-speed clamping status, in which motors' positions are clamped in the range of ±1 pulse. If the input signal of ZSPD is ineffective or the absolute value of analog speed command is bigger than that of PA28, servo drivers exit from the clamping status and motors are driven normally.

If an external constant analog speed command corresponds to zero speed, read the rotation speed in SPEED menu (DP) and set it in PA27.

Note:

1. The state of input signals can be read in IN menu (DP). The active level of ACLR, INH/SC2, CLE/SC1/ZSPD, CCWI, CWI and SVON are 1.
2. When ZSPD is not connected with any external lines, the active level of it can be set by PA54.
3. The polarity of ZSPD can be set by PA59.
4. In velocity control mode or velocity pilot running control mode, if the rotation speed is in the range specified by PA37 and PA38, the output signal VCMP is valid.

7.7 Torque control mode

Follow the below procedures before running in torque control mode.

1. Ensure that the servo enable signal is turned off.
2. Turn on the power of control circuits and main circuits.
3. Select the correct motor model and set PA01.
4. Set PA04 to TOR. Confirm the values of PA53, PA39, PA42 and PA43 are proper. Confirm the input signal TCMD is valid.
5. If no abnormality or malfunction happens, host controllers can send servo enable signal to drive motors.

General view of torque control mode is as follows:

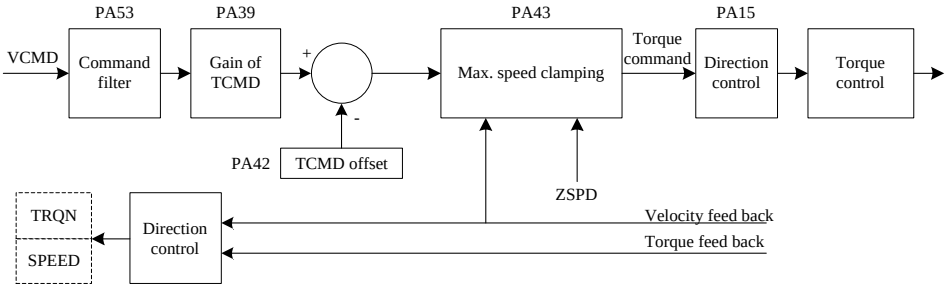


Figure 7-6 General view of torque control mode

Motors will be accelerated when the torque outputted is bigger than the actual load. SD300 provides the over-speed clamping function to protect the load equipment. The maximum speed is set in PA43. When the over-speed clamping function is active, output signal VLT is effective. If the value of PA43 is bigger than the maximum speed of motors, before the actual rotation speed reaches the value set by PA43, Er.01 will be issued. If the external analog torque command reduces to normal range when the rotation speed is clamped, servo drivers will ineffective the clamping function and work in torque control mode.

If an external constant analog torque command corresponds to zero speed, read the rotation speed in TRQN menu (DP) and set it in PA42.

7.8 Single-axis positioning

The single-axis positioning operation is suitable for the following situations:

1. When simple positioning operation is needed without host controllers
2. Demonstration running without host controllers

Set PA04 to A-POS to enter the single-axis positioning mode. Four positions are specified in PA49~PA52 and their corresponding speed (absolute value) when positioning are specified in PA29~PA32. The general view of single-axis positioning is as follows:

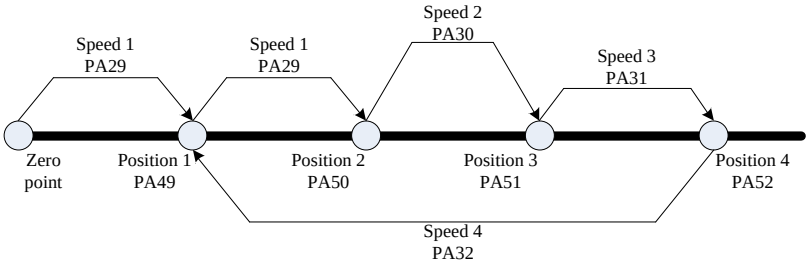


Figure 7-7 Schematic diagram of the A-POS control mode

Procedure of performing the single-axis positioning operation:

Set PA33 to ON and supply power to the motor. The current position is regarded as the zero point and servo driver performs the positioning operation to the next point specified. When positioning, the linear acceleration process is used. When reaching the target point, servo driver delays a time specified by PA19 and waits until the POSI_RDY signal is effective and perform the positioning operation to the next point. When reaching the position 4 specified by PA52, servo driver moves to the position 1 as the next point periodically.

The values' unit of PA49~PA52 is specified by PA77 and the range is from 1r to 0.001r. The delay time after a single positioning operation is specified by PA19, its range is from 0s~1000s. The absolute value of the acceleration speed is specified by PA25.

The upper distance limitation between two positioning points is 16000r. The

longest time of positioning process should shorter than 500 seconds. When the above limitations are reached, Er.039 will be issued.

Note

1 If the distance between two positioning points is short while the positioning speed is high, the positioning speed may not be reached because of the acceleration process.

2 When positioning, the motor's coordinate can be read in the PCOR displaying item.

3 The CW direction of the motor is regarded as the positive direction of positioning operation.

4 POSI_RDY signal uses the DI_EXT1 terminal. If the DI_EXT1 terminal is not connected with any line, it is available to set POSI_RDY effective forcibly using PA54.

5 For safety consideration, setting PA04 to A-POS is only valid for the current restarting operation. PA04 is set to POS automatically after rebooting the driver.

7.9 Revolving table

When driving a revolving table with a motor equipped with absolute encoder, servo driver is able to read the angle of the revolving table in real time. Even through the power to the whole servo system is cut off, the angle can also be read when power-on again.

Follow the procedures below to set parameters when driving revolving tables. Assume that the speed ratio of motor to revolving table is m:n.(m represents the speed of motor and n represents the speed of revolving table)

Set electronic gear ratio (PA12/PA13)

Set electronic gear ratio following the equation below.

$$\frac{PA12}{PA13} = \frac{Pulse\ number\ per\ circle\ from\ encoder}{Command\ pulse\ number\ per\ circle}$$

For the motors equipped with a 17-bit absolute encoder, the pulse number per circle is 131072.

Example:

Assume that m = 90, n = 1. Command pulse number used to control the

revolving table to rotate one circle is 360000. That is to say, motor rotates 90 circles, revolving table rotates one circle. The electronic gear ratio are calculated by the equation below.

$$\frac{PA12}{PA13} = \frac{131072}{360000 \times \frac{1}{90}} = \frac{4096}{125}$$

Set PA12 to 4096 and set PA13 to 125.

Set transmission ratio (PA65/PA66)

Set the transmission ratio of motor to revolving table following the equation below.

$$\frac{PA65}{PA66} = \frac{Circle\ numbe\ ro\ motor}{Circle\ number\ of\ revolving\ table}$$

Example:

Assume that m=90, n=1. That is to say, motor rotates 90 circles, revolving table rotates one circle. In this case, set PA65 to 90 and set PA66 to 1.

Enable the revolving table function (PA73.3)

Set PA73.3 to 1 enable the revolving table function. After this operation, the range of the position data transmitted up to the host controller is from 1 to the pulse number used to make revolving table rotate one circle.

Set PA73.3 to 0 to disable this function if ir is not used on your application.

7.10 Friction compensation function

Generally, load friction increases the follow error at the start-stop time or reverse time. Friction compensation function is used to decrease the follow error in this situations.

Explanations

Set load inertia first(PA56) before friction compensation operation. Perform “tU1” operation to set load inertia. Vibration may happen in the process of adjusting friction compensation parameters if the load inertial is not correct or appropriate.

To purchace better performance, it is recommended to set resonance frequency first and set trap filter (PA80) to depress it, then set system

rigidity (PA55) to an appropiate value.

Step of setting parameters

1. Set the parameters controlling friction compenastion function to the default values
   Gain of friction compensation(PA60): 100%
   Ratio of friction compensation(PA61): 0%
   Gain correction of friction compensation(PA62): 0%
   Switch of friction compensation function(PA79.2): 1
2. Adjust PA61
   Increase the value of PA61 to achieve better performance by monitoring the follow error of tool path on CNC screen or checking the machining effect at the point of quadrant junction.
3. Adjust PA60
   If the result in step 2 can not satisfy your requirement, try increasing the value of PA60 step by step at the interval of 10%. To avoid vibrating in these operations.
4. Generally it is not necessary to adjust PA62.

Friction compensation effect

1. The effect of parameter adjustment
   PA60: It determins the response speed to external load disturbance. Bigger valeu leads to quicker response. If there exists resonance frequency in the load system, setting PA60 to a big value may result in vibration.
   PA61: It determins the final effect fo friction compensation. Bigger value leads to better effect, but too big value may result in vibration. Generally set it to a value smaller than 95%.
2. The effect of friction compensation
   Generally, when machining an arc with 2 axes involed at least, a bulge will be generated at the quadrant junction because of friction discontinuity. Parameters adjustment of friction compenstion funciton is available to decrease the bulge obviously.

Notes on parameter adjustment

Try increasing the value of PA61 step by step at the interval less than 10%

to prevent resulting in vibration of machine tool.

If vibration happens in the process of adjusting PA60, try decreasing its value step by step to depress vibration.

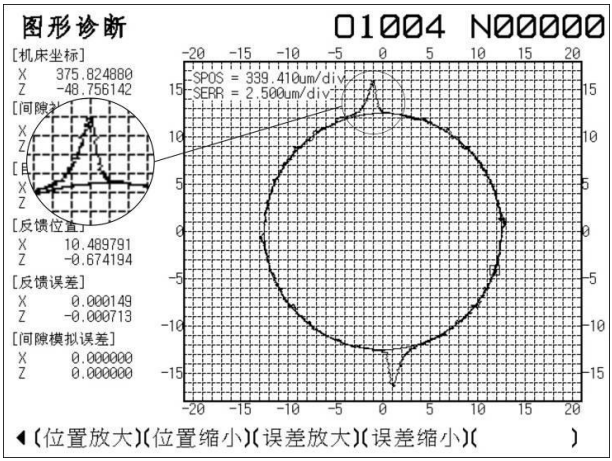
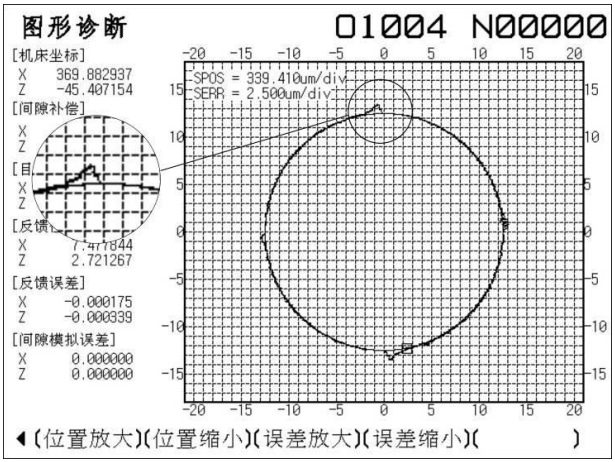


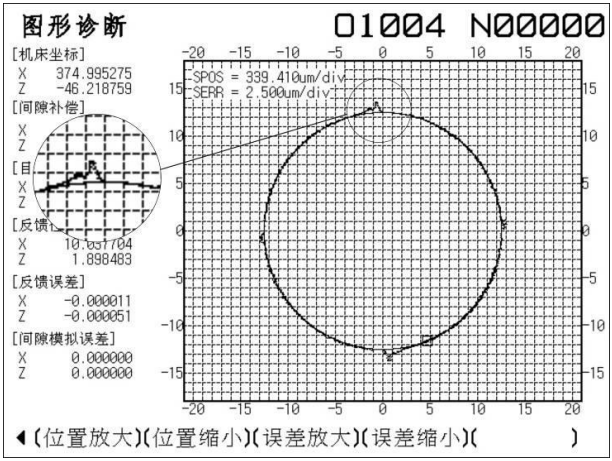
Fig.（a） PA60=100，PA61=0

No friction compensation, bulge height is about 10um



图（b） PA60=100，PA61=80

Bulge height is about 2.5um, compensation effect is obviouse



图（c） PA60= 50，PA61=80

Bulge height is 2.5um, follow error of the tool path overshoots

7.11 FAQ

7.11.1 Er009/Er030/Er032/Er034 is generated frequently

These alarms indicate that encoders are damaged or the feedback cables are not connected firmly or correctly. Solve the problem following the procedures below.

1. Check the connection between cables and sockets.
2. Check the connection of shield wires.
3. Check that the FG terminals of servo driver and motor are grounded well.
4. Too long feedback cables may result in relatively higher pressure loss. In this case, use multiple wires to connect the 5V and 0V signals between drivers and motors.
5. Install feedback cables away from heavy-current cables.
6. Change a same model motor.

If the measures above do not work, please contact the technical support centers of KND.

Note:

When setting PA36 to 1, servo drivers will not detect the alarms about incremental encoders. When driving motors with saving-line encoders, set PA36 to 1.

7.11.2 POWER indicator can't be lit up

When the power of main circuits and control circuits are turned on and work well, nixie tubes display no alarms and errors, but the POWER indicator can't be lit up and servo drivers do not work. The problem may possibly be caused by the malfunction of braking circuits, which put servo drivers into protection status. Please connect the technical support centers of KND.

7.11.3 Don't response command from host controllers

When the RUN indicator is lit up after the servo enable signal from host controllers is received, servo drivers do not response command pulses and motors stay still. The command position monitored in dP menu do not change. The problem may possibly be caused by the following reasons:

1. PA04 is not set to POS correctly.
2. The input signal INH is effective.
3. The input signal CLE is effective.

7.11.4 Motors stay still when performing –tU1 operation

When drivers run in position control mode and are enabled, after performing –tU1 operation, "------" will be displayed, after which motors should rotates. If motors stay still, the possibly reason is that CLE is effective.

7.11.5 How to exit from error or alarm status

An error code will be displayed when some malfunction happens. Press Exit to exit from flickering menu, but the decimal point on the right bottom corner of the nixie tubes continues to be flickering which indicates that the driver is error status. The error code can be read in the Er item in monitoring menu. After solving the problem, input ACLR signal or restart the driver to exit from the error status.

An alarm code will be displayed when some malfunction happens. Press Exit to exit from flickering menu, but the left second decimal point of the nixie tubes continues to be flickering which indicates that the driver is in some trouble. The alarm code can be read in the AL item in monitoring menu. After solving the problem, Pressing Exit to exit from the alarm status and the decimal point stops flickering.

7.11.6 Drive low-power motors with high-power drivers

Generally, Use different models of servo driver to drive different motors according to the rated power. SD300-30 is used to drive motors whose rated power is lower than 2kW. SD300-50 is used to drive motors whose rated power is higher than 1.5kW and lower than 5.5kW. In some special applications, it is available to driver motors out of the ordinary power range with SD300. Please connect the technology support centers of KND. Note that never attempt to drive motors whose rated power are higher than 2kW with SD300-30, or the servo driver may be damaged.

7.11.7 What occasion will -tU3 operation be performed

When motors with absolute encoders are used for the first time, -tU3 operation should be performed. The result will be remembered in the memory of encoders, so usually –tU3 operation is performed only once for a certain motor.

7.11.8 Er032 happens when using saving-line encoders

Set PA36 to 1 to disable the alarm detecting function of incremental encoders.

7.11.9 How to perform tU3 for incremental encoders

tU3 operation should be performed when an incremental encoder is changed or its installation position shifts. PA73.2 is used the select the search style of Z-signal. In tU3 operation process, servo driver locks motor, and searches the Z-signal manually or automatically.

If PA73.2 is set to 1, servo driver searches the Z-signal automatically and

set the detected value in PA26.

If PA73.2 is set to 0(default value), servo driver works in the same way of SD200. Operation procedures are as follows.

1. Make sure the cable between servo driver and motor is correct and connect no load on the motor.
2. Turn on the power to the servo driver and ensure the motor's model is correct(PA01).
3. Set PA73.2 to 0. (Search Z-signal manually)
4. Set PA00 to 385, and perform tU3 operation.
5. Rotate the outer sleeve in the endocone of encoder. The angle value can be read in the APO item in dP menu and varies in the range from 0 to 32767. Find the position when the angle value is in the ranges from 32667 to 32767 or from 0 to 100(The best value is 0.). Fix the encoder on motor.
6. Adjust the position of encoder and fix it.
7. Perform the tU9 operation.
8. PA04=D-SPD, PA33=ON, PA21=10-1000-rated speed. If on alarm is generated and motor rotates smoothly, the tU3 operation is successfully finished.

7.11.10 An error is generated after tU3

tU3 operation should be performed when no alarm is generated. If tU3 operation is performed when the rightest decimal points is flickering, "Error" will be displayed. In this case, check the error (Dp-Err) and solve it and perform the tU3 operation again.

Warnings don't affect the tU3 operation.

7.12 Relative knowledge

7.12.1 Lag pulses in position control mode

In position control mode, the difference between feedback pulses number and command pulses number after electronic gear ratio is called lag pulses. The lag pulses number can be read in the motoring menu EPo in dP interface.

Lag pulses, the frequency of command pulses, the gain of position loop and the feed forward quotient of position loop meet the following equation:

$$Log\ pulses = \frac{The\ frequency\ of\ command\ pulses}{PA09} \times (100 - PA10)\%$$

7.12.2 Relationship between lag pulses and motors' speed

In position control mode, the lag pulses and the rotation speed of motors meet the following equation:

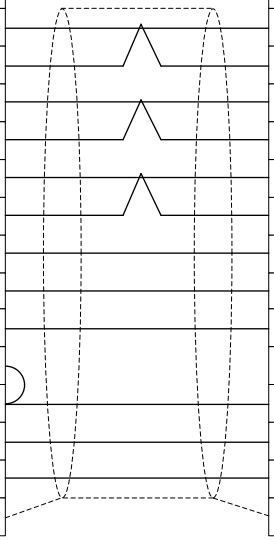
$$Rotation\ speed = \frac{Lag\ pulses}{Command\ pulses\ corresponding\ one\ circle} \times \frac{PA09 \times 60}{(100 - PA10)\%}$$

8 Connect with KND CNC systems

8.1 Command cables for K100 & K1000 CNC

DB15M:XS52/XS50/XS53/XS51 DB44-3: CN1 X/Y/Z/4

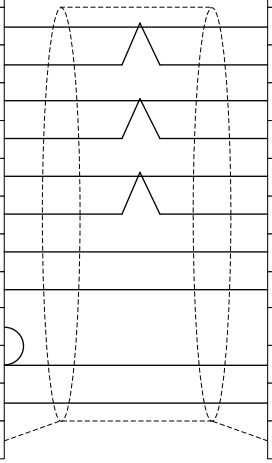
Signal name	Pin		Pin	Signal name
XCP+	1		14	PULS+
XCP-	9		13	PULS-
XDIR+	2		44	SIGN+
XDIR-	10		43	SIGN-
XPC+	3		5	OZ+
XPC-	11		21	OZ-
0V	14		8	ALM-
ALM	5		7	ALM+
XMRDY1	7		41	SON
XMRDY2	8			
0V	15		38	SRDY-
DRDY	4		37	SRDY+
VP=+24V	13		29	COM+
FG	Shell		15	FG



8.2 Command cables for K10M CNC

DB15M: XS30/XS31/XS32

Signal name	Pin
XCP+	1
XCP-	9
XDIR+	2
XDIR-	10
XPC+	3
0V	15
ALM	5
XMRDY1	7
XMRDY2	8
0V	14
VP=+24V	13
FG	Shell



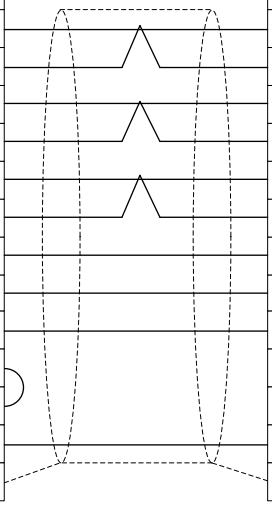
CN1 X/Y/Z : DB44-3

Pin	Signal name
14	PULS+
13	PULS-
44	SIGN+
43	SIGN-
5	OZ+
35	GND
7	ALM+
41	SON
8	ALM-
29	COM+
15	FG

8.3 Command cables for K1 CNC

DB15M: XS51/XS52

Signal name	Pin
XCP+	1
XCP-	9
XDIR+	2
XDIR-	10
XPC+	3
XPC-	11
0V	14
ALM	5
XMRDY1	7
XMRDY2	8
0V	15
VP=+24V	13
FG	Shell



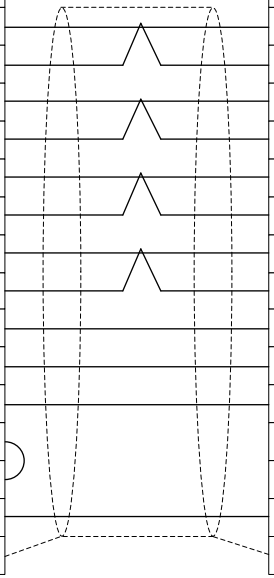
CN1 X/Z:DB44-3

Pin	Signal name
14	PULS+
13	PULS-
44	SIGN+
43	SIGN-
5	OZ+
21	OZ-
8	ALM-
7	ALM+
41	SON
29	COM+
15	FG

8.4 Command cables for K2000 CNC

DB15M:XS52/XS50/XS53/XS51

Signal name	Pin
XCP+	1
XCP-	9
XDIR+	2
XDIR-	10
XPC+	3
XPC-	11
BISS2SYS-	6
BISS2SYS+	4
0V	14
ALM	5
XMRDY1	7
XMRDY2	8
0V	15
VP=+24V	13
FG	Shell



DB44-3: CN1 X/Y/Z/4

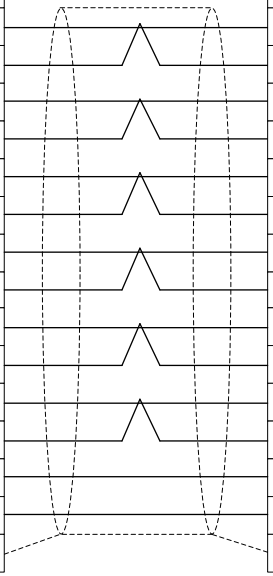
Pin	Signal name
14	PULS+
13	PULS-
44	SIGN+
43	SIGN-
5	OZ+
21	OZ-
2	PS-
18	PS+
8	ALM-
7	ALM+
41	SON
29	COM+
15	FG

8.5 Feedback cables of incremental encoders

8.5.1 Non-saving-line encoders

Driver side CN2: DB26-3 male

Signal name	Pin
A+	1
A-	2
B+	3
B-	4
Z+	5
Z-	6
U+	19
U-	20
V+	21
V-	22
W+	23
W-	24
+5V	17
0V	12
FG	Shell



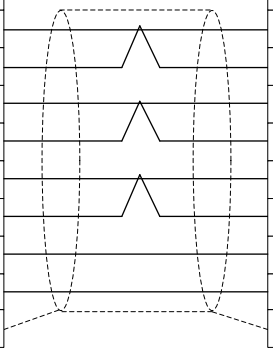
Motor side: AYD28K15TS

Pin	Signal name
4	A+
7	A-
5	B+
8	B-
6	Z+
9	Z-
10	U+
13	U-
11	V+
14	V-
12	W+
15	W-
2	+5V
3	0V
1	FG

8.5.2 Saving-line encoders

Driver side CN2: DB26-3 male

Signal name	Pin
A+/V-	1/22
A-/V+	2/21
B+/U-	3/20
B-/U+	4/19
Z+/W-	5/24
Z-W+	6/23
+5V	17
0V	12
FG	Shell



Motor side: F1 socket 9 pins

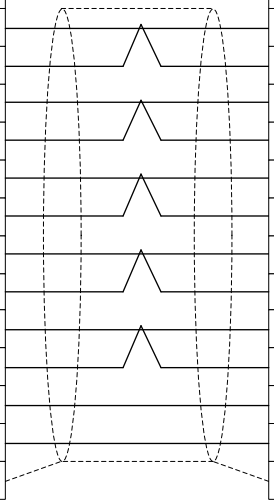
Pin	Signal name
5	B+
8	B-
4	A+
7	A-
6	Z+
9	Z-
2	+5V
3	0V
1	FG

8.6 Feedback cables of 17-bit absolute encoders

8.6.1 17-bit single circle/12-bit multi-circle encoders (M1 motors)

Driver side CN2: DB26-3 male

Signal name	Pin
A+	1
A-	2
B+	3
B-	4
MAY	23
MAZ	24
SLA	25
SLB	26
Sensor+	18
Sensor-	13
+5V	17
0V	12
FG	Shell



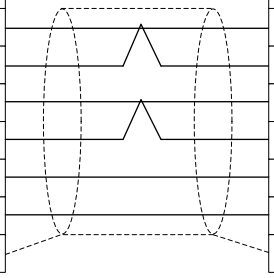
Motor side: AYD28K15TS

Pin	Signal name
4	A+
7	A-
5	B+
8	B-
12	MAY
15	MAZ
11	SLA
14	SLB
10	5V S
13	0V S
2	Ub
3	Un
1	FG

8.6.2 17-bit single circle encoders(Hua Da)

Driver side CN2: DB26-3 male

Signal name	Pin
SD+	23
SD-	24
BAT+	7
BAT-	16
+5V	17
0V	12
FG	Shell



Motor side: E Socket (7 pins)

Pin	Signal name
6	SD+
4	SD-
3	E+
2	E-
7	+5V
5	0V
1	FG

Note:

1. It is recommended to use paired shield cables (RVVP 12 ×0.2 mm^2) as command

cables and feedback cables.

2. When using KND series CNC systems to control SD300, ensure that the VP voltage is +24V and the PC (one circle signal) active level is +5V.
3. When driving motors with saving-line encoders, please set PA36 to 1 to mask the Er032 alarm.

9 Appendix

9.1 Motors Specification

9.1.1 Rated current

Model	Rate current (A)
SD300-30	I≤6
SD300-50	6<I≤10
SD300-75	10<I≤15
SD300-100	15<I≤25

9.1.2 Motors specification

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
1	C01030	KND 80STM01030	0.3	1	3000	2.6	30
2	C01330	KND 80STM01330	0.4	1.3	3000	3.6	30
3	C02430	KND 80STM02430	0.75	2.4	3000	4.5	30
4	C03330	KND 80STM03330	1	3.3	3000	5.0	30
5	D01530	KND 90STM01530	0.45	1.5	3000	2.8	30
6	D02430	KND 90STM02430	0.75	2.4	3000	3.0	30
7	D03530	KND 90STM03530	1.1	3.5	3000	4.0	30
8	E02020	KND110STM02020	0.4	2	2000	2.3	30
9	E02030	KND110STM02030	0.6	2	3000	2.7	30
10	E04020	KND110STM04020	0.8	4	2000	3.6	30
11	E04030	KND110STM04030	1.2	4	3000	4.3	30
12	E05030	KND110STM05030	1.5	5	3000	5.0	30
13	E06020	KND110STM06020	1.2	6	2000	4.3	30
14	E06030	KND110STM06030	1.8	6	3000	5.8	30
15	F04015	KND130STM04015	0.6	4	1500	2.6	30
16	F04025	KND130STM04025	1	4	2500	3.4	30

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
17	F05015	KND130STM05015	0.75	5	1500	3.4	30
18	F05025	KND130STM05025	1.3	5	2500	5.9	30
19	F06015	KND130STM06015	1	6	1500	4.2	30
20	F06025	KND130STM06025	1.5	6	2500	5.8	30
21	F07715	KND130STM07715	1.2	7.7	1500	4.6	30
22	F07725	KND130STM07725	2	7.7	2500	7.5	50
23	F10015	KND130STM10015	1.6	10	1500	4.9	30
24	F10025	KND130STM10025	2.6	10	2500	7.5	50
25	F15015	KND130STM15015	2.4	15	1500	8.7	50
26	F15025	KND130STM15025	3.9	15	2500	12.6	75
27	H18015	KND150STM18015	2.8	18	1500	8.8	50
28	H23015	KND150STM23015	3.6	23	1500	11.8	75
29	H27015	KND150STM27015	4.2	27	1500	15	75
30	H32015	KND150STM32015	5.0	32	1500	18.5	100
31	C0103D	KND 80STM01030M	0.3	1	3000	2.6	30
32	C0133D	KND 80STM01330M	0.4	1.3	3000	3.6	30
33	C0243D	KND 80STM02430M	0.75	2.4	3000	4.5	30
34	C0333D	KND 80STM03330M	1	3.3	3000	5.0	30
35	D0153D	KND 90STM01530M	0.45	1.5	3000	2.8	30
36	D0243D	KND 90STM02430M	0.75	2.4	3000	3.0	30
37	D0353D	KND 90STM03530M	1.1	3.5	3000	4.0	30
38	E0202D	KND110STM02020M	0.4	2	2000	2.3	30
39	E0203D	KND110STM02030M	0.6	2	3000	2.7	30
40	E0402D	KND110STM04020M	0.8	4	2000	3.6	30
41	E0403D	KND110STM04030M	1.2	4	3000	4.3	30
42	E0503D	KND110STM05030M	1.5	5	3000	5.0	30
43	E0602D	KND110STM06020M	1.2	6	2000	4.3	30
44	E0603D	KND110STM06030M	1.8	6	3000	5.8	30
45	F0401D	KND130STM04015M	0.6	4	1500	2.6	30

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
46	F0402D	KND130STM04025M	1	4	2500	3.4	30
47	F0501D	KND130STM05015M	0.75	5	1500	3.4	30
48	F0502D	KND130STM05025M	1.3	5	2500	5.9	30
49	F0601D	KND130STM06015M	1	6	1500	4.2	30
50	F0602D	KND130STM06025M	1.5	6	2500	5.8	30
51	F0771D	KND130STM07715M	1.2	7.7	1500	4.6	30
52	F0772D	KND130STM07725M	2	7.7	2500	7.5	50
53	F1001D	KND130STM10015M	1.6	10	1500	4.9	30
54	F1002D	KND130STM10025M	2.6	10	2500	7.5	50
55	F1501D	KND130STM15015M	2.4	15	1500	8.7	50
56	F1502D	KND130STM15025M	3.9	15	2500	12.6	75
57	H1801D	KND150STM18015M	2.8	18	1500	8.8	50
58	H2301D	KND150STM23015M	3.6	23	1500	11.8	75
59	H2701D	KND150STM27015M	4.2	27	1500	15	75
60	H3201D	KND150STM32015M	5.0	32	1500	18.5	100
61	C0103B	KND 80STM01030E	0.3	1	3000	2.6	30
62	C0133B	KND 80STM01330E	0.4	1.3	3000	3.6	30
63	C0243B	KND 80STM02430E	0.75	2.4	3000	4.5	30
64	C0333B	KND 80STM03330E	1	3.3	3000	5.0	30
65	D0153B	KND 90STM01530E	0.45	1.5	3000	2.8	30
66	D0243B	KND 90STM02430E	0.75	2.4	3000	3.0	30
67	D0353B	KND 90STM03530E	1.1	3.5	3000	4.0	30
68	E0202B	KND110STM02020E	0.4	2	2000	2.3	30
69	E0203B	KND110STM02030E	0.6	2	3000	2.7	30
70	E0402B	KND110STM04020E	0.8	4	2000	3.6	30
71	E0403B	KND110STM04030E	1.2	4	3000	4.3	30
72	E0503B	KND110STM05030E	1.5	5	3000	5.0	30
73	E0602B	KND110STM06020E	1.2	6	2000	4.3	30
74	E0603B	KND110STM06030E	1.8	6	3000	5.8	30

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
75	F0401B	KND130STM04015E	0.6	4	1500	2.6	30
76	F0402B	KND130STM04025E	1	4	2500	3.4	30
77	F0501B	KND130STM05015E	0.75	5	1500	3.4	30
78	F0502B	KND130STM05025E	1.3	5	2500	5.9	30
79	F0601B	KND130STM06015E	1	6	1500	4.2	30
80	F0602B	KND130STM06025E	1.5	6	2500	5.8	30
81	F0771B	KND130STM07715E	1.2	7.7	1500	4.6	30
82	F0772B	KND130STM07725E	2	7.7	2500	7.5	50
83	F1001B	KND130STM10015E	1.6	10	1500	4.9	30
84	F1002B	KND130STM10025E	2.6	10	2500	7.5	50
85	F1501B	KND130STM15015E	2.4	15	1500	8.7	50
86	F1502B	KND130STM15025E	3.9	15	2500	12.6	75
87	H1801B	KND150STM18015E	2.8	18	1500	8.8	50
88	H2301B	KND150STM23015E	3.6	23	1500	11.8	75
89	H2701B	KND150STM27015E	4.2	27	1500	15	75
90	H3201B	KND150STM32015E	5.0	32	1500	18.5	100
91	C0103T	KND 80STM01030M1	0.3	1	3000	2.6	30
92	C0133T	KND 80STM01330M1	0.4	1.3	3000	3.6	30
93	C0243T	KND 80STM02430M1	0.75	2.4	3000	4.5	30
94	C0333T	KND 80STM03330M1	1	3.3	3000	5.0	30
95	D0153T	KND 90STM01530M1	0.45	1.5	3000	2.8	30
96	D0243T	KND 90STM02430M1	0.75	2.4	3000	3.0	30
97	D0353T	KND 90STM03530 M1	1.1	3.5	3000	4.0	30
98	E0202T	KND110STM02020 M1	0.4	2	2000	2.3	30
99	E0203T	KND110STM02030 M1	0.6	2	3000	2.7	30
100	E0402T	KND110STM04020 M1	0.8	4	2000	3.6	30
101	E0403T	KND110STM04030 M1	1.2	4	3000	4.3	30
102	E0503T	KND110STM05030 M1	1.5	5	3000	5.0	30
103	E0602T	KND110STM06020 M1	1.2	6	2000	4.3	30

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
104	E0603T	KND110STM06030 M1	1.8	6	3000	5.8	30
105	F0401T	KND130STM04015 M1	0.6	4	1500	2.6	30
106	F0402T	KND130STM04025 M1	1	4	2500	3.4	30
107	F0501T	KND130STM05015 M1	0.75	5	1500	3.4	30
108	F0502T	KND130STM05025 M1	1.3	5	2500	5.9	30
109	F0601T	KND130STM06015 M1	1	6	1500	4.2	30
110	F0602T	KND130STM06025 M1	1.5	6	2500	5.8	30
111	F0771T	KND130STM07715 M1	1.2	7.7	1500	4.6	30
112	F0772T	KND130STM07725 M1	2	7.7	2500	7.5	50
113	F1001T	KND130STM10015 M1	1.6	10	1500	4.9	30
114	F1002T	KND130STM10025 M1	2.6	10	2500	7.5	50
115	F1501T	KND130STM15015 M1	2.4	15	1500	8.7	50
116	F1502T	KND130STM15025 M1	3.9	15	2500	12.6	75
117	H1801T	KND150STM18015 M1	2.8	18	1500	8.8	50
118	H2301T	KND150STM23015 M1	3.6	23	1500	11.8	75
119	H2701T	KND150STM27015 M1	4.2	27	1500	15	75
120	H3201T	KND150STM32015 M1	5.0	32	1500	18.5	100
121	L01330	HuaDa80STM01330	0.4	1.3	3000	2.6	30
122	L02430	HuaDa80STM02430	0.75	2.4	3000	4.2	30
123	L03330	HuaDa80STM03330	1	3.3	3000	4.2	30
124	P02030	HuaDa110STM02030	0.6	2	3000	4.0	30
125	P04030	HuaDa110STM04030	1.2	4	3000	5.0	30
126	P05030	HuaDa110STM05030	1.5	5	3000	6.0	30
127	P06020	HuaDa110STM06020	1.2	6	2000	6.0	30
128	P06030	HuaDa110STM06030	1.8	6	3000	8.0	50
129	Q04025	HuaDa130STM04025	1	4	2500	4.0	30
130	Q05025	HuaDa130STM05025	1.3	5	2500	5.0	30
131	Q06025	HuaDa130STM06025	1.5	6	2500	6.0	30
132	Q07720	HuaDa130STM07720	1.6	7.7	2000	6.0	30

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
133	Q07730	HuaDa130STM07730	2.4	7.7	3000	9.0	50
134	Q10015	HuaDa130STM10015	1.5	10	1500	6.0	30
135	Q10025	HuaDa130STM10025	2.6	10	2500	10.0	50
136	Q15015	HuaDa130STM15015	2.3	15	1500	9.5	50
137	Q15025	HuaDa130STM15025	3.9	15	2500	17.0	100
138	U15025	HuaDa150STM15025	3.8	15	2500	16.5	100
139	U18020	HuaDa150STM18020	3.6	18	2000	16.5	100
140	U23020	HuaDa150STM23020	4.7	23	2000	20.5	100
141	U27020	HuaDa150STM27020	5.5	27	2000	20.5	100
142	L0243B	HuaDa80STM02430LE	0.75	2.4	3000	4.2	30
143	L0333B	HuaDa80STM03330LE	1.0	3.3	3000	4.2	30
144	P0242B	HuaDa110STM02420LE	0.5	2.4	2000	2.9	30
145	P0482B	HuaDa110STM04820LE	1.0	4.8	2000	6.0	30
146	P0541B	HuaDa110STM05415LE	0.85	5.4	1500	4.5	30
147	P0641B	HuaDa110STM06415LE	1.0	6.4	1500	8.0	50
148	Q0482B	HuaDa130STM04820LE	1.0	4.8	2000	6.2	30
149	Q0541B	HuaDa130STM05415LE	0.85	5.4	1500	7.0	50
150	Q0722B	HuaDa130STM07220LE	1.5	7.2	2000	9.5	50
151	Q0962B	HuaDa130STM09620LE	2.0	9.6	2000	13.5	75
152	Q1432B	HuaDa130STM14320LE	3.0	14.3	2000	17.0	100
153	L0243D	HuaDa80STM02430LM	0.75	2.4	3000	4.2	30
154	L0333D	HuaDa80STM03330LM	1.0	3.3	3000	4.2	30
155	P0242D	HuaDa110STM02420LM	0.5	2.4	2000	2.9	30
156	P0482D	HuaDa110STM04820LM	1.0	4.8	2000	6.0	30
157	P0541D	HuaDa110STM05415LM	0.85	5.4	1500	4.5	30
158	P0641D	HuaDa110STM06415LM	1.0	6.4	1500	8.0	50
159	Q0482D	HuaDa130STM04820LM	1.0	4.8	2000	6.2	30
160	Q0541D	HuaDa130STM05415LM	0.85	5.4	1500	7.0	50
161	Q0722D	HuaDa130STM07220LM	1.5	7.2	2000	9.5	50

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
162	Q0962D	HuaDa130STM09620LM	2.0	9.6	2000	13.5	75
163	Q1432D	HuaDa130STM14320LM	3.0	14.3	2000	17.0	100
164	R03530	Mige 80STM03530	1.0	3.5	3000	4.5	30
165	T04025	Mige 90STM04025	1.0	4.0	2500	4.0	30
166	F07730	KND130STM07730	2.4	7.7	3000	8.8	50
167	F0773D	KND130STM07730M	2.4	7.7	3000	8.8	50
168	F0773B	KND130STM07730E	2.4	7.7	3000	8.8	50
169	F0773T	KND130STM07730M1	2.4	7.7	3000	8.8	50
170	I18015	KND180STM18015	3.0	18	1500	16.5	75
171	I1801D	KND180STM18015M	3.0	18	1500	16.5	75
172	I1801B	KND180STM18015E	3.0	18	1500	16.5	75
173	I1801T	KND180STM18015M1	3.0	18	1500	16.5	75
174	I25015	KND180STM25015	4.0	25	1500	24.5	100
175	I2501D	KND180STM25015M	4.0	25	1500	24.5	100
176	I2501B	KND180STM25015E	4.0	25	1500	24.5	100
177	I2501T	KND180STM25015M1	4.0	25	1500	24.5	100
178	I32015	KND180STM32015	5.1	32	1500	31.0	100
179	I3201D	KND180STM32015M	5.1	32	1500	31.0	100
180	I3201B	KND180STM32015E	5.1	32	1500	31.0	100
181	I3201T	KND180STM32015M1	5.1	32	1500	31.0	100
182	I40010	KND180STM40010	4.2	40	1000	24.0	100
183	I4001D	KND180STM40010M	4.2	40	1000	24.0	100
184	I4001B	KND180STM40010E	4.2	40	1000	24.0	100
185	I4001T	KND180STM40010M1	4.2	40	1000	24.0	100
186	I50010	KND180STM50010	5.3	50	1000	32.0	100
187	I5001D	KND180STM50010M	5.3	50	1000	32.0	100
188	I5001B	KND180STM50010E	5.3	50	1000	32.0	100
189	I5001T	KND180STM50010M1	5.3	50	1000	32.0	100
190	I63010	KND180STM63010	6.6	63	1000	37.0	100

No.	Name	Motor model	Rated Power (KW)	Still torque (Nm)	Rated speed (rpm)	Rated current (A)	Driver
191	I6301D	KND180STM63010M	6.6	63	1000	37.0	100
192	I6301B	KND180STM63010E	6.6	63	1000	37.0	100
193	I6301T	KND180STM63010M1	6.6	63	1000	37.0	100
194	I75010	KND180STM75010	7.8	75	1000	45.0	100
195	I7501D	KND180STM75010M	7.8	75	1000	45.0	100
196	I7501B	KND180STM75010E	7.8	75	1000	45.0	100
197	I7501T	KND180STM75010M1	7.8	75	1000	45.0	100
198	H18025	KND150STM18025	4.0	18	2500	20.0	100
199	H1802D	KND150STM18025M	4.0	18	2500	20.0	100
200	H1802B	KND150STM18025E	4.0	18	2500	20.0	100
201	H1802T	KND150STM18025M1	4.0	18	2500	20.0	100
202	H23025	KND150STM23025	6.0	23	2500	20.0	100
203	H2302D	KND150STM23025M	6.0	23	2500	20.0	100
204	H2302B	KND150STM23025E	6.0	23	2500	20.0	100
205	H2302T	KND150STM23025M1	6.0	23	2500	20.0	100

9.1.3 Motor's model explanation

<table>
<tr><th>C</th><th>0103</th><th>0</th></tr>
<tr>
<td>Motor's frame code:
KND Motors
<table>
<tr><td>C</td><td>80</td></tr>
<tr><td>D</td><td>90</td></tr>
<tr><td>E</td><td>110</td></tr>
<tr><td>F</td><td>130</td></tr>
<tr><td>H</td><td>150</td></tr>
<tr><td>I</td><td>180</td></tr>
</table>
</td>
<td>The first three bits represent the rated torque. The last bit represents the kilobit of rated speed.
For example, 0103 represents that the rated torque is 1.0 Nm and the kilobit of rated speed is 3; 0482 represents that the rated torque is 4.8 Nm and</td>
<td>Number:
When using 2500 pulses incremental encoders, the number represents the hundred-bit of rated speed.
Character:
B: Use 17-bit single circle and 0-bit multi-circle absolute encoders (Without battery).
D: Use 17-bit single circle and 16-bit multi-circle absolute encoders (With</td>
</tr>
</table>

HuaDa motors L 80 P 110 Q 130 U 150	the kilobit of rated speed is 2.	battery) T: Use 17-bit single circle and 12-bit multi-circle mechanical absolute encoders (Without battery)

9.1.4 Meaning of PA00

Bit2	Bit1	Bit0
3(fixed)	0: Reserved 1: Reserved 2: KND motors 3: HUADA motors 4: MIGE motors 8: All	0: Incremental encoders(0) 1: Multiple-cycle absolute encoders with battery(D) 2: Single-cycle absolute encoders(B) 3: Mechanical multipley-cycle absolute encoders(T) 5: All

9.2 Parameter Table

No.	Function	Default	Min.	Max.	Unit
00	Password	315	0	65535	—
01	Motor's model	—	—	—	—
02	Software version(read only)	—	—	—	—
03	Default status displayed when turning on the power	—	—	—	—
04	Control Mode Selection	—	—	—	—
05	Gain of velocity loop	40	1	200	Hz
06	Integration time of velocity loop	25	1	1000	ms
07	Band width of the torque filter	160	1	4000	Hz
08	bit0: switch of the closed-loop monitor function	0001	—	—	—

No.	Function	Default	Min.	Max.	Unit
	0: disabled 1: enabled bit1: — bit2: — bit3: —				
09	Gain of position loop	40	1	200	1/s
10	Position loop feed forward quotient	0	0	100	%
11	Band width of the position loop feed forward filter	1000	50	2000	Hz
12	Numerator of the electronic gear ratio	1	1	32767	—
13	Denominator of the electronic gear ratio	1	1	32767	—
14	Input mode of the command pulses	0	0	2	—
15	Select the rotary direction of motors	0	0	1	—
16	Specify the range used to check whether the positioning operation is finished.	1	0	20000	0.001r
17	Limitation of the position offset.	2000	0	20000	0.001r
18	Delay time after single axis positioning operation	1.0	0.0	1000.0	s
19	Filter time of position commands	0	0	1000	ms
20	Upper percentage limitation of maximum speed to rated speed.	120	50	300	%
21	The speed specified by key panel manually when the driver is working in pilot running control mode.	0	0	Max. speed	rpm
22	Reserved				

No.	Function	Default	Min.	Max.	Unit
23	Select the data source used to specify motor speed in velocity control mode(SPD).	0	0	1	—
24	Gain of the VCMD signal	100	−5000	5000	rpm/V
25	Acceleration speed used in single axis positioning mode	10	1	500	r/s^2
26	Zero value of encoders	—	0	65535	—
27	Zero offset compensation of the analog voltage specifying rotation speed in SPD mode.	0	−5000	5000	rpm
28	Threshold value of the zero speed clamping function in SPD mode.	10	0	500	rpm
29	1^{st} internal speed value SC2SC1 = 00	0	−5000	5000	rpm
30	2^{nd} internal speed value SC2SC1 = 01	0			rpm
31	3^{rd} internal speed value SC2SC1 = 10	0			rpm
32	4^{th} internal speed value SC2SC1 = 11	0			rpm
33	Force the SVON signal to be enabled	0	0	1	—
34	Torque limitation value (CW)	300	0	300	%
35	Torque limitation value (CCW)	300	0	300	%
36	Select the function of monitoring incremental encoders	0	0	1	—
37	Speed when the VCMD signal is valid	0	0	5000	rpm
38	Speed fluctuation range when the VCMD signal is valid	10	0	5000	rpm
39	Gain of the TCMD signal	1000	−5000	5000	0.001

No.	Function	Default	Min.	Max.	Unit
					Nm/V
40	Acceleration time in velocity control mode and pilot running control mode	0	0	1000	ms
41	Deceleration time in velocity control mode and pilot running control mode	0	0	1000	ms
42	Zero offset compensation of the analog voltage specifying torque in TOR mode.	0	－5000	5000	0.001 Nm
43	Upper speed limitation in TOR mode.	500	0	5000	rpm
44	Software overtravel limitation in the positive direction	30000	－30000	30000	PA82.2
45	Software overtravel limitation in the negative direction	－30000			
46	Reserved				
47	Reserved				
48	Velocity monitoring coefficient	150	100	600	%
49	1st position used in single axis positioning mode	0	－30000	30000	PA77.2
50	2nd position used in single axis positioning mode				
51	3rd position used in single axis positioning mode				
52	4th position used in single axis positioning mode				
53	Time of the low band filter of the analog signals	1	0	1000	ms
54	Simulating of input signals	00000	—	—	—
55	Rigidity of servo system	4	0	12	—

No.	Function	Default	Min.	Max.	Unit
56	Inertia ratio	100	50	800	%
57	Change the polarity of the output signals reversely.	0000	—	—	—
58	Delay time from the beginning of external brake working to cutting of the controlling of motors.	0	0	500	10ms
59	Change the polarity of the input signals reversely.	00000	—	—	—
60	Gain of friction compensation	100	10	600	%
61	Ratio of friction compeasation	0	0	100	%
62	Gain correction of friction compensation	0	0	100	%
63	Reserved				
64	Reserved				
65	Numerator of the speed ratio of motor to machine	1	1	32767	—
66	Denominator of the speed ratio of motor to machine	1	1	32767	—
67	Reserved				
68	Reserved				
69	Reserved				
70	Reserved				
71	Reserved				
72	Reserved				
73	Bit Parameter	0000	—	—	—
74	Reserved				
75	Reserved				
76	Average filtering time for position commands	0	0	64	ms
77	Bit Parameter	0000	—	—	—
78	The distance in which motor	5.00	0.00	100.00	r

No.	Function	Default	Min.	Max.	Unit
	decelerates and stops when over travel happens.				
79	Bit Parameter	0100	—	—	—
80	Frequency of 1st notch filter	4000	100	4000	Hz
81	Reserved				
82	Bit Parameter	0000	—	—	—
83	Frequency of 2nd notch filter	4000	100	4000	Hz
84	Reserved				
85	Reserved				
86	Reserved				
87	Reserved				
88	Reserved				
89	Reserved				
90	Maximum speed of tU1 Ensure that the mechanical equipment has the ability to run at this speed.	1500	500	2000	rpm
91	Maximum circle of tU1 Make sure that the mechanical equipment will not crash in the specified range.	4	1	9	r
92	Gain of acceleration speed feedback	0	0	1000	%
93	Gain of torque feedforward	0	0	600	%
94	Band width of torque feedforward	1000	50	2000	Hz
95	Reserved				
96	Reserved				
97	Reserved				
98	Reserved				
99	Reserved				