SD Series Servo Drive

Operation Manual

for 220VAC

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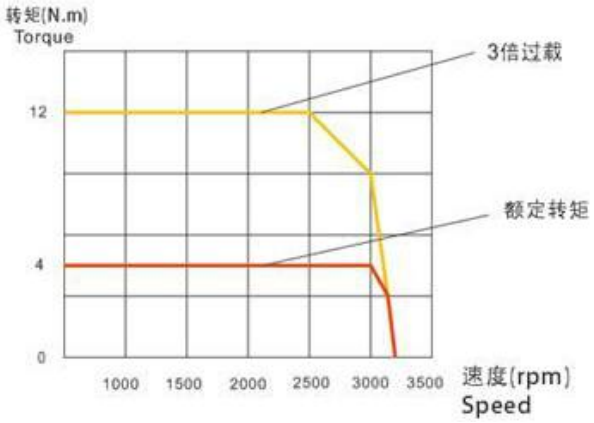
SD AC Servo Drive

Features

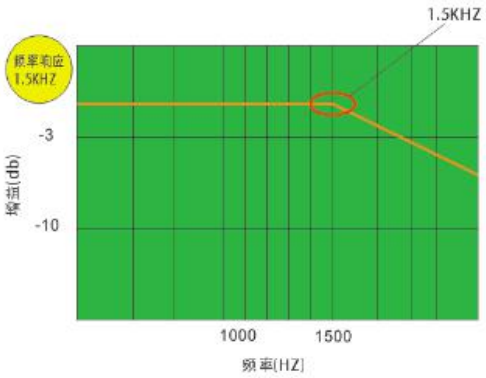
1) Strong Overload Capability

Because it adopts industrial intelligent power module IPM, it has advantages of strong overload capacity and high starting torque. Moreover, the maximum load that it withstands is three times higher than the rated torque of the related motor (when supplied by 3Ph-220Vac supply). it is pretty good on the occasions which the load has sudden fluctuations and is required to be re-started in work quickly.



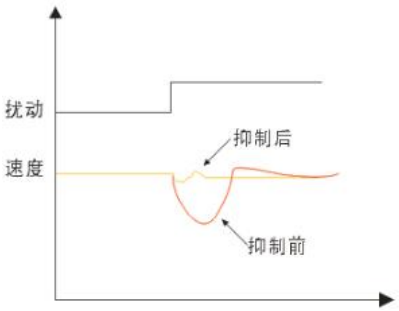
2) High Response Frequency (1.5KHz)

Due to the perfect use of the advanced PID control algorithm and the feed-forward torque, It greatly improves the dynamic response performance, and effectively shorten the settling time. Time of acceleration and deceleration of the motor is short, which is usually within tens of milliseconds. The frequency response of the drive in speed mode can be up to 1.5KHz and the rated speed of the motor can be up to 3000rpm.



3) Excellent Anti-interference Ability

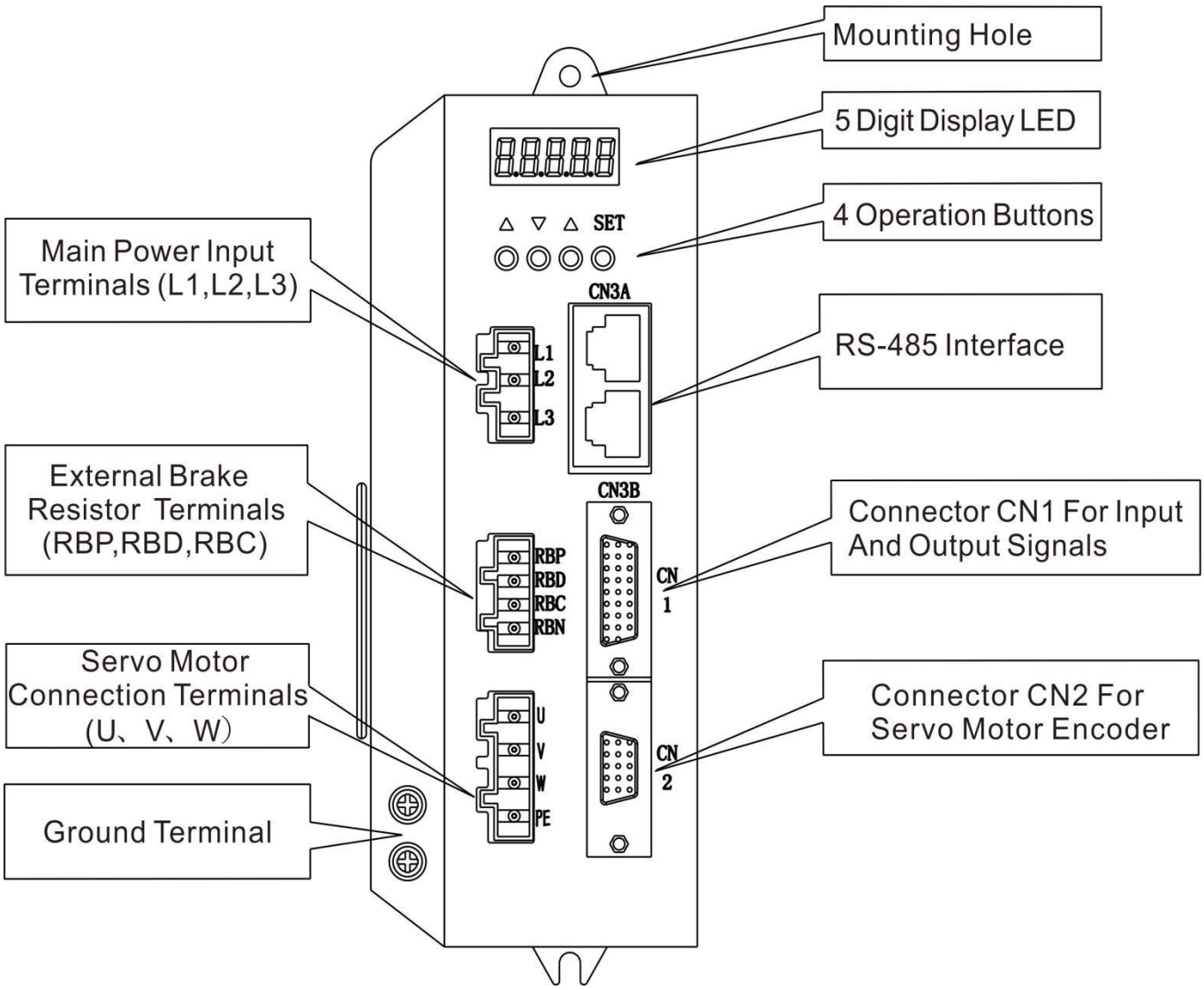
By real-time observation of external disturbance and real-time dynamic compensation, the speed fluctuation and torque fluctuation caused by external disturbance are reduced.



4) Good Position Following Capability

By adopting load identification and torque feed-forward advanced control algorithm, very small velocity ripple and position error can be achieved. Moreover, we configure 17-bit absolute encoder so that it can largely improve the stability in low speed and positioning accuracy. it also provides control modes including position, speed, torque, and JOG for our customers to choose conveniently.

Front View



"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.

Motor and Drive Installation

The 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:

λAmbient temperature: 0 to 40 °C, Ambient humidity, less than 80% (no dew).

λStorage temperature: -40 to 50 °C, Storage humidity, less than 93% (no dew).

λPreventive measure shall be taken against raindrop or moist environment.

λPreventive measure shall be taken against corrosion by oil mist and salinity.

λWhen 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.

λIf there are vibration sources nearby (punch press for example) and no way to avoid it, please use absorber or anti-vibration rubber filling piece.

λIf there is disturbance from interferential equipment nearby along the wirings 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.

The Method of Installation of drive

λIn order to get good cooling the servo drive should normally mount in vertical direction with the topside down.

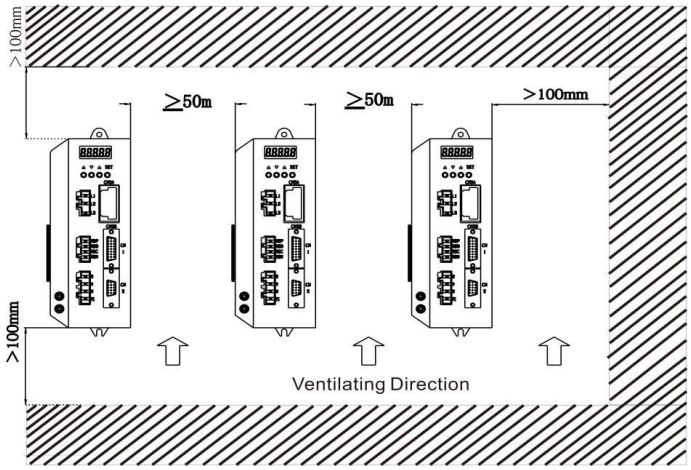
λFor installing the servo drive, fasten the backboard of servo driver with M4 screw.

λReserve 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.

λTo provide vertical wind to the heat sink of the servo drive should install ventilating fans in the control cubicle.

λPrevent the dust or the iron filings entering the servo drive when install the control cubicle.

Keep enough space between drives in the electric cabinet.



Servo motor installation

The Environmental Conditions for Installation of motor

λAmbient temperature: 0 to 40°C, Ambient humidity less than 80% (no dew).

λStorage temperature: -40 to 50°C, Storage humidity less than 30% (no dew).

λVibration: less than 0.5G.

λInstall the servo motor in well-ventilated place with less moisture and a few dusts.

λInstall the servo motor in a place without corrosive liquid, flammable gas, oil vapor, cutting cooling liquid, cutting chips, iron powder and so on.

λInstall the servo motor in a place without water vapor and direct sunlight.

The Method of Installation of motor

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

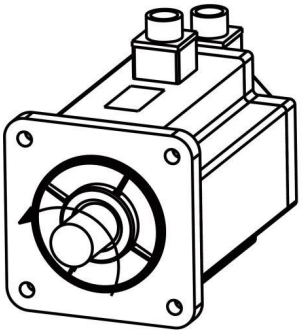
λFor vertical installation:
if the shaft of the servo motor is in upward direction with a speed reducer, some prevention measure shall be taken against entering inside of the servo motor by oil come from the speed reducer.

λMotor shaft extension should be long enough, or may cause vibration while motor is in running.

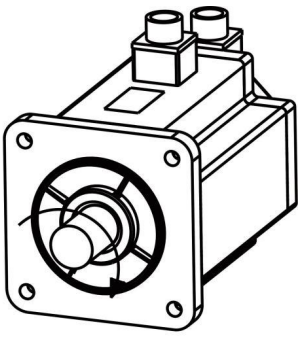
λIn case of installation or removing the servo motor, please do not hit the servo motor with a hammer, otherwise the shaft and the encoder can be damaged.

The 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)



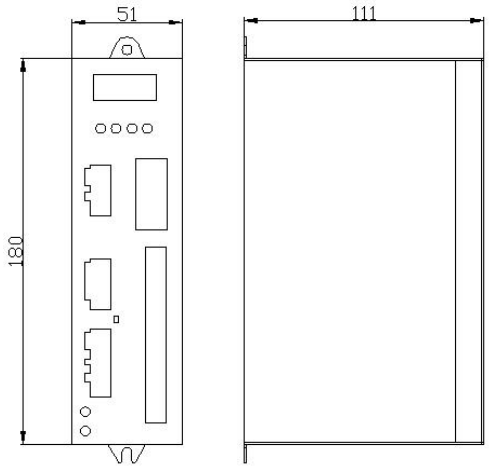
Reversal Rotation
(CW)

Technical specification

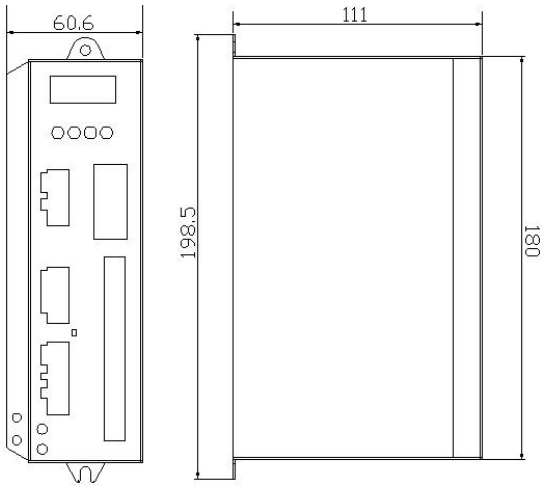
Model		SZGH-SD2004	SZGH-SD2010	SZGH-SD2026
Power Range		50W~400W	400W-1000W	1000W~2600W
Input Power Supply		1 / 3-phase , AC220V +/- 15% , 50/60Hz +/- 5%		
Environmental	Temperature	Operation 0 °C ~ 40 °C, Storage -40 °C ~ 50 °C		
	Humidity	Less than 90% RH (non-condensing)		
	IP Class	IP20		
Control Method		Vector control		
Regeneration		Built-in / External		
Encoder Feedback		2500ppr / 17-bit ppr		
Control Mode		Position, Speed, Torque, JOG, Test trial running, Position/Speed, Position/Torque, Speed/Torque		
Digital Input		4 programmable Input terminals (optically isolated) Functions: SERVO-ON, ACLR, CW-inhibition, CCW-inhibition, CW torque inhibition, CCW torque inhibition, Command Zero, Electronic gear selections (1~4), Position deviation clear, pulse input inhibition, and many more		
Digital Output		4 programmable Output terminals (optically isolated) Functions: SRDY, Alarm, In Position, AT speed, AT Torque, Electro-magnetic brake, Torque Restrictions, and many more		
Encoder Signal Output		A,B,Z differential output, Z-signal open-collector output		
Position	Input Frequency	Differential input ≦ 4MHz, Single-ended input ≦ 200KHz		
	Command Modes	Pulse+Dir, CCW Pulse/ CW Pulse, Orthogonal Pulse (A/B phase)		
	Electronic gear ratio	1-32767 / 1-32767 (the ratio must be less than 50)		
Speed	Analog Command Input	-10V~10V, input impedance 10KΩ		
	Acceleration/ Deceleration	By Parameter setting		
	Command Source	Analog input / by internal parameters		
Torque	Analog Command Input	-10V~10V, input impedance 10KΩ		
	Speed Limit	By Parameter setting		
	Command Source	Analog input		
Monitor Function		Motor speed, Current position, Position deviation, Motor torque, Motor current, DC-Line voltage, and many more		
Protection Function		Over-speed, Over-voltage, Over-load, Abnormal main power, Abnormal encoder, encoder out of tolerance and many more		
Communication		RS485 (for factory use, only)		
Certification		ISO9001:2008		

Mechanical Dimensions

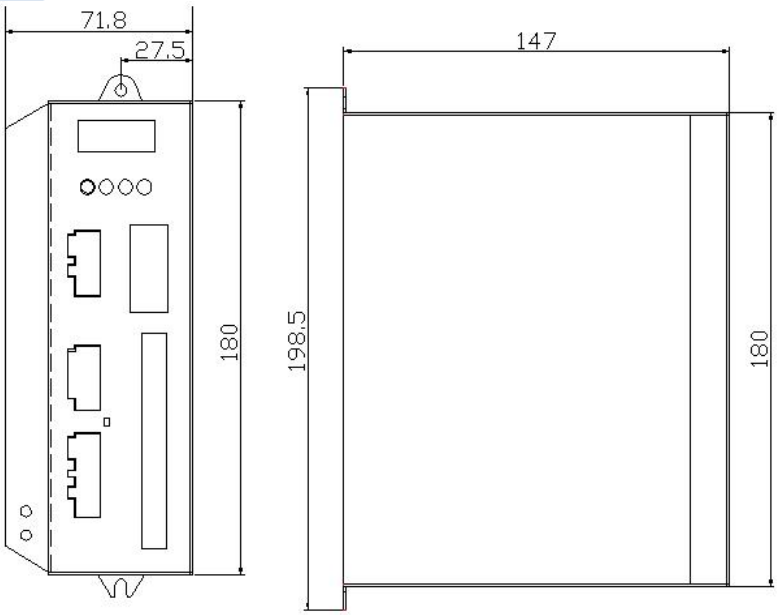
40W~400W



400W~1000W



1000W~2600W

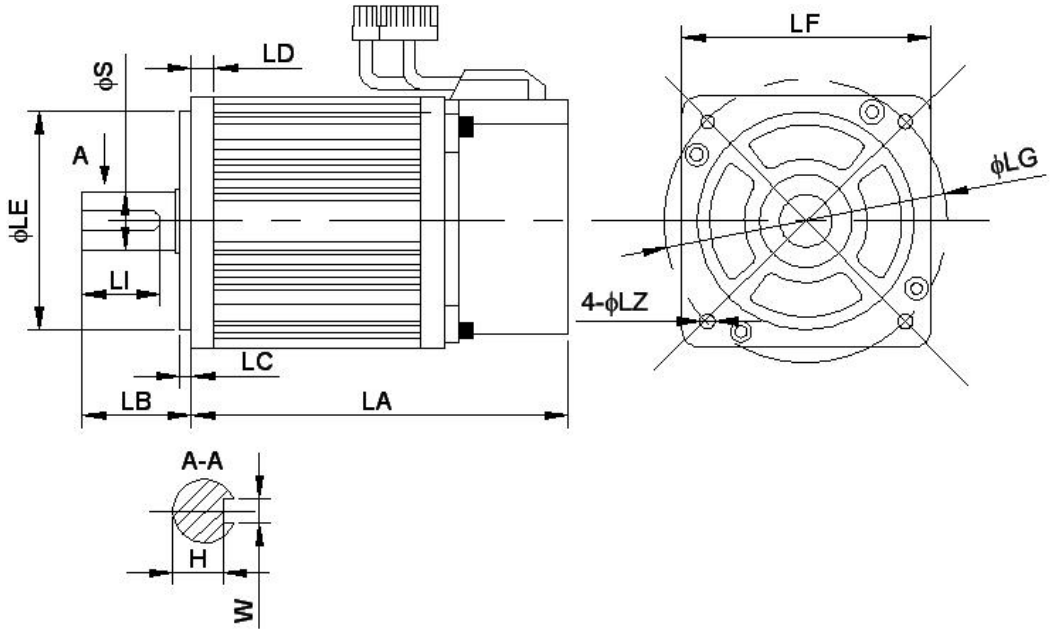


Motors table

Flange	Model	Power (W)	Torque (N.m.)	Speed (rpm)	Matched Servo Drive
60mm	SZGH-04005D	200	0.6	3000	SZGH-SD2004
	SZGH-04010D	400	1.3	3000	SZGH-SD2004
	SZGH-06020DC	600	1.9	3000	SZGH-SD2004
80mm	SZGH-08075DC	400	1.3	3000	SZGH-SD2010
	SZGH-08075BC	750	2.4	3000	SZGH-SD2010
	SZGH-08100CC	1000	3.5	2000	SZGH-SD2010
	SZGH-09075DC	1000	4	2500	SZGH-SD2010
110mm	SZGH-11060DC	600	2	3000	SZGH-SD2026
	SZGH-11080DC	800	4	2000	SZGH-SD2026
	SZGH-11120DC	1200	4	3000	SZGH-SD2026
	SZGH-11150DC	1500	5	3000	SZGH-SD2026
	SZGH-11120BC	1200	6	2000	SZGH-SD2026
	SZGH-11180DC	1800	6	3000	SZGH-SD2026
130mm	SZGH-13100CC	1000	4	2500	SZGH-SD2026
	SZGH-13130CC	1300	5	2500	SZGH-SD2026
	SZGH-13150CC	1500	6	2500	SZGH-SD2026
	SZGH-13200CC	2000	7.7	2500	SZGH-SD2026
	SZGH-13100AC	1000	10	1000	SZGH-SD2026
	SZGH-13150AC	1500	10	1500	SZGH-SD2026
	SZGH-13230AC	2300	15	1500	SZGH-SD2026
	SZGH-13260CC	2600	10	2500	SZGH-SD2026

Mechanical Dimensions

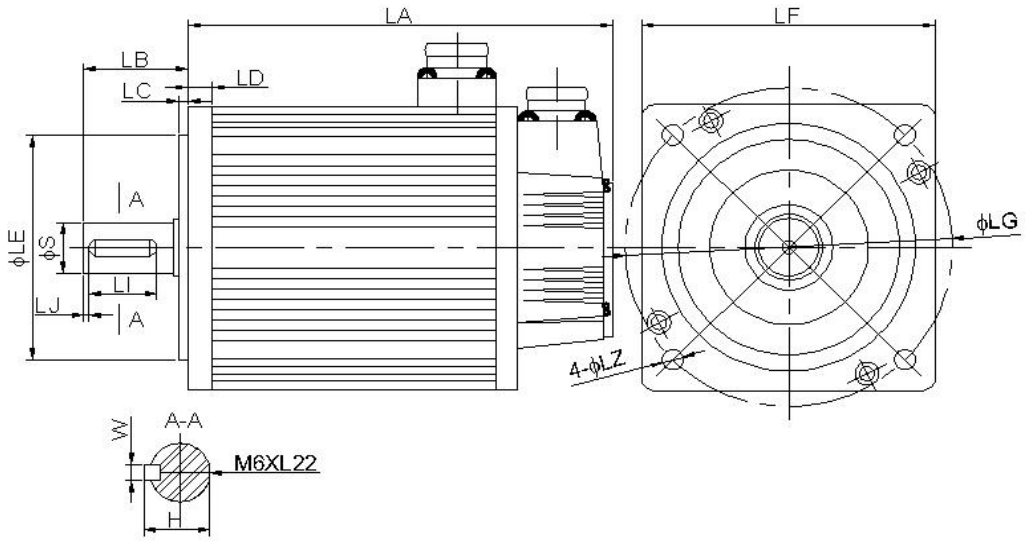
Flange 60mm / 80mm / 90mm Series



Model	LA	LB	LC	LD	LE	LF	LG	LZ	S	LI	W
SZGH-06020DC	116	30	3	10	50	60.2	70	4.5	14	20	$5^{0}_{-0.03}$
SZGH-06020DC-T(with brake)	164	30	3	10	50	60.2	70	4.5	14	20	$5^{0}_{-0.03}$
SZGH-06040DC	141	30	3	10	50	60.2	70	4.5	14	20	$5^{0}_{-0.03}$
SZGH-06040DC-T(with brake)	189	30	3	10	50	60.2	70	4.5	14	20	$5^{0}_{-0.03}$
SZGH-06060DC	169	30	3	10	50	60.2	70	4.5	14	20	$5^{0}_{-0.03}$
SZGH-06060DC-T(with brake)	217	30	3	10	50	60.2	70	4.5	14	20	$5^{0}_{-0.03}$
SZGH-08075DC	151	35	3	8	70	80.4	90	5.5	19	25	6
SZGH-08075DC-T(with brake)	205	35	3	8	70	80.4	90	5.5	19	25	6
SZGH-08075BC	179	35	3	8	70	80.4	90	5.5	19	25	6
SZGH-08075BC-T(with brake)	233	35	3	8	70	80.4	90	5.5	19	25	6
SZGH-08100CC	191	35	3	8	70	80.4	90	5.5	19	25	6
SZGH-08100CC-T(with brake)	245	35	3	8	70	80.4	90	5.5	19	25	6
SZGH-09075DC	150	35	3	8	80	86.6	100	6	16	25	5
SZGH-09075DC-T(with brake)	207	35	3	8	80	86.6	100	6	16	25	5
SZGH-09075DC	172	35	3	8	80	86.6	100	6	16	25	5
SZGH-09075DC-T(with brake)	229	35	3	8	80	86.6	100	6	16	25	5
SZGH-09100DC	182	35	3	8	80	86.6	100	6	16	25	5
SZGH-09100DC-T(with brake)	239	35	3	8	80	86.6	100	6	16	25	5

Units: mm

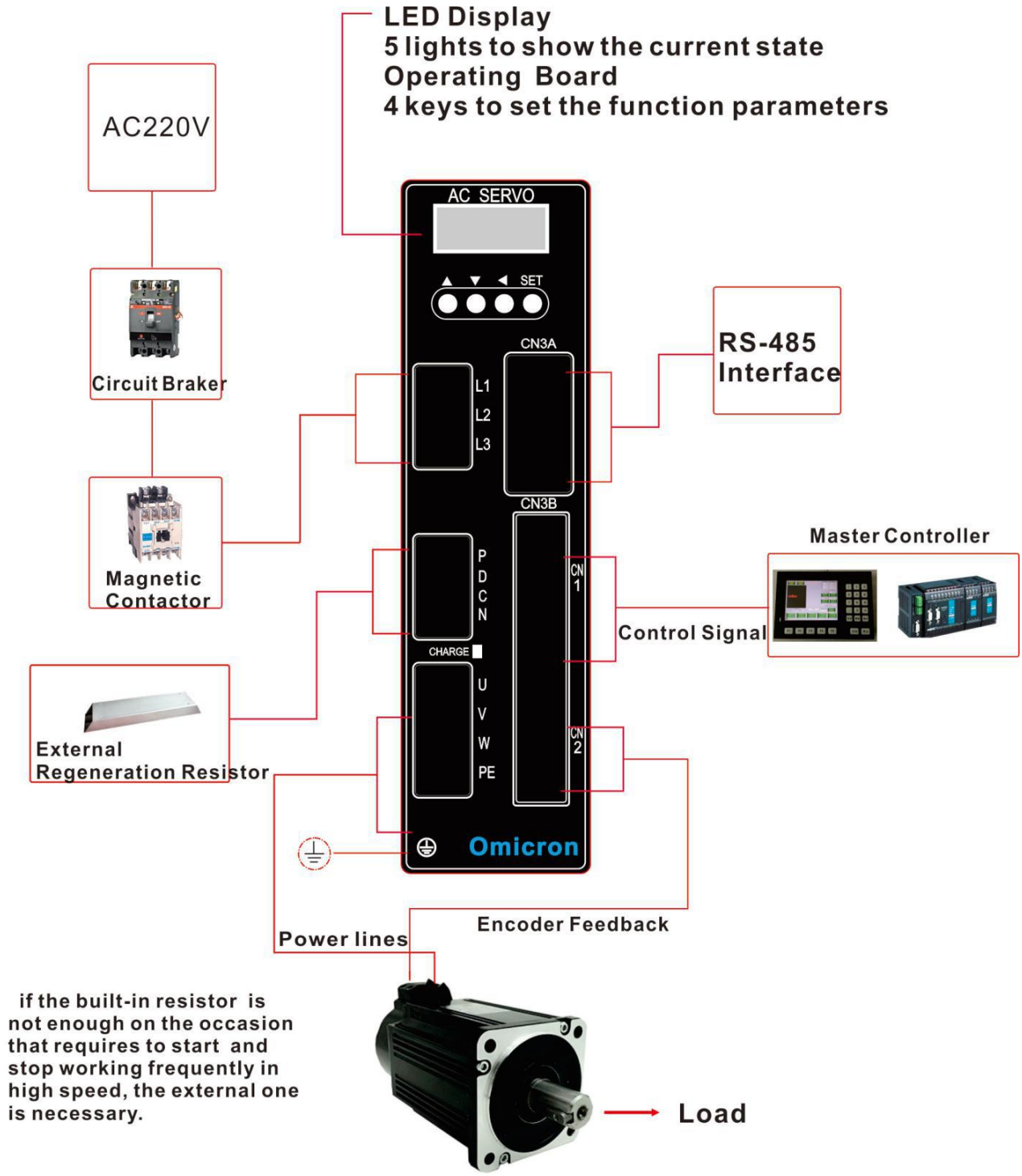
Flange 110mm / 130mm Series



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

SZGH-13100CC	166	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13100CC-T(with brake)	236	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13130CC	171	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13130CC-T(with brake)	241	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150CC	179	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150CC-T(with brake)	249	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13200CC	192	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13200CC-T(with brake)	262	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13100AC	213	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13100AC-T(with brake)	283	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150AC	213	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13150AC-T(with brake)	283	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13260CC	209	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13260CC-T(with brake)	279	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13230AC	241	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13230AC-T(with brake)	311	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13380CC	231	57	5	14	110	130	145	9	22	24.5	6	40
SZGH-13380CC-T(with brake)	301	57	5	14	110	130	145	9	22	24.5	6	40

Servo Drive Wiring Configuration



Wiring Explanations And Notes

λThe control cable length should be less than 3 meters and the encoder cable length less than 20 meters.

λCheck that the MAIN power voltage (220VAC) and wiring of L1, L2, L3 is correct.

λ**Do not** connect to 380V power supply.

λThe 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.

λEarth wiring must be reliable with a single-point connection.

λ**Pay attention** to the correct direction of free-wheel diode which is connected to the relay at the output terminal, otherwise will cause the output circuit breakdown.

λIn 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.

λPower 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.

λInstall a non-fuse circuit breaker that can shut off the main power supply immediately in case of the servo drive fault.

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-wire or thick wire must be used for the encoder power supply wiring.

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
Regenerative Resistor Terminal	P, D	When use the built-in resistor, Please connect P and D.
	P, C	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	⏚	Ground terminal of servo motor
	⏚	Ground terminal of servo drive

Note: The built-in resistor has been set as default by factory.

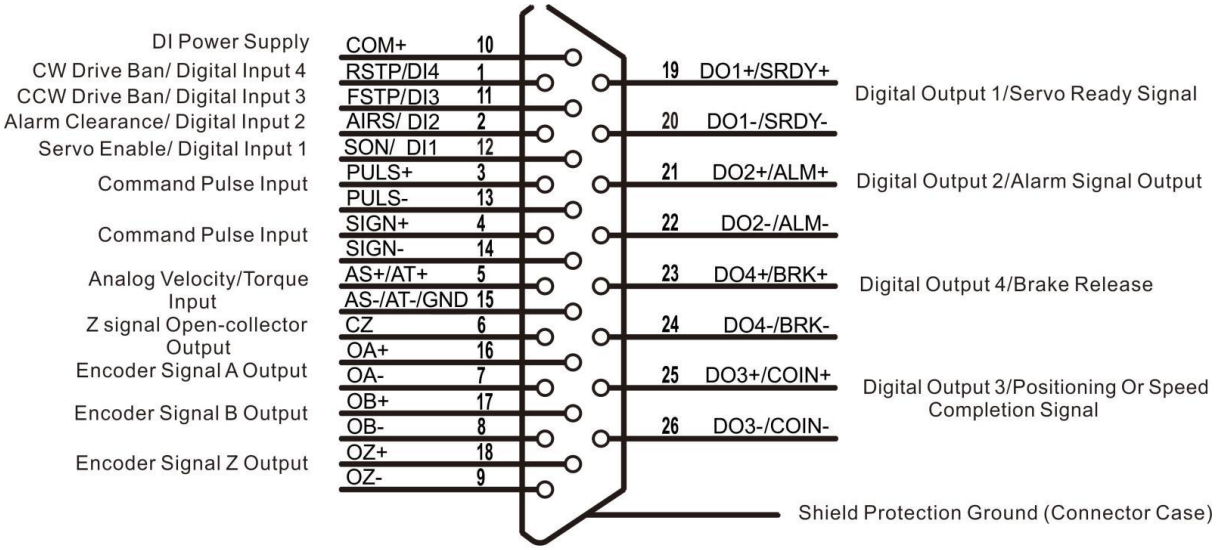
CN1 Terminal For Control Signals

The CN1 connector DB26 plug (26-pin) provides the signals interfaced with the host-controller. They are:

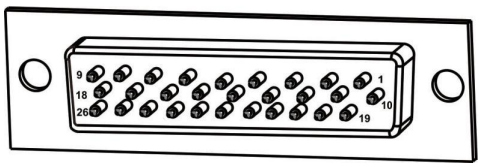
λ4 programmable input
λ4 programmable output
λAnalog command input
λPulse command input
Encoder signal output

CN1 Terminal Connector

The CN1 connector plug uses DB26 male head, the contour and pin configuration is as the following:



CN1 Connector



Connector CN1 Soldering view

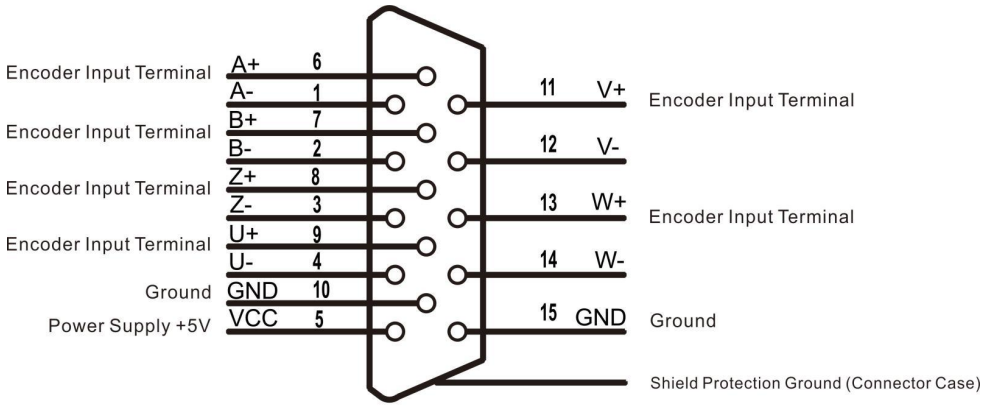
CN1 Connector Explanation

Name Of Signal		Pin Number	Function
Digital Input	DI1	12	Opto-coupler Input; Function is programmable; Defined by parameter P3-series (P3-0 ~ P3-17)
	DI2	2	
	DI3	11	
	DI4	1	
	COM+	10	
Digital Output	DO1+	19	Opto-coupler output; Function is programmable; Defined by parameter P3 series (P3-20 ~ P3-23)
	DO1-	20	
	DO2+	21	
	DO2-	22	
	DO3+	25	

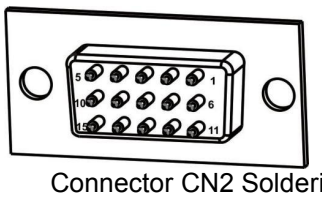
	DO3-	26	
	DO4+	23	
	DO4-	24	
Position Command Pulse	PULS+	3	High-speed opto-coupler input, Working mode set by parameter PA14, Pulse+Dir, CCW/CW Pulse, A/B Orthogonal pulse
	PULS-	13	
	SIGN+	4	
	SIGN-	14	
Analog Command Input	AS+/AT+	5	Analog velocity / torque input, range: -10V ~ 10V
	AS-/AT-/GND	15	
Encoder Signal Output	OA+	16	Motor encoder signal output
	OA-	7	
	OB+	17	
	OB-	8	
	OZ+	18	
	OZ-	9	
	CZ	6	
Shielded Cable Ground Protection		Metal case of connector	Shielded wire for connection with shielded cable

CN2 Connector For Encoder

The encoder signal connector CN2 connects to the servo motor encoder. A three-row DB15 plug (VGA plug) is used. The contour and pin configuration is as following:



CN2 Connector



Connector CN2 Soldering view

CN2 Connector Explanation

Signal Name Of Encoder		Pin No.	Function
Encoder Power Supply	5V	5	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.
	0V	10	
A-Phase	A+	6	Connect with A-phase output of encoder
	A-	1	
B-Phase	B+	7	Connect with B-phase output of encoder
	B-	2	

Z-Phase	Z+	8	Connect with Z-phase output of encoder
	Z-	3	
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	
Ground	0V	15	Encoder Power supply 0V
Shield Ground		Metal Case	Connect with cable shield wire

Note: The U, V, W signals of encoder does not exist on wire-saving encoder which has only A, B, Z.

CN3A and CN3B Terminal Definition

RS485	Can be connected to the PC or controller through special serial cable. Don't plug it to any power supply. Twisted-pair shielded wires are suggested with less than 2 meters in length.				
Terminal	**CN3A**	Name	**CN3B**	Name	Picture
1	VCC	Positive power supply	VCC	Positive power supply	
2	GND	Ground	GND	Ground	
3	TX-D	RS485 Transmitting end	TX-D	RS485 Transmitting end	
4	RSB	RS485 Communication signal	RSB	RS485 Communication signal	
5	RSA		RSA		
6	RXD	RS485 Receiving end	RXD	RS485 Receiving end	
7	GND	Ground	GND	Ground	
8	VCC	Positive power supply	NC	Free end	

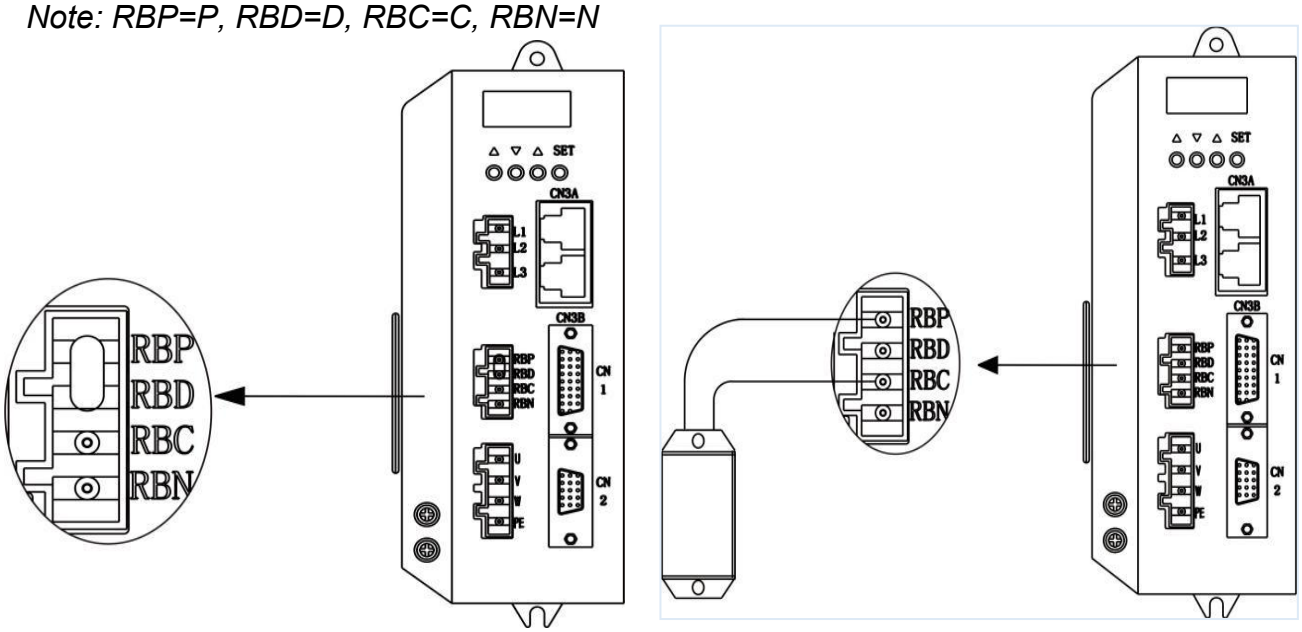
Regenerative Resistor Connection

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.

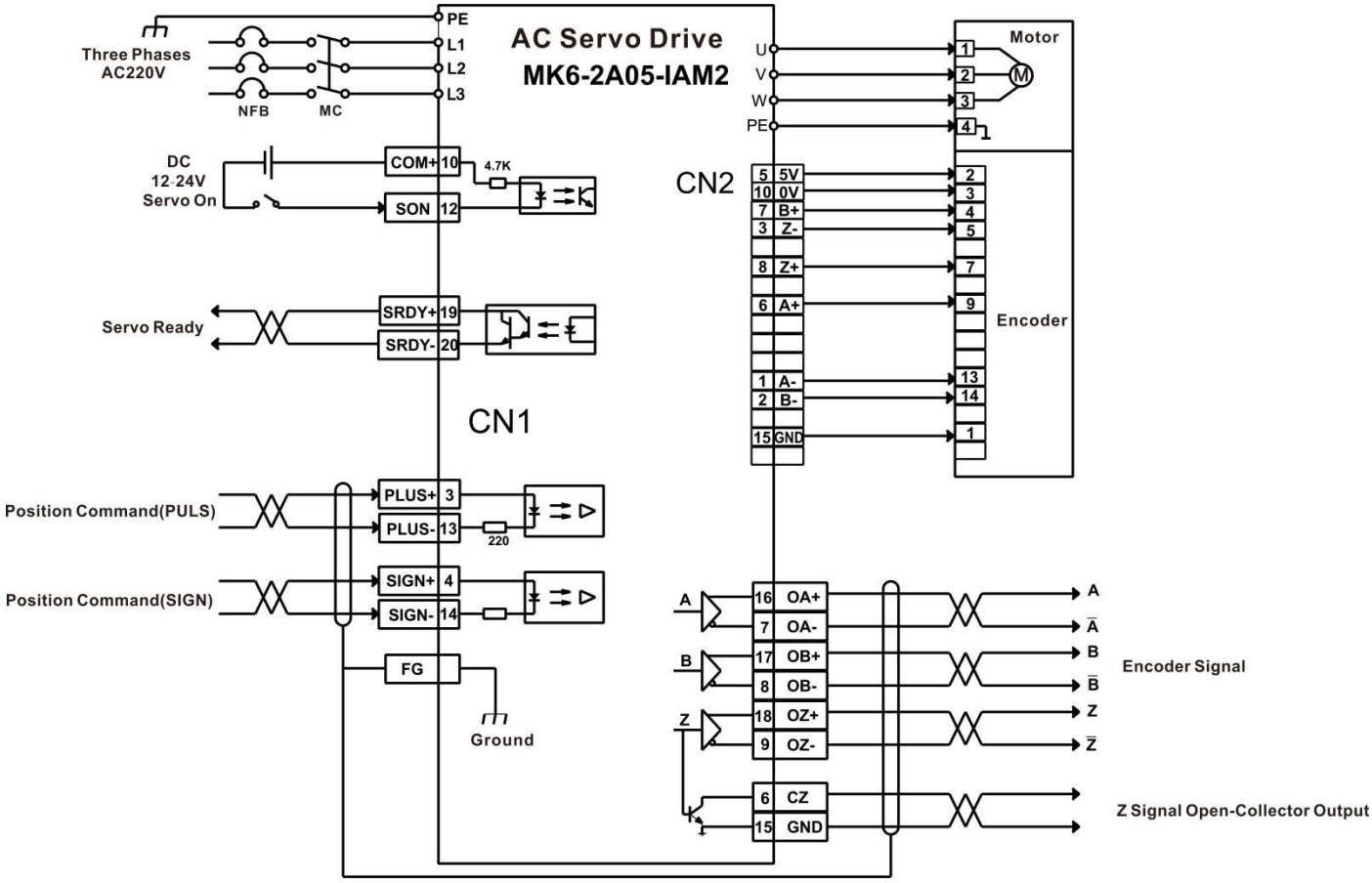
Then the external regenerative resistor should be connected between P and C, as showed in picture B.

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



Wiring Example in Position Mode

MK6-series drive connecting to motor (Wire-Saving Encoder)



The wiring example (above) is for servo motors with flange size 60mm, 80mm and 90mm. When connected with servo motors with flange size110mm and 130mm, please connect as following:

Power	Signal	U			V				W				PE			
	Pin No.	2			3				4				1			
Encoder	Signal	5V	0V	A+	B+	Z+	A-	B-	Z-	U+	V+	W+	U-	V-	W-	PE
	Pin No.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1

Notes:

1. If use 3-phase AC220V main power supply, please connect with terminal L1, L2, L3.
2. If use 1-phase AC220V main power supply, please connect with terminal L1, L3.
3. Current capacity of the external power supply for digital inputs and outputs (12~24vdc) should be more than 100mA.
4. AWG24-26 shielded cable is recommended for control and feedback signals. DO ground the shield of the cable.
5. Cable for control signals (CN1) should be less than 3 meters long, and cable for feedback signals (CN2) should be less than 10 meters long.
6. A Circuit breaker (NFB) is recommended to cut off power in case of an overload. Use an electromagnetic contactor to switch servo motor ON and OFF.

Parameters in Position Mode

The following parameters need to be adjusted when in position mode:

Parameter	Definition	Value	Default Value
PA4	Control mode	0	0
PA9	Position Proportional Gain	1-1000	40
PA19	Position Command Smooth Filter	0-30,000×0.1ms	300
PA11	Command pulses for one rotation of motor	0-30,000 pulse	10,000
PA12	1st numerator of electronic gear for position command pulse	1~32,767	0
PA13	Denominator of electronic gear for position command pulse	1~32,767	10,000
PA14	mode of position command pulse	0-2	0
PA15	Direction change of position command pulse	0-1	0
PA59	The effective edge of command pulse	0-1	0
PA77	2nd numerator of electronic gear for position command pulse	1~32,767	0
PA78	3rd numerator of electronic gear for position command pulse	1~32,767	0
PA79	4th numerator of electronic gear for position command pulse	1~32,767	0
PA80	Effective level of command direction signal	0-1	0
PA81	Command pulse (PULS) signal filter	0-15	4
PA82	Command pulse (SIGN) signal filter	0-15	4
PA16	Range of positioning completion	0~3000 pulse	10
PA17	Detection of over-travel range	0~30,000×100 pulse	400
PA18	Invalid error of over travel	0-1	0
PA83	CWL, CCWL direction prohibited mode	0-1	0
PA84	Hysteresis for position completion	0~32,767 pulse	5
PA85	Range for approach positioning	0~32,767 pulse	500
PA86	Hysteresis for approach positioning	0~32,767 pulse	50

Parameters related to Input and Output Terminals

Parameter	Definition	Value	Default Value
PA55	Effective level control for input terminals	0000-1111	0000
PA57	Effective level control for output terminals	0000-1111	0000
PA58	Anti-jitter time constant of digital input terminals	1-1000×0.1ms	2
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
P3-15	Force digital input 1	00000000-11111111	00000000
P3-16	Force digital input 2	00000000-11111111	00000000
P3-17	Force digital input 3	00000000-11111111	00000000

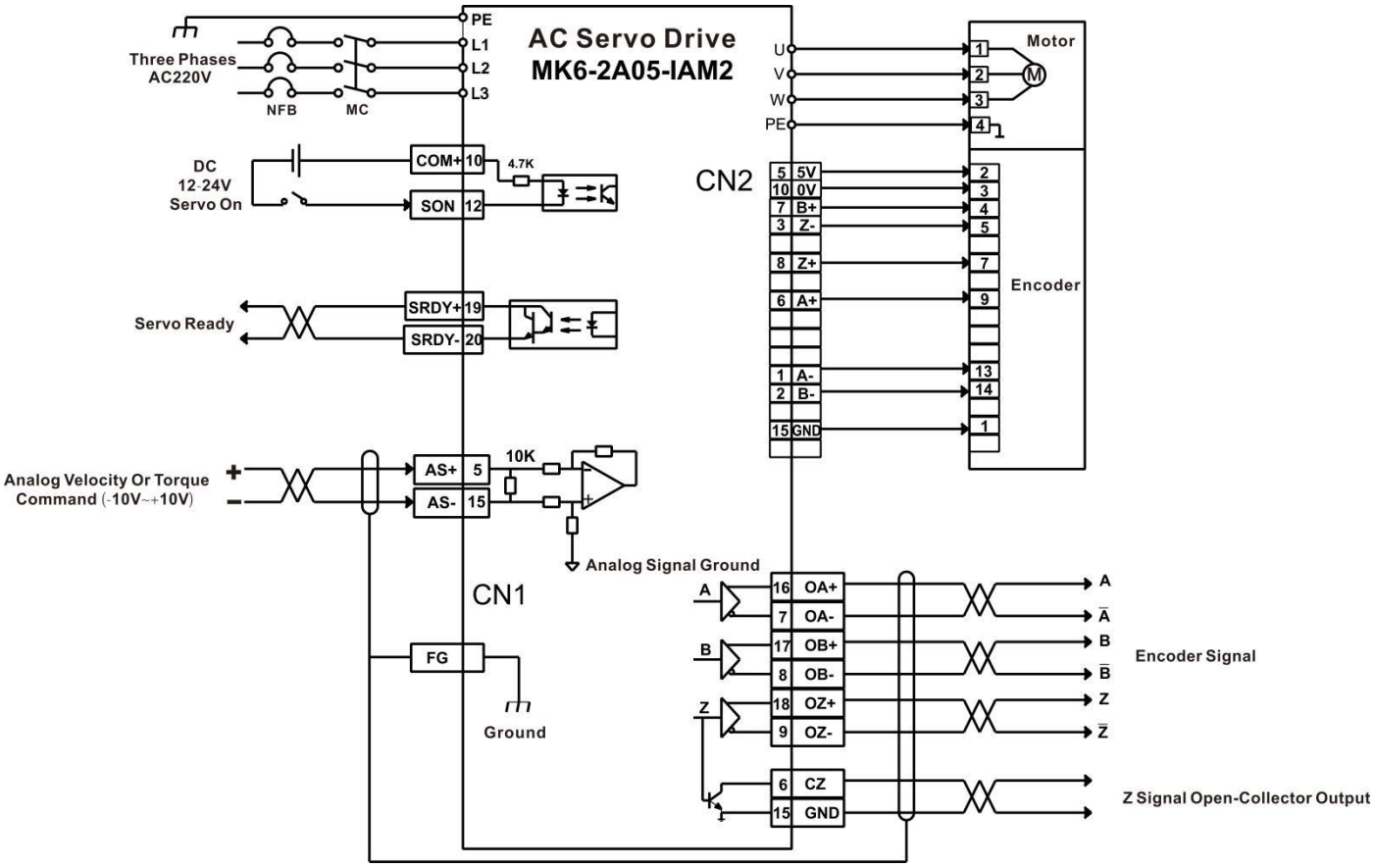
P3-20	Digital Input DO1 function	0-99	2
P3-21	Digital Input DO2 function	0-99	3
P3-22	Digital Input DO3 function	0-99	4
P3-23	Digital Input DO4 function	0-99	8

Parameters related to ModBus communication

Parameter	Definition	Value	Default Value
PA71	MODBUS ID No.	1-254	1
PA72	MODBUS Communication Baud Rate	48-1152×100	96
PA73	MODBUS Protocol Selection	0-2	1
PA74	Communication Error Handling	0-1	0

Wiring Example in Speed / Torque Mode

MK6-series drive connecting to motor (Wire-Saving Encoder)



The wiring example (above) is for servo motors with flange size 60mm, 80mm and 90mm. When connected with servo motors with flange size110mm and 130mm, please connect as following:

Power	Signal	U			V				W				PE			
	Pin No.	2			3				4				1			
Encoder	Signal	5V	0V	A+	B+	Z+	A-	B-	Z-	U+	V+	W+	U-	V-	W-	PE
	Pin No.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1

Notes

1.If use 3-phase AC220V main power supply, please connect with terminal L1, L2, L3.

2.If use 1-phase AC220V main power supply, please connect with terminal L1, L3.

3. Current capacity of the external power supply for digital inputs and outputs (12~24vdc) should be more than 100mA.

4. AWG24-26 shielded cable is recommended for control and feedback signals. DO ground the shield of the cable.

5. Cable for control signals (CN1) should be less than 3 meters long, and cable for feedback signals (CN2) should be less than 10 meters long.

6. A Circuit breaker (NFB) is recommended to cut off power in case of an overload. Use an electromagnetic contactor to switch servo motor ON and OFF.

Parameters in Speed Mode

The following parameters need to be adjusted when in Speed mode:

Parameter	Definition	Value	Default Value
PA4	Control Mode	1	0
PA5	Gain Of Speed Loop	5-2000 Hz	150
PA6	Integral time constant of Speed loop	1-1000 ms	75
PA22	The source of Speed Command	0-5	0
PA24	Internal Speed 1	-6000~6000 rpm	100
PA25	Internal Speed 2	-6000~6000 rpm	500
PA26	Internal Speed 3	-6000~6000 rpm	1000
PA27	Internal Speed 4	-6000~6000 pm	2000
PA28	Arrival Speed	0-3000 rpm	3000
PA40	Acceleration Time Constant of Speed Command	1-10,000 ms	100
PA41	Deceleration Time Constant of Speed Command	1-10,000 ms	100
PA43	Gain of Analog Speed Command	10-3000 rpm/V	10
PA44	Direction of Analog Speed Command	0-1	0
PA45	Zero Offset Compensation of Analog Speed Command	-5000~5000 mv	0
PA46	Filter of Analog Speed Command	1-1000 Hz	100
PA75	Range For “Zero-Speed” Detection	0-1000 rpm	10
PA76	Speed Coincidence Range	0-1000 rpm	10
PA87	Hysteresis Of Arrival Speed	0-5000 rpm	30
PA88	Polarity Of Arrival Speed	0-1	0
PA92	Hysteresis For “Zero-Speed” Detection	0-1000 rpm	5

Parameters in Torque Mode

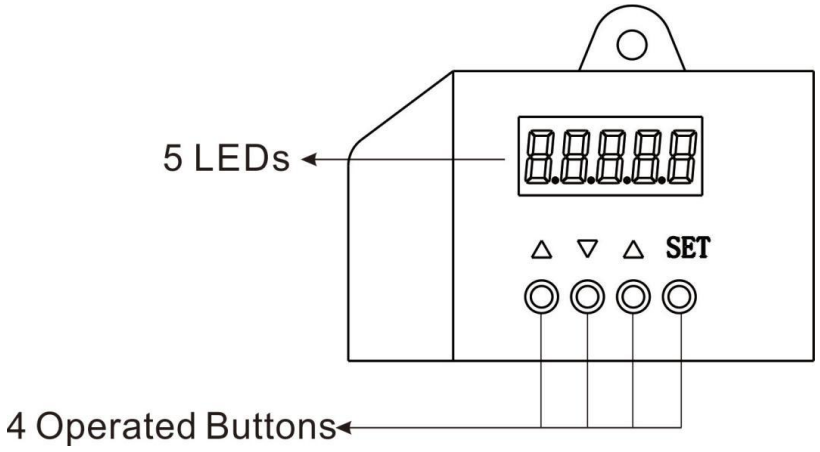
The following parameters need to be adjusted when in Torque mode:

Parameter	Definition	Value	Default Value
PA4	Control Mode	2	0
PA29	Gain of Analog Torque Command	Set by user	30
PA32	Selection For Internal And External Torque Command	0-2	0
PA33	Direction of Analog Torque Command	0	0
PA39	Zero Offset Compensation of Analog Speed Command	0	0
PA50	Speed Limit In Torque Control Mode	Set by user	Rated speed
PA64	Internal Torque 1	-3000~3000	0
PA65	Internal Torque 2	-3000~3000	0
PA66	Internal Torque 3	-3000~3000	0
PA67	Internal Torque 4	-3000~3000	0
PA83	Inhibition Method	0-1	0
PA89	Arrival Torque	-300% ~ 300%	100
PA90	Hysteresis of Arrival Torque	0% ~ 300%	5
PA91	Polarity of Arrival Torque	0-1	0

Operation and display

Introduction to Front Panel And Function

Front Panel:



Pic 1. Front Panel

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

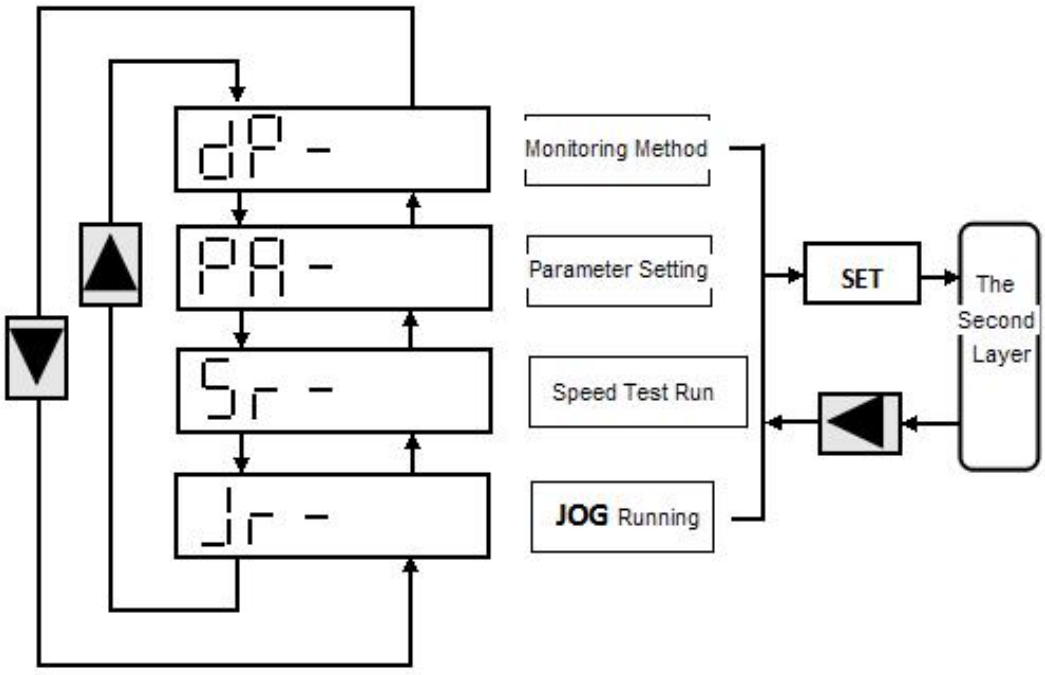
The operation is hierarchical. ← button indicates “Back” and SET button indicates “forward” while it also has the meaning of “Enter” . ← button also has the meaning of “Cancel” and “Exit”. ↑ button indicates “Increase” and ↓ button indicates “Decrease”. If you press and hold the ↑ button or ↓ button,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

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

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.



Pic 2. Operating display layer

Status Monitoring

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.	SET	C. 12	
dP-EPo		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- In		In	Digital Input Terminal
dP-oUt		oUt	Digital Output Terminal
dP-Cod		Cod	Encoder Signal
dP- rn		rn - on	Running State
dP-Err		Err 9	Alarm No.9

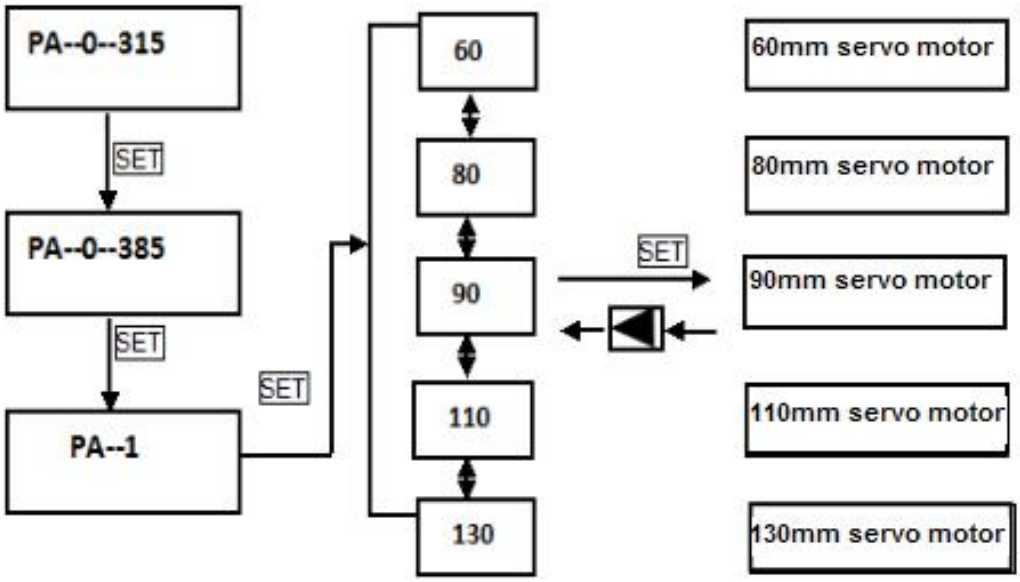
Parameters Setting

Steps to Set Parameters

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.*

How to match drive with your motor

The parameter PA-01 of drive must be configured with the exact motor that you use.
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, MK6-2A05-IAM2 has the factory default model of ac servo motor as OMA8-02430-3NA.
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

Resume the Parameter Default Values

In case of the following situations, please use the function of resuming the default parameters (manufacture default parameter):
λThe parameter is adjusted chaotically; the system is unable to work normally.
λThe servo motor is replaced by a different new model.
λFor 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 new servo motor code.

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.

How to do:

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.

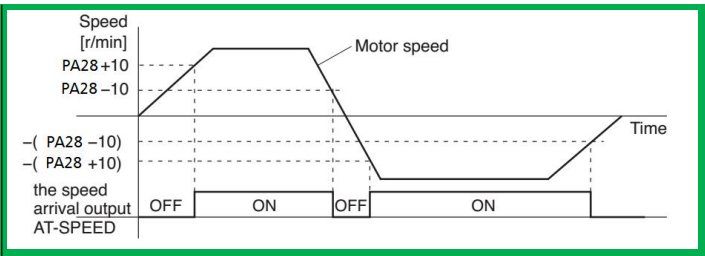
Parameters:

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	OMA8-02430
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 3: position + speed control mode 4: position + torque control mode 5: speed + torque control mode	0-5	0
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	5-2000Hz	150

		the value. 2. Set as high value as system does not generate any oscillation.		
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)	40
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 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:	0-32,767	0

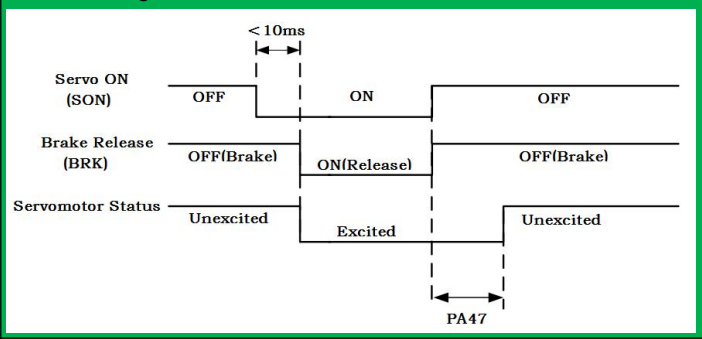
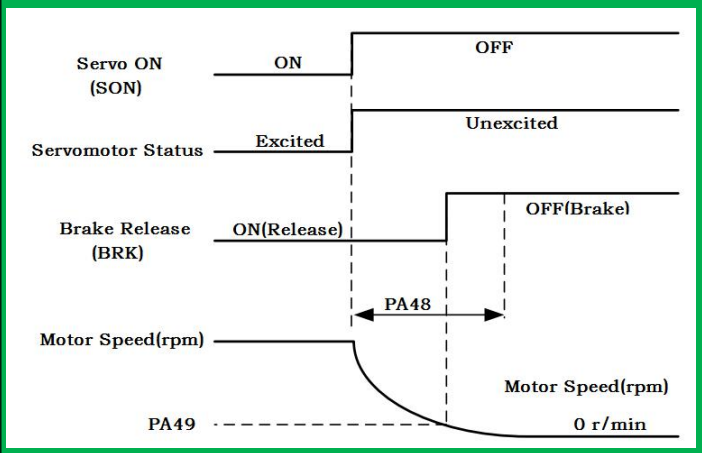
<table>
<tr><td></td><td></td><td>
<table>
<tr><th colspan="2">DI Signal</th><th rowspan="2">Numerator</th></tr>
<tr><th>Gear 2</th><th>Gear 1</th></tr>
<tr><td>0</td><td>0</td><td>1ST Numerator (Parameter PA 12)</td></tr>
<tr><td>0</td><td>1</td><td>2nd Numerator (Parameter PA 77)</td></tr>
<tr><td>1</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.</td><td>0-2</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.
(4. When the motor runs, there are step jumps in speed.
(5. When set to value”0”, the filter does not work.</td><td>0-30,000 x 0.1ms</td><td>300</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.</td><td>0-1</td><td>1</td></tr>
</table>

<table>
<tr><td></td><td></td><td>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></td><td></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>
<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>1. 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.
2. The comparator has hysteresis function set by PA87. Detection is associated with 10 r/min hysteresis.</td><td>0-3000
rpm</td><td>3000</td></tr>
</table>

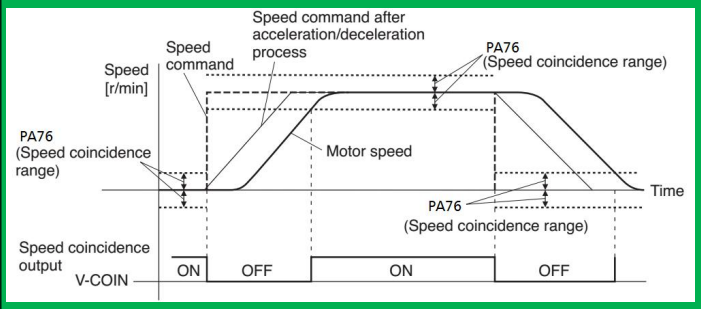
<table>
<tr><td></td><td></td><td> 

3. It also has the polarity setting function:
<table>
<tr><th>PA88</th><th>PA28</th><th>Comparator</th></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></td><td></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><th colspan="2">DI Signal</th><th rowspan="2">Torque Command</th></tr>
<tr><th>TRQ2</th><th>TRQ1</th></tr>
<tr><td>0</td><td>0</td><td>Internal Torque1（Parameter PA64)</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>
Note: 0=OFF, 1=ON
2: Analog torque command + internal torque command:
<table>
<tr><th colspan="2">DI Signal</th><th rowspan="2">Torque Command</th></tr>
<tr><th>TRQ2</th><th>TRQ1</th></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>0-1</td><td>0</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>
</table>

34	Internal CCW torque limit	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.	0~300%	300%
35	Internal CW torque limit	Refer to PA34.	-300~0%	-300%
36	Externally controlled CCW torque limit	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).	0~300%	100%
37	External CW torque limit	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).	-300~0%	-100%
39	Zero offset compensation of analog torque command	Make an offset adjustment for analog torque command.	-2000~2000	0
40	Acceleration time constant	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 combination with an external position loop controller (like CNC controller) to avoid extra acc/dec which is not decided by the controller.	1-10,000ms	100
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	Make an offset adjustment for analog speed command with this parameter.	-5000~5000	0

	analog speed command			
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	Refers to the explanation of parameter PA48.	0-3000 rpm	100

<table>
<tr><td></td><td>brake When servomotor is in motion</td><td></td><td></td><td></td></tr>
<tr><td>50</td><td>Speed limit in torque control mode</td><td>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.</td><td>0-5000 rpm</td><td>3000</td></tr>
<tr><td>53</td><td>Servo Force Enable</td><td>0: The enable signal is controlled by SON of digital input (DI)
1: Software forces to servo ON.</td><td>0-1</td><td>0</td></tr>
<tr><td>54</td><td>Servo enable delay time at SERVO-OFF</td><td>After the servo signal is deactivated on the digital input, it delays to cut the current of motor by this delay time.</td><td>0-30,000× 0.1ms</td><td>0</td></tr>
<tr><td>55</td><td>Effective level control of digital inputs</td><td>Represented by a byte of 4 bits. Each bit corresponds to one digital input. If any bit is 0, it means the related digital input terminal acts as normal and does not reverse (is activated when closed). While it is 1, it means the terminal logic is reversed (is activated when opened).
The byte represents the digital input terminals as following:
<table><tr><td>bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>definition</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr></table>0: High level is valid (is activated when closed)
1: Low level is valid (is activated when opened)</td><td>0000-1111</td><td>0000</td></tr>
<tr><td>57</td><td>Effective level control of digital outputs</td><td>Represented by a byte of 4 bits. Each bit corresponds to one digital output. If any bit is 0, it means the related digital output terminal acts as normal and does not reverse (is activated when switched ON). While it is 1, it means the terminal logic is reversed (is activated when switched OFF).
The byte represents the digital output terminals as following:
<table><tr><td>bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>definition</td><td>DO4</td><td>DO3</td><td>DO2</td><td>DO1</td></tr></table>0: High level is valid (is activated when switched ON)
1: Low level is valid (is activated when switched OFF)</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)
1: wire-saving 2500-line encoder (A, B, Z)</td><td>0-1</td><td>0</td></tr>
<tr><td>63</td><td>Load inertia ratio</td><td>Set the ratio of load inertia to motor inertia.
The setting value = [(load inertia + rotating inertia) / (rotating inertia)]x100.</td><td>1-500</td><td>100</td></tr>
<tr><td>64</td><td>Internal Torque 1</td><td>In torque control mode (PA4=2 and PA32=1), when TRQ1=OFF</td><td>-300~300</td><td>0</td></tr>
</table>

		and TRQ2=OFF, internal torque 1 is as the torque command.		
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.  * 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	0-1000 rpm	10
77	2nd numerator of	Refer to parameter PA12	0-32,767	0

	electronic gear ratio			
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
85	Range for approach positioning	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.	0-32,767 pulse	500
86	Hysteresis for approach positioning	Refer to parameter PA85.	0-32,767 pulse	50

<table>
<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><th>PA88</th><th>PA28</th><th>Comparator</th></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><th>PA91</th><th>PA89</th><th>Comparator</th></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><th>PA91</th><th>PA89</th><th>Comparator</th></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>

P3 Group Parameter

Parameter Table

MK6-2A05 and MK6-2A10 servo drives have 4 Digital Input terminals and 4 Digital Output terminals.
You can change their definition values through P3 group parameters.
Low level is effective as default.

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
P3-15	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

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)

11	SP2	Speed Choice 2	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)
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. ON: position command pulse is inhibited (motor stops even if the controller sends the command pulse).
22	JOGP	CCW Inching	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.
23	JOGN	CW Inching	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.

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.

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

Parameter explanation:

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

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）

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

Alarm definitions:

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
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
60	The interrupt of current loop is timeout	The operation of internal procedure is abnormal