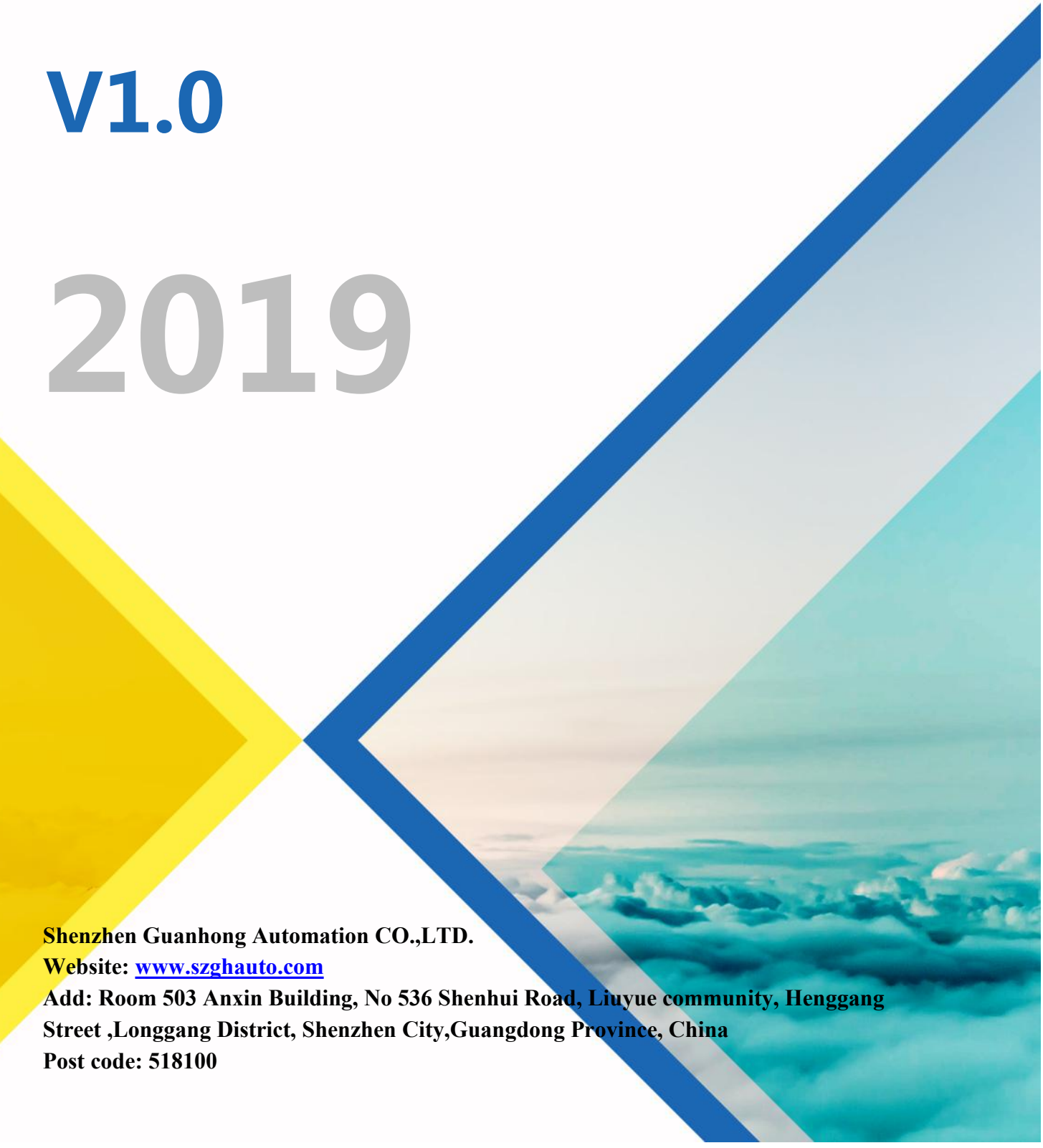
SD Series EtherCAT Type Servo Driver

User Manual

V1.0

2019



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Warning and Alert

Warning

- **Do not proceed to the assembly of the line while electrifying.**
- **Input power of servo driver have two series: 220V & 380V , please pay more attention during using**
- **All needs to add isolation transformer; add electrical reactor when using 380V servo driver.**
- **Circuit & change components between entering shutting down the power supply and stopping showing LED light of the Servo Driver.**
- **The output of servo drive[U,V,W]must NOT touch the AC power, and UVW is connected to UVW of servo motor one by one.**
- **Before remove servo driver, must power off over 5 minutes.**

Alert

- **Install the fan if the temperature around is too high while the Servo Driver is installed in the Control Board**
- **Do not proceed to the Anti-Pressure-Test to the Servo Driver.**
- **Confirm the quick stop function is available before operate Servo Driver.**
- **Matching up machine to change the user parameter setting before machine performs.If there is no according correct setting number,it could lead to out of control or breakdown.**

Safety Proceeding:

Check the covering letter details before installing,running,maintaining and examining. Furthermost, only the profession-qualified people can proceed to the line-assembly.

Safety proceeding in the covering letter discriminate between “Warning” & “Alert”.

Warning : Indicating the possibility dangerous situation. It could cause the death or serious damage if being ignored.

Alert : Indicating the possibility dangerous situation. It could cause smaller or lighter human injured and damage of equipment.

Please read the user manual detail before using Servo Driver.

First of all,thank you for using SZGH SD series EtherCAT type Servo Driver and EtherCAT type Servo Motors. SZGH Servo Driver can be controlled by CNC Controller or motion control card, and provide excellent performance for a wide range of applications and different requirement from customers.

Read this user manual before using SZGH SD Series EtherCAT Type Servo Driver.Contents of the manual comprises:

◆ Servo System checking,installing and procedure of assembly line.

◆ Controller procedure for digital board,Status displaying,unusual alarm and strategy explanation.

◆ Servo System control function,running testing and procedures adjusted.

◆Explanation for all parameter of Servo Driver.

In order to daily examine,maintain and understand the reason of unusual situation and handle strategy,please put this user manual in safe place to read it anytime.

P.S: The end user should own this user manual,in order to make the Servo Driver bring the best performance.

-Catalog-

Chapter 1 Checking and Installing

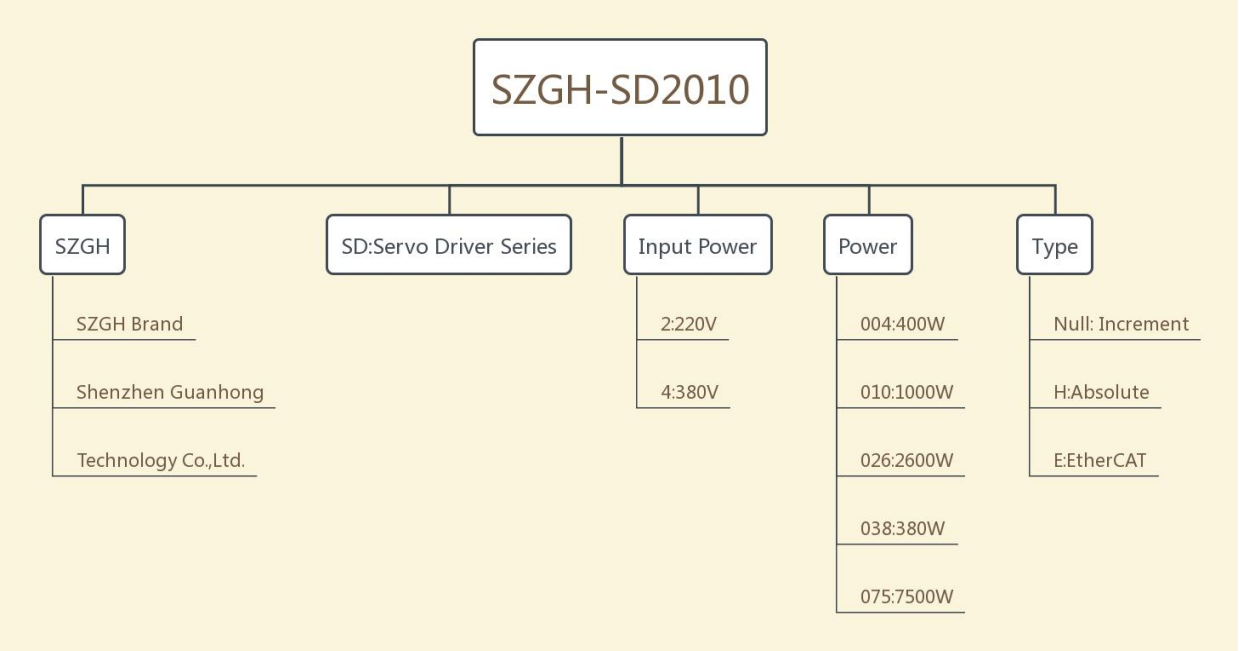
1.1 Checking Products

Our Servo Pack have already completely been functionally examined before leaving the factory. In order to protect the products from the damage during transportation, please check the items below before sealing off the pack:

- Check if the model of servo driver and motor are the same with the models of ordering. (About the model explanation, please check the chapters below)
- Check if there are damage or scrape out side of the servo driver and motor. (If there is any damage during transportation, do not power ON)
- Check if there are any bad assembly or slipped component in the Servo Driver and Motor.
- Check if the Motor's rotor and shaft can be rotated smoothly by hand (The Servo Motor with Mechanical-Brake can not be rotated directly)
- Check if there is user manual and accessories in the servo pack.
- There must be the "QC"-seal in each servo drive, if not,please do not proceed Power ON.

If there is any bug or irregular under the situation above,please contact with us or SZGH Local sales representative or distributor instantly.

1.1.1 Confirming with Servo Drivers



Note: 1.With E means EtherCAT type , without E or H means increment type servo driver.

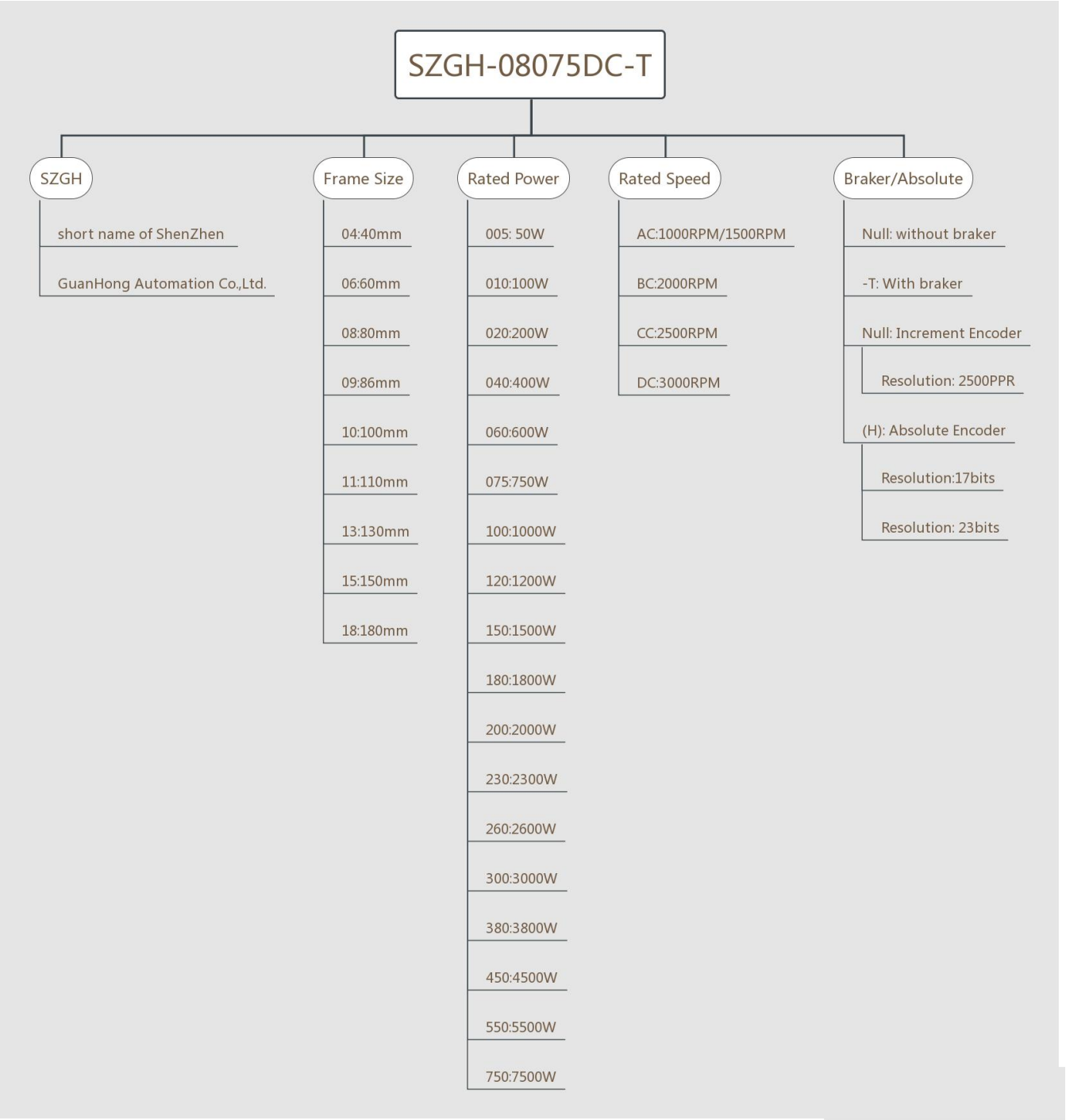
2. SZGH-SD2004E servo driver can drive SZGH-06060DC(H) max.

3.SZGH-SD2026E servo driver can drive SZGH-13380CC(H) max.

4.SZGH-SD4038E servo driver can drive SZGH-18370AC(H) max.

5.SZGH-SD4075E servo driver can drive SZGH-18750CC(H) max.

1.1.2 Confirming with Servo Motor

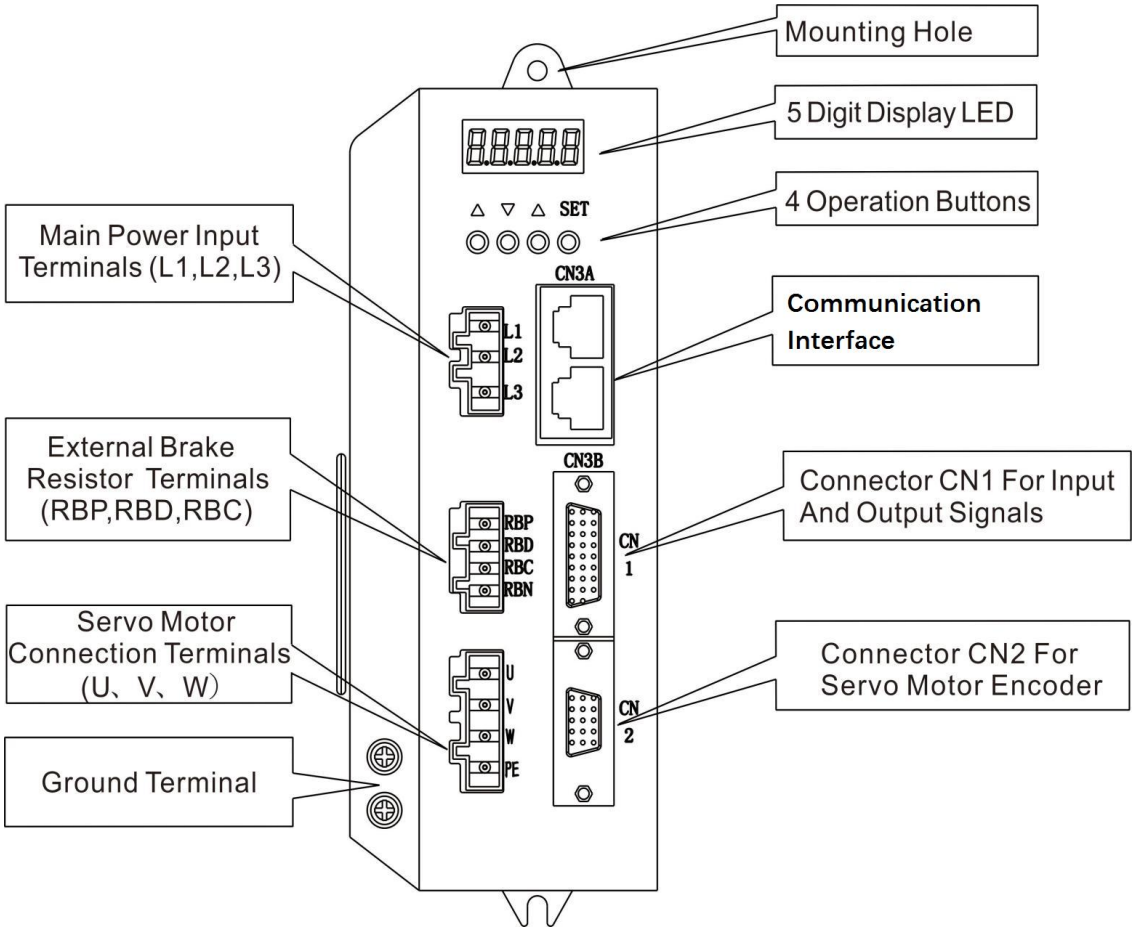


Note: 1. With E means absolute type , without E or H means increment type servo motor.

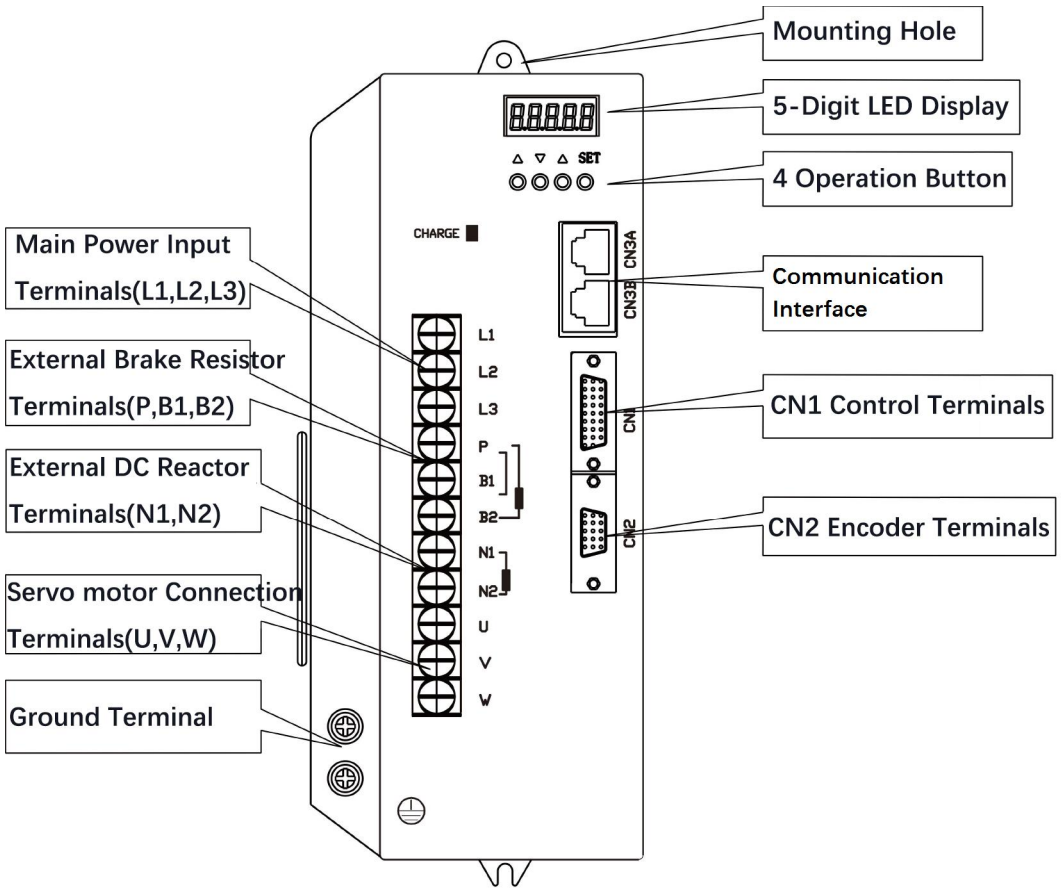
2. These are only some model of servo motors display above as limit,not all model. Any doubts ,please discuss with our sales representative or distributor.

1.2 Front Panel of Servo Driver

1.2.1 Front Panel of SZGH-SD2004E/SD2010E/SD2026E



1.2.2 Front Panel of SZGH-SD4038H/SD4075H

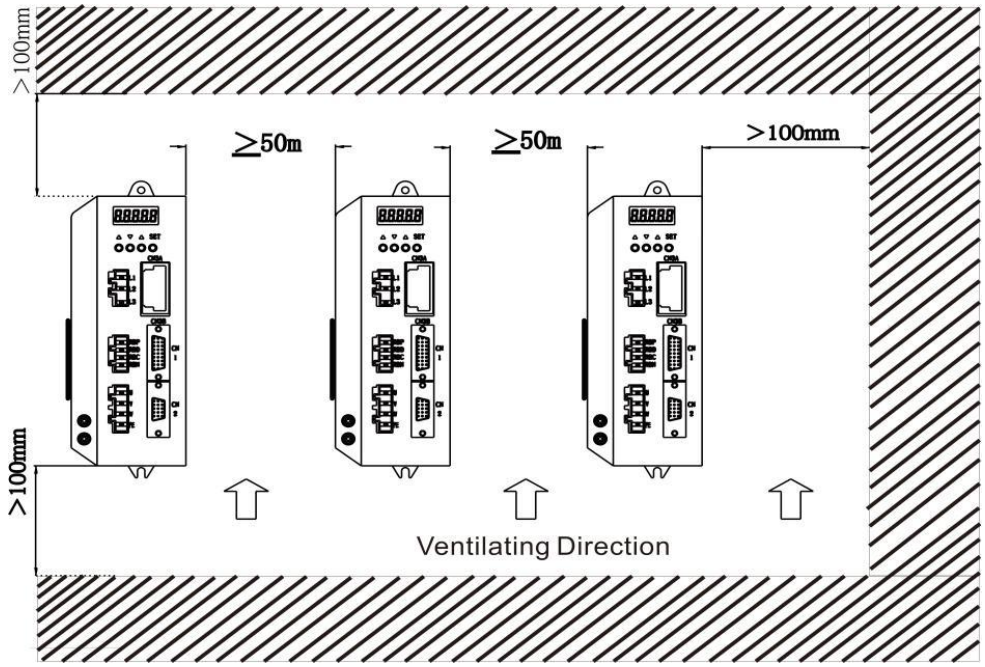


1.3 Motor and Drive Installation

1.3.1 Method of Installation of drive

- In order to get good cooling the servo drive should normally mount in vertical direction with the topside down.
- For installing the servo drive, fasten the backboard of servo driver with M4 screw.
- Reserve enough space around the servo drives as shown in the reference diagram. In order to guarantee the performance of the servo drive and the lifetime, please make the space as full as possible.
- To provide vertical wind to the heat sink of the servo drive should install ventilating fans in the control cubicle.
- Prevent the dust or the iron filings entering the servo drive when install the control cubicle.

Keep enough space between drives in the electric cabinet.



1.3.2 Environmental Conditions for Installation of drive

Since the environment conditions for servo drive installation have the direct influence to the normal function and service life of the servo driver, therefore the environment conditions must be conformed to the following conditions:

- Ambient temperature: 0 to 40 °C, Ambient humidity, less than 80% (no dew).
- Storage temperature: -40 to 50 °C, Storage humidity, less than 93% (no dew).
- Vibration: less than 0.5G.
- Preventive measure shall be taken against raindrop or moist environment.
- Preventive measure shall be taken against corrosion by oil mist and salinity.
- When several drive installments in a control cubicle, for good ventilation please reserve enough space around each driver, install fans to provide effective cooling, keep less than 40 °C for long-term trouble-free service.

- If there are vibration sources nearby (punch press for example) and no way to avoid it, please use absorb or anti-vibration rubber filling piece.
- If there is disturbance from interfering equipment nearby along the wiring to the servo, anti-jamming measure must be used to guarantee normal work of the servo drive. However, the noise filter can increase current leakage; therefore an insulating transformer in the input terminals of power supply should be installed.

1.3.3 Method of Servo motor Installation

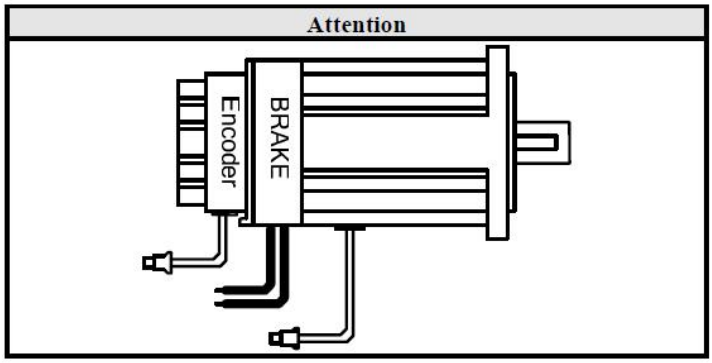
- For horizontal installation:

in order to prevent water, oil, etc. from entering inside of the servo motor, please put the cable connector downward.

- For vertical installation:

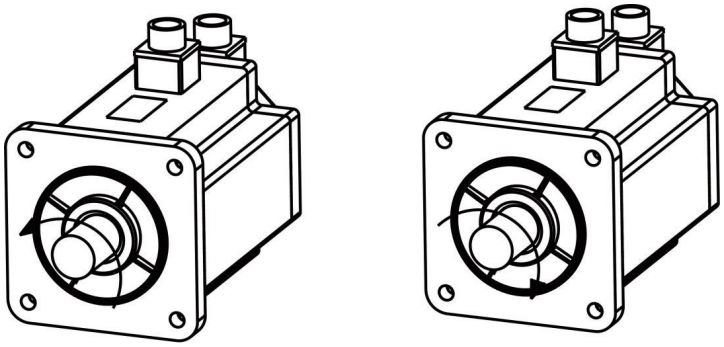
if the shaft of the servo motor is in upward direction with a speed reducer, some prevention measure shall be taken against entering inside of the servo motor by oil come from the speed reducer.

- Motor shaft extension should be long enough, or may cause vibration while motor is in running.
- In case of installation or removing the servo motor, please do not hit the servo motor with a hammer, otherwise the shaft and the encoder can be damaged.



1.3.4 Definition of Rotation Direction for Servo Motor

The motor rotating direction description in this manual is defined as facing the shaft of the servo motor. If the rotating shaft is in counterclockwise direction it will be called as positive direction, and in clockwise as reversal direction.



Positive Rotation (CCW)

Reversal Rotation (CW)

Chapter 2 Specifications

2.1 Characteristics

EtherCAT series servo driver add modbus communication function, which is based on high-performance type servo driver. It adopts EtherCAT modbus communication interface,based on sub-station technology of EtherCAT, with 100Mb/s transmission rate, to finish real-time control and communication. It also includes multi-functional digital inputs & outputs, and support CSP, CSV , CST, PP, PV, PT,HM running mode. Corresponding to pulse servo driver, it applies to long-distance , multi-axes interpolation, reduce cables and increase stability.such as: robot system, CNC system,etc. automatically applications.

- Input Working Voltage is AC Power, single phase/3 phase, 50/60Hz;
- Support EtherCAT communication protocol, address are assigned by master station.
- 8 digital inputs,single-ended, isolation,positive common port, Max input frequency is 10KHz,input voltage can be 5V or 24V(default)(set before ex-factory).
- 6 digital outputs,optocoupler isolation, max drive current is 50mA, max suffering voltage: 20Vdc.

2.2 Introduction of Specifications

SD Series	SD2004E	SD2010E	SD2026E	SD4038E	SD4075E
Output Power	50W~600W	400W~1kW	600W~3.8kW	1kW~3.8kW	3kW~7.5kW
Input Power	Single/Three Phase AC220V-15%~+10% 50/60Hz			Three Phase 380V	
Control Mode	0: Position Control; 1:Speed Control; 2: Dry Control; 3:JOG; 6:Torque Control;				
Protective Function	Over-speed/Over-voltage/Under-voltage/Over-current/Overload/Encoder Error/ Control Power Error/ Position Offset Error				
Monitor Function	Speed/Position/Pulses/Offset/Torque/Current/Status...				
Digital Input	1:Servo Enable; 2:Alarm Reset; 3:CCW-Forbidden; 4:CW-Forbidden; 5:Clear Position Offset; 6:Pulse Input Forbidden; 7:CCW Torque Limit; 8:CW Torque Limit				
Digital Output	Servo-Ready On/Alarm/Orientation End/Braker Control				
Energy Braking	Support built-in/External Resistor Braking				
Drive Load	Less than 3 times of rotor inertia				
Display	5 bits LED Indicator display , 4 Operate keys				
Communication	EtherCAT				
Position Control	Input Mode	Modbus Communication			
	Electric Ratio	Electric Ratio: 1~32767 Encoder: 17bits/23bits absolute encoder			
Coolant	Environment cooling or Force Fan cooling				
Environmental Conditions	Temperature	0~50℃ （Store Temperature: -20~65℃）			
	Humidity	40~90%RH			
	Situation	Do not mount the servo drive or motor in a location where temperatures and humidity will exceed specification. Avoid the insolation, the erosion of grease and salt, the corrosive gases and liquids. To avoid the invading of airborne dust or metallic particles			

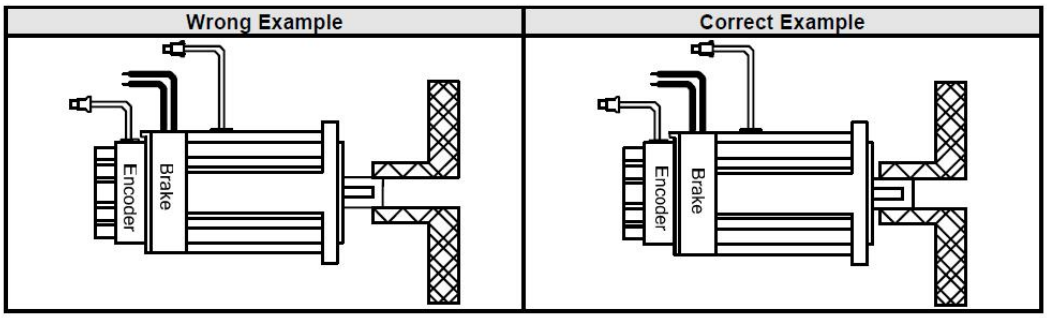
2.3 Motors table

Flange	Model	Power (W)	Torque (N.m.)	Speed (rpm)	Matched Servo Drive
40mm	SZGH-04005D(H)	50	0.16	3000	SZGH-SD2004E
	SZGH-04010D(H)	100	0.32	3000	SZGH-SD2004E
60mm	SZGH-06020DC(H)	200	0.6	3000	SZGH-SD2004E
	SZGH-06040DC(H)	400	1.3	3000	SZGH-SD2004E
	SZGH-06060DC(H)	600	1.9	3000	SZGH-SD2004E
80mm	SZGH-08040DC(H)	400	1.3	3000	SZGH-SD2010E
	SZGH-08075DC(H)	750	2.4	3000	SZGH-SD2010E
	SZGH-08075BC(H)	750	3.5	2000	SZGH-SD2010E
	SZGH-08100CC(H)	1000	4	2500	SZGH-SD2010E
90mm	SZGH-09075DC(H)	750	2.4	3000	SZGH-SD2010E
	SZGH-09075BC(H)	750	3.5	2000	SZGH-SD2010E
	SZGH-09100CC(H)	1000	4	2500	SZGH-SD2010E
110mm	SZGH-11060DC(H)	600	2	3000	SZGH-SD2026E
	SZGH-11080DC(H)	800	4	2000	SZGH-SD2026E
	SZGH-11120DC(H)	1200	4	3000	SZGH-SD2026E
	SZGH-11150DC(H)	1500	5	3000	SZGH-SD2026E
	SZGH-11120BC(H)	1200	6	2000	SZGH-SD2026E
	SZGH-11180DC(H)	1800	6	3000	SZGH-SD2026E
130mm	SZGH-13100CC(H)	1000	4	2500	SZGH-SD2026E
	SZGH-13130CC(H)	1300	5	2500	SZGH-SD2026E
	SZGH-13150CC(H)	1500	6	2500	SZGH-SD2026E
	SZGH-13200CC(H)	2000	7.7	2500	SZGH-SD2026E/ SZGH-SD4038E(380V)
	SZGH-13100AC(H)	1000	10	1000	SZGH-SD2026E
	SZGH-13150AC(H)	1500	10	1500	SZGH-SD2026E
	SZGH-13230AC(H)	2300	15	1500	SZGH-SD2026E/ SZGH-4038E(380V)
	SZGH-13260CC(H)	2600	10	2500	SZGH-SD2026E/ SZGH-4038E(380V)
	SZGH-13380CC(H)	3800	15	2500	SZGH-SD2026E/ SZGH-4038E(380V)
150mm	SZGH-15380CC(H)	3800	15	2500	SZGH-4038E
	SZGH-15300BC(H)	3000	15	2000	SZGH-4038E
	SZGH-15360BC(H)	3600	18	2000	SZGH-4038E
	SZGH-15470BC(H)	4700	23	2000	SZGH-4075E
	SZGH-15550BC(H)	5500	27	2000	SZGH-4075E
180mm	SZGH-18270BC(H)	2700	17.2	1500	SZGH-4075E

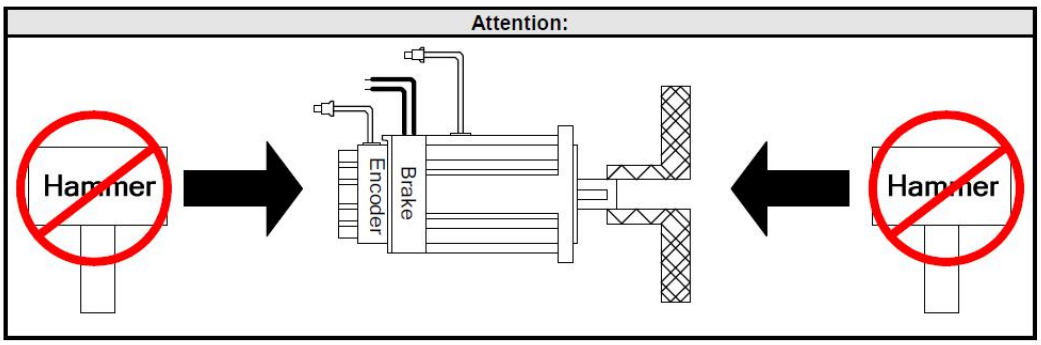
	SZGH-18290BC(H)	2900	27	1000	SZGH-4075E
	SZGH-18300CC(H)	3000	19	1500	SZGH-4075E
	SZGH-18370BC(H)	3700	35	1000	SZGH-4075E
	SZGH-18430AC(H)	4300	27	1500	SZGH-4075E
	SZGH-18450CC(H)	4500	21.5	2000	SZGH-4075E
	SZGH-18550CC(H)	5500	35	1500	SZGH-4075E
	SZGH-18750CC(H)	7500	48	1500	SZGH-4075E

2.4 Notice for Install Motor

1. Please using oil-seal-motor to avoid the oil from reduction gear flowing into the motor through the motor shaft.
2. The cable need to be kept dry.
3. Please fixing the wiring cable certainly, to avoid the cable ablating or breaking.
4. The extending length of the shaft shall be enough, otherwise there will be the vibration from motor operating.

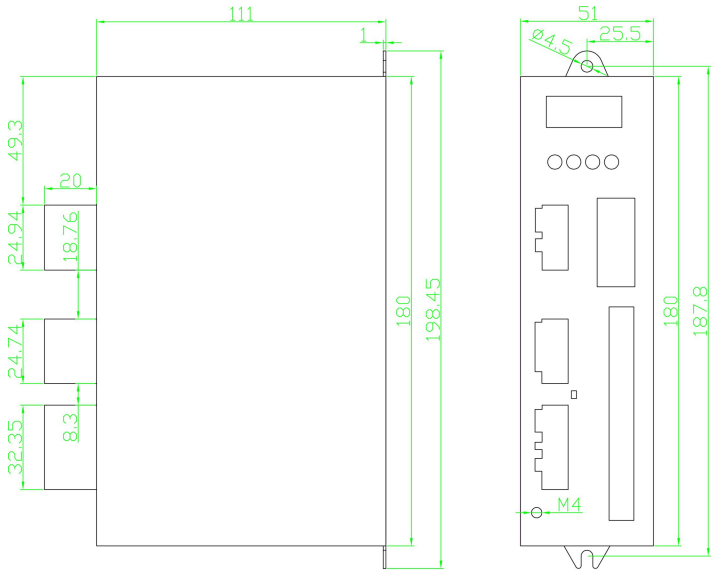


5. Please do not beat the motor when installing or taking it apart. Otherwise the shaft and the encoder of backside will be damaged.

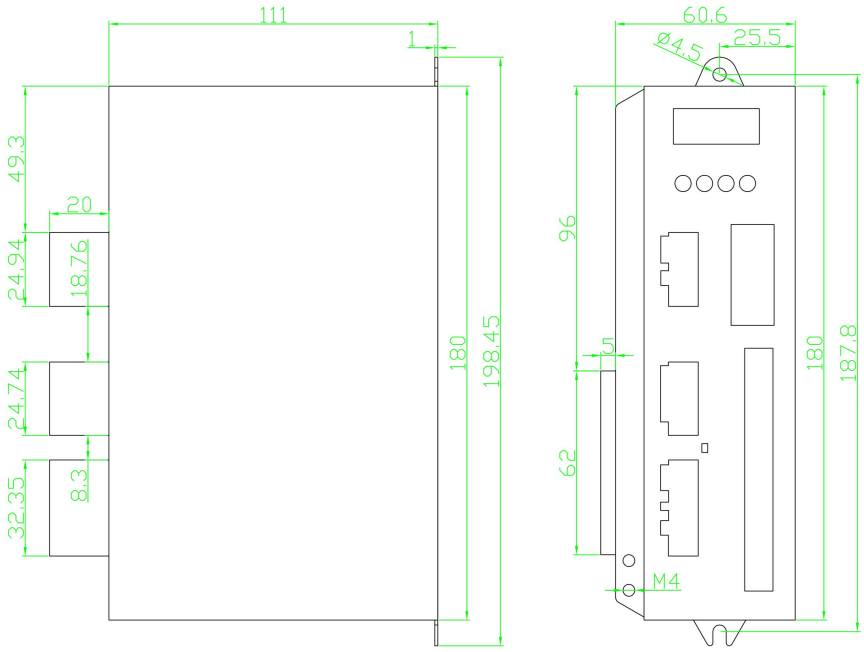


2.5 Mechanical Dimensions

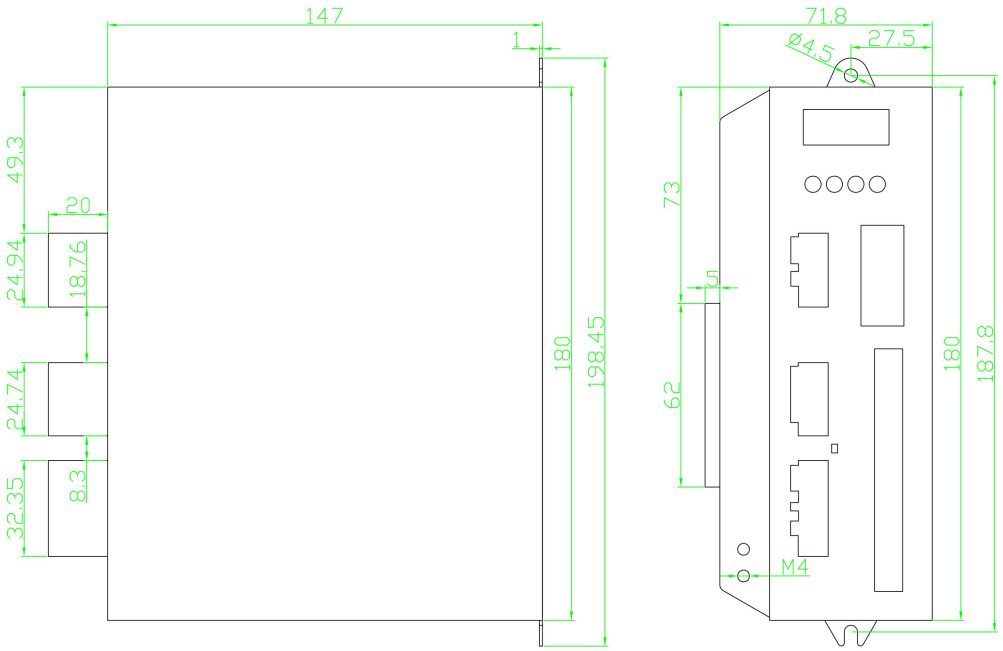
SZGH-SD2004E



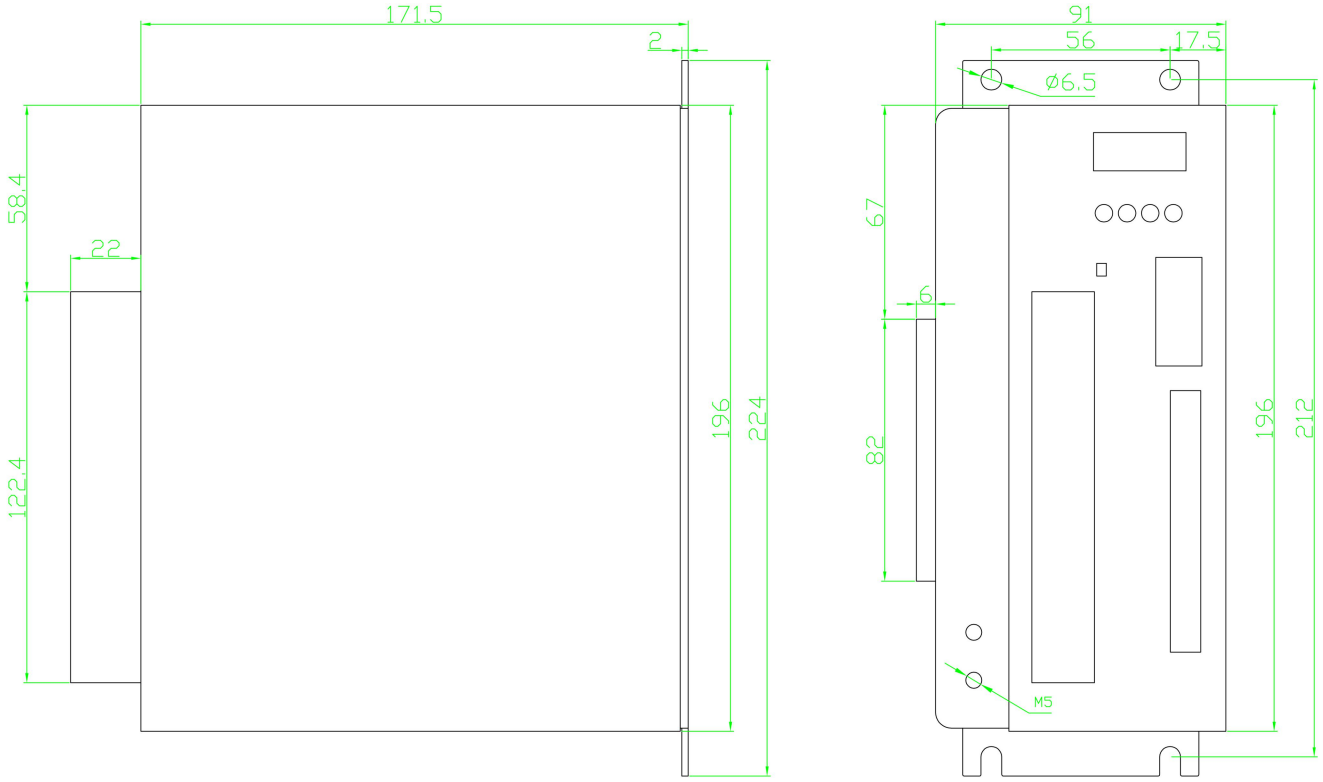
SZGH-SD2010E



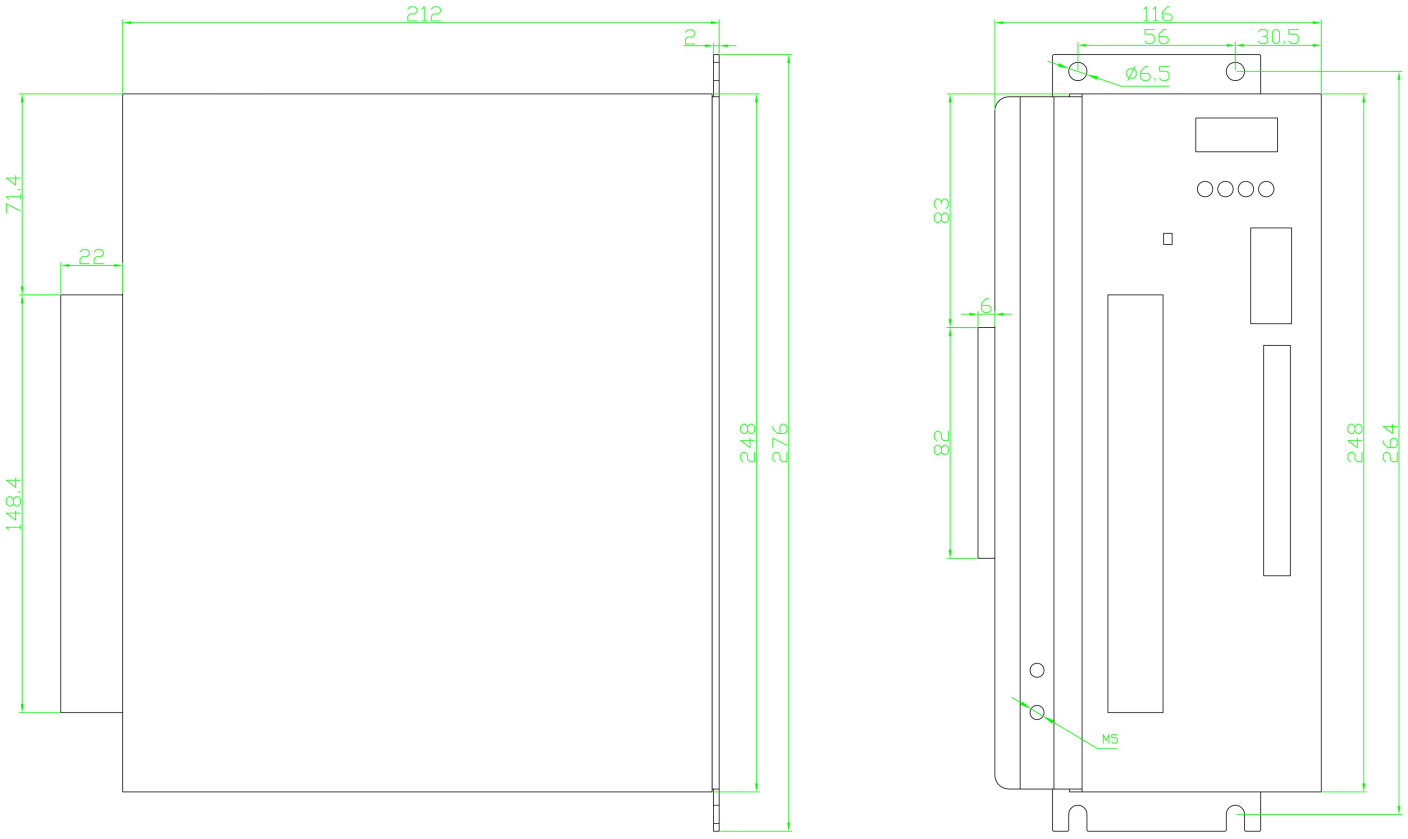
SZGH-SD2026E



SZGH-SD4038E

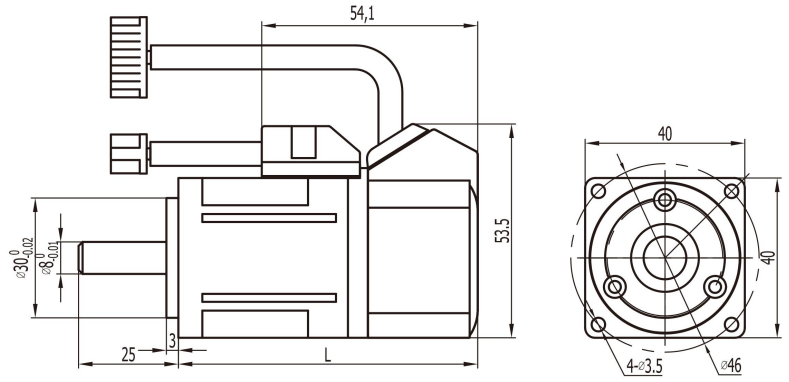


SZGH-SD4075E



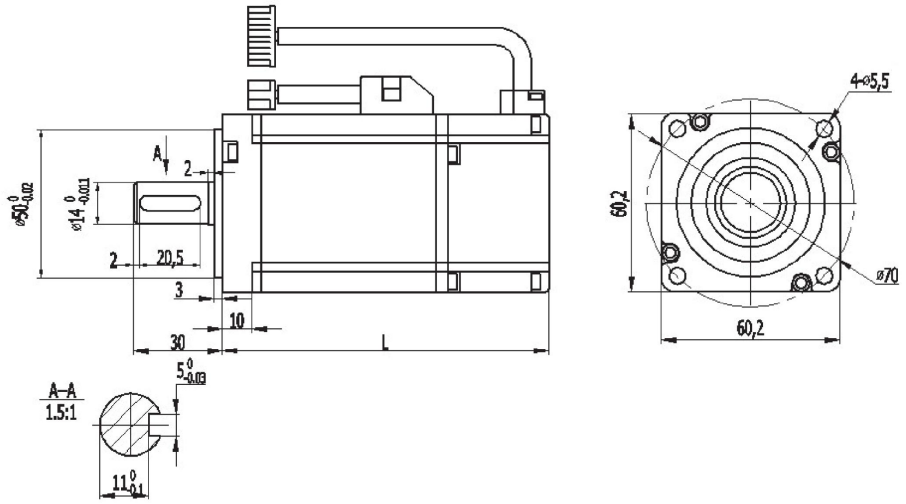
2.6 Mechanical Dimensions

2.6.1 Flange 40mm series (Unit:mm)



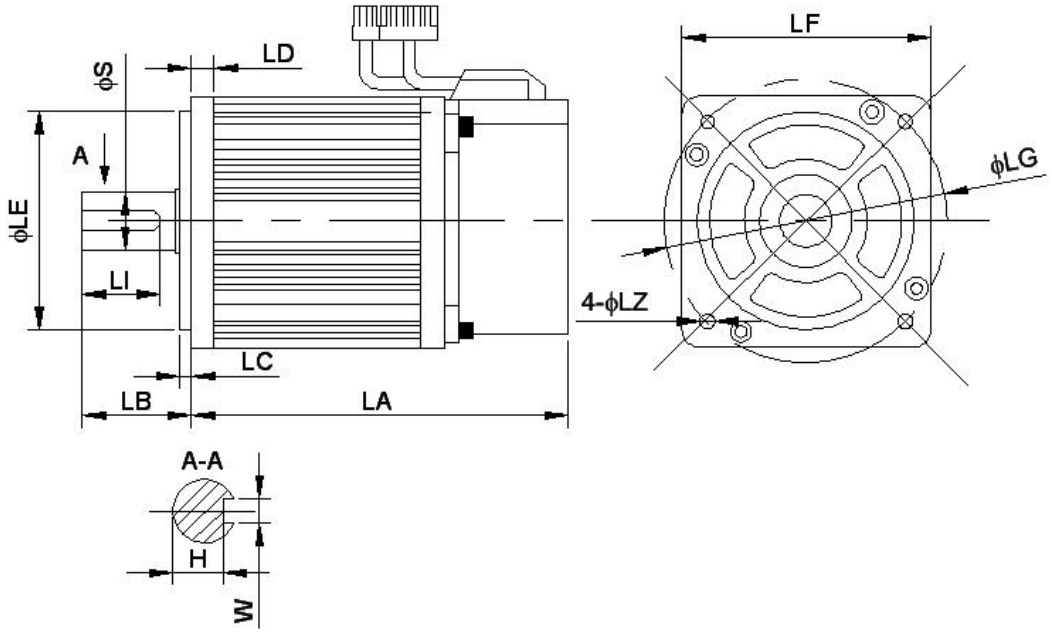
Model	L	Model	L
SZGH-04005D(H)	75	SZGH-04005D-T(H)(with brake)	109
SZGH-04010D(H)	190	SZGH-04010D-T(H)(with brake)	124

2.6.2 Flange 60mm Series (Unit:mm)



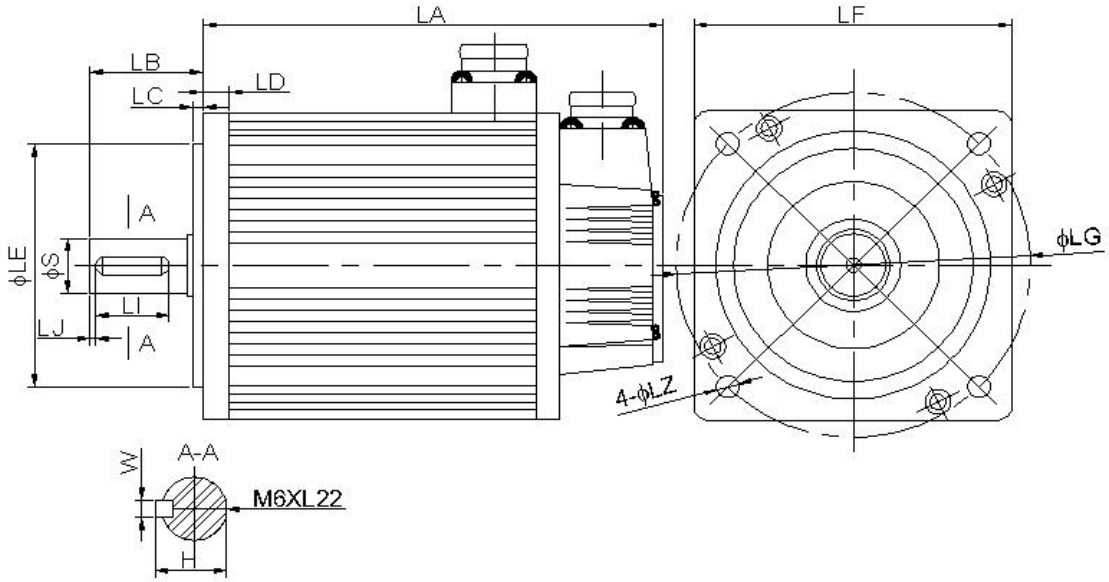
Model	L	Model	L
SZGH-06020DC(H)	116	SZGH-06020DC-T(H)(with brake)	164
SZGH-06040DC(H)	141	SZGH-06040DC-T(H)(with brake)	189
SZGH-06060DC(H)	169	SZGH-06060DC-T(H)(with brake)	217

2.6.3 Flange 80mm / 90mm Series (Unit:mm)



Model	LA	LB	LC	LD	LE	LF	LG	LZ	S	LI	W	H
SZGH-08040DC(H)	124	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08040DC-T(H)(with brake)	164	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08075DC(H)	151	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08075DC-T(H)(with brake)	191	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08075BC(H)	179	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08075BC-T(H)(with brake)	219	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08100CC(H)	191	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-08100CC-T(H)(with brake)	231	35	3	8	70	80.4	90	6	19	25	6	15.5
SZGH-09075DC(H)	150	35	3	8	80	86.6	100	6.5	16	25	5	13
SZGH-09075DC-T(H)(with brake)	198	35	3	8	80	86.6	100	6.5	16	25	5	13
SZGH-09075DC(H)	172	35	3	8	80	86.6	100	6.5	16	25	5	13
SZGH-09075DC-T(H)(with brake)	220	35	3	8	80	86.6	100	6.5	16	25	5	13
SZGH-09100DC(H)	182	35	3	8	80	86.6	100	6.5	16	25	5	13
SZGH-09100DC-T(H)(with brake)	230	35	3	8	80	86.6	100	6.5	16	25	5	13

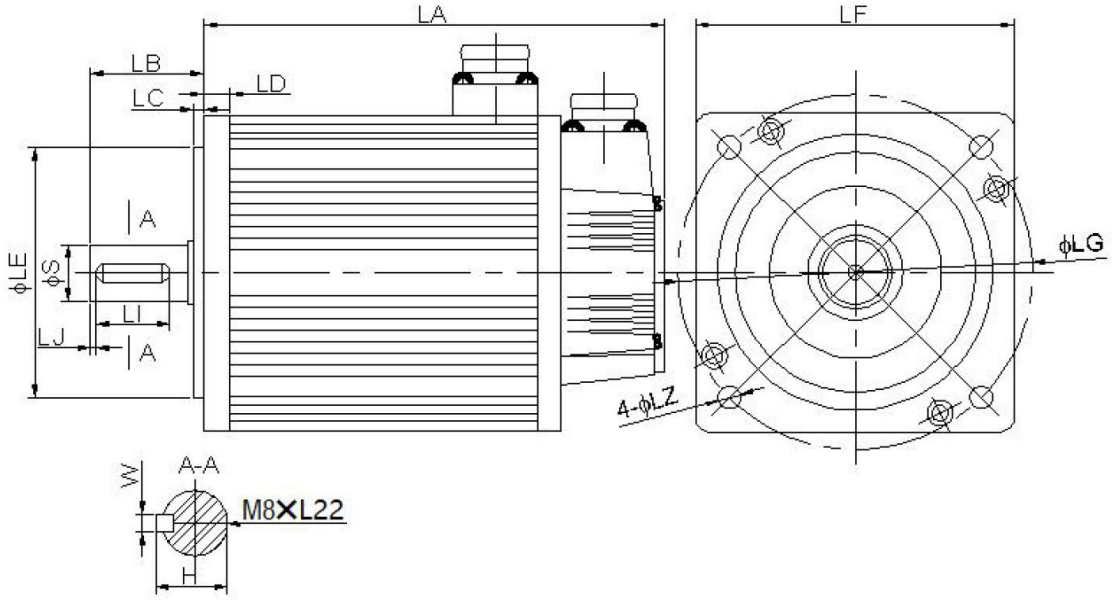
2.6.4 Flange 110mm / 130mm Series



Model	LA	LB	LC	LD	LE	LF	LG	LZ	S	H	W	LI
SZGH-11060DC(H)	159	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11060DC -T(H)(with brake)	215	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11080DC(H)	189	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11080DC-T(H)(with brake)	245	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11120DC(H)	189	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11120DC-T(H)(with brake)	245	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11150DC(H)	204	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11150DC-T(H)(with brake)	260	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11120BC(H)	219	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11120BC-T(H)(with brake)	275	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11180DC(H)	219	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-11180DC-T(H)(with brake)	275	55	5	12	95	110	130	9	19	21.5	6	40
SZGH-13100CC(H)	166	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13100CC-T(H)(with brake)	236	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13130CC(H)	171	57	5	14	110	130	145	9	22	24.5	6	40

SZGH-13130CC-T(H)(with brake)	241	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150CC(H)	179	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150CC-T(H)(with brake)	249	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13200CC(H)	192	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13200CC-T(H)(with brake)	262	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13100AC(H)	213	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13100AC-T(H)(with brake)	283	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150AC(H)	213	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150AC-T(H)(with brake)	283	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13260CC(H)	209	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13260CC-T(H)(with brake)	279	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13230AC(H)	241	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13230AC-T(H)(with brake)	311	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13380CC(H)	231	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13380CC-T(H)(with brake)	301	57	5	14	110	130	145	9	22	24.5	6	40

2.6.5 Flange 150mm / 180mm Series



型号	LA	LB	LC	LD	LE	LF	LG	LZ	S	H	W	LI
SZGH-15380CC(H)	230	58	5	14	130	150	165	11	28	31	8	45
SZGH-15380CC-T(H)	303	58	5	14	130	150	165	11	28	31	8	45
SZGH-15300BC(H)	230	58	5	14	130	150	165	11	28	31	8	45
SZGH-15300BC-T(H)	303	58	5	14	130	150	165	11	28	31	8	45
SZGH-15360BC(H)	248	58	5	14	130	150	165	11	28	31	8	45
SZGH-15360BC-T(H)	321	58	5	14	130	150	165	11	28	31	8	45
SZGH-15460BC(H)	278	58	5	14	130	150	165	11	28	31	8	45
SZGH-15460BC-T(H)	351	58	5	14	130	150	165	11	28	31	8	45
SZGH-15550BC(H)	302	58	5	14	130	150	165	11	28	31	8	45
SZGH-15550BC-T(H)	375	58	5	14	130	150	165	11	28	31	8	45
SZGH-18270BC(H)	226	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18270BC-T(H)	298	65	5	14	130	180	200	13.5	35	38	10	51

SZGH-18290BC(H)	232	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18270BC-T(H)	304	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18300CC(H)	243	65	5	14	130	180	200	13.5	35	38	10	51
SZGH18300CC-T(H)	315	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18430AC(H)	262	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18430AC-T(H)	364	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18450CC(H)	262	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18450CC-T(H)	334	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18550CC(H)	292	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18550CC-T(H)	364	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18750CC(H)	346	65	5	14	130	180	200	13.5	35	38	10	51
SZGH-18750CC-T(H)	418	65	5	14	130	180	200	13.5	35	38	10	51

Chapter 3 Wiring

3.1 Servo Drive Wiring Configuration

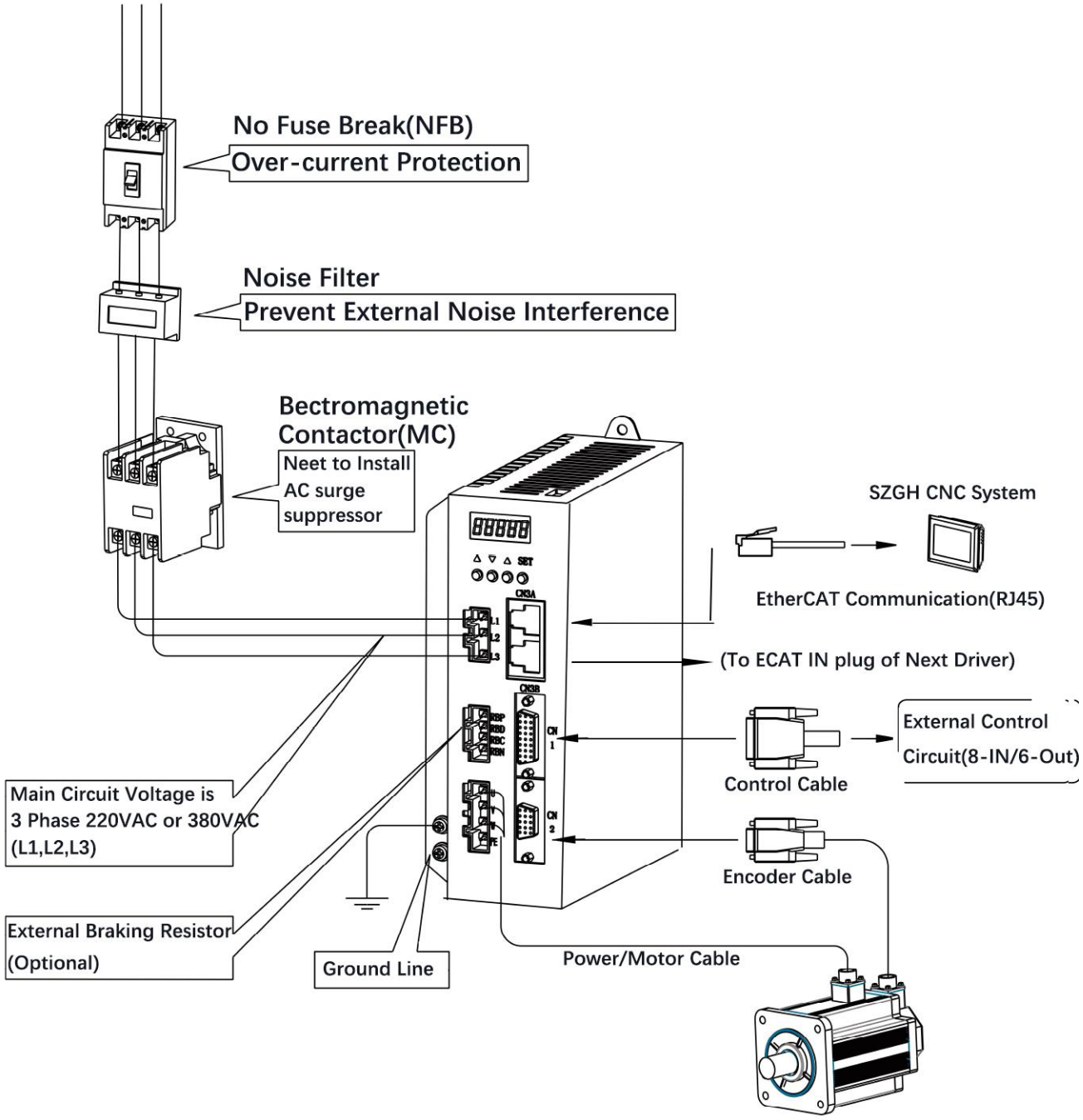


Fig.4.1 Wiring Diagram for Servo System

3.2 Wiring Explanations And Notes

- Encoder cable length should be less than 20 meters.
- Check if MAIN power voltage (220VAC/380VAC) and wiring of L1, L2, L3 is correct.
- Do not connect to 380V power supply to 220V Servo Driver.
- The output terminals of drive (U, V, W) must be connected to the servo motor connections (U, V, W) correspondingly, otherwise the servo motor will stop or over-speed. However, by exchanging three-phase terminal cannot cause the motor to reverse; this point is different from asynchronous motor.
- Earth wiring must be reliable with a single-point connection.

- Pay attention to the correct direction of diode which is connected to the relay at the output terminal, otherwise will cause the output circuit breakdown.
- In order to protect the servo drive from noise interference that can cause malfunction, please use an insulation transformer and noise filter on the power lines.
- Power lines (power supply lines, main circuit lines, and motor power cable) MUST be laid apart from the control signal wires (at least 30cm). Do not lay them in one conduit.
- Install a non-fuse circuit breaker that can shut off the main power supply immediately in case of the servo drive fault.
- Because there are some big capacitor in inner side of servo drier,even if power off, high voltage still exist in inner circuit, so please don't touch servo driver and motor within 5 minutes power off.

3.3 Wires Specification

Terminal	Symbol	Wire Specification
Main Power Supply	L1, L2, L3	1.5~4mm^2
Servo Motor	U, V, W	1.5~4mm^2
Ground	⏚	1.5~4mm^2
Control Signals	CN1	≧ 0.14mm^2 (AWG26), Shielded
Encoder Signals	CN2	≧ 0.14mm^2 (AWG26), Shielded
Regenerative Resistors Terminals	P, D / P, C	1.5~4mm^2

User must use a twisted-pair cable for the encoder signal wiring. If the encoder signal cable is too long(＞20m), in which the encoder power supply can be insufficient, multi-wires or thick wire must be used for the encoder power supply wiring.

3.4 Terminals Explanation

Terminal Name	Symbol	Detailed Explanation
Main Power Supply	L1, L3	**For 1- phase supply:** Single phase 220VAC -15% ~ +10%, 50/60Hz
	L1, L2, L3	**For 3-phase supply:** Three phase 220VAC -15% ~ +10%, 50/60Hz
	L1,L2,L3	Three Phase 380VAC(for SZGH-SD4038/SZGH-SD4075)
Regenerative Resistor Terminal	RBP, RBD	When use the built-in resistor, Please connect P and D.
	RBP, RBC	When the external regenerative resistor is needed, please disconnect P and D and connect the resistor to terminal P and C. Leave N unconnected.
Servo Motor terminal	U	U-phase output to servo motor
	V	V-phase output to servo motor
	W	W-phase output to servo motor
Ground	⏚	PE/Ground terminal of servo motor

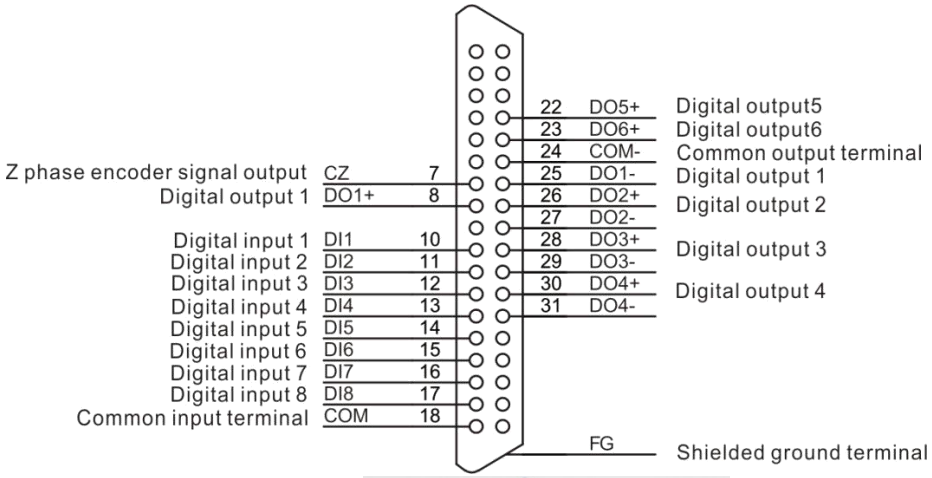
Note: The built-in resistor has been set as default by factory.RBP & RBD is short circuit.

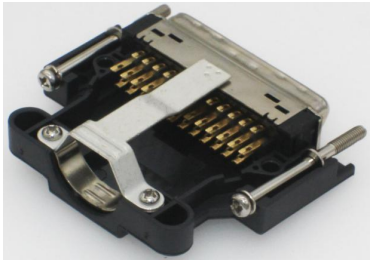
3.5 Terminal Introduction

Terminal	Description
CN1	Input and output terminal
CN2	Encoder connecting terminal
ECAT_IN	EtherCAT input terminal
ECAT_OUT	EtherCAT output terminal

3.5.1 CN1 Terminal For Input And Output

The CN1 connector plug uses DB36 male head, the contour and pin configuration is as the following:





Connector CN1 Soldering view

EtherCAT series has 8 input terminals and 6 output terminals. The definition values of input and output can be changed by P3 group parameters, and all kinds of input and output definitions can be completed (low level of input terminal is valid as default). Only input signals with function numbers between 33 and 48 defined by the input terminal can be sent to the master station and it can be obtained through the Digital Inputs object of 0x60fd in the object dictionary, which in turn maps to the object's bit0-bit15, Where the inputs for probe 1 and probe 2 functions must select high-speed input terminals 1 and 2:

Definition	Symbol	Function
33	HOME	homing signal
34	POSLIM	forward limit signal
35	NEGLIM	negative limit signal
36	QUICK STOP	quick stop
37	PROBE1	probe 1
38	PROBE2	probe 2

When the defined function number is between 18 and 33, the bit0-bit15 of the Digital Outputs object

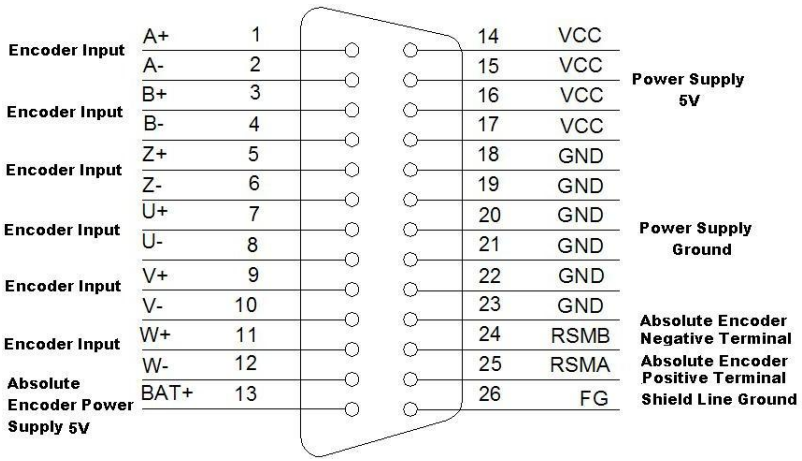
of 0x60fe object in the dictionary is mapped to the corresponding port in the order of the defined function number.

3.5.2 CN1 Connector Explanation

Name Of Signal		Pin Number	Function
Digital Input	DI1	10	Optical Isolation Input; Function is programmable; Defined by parameter P3-series (P3-0 ~ P3-17)
	DI2	11	
	DI3	12	
	DI4	13	
	DI5	14	
	DI6	15	
	DI7	16	
	DI8	17	
	COM+	18	
Digital Output	DO1+	8	Opto-coupler output; Function is programmable; Defined by parameter P3 series (P3-20 ~ P3-23)
	DO1-	25	
	DO2+	26	
	DO2-	27	
	DO3+	28	
	DO3-	29	
	DO4+	30	
	DO4-	31	
	DO5+	22	
	DO6+	23	
	COM-	24	
	CZ	7	
Shielded Cable Ground Protection	FG1	36	Shielded wire for connection with shielded cable/Metal case of connector

3.5.3 CN2 Connector For Encoder

The encoder signal connector CN2 connects to the servo motor encoder. A three-row DB26 plug (VGA plug) is used. The contour and pin configuration is as following:

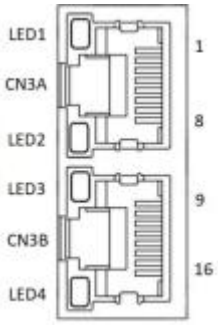


3.5.4 CN2 Connector Explanation

Signal Name Of Encoder		Pin No.	Function
Encoder Power Supply	VCC	14/15/ 16/17	Use 5V power supply provided by servo drive. If the cable is longer than 20m, in order to prevent encoder from voltage-drop, use multi-wire or thick wires for power line and ground line.
	GND	18/19/ 20/21/22	
A-Phase	A+	1	Connect with A-phase output of encoder
	A-	2	
B-Phase	B+	3	Connect with B-phase output of encoder
	B-	4	
Z-Phase	Z+	5	Connect with Z-phase output of encoder
	Z-	6	
U-Phase	U+	9	Connect with U-phase output of encoder
	U-	4	
V-Phase	V+	11	Connect with V-phase output of encoder
	V-	12	
W-Phase	W+	13	Connect with W-phase output of encoder
	W-	14	
RSMB	RSMB	9	Connect with SD- of absolute encoder
RSMA	RSMA	11	Connect with SD+ of absolute encoder
Battery+	BAT+	13	Battery power specially for absolute encoder(+5V)
Shield Ground	FG	26	Connect with cable shield wire

Note: when connect to servo motor with absolute encoder,only connect RSMB,RSMA,VCC,GND.

3.5.5 Network Communication Terminal

Terminal	Picture	Pin No.	Signal	Name
CN3		1，9	E_TX+	EtherCAT data sending forward end
		2，10	E_TX-	EtherCAT negative end of data transmission
		3，11	E_RX+	EtherCAT data receiving positive end
		4，12	/	/
		5，13	/	/
		6，14	E_RX-	EtherCAT data receiving negative end
		7，15	/	/
		8，16	/	/
		Connector cover	PE	shield grounded
Remark	1）LED1 shows the state of “Link/Activity IN” and the color is orange; 2）LED3 shows the state of “Link/Activity OUT” and the color is orange; 3）LED2 and LED4 are the state of“RUN” and the color is green.			

3.5.6 Regenerative Resistor Connection

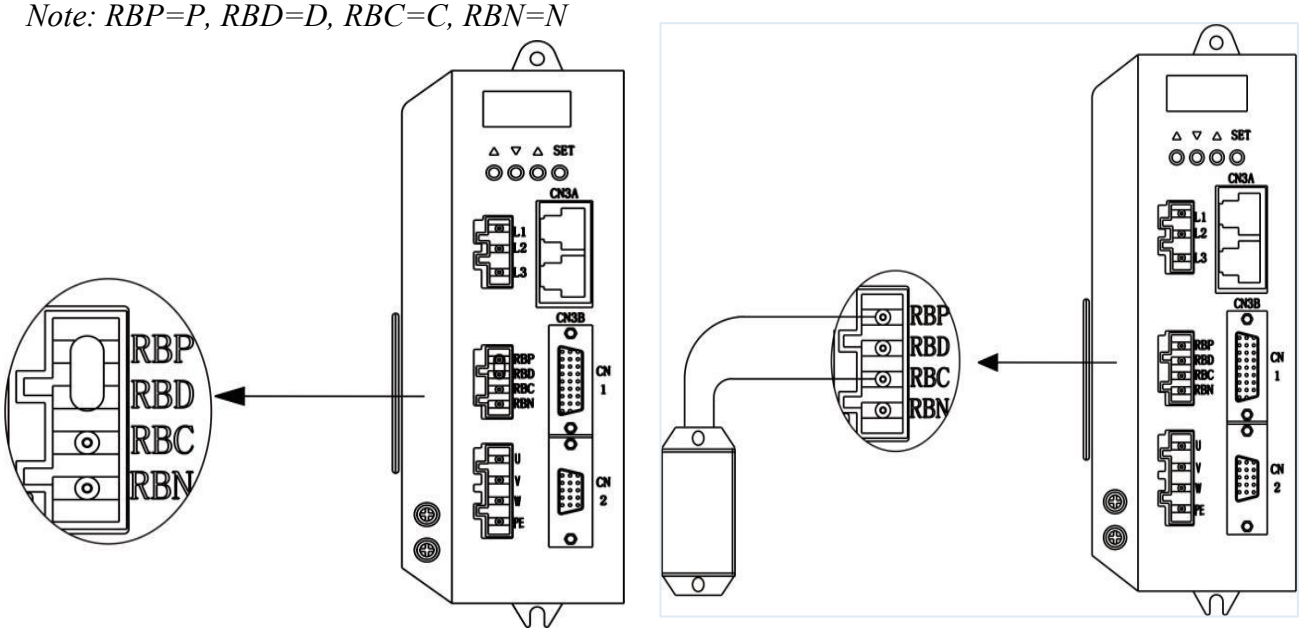
Terminal	Signal	Function	Explanation
1	RBP	Connect to External Braking Resistor	Inner: Short circuit between RBP & RBD. External: disconnect RBP & RBD, and then external resistor are connected to RBP & RBC. Forbidden Connection of RBP&RBN.
2	RBD		
3	RBC		
4	RBN	Ground Port of DC High-Voltage	

If use the built-in resistor, please connect P and D (The built-in resistor has been connected by factory, so you can use directly), as showed in picture A.

When an **external** regenerative resistor is needed to be connected to the servo drive, firstly, the short circuit between terminal P and D must be disconnected.

Then external regenerative resistor should be connected between P and C, as showed in picture B.

Note: RBP=P, RBD=D, RBC=C, RBN=N



Chapter 4 EtherCAT Field Bus

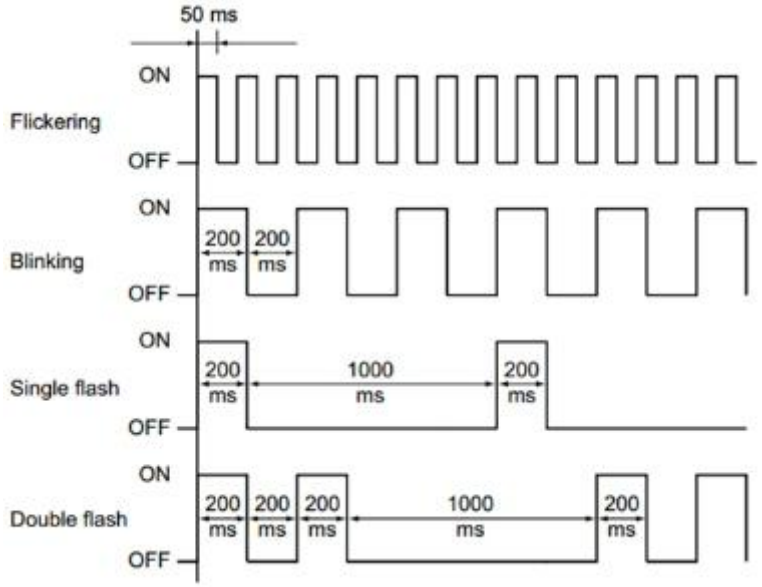
4.1 Communication Specification

Item		Description
EtherCAT Communication	Physical Layer	100BASE-TX
	Communication Connector	RJ45 × 2（terminal CN3A=IN，CN3B=OUT）
	Network Topology	Field bus type
	Baud Rate	2 × 100 Mbps（full duplex ）
	Frame Data Length	1484 bytes（max）
	Synchronization Manager	SM0：mailbox reception（master to slave） SM1：mailbox sending（slave to master） SM2：process data output（master to slave） SM3：process data input（slave to master）
	Synchronous Mode	DC Synchronization（SYNC0） Free Run
	Communication Object	SDO：service data object PDO：process data object
	LED Indication	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1
	Communication Protocol Standard	CoE：CANopen over EtherCAT
	Equipment Agreement Standard	IEC61800-7 CiA402 drive profile
CiA402 Operator Mode	Cyclic synchronization position mode（CSP）、Cyclic synchronous velocity mode（CSV）、Cyclic synchronous torque mode（CST）、Profile position mode（PP）、Profile velocity mode（PV）、Profile torque mode（PT）、Homing mode（HM）	

4.2 LED State Instruction

Name	Color	State	Description
RUN	Green	OFF	Initial state
		Blinking	Pre-operational state
		Single flash	Safe-operational state
		ON	Operational state
L/A IN	Orange	OFF	Physical layer link not established
		ON	Physical layer link establishment
		Flickering	Interactive data after link establishment
L/A OUT	Orange	OFF	Physical layer link not established
		ON	Physical layer link establishment
		Flickering	Interactive data after link establishment

The status of the indicator light is described as follows:



Pic 4.3 Indicator Flashing Time

4.3 Communication Object

The parameters include communication parameters, factory defined parameters and 402 group parameters.

Address	Name	Read/ Write	Default Value	Range	Introduction
1000h	device type	R	0x00040192		
1001h	wrong register	R	0		
1008h	device name		DSX00E		
1009h	Hardware version		V1.0		
100Ah	software release		V1.0		
1018h+01	Manufacturer ID	R	0x00445653		
1018h+02	Product code	R	0x00000001		
1018h+03	Modified coding	R	0x00000001		
1018h+04	serial number	R	0x00000001		
1600h	RXPDO mapping object0	RW			It can configure the number and content of RPDO
1701h	RXPDO mapping object258	R	0x60400010 0x607A0020 0x60B80010 0x60FE0120		
1702h	RXPDO mapping object259	R	0x60400010 0x607A0020 0x60FF0020 0x60710010 0x60600008 0x60B80010 0x607F0020		
1703h	RXPDO mapping object 260	R	0x60400010 0x607A0020		

			0x60FF0020 0x60600008 0x60B80010 0x60E00010 0x60E10010		
1704h	RXPDO mapping object261	R	0x60400010 0x607A0020 0x60FF0020 0x60710010 0x60600008 0x60B80010 0x607F0020 0x60E00010 0x60E10010		
1705h	RXPDO mapping object 262	R	0x60400010 0x607A0020 0x60FF0020 0x60600008 0x60B80010 0x60E00010 0x60E10010 0x60B20010		
1A00h	TXPDO mapping object0	RW			It can configure the number and content of TPDO
1B01h	TXPDO mapping object258	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60F40020 0x60B90010 0x60BA0020 0x60BC0020 0x60FD0020		
1B02h	TXPDO mapping object259	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60610008 0x60B90010 0x60BA0020 0x60BC0020 0x60FD0020		
1B03h	TXPDO mapping object260	R	0x603F0010 0x60410010		

			0x60640020 0x60770010 0x60F40020 0x60610008 0x60B90010 0x60BA0020 0x60BC0020 0x60FD0020		
1B04h	TXPDO mapping object261	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60610008 0x60F40020 0x60B90010 0x60BA0020 0x60BC0020 0x606C0020		
1C12h	RXPDO distribution	RW	0	0x1600 0x1701~ 0x1705	
1C13h	TXPDO distribution	RW	0	0x1A00 0x1B0~ 0x1B04	
2000h	Basic control parameters	RO			
2000h+1	Initial status display	RW	17	0-23	
2000h+2	Action setting in motor stopping	RW	0	0-200	
2000h+3	Actuator action setting	RW	0	0-200	
2000h+4	The speed of mechanical brake when the motor is running	RW	100	0-3000	
2000h+5	Speed limit in torque control	RW	3000	0-5000	
2000h+6	The delay time of servo on to close	RW	0	0-30000	
2000h+7	Input terminal effective level control word	RW	0	0-31	
2000h+8	Output terminal effective level control word	RW	0	0-31	
2000h+9	Time constant of	RW	2	1-1000	

	removing jitter of IO terminal				
2000h+10	Encoder selection	RW	5	1-5	Encoder types： 4:Absolute value without battery; 5:Absolute value with battery (as default).
2000h+11	Encoder resolution	RW	23	0-32	Select the number of motor encoder lines（23 bits as default）
2000h+12	Motor poles	RW	4	1-360	4 poles as default
2000h+13	PWM duty cycle	RW	50	5-90	
2001h	PID adjustment				
2001h+1	Position proportional coefficient	RW	40	1-1000	
2001h+2	Velocity proportional coefficient	RW	150	5-2000	
2001h+3	Velocity integral constant	RW	75	1-1000	
2001h+4	Position command smoothing filter.	RW	200	1-1000	
2001h+5	Torque filter	RW	100	20-500	
2001h+6	Velocity detection filter	RW	100	20-500	
2001h+7	Acceleration time constant	RW	100	1-10000	
2001h+8	Deceleration time constant	RW	100	1-10000	
2002h	communicational parameter				
2002h+1	Communication virtual input	RW	0	0-1	It is effective to set the function number of input terminal only when it is set to 1.
2002h+2	Communication virtual output	RW	0	0-1	It is effective to set the function number of output terminal only when it is set to 1.
2002h+3	fixed address	RW	0	0-32767	
2003h	Function number of input teminals				
2003h+1	Digital input DI1 function	RW	1	0-99	
2003h+2	Digital input DI2	RW	2	0-99	

	function				
2003h+3	Digital input DI3 function	RW	3	0-99	
2003h+4	Digital input DI4 function	RW	4	0-99	
2003h+5	Digital input DI5 function	RW	5	0-99	
2003h+6	Digital input DI6 function	RW	6	0-99	
2003h+7	Digital input DI7 function	RW	7	0-99	
2003h+8	Digital input DI8 function	RW	8	0-99	
2004h	Output terminal function number				
2004h+1	Digital output DO1 function	RW	18	0-48	
2004h+2	Digital output DO2 function	RW	19	0-48	
2004h+3	Digital output DO3 function	RW	2	0-48	
2004h+4	Digital output DO4 function	RW	3	0-48	
2004h+5	Digital output DO5 function	RW	5	0-48	
2004h+6	Digital output DO6 function	RW	8	0-48	
2005h	Auxiliary function parameters				
2005h+1	Fault reset	RW	0	0-1	
2005h+2	Whether the soft limit is on or not	RW	0	0-1	
2005h+3	Whether the parameters are saved to eeprom	RW	1	0-1	
2006h	Monitoring parameters				
2006h+1	Drive current	RO			
2006h+2	Driver temperature	RO			
2006h+3	Busbar voltage	RO			
2007h	Servo motor parameters				
2007h+1	Motor type	RW	1		The corresponding motors to each index are as follow table.

2008h	Step mode parameter				
2008h+1	Locking current	RW			
2008h+2	Running current	RW			

SZGH-SD2004E	
0	SZGH-04005D(H)(40-00130)
1	SZGH-04010D(40-00330)
2	SZGH-06020DC(60-00630)
3	SZGH-06040DC(60-01330) (default)
4	SZGH-06060DC(60-01930)
SZGH-SD2010E	
5	SZGH-08040DC(80-01330)
6	SZGH-08075DC(80-02430)(default)
7	SZGH-08075BC(80-03520)
8	SZGH-08100CC(80-04025)
9	SZGH-09075DC(90-02430)
10	SZGH-09075BC(90-03520)
11	SZGH-09100CC(90-04025)
12	SZGH-11060DC(110-02030)
13	SZGH-11080BC(110-04020)
14	SZGH-11120DC(110-04030)
15	Restoring default value
SZGH-SD2006E	
0	SZGH-08075DC(80-02430)
1	SZGH-08100CC(80-04025)
2	SZGH-09100CC(90-04025)
3	-
4	-
5	SZGH-11060DC(110-02030)
6	SZGH-11080BC(110-04020)
7	SZGH-11120DC(110-04030)(default)
8	SZGH-11150DC(110-05030)
9	SZGH-11120BC(110-06020)
10	SZGH-11180DC(110-06030)
11	SZGH-13100CC(130-04025)
12	SZGH-13130CC(130-05025)
13	SZGH-13150CC(130-06025)
14	SZGH-13200CC(H)(130-07725)
15	SZGH-13100AC(130-10010)
16	SZGH-13150AC(130-10015)
17	SZGH-13260CC(130-10025)
18	SZGH-13230AC(130-15015)
19	SZGH-13380CC(130-15025)
20	Restoring default value

SZGH-SD2075E	
220V	
0	SZGH-15300CC(150-15025)
1	SZGH-15380BC(150-15020)
2	SZGH-15360BC(150-18020)
3	SZGH-15470BC(150-23020)
4	SZGH-15550BC(150-27020)
5	SZGH-18270BC(180-17215)
6	SZGH-18300CC(180-19015)
7	SZGH-18450BC(180-21520)
8	SZGH-18290AC(180-27010)
9	SZGH-18430AC(180-27015)
10	SZGH-18370AC(180-35010)
11	SZGH-18550CC(180-35015)
12	SZGH-18750CC(180-48015)
SZGH-SD4075E	
13	-
14	SZGH-18270BC(180-17215)
15	SZGH-18300CC(180-19015)
16	SZGH-18450BC(180-21520)
17	SZGH-18290AC(180-27010)
18	SZGH-18430AC(180-27015)
19	SZGH-18370AC(180-35010)
20	SZGH-18550CC(180-35015)(Default)
21	SZGH-18750CC(180-48015)
22	Restoring default value

Address	Name	Read/ Write	Default Value	Range	Introduction	Address
603Fh	Recent error code	R	TPDO	0	Unsigned 16 bits	The last error code.
6040h	Control word	RW	RPDO	0	Unsigned 16 bits	Control word
6041h	Status word	R	TPDO	0	Unsigned 16 bits	Status word
605Ah	Quick stop code	RW	NO	1	Signed 16 bits	1:It enters the unenabling state after the slope stops. 2:Stops quickly and enters into the unenbaling state. 5:Slope shutdown completed and maintained in a fast stop state. 6:The fast stop

						is completed and maintained in the fast stop state. Other: invalid
6060h	Mode setting	RW	RPDO	8	Unsigned 8 bits	Working modes： 1:Profile position mode 3:Profile velocity mode 4:Profile torque mode 6:Homing mode 8:Periodic synchronization position mode 9:Periodic synchronous velocity mode 10:Periodic synchronous torque mode
6061h	Code check	R	TPDO	0	Unsigned 8 bits	Display the working state of the drive.
6062h	Position instruction	R	TPDO	0	Signed 32 bits	Instruction unit
6063h	position feedback	R	TPDO	0	Signed 32 bits	Actual position of motor (encoder unit)
6064h	physical location	R	TPDO	0	Signed 32 bits	Display the actual motor position (instruction unit)
6067h	Position arrival threshold	RW	RPDO	130	Unsigned 32 bits	Encoder unit
606Ch	actual velocity	R	TPDO	0	Signed 32 bits	Display the actual motor speed (instruction unit)
6071h	Target torque	RW	RPDO	0	Signed 16 bits	Input value of torque value in torque mode (thousand value)
6072h	max torque	RW	RPDO	3000	Signed 16 bits	The input torque value in torque mode
6077h	Actual torque	R	TPDO	0	Signed 16 bits	Display the actual motor torque
607Ah	target position	RW	RPDO	0	Signed 32 bits	Target position in position mode (instruction unit)
607Ch	Origin offset	RW	RPDO	0	Signed 32 bits	Origin offset
607Dh+01	Min position limit	RW	RPDO	-2000000000	Signed 32 bits	Reverse limit
607Dh+02	Max position limit	RW	RPDO	2000000000	Signed 32 bits	Forward limit
607Fh	Max speed	RW	RPDO	600000	Signed 32 bits	The max running speed

6081h	Ladder velocity	RW	RPDO	250000	Unsigned 32 bits	Speed value in uniform speed stage of profile position mode,inc/s
6083h	Ladder acceleration	RW	RPDO	250000	Unsigned 32 bits	Acceleration of ladder curve
6084h	Ladder deceleration	RW	RPDO	250000	Unsigned 32 bits	Deceleration of ladder curve(acceleration value)
6085h	Quick stop deceleration	RW	RPDO	300000	Unsigned 32 bits	The deceleration for emergency stop 605A in the of selecion in 1 or 5.
6087h	Torque slope	RW	RPDO	1	Unsigned 32 bits	Torque variation of per unit time (1ms)
6091h+ 02	Gear ratio: shaft accuracy	RW	RPDO	10000	Unsigned 32 bits	The number of instructions for the external shaft to control the motor to turn a rotate.
6098h	Homing mode	RW	RPDO	17	Signed 8 bits	Look for origin mode (support for 17 and 18, forward and reverse limit switches)
6099h+ 01	Homing mode high speed	RW	RPDO	150000	Unsigned 32 bits	Search for the velocity value of the origin signal in high speed (instruction / s)
6099h+ 02	Homing mode low speed	RW	RPDO	10000	Unsigned 32 bits	Search for the velocity value of the Origin signal in low speed (instruction / s)
609Ah	Homing accelerated/ decelerated speed	RW	RPDO	200000	Unsigned 32 bits	Acceleration and deceleration for origin mode (instruction / S^2)
60B8h	Probe function	RW	RPDO	0x3131	Unsigned 16 bits	Set probe function. (Details are in the see the functional description of the probe)
60B9h	Probe state	R	TPDO	0	Unsigned 32 bits	Display probe action status.(Details are in the see the functional description of the probe)
60BAh	Probe 1 rising along latch position	R	TPDO	0	Signed 32 bits	Probe 1 rising along latch position
60BBh	Probe 1 falling down latch position	R	TPDO	0	Signed 32 bits	Probe 1 falling down latch position
60BCh	Probe 2 rising along	R	TPDO	0	Signed 32 bits	Probe 2 rising along latch position

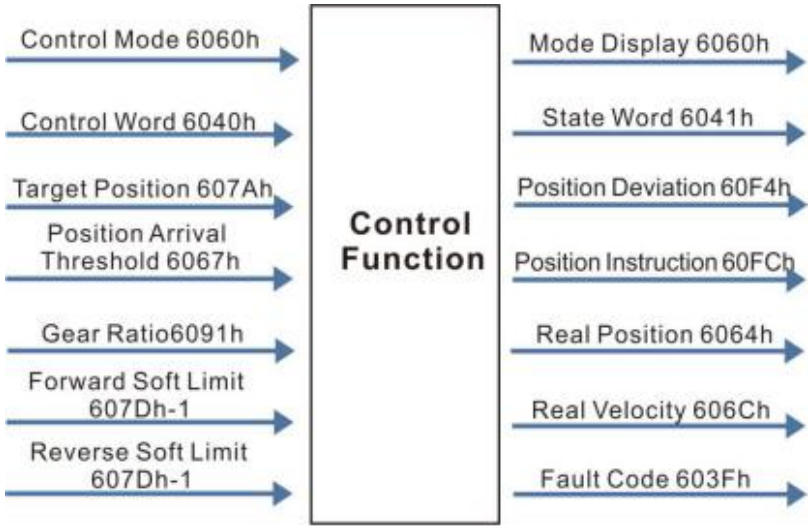
	latch position					
60BDh	Probe 2 falling down latch position	R	TPDO	0	Signed 32 bits	Probe 2 falling down latch position
60E0h	Forward torque limit	RW	RPDO	3000	Signed 16 bits	The torque limit of limiting the forward rotation (permillage)
60E1h	Reverse torque limit	RW	RPDO	3000	Signed 16 bits	The torque limit of limiting the reversed rotation (permillage)
60F4h	Position error	R	TPDO		Signed 32 bits	Position error (instruction unit)
60FDh	Input IO status	R	TPDO		Unsigned 32 bits	bit0:origin signal bit1:forward limit bit2:negative limit bit3:emergency stop bit4:probe1 function (High speed input port1) bit5:probe2 function (High speed input port2)
60FE+ 01	Physical output	RW	RPDO	0	Unsigned 32 bits	
60FEh+ 02	Physical output enable	RW	NO		Unsigned 32 bits	Not used
60FFh	Target speed	RW	RPDO		Signed 32 bits	Target speed in speed mode. (instruction unit / s)
6502h	Supported operations mode	R	NO		Unsigned 32 bits	The supported operation modes pf the drive.

Chapter 5 Control Mode

5.1 Cycle Synchronous Position Mode CSP

5.1.1 Controlling Diagram

In the cycle synchronization position mode, the controller completes the position instruction and then sends the planned target position 607Ah to the servo driver in the way of cycle synchronization.Position, speed and torque control are completed by the servo driver.



Pic5.1 The input/output objects of cycle position mode.

5.1.2 Related Object

Control Word 6040h		
Bit	Name	Description
0	Servo ready	Bit0-bit3 are 1 which means it starts working.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
Remark: CSP mode only supports absolute location instructions.		
State Word 6041h		
Bit	Name	Description
10	Target arrival	0:Not reached the target position; 1: Reached the target position.
11	Software Internal Position Overrun	0:The location instruction is not in excess of the limit. 1:Position instruction overrun
12	Follow instructions from the station	0:The station does not follow the instruction. 1:The station follow the instruction.
13	Following error	0:There is no fault with excessive position deviation. 1:Excessive position deviation fault occurs.

5.1.3 Recommended Configuration

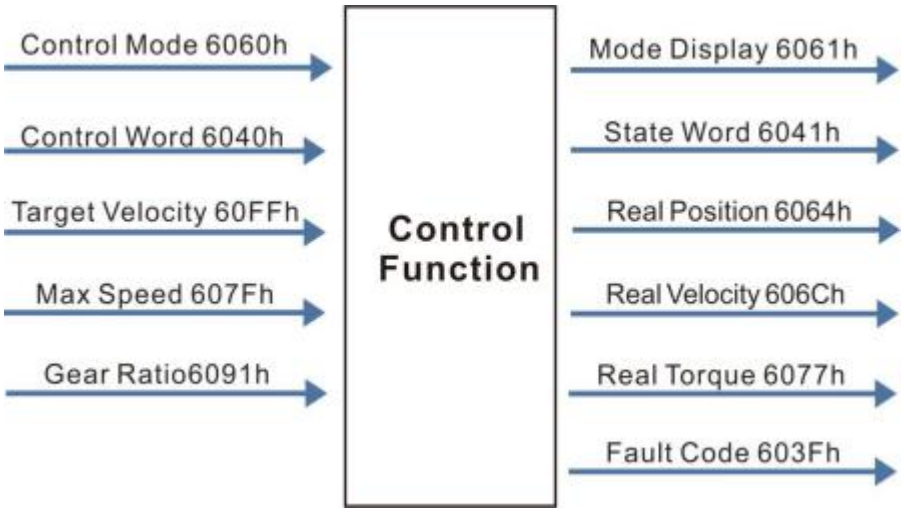
In cycle position mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
607A: target position	6064: position feedback	must choose
6060: mode selection	6061: running mode display	optional

5.2 Cycle Synchronous Velocity Mode CSV

5.2.1 Controlling Diagram

In the cycle synchronization velocity mode, the controller periodically synchronizes the calculates target speed 60FF to the servo driver. Speed and torque adjustment is performed by the servo drive.



Pic 5.2 The input/output objects of cycle velocity mode.

5.2.2 Basic Configuration

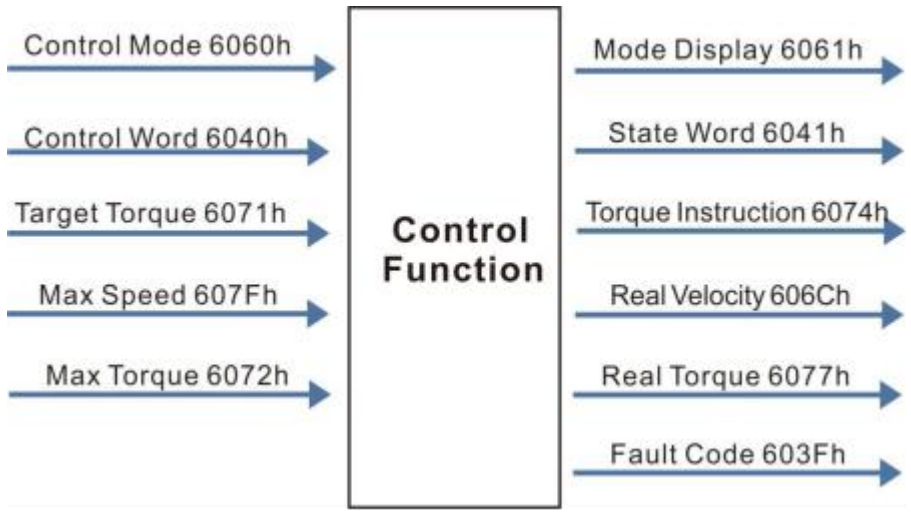
In cycle velocity mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
60FF: target velocity		must choose
	6064: position feedback 606C: speed feedback	optional
6060: mode selection	6061: running mode display	optional

5.3 Cycle Synchronous Torque Mode CST

5.3.1 Controlling Diagram

In this mode, the controller sends the calculated target torque 6071 h periodically and synchronously to the servo drive, and the torque adjustment is performed by the servo drive itself. When the speed reaches the limit, it will enter the speed regulation stage.



Pic 5.3 The input/output objects of cycle torque mode.

5.3.2 Basic Configuration

In cycle torque mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
6071: target toque		must choose
	6064: position feedback 606C: speed feedback 6077: torque feedback	optional
6060: mode selection	6061: running mode display	optional

5.4 Profile Position Mode PP

5.4.1 Related Object

This mode is mainly used for point-to-point positioning applications. In this mode, the controller gives the target position (absolute or relative), the speed of the position curve, acceleration and deceleration. The trajectory generator of the servo will generate the target position curve instruction according to the setting and the drive completes position control, speed control, torque control.

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1 which means the servo current main circuit is charging and in enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
4	New target position	From 0 to 1 , it indicates that there is a new location.
5	Updated immediately	0:Not immediately 1:Immediately
6	Absolute position / relative position	0:The target position is absolute position. 1:The target position is relative position.
State Word 6041		
Bit	Name	Description

10	Target arrival	0:Not reached the target position. 1:Reached the target position.
12	Target position updated	0:The target location can be updated. 1:The target location can not be updated.
13	Following error	0:There is no fault with excessive position deviation. 1:Excessive position deviation fault occurs

Index	Sub Index	Name	Visit	Data Type	Unit	Range	Default Value
603F	00	error code	RO	UINT16	-	0-65535	0
6040	00	control word	RW	UINT16	-	0-65535	0
6041	00	status word	RO	UINT16	-	0-65535	0
6060	00	operator mode	RW	INT8	-	0-10	8
6061	00	mode display	RO	INT8	-	0-10	0
6062	00	position instruction	RO	INT32	instruction unit	-	-
6063	00	position feedback	RO	INT32	encoder unit	-	-
6064	00	position feedback	RO	INT32	instruction unit	-	-
6067	00	position arrival threshold	RW	UINT32	encoder unit	0-65535	130
606C	00	actual velocity	RO	INT32	instruction unit/s	-	0
6077	00	actual torque	RO	INT16	0.1%	-3000~3000	0
607A	00	target location	RW	INT32	instruction unit	-2^{31}~2^{31}-1	0
607F	00	maximum speed	RW	UINT32	instruction unit/s	0-2^{32}-1	600000
6081	00	profile velocity	RW	UINT32	instruction unit/s	0~2^{32}-1	250000
6083	00	profile acceleration	RW	UINT32	instruction unit/s^2	0~2^{32}-1	250000
6091	02	axial resolution	RW	UINT32	-	1~2^{32}-1	10000
60FC	00	position instruction	RO	INT32	encoder unit	-	-
60E0	00	forward torque limit	RW	UINT16	0.1%	0-3000	3000
60E1	00	reverse torque limit	RW	UINT16	0.1%	0-3000	3000

5.4.2 Position Curve Generator

1. Control instruction timing1---update immediately：

a） The upper computer first updates other properties of displacement instruction as needed(acceleration time 6083 h, deceleration time 6084 h, profile velocity 6081h and target displacement 607Ah).

b） The upper computer sets the bit4 of 6040h from 0 to 1, which suggests that there are new displacement instructions from the station that need to be enabled.

c） From the station after receiving the rising edge of the bit4 of 6040h, it is determined whether the new displacement instruction can be received:

If the initial state of bit5 of 6040 is 1, and the bit12 of 6041 h is 0, the new displacement instruction 1 can be received from the station.After receiving the new displacement instruction from the station, 6041 of the bit12 is set from 0 to 1, indicating that the new displacement instruction 1 has been received and that the current slave station is unable to continue to receive the new displacement instruction. In immediate update mode, once the new displacement instruction is received (6041 bit12 is changed from 0 to 1), the servo immediately executes the displacement instruction.

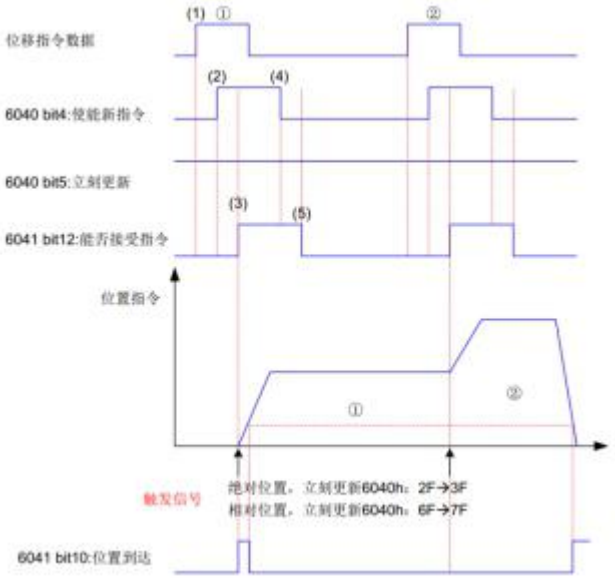
d） After the upper computer receives the bit12 from the state word 6041 h of the station to 1, the displacement instruction data can be released, and the bit4 of the control word 6040 h can be set from 1 to 0, indicating that there is no new position instruction at present.

Because the bit4 of 6040h is valid along the change, this operation does not interrupt the displacement instruction being executed.

e） When the bit4 of the control word 6040h is detected from 1 to 0, the bit12 of the status word 6041 h can be set from 1 to 0, indicating that the slave station is ready to receive new displacement instructions.

In the immediate update mode, when the bit4 of the control word 6040h is detected from the station from 1 to 0, the bit12 of 6041 h is always cleared to zero.

In the immediate update mode, a new displacement instruction 2 is received during the execution of the displacement instruction 1 of current stage, and the unexecuted displacement instruction in 1 is not discarded. For the relative position instruction, after the second displacement instruction is located, the total displacement increment = 1 target position increment 607Ah +2 target position increment 607Ah. For absolute position instruction, after the second displacement instruction is located, the absolute position = the target position of 2 is 607Ah.



Pic 5.4 Immediate updating of timing diagram and motor operation curve

2.Control instruction timing 2-not immediately updated

a） The upper computer first updates the other properties of the displacement instruction as needed

(acceleration time 6083, deceleration time 6084, maximum running speed 6081, target displacement 607A).

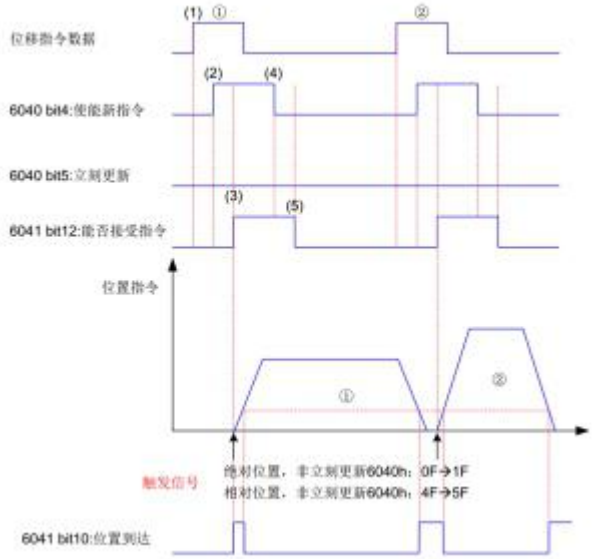
b） The upper computer sets 6040 bit4 from 0 to 1, suggesting that there are new displacement instructions from the station that needs to be enabled.

c） From the station after receiving the rising edge of 6040 of the bit4, it is determined whether the new displacement instruction can be received:

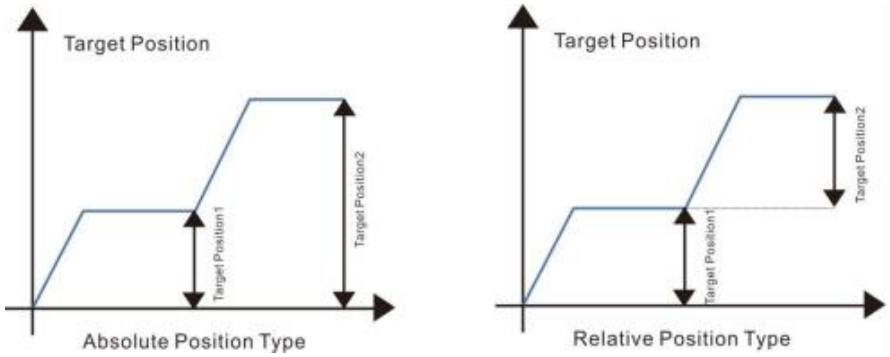
If the initial state of 6040 bit5 is 0, and the bit12 of 6041 is 0, it indicates that the new displacement instruction 1 can be received from the station. After receiving the new displacement instruction from the station, 6041 bit12 is set from 0 to 1, which indicates that the new displacement instruction 1 has been received and that the slave station is currently unable to continue to receive the new displacement instruction

d） After the upper computer receives the bit12 of the state word 6041 to 1, it can release the displacement instruction data, and set the bit4 of the control word 6040 from 1 to 0, indicating that there is no new position instruction at present. Because 6040 of the bit4 is valid along the change, this operation does not interrupt the displacement instruction being executed.

e） The bit4 of the control word 6040 is detected from 1 to 0. after the positioning of the current segment is completed, the bit12 bit of 6041 is released, indicating that the slave station is ready to receive the new displacement instruction. In non-immediate update mode, when the current segment is in operation, the servo cannot receive a new displacement instruction, the current segment positioning is completed, and the servo can receive a new displacement instruction once received (6041 of the bit12 is changed from 0 to 1), The servo immediately executes the displacement instruction.



Pic 5.5 Non-immediate update sequence diagram and motor operation curve



Pic 5.6 The difference between absolute position and relative position instruction

5.4.3 Recommended configuration

In profile position mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
607A: target position	6064: position feedback	must choose
6081: profile speed		optional
6083: profile acceleration		optional
6060: mode selection	6061: running mode display	optional

5.5 Profile Velocity Mode PV

5.5.1 Related Objects

In this mode, the controller sends the target speed and acceleration to the servo drive. Speed and torque adjustment is performed by the servo drive.

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1, indicating that the servo is charged by the current main circuit and is in an enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	

Status Word6041		
Bit	Name	Description
10	Target arrival	0：Not reach the target speed. 1：The target speed has arrived.
11	Software internal limit	0：Not reach soft limit. 1：Reach the soft limit.

Index	Sub Index	Name	Visit	Data Type	Unit	Range	Default Value
603F	00	error code	RO	UINT16	-	0-65535	0
6040	00	control word	RW	UINT16	-	0-65535	0
6041	00	status word	RO	UINT16	-	0-65535	0
6060	00	operator mode	RW	INT8	-	0-10	8
6061	00	mode display	RO	INT8	-	0-10	0
607F	00	max speed	RW	UINT32	/s	$0\text{-}2^{32}\text{-}1$	600000
6083	00	profile acceleration	RW	UINT32	instruction unit/s	$0\text{-}2^{32}\text{-}1$	250000
6063	00	position feedback	RO	INT32	encoder unit	-	-
6064	00	position feedback	RO	INT32	instruction unit	-	-
60FF	00	target speed	RW	INT32	instruction unit	$-2^{31}\sim2^{31}\text{-}1$	0
60E0	00	forward torque limit	RW	UINT16	0.1%	0-3000	3000
60E1	00	reverse torque limit	RW	UINT16	0.1%	0-3000	3000
606C	00	actual speed	RO	INT32	instruction	-	0

					unit/s		
6077	00	actual torque	RO	INT16	0.1%	-3000~ 3000	0

Remark: When the acceleration of the profile is calculated, the velocity can be added only if the converted value is greater than 1.

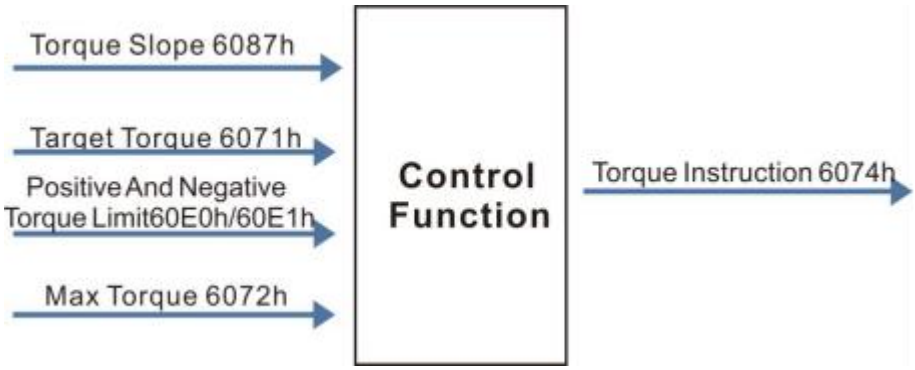
5.5.2 Recommended Configuration

In profile speed mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: status word	must choose
607A: target position		optional
	6064: position feedback 606C: speed feedback	optional
60FF: target speed		must choose
6083: profile acceleration		optional
6060: mode selection	6061: running mode display	optional

5.6 Profile Torque Mode PT

In this mode, the upper controller sends the target torque 6071 h and the torque ramp constant 6087h to the servo driver, and the torque adjustment is performed by the servo. When the speed reaches the limiting value, it will enter the speed regulation stage.



Pic5.7 Profile torque mode input/ output block diagram

5.6.1 Related Objects

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1, indicating that the servo is charged by the current main circuit and is in an enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	

State Word 6041		
Bit	Name	Description
10	Target arrival	0：Not reached the target position. 1：Reached the target position.
11	Soft internal limit	0：Not reached the soft limit.

		1：Reached the soft limit.

Index	Sub Index	Name	Visit	Data Type	Unit	Range	Default Value
603F	00	error code	RO	UINT16	-	0-65535	0
6040	00	control word	RW	UINT16	-	0-65535	0
6041	00	status word	RO	UINT16	-	0-65535	0
6060	00	operator mode	RW	INT8	-	0-10	8
6061	00	mode display	RO	INT8	-	0-10	0
606C	00	actual velocity	RO	INT32	/s	-	-
6071	00	target torque	RW	INT16	0.1%	-3000~3000	0
6072	00	maximum torque	RW	UINT16	0.1%	0-3000	3000
6074	00	torque instruction	RO	INT16	0.1%	-	-
6077	00	actual torque	RO	INT16	0.1%	-	-
6087	00	torque slope	RW	UINT32	0.1%/ ms	0-2^{32}-1	1

5.6.2 Recommended configuration

In profile torque mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: status word	must choose
6071: target torque		must choose
6087: torque slope		
	6064: position feedback 606C: speed feedback 6077: torque feedback	optional
6060: mode selection	6061: running mode display	must choose

5.7 Homing Mode HM

The homing mode is used to find the mechanical origin and locate the position relationship between the mechanical origin and the mechanical zero.

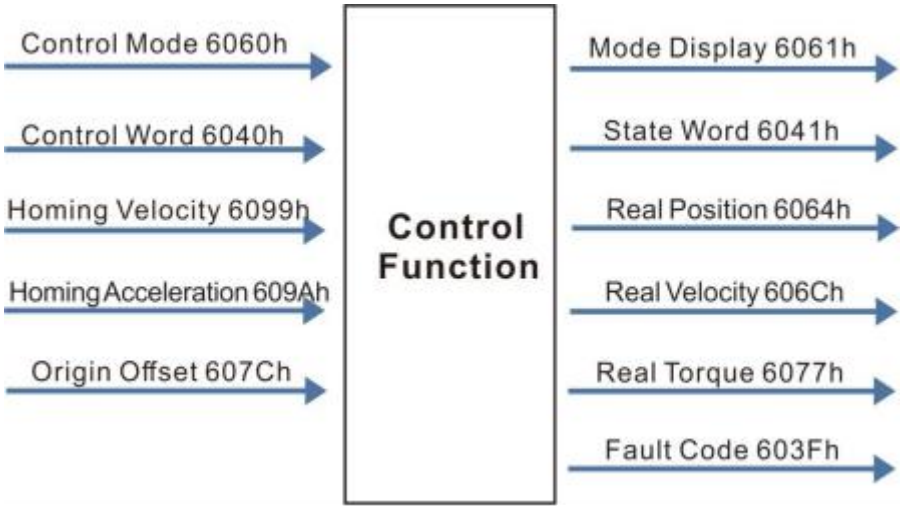
Mechanical origin: a fixed position on the machine, which can correspond to a certain origin switch and the Z signal of the motor.

Mechanical zero: mechanical absolute zero position..

When the homing is finished, the stop position of the motor is the mechanical origin, and the 607Ch automatically sets the relationship between the mechanical origin and the mechanical zero:

Mechanical origin = mechanical zero +607Ch (origin offset)

When 607Ch=0, the mechanical origin coincides with the mechanical zero.



Pic 5.8 Input and output object of origin regression mode

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1, indicating that the servo is charged by the current main circuit and is in an enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
4	Homing	0-->1：Homing. 1-->0：The drive received the homing signal.

Control Word 6041		
Bit	Name	Description
10	Target Arrival	0：Not reached the target position. 1：Reached the target position.
12	Homing	0：Homing has been finished and it can receive zeroing signal. 1：It is homing and can not receive homing signal.
13	Homing Fault	0：There is no fault in zeroing. 1：Homing timeout or excessive deviation error.

The basic configuration is as follows:

RPDO	TPDO	备注
6040: control word	6041：status word	must choose
6098: homing mode		optional
6099-01: search limit switch signal speed		optional
6099-02: search homing signal speed		optional
609A: homing acceleration		optional
	6064: position feedback 606C: speed feedback 6077: torque feedback	optional
6060：mode selection	6061: running mode display	must choose

Note: When to calculate the homing acceleration, it needs to converted to r/min/ms. Only if the converted value is greater than 1 can the homing speed be changed.

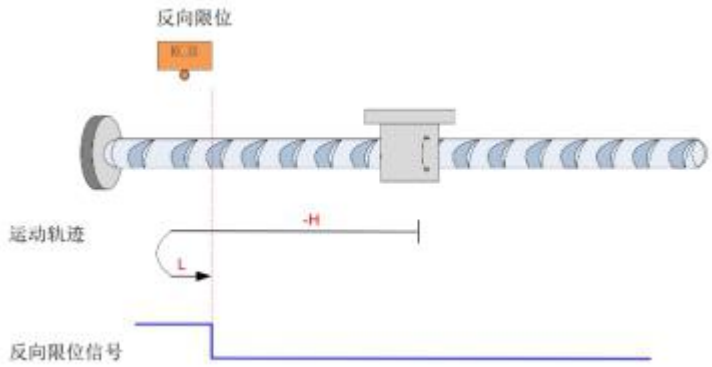
The introduction of homing mode currently supported by DSX00E :

1）6098h=17

Mechanical origin: reverse over-range switch.

Deceleration point:: reverse over-range switch.

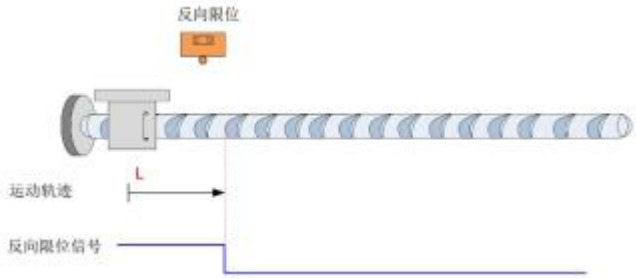
a）The deceleration point signal is invalid when homing starts.



Note: In the figure, "H" stands for high speed 6099-1h and "L" stands for low speed 6099-2 h.

When homing starts and N-OT =0, it reverses with high speed.. When it encounters N-OT rising edge, it decelerates, reverses and forwards with low speed.. When encountering the falling edge of N-OT, it stops running.

b）The deceleration point signal is effective when homing starts.



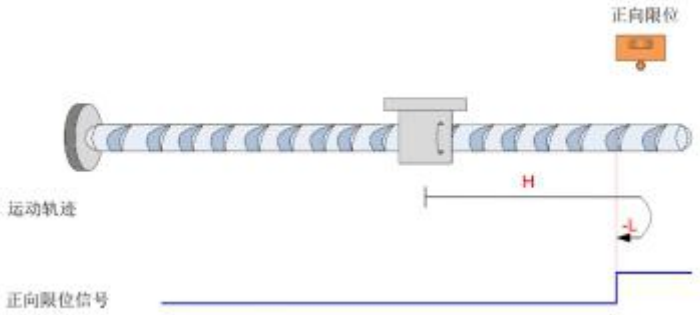
When homing starts and N-OT=1, it starts to homing at low speed directly, and stops at the falling edge of N-OT.

2）6098h=18

Origin: forward over-range switch..

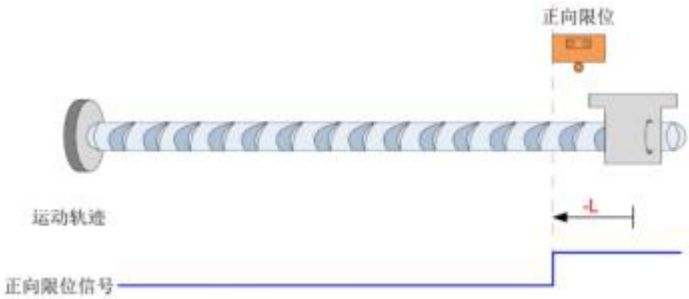
Deceleration point: forward over-range switch..

a) The deceleration point signal is invalid when homing starts.



When homing starts and P-OT=0 , it forwards with high speed. When encountering the rising edge of P-OT, it decelerates, reverses and operates at low speed . When encountering the falling edge of P-OT, it stops.

b）The deceleration point signal is effective when homing starts.



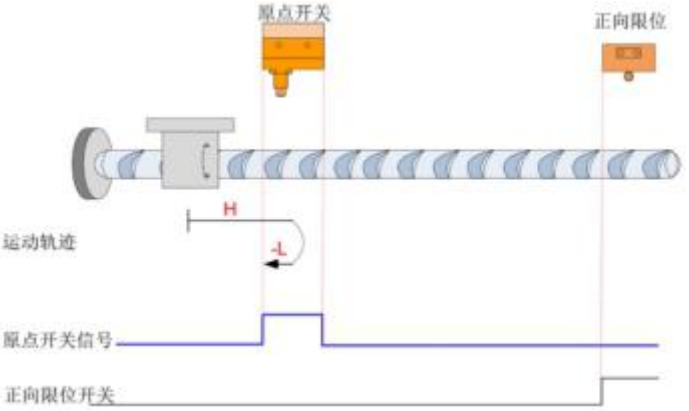
When homing starts and P-OT=1, it reverses with low speed directly. And when encountering the falling edge of P-OT , it shuts down.

3）6098h=23

Origin: Origin switch.

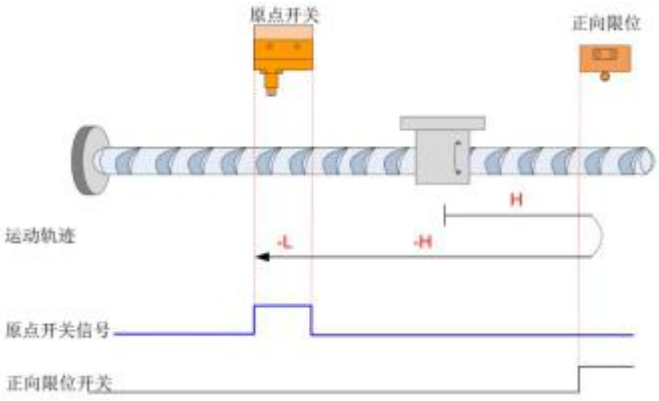
Deceleration point: Origin switch.

a) The deceleration point signal is invalid when zeroing starts and it did not encounter the forward limit switch.



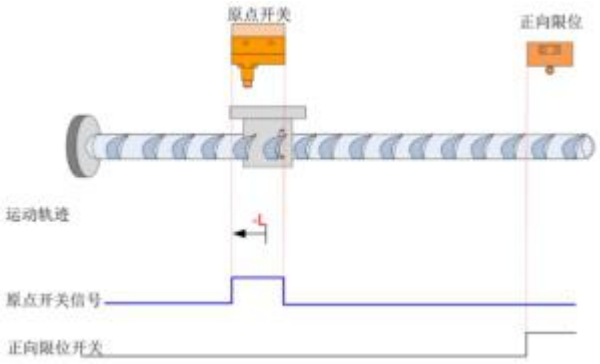
When homing starts and HW=0, it forwards with high speed and does not encounter limit switch.When encountering rising edge of HW, it slows down and reverse with low speed. When encountering the falling edge of HW, it shuts down.

b) The deceleration point signal is invalid when returning to zero starts, and the forward limit switch is encountered.



When homing starts and HW=0, it forwards with high speed and encounters limit switch. Then it automatically reverses and runs at high speed. When encountering rising edge of HW, it slows down and keeps reversing with low speed. When encountering the falling edge of HW, it shuts down.

c) The deceleration point signal is effective when returning to zero starts.



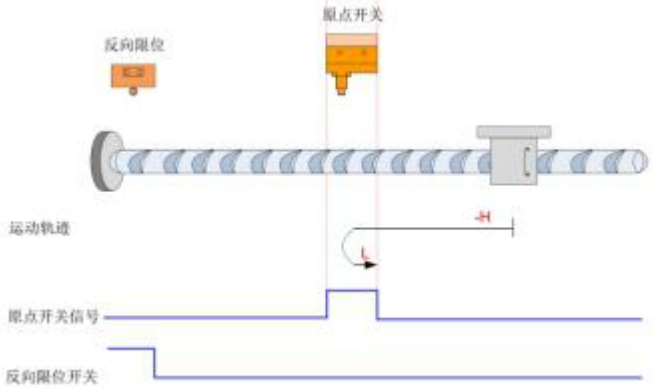
When homing starts and HW=1, it starts zeroing at a reverse low speed directly.When encountering the falling edge of HW, it shuts down.

4）6098h=27

Origin: Origin switch.

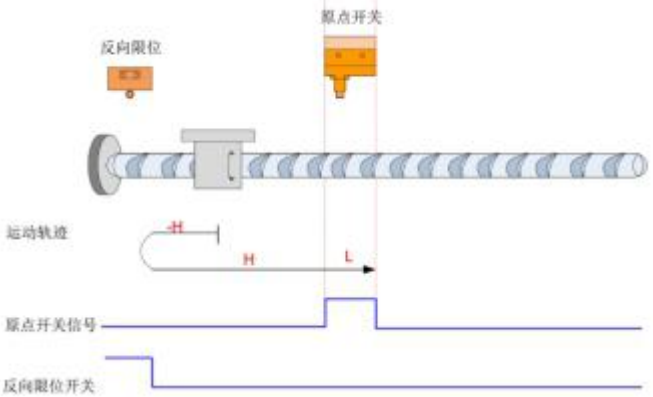
Deceleration point: Origin switch.

a) The deceleration point signal is invalid when returning to zero starts and did not encounter limit switch.



When homing starts and HW=0, it returns to zero with reversed high speed and does not encounter limit switch.When encountering rising edge of HW, it slows down, reverse and forwards with low speed. When encountering the falling edge of HW, it shuts down.

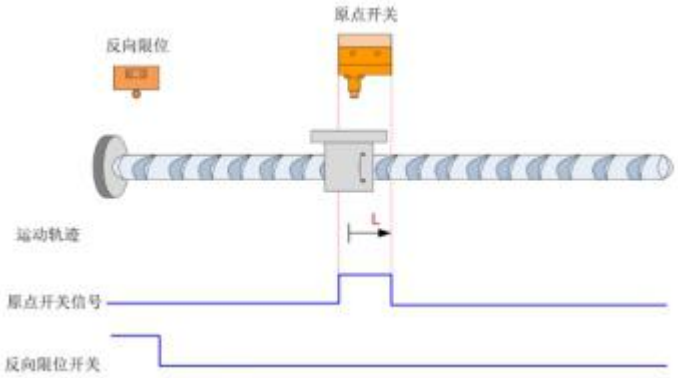
b) The deceleration point signal is invalid when returning to zero starts and the reverse limit switch is encountered.



When homing starts and HW=0, it returns to zero with reversed high speed and encounters limit switch.Then it automatically reverses and runs at high speed. When encountering rising edge of HW, it

slows down and keeps forwarding with low speed. When encountering the falling edge of HW, it shuts down.

c) The deceleration point signal is valid when zeroing.



When homing starts and HW=1, it forwards with low speed directly. When encountering the falling edge of HW, it shuts down.

Chapter 6 Operation and display

6.1 Introduction to Front Panel And Function

6.1.1 Front Panel

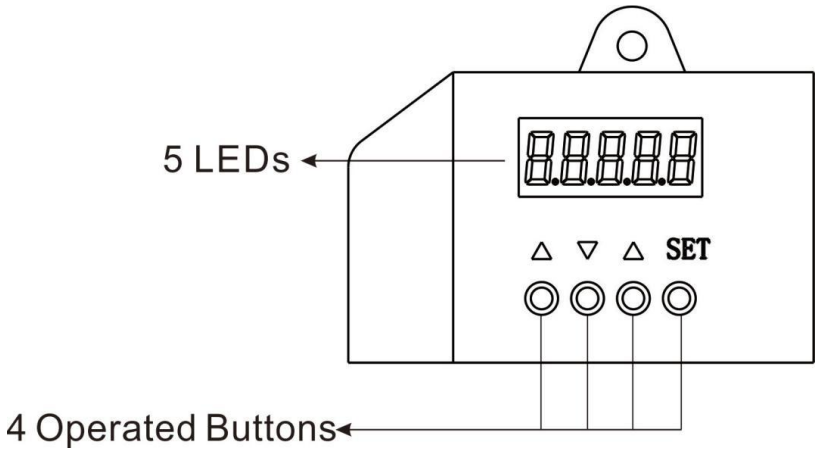


Fig6.1 Front Panel

"SET" Button: Enter the parameter settings or set the values to select parameters and exit.

▲ UP Button: Increase the selected value by 1.

▼ DOWN Button: Decrease the selected value by 1.

◀ BACK Button: Press this to come back to before data.

The panel consists of 5 digital LED and 4 buttons including ↑ , ↓ , ← , SET to display all system status and set parameters.

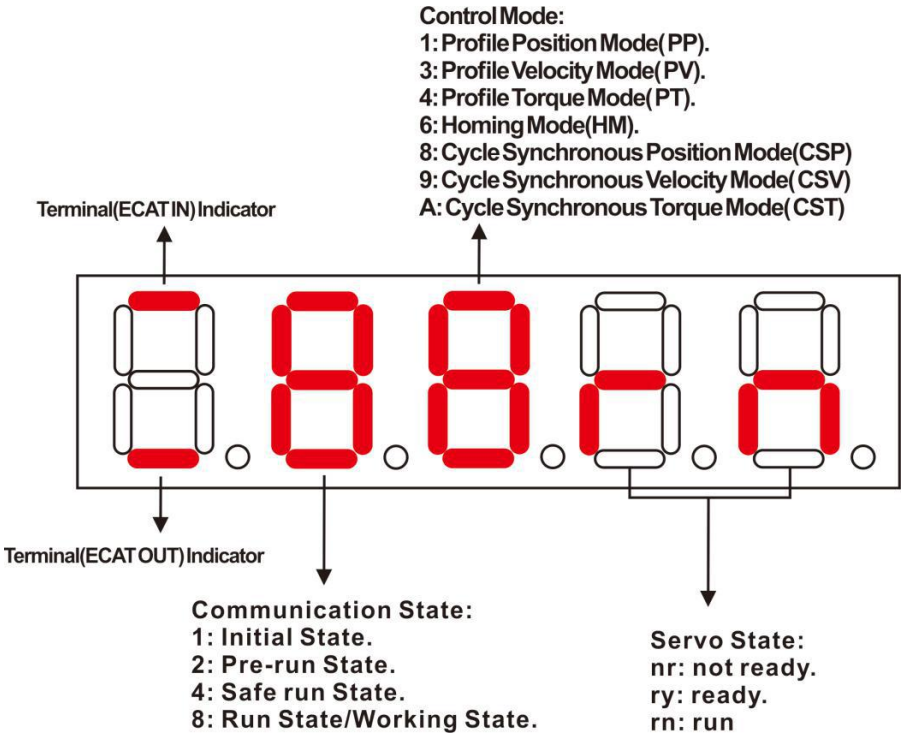
The operation is hierarchical. ← button indicates "Back" and SET button indicates "forward" while it also has the meaning of "Enter" . ← button also has the meaning of "Cancel" and "Exit". ↑ button indicates "Increase" and ↓ button indicates "Decrease". If you press and hold the ↑ button or ↓ button, you would get a duplicate result and when hold longer, the repetition rate is higher.

Please firstly select "PA-", and press **SET** button to enter the status of parameter setting mode. And use ↑or ↓to choose parameters and **SET** button to display the parameter's value. You can modify the parameter's value with ↑or ↓. Press ↑or ↓button one time, the parameter increases or decreases by 1. Pressing and holding ↑or ↓key can make the value increased or decreased continuously. After modifying the value of the parameter,please press **SET** button and when the LED flashes two times, it means changes are completed . Finally please recharge, then the new parameter is effective.

6.1.2 Front Panel keys explanation

Symbol	Name	Function
▲	Increase	Increase number or value; Press down and hold to repeat increasing.
▼	Decrease	Decrease number or value; Press down and hold to repeat decreasing.
◀	Exit, Back	Menu exit; Cancel the operation
SET	Confirm, Set	Menu entered; Confirm the operation

6.1.3 State Indicator



6.2 Main Menu

The first layer is the main menu and has four operating modes. Press ↑ or ↓ button to change the operation mode. Then press **SET** button to enter into the second layer. Press ← button returns to the main menu from the second layer.

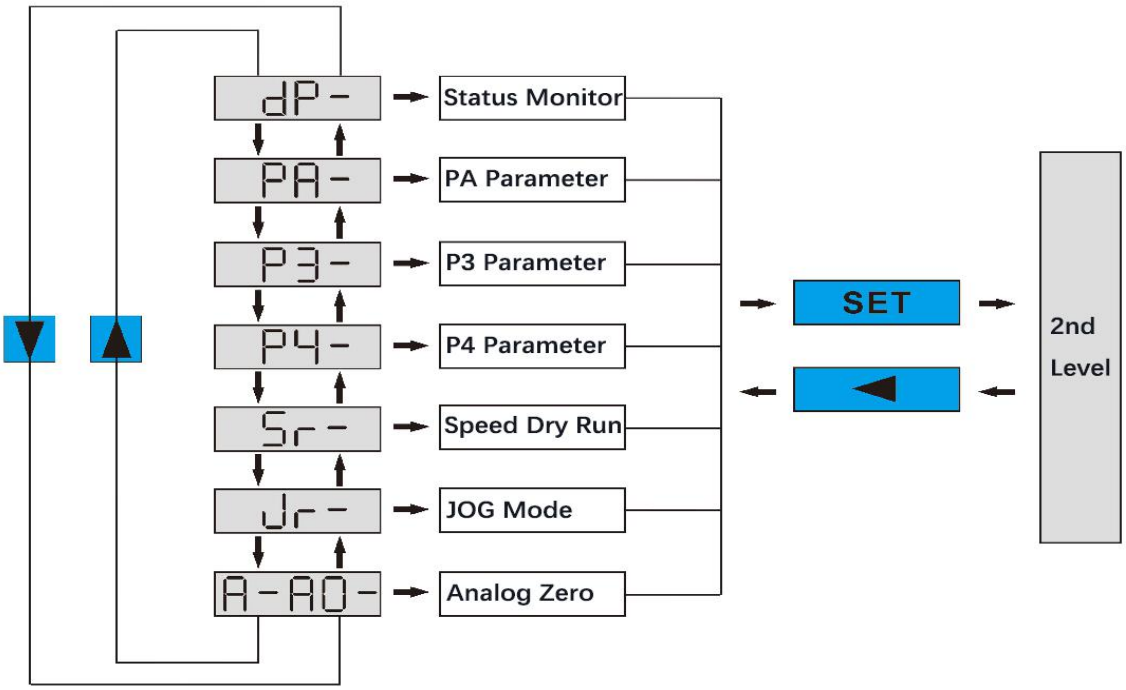


Fig6.2 Operating display layer

In the first layer, please select "dP--" and press the **SET** button to enter into monitoring mode. There are 16 statuses to be displayed in total. You can select the desired display mode with ↑ or ↓ button, and then press **SET** button to enter into the specific status.

Monitoring	Operation	Example	Definition
dP-SPd		r 1000	Speed : 1000 r / min
dP-PoS		P45806	The current position of rotor : 1245806 pulse
dP-PoS.		P. 12	
dP-CPo		C45810	Position Command : 1245810 pulse
dP-CPo.		C. 12	
dP-EPo	SET	E 4	Position Deviation : 4 pulse
dP-EPo.		E. 0	
dP-tr9		t 70	Motor Torque 70%
dP- I		I 2.3	Motor Current 2.3A
dP-Cnt		Cnt 0	Control Method 0
dP-APo		A 3265	Absolute Rotor Position : 3265
dP-APo.		A .0	
dP- In		In	Digital Input Terminal
dP-oUt		oUt	Digital Output Terminal
dP-Cod		Cod	Encoder Signal
dP-UdC		UC336	Bus Voltage: 336V
dP- rn		rn - on	Running State
dP-Err		Err 9	Alarm No.9

6.3 Process of Setting Parameter

Please firstly select “PA--”, and press **SET** button to enter the status of parameter setting mode. Use ▲ or ▼ to choose required parameter and push **SET** button to display the parameter value. You can modify the parameter value with ▲ or ▼ . Press ▲ or ▼ button one time, the parameter increases or decreases by 1. Pressing and holding ▲ or ▼ key can continuously increase or decrease the value. After modifying the value of the parameter press SET button and when the LED flashes two times, it means modification is completed. Finally turn the drive OFF and ON again to activate the changes.

6.4 Setting Analog Quantity to 0

After the setting, driver will test offset of analog quantity and reserve it into PA39(or PA45). It need not to write parameter again because the operation of setting analog to 0 reserved the parameter to EEPROM.

Firstly, choose the parameter 'A-A0', then press SET to enter. Next choose 'A-SPd' (Setting speed analog quantity to 0) or 'A-Trq'(Setting torque analog quantity to 0) by ▲ and ▼ , choose one of the operation and Holding & press 'SET' button for more than 3 seconds, wait for displaying 'donE' on the screen, activate the operation. After that, you can press ◀ button back to the menu.

6.5 Recovery Parameters To Default Values

In case of the following situations, please use the function of resuming the default parameters (ex-factory default parameter):

- The parameter is adjusted chaotically; the system is unable to work normally.
- The servo motor is replaced by a different new model.
- For any other reason, drive is not matched with motor model which is set in PA01.

The procedure for resuming the default parameter values is as the following:

1. Inspect servo motor code (PA01) whether it is correct or not.
2. Modify the password (PA0) from 315 to 385.
3. Modify the servo motor code (PA1) with related servo motor code.
4. Enter operations of parameter,do following steps

Resume default value of all parameters means that all of parameters that have been edited by customers would be recovered to the manufacture parameters value.

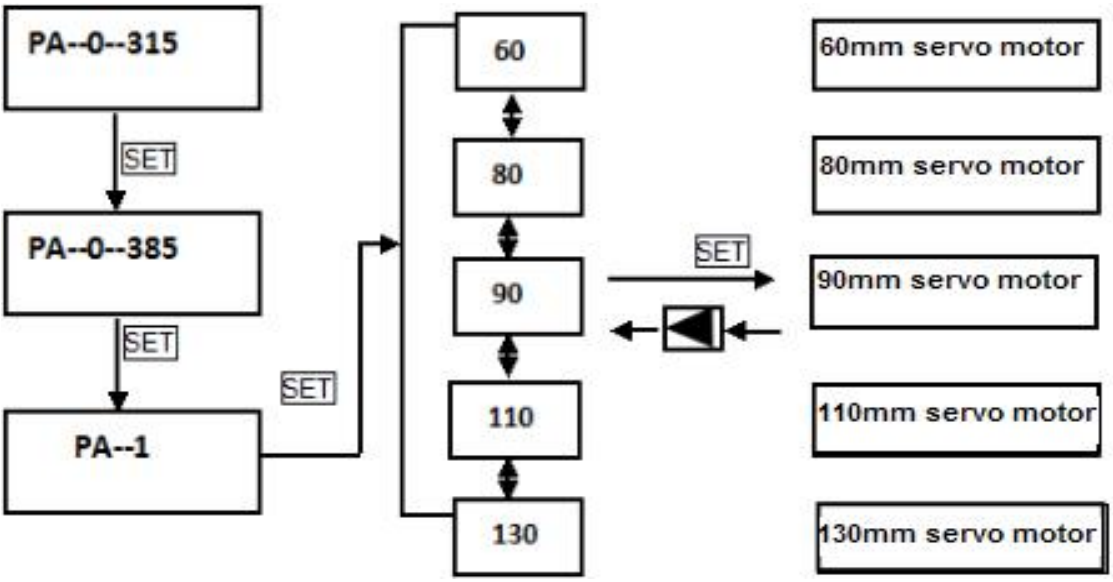
Press ◀ button back to main menu, and choose "PA--" mode with ▲ or ▼ button. Press **SET** button entering into the second layer. Then press ▲ or ▼ button to set PA=0 and press **SET** button going into the third layer to set PA0=385, and press **SET** button to enter it.

Press ◀ button back to the "PA--" layer, and set PA1=dEF-. Press **SET** button for 5 seconds. When the LEDs in the screen flashes several times, it means the operation is successful. Finally turn OFF and ON the power to activate the changes.

6.6 Parameter Set for Servo Motor Code

The value of PA-01 should be set referring to the following table. If there is a mismatch, it will cause an alarm. Pay attention that different motors have different default parameters.
For example, SZGH-08075DC(H) (80mm frame size,2.4Nm,3000RPM,code is 80-02430),so the factory default model of this ac servo motor is 80-02430.

If there is necessary to modify the motor code or restore setting parameters that was already set by manufacturer, please firstly change ***PA--0 from 315 to 385***, then enter into PA-01 and press ▲ or ▼ key to select the appropriate motor model. The steps are shown as the following picture:



Pic 3. Choose motor type

Note: 1.The parameter PA-01 of drive must be configured with the exact servo motor that you are using,if not,which will affect efficient of servo motor would be down or alarm .

2.Normally we set PA1 parameter well before ex-factory,please use related SZGH-SD series driver for related SZGH series servo motor.

Chapter 7 Parameters

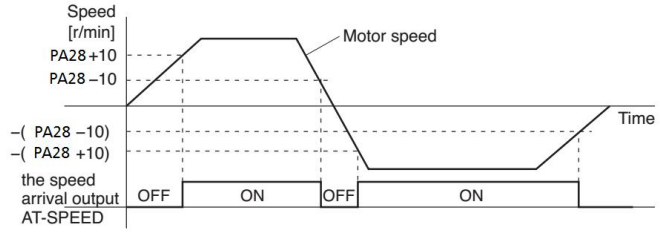
7.1 PA Group Parameter

No.	Name	Function	Range	Default Value
0	Password	1. Default password is 315 to set or change parameters. 2. To change the Motor type it must be changed to 385.	0-9999	315
1	Motor type selection	1. The different motor type code has different default parameters. If you want to use the function of recovering the default parameter value make sure that you have chosen the correct motor type. 2. If you want to edit PA-01 parameter, please set the PA0 to 385 firstly.	80-90-110-130-150-180	-
3	Initial display status	0. Display the current motor speed 1. Display the current position in 5-bit (low byte) 2. Display the current position in 5-bit (high byte) 3. Display position command (command pulse accumulation) in 5-bit (low byte) 4. Display position command (command pulse accumulation) in 5-bit (high byte) 5. Display position deviation in 5-bit (low byte) 6. Display position deviation in 5-bit (high byte) 7. Display motor torque 8. Display motor current 9. Display control mode 10. Display temperature of heat-sink on IPM 11. Display Analog speed command 12. Display Analog torque command 13. Display absolute position of the rotor in a turn in 5-bit (low byte) 14. Display absolute position of the rotor in a turn in 5-bit (high byte) 15. Display Digital input status 16. Display Digital output status 17. Display encoder input signal 18. Display DC voltage value of main power 19. Display alarm code 20. Display logic chip version number 21. Display the actuation state of the relay 22. Display external voltage state 23. Display external voltage state	0-23	0
4	Control mode	0: position control mode 1: speed control mode 2: torque control mode	0-5	0

		3: position + speed control mode 4: position + torque control mode 5: speed + torque control mode		
5	Proportional gain of speed loop	1. The bigger value means the more gain and higher rigidity. The parameter value is set according to your servo motor model and the load behavior. Generally, the greater the load inertia, the bigger the value. 2. Set as high value as system does not generate any oscillation.	5-2000Hz	200
6	Integral constant of speed loop	1.The smaller value means the integral time is faster and the ability of system in resisting deviation is stronger. But if it is too small, it will cause oscillation.	1-1000ms	75
7	Torque filter	1. To set the character of torque command filter. 2. To suppress resonance from torque applied to load. 3. The smaller value means the cut-off frequency is lower and vibration with generated noise by the motor is less. If the load inertia is great, reduce the setting value. If the value is too small, it would lead to low response, which would result in shaking and non-smooth operation. 4. The bigger value means the cut-off frequency is higher and the response frequency is quicker. If you need higher torque response frequency,increasing the setting value is recommended.	20-500%	100
8	Speed detection filter	1. To set the degree of speed detection filter. 2. The smaller value means the cut-off frequency is lower and noise from the motor is smaller. If the load inertia is great, reducing the setting value is recommended. If the value is too small, it would lead to low response, which would result in shaking and non-smooth operation. 3. The bigger value means the cut-off frequency is higher and the response frequency is quicker. If you need higher speed response frequency, it is recommended to increase the setting value.	20-500%	100
9	Proportional gain of position loop	1. The bigger value means the gain is higher and its rigidity is stronger. So the position lag is smaller under the same frequency command pulse condition. But if it is too big, it will cause oscillation. 2. The parameter value is set according to your servo motor model and the load condition.	1-1000 (1/s)	80
11	Command pulses for one turn of motor rotation	1. **When it is set to 0**, then PA12 and PA13 are valid, otherwise this parameter defines the input pulse command number required to turn the motor for one turn.	1-30,000 pulse	10,000
12	1st numerator of electronic gear for position command pulse	1. In position control mode, it is convenient to match all kinds of pulse source through setting the parameter PA12 and PA13, which helps to reach ideal control resolution (angle/pulse). 2. **P×G=N×C×4** **P**: input pulse command number, **G**: electric gear ratio, **N**: numbers of motor rotation, **C**: resolution of optical encoder (ppr), default value is 2500. 3. For example: for input command pulse P of 6000, we need the	0-32,767	0

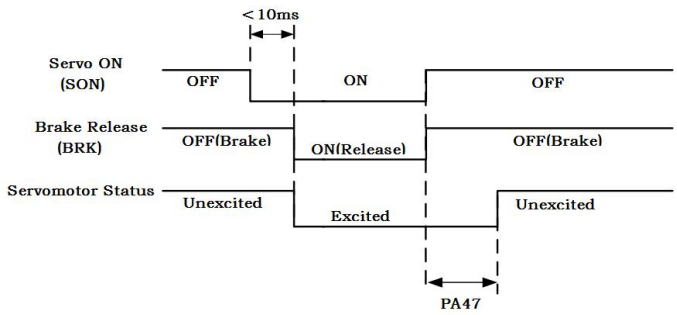
<table>
<tr><td></td><td></td><td>servo motor to rotate one turn
4. G=(N×C×4)/P = (1×2500×4)/6000=5/3, So PA12 should be set to 5, PA13 should be set to 3.
5.The numerator of electronic gear for command pulse is decided by combination of Gear1 and Gear2 digital inputs which points to one of the parameters PA12, PA77, PA78, and PA79.
The denominator is decided by PA13.
The detail is as following:
<table><tr><td colspan="2">DI Signal</td><td rowspan="2">Numerator</td></tr><tr><td>Gear 2</td><td>Gear 1</td></tr><tr><td>0</td><td>0</td><td>1ST Numerator (Parameter PA 12)</td></tr><tr><td>0</td><td>1</td><td>2nd Numerator (Parameter PA 77)</td></tr><tr><td>1</td><td>0</td><td>3rd Numerator (Parameter PA 78)</td></tr><tr><td>1</td><td>1</td><td>4th Numerator (Parameter PA 79)</td></tr></table>Note: 0=OFF, 1=ON.</td><td></td><td></td></tr>
<tr><td>13</td><td>Denominator of position command pulse</td><td>Refers to parameter PA12</td><td>1-32,767</td><td>10,000</td></tr>
<tr><td>14</td><td>mode of position command pulse</td><td>To set one of 3 input modes:
0: Pulse+Direction
1: CCW pulse/CW pulse
2: A-phase and B-phase orthogonal input.
3:External position input</td><td>0-3</td><td>0</td></tr>
<tr><td>15</td><td>Direction of command pulses</td><td>0: Normal
1: Reverse position command pulse</td><td>0-1</td><td>0</td></tr>
<tr><td>16</td><td>Range of positioning completion</td><td>1. To Set the pulse range of positioning completion under the position control mode.
1. To set the pulse range of positioning completion under the position control mode.
2. When the pulse number in the position deviation counter is smaller than or equal to this setting value , the digital output (DO) COIN is ON, otherwise is OFF.
3. The comparator has hysteresis function, it is set by PA84.</td><td>0-30,000 pulse</td><td>10</td></tr>
<tr><td>17</td><td>Detection of over-travel range</td><td>In position control mode, if the value in position deviation counter is greater than this parameter, the drive will alarm.</td><td>0-30,000x 100 pulse</td><td>400</td></tr>
<tr><td>18</td><td>Invalid error of over travel</td><td>0: The alarm for detection of over travel is valid.
1: The alarm for detection of over travel is invalid, and stops to detect the error.</td><td>0-1</td><td>0</td></tr>
<tr><td>19</td><td>Position command smooth filter</td><td>1. To filter the input command pulse. Acceleration and deceleration are with exponential form. The value is time constant.
2. The filter does not lose input pulses, but will cause a command delay.
3.The filter applies in
(1. PC controller without acceleration and deceleration function.
(2. The electronic gear ratio is big (>10).
(3. The command frequency is low.</td><td>0-30,000 x 0.1ms</td><td>300</td></tr>
</table>

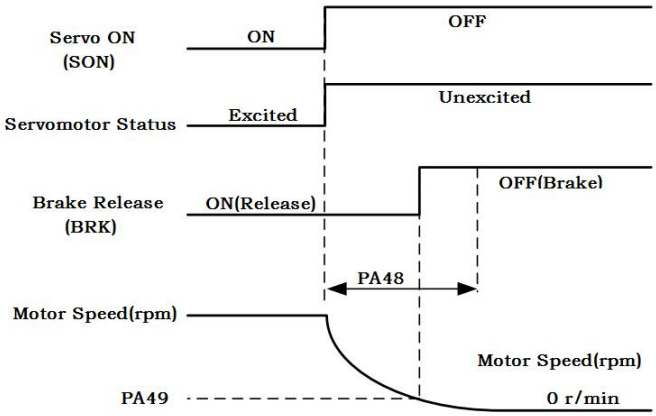
<table>
<tr><td></td><td></td><td>(4. When the motor runs, there are step jumps in speed.
(5. When set to value”0”, the filter does not work.</td><td></td><td></td></tr>
<tr><td>20</td><td>drive inhibition</td><td>0: CCW drive inhibition or CW drive inhibition is effective.
If the digital input of CCW drive inhibition is ON (N.C. contact on its digital input), CCW drive is permitted. If the switch of CCW drive inhibition is OFF (the contact has been opened), CCW torque keeps 0.
The similar definition is for CW drive inhibition but in opposite direction.
If both CCW and CW drive inhibition are OFF, it will come to error alarm of drive inhibition input.
1: Cancel CCW or CW drive inhibition. No matter what state of the contact of CCW or CW drive inhibition inputs are, CCW or CW drive is allowed. Meanwhile, if the contacts of CCW and CW drive inhibition are OFF, it will not cause any alarm.</td><td>0-1</td><td>1</td></tr>
<tr><td>21</td><td>JOG speed</td><td>Set the running speed of JOG operating.</td><td>0-6000
rpm</td><td>100</td></tr>
<tr><td>22</td><td>The source of speed command</td><td>In speed control mode, it sets the source of speed command.
0: Analog Terminal AS+, AS- input analog speed command.
1: Internal speed command is decided by SP1 and SP2 digital inputs :
<table>
<tr><th colspan="2">DI Signal</th><th rowspan="2">Speed Command</th></tr>
<tr><th>SP2</th><th>SP1</th></tr>
<tr><td>0</td><td>0</td><td>Internal Speed 1 (Parameter PA24)</td></tr>
<tr><td>0</td><td>1</td><td>Internal Speed 2 (Parameter PA25)</td></tr>
<tr><td>1</td><td>0</td><td>Internal Speed 3 (Parameter PA26)</td></tr>
<tr><td>1</td><td>1</td><td>Internal Speed 4 (Parameter PA27)</td></tr>
</table>
Note: 1=ON, 0=OFF
2: Analog speed command + internal speed command:
<table>
<tr><th colspan="2">DI Signal</th><th rowspan="2">Speed Command</th></tr>
<tr><th>SP2</th><th>SP1</th></tr>
<tr><td>0</td><td>0</td><td>Analog Speed Command</td></tr>
<tr><td>0</td><td>1</td><td>Internal Speed 2 (Parameter PA25)</td></tr>
<tr><td>1</td><td>0</td><td>Internal Speed 3 (Parameter PA26)</td></tr>
<tr><td>1</td><td>1</td><td>Internal Speed 4 (Parameter PA27)</td></tr>
</table>
3: JOG speed command, if carry out JOG operation.
4: Keyboard speed command, if carry out Sr—operation.
5: control of JOG operation from digital input terminals.</td><td>0-5</td><td>0</td></tr>
<tr><td>23</td><td>Maximum speed limit</td><td>Set the highest speed of the servo motor.
It is independent to rotating direction.
If the setting value is beyond the rated speed of the motor, the rated speed of the motor is considered as the maximum permissible value.</td><td>0-6000
rpm</td><td>5000</td></tr>
<tr><td>24</td><td>Internal speed 1</td><td>In speed control mode (PA22=1), when SP1 and SP2 are OFF, internal speed 1 is as the speed command.</td><td>-6000~6000
rpm</td><td>100</td></tr>
</table>

<table>
<tr><td>25</td><td>Internal speed 2</td><td>In speed control mode (PA22=1 or 2), when SP1 is ON, while SP2 is OFF, internal speed 2 is as the speed command.</td><td>-6000~6000 rpm</td><td>500</td></tr>
<tr><td>26</td><td>Internal speed 3</td><td>In speed control mode (PA22=1 or 2), when SP1 is OFF, while SP2 is ON, internal speed 3 is as the speed command.</td><td>-6000~6000 rpm</td><td>1000</td></tr>
<tr><td>27</td><td>Internal speed 4</td><td>In speed control mode (PA22=1 or 2), when SP1 and SP2 are ON, internal speed 4 is as the speed command.</td><td>-6000~6000 rpm</td><td>2000</td></tr>
<tr><td>28</td><td>At speed
(Speed arrival)</td><td>Set the detection timing of the speed arrival output.
When the servomotor speed surpasses this parameter, the digital output (DO) ASP (arrival speed) is ON, otherwise is OFF.
The comparator has hysteresis function set by PA87.
Detection is associated with 10 r/min hysteresis.
 

3. It also has the polarity setting function:
<table>
<tr><td>PA88</td><td>PA28</td><td>Comparator</td></tr>
<tr><td>0</td><td>>0</td><td>Speed independent to direction</td></tr>
<tr><td rowspan="2">1</td><td>>0</td><td>Only detect CCW speed</td></tr>
<tr><td><0</td><td>Only detect CW speed</td></tr>
</table></td><td>0-3000 rpm</td><td>3000</td></tr>
<tr><td>29</td><td>Gain of analog torque command</td><td>1. Set the relation between input analog voltage for torque command and the actual motor running torque.
2. The setting value unit is 0.1v/100%.
3. The default value is 30, corresponding to 3v/100%. it means if the input voltage is 3V, it would generate 100% rated torque.</td><td>10-100 (0.1v/100%)</td><td>30</td></tr>
<tr><td>30</td><td>The alarm value of torque overload</td><td>1. The value is the percentage of rated torque. The limit is independent to direction and CW or CCW direction is protected.
2. When PA31＞9, motor torque＞PA30 and duration＞PA31, the drive alarms and the code is Err-29. The motor stops working. It must repower on after clearing errors.</td><td>1-300</td><td>300</td></tr>
<tr><td>31</td><td>The detection time for torque overload</td><td>1. The detection time for torque overload, unit:ms. Detection time=PA31×0.1；
2. When set to 0~9, the function of torque overload alarming is prohibited. In general,the value is set to 0.</td><td>0-32,767</td><td>0</td></tr>
<tr><td>32</td><td>The source of torque command</td><td>0: Analog input torque command by terminals AS+ and AS-.
1: Internal torque command by combination of TRQ1 and TRQ2 digital inputs (DI) which points to one of the parameters PA64, PA65, PA66, and PA67.
<table>
<tr><td colspan="2">DI Signal</td><td rowspan="2">Torque Command</td></tr>
<tr><td>TRQ2</td><td>TRQ1</td></tr>
<tr><td>0</td><td>0</td><td>Internal Torque1（Parameter PA64)</td></tr>
</table></td><td>0-1</td><td>0</td></tr>
</table>

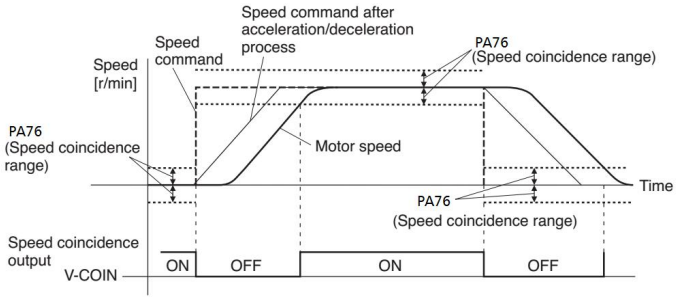
<table>
<tr><td></td><td></td><td>
<table>
<tr><td>0</td><td>1</td><td>Internal Torque2（Parameter PA65)</td></tr>
<tr><td>1</td><td>0</td><td>Internal Torque3（Parameter PA66)</td></tr>
<tr><td>1</td><td>1</td><td>Internal Torque4（Parameter PA67)</td></tr>
</table>
Note: 0=OFF, 1=ON
2: Analog torque command + internal torque command:
<table>
<tr><td colspan="2">DI Signal</td><td rowspan="2">Torque Command</td></tr>
<tr><td>TRQ2</td><td>TRQ1</td></tr>
<tr><td>0</td><td>0</td><td>Analog Torque Command</td></tr>
<tr><td>0</td><td>1</td><td>Internal Torque2（Parameter PA65)</td></tr>
<tr><td>1</td><td>0</td><td>Internal Torque3（Parameter PA66)</td></tr>
<tr><td>1</td><td>1</td><td>Internal Torque4（Parameter PA67)</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>33</td><td>Direction of analog torque command</td><td>When set to 0 and the analog torque command is positive, torque direction is CCW.
When set to 1 and the analog torque command is positive, torque direction is CW.</td><td>0-1</td><td>0</td></tr>
<tr><td>34</td><td>Internal CCW torque limit</td><td>1. The setting value is the percentage of rated torque.
2. It is always valid independence of the drive control mode.
3. If the setting value is bigger than the maximum overload capacity of the drive for the matched motor, the max overload capacity is concerned as the actual torque limit.</td><td>0~300%</td><td>300%</td></tr>
<tr><td>35</td><td>Internal CW torque limit</td><td>Refer to PA34.</td><td>-300~0%</td><td>-300%</td></tr>
<tr><td>36</td><td>Externally controlled CCW torque limit</td><td>1. It is valid only when the input terminal (FIL) of CCW torque limit is ON.
2. When the limit function is valid, the actual torque limit is the Minimum value of:
1: max overload capacity of the drive for matched motor,
2: internal CCW torque limit (PA34),
3: externally controlled CCW torque limit (PA36).</td><td>0~300%</td><td>100%</td></tr>
<tr><td>37</td><td>External CW torque limit</td><td>1. It is valid only when the input terminal (RIL) of CW torque limit is ON.
2. When the limit function is valid, the actual torque limit is the Minimum value of:
1: max overload capacity of the drive for matched motor,
2: internal CW torque limit (PA35),
3: externally controlled CW torque limit (PA37).</td><td>-300~0%</td><td>-100%</td></tr>
<tr><td>39</td><td>Zero offset compensation of analog torque command</td><td>Make an offset adjustment for analog torque command.</td><td>-2000~2000</td><td>0</td></tr>
<tr><td>40</td><td>Acceleration time constant</td><td>Linear acceleration / deceleration characteristics are available.
The setting value means the acceleration time of the motor from 0 rpm to 1000 rpm (or from 1000 rpm to 0 rpm).
It only applies in speed control mode, while is invalid in position control mode.
This parameter should be set to 0 if the drive is used in</td><td>1-10,000ms</td><td>100</td></tr>
</table>

		combination with an external position loop controller (like CNC controller) to avoid extra acc/dec which is not decided by the controller.		
41	Deceleration time constant	Refer to PA40.	1-10,000ms	100
43	Gain of analog speed command	1. Set the relation between input analog voltage for speed command and the actual motor running speed. 2. The setting value unit is 0.1v/100%. 3. The default value is 10; corresponding to 10 rpm/V, it means if the input voltage is 5V, it would run the motor at 50 rpm.	10-3000 rpm/V	300
44	Direction of analog speed command	1.If Set to 0 and analog speed command is positive, the speed direction is CCW. 2.If Set to 1 and analog speed command is positive, the speed direction is CW.	0-1	0
45	Zero offset compensation of analog speed command	Make an offset adjustment for analog speed command with this parameter.	-5000~5000	0
46	Filter of analog speed command	1.The input low pass filter of analog speed command. 2.If the setting value is bigger, the response frequency is quicker to speed input analog quantity and the influence of signal noise is higher.	1-1000Hz	300
47	Delay time for electromagnetic brake when servomotor is in standstill	1. Use the electromagnetic brake when SON is from ON to OFF or alarm occurs in the servo driver. This parameter defines the delay time from the action(the BRK is OFF from DO terminals) of The electromagnetic brake until excitation removal of the servomotor during the servomotor to be in static. 2.After setting, the parameter should not be smaller than the delay time in which the machinery applies the brake. This parameter will make the brake reliable and then turns off the servomotor excitation to guarantee against the small displacement of the servomotor or depreciation of the work piece. 3. The timing chart as follow:  	0-200 x10ms	0

48	Waiting time for electromagnetic brake when servomotor is in motion	1. Use the electromagnetic brake when SON is from ON to OFF or alarm occurs in the servo driver. This parameter defines the delay time from excitation removal of the servomotor until the action(the BRK is OFF from DO terminals) of the electromagnetic brake during the servomotor to be in motion. 2. This parameter will make the servomotor deceleration from high speed down to low speed and then applies the brake to avoid damaging the brake. 3. The actual action time is the smaller value between the parameter PA48 and the time in which the servomotor decelerates to the value of PA49. 4. The timing chart as below: 	0-200 ×10ms	50
49	Action speed for electromagnetic brake When servomotor is in motion	Refers to the explanation of parameter PA48.	0-3000 rpm	100
50	Speed limit in torque control mode	1: In torque control mode, the motor running speed is limited in the range of this parameter. 2: It prevents over-speed due to the light load.	0-5000 rpm	3000
51	Dynamic Electric Gear	1. If set to 0, the dynamic electric gear is invalid and the function of input terminal INH is command pulse prohibited.		
52	The numerator of the second position command pulse	To set the gear ratio of the second position command pulses. If use dynamic electric gear, it must set PA51=1. Then the function of input terminal INH(command pulse inhibition) is converted to an electronic gear switching to the input control terminal. When INH=OFF, the input electric gear is PA12/PA13; When INH=ON, the input electric gear is PA52/PA13; To change the percentage values through changing the electric ratio. Pay attention to the denominators of first and second electric gear are the same.	1-32767	1
53	8-bit low input terminal force ON control byte	To set the input terminal to force the ON effectively. 1.For unforced ON terminal, it needs to control ON in the external connection. For forced ON terminal, external connection is unnecessary, and it is automatic to set ON inside the drive. 2.8-bit binary number as representation, if it is 0, it means input	00000000-11111111	00000000

<table>
<tr><td></td><td></td><td>terminal does not force ON. If it is 1, it means input terminal forces ON. The binary numbers represent the input terminals as following:
RIL: CW torque limitation FIL: CCW torque limitation INH: Command pulse inhibit
CLE: Deviation counter clearance SON: Servo enable
ALRS: Alarming clearance FSTP: CCW drive inhibit RSTP: CW drive inhibit</td><td></td><td></td></tr>
<tr><td>54</td><td>The delay time of Servo-OFF</td><td>Set the delay time to cut off the motor current after the motor turns to Servo-OFF.</td><td>0~30000×
0.1ms</td><td>0</td></tr>
<tr><td>55</td><td>Control byte reversal of
8-bit input terminal</td><td>Set the reversal of input terminal.For the reversal terminal, if the switch is ON, it is invalid, while the switch is OFF, it is effective. 8-bit binary number as representation,when it is 0, the input terminal is not reversal, while it is 1, the terminal reverses.The binary numbers represent the input terminals as following:
<table>
<tr><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>RIL</td><td>FIL</td><td>INH</td><td>CLE</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>RSTP</td><td>FSTP</td><td>ALRS</td><td>SON</td></tr>
</table>
RIL: CW torque limit FIL:CCW torque limit
INH:Command pulse prohibition CLE:Deviation counter clear
SON: Servo-ON
ALRS: Alarm clear
FSTP: CCW drive prohibition RSTP: CW drive prohibition</td><td>00000000-11111111</td><td>00000000</td></tr>
<tr><td>56</td><td>Remain</td><td>Inner parameter of Servo System,remain for using</td><td>0</td><td>0</td></tr>
<tr><td>57</td><td>Reversal control byte of output terminal</td><td>Set the reversal of output terminal. The definitions of breakover and cut-off is contrary to standard definitions. Four bit binary as representation, when it is 0, the output terminal is not reversal, while it is 1, the output terminal reverses.The binary numbers represent the output terminals as following:
<table>
<tr><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>BRK</td><td>COIN</td><td>ALM</td><td>SRDY</td></tr>
</table>
SRDY: Servo ready ALM: Servo alarm
COIN: Positioning complete/ Speed arrival
BRK: Brake signal release</td><td>0000-1111</td><td>0000</td></tr>
<tr><td>58</td><td>Anti- jitter time constant of digital input terminals</td><td>1. If the value is smaller, the input terminal frequency response is faster.
2. If the value is bigger, the anti-jitter performance of input terminal is better, but the response frequency becomes slower.</td><td>1-20ms</td><td>2</td></tr>
<tr><td>59</td><td>Effective command pulse edge</td><td>0: the rising edge is effective
1: the falling edge is effective</td><td>0-1</td><td>0</td></tr>
<tr><td>60</td><td>Soft reset</td><td>0: Soft reset is invalid
1: Soft reset is effective and the system will be restart.</td><td>0-1</td><td>0</td></tr>
<tr><td>61</td><td>System alarm clear</td><td>0: System alarm clear is invalid
1: System alarm clear is effective</td><td>0-1</td><td>0</td></tr>
<tr><td>62</td><td>Encoder selection</td><td>0: 15-line incremental 2500-line encoder (A, B, Z, U, V, W)</td><td>0-1</td><td>0</td></tr>
</table>

		1: wire-saving 2500-line encoder (A, B, Z)		
63	Load inertia ratio	Set the ratio of load inertia to motor inertia. The setting value = [(load inertia + rotating inertia) / (rotating inertia)]x100.	1-500	100
64	Internal Torque 1	In torque control mode (PA4=2 and PA32=1), when TRQ1=OFF and TRQ2=OFF, internal torque 1 is as the torque command.	-300~300	0
65	Internal Torque 2	In torque control mode (PA4=2 and PA32=1), when TRQ1=ON and TRQ2=OFF, internal torque 2 is as the torque command.	-300~300	0
66	Internal Torque 3	In torque control mode (PA4=2 and PA32=1), when TRQ1=OFF and TRQ2=ON, internal torque 3 is as the torque command.	-300~300	0
67	Internal Torque 4	In torque control mode (PA4=2 and PA32=1), when TRQ1=ON and TRQ2=ON internal torque 4 is as the torque command.	-300~300	0
71	MODBUS ID No.	MODBUS communication ID No.	1-254	1
72	MODBUS communication baud rate	MODBUS communication baud rate	48-1152 ×100	96
73	MODBUS protocol selection	0: 8, N, 2 (MODBUS, RTU) 1: 8, E, 1 (MODBUS, RTU) 2: 8, O, 1 (MODBUS, RTU) The parameter decides the communication protocol. Value 8 represents the transmitted data is 8 bits long; N, E, O indicates “none”, “even” and “odd” priority, respectively. Value 1 or 2 indicates communication of 1 byte or 2 bytes.	0-2	0
74	Communication error handing	When communication is wrong, choose: 0: keep working, OR 1: Alarm and stop working	0-1	0
75	Range for zero speed detection	1. If the motor running speed is less than the value of this parameter, the ZSP (zero speed) of digital output (DO) is ON, and else is OFF. 2. If ZCLAMP of digital input (DI) is ON and speed command is less than the value of this parameter, the value of speed command is forced to be zero and the motor stops. 3. The comparator has hysteresis function. It is set by PA92.	0-1000 rpm	10
76	Speed Coincidence Range	1. Set the speed coincidence(VCOIN) output detection timing. 2. Output the speed coincidence(VCOIN ON) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter PA76, otherwise is OFF. For example, PA76=10 and the command speed is 1000rpm, while the actual speed ranges from 990rpm~1010rpm, then the digital output VCOIN is ON.	0-1000 rpm	10

		 * Because the speed coincidence detection is association with 10 r/min hysteresis, actual detection range is as shown below: Speed coincidence output OFF → ON timing(PA76-10)r/min Speed coincidence output ON → OFF timing(PA76+10)r/min		
77	2nd numerator of electronic gear ratio	Refer to parameter PA12	0-32,767	0
78	3rd numerator of electronic gear ratio	Refer to parameter PA12	0-32,767	0
79	4th numerator of electronic gear ratio	Refer to parameter PA12	0-32,767	0
80	Effective level of **Direction (SIGN)**	0: High level is positive direction 1: Low level is positive direction	0-1	0
81	PULS input command filter	1. To filter the input PULS command. 2. The default value (4) is correspondent to the maximum pulse input frequency, which is 500Khz. If the value of this parameter is bigger, the maximum workable input frequency will be smaller. 3. To filter the noise from the signal line in order to avoid incorrect counting. If it goes wrong due to the incorrect counting, you can increase the value of this parameter properly. 4. After editing this parameter, you must save it and turn the drive OFF and ON to make it effective.	0-15	4
82	SIGN input command filter	1. To filter the input SIGN command. 2. The default value (4) is correspondent to the maximum pulse input frequency, which is 500Khz (when used in CW/CCW pulse mode). If the value of this parameter is bigger, the maximum workable input frequency will be smaller. 3. To filter the noise from the signal line in order to avoid incorrect counting. If it goes wrong due to the incorrect counting, you can increase the value of this parameter properly. 4. After editing this parameter, you must save it and turn the drive OFF and ON to make it effective.	0-15	4
83	CWL/CCWL inhibit method	When the machine touches the mechanical limit switch at any end of stroke and activates CW/CCW limit, you can choose the following methods to work with this parameter. 0: To limit the torque in the current direction to be 0. 1: The input pulse of the current direction is inhibited.	0-1	0
84	Hysteresis for positioning completion	Refer to parameter PA16.	0-32,767 pulse	5

<table>
<tr><td>85</td><td>Range for approach positioning</td><td>1. To set the pulse range of approach positioning under the position control mode.
2. When the pulse number in position deviation counter is smaller than or equal to the setting value of this parameter, the digital output (DO) NEAR(approach positioning) is ON, otherwise is OFF.
3. The comparator has hysteresis function set by PA86.
4. Use this function in case that in near positioning, the host controller is accepting the NEAR signal to carry on the preparation to the next step. In general, this parameter value should be bigger than PA16.</td><td>0-32,767 pulse</td><td>500</td></tr>
<tr><td>86</td><td>Hysteresis for approach positioning</td><td>Refer to parameter PA85.</td><td>0-32,767 pulse</td><td>50</td></tr>
<tr><td>87</td><td>Hysteresis of arrival speed</td><td>Refer to parameter PA28.</td><td>0-5000 rpm</td><td>30</td></tr>
<tr><td>88</td><td>Polarity of arrival speed</td><td>Refer to parameter PA28.
The polarity setting function:
<table>
<tr><td>PA88</td><td>PA28</td><td>Comparator</td></tr>
<tr><td>0</td><td>>0</td><td>Speed independent to direction</td></tr>
<tr><td rowspan="2">1</td><td>>0</td><td>Only detect CCW speed</td></tr>
<tr><td><0</td><td>Only detect CW speed</td></tr>
</table>
.</td><td>0-1</td><td>0</td></tr>
<tr><td>89</td><td>Arrival torque</td><td>1. When the servomotor torque surpasses this parameter, the digital output (DO) ATRQ (arrival torque) is ON, otherwise is OFF.
2. The comparator has hysteresis function set by PA90.
3.It also has the polarity setting function:
<table>
<tr><td>PA91</td><td>PA89</td><td>Comparator</td></tr>
<tr><td>0</td><td>>0</td><td>Torque independent to direction</td></tr>
<tr><td rowspan="2">1</td><td>>0</td><td>Only detect CCW torque</td></tr>
<tr><td><0</td><td>Only detect CW torque</td></tr>
</table></td><td>-300% ~300%</td><td>100%</td></tr>
<tr><td>90</td><td>Hysteresis of arrival torque</td><td>Hysteresis for PA89.</td><td>0-300%</td><td>5%</td></tr>
<tr><td>91</td><td>Polarity of arrival torque</td><td>Refer to parameter PA89.
The polarity setting function:
<table>
<tr><td>PA91</td><td>PA89</td><td>Comparator</td></tr>
<tr><td>0</td><td>>0</td><td>Torque independent to direction</td></tr>
<tr><td rowspan="2">1</td><td>>0</td><td>Only detect CCW torque</td></tr>
<tr><td><0</td><td>Only detect CW torque</td></tr>
</table></td><td>0-1</td><td>0</td></tr>
<tr><td>92</td><td>Hysteresis of zero speed detection</td><td>Hysteresis for PA75.</td><td>0-1000 rpm</td><td>5</td></tr>
<tr><td>94</td><td>The delay time of brake on</td><td>This parameter defines the delay time from the servomotor energized until the action(the digital output(DO) BRK is ON).</td><td>0-200×10ms</td><td>0</td></tr>
</table>

7.2 P3 Group Parameter

7.2.1 Parameter Table

SZGH-SD Series servo drivers have 4 Digital Input terminals and 4 Digital Output terminals. which can be re-defined their functions through P3 group parameters.

Default valid level of Input pins is Low level.

Parameter	Definition	Range	Default Value
P3-0	Digital Input DI1 Function	0-99	1
P3-1	Digital Input DI2 Function	0-99	2
P3-2	Digital Input DI3 Function	0-99	3
P3-3	Digital Input DI4 Function	0-99	4
P3-4	Digital Input DI5 Function	0-99	8
P3-5	Digital Input DI6 Function	0-99	21
P3-6	Digital Input DI7 Function	0-99	5
P3-7	Digital Input DI8 Function	0-99	6
P3-15	Digital Input DI forced effective1	00000000-11111111	00000000
P3-16	Digital Input DI forced effective2	00000000-11111111	00000000
P3-17	Digital Input DI forced effective3	00000000-11111111	00000000
P3-20	Digital Output DO1 Function	0-99	2
P3-21	Digital Output DO2 Function	0-99	3
P3-22	Digital Output DO3 Function	0-99	5
P3-23	Digital Output DO4 Function	0-99	8
P3-30	Virtual Input Control	0-1	0
P3-31	Virtual Input Statues Value	00000000-11111111	00000000
P3-32	Virtual Output Control	0-1	0
P3-33	Virtual Output Statues Value	00000000-11111111	00000000

7.2.2 DI Function Explanation

Digital Input terminals (4 input terminals are corresponding to the definitions of P3-0, P3-1, P3-2, P3-3)

Value	Symbol	Function	Explanation
0	NULL	No	Input is deactivated.
1	SON	Servo Enable	Input terminal of servo enable. OFF: servo drive is not enabled and servo motor is not energized. ON: servo drive is enabled and servo motor is energized.
2	ARST	Alarm Clear	Input terminal of alarm clear. When an alarm occurs and the alarm has permission to be cleared, then the rising edge of ARST will clear the alarm. Attention: only some part of alarms has the permission to be cleared.
3	CCWL	CCW Drive Inhibition	1. Input terminal of CCW drive inhibition: OFF: Inhibit CCW running. ON: Enable CCW running. 2. Use this function for protection of the mechanical stroke limit. The function is controlled by the parameter PA20. Pay attention that the default value of PA20 neglects this function. Therefore you need to modify PA20 if need to use this function: (1): When PA20=0, the function of input inhibition is effective. Order to inhibit for CCW direction is decided by PA83. (2): When PA20=1, the function of input inhibition is not effective. 2. Inhibition function is valid (PA20=0): **(1)** PA83=0, CCW torque limit is 0, but it does not limit CCW pulse input. **(2)** PA83=1, it inhibits CCW pulse input.
4	CWL	CW Drive Inhibition	1. Input terminal of CW drive inhibition: OFF: Inhibit CW running. ON: Enable CW running. 2. Use this function for protection of the mechanical stroke limit. The function is controlled by the parameter PA20. Pay attention that the default value of PA20 neglects this function. Therefore you need to modify PA20 if need to use this function: (1): When PA20=0, the function of input inhibition is effective. Order to inhibit for CW direction is decided by PA83. (2): When PA20=1, the function of input inhibition is not effective. 3. Inhibition function is valid (PA20=0): **(1)** PA83=0, CW torque limit is 0, but it does not limit CW pulse input. **(2)** PA83=1, it inhibits CW pulse input.
5	TCCW	CCW Torque Limitation	OFF: Torque is not limited by parameter PA36 in CCW direction. ON: Torque is limited by parameter PA36 in CCW direction. Attention: Whether the TCCW is effective or not, the torque is also limited by PA34 in CCW direction.
6	TCW	CW Torque Limitation	OFF: Torque is not limited by parameter PA37 in CW direction. ON: Torque is limited by parameter PA37 in CW direction. Attention: Whether the TCW is effective or not, the torque is also limited by

			PA35 in CW direction.
7	ZCLAMP	Zero Speed Clamping	When the following conditions are satisfied, the function of zero speed clamping is activated (speed is forced to zero): 1: speed control mode (PA4=1) and external speed source is chosen (PA22=0). 2: ZCLAMP digital input is ON. 3: speed command is lower than the value of PA75. When any one of the above conditions is not satisfied, it will perform normal speed control.
8	CZERO	Zero Command	In speed or torque control mode, speed or torque input command will be: OFF: Normal command ON: Zero command
9	CINV	Command inverse	In speed or torque control mode, speed or torque command will be: OFF: Normal command ON: Reverse Command
10	SP1	Speed Choice 1	In speed control mode (PA4=1) and internal speed selection (PA22=1). SP1 and SP2 combinations are used to select different internal speeds: SP2= OFF, SP1= OFF: internal speed 1PA-24) SP2= OFF, SP1= ON: internal speed 2 (PA-25) SP2= ON, SP1= OFF: internal speed 3 (PA-26) SP2 =ON, SP1= ON: internal speed 4 (PA-27)
11	SP2	Speed Choice 2	
13	TRQ1	Torque Choice 1	In torque control mode (PA4=2) and internal torque selection (PA32=1). TRQ1 and TRQ2 combinations are used to select different internal torque: TRQ2 =OFF, TRQ1= OFF: internal torque 1 (PA-64) TRQ2 =OFF, TRQ1= ON: internal torque 2 (PA-65) TRQ2 =ON, TRQ1= OFF: internal torque 3 (PA-66) TRQ2 =ON, TRQ1= ON: internal torque 4 (PA-67)
14	TRQ2	Torque Choice 2	
16	CMODE	Mix Control Mode	When PA4 is set to 3, 4, 5, it is in mix control mode. It can change control mode with this input terminal: (1)PA4=3, CMODE =OFF, it is position control mode; CMODE =ON, it is speed control mode; (2)PA4=4, CMODE =OFF, it is position control mode; CMODE =ON, it is torque control mode; (3)PA4=5, CMODE= OFF, it is speed control mode; CMODE= ON, it is torque control mode.
18	GEAR1	Electronic Gear 1	When PA11=0, Gear1 and Gear2 combinations are used to select different numerator of gear ratio: GEAR2 =OFF, GEAR1 =OFF: numerator 1 (PA-12) is selected. GEAR2= OFF, GEAR1 =ON: numerator 2 (PA-77) is selected. GEAR2= ON, GEAR1= OFF: numerator 3 (PA-78) is selected. GEAR2= ON, GEAR1= ON: numerator 4 (PA-79) is selected.
19	GEAR2	Electronic Gear 2	
20	CLR	Position Deviation Clear	In position control mode, it is the position deviation counter clear input terminals.
21	INH	Input Pulse Inhibit	In position control mode it is position command pulse inhibit terminal: OFF: permits the position command pulse to go through the drive.

<table>
<tr><td></td><td></td><td></td><td>ON: position command pulse is inhibited (motor stops even if the controller sends the command pulse).</td></tr>
<tr><td>22</td><td>JOGP</td><td>CCW Inching</td><td>In speed control mode, if PA22=5, by activating this input, motor starts in inching motion in CCW direction with a speed which is set by PA21.
Attention: If both JOGP and JOGN inputs are activated simultaneously, inching function does not work.</td></tr>
<tr><td>23</td><td>JOGN</td><td>CW Inching</td><td>In speed control mode, if PA22=5, by activating this input, motor starts in inching motion in CW direction with a speed which is set by PA21.
Attention: If both JOGP and JOGN inputs are activated simultaneously, inching function does not work.</td></tr>
<tr><td>27</td><td>HOLD</td><td>Internal Position Control Command Stops</td><td>When at internal position register mode, the signal ON and motor will stop motion.(Only can be used when internal position mode parameter PA-14=3)</td></tr>
<tr><td>28</td><td>CTRG</td><td>Internal Position Command trigger</td><td>Chose POS0-2(Internal Position register control command) when at internal position register mode, then signal will be triggered, and motor motion according to the command. Only after output ZSPD=1, it would received the next internal position command.</td></tr>
<tr><td>29</td><td>POS0</td><td>Internal Position Command selection 0</td><td rowspan="3">
<table>
<tr><th>Position Command</th><th>POS2</th><th>POS1</th><th>POS0</th><th>CTRG</th><th>Corresponding Parameter</th></tr>
<tr><td rowspan="2">P1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P4-2</td></tr>
<tr><td>P4-3</td></tr>
<tr><td rowspan="2">P2</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P4-5</td></tr>
<tr><td>P4-6</td></tr>
<tr><td rowspan="2">P3</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P4-8</td></tr>
<tr><td>P4-9</td></tr>
<tr><td rowspan="2">P4</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P4-11</td></tr>
<tr><td>P4-12</td></tr>
<tr><td rowspan="2">P5</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P4-14</td></tr>
<tr><td>P4-15</td></tr>
<tr><td rowspan="2">P6</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P4-17</td></tr>
<tr><td>P4-18</td></tr>
<tr><td rowspan="2">P7</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P4-20</td></tr>
<tr><td>P4-21</td></tr>
<tr><td rowspan="2">P8</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P4-23</td></tr>
<tr><td>P4-24</td></tr>
</table>
</td></tr>
<tr><td>30</td><td>POS1</td><td>Internal Position Command selection 1</td></tr>
<tr><td>31</td><td>POS2</td><td>Internal Position Command selection 2</td></tr>
<tr><td>33</td><td>SHOM</td><td>Start Homing</td><td>When at internal register mode, the origin need to be found and the searching origin function is started after the signal connected.(Please consult the setting about P4-34)</td></tr>
<tr><td>34</td><td>ORGP</td><td>The Origin</td><td>Searching origin when at internal register mode, the point will become origin after servo system connected.(Please consult the setting of P4-32.)</td></tr>
</table>

7.2.3 DO Function Explanation

Digital Output terminals (4 Output terminals are corresponding to the definitions of P3-20, P3-21, P3-22, P3-23)

Value	Symbol	Function	Explanation
1	ON	Always valid	Forced Output ON.
2	RDY	Servo Ready	OFF: servo main power supply is OFF, or there is an alarm. ON: servo main power supply is normal, no alarm.
3	ALM	Alarm	OFF: there is an alarm. ON: no alarm.
4	ZSP	Zero Speed	In speed or torque control mode: OFF: motor speed is higher than the value of PA-75 (independent to direction). ON: motor speed is lower than the value of PA-75 (independent to direction).
5	COIN	Positioning Completion	In position control mode: OFF: position deviation is bigger than parameter PA-16. ON: position deviation is smaller than parameter PA-16.
6	ASP	At Speed	In speed or torque control mode: OFF: motor speed is lower than parameter PA28. ON: motor speed is higher than parameter PA28. Refer to the explanation of PA28 for polarity selection.
7	ATRQ	At Torque	OFF: motor torque is lower than parameter PA89. ON: motor torque is higher than parameter PA89. Refer to the explanation of PA89 for polarity selection.
8	BRK	Electromagnetic Brake	OFF: electromagnetic brake engages the brake with rotor. ON: electromagnetic brake releases the brake from rotor.
9	RUN	Servo Running	OFF: servo motor is not energized. ON: servo motor is energized.
10	NEAR	Approach Position	In position control mode: OFF: position deviation is bigger than parameter PA-85. ON: position deviation is smaller than parameter PA-85.
11	TRQL	Torque Limitation	OFF: motor torque has not reached the limitation. ON: motor torque has reached the limitation. Torque limitation is set by PA34, PA35, PA36 and PA37.
12	SPL	Speed Limitation	In torque control mode: OFF: motor speed has not reached the limitation. ON: motor speed has reached the limitation. Speed limitation is set by PA-50.
13	VCOIN	Speed Coincidence Range	Output the speed coincidence(VCOIN ON) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter PA76, otherwise is OFF.
15	HOME	Origin regression complete	OFF:Origin regression not completed, no output signal ON:Origin regression completed, output signal
16	CMDOK	Internal Position Command complete	OFF:When internal position command not competed or stop, no output signal.

			ON;When internal position command competed or stop, output signal after the time set by P4-1.

7.2.4 DI Forced activated

There are 3 parameters (P3-15, P3-16, and P3-17) in P3-group which are used to turn the digital inputs ON and OFF by bits. They are useful when you need to communicate with drive through MODBUS protocol.

(1) Corresponding functions for P3-15 is represented by 8-bit binary:

bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Function	CZERO	ZCLAMP	TCW	TCCW	CWL	CCWL	ARST	SON

(2) Corresponding functions for P3-16 is represented by 8-bit binary:

bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Function	CMODE	NULL	TRQ2	TRQ1	NULL	SP2	SP1	CINV

(3) Corresponding functions for P3-17 is represented by 8-bit binary:

bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Function	NULL	JOGN	JOGP	INH	CLR	GEAR2	GEAR1	NULL

(4) Corresponding functions for P3-18 is represented by 8-bit binary:

bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Function	NULL	POS2	POS1	POS0	CTRG	HOLD	NULL	NULL

(5) Corresponding functions for P3-19 is represented by 8-bit binary:

bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Function	NULL	NULL	NULL	NULL	NULL	NULL	ORPG	SHOM

Parameter explanation:

Already Planned means functions of parameters has been chosen by P3-0~P3-3 in digital input definition DI1~DI4 section.

Unplanned means functions of parameters has not been chosen by P3-0~P3-3.

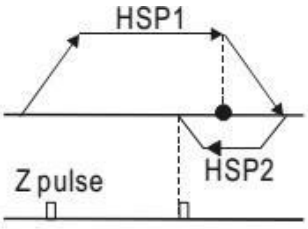
ANY of 3 parameters	**Corresponding Function**	**Result**
0	Unplanned	OFF (forced Deactivated）
	Already Planned	Its function is according to its definition through related parameter P3-0~P3-3.
1	Either Unplanned Or Already Planned	ON (forced Activated）

7.3 P4 Group Parameter

NO.	Para.name	Function	Parameter Range	Initial Value
P4-0	Internal position instruction control mode	0:Absolute position instruction 1:Incremental position instruction	0-1	0
P4-1	Internal position command completes digital output delay	After the internal command or stop and then waiting for the while set by P4-1, Output internal position to finish DO signal. When P4-1 set to 0, the ZSPD set to 1, it will received the signal to trigger internal position command. Setting P4-1 set to other number, or setting to 1 after DO signal finished Internal Position Command complete(CMDOK), and the Internal Position Command can be triggered by DI Signal Command trigger(CTRG).	0~200ms	0
P4-2	Setting the laps of position of internal position instruction 1	Setting the laps of position at the first step internal position.	-30000~30000	0
P4-3	Setting the pulse of internal position instruction 1	1.Setting the position and pulse at the first internal position 2.Internal position instruction 1= the value of laps in position+the value of pulse at first internal position.	+/-max. cnt/rev	0
P4-4	Setting speed of internal position control 1	Setting speed of internal position control 1	0-5000r/min	1000
P4-5	Setting the laps at position of internal position instruction 2	Setting the laps at position of internal position instruction 2	-30000-30000	0
P4-6	Setting the pulse in one cycle at position of internal position instruction 2	Setting the laps at position of internal position instruction 2 Internal position instruction 2= the value of laps in position+the value of pulse at second internal position.	+/-max. cnt/rev	0
P4-7	Setting speed of internal position control 2	Setting speed of internal position control 2	0-5000r/min	1000
P4-8	Setting the laps at position of internal position instruction 3	Setting the laps at position of internal position instruction 3	-30000-30000	0

P4-9	Setting the pulse in one cycle at position of internal position instruction 3	Setting the laps at position of internal position instruction 3 Internal position instruction 3= the value of laps in position+the value of pulse at third internal position.	+/-max. cnt/rev	0
P4-10	Setting speed of internal position control 3	Setting speed of internal position control 3	0-5000r/min	1000
P4-11	Setting the laps at position of internal position instruction 4	Setting the laps at position of internal position instruction 4	-30000-30000	0
P4-12	Setting the pulse in one cycle at position of internal position instruction 4	Setting the laps at position of internal position instruction 4 Internal position instruction 4= the value of laps in position+the value of pulse at forth internal position.	+/-max. cnt/rev	0
P4-13	Setting speed of internal position control 4	Setting speed of internal position control 4	0-5000r/min	1000
P4-14	Setting the laps at position of internal position instruction 5	Setting the laps at position of internal position instruction 5	-30000-30000	0
P4-15	Setting the pulse in one cycle at position of internal position instruction 5	Setting the laps at position of internal position instruction 5 Internal position instruction 5= the value of laps in position+the value of pulse at fifth internal position.	+/-max. cnt/rev	0
P4-16	Setting speed of internal position control 5	Setting speed of internal position control 5	0-5000r/min	1000
P4-17	Setting the laps at position of internal position instruction 6	Setting the laps at position of internal position instruction 6	-30000-30000	0
P4-18	Setting the pulse in one cycle at position of internal position instruction 6	Setting the laps at position of internal position instruction 6 Internal position instruction 6= the value of laps in position+the value of pulse at sixth internal position.	+/-max. cnt/rev	0
P4-19	Setting speed of internal position control 6	Setting speed of internal position control 6	0-5000r/min	1000
P4-20	Setting the laps at position of	Setting the laps at position of internal position instruction 7	-30000-30	0

	internal position instruction 7		000	
P4-21	Setting the pulse in one cycle at position of internal position instruction 7	Setting the laps at position of internal position instruction 7 Internal position instruction 7= the value of laps in position+the value of pulse at seventh internal position.	+/-max. cnt/rev	0
P4-22	Setting speed of internal position control 7	Setting speed of internal position control 7	0-5000r/min	1000
P4-23	Setting the laps at position of internal position instruction 8	Setting the laps at position of internal position instruction 8	-30000-30000	0
P4-24	Setting the pulse in one cycle at position of internal position instruction 8	Setting the laps at position of internal position instruction 2. Internal position instruction 8= the value of laps in position+the value of pulse at seventh internal position.	+/-max. cnt/rev	0
P4-25	Setting speed of internal position control 8	Setting speed of internal position control 8	0-5000r/min	1000
P4-32	Origin detector type and search direction setting	0: Return to origin forward, as CCWL as origin 1:Return to origin reverse, as CWL as origin 2:Return to origin forward, as ORGP as origin 3:Return to origin reverse, as ORGP as origin 4:Search Z pulse and used it as origin forward. 5:Search Z pulse and used it as origin reverse.	0-5	0
P4-33	The setting of short range movement mode to reach the origin	0: Found reference origin,then find Z pulse as mechanical origin inversely 1:Found reference origin and further to find Z pulse as mechanical origin 2:Find the rising edge of ORGP detector as mechanical origin and then decelerate to stop(when P4-33 set to 2, P4-32 can set to 2, 3, 4, 5.	0-2	0
P4-34	Origin regression start mode	0: Close 1: Execution automatically when power on 2: Origin regression activated when origin searching function(SHOM) input contact.	0-2	0
P4-35	Origin cease mode setting	0: After origin detection finished, motor come back to origin with deceleration 1: After origin detection finished, motor decelerate to stop further.	0-1	0

P4-36	The origin regression speed setting at 1st high speed range(HSPD1)	Setting the origin regression speed at 1st high speed range  	1-2000 r/min	1000
P4-37	The origin regression speed setting at 2nd high speed range(HSPD2)	Setting the origin regression speed at 2nd high speed range	1-500 r/min	50
P4-38	The number of offset cycles should move after origin regression (HOF1)	Setting the number of offset cycles	-30000 ~ +30000	0
P4-39	The number of offset pulse should move after origin regression (HOF2)	Setting the number offset pulse When HOF1 and HOF2 are setting to 0, the origin will be chosen to Z pulse or ORPG according to the type of origin regression.If setting to another value, origin will additionally add (HOF×10000+HOF2) as new origin at the base of chosen Z pulse or ORGP	+/-max. cnt/rev	0

Chapter 8 Alarm

8.1 Alarm Message

Alarm No.	Fault Name	Reason of alarm
--	Normal	
1	Over-speed	Motor speed is greater than the setting value
2	Main circuit over-voltage	The voltage of main circuit is too high
3	Main circuit under-Voltage	The voltage of main circuit is too low
4	Over-travel	The value of position deviation counter is more than the limit value.
5	Drive over-heat	The temperature of the drive is too high
6	Speed amplifier saturation fault	Motor speed has not reached to the Speed command for long time
7	Drive inhibition abnormal	The inputs of CW/CCW drive inhibition are not effective
8	Position deviation accumulation is out of range	Absolute value of position deviation accumulation is greater than 2^{30} pulses.
9	Encoder error	Encoder Signal Error
10	Disconnection alarm	Power line UVW to motor is disconnected or one phase is disconnected
11	IPM module error	IPM smart module error
13	Drive over-load	Servo drive and motor over-load (or over-heat instantaneously)
14	Brake fault	Regenerative brake resistor circuit Error
15	Encoder counter error	Encoder counts wrongly
19	Delay to open the brake	PA94 was set too big
20	EEPROM error	EEPROM error
21	FPGA module error	FPGA module function is abnormal
23	Current sampling circuit fault	Current sensor or sampling circuit fault
29	Alarm for torque overload	PA30 and PA31 settings are unreasonable; Large load suddenly occurs
30	Encoder Z-pulse missing	Encoder Z-pulse error
31	Encoder UVW signal error	Encoder UVW signal corrupted; Encoder Z signal corrupted; Bad cables; Bad shielding of cables; The shielding ground is not connected well; The circuit around the encoder interface occurs error
32	Illegal coding of encoder UVW signal	All UVW signal of the encoder are in high level or low level, Or the encoder is mismatched.
33	UVW signal fault	No high-Z at encoder outputs in powering ON of the drive

34	UVW signal unstable	UVW signal unstable
36	When connecting to 9-line encoder, illegal states for long time	When connecting to 9-line encoder, illegal states for long time at encoder outputs
42	AC input under-voltage	AC input under-voltage
44	Phase of Input power lost	Specially for SZGH-SD4038/SZGH-SD4075 1: Power input lost phase 2: Connection of input power isnot good or under-voltage.
47	Over-voltage when main circuit in power ON	Over-voltage when main circuit in power ON
55	CRC check occurs errors for 3 times in a row	The check for internal communication occurs error
56	MODBUS frame is too long	Data Receiving from MODBUS frame is too long
57	MODBUS serial communication abnormal	Internal communication abnormal

8.2 Fault Code

Symbol	Name	Code 603Fh	Resetable Or Not
1	Over speed	0x8400	Yes
2	Bus overvoltage fault	0x3210	Yes
3	Bus undervoltage fault	0x3220	Yes
4	The position deviation is too large	0x8611	Yes
5	Over heat	0x4210	Yes
6	Speed amplifier saturation	0x1000	Yes
7	Drive inhibit exception	0x1000	Yes
8	Position deviation counter overflow	0x1000	Yes
9	Encoder signal error difference signal detection error	0x7305	Yes
11	Hardware (short) protection IPM smart module failure	0x5400	No
12	Over current	0x2220	No
13	Overload	0x3230	Yes
14	Brake circuit failure	0x1000	Yes
15	Encoder count exception	0x7305	Yes
18	Relay fault	0x1000	Yes
19	The pulses input when the brake is delayed.	0x7110	Yes
20	Parameter storage exception	0x6320	No
21	FPGA module failure	0x7500	No
23	Ad sampling module failure	0x0FFF	No
29	User-defined overload alarm	0x3230	Yes
30	Encoder Z-signal error	0x7305	No
31	Encoder UVW signal error	0x0FFF	No
32	UVW signal has full height or full low level.	0x0FFF	No
33	Save-line encoder signal error	0x7305	No
34	Encoder signal error	0x7305	No

36	The full time charging for the encoder is too long.	0x7305	No
42	AC undervoltage fault	0x3220	No
44	AC phase deficiency	0x3130	No
47	Over voltage happens when powering on	0x3210	No
50	No communication link established.	0x7305	No
51	Communication interrupt	0x7305	No
52	Battery voltage alarms but it can also be used, it needs to be replaced	0x7305	Yes
53	Battery voltage error and is unavailable to use. It must be replaced.	0x7305	Yes
54	Information of multiple cycles is needed to be reset due to other errors which are not battery error	0x7305	Yes
55	Three consecutive errors in CRC effect verification.	0x7305	No
56	The received MODBUS frame data is too long.	0x7305	No
57	Serial communication abnormal error	0x7305	Yes
58	The counting of single turn encoder happened error and it needs to be turned on and restarted.	0x7305	No
59	Validation error occurred in CF domain	0x7305	No
60	50us interrupt timeout	0x1000	No
61	Slave station communication anomaly	0x7500	Yes
62	Exceed the soft limit	0x5443 (Positive)/ 0x5444 (Negative)	Yes

8.3 Solution for Solve Alarm

Alarm No.	Alarm name	Motion state	Reason	Measures
1	Overspeed	Emerge with connecting control power	The board of control electric circuit in trouble. Encoder in trouble.	Exchange the servo driver. Exchange the servo motor.
		Emerge with motor working	The pulse frequency input too high	Input pulse frequency correctly
			Acceleration/Deceleration time is so short that speed overshoot is too large	Increase the number of acceleration/deceleration time
			It is large for the rate of electronic gear	Setting it correctly
			Encoder in trouble	Exchange the servo motor
			Encoder cable in trouble	Exchange the encoder cable
			The unstable servo system lead to speed	Reset the gain number If unable to set to appropriate number, please try to decrease

			overshoot	the dynamic inertia ratio.
		Emerge once motor be in motion	Excessive load	Decrease the loads Replace driver and motor by high power
			Error for zero point of encoder. Error for connection of motor cable(U, V, W). Error for connection of encoder cable.	Exchange the servo motor. Demand manufacturer to reset zero point of encoder. Connection cable correctly.
2	Main circuit over voltage	Emerge with connecting control power	The circuit board breakdown	Exchange the servo driver
		Emerge with connecting main circuit	Power supply voltage is too high Power supply voltage waveform abnormally	Check up the power supply
		Emerge with motor working	Brake resistance disconnected.	Recover the connection
			Brake transistor breakdown. Internal brake resistance breakdown.	Exchange the servo driver
			The resistance is insufficient	Reduce the frequency of Start-Stop Increase the number of acceleration/deceleration time Decrease the limited number of torque. Decrease the loads inertia. Replace the driver and motor by high power
3	Main circuit under voltage	Emerge with connecting main circuit	The board of circuit breakdown. The insurance of power supply breakdown. The soft-startup power supply in trouble Rectifier breakdown.	Exchange servo driver
			The power supply under voltage. The time of power cut more than 20 seconds	Check the power supply
		Emerge with motor	The power capacity is not enough. Instantaneous power	Check the power supply

		working	failure.	
			Heatsink OT	Check the case of loads
4	Position overshoot	Emerge with connecting control power	The board of power breakdown.	Exchange the servo driver
		After everything were installed,the motor not to rotate or reverse	Zero point change for encoder. Encoder breakdown.	Adjust the zero point for encoder. Exchange the servo driver.
		Emerge with motor working	The detection range of position overshoot is too small.	Increase the detection of position overshoot.
			Position proportional gain is too small	Increase the number of gain
			Torque deficiency	Check the limited number of torque. Decrease the loads. Switch to more powerful drivers and motors.
			The pulse frequency of instruction too high	Decrease the frequency
			Zero change of encoder	Reset the zero of encoder
5	Driver overheatin g	Emerge during the motion of driver	The board of circuit in trouble. Driver overheating.	Decrease the temple of driver. Exchange the servo driver.
6	The speed increase reach even more than the largest limitation	Emerge with motor working	Overload. The motor was stuck by machine.	Decrease the load. Switch to more powerful drivers and motors. Check the load part of machine.
7	The stop			Check the connection of cable

	instruction of driver is abnormal		The driver plug for input CW/CCW disconnected.	
8	The date exceed the limitation Position deviation counter		The motor was stuck by machine. Input instruction pulse abnormality.	Check the load part of machine. Check instruction pulse. Check whether the motor rotates according to the instruction pulse.
11	PM module failure	Emerge with connecting control power	Circuit board fault	Exchange the servo driver
			Under voltage. Overheating.	Check the driver Power on again Exchange the driver
			The motor cable(U, V,W) Short-circuit	Check the cable connection
		Emerge with motor working	Bad contact of ground wire.	Connection correctly
			The insulation was damaged.	Exchange the motor
			Be disturbed	Add line Filter Far away from the disturb origin
		Emerge with connecting control power	The circuit board fault	Exchange the servo driver
		Emerge with motor	Motion over rated torque	Check the load. Decrease the frequency of Star-stop. Decrease the limitation of torque witch to more powerful drivers and motors.
			Holding brake close	Check the brake
			Motor unstable oscillation	Adjust the gain Increase the time of

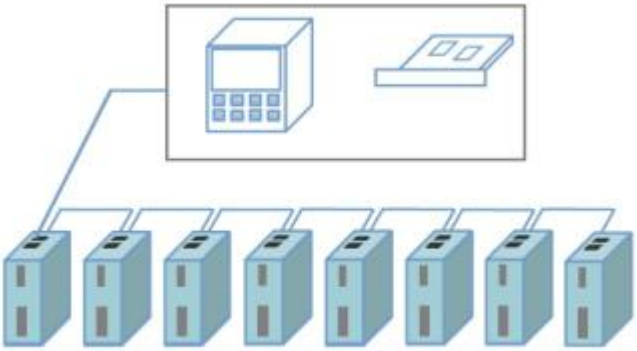
13	Overload	working		acceleration/deceleration Reducing load inertia
			One of U, V,W cable disconnected. Error connection of encoder cable.	Check the connection of cable
14	Brake failure		Brake circuit failure	Exchange the driver
15	Encoder counting error		Encoder breakdown Incorrect number of encoder line The encoder disc breakdown False Z signal exist in encoder.	Exchange the encoder
			The encoder cable connection is incorrect	Check the connection
			Imprefect grounding	Correct grounding Check whether the shield line is grounded
18	Relay switch failure		Relay damage	Return to factory for repair
19	Brake holding delay not opened		Parameter values setting so large that the control pulse is coming but the brake hasn't been opened yet	Decrease the number of PA94
20	EEPROM Fault		Chip or circuit board damage	Exchange the servo motor. After repairing, driver model must be reset(PA10) then restored default parameters
21	FPGA Module failure		FPGA module dysfunction	Exchange the driver
23	Current Acquisition Circuit Fault		Current Acquisition Circuit Fault	Exchange the servo driver
	User		PA30, PA31 parameters	

29	Torque Overload Alarm		is Unreasonable. Unexpected heavy load	Modify parameters. Inspection machinery
30	Z-pulse loss of encoder		Z pulse does not exist and encoder is damaged Poor cable Poor shielding of cables. Shielded ground wire not connected properly Encoder Interface Circuit Fault.	Exchange the encoder. Check Coder Interface Circuit
31	Encoder and UVW Signal Error		Encoder and UVW Signal breakdown. The Z signal of encoder breakdown. Bad cable. Bad shielding of cables. Shielded ground wire not connected properly. Encoder Interface Circuit Fault.	Exchange the encoder. Check the encoder interface circuit.
32	The signal of encoder and U, V, W code illegal		Encoder and UVW Signal breakdown. Bad cable. Bad shielding of cables. Shielded ground wire not connected properly. Encoder Interface Circuit Fault.	Exchange the encoder. Check the encoder interface circuit.
33	Dart encoder alarm		Parameter mismatch	Setting parameter PA62 correctly
34	The signal of U, V, W instability		The signal of U, V, W instability	Check the connection

36	When connect dart encoder, the length of illegal time excessive		When connect dart encoder, the length of illegal time excessive	Check the connection
42	AC input voltage is too low	Running on power failure	Normal. AC input voltage is too low	Check the input of AC 220V
44	Phase of Input power lost		Specially for SZGH-SD4038 / SZGH-SD4075 1: Power input lost phase 2: Connection of input power isnot good or under-voltage.	1.Check if connection of L1,L2,L3 are right. 2.1.Check if input voltage of L1,L2,L3 are right.
47	Overvoltage of main circuit when power on		External AC voltage input is too high Main Circuit Fault	Check the input of AC 220V. Exchange driver
55	Three consecutive errors in CRC calibration		MODBUS communication data CRC calibration error continuously	Exchange driver
56	MODBUS frame overlength error		Communication protocol mismatch. Be disturbed	Confirm the length of frame. Increase line filter, away from interference
57	MODBUS abnormal communication format		Improper setting of communication parameters. Incorrect communication address or value	Exchange the driver.

Appendix Application Description

1 Drive Wiring



Pic 6.1 Drive wiring diagram

Note:

1) When the EtherCAT interface is connected to other drives, it must put in with ECAT IN and put out with ECAT OUT.

2) Cables and conductors shall be fixed to avoid close proximity to the heat sink of the drive and motor, so as to avoid heat and reducing the insulation performance.

2 The Example Of Cooperating With TwinCAT Master Station

1） Install TwinCAT software

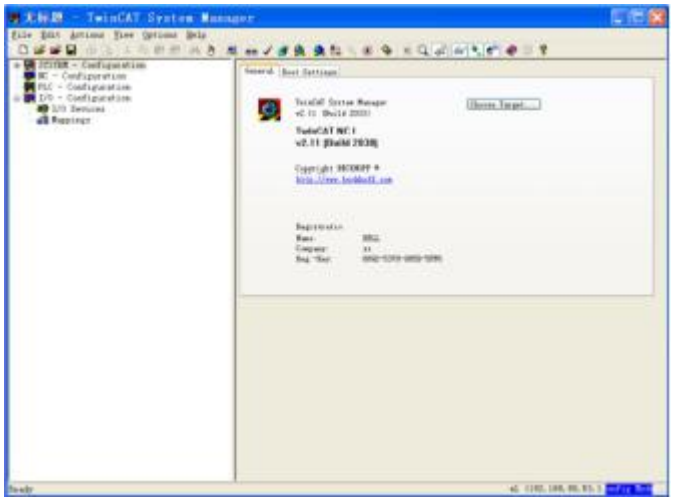
The twinCAT software in the official website of Beckhoff company supports up to 32-bit win7 systems and does not support win7 64-bit systems.

- Windows xp system: it is recommended install tcat_2110_2230
- Windows 7 32-bit system: it is recommended to install tcat_2110_2248

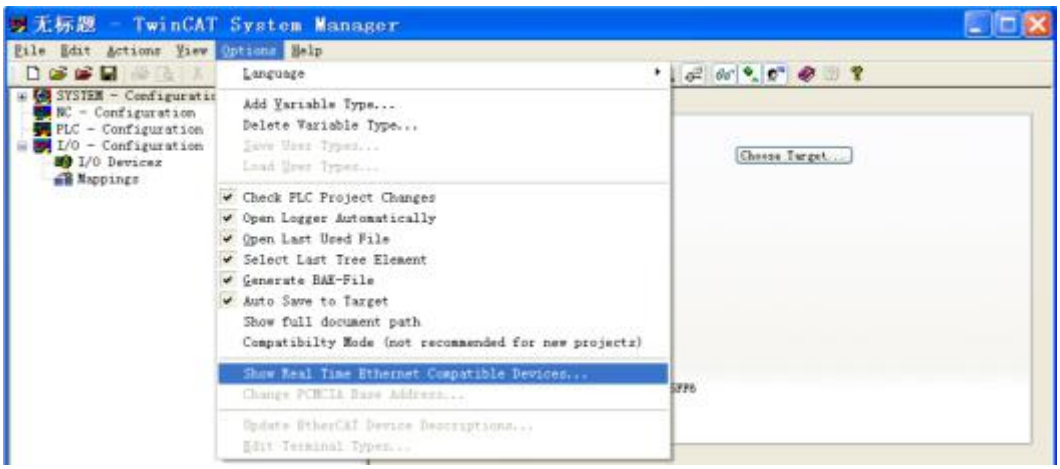
Note: About the network card, please choose a 100 megabit Ethernet card with a Intel chip. Other brands of network cards, there is a risk of not supporting EtherCAT operation.

2） Copy the EtherCAT configuration file (SZGH_ETHCAT_V1.0.xml) of ECAT100E to the TwinCAT installation directory:\ TwinCAT\ IO\ EtherCAT.

3）Open TwinCAT.



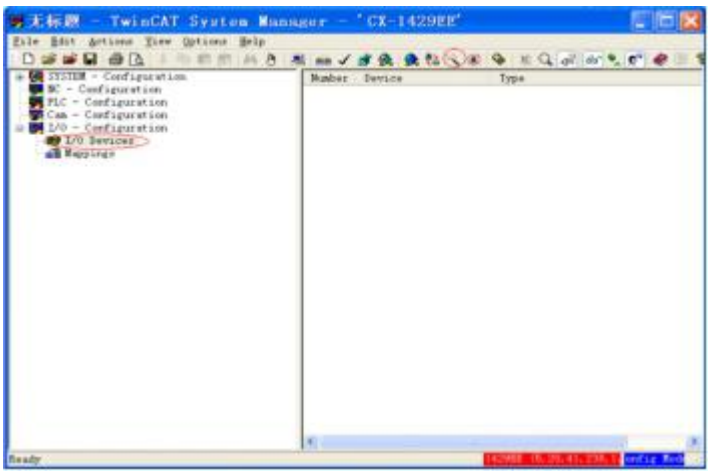
4） Install TwinCAT network card drive.



Open the menu "Show Real Time Ethernet Compatible Devices" as above. Jump out of the following dialog box and click “install “after selecting the local site in the “Incompatble devices”column. After the installation is complete, the network card that has been installed appears in the "Instaled and ready to use devices" column.

5）Device search

After you create a new project page, right-click I / O Devices to start searching for the device, as shown in the following figure:



6) Select " OK"(确定).

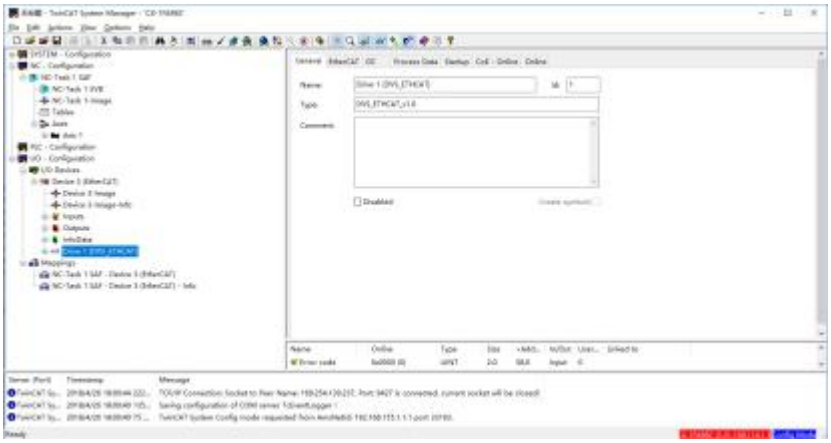
7) Select "OK".

8) Select "Yes"("是").

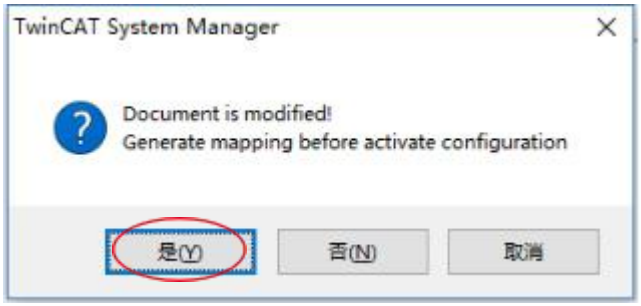
9) Select "Yes"("是").

10) Select "No"("否").

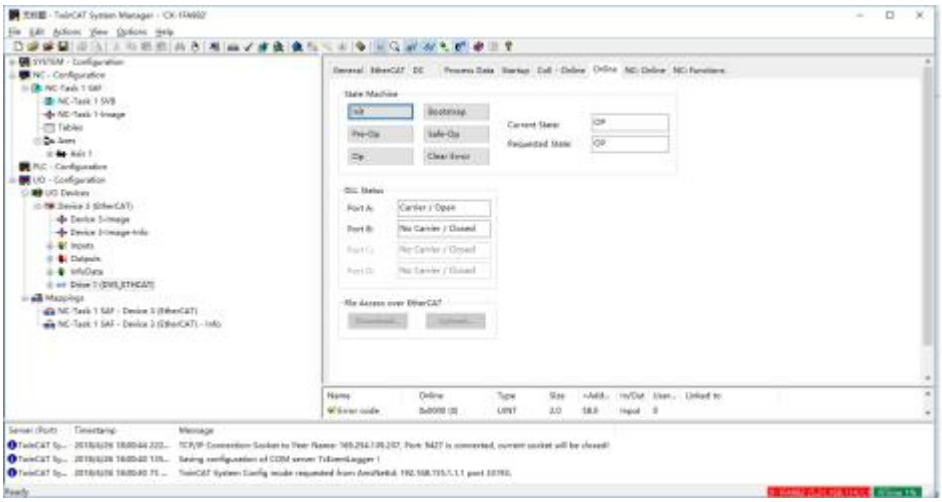
11) The device has been finished to search here as shown in the following figure:



12）According to the default configuration, please click activate and switch to run mode: click “Yes”.

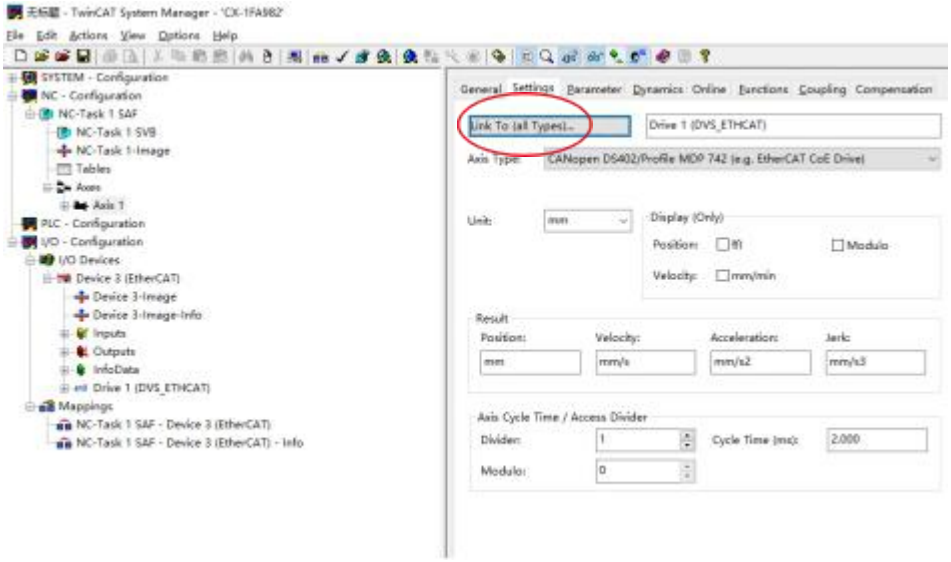


13） According to the default configuration, click activate and switch to run mode: click “ Yes”. After "OK", on the "Online" interface, you can see the device entering the OP state, while the running lamp of the driver is kept in the green state.

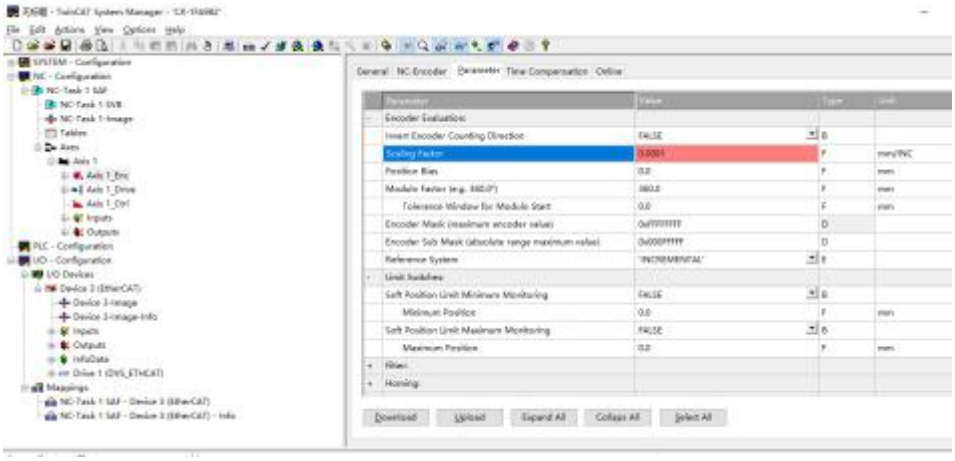


14）Control servo through NC or PLC program.

a）Set units when testing, units : mm.



b）Set quantitative(scaling) factor.

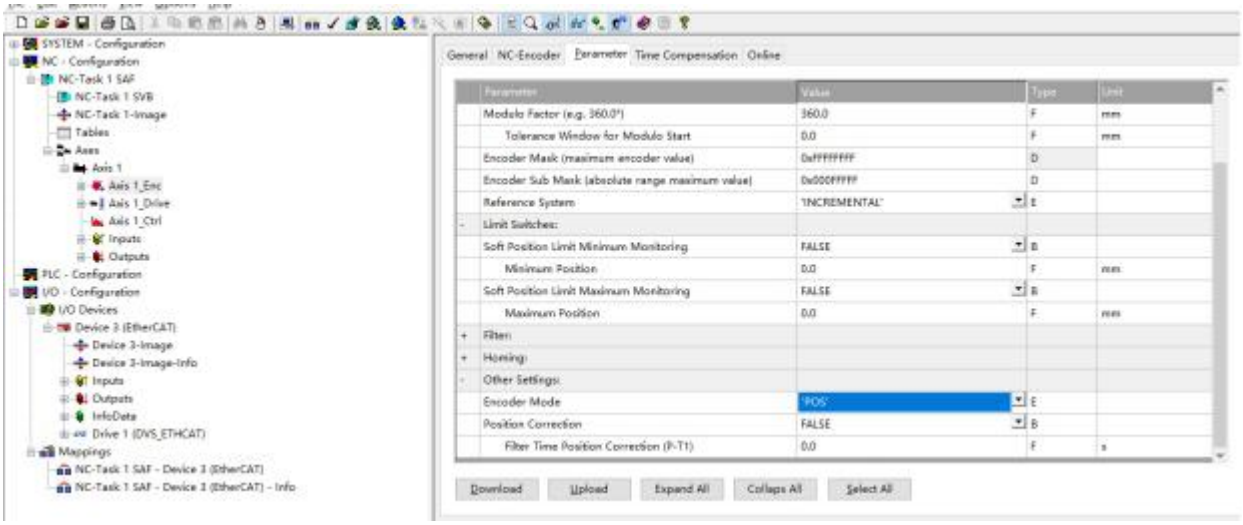


Scaling Factor：The distance corresponding to the encoder pulse for each position feedback. For example, if the motor rotates a roll with 1,311,072 pulses, and if the motor rotates a roll for 1 mm, the ScalingFactor is 1/131072=0.00000762939453125 mm/Inc.

Tip: for no-load debugging, it is customary to set a roll to 60mm, so that the speed of 1mm/s is equivalent to 1 lap / min. Because the rated speed unit of the motor is rpm, debugging with rpm as the

speed unit is more intuitive. So the quantitative factor is set to: 60 /131072.

c）Set encoder feedback mode to pos.



Other settings:

Encoder mode and there are three options:

●Pos: The encoder is only used to calculate the position and is used when the position loop is in the drive.

●PosVelo: The encoder is only used to calculate position and speed when the position ring is used in TWinCAT NC.

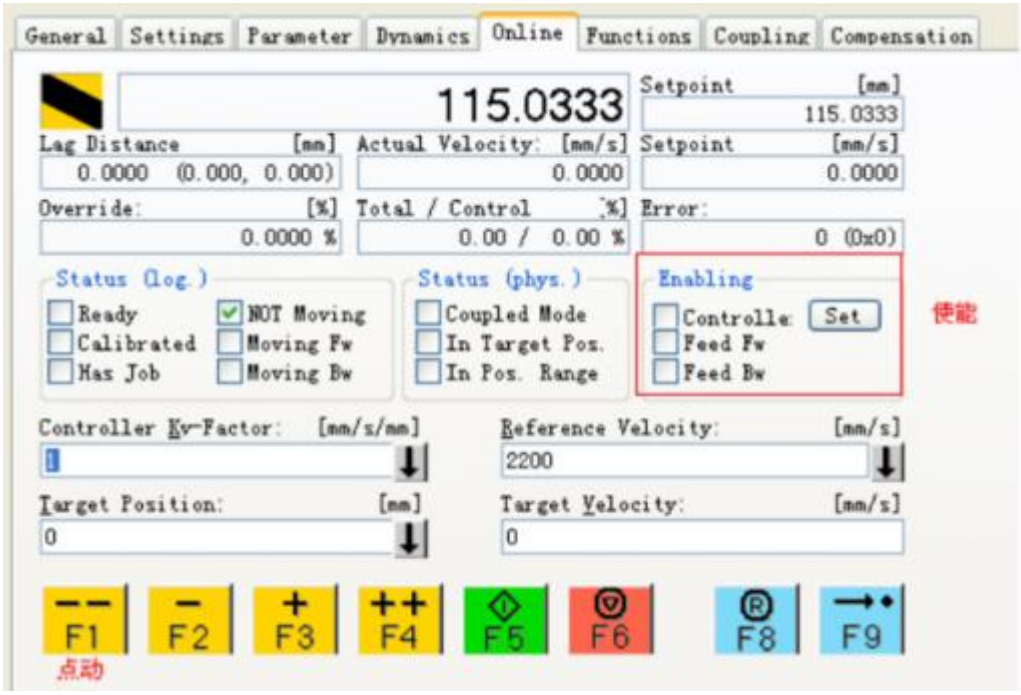
●PosVeloAcc: TWinCAT NC uses encoders to determine position, speed and acceleration.

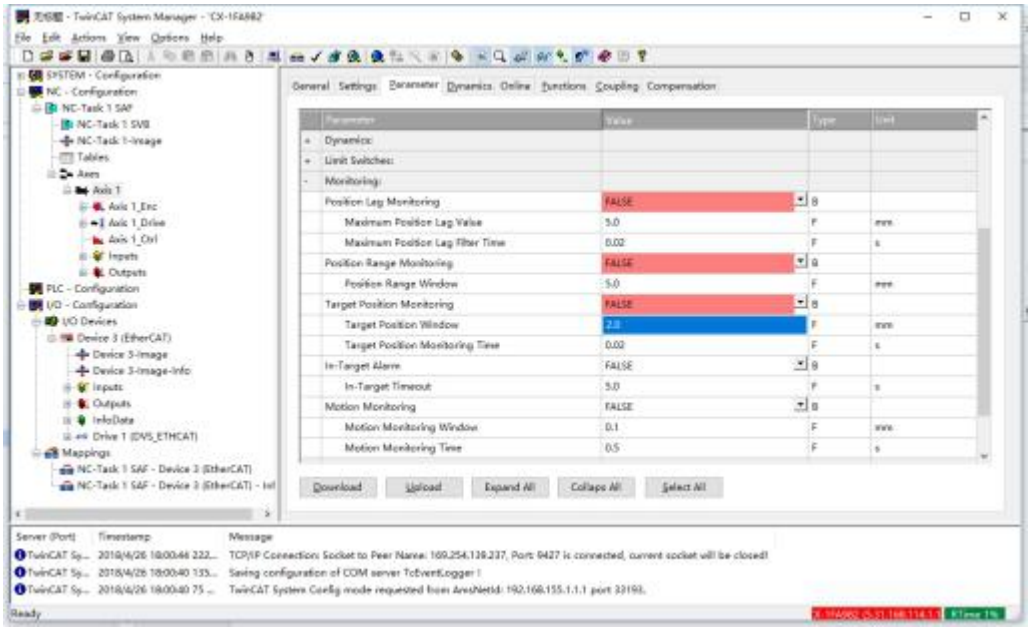
●Pos：The upper computer is only responsible for sending the position instruction. The servo runs in the periodic synchronous position mode (6060 =8), and the position loop is calculated internally.

●PosVelo：The upper computer establishes the position loop and outputs the speed instruction. The servo runs in the cycle synchronous velocity mode (6060 =9).

d) Point motion test

Temporarily shield system deviation. Click "Set" to jump out of the dialog box, and then click "All". After that, the servo drive is enabled. Through F1 ~F4, it can realize point motion operation.




TwinCAT System Manager - CX-1FA982
File Edit Actions View Options Help
SYSTEM - Configuration
NC - Configuration
NC-Task 1 SAF
NC-Task 1 SVB
NC-Task 1 Image
Tables
Axes
Axis 1
Axis 1_Enc
Axis 1_Drive
Axis 1_Ctrl
Inputs
Outputs
PLC - Configuration
I/O - Configuration
I/O Devices
Device 3 (EtherCAT)
Device 3-Image
Device 3-Image-Info
Inputs
Outputs
InfoData
Drive 1 (DNS_ETHCAT)
Mappings
NC-Task 1 SAF - Device 3 (EtherCAT)
NC-Task 1 SAF - Device 3 (EtherCAT) - Inf
General Settings Parameter Dynamics Online Functions Coupling Compensation
Parameter Value Type Unit
Dynamics:
Limit Switches:
Monitoring:
Position Lag Monitoring FALSE B
Maximum Position Lag Value 5.0 F mm
Maximum Position Lag Filter Time 0.02 F s
Position Range Monitoring FALSE B
Position Range Window 5.0 F mm
Target Position Monitoring FALSE B
Target Position Window 2.0 F mm
Target Position Monitoring Time 0.02 F s
In-Target Alarm FALSE B
In-Target Timeout 5.0 F s
Motion Monitoring FALSE B
Motion Monitoring Window 0.1 F mm
Motion Monitoring Time 0.5 F s
Download Upload Expand All Collapse All Select All
Server (Port) Timestamp Message
TwinCAT Sy... 2018/4/26 18:00:44 222... TCP/IP Connection Socket to Peer Name: 169.254.138.237, Port: 9427 is connected, current socket will be closed!
TwinCAT Sy... 2018/4/26 18:00:40 135... Saving configuration of COM server TcEventLogger !
TwinCAT Sy... 2018/4/26 18:00:40 75 ... TwinCAT System Config mode requested from AmsNetId: 192.168.155.1.1.1 port 33193.
Ready