Interface

I. Summary

1.1 Product Check

After receiving the AC servo drive, please check for the following:

Item	Content
Check for damage	Inspect the unit to insure it was not damaged during shipment.
Ensure that the product is what you have ordered.	Verify the part number indicated on the nameplate corresponds with the part number of your order
Accessories completeness	Ensure that the model and quantity of accessories are enough.
Ensure that the servo motor shaft rotates freely.	Rotate the motor shaft by hand; a smooth rotation will indicate a good motor. (However, a servo motor with an electromagnetic brake can not be rotated manually.)

! Caution

★ The damaged servo motor and drive are forbidden to be used.

★ Please ensure that both the servo drive and motor are correctly matched for size (power rating).

★ If any items are damaged or incorrect, please inform the distributor whom you purchased the product from or manufacturer.

Model of servo drive and motor:

Servo drive note 1	Input power wiring	Output power wiring	Wire of control loop	Encoder wiring note 2
SD10-Z0110T3C1	6 **mm²**	6 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0150T3C2	10 **mm²**	10 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0185T3C2	10 **mm²**	10 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0220T3C3	16 **mm²**	16 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0300T3C3	16 **mm²**	16 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0370T3C5	25 **mm²**	25 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0450T3C5	35 **mm²**	25 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0550T3C5	50 **mm²**	35 **mm²**	1.5 **mm²**	XB-8-*
SD10-Z0750T3C6	50 **mm²**	35 **mm²**	1.5 **mm²**	XB-8-*

Note 1: servo drive has built-in braking unit and external braking resistor.
Note 2: * means wiring length, the unit is m. The optional length is 3m, 4m and 6m. Please select shorter shielded twisted-pair cable as encoder cable. The manufacture motor cable is 2.5M.

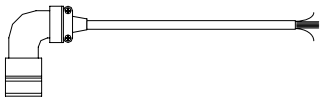


Fig 1-1 Encoder aviation plug

1.2 Servo Drive Nameplate

Take SD10-Z series 11kW servo drive special for injection molding machine for the example:

EURA DRIVES ELECTRIC CO., LTD	
Model	SD10-Z0110T3C1
Input	3PH AC 400 V 50/60 Hz
Output	3PH AC 0-400 V 23 A
	11 kW 0-400.0 Hz
IP20	Bar code

Fig 1-2 Servo Drive Nameplate

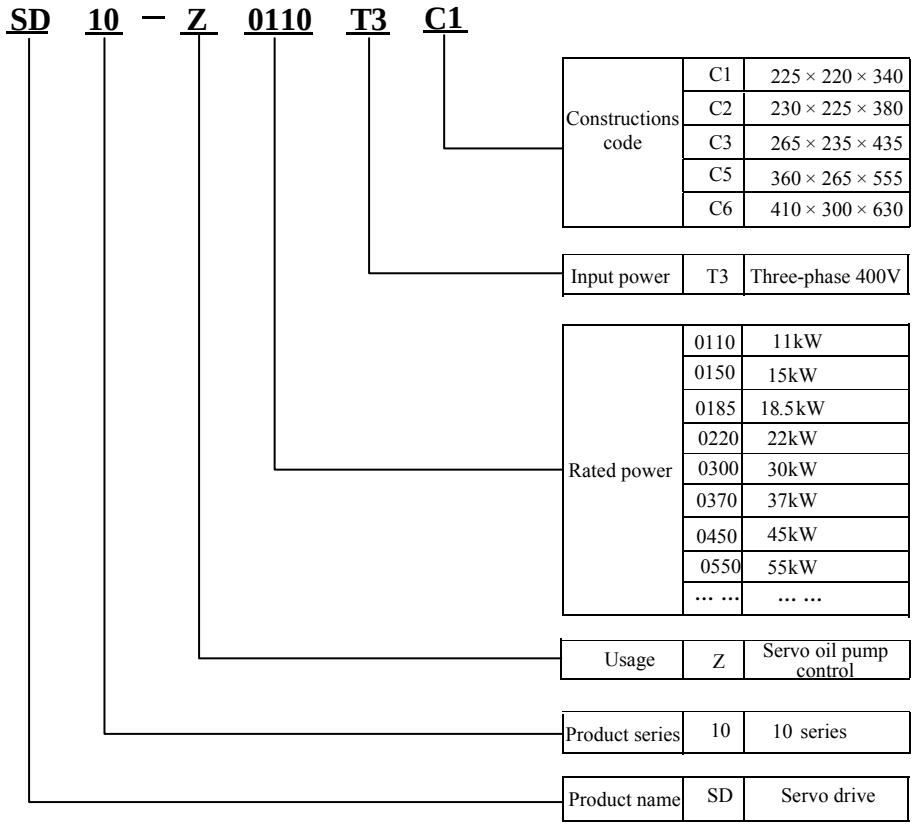
1.3 Servo Motor Nameplate

Take the ST series 11kW servo motor special for injection molding machine for the example:

SM17-0110R6BEDFS		
Rated power : 11 KW	Rated voltage : 400V	Rated torque : 64 N·M
Speed : 1700 r/min	Rated current : 23 A	Fan voltage : 220V
TH.CI.F IP 54	No.:	
Magnetic field angle:	Production date:	
AC permanent magnetic synchronous servo motor		

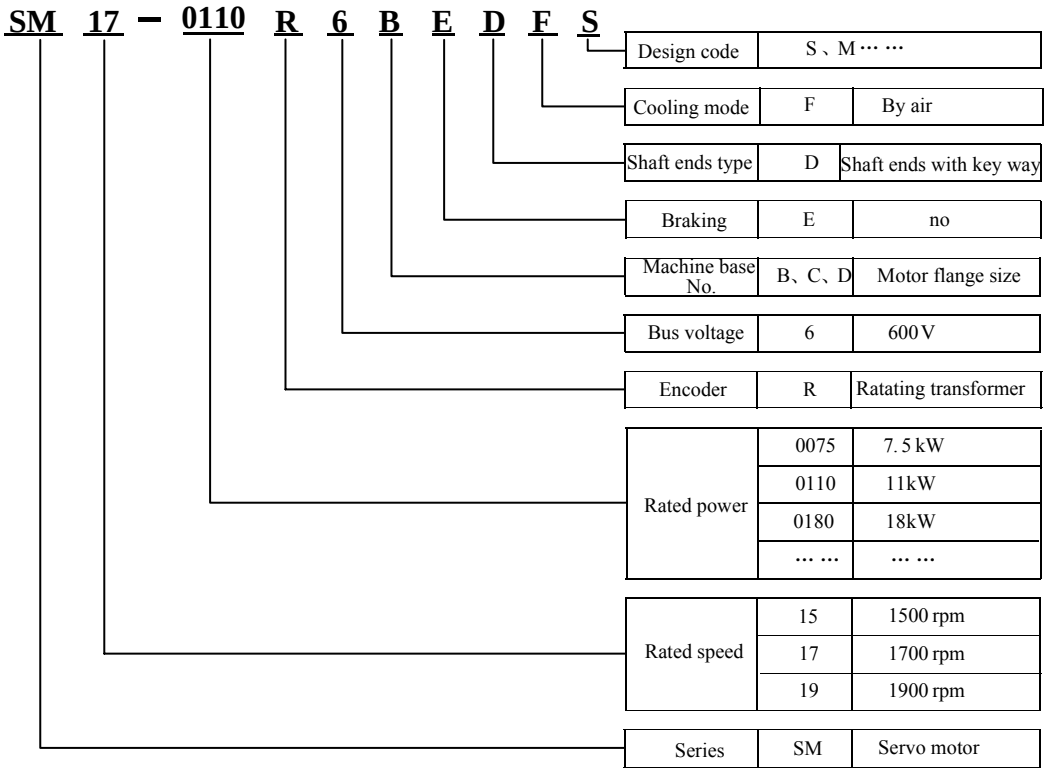
Fig 1-3 Servo Motor Nameplate

1.4 Servo drive naming rule



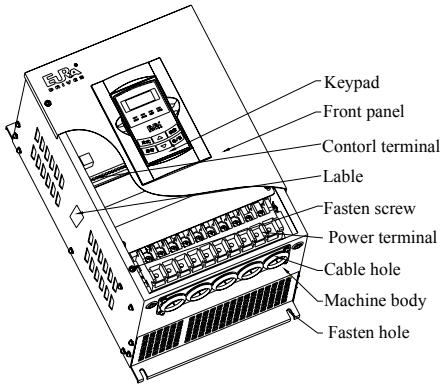
Note: all series products has built-in braking unit, and connect braking resistor externally.

1.5 Servo motor naming rule



1.6 Appearance

SD10-Z series servo drive adopts metal hanging housing. its appearance and structure are shown as in right figure, with detachable one-side door hinge structure adopted for front cover, convenient for wiring and maintenance.



1.7 Precautions

1.7.1 Installation instructions

- Do not drop anything into servo drive.
- Do not hold the product by the cables, aviation plug or motor shaft while transporting it.
- Never install or use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
- Be sure to install the product vertically in the correct direction.
- Provide the specified clearances between the top and bottom of servo drive (longer than 200mm).
- Do not strike the motor shaft ends.

1.7.2 Wiring instructions

- Please cut off all power supply while installing and wiring.
- Please match the cables and current capacity. Be sure to wire correctly and securely.
- Securely connect the motor terminals and servo drive output terminals.
- Please connect servo drive to motor directly, without any chokes, filters, etc.
- Securely connect grounding terminal of servo drive and external shell of motor.
- Do not bundle or run power and signal lines together in the same duct.
- Use twisted-pair shielded wires or multi-core twisted pair shielded wires for signal and feedback lines.

1.7.3 Operation instructions

- Please check the wiring before power on servo drive.
- Please check injection molding machine safe valve and output signal.

1.7.4 Maintenance

- Installation, disassembly, or repair must be performed only by authorized personnel.
- Never touch the internal elements within 15 minutes after power off. Wait till it is completely discharged.
- If servo drive is stored for long time, please charge the servo drive within half a year to prevent the electrolytic capacitors damaged.

1.7.5 Disposal

- When disposing of the products, treat them as ordinary industrial waste.

2 Servo system Specifications and model selection

2.1 Servo Drive Specifications and parameters

2.1.1 Specifications

	Item	Instructions
Input	Rated voltage	Three-phase 400V±10%
	Rated frequency	50/60Hz
Output	Rated voltage	Three-phase 0～400V
	Frequency range	0.00～400.00Hz
Structure	Hanging. Protection grade: IP20	
Cooling mode	Forced air cooling	
Encoder	Rotating transformer	
Control terminal Input/ output	Pressure command given	External analog signal (0~10V/ 0~20mA)
	Flow command given	External analog signal (0~10V/ 0~20mA)
	Pressure feedback	External analog signal (0~10V/ 0~20mA)
	Control input	6 channels isolated input
	Control output	3 channels isolated output
	Analog output	1 channel analog output.
Protection Function	Input out-phase, input under-voltage, over-voltage, over-current, servo drive over-load, servo drive over-heat, motor over-load, motor over-heat, external disturbance, pressure sensor fault, oil pump reverser running fault, encoder fault.	
Display	LED nixie tube showing present output frequency, present rotate-speed (rpm), present output current, present output voltage, types of faults, and parameters for the system and operation; LED indicators showing the current working status of servo drive.	
Environment Conditions	Equipment Location	In an indoor location, Prevent exposure from direct sunlight, Free from dust, tangy caustic gases, flammable gases, steam or the salt-contented, etc.
	Environment temperature	-10℃～+50℃
	Environment Humidity	Below 90% (no water-bead coagulation)
	Vibration Strength	Below 0.5g (acceleration)
	Height above sea level	1000m or below

Designed Standards for Implementation

- GB/T 12668.2 2002 Stipulation of rated value of AC low voltage electric drive system;
- GB 12668.3 2003 Standard for EMC and the specific experimental methods
- GB 12668.5 security requirements relating to electric, heat and energy.
- IEC/EN 61800-5-1: 2003 Adjustable speed electrical power drive systems safety requirements.

2.1.2 Servo drive parameter and equipment model selection

Servo drive	Rated current(A)	Overload current (A)	Duration time of overload current(S)	MCCB (A)	Recommend Contact (A)	Recommend EMC input filter (A)	Weight (Kg)
SD10-Z0110T3C1	23	34.5	60	63	40	50	11.8
SD10-Z0150T3C2	32	48	60	63	40	50	14.3
SD10-Z0185T3C2	38	57	60	100	63	80	14.4
SD10-Z0220T3C3	44	66	60	100	63	80	20.1
SD10-Z0300T3C3	60	90	60	125	100	100	22.6
SD10-Z0370T3C5	75	112.5	60	160	100	120	37.7
SD10-Z0450T3C5	90	135	60	200	125	150	38.7
SD10-Z0550T3C5	110	165	60	200	125	150	41.6
SD10-Z0750T3C6	140	210	60	250	160	200	55.1

2.2 Servo Motor Specifications

2.2.1 Servo motor technical specification

Insulation rate	F grade
Protection grade	IP54
Vibration Strength	Below 0.5g (acceleration)
Installation type	Bracket mounting
Usage temperature	-20℃~+40℃
Storage temperature	-25℃~+65℃
Humidity and heat	95% 30℃ and no water-bead coagulation
Standard height	2000m or below.
Encoder	Rotating transformer

2.2.2 Servo motor main parameter

Motor	Rated torque	Rated torque	Rated current	Rated speed	Max speed	Weight
	N·m	N·m	A	rpm	N·m	kg
SM15-0082R6BEDF	52	62.4	16.6	1500	130	65
SM15-0100R6BEDF	64	76.8	20.7	1500	160	75
SM15-0124R6BEDF	79	94.8	24.7	1500	198	80
SM15-0160R6BEDF	102	122.4	33.5	1500	255	85

SM15-0190R6CEDF	122	146.4	37.1	1500	305	120
SM15-0240R6CEDF	152	182.4	46.7	1500	380	132
SM15-0290R6DEDF	185	222	57.5	1500	462	150
SM15-0400R6DEDF	255	306	79	1500	637	187
SM17-0075R6BEDF	42	50.4	13.7	1700	105	60
SM17-0092R6BEDF	52	62.4	18	1700	130	65
SM17-0110R6BEDF	64	76.8	23	1700	160	75
SM17-0140R6BEDF	79	94.8	29.2	1700	198	80
SM17-0180R6BEDF	102	122.4	38.5	1700	255	85
SM19-0200R6BEDF	102	122.4	43	1900	255	85
SM17-0220R6CEDF	122	146.4	43	1700	305	120
SM17-0270R6CEDF	152	182.4	57.5	1700	380	132
SM17-0330R6DEDF	185	222	68	1700	462	150
SM17-0450R6DEDF	255	306	94	1700	637	187
SM17-0550R6DEDF	307	368.4	110	1700	767	205

2.3 Recommended configuration table

The table of some brands oil pumps are for reference only.

Pump flow (mL/r)	**Gear pump of ECKERLE**	**Gear pump of VOITH**	**Gear pump of SUMITOMO**	**Screw pump of SETTIMA**	**Gear pump of Chengjie**
25, 28	EIPC3-025	IPV4-25	QT42-25	GR47-28	NT3-25G
32	EIPC3-032	IPV4-32	QT42-31.5	GR47-32	NT3-32G
40	EIPC3-040	IPV5-40	QT52-40	GR47-40	NT4-40G
45	---	---	---	GR47-45	---
50	EIPC3-050	IPV5-50	QT52-50	GR47-50	NT4-50G
64	EIPC3-064 (1800 rpm) EIPC5-064 (3000 rpm)	IPV5-64 (2200 rpm) IPV6-64 (2600 rpm)	QT52-63	GR55-63	NT4-63G
75	---	---	---	GR55-75	---
80	EIPC5-080	IPV6-80	QT62-80	---	NT5-80G
90	---	---	---	GR55-90	---
100	EIPC5-100	IPV6-100	QT62-100	GR72-101	NT5-100G
125	---	IPV6-125 (1800 rpm) IPV7-125 (2200 rpm)	QT62-125	GR72-125	NT5-125G
150, 160	---	IPV7-160	---	GR72-150	---

Remarks:

Please pay attention to configuration when model selection, or else, system can not work normally.

Oil pump of SUMITOMO is only fit for molding machine with 140, 160 bar system pressure.

The instruction of model selection:

1. Please select speed zone according to max speed of system.
2. Please select oil pump according to requirement of system flow and pressure.
3. Please select servo drive and motor according to oil pump.

Please refer to next configuration table for servo driven and motor, oil pump.

System flow (L/min)	System pressure (bar)	Max speed (rpm)	Pump flow (mL/r)	Servo drive	Servo motor	Braking resistor
50	140	1800	28	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
58	140	1800	32	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
72	140	1800	40	SD10-Z0110T3C1	SM15-0082R6B	50Ω/500W
81	140	1800	45	SD10-Z0150T3C2	SM15-0100R6B	50Ω/500W
90	140	1800	50	SD10-Z0150T3C2	SM15-0100R6B	50Ω/500W
115	140	1800	64	SD10-Z0185T3C2	SM15-0160R6B	30Ω/1kW
135	140	1800	75	SD10-Z0220T3C3	SM15-0160R6B	30Ω/1kW
144	140	1800	80	SD10-Z0220T3C3	SM15-0190R6C	15Ω/1.5kW
162	140	1800	90	SD10-Z0300T3C3	SM15-0240R6C	15Ω/1.5kW
180	140	1800	100	SD10-Z0300T3C3	SM15-0240R6C	15Ω/1.5kW
225	140	1800	125	SD10-Z0370T3C5	SM15-0290R6D	15Ω/4kW
288	140	1800	160	SD10-Z0450T3C5	SM15-0400R6D	15Ω/6kW
50	160	1800	28	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
58	160	1800	32	SD10-Z0110T3C1	SM15-0082R6B	50Ω/500W
72	160	1800	40	SD10-Z0150T3C2	SM15-0100R6B	50Ω/500W
81	160	1800	45	SD10-Z0150T3C2	SM15-0124R6B	50Ω/500W
90	160	1800	50	SD10-Z0150T3C2	SM15-0124R6B	50Ω/500W
115	160	1800	64	SD10-Z0220T3C3	SM15-0160R6B	30Ω/1kW
135	160	1800	75	SD10-Z0220T3C3	SM15-0190R6C	15Ω/1.5kW
144	160	1800	80	SD10-Z0300T3C3	SM15-0240R6C	15Ω/1.5kW
162	160	1800	90	SD10-Z0300T3C3	SM15-0240R6C	15Ω/1.5kW
180	160	1800	100	SD10-Z0370T3C5	SM15-0290R6D	15Ω/4kW
225	160	1800	125	SD10-Z0450T3C5	SM15-0400R6D	15Ω/6kW

System flow (L/min)	System pressure (bar)	Max speed (rpm)	Pump flow (mL/r)	Servo drive	Servo motor	Braking resistor
288	160	1800	160	SD10-Z0550T3C5	SM17-0550R6D	15Ω/9kW
50	175	1800	28	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
58	175	1800	32	SD10-Z0110T3C1	SM15-0082R6B	50Ω/500W
72	175	1800	40	SD10-Z0150T3C2	SM15-0100R6B	50Ω/500W
81	175	1800	45	SD10-Z0150T3C2	SM15-0124R6B	50Ω/500W
90	175	1800	50	SD10-Z0185T3C2	SM15-0124R6B	50Ω/500W
115	175	1800	64	SD10-Z0220T3C3	SM15-0190R6C	15Ω/1.5kW
135	175	1800	75	SD10-Z0300T3C3	SM15-0240R6C	15Ω/1.5kW
144	175	1800	80	SD10-Z0300T3C3	SM15-0240R6C	15Ω/1.5kW
162	175	1800	90	SD10-Z0370T3C5	SM15-0290R6D	15Ω/4kW
180	175	1800	100	SD10-Z0370T3C5	SM15-0290R6D	15Ω/4kW
225	175	1800	125	SD10-Z0450T3C5	SM15-0400R6D	15Ω/6kW
288	175	1800	160	SD10-Z0550T3C5	SM17-0550R6D	15Ω/9kW
59	140	2100	28	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
67	140	2100	32	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
84	140	2100	40	SD10-Z0110T3C1	SM17-0092R6B	50Ω/500W
95	140	2100	45	SD10-Z0150T3C2	SM17-0110R6B	50Ω/500W
105	140	2100	50	SD10-Z0150T3C2	SM17-0110R6B	50Ω/500W
134	140	2100	64	SD10-Z0220T3C3	SM17-0180R6B	30Ω/1kW
158	140	2100	75	SD10-Z0300T3C3	SM17-0180R6B	30Ω/1kW
168	140	2100	80	SD10-Z0300T3C3	SM17-0180R6B	15Ω/1.5kW
189	140	2100	90	SD10-Z0300T3C3	SM17-0270R6C	15Ω/1.5kW
210	140	2100	100	SD10-Z0370T3C5	SM17-0270R6C	15Ω/1.5kW
262	140	2100	125	SD10-Z0450T3C5	SM17-0330R6D	15Ω/4kW
288	140	1800	160	SD10-Z0550T3C5	SM17-0450R6D	15Ω/6kW
59	160	2100	28	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
67	160	2100	32	SD10-Z0110T3C1	SM17-0092R6B	50Ω/500W
84	160	2100	40	SD10-Z0150T3C2	SM17-0110R6B	50Ω/500W
95	160	2100	45	SD10-Z0150T3C2	SM17-0140R6B	50Ω/500W
105	160	2100	50	SD10-Z0185T3C2	SM17-0140R6B	50Ω/500W
134	160	2100	64	SD10-Z0220T3C3	SM17-0180R6B	30Ω/1kW
158	160	2100	75	SD10-Z0300T3C3	SM17-0220R6C	15Ω/1.5kW

System flow (L/min)	System pressure (bar)	Max speed (rpm)	Pump flow (mL/r)	Servo drive	Servo motor	Braking resistor
168	160	2100	80	SD10-Z0300T3C3	SM17-0270R6C	15Ω/1.5kW
189	160	2100	90	SD10-Z0370T3C5	SM17-0270R6C	15Ω/1.5kW
210	160	2100	100	SD10-Z0370T3C5	SM17-0330R6D	15Ω/4kW
262	160	2100	125	SD10-Z0450T3C5	SM17-0450R6D	15Ω/6kW
288	160	1800	160	SD10-Z0550T3C5	SM17-0550R6D	15Ω/9kW
59	175	2100	28	SD10-Z0110T3C1	SM17-0075R6B	50Ω/500W
67	175	2100	32	SD10-Z0110T3C1	SM17-0092R6B	50Ω/500W
84	175	2100	40	SD10-Z0150T3C2	SM17-0110R6B	50Ω/500W
95	175	2100	45	SD10-Z0185T3C2	SM17-0140R6B	50Ω/500W
105	175	2100	50	SD10-Z0185T3C2	SM17-0140R6B	50Ω/500W
134	175	2100	64	SD10-Z0300T3C3	SM17-0180R6B	30Ω/1kW
158	175	2100	75	SD10-Z0300T3C3	SM17-0270R6C	15Ω/1.5kW
168	175	2100	80	SD10-Z0370T3C5	SM17-0270R6C	15Ω/1.5kW
189	175	2100	90	SD10-Z0370T3C5	SM17-0330R6D	15Ω/4kW
210	175	2100	100	SD10-Z0450T3C5	SM17-0330R6D	15Ω/4kW
262	175	2100	125	SD10-Z0550T3C5	SM17-0450R6D	15Ω/6kW
288	175	1800	160	SD10-Z0750T3C6	SM17-0550R6D	15Ω/9kW

3 Installation

3.1 Servo drive installation

3.1.1 Servo drive structure

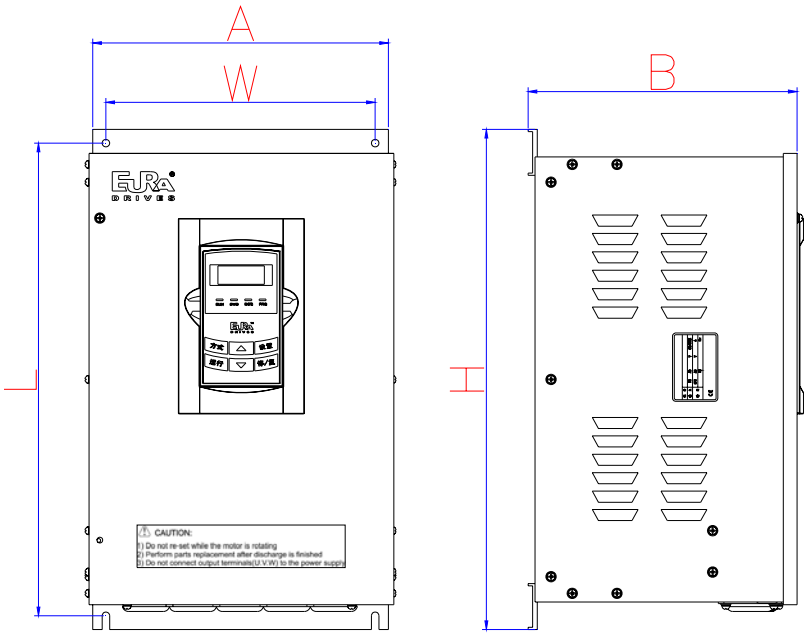


Fig 3-1 Installation Sketch

Structure code	External size(A×B×H)	Installation size (W×L)	Screw
C1	225×220×340（mm）	160×322（mm）	M6
C2	230×225×380（mm）	186×362（mm）	M6
C3	265×235×435（mm）	235×412（mm）	M6
C5	360×265×555（mm）	320×530（mm）	M8
C6	410×300×630（mm）	370×600（mm）	M10

3.1.2 Servo drive installation

Servo drive must be installed vertically, as shown in Fig 3-2. Sufficient ventilation space should be ensured in its surrounding.

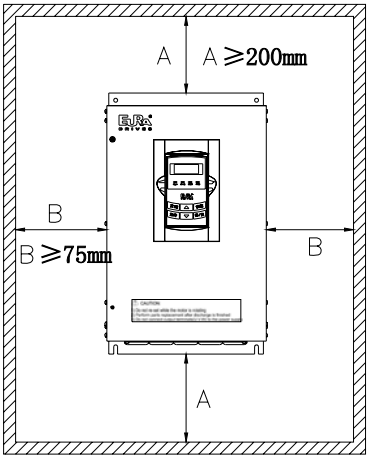


Fig 3-2 Installation Sketch

3.2 Servo motor installation

Please do not strike motor shaft ends, to avoid ruining bearing or speed sensor.

Note: please install motor in a better ventilated place, to avoid motor demagnetization because motor temperature is too high.

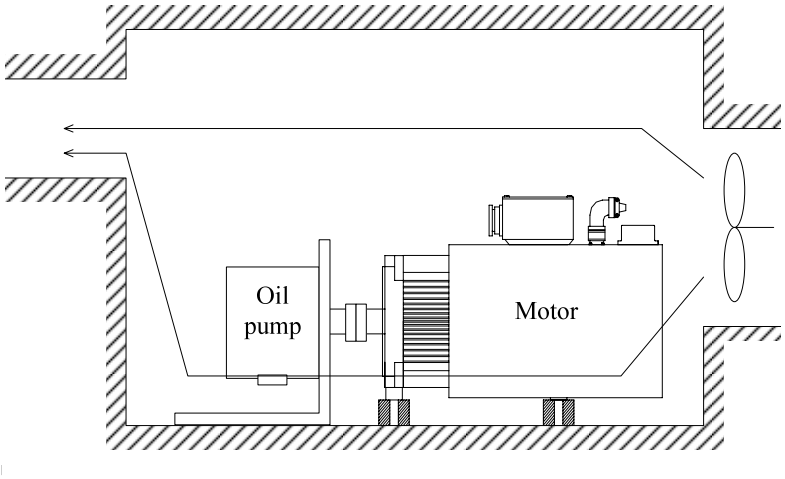


Fig 3-4 Correct installation mode

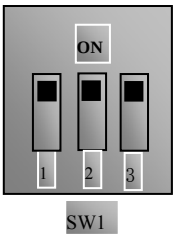
3.3 Braking unit and braking resistor

There is no "-" terminal for 37kW and above 37kW servo drive, if user need external braking unit, it needs to be customized.

Optional braking unit: HFBU-DR series.

Braking resistor must be non-inductive resistor.

Braking voltage of braking unit can be adjusted by switching code SW1.



Switching code 1	Switching code 2	Switching code 3	Braking voltage
ON	OFF	OFF	720V
OFF	ON	OFF	690V
OFF	OFF	ON	650V

Installation: the distance between braking unit and servo drive should be lower than 1m. Braking unit has four terminals DC(+)/P, DC(-)/-, BR1/P and BR2/B. The two ends of braking resistor are connected to terminals of BR1/P and BR2/B. Terminal DC(+)/P is connected to the positive terminal of servo DC bus line, and terminal DC(-)/- is connected to the negative terminal of servo DC bus line.

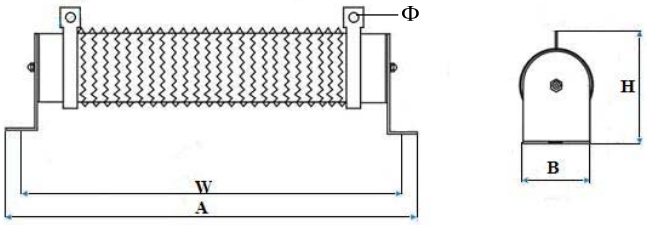


Fig 3-4 Braking resistor size

Resistor power	External size			Installation size		Resistor type
	Length (A)	Width (B)	Height (H)	Length (W)	Hole size (Φ)	
500W	360±3.0	50±1.0	91±3.0	338±3.0	Φ8±0.3	non-inductive resistor
1kW	350±3.0	60±2.0	119±3.0	325±5.0	Φ8.5±0.5	non-inductive resistor
1.5kW	484±5.0	68±1.0	125±3.0	454±4.0	Φ8.5±0.5	non-inductive resistor
2kW	557±5.0	60±1.0	119±3.0	532±4.0	Φ8.5±0.5	non-inductive resistor
4kW	587±5.0	70±1.0	210±5.0	559±4.0	Φ10±0.5	Double vertical non-inductive resistor
6kW	661±5.0	70±1.0	210±5.0	633±4.0	Φ10±0.5	Three vertical non-inductive resistor
9kW	660±5.0	260±1.0	133±5.0	635±4.0	Φ9.5±0.3	Three transverse non-inductive resistor
4kW	562±5.0	140±1.0	119±5.0	537±4.0	Φ10±0.5	Double transverse non-inductive resistor
6kW	562±5.0	220±1.0	119±5.0	537±4.0	Φ10±0.5	Three transverse non-inductive resistor
9kW	652±5.0	300±1.0	119±5.0	627±4.0	Φ9.5±0.3	Four transverse non-inductive resistor

4 System wiring

4.1 System construction

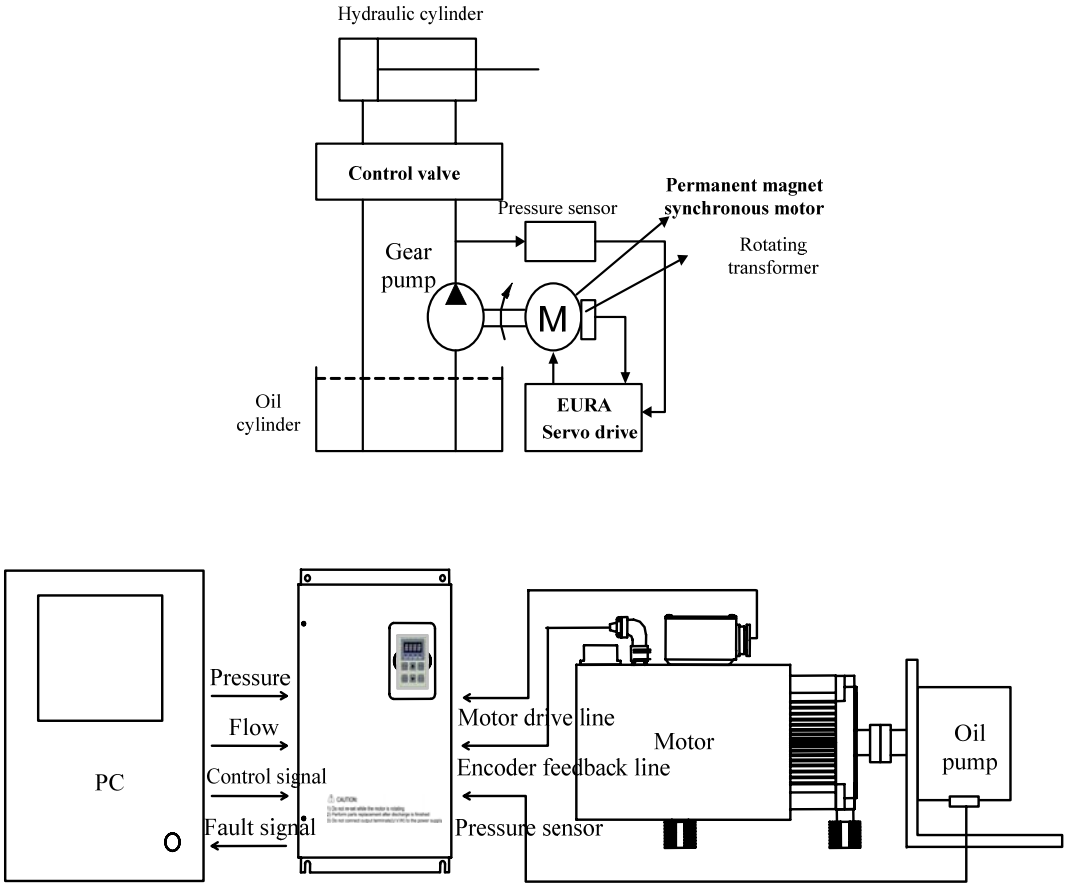


Fig 4-1 System construction

4.2 Connection

4.2.1 main circuit connection

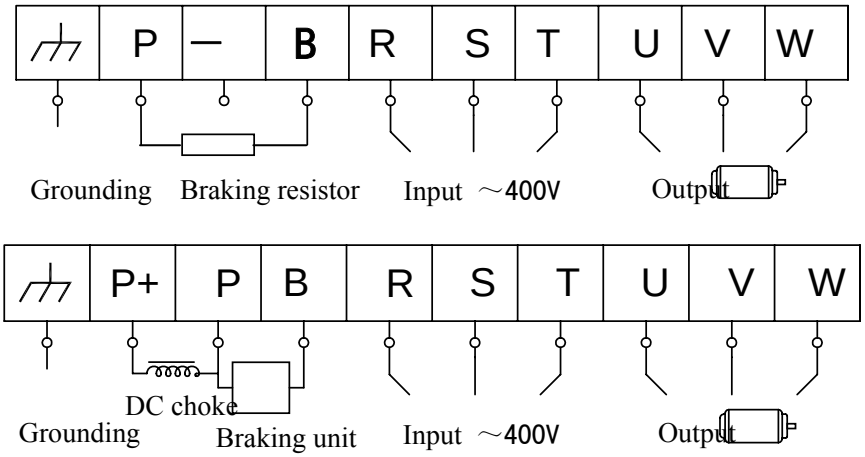


Fig 4-2 Main circuit connection

(The figure is only sketch, terminals order of practical products may be different from the above-mentioned figure.)

Fig 4-1 **Introduction of terminals of power loop**

Terminal	Terminal marking	**Terminal Function Description**
Power Input Terminal	R S T	Input terminals of three-phase 400V AC voltage
Output Terminal	U V W	Servo drive output terminal, connected to motor.
Grounding Terminal	⏚ (PE)	Servo drive grounding terminal (This terminal should be connected to motor shell and connected to ground).
Rest Terminal	P B	External braking resistor (Note: no Terminal B for servo drive without built-in braking unit).
	P -	Externally connected to braking unit. P connected to input terminal "DC (+) or P" of braking unit, - connected to input terminal of braking unit "DC(-)". No terminal "-" for 37KW and 37KW servo drive, external braking unit needs to be customized.
	P P+	Externally connected to DC reactor. The choke is optional, the rated voltage should be higher than 400V, and the rated current should be higher than 1.5 times of motor rated power.

4.2.2 **Functions of control terminals**

Fig 4-2 Functions of Control Terminals

Terminal	Type	Description	Function
DO1、 DO2	Output signal	Multifunctional output terminal	When the token function is valid, the value between this terminal and CM is 0V; when the servo drive is stopped, the value is 24V.
TA		Relay contact	TC is a common point, TB-TC are normally closed contacts, TA-TC are normally open contacts. The contact capacity is 6A/125VAC, 3A/250VAC and 3A/30VDC.
TB			
TC			
AO		Motor speed token	It is connected with frequency meter or speedometer externally, and its
10V	Analog power supply	Self contained power supply	Internal 10V self-contained power supply of the servo drive provides power to itself. When used externally, it can only be used as the power supply for voltage control signal, with current restricted below 20mA. **Pressure transformer must use external power supply.**
AI1	Input signal	Voltage analog input	Pressure given input terminal. The grounding terminal is GND.
AI2		Voltage analog input	Pressure feedback input terminal. The grounding terminal is GND.
AI3		Voltage analog input	Flow given input terminal. The grounding terminal is GND.
GND	Grounding terminal	Self-contained power supply ground	Ground terminal of external control signal is also the ground of 10V power supply of this servo drive.
24V	Power supply	Control power supply	Power: 24±1.5V, grounding: CM; current is restricted below 50mA for external use.
OP1	Digital input control terminal	Motor over-heat signal	This terminal is valid when connecting to 24V. Servo drive will display ESP after disconnecting to 24V.
OP2		Reserved	Programmable control input.
OP3		Enable signal	This terminal is valid when connecting to 24V. If users can cancel enable signal, please disconnect this terminal to 24v, and press "stop/reset" key.
OP4		Malfunction reset	This terminal is valid when connecting to 24V.
OP5		Free stop signal	This terminal is valid when connecting to 24V.
OP6		Reserved	Programmable control input.
CM	Common port	Grounding of control power supply	The grounding of 24V power supply. The grounding 00 of glue-injection signal is connected to CM terminal.
RE1、RE2	Rotating transformer signal		Standard wiring from manufacture is 3m, special length wiring needs to be customized.
SIN+、SIN-			
COS+、COS-			
A+	485 communication terminals	Positive polarity of differential signal	Standard: TIA/EIA-485(RS-485) Communication protocol: Modbus Communication rate: 1200/2400/4800/9600/19200/38400/57600bps
B-		Negative polarity of Differential signal	
CAN+	CAN communication terminals	CAN+	It is used among servo drives communication. Do not use it externally. When several servo drives correspondence, the first and last drives need to connect 120ohm resistor externally, the other drives are not connected resistors.
CAN-		CAN-	

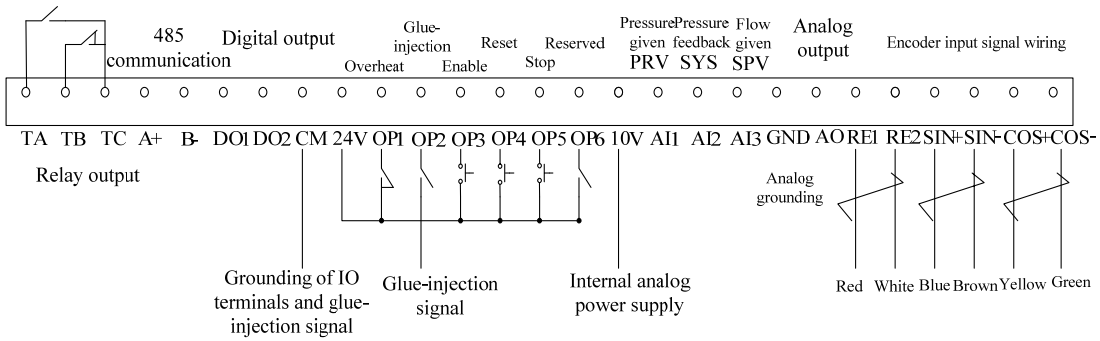


Fig **4-3 Servo drive control PCB**

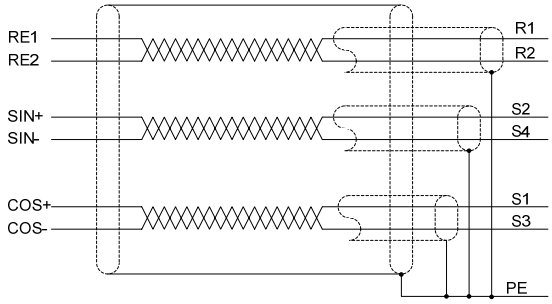


Fig 4-4 Rotating transformer wiring

Note:

1 Switch J7 turns to PNP position, 24V is common terminal. Switch J7 turns to NPN position, CM is common terminal.

2 Please refer to table 4-3 about the relationship of line of rotating transformer and servo drive.

3 The input/output signal of rotating transformer is differential analog, the transform line must adopt shielded differential twisted line. (The standard line is 1.5M).

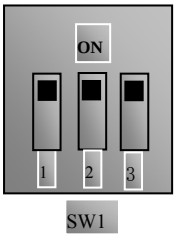
Table 4-3 Relationship between rotating transformer line and servo drive line

Encoder line NO.	R1	R2	S2	S4	S1	S3	J1	J2
Servo drive	RE1	RE2	Sin+	Sin-	COS+	COS-	OP1	24V
Line color	Red	White	Blue	Brown	Yellow	Green	Grey	Black
Aviation plug No.	1	2	5	6	3	4	7	8

4.2.3 Analog channel switchover

Switching code setting

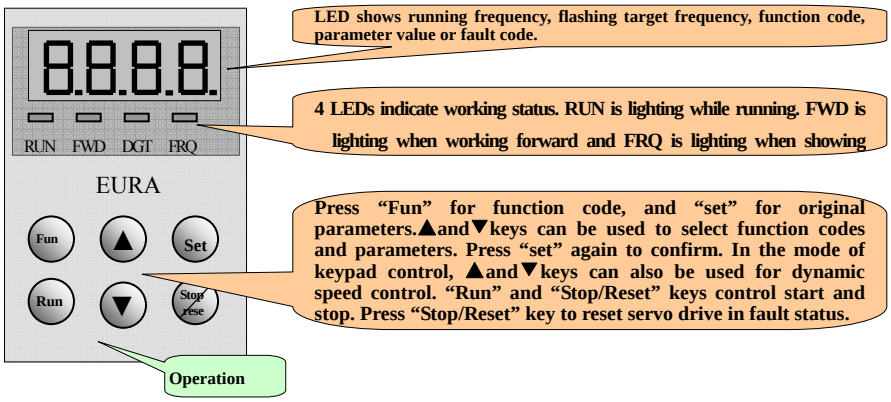
Switching code 1	Switching code 2	Switching code 3	Signal type
AI1	AI2	AI3	
ON	ON	ON	0～20mA current
OFF	OFF	OFF	0～10V voltage



5 Keypad panel

5.1 Panel Illustration

The panel covers three sections: data display section, status indicating section and keypad operating section, as shown in Fig. 5-1.



5.2 Panel Operation

All keys on the panel are available for user. Refer to Table 2-1 for their functions.

Table 5-1 Uses of Keys

Keys	Names	Remarks
Fun	Fun	To call function code and switch over display mode.
Set	Set	To call and save data.
▲	Up	To increase data (speed control or setting parameters)
▼	Down	To decrease data (speed control or setting parameters)
Run	Run	To start servo drive;
Stop/reset	Stop or reset	To stop servo drive; to reset in fault status; to change function codes in a code group or between two code groups.

5.3 Parameters Setting

Table 5-2 Steps for Parameters Setting

Steps	Keys	Operation	Display
1	Fun	**Press "Fun" key to display function code**	F100
2	▲ or ▼	**Press "Up" or "Down" to select required function code**	F114
3	Set	**To read data set in the function code**	5.0
4	▲ or ▼	**To modify data**	9.0
5	Set	**To display the current function code**	F114

The above-mentioned step should be operated when servo drive is in stop status.

5.4 Function Codes Switchover in/between Code-Groups

Press "Fun" key so that the keypad controller will display function code. If press "▲" or "▼" key then, function code will circularly keep increasing or decreasing by degrees within the group; if press the "stop/reset" key again, function code will change circularly between two code groups when operating the "▲" or "▼" key.

e.g. when function code shows F111 and DGT indicators on, press "▲"/ "▼" key, function code will keep increasing or decreasing by degrees within F100～F160; press "stop/reset" key again, DGT indicator will be off. When pressing "▲"/ "▼" key, function codes will change circularly among the 10 code-groups, like F211, F311… F111…, Refer to Fig 5-2

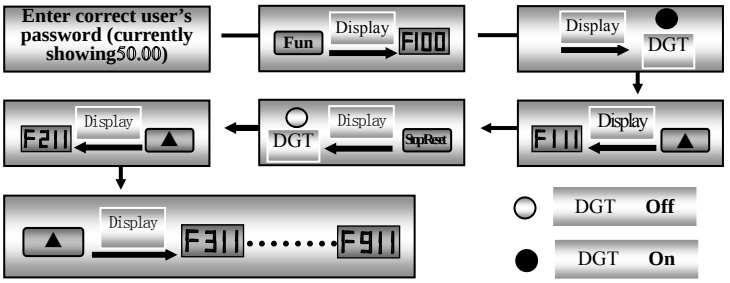


Fig 2-2 Switch over in a Code Group or between Different Code-Groups

5.5 Panel Display

Items and Remarks Displayed on the Panel

Items	Remarks
-HF-	It indicates servo drive is resetting.
OC，OE，OL1，OL2，OH，ESP，LU，PF1, PP-1, PP-2, PGo	Fault code, indicating “over-current ”, “over-voltage”, “servo drive over-load”, “motor over-load”“servo drive over-heat”, "motor over-heat" “under-voltage for input”, “out-phase for input” , “pressure sensor fault”, “pump reverse running fault”, “encoder fault” respectively.
H.H.	Interruption code, indicating “external interruption” signal input and showing “0” after reset.
TEST	Motor magnetic angle study.
F152	Function code (parameter code).
10.00	Indicating current running frequency and parameter setting values, etc.
2100	Indicating servo motor current speed.
50.00	Sparkling in stopping status to display target frequency.
A100、U100	Output current (100A) and output voltage (100V). Keep one digit of decimal when current is below 100A.

5.6 Function Parameters

5.6.1 Basic parameters

F100 User's Password	Setting range: 0～9999	Mfr's value: 8

·When F107=1 with valid password, the user must enter correct user's password after power on or fault reset if you intend to change parameters. Otherwise, parameter setting will not be possible, and a prompt "Err1" will be displayed.

Relating function code: F107 Password valid or not

F108 Setting user's password

F111 Max Frequency	Setting range: F113～400.0Hz	Mfr's value: 200.0Hz
F112 Min Frequency	Setting range: 0.00Hz～F113	Mfr's value: 0.00Hz

·The max/min frequency can be set according to servo motor.

F113 Target frequency in speed mode	Setting range: 0～400.0	Mfr's value: 1.00

·When servo drive is in the FA30=0 state, the running frequency can be set by F113, which can be adjusted by up and down key.

F114 Acceleration Time(S)	Setting range:0.001～32.00S	Mfr's value: Subject to model
F115Deceleration Time (S)		

Acceleration Time: The time for servo drive to accelerate to 50Hz from 0Hz
Deceleration Time: The time for servo drive to decelerate to 0Hz from 50Hz

5.6.2 Running control mode

F200 Source of start command	Setting range: 0: Keypad command; 1: Terminal command; 2: Keypad＋Terminal	Mfr's value: 2
F201 Source of stop command	Setting range: 0: Keypad command; 1: Terminal command; 2: Keypad＋Terminal;	Mfr's value: 2

· F200 and F201 are the resource of selecting control commands.
· Control commands include: starting, stopping, forward running, reverse running, jogging, etc.
·"Keypad command" refers to the start/stop commands given by the "Run" or "stop/reset" key on the keypad.
·"Terminal command" refers to the start/stop command given by the "Run" terminal defined by F316-F323.
·When F200=2 and F201=2, "keypad command" and "terminal command" are valid at the mean time.

F202 Mode of direction setting	Setting range: 0: Forward running locking; 1: Reverse running locking; 2: Terminal setting	Mfr's value: 0

The running direction is controlled by this function code together with other speed control mode which can set the running direction.

F203 Main frequency source X	Setting range: 0: Memory of digital given; 1: External analog AI1; 2: External analog AI2; 6: External analog AI3; 11: MODBUS 12: CAN communication	Mfr's value: 0

· Main frequency source is set by this function code.

·0: Memory of digital given

Its initial value is the value of F113. The frequency can be adjusted through the key “up” or “down”, or through the “up”, “down” terminals.
“Memory of digital given” means after servo drive stops, the target frequency is the running frequency before stop.

1: External analog AI1; 2: External analog AI2 6：External analog AI3
The frequency is set by analog input terminal AI1, AI2 and AI3.
11. Multiple pump control MODBUS communication setting
This function is valid when multi-pump is as accessorial pump, and main pump will control speed by MODBUS.
12. Multiple pump control CAN communication setting
If auxiliary pump is multiple pump control, this function is valid. Master pump will control the speed by CAN communication. When several drives correspondence, the first and last drives needs to connect 120ohm resistor, the other drives need to remove the resistor.

F208 Terminal two-line/three-line operation control	Setting range: 0: No function; 1: Two-line operation mode 1; 2: Two-line operation mode 2;	Mfr’s value: 0

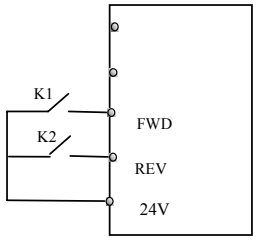
· When selecting two-line type or three-line type), F200, F201 and F202 are invalid.

“FWD” and “REV” are two terminals designated in programming OP1～OP6.

1: Two-line operation mode 1: this mode is the most popularly used two-line mode. The running direction of mode is controlled by FWD, REV terminals.

For example: “FWD” terminal-----“open”: stop, “closed”: forward running;
“REV” terminal-----“open”: stop, “closed”: reverse running;
“24V” terminal-----common port

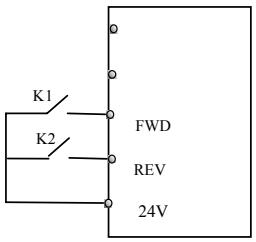
K1	K2	Running command
0	0	Stop
1	0	Forward running
0	1	Reverse running
1	1	Stop



2. Two-line operation mode 2: when this mode is used, FWD is enable terminal, the direction is controlled by REV terminal （It is only valid when FA30=0）.

For example: “FWD” terminal-----“open”: stop, “closed”: running;
“REV” terminal-----“open”: forward running, “closed”: reverse running;
“CM” terminal-----common port

K1	K2	Running command
0	0	Stop
0	1	Stop
1	0	Forward running
1	1	Reverse running



F209 Selecting the mode of stopping the motor	Setting range: 0: stop by deceleration time; 1: free stop	Mfr's value: 0

When the stop signal is input, stopping mode is set by this function code:

F209=0: stop by deceleration time

Servo drive will decrease output frequency according to setting acceleration/deceleration curve and decelerating time, after frequency decreases to 0, servo drive will stop. This is common used stopping type.

F209=1: free stop

After stop command is valid, servo drive will stop output. Motor will free stop by mechanical inertia.

F210 Frequency display accuracy	Setting range: 0.01～2.00	Mfr's value: 0.01

Under keypad speed control or terminal UP/DOWN speed control, frequency display accuracy is set by this function code and the range is from 0.01 to 2.00. For example, when F210=0.5, UP/DOWN terminal is pressed at one time, frequency will increase or decrease by 0.5Hz.

5.6.3 Multifunctional Input and Output

Function code	Definition	Setting range	Mfr's value	Note
F300	Relay token output	0：No function 1：Fault protection 5：Servo on 10: Servo drive overload pre-alarm 11: Servo motor overload pre-alarm 13: Servo ready 16: Servo overheat pre-alarm	1	√
F301	DO1 token output		11	√
F302	DO2 token output		0	√
F316	OP1 function setting	0：No function 1：Enable terminal 2：Deceleration stop terminal 7：Fault reset terminal 8：Free stop terminal 9：Motor over-heat terminal 15: FWD forward running terminal 16: REV reverse running terminal 19: Injection signal 40: Synchronous pump 1 switching signal input 41: Synchronous pump 2 switching signal input 42: Running mode switching signal input 43: Register terminal internal master pump Rest: Reserved	9	√
F317	OP2 function setting		19	√
F318	OP3 function setting		1	√
F319	OP4 function setting		7	√
F320	OP5 function setting		8	√
F321	OP6 function setting		15	√

Instructions for digital multifunctional output terminal (F300-F302):

Value	Function	Instructions
0	No function	Output terminal has no functions.
1	Fault protection	When servo works wrong, ON signal is output.
5	Servo on	When servo is enabled, ON signal is output.
10	Servo drive overload	After servo overloads, ON signal is output after the half time of protection

	pre-alarm	timed, ON signal stops output after overload stops or overload protection occurs.
11	Servo motor overload pre-alarm	After motor overloads, ON signal is output after the half time of protection timed, ON signal stops output after overload stops or overload protection occurs.
13	Servo ready	When servo is powered on and protection function is not in action, ON signal is output.
16	Servo overheat pre-alarm	When testing temperature reaches 80% of setting value, ON signal is output. When overheat protection occurs or testing value is lower than 80%of setting value, ON signal stops output.

Instructions for digital multifunctional output terminal (F316-F321):

Value	Function	Instructions
0	No function	Even if signal is input, servo will not be action. So user can set 0 to the terminals which are not being used to avoid mis-operation.
1	Enabled terminal	When starting command is controlled by terminals and this function is valid, servo drive will start.
2	Deceleration stop terminal	When stopping command is controlled by terminals and this function is valid, servo drive will stop.
7	Fault reset terminal	This function is the same as the "reset" key in the keypad.
8	Free stop terminal	Servo drive has no output, the stop process of motor is not controlled by servo drive.
9	Motor overheat terminal	When motor sends the overheat signal to servo drive, overheat fault occurs and servo drive will stop.
15	FWD terminal	When F208=1 or 2, this terminal is valid and motor runs forward.
16	REV terminal	When F208=1 or 2, this terminal is valid and motor runs reverse.
19	Injection signal	Injection signal will control relay. The common-open contact of relay will control this terminal.
40	Synchronous pump 1 switching signal input	Synchronous pump starting signal (used by master pump)
41	Synchronous pump 2 switching signal input	Synchronous pump 2 starting signal (used by master pump)
42	Running mode switching signal input	Synchronous pump running switching mode. When this terminal is valid, synchronous pump is control by pressure mode. When this terminal is invalid, synchronous is as auxiliary pump, which is controlled by speed mode.
43	Register terminal internal master pump	When this terminal is valid, main pump controller will work according to the pressure set by Fb10 not given by analog.

5.6.4 Analog input and output

Function code	Definition	Setting range	Mfr's value	Note
FB16	AI1 input voltage display	NC	NC	△
FB17	AI2 input voltage display	NC	NC	△
FB18	AI3 input voltage display	NC	NC	△
FB19	FB16-FB18 display filtering	1-9999	500	√

FB63	AI1filtering time constant	0-255	0	√
FB64	AI2filtering time constant	0-255	0	√
FB65	AI3filtering time constant	0-255	0	√
F423	AO output range selecting	0：0～5V 1：0～10V	0	√
F424	Corresponding frequency for lowest voltage of AO output	0.0～F425	0.05Hz	√
F425	Corresponding frequency for highest voltage of AO output	F425～F111	200.00Hz	√
F426	AO output compensation	0～120%	100	√
F431	AO analog output signal selecting	0: Running frequency; 1: Output current; 2: Output voltage; 6: Auxiliary pump speed given	0	√
F433	Corresponding current for full range of external voltmeter	0.1～5 times of rated current	2.00	×

FB16, FB17, FB18 are used to display input voltage.
They are used to display the voltage of analog channel, 0-20mA current signal of current channel will display corresponding 0-10V voltage signal.
FB19 is used to set analog display filtering
The bigger filtering constant is, the more stable analog displaying is. Please adjust it according actual situation.
FB63, FB64 and FB65 are used to set analog input filtering time constant.
The bigger filtering constant is, the more stable analog testing is, but the precision is reduced and response will be slower. Please adjust it according actual situation.
AO output range is selected by F423. When F423=0, AO output range selects 0-5V, and when F423=1, AO output range selects 0-10V.
Correspondence of output voltage range (0-5V or 0-10V) to output frequency is set by F424 and F425. For example, when F423=0, F424=10 and F425=120, analog channel AO outputs 0-5V and the output frequency is 10-120Hz.
AO output compensation is set by F426. Analog excursion can be compensated by setting F426.
Token contents output by analog channel are selected by F431. Token contents include running frequency, output current and output voltage.
When output current is selected, analog output signal is from 0 to twofold rated current.
· When output voltage is selected, analog output signal is from 0V to rated output voltage 400V.
In case of F431=1 and AO channel for token current, F433 is the ratio of measurement range of external voltage type ammeter to rated current of the servo drive.
For example: measurement range of external ammeter is 100A, and rated current of the servo is 30A, then, F433=100/30=3.33.

5.6.5 Braking and Protection

Function code	Definition	Setting range	Mfr's value	Note
F611	Dynamic Braking threshold	200～1000	660V	△
F612	Dynamic braking duty ratio	0～100%	100	×
F706	Servo drive overloading Coefficient (%)	120～190	150	×

F707	Motor Overloading Coefficient (%)	20～100	100	×
F724	Input out-phase	0: invalid; 1: valid	1	×
F725	Under-voltage	0: invalid; 1: valid	1	×
F726	Servo drive overheat	0: invalid; 1: valid	1	×
F728	Input out-phase filtering constant	0.1～60.0	0.5	√
F729	Under-voltage filtering constant	0.1～60.0	5.0	√
F730	Overheat protection filtering constant	0.1～60.0	5.0	√
FB59	Pressure sensor test fault enable	0: Invalid 1: Valid	0	√
FB60	Pressure feedback threshold	1～100	5	√
FB61	Current threshold	1～500	35	√
FB62	Duration time after checking fault	10～1000	40	√

F611	Dynamic Braking threshold	Setting range: 200～1000	Mfr's value: 660V
F612	Dynamic braking duty ratio (%)	Setting range: 0～100	Mfr's value: 100

This function is only valid for the servo drive with B terminal of built-in braking unit.

Initial voltage of dynamic braking threshold is set by F611, which of unit is V. When DC bus voltage is higher than the setting value of this function, dynamic braking starts, braking unit starts working. After DC bus voltage is lower than the setting value, braking unit stops working.
Dynamic braking duty ratio is set by F612, the range is 0~100%.

F706	Servo drive overloading Coefficient (%)	Setting range: 120～190	Mfr's value: 150
F707	Motor Overloading Coefficient (%)	Setting range: 20～100	Mfr's value: 100

Servo drive overloading coefficient: the ratio of overload-protection current and rated current, whose value shall be subject to actual load.
· Motor overloading coefficient (F707): when inverter drives lower power motor, please set the value of F707 by below formula in order to protect motor
Please set F707 according to actual situation. The lower the setting value of F707 is, the faster the overload protection speed.
"Under-voltage" / "out-phase" signal filtering constant is used for the purpose of eliminating disturbance to avoid mis-protection. The greater the set value is, the longer the filtering time constant is and the better for the filtering effect.

FB59 is used to set pressure feedback sensor testing fault. During control mode running process, if feedback pressure value will not change as given pressure and feedback speed, and the duration time is longer than the time set by FB62, pressure sensor fault will occur and servo drive stops and trip into PP-1.

FB60 is used to set pressure feedback threshold, if pressure feedback value is always lower than setting value, pressure feedback sensor fault will occur.

FB61 is the current threshold, if the current is higher than this value, servo drive will start to check whether pressure feedback sensor has fault.

FB62 is duration time after servo drive detects pressure sensor fault.

5.6.6 Motor parameters

Function code	Definition	Setting range	Mfr's value	Note
F801	Rated power	0.4～315KW	Subject to model	×
F802	Rated voltage	220～460V	380	×
F803	Rated current	0.1～6500A	Subject to model	×
F804	Number of motor poles	2～100	8	×
F805	Rated rotary speed	1～3000	Subject to model	×
F806	Maximum rotary speed	1～3000	Subject to model	×
F807	Motor series	0~10	Subject to model	
F808	HAITIAN and PHASE motor series selection	0~23		
F810	Motor rated frequency	1～300	Subject to model	×
F813	Rotary speed loop KP	0.01～50.00	Subject to model	√
F814	Rotary speed loop KI	0.01～10.00	Subject to model	√
F815	d axis inductance	0~9999	Subject to model	×
F816	Back EMF voltage (corresponding to maximum rotary speed)	0~9999	Subject to model	×
F817	Poles position compensation value	0～100	25	×
F822	Poles position study	0, 1	0	×
F907	Quadrature axle inductance	0~20.00	Subject to model	×
F910	Phase resistor of stator coil	0~9.999	Subject to model	×
FA27	Current loop KP	0~300	Subject to model	√
FA28	Current loop KI	0~300	Subject to model	√

Please set the parameters in accordance with those indicated on the nameplate of the motor.
·Excellent control performance of servo drive requires accurate parameters of the motor.
·In order to get the excellent control performance, please configurate the motor in accordance with adaptable motor of the servo drive. In case of too large difference between the actual power of the motor and that of adaptable motor for servo drive, the servo drive's control performance will decrease remarkably.

F807 Motor series selection	Setting range: 0: S series motor 1: Reserved 2: M series motor 3:HAITIAN motor 4: PHASE motor	Subject to model

When parameters of S, M series motor are called, please set F807 at first, then set F801.

S system motor parameters: F807=0

Motor model	F801	F802	F803	F805	F806	F810	F815	F816	F907	F910
SM15-0082R6BEDFS	8.2	400	16.6	1500	1800	100	447	172	8.83	0.448
SM15-0100R6BEDFS	10	400	20.7	1500	1800	100	354	171	7.03	0.334
SM15-0124R6BEDFS	12.4	400	24.7	1500	1800	100	292	172	5.84	0.262
SM15-0160R6BEDFS	16	400	33.5	1500	1800	100	217	162	4.35	0.184
SM15-0190R6CEDFS	19	400	37.1	1500	1800	100	278	173	5.76	0.133
SM15-0240R6CEDFS	24	400	46.7	1500	1800	100	227	176	4.73	0.103
SM15-0290R6DEDFS	29	400	57.5	1500	1800	100	164	173	3.66	0.067
SM15-0400R6DEDFS	40	400	83	1500	1800	100	109	160	2.45	0.037
SM17-0075R6BEDFS	7.5	400	13.7	1700	2100	113	488	180	9.61	0.556
SM17-0092R6BEDFS	9.2	400	18	1700	2100	113	387	182	7.69	0.388
SM17-0110R6BEDFS	11	400	23	1700	2100	113	246	164	4.88	0.239
SM17-0140R6BEDFS	14	400	29.2	1700	2100	113	237	176	4.73	0.212
SM17-0180R6BEDFS	18	400	38.5	1700	2260	113	167	179	3.33	0.141
SM19-0200R6BEDFS	20	400	43	1900	2260	127	123	155	2.45	0.105
SM17-0220R6CEDFS	22	400	43	1700	2100	113	151	155	3.16	0.100
SM17-0270R6CEDFS	27	400	57.5	1700	2250	113	135	155	2.80	0.061
SM17-0330R6DEDFS	33	400	68	1700	2100	113	110	161	2.45	0.042
SM17-0450R6DEDFS	45	400	94	1700	2100	113	77	165	1.76	0.032
SM17-0550R6DEDFS	55	400	110	1700	2000	113	65	157	1.48	0.027

M system motor parameters: F807=2

Motor model	F801	F802	F803	F805	F806	F810	F815	F816
SM17-0092R6BEDFM	9.2	380	18.8	1700	2100	110	428	165
SM17-0110R6BEDFM	11	380	22.8	1700	2100	110	378	170
SM17-0140R6BEDFM	14	380	27.6	1700	2100	110	241	157
SM18-0190R6BEDFM	19	380	39.6	1800	2260	120	179	156

When F807=3, HAITIAN motor is selected. When F807=4, PHASE motor is selected. There is no need to set F801 when HAITIAN and PHASE motors are selected.

Code	HAITIAN motor parameters						PHASE motor parameters					
F808	Motor model	F801	F802	F803	F805	F810	Motor model	F801	F802	F803	F805	F810
0	HS1804152-F	8.3	380	17	1500	100	U1004F.15.3	6.0	380	11.6	1500	100
1	HS1805152-F	11	380	23	1500	100	U1004F.17.3	7.6	380	15.2	1700	113.3
2	HS1807152-F	13.7	380	27	1500	100	U1004F.20.3	8.7	380	18.8	2000	133.3
3	HS1808152-F	16.5	380	35	1500	100	U1005F.15.3	8.6	380	16.6	1500	100

4	HS1811152-F	22	380	49	1500	100	U1005F.17.3	10.0	380	20.4	1700	113.3
5	HS2513152-F	24.5	380	48	1500	100	U1005F.20.3	12.0	380	24.3	2000	133.3
6	HS2517152-F	32.7	380	57	1500	100	U1007F.15.3	11.6	380	23.9	1500	100
7	HS2521152-F	41	380	75	1500	100	U1007F.17.3	14.0	380	28.2	1700	113.3
8	HS2525152-F	49	380	80	1500	100	U1007F.20.3	18.2	380	36.7	2000	133.3
9	HS2529152-F	57	380	120	1500	100	U1008F.15.3	16.4	380	33.2	1500	100
10	HS2533182-F	78	380	150	1800	120	U1008F.17.3	17.6	380	35.1	1700	113.3
11	HS1804202-F	11	380	22	2000	133.3	U1008F.20.3	20.4	380	40.1	2000	133.3
12	HS1805202-F	15	380	28	2000	133.3	U1010F.15.3	20.0	380	41.0	1500	100
13	HS1807202-F	18	380	32	2000	133.3	U1010F.18.3	23.0	380	44.0	1800	120
14	HS1808202-F	22	380	40	2000	133.3	U1010F.20.3	28.3	380	60.5	2000	133.3
15	HS1811202-F	29	380	55	2000	133.3	U1013F.15.3	29.0	380	61.0	1500	100
16	HS2513202-F	33	380	64	2000	133.3	U1013F.17.3	28.7	380	55.4	1700	113.3
17	HS2517202-F	43.6	380	87	2000	133.3	U1013F.20.3	36.7	380	73.7	2000	133.3
18	HS2521202-F	55	380	109	2000	133.3	U1320F.15.3	33.0	380	62.0	1500	100
19	HS1803102-F	4.5	380	9.2	1000	66.7	U1320F.17.3	39.4	380	92.6	1700	113.3
20	HS2517102-F	22	380	48	1000	66.7	U1320F.20.3	56.3	380	120.7	2000	133.3
21	HS2521102-F	27.2	380	52	1000	66.7	U1330F.15.3	60.0	380	106.0	1500	100
22	HS2525102-F	32.7	380	63	1000	66.7	U1330F.17.3	62.0	380	145.0	1700	113.3
23							U1330F.20.3	81.0	380	155.0	2000	133.3

F813 Rotary speed loop KP	Setting range: 0.01～50.00	Subject to model
F814 Rotary speed loop KI	Setting range: 0.01～10.00	Subject to model
FA27 current loop KP	Setting range: 0~300	Subject to model
FA28 current loop KI	Setting range: 0~300	Subject to model

Dynamic response of control speed can be adjusted through adjusting proportional and storage gains of speed loop. Increasing KP and KI can speed up dynamic response of speed loop. However, if proportional gain or storage gain is too large, it may give rise to oscillation.
Recommended adjusting procedures:
Make fine adjustment of the value on the basis of manufacturer value if the manufacturer setting value can not meet the needs of practical application. Be cautious that amplitude of adjustment each time should not be too large.
In the event of weak loading capacity or slow rising of rotary speed, please increase the value of KP first under the precondition of ensuring no oscillation. If it is stable, please increase the value of KI properly to speed up response.
In the event of oscillation of current or rotary speed, decrease KP and KI properly.
Note: Improper setting of KP and KI may result in violent oscillation of the system, or even failure of normal operation. Please set them carefully.

F817 Poles position compensation value	Setting range: 0～100	Mfr's value: 25
F822 Poles position study	Setting range: 0, 1	Mfr's value: 0

In order to control permanent magnet synchronous motor, please study the poles position of motor. Please do not modify the value of F817.
When motor runs without load, please set F113=1.00, F822=1 and FA30=0, and press "run" key to finish studying poles position. After studying poles position, motor goes on running, user can control speed by pressing UP and DOWN key and check whether the running status is normal. Servo drive will be stored in the function code F817, and F822 will turn to 0 automatically. If user wants to study it again, please stop the servo drive and power on servo drive. To make sure the poles position correct, please study it several times and then take the average.
After studying process is finished, and motor runs normally, please set FA30=1. Wrong poles position and motor connections will lead to motor out of control and current too high. (the current should be lower than 3A when motor runs without loads)

5.6.7 Pressure control parameters

Function code	Definition	Instructions
F735	Pressure ascent segment proportional Kp	The higher the value is, the faster the response is, and pressure rises faster. If the value is too high, pressure will be not steady. The lower the value is, the slower the response is, and pressure rises slower. If the value is too low, slow adjustment will bring into pressure overshoot.
F736	Pressure ascent segment integration Ki	If the value is too high, it will bring into overshoot. If the value is too low, pressure will rise slowly.
F737	Pressure ascent segment differential Kd	Please increase this value if pressure overshoots during rising. Please decrease this value when pressure rises slowly.
F738	Pressure descent segment proportional Kp	The higher the value is, the faster the response is, and pressure rises faster. If the value is too high, pressure will be not steady. The lower the value is, the slower the response is, and pressure rises slower. If the value is too low, slow adjustment will bring into pressure overshoot.
F739	Pressure descent segment integration Ki	If the value is too high, it will bring into overshoot. If the value is too low, pressure will rise slowly.
F740	Pressure descent segment differential Kd	Please increase this value if pressure overshoots during rising. Please decrease this value when pressure rises slowly.
FA10	Filtering time during ascent segment	If the value is too high, the response is slow, pressure will rise in an arc. If the value is too low, the response is fast, and pressure rise rapidly, it will bring into peak overshoot.
FA11	Filtering time during descent segment	If the value is too high, the pressure will decrease slowly; and if the value is too low, pressure will decrease quickly.
FB79	Inhibition pressure overshoot coefficient 1	The lower the value is, the better the effect of inhibition overshoot is. But if this value is too low, the speed of injection and melting will not be steady, so please increase this value properly.
FB80	Inhibition pressure overshoot coefficient 2	

Dynamic response of vector control speed can be adjusted through adjusting Kp, Ki and Kd. Increasing KP and KI can speed up dynamic response of speed loop. However, if Kp and Ki is too large, it may give rise to oscillation.

Troubleshooting	Solution
Injection pressure overshoot during ascent segment	Step 1: decrease F736, and increase F737 Step 2: increase F735 Step 3: step 1+step 2
Injection pressure slow response during ascent segment	Increase F736, and decrease F737

During pressure-holding process, pressure overshoot from high-voltage to low-voltage	Step 1: decrease F739 and increase F740 Step 2: increase F738. Step 3: step 1+step 2
Injection unit vibration	Step 1: decrease F735 and increase F738 Step 2: decrease F737 and F740. Step 3: step 1+step 2
Second voltage rising	Decrease F736.
Pressure-holding unsteady	Step 1: decrease F736 and F739. Step 2: decrease F737 and F740. Step 3: step 1+step 2 Other: 1. During pressure-holding process, check motor speed to judge whether inner-leakage is too big. 2. During pressure-holding process, check the current to judge whether position of motor magnetic pole is correct and motor is loss of excitation.
Melting speed unsteady	Decrease F737, and decrease F740
Injection speed changes rapidly	Step 1: Increase the value of Fb79 one by one, do not exceed 5. Step 2: Increase the value of Fb80 one by one, do not exceed 20.
OC occasionally	Increase F114 and F115, then decrease FA23.

FA12 System max pressure (MP)	Setting range: 0.00～99.99	Mfr's value: 17.50

Because of analog given signal error, the setting pressure is a little different with system pressure meter. So please adjust the value in a small range, if the difference is too large, please check whether the analog signal is correct.

FA18 Max range of pressure sensor (MP)	Setting range: 0.00～50.00	Mfr's value: 25.00
FA19 Zero pressure voltage of pressure sensor (V)	Setting range: 0.00～10.00	Mfr's value: 0.00

FA18 is used to set max range of pressure sensor corresponding to 10V analog.(The unit is MP).

FA19 is used to set zero pressure voltage of pressure sensor.

The default transformer range is 0~25MP which corresponds to 0~10V analog. If 0~25MP corresponds to 1~5V feedback analog, so FA18=50.00, FA19=1.00.

Function code	Definition	Instructions
FA16	Max analog voltage of pressure given	User can adjust the setting of function code according to actual output voltage, and user can adjust the actual output voltage according to the setting of function code. When analog channel selects current signal, 0-20mA current signal corresponds to 0-10V voltage signal.
FA17	Analog voltage of zero pressure given	
FA21	Max analog voltage of flow given	
FA22	Analog voltage of zero flow given	
FA23	Torque limit	The max torque limit, corresponds to the times of motor rated torque.

Please do not set the value of FA23 too high.

FA25 System flow coefficient	Setting range: 0～9999	Mfr's value: 1.00

The Mfr's value of FA25 is the max flow of injection molding machine. Please set this value according to actual flow.

For example: when FA25=0.80, the actual flow is 0.8 times of max flow.

FA29 System underflow setting	Setting range: 0.0～100.0	Mfr's value: 1.0

This function is used to set motor min speed when molding machine doest not give any command. Proper underflow will increase pressure response speed, but oil pump will be action when molding machine does not give any command.

FA30 System work mode	Setting range: 0, 1	Mfr's value: 1

0 Speed mode

Servo drive controls speed of motor, the target frequency of motor is F113. When user needs to study poles position of motor and judge whether motor and servo drive are normal, please select speed mode.

1 Pressure closed-loop mode

In this mode, servo drive can perform the control command of injection molding machine.

5.6.8 Multiple pump combined control

5.6.8.1 Multiple pump combined control parameters

Function code	Function definition	Setting range	Mfr's value	Note
FC00	Master/auxiliary pump selection 0:auxiliary pump 1: master pump 2: reserved	0～2	0	×
FC01	The numbers of auxiliary pumps. The numbers of auxiliary pumps are needs to be set in the master pump drive, and please set the numbers in the auxiliary pumps to zero.	0～6	0	×
FC02	Master pump capacity Unit：mL/r	1～260	1	×
FC03	Capacity of auxiliary pump 1 unit: mL/r	1～260	1	×
FC04	Capacity of auxiliary pump 2 unit: mL/r	1～260	1	×
FC05	Capacity of auxiliary pump 3 unit: mL/r	1～260	1	×
FC06	Capacity of auxiliary pump 4 unit: mL/r	1～260	1	×
FC07	Capacity of auxiliary pump 5 unit: mL/r	1～260	1	×
FC08	Capacity of auxiliary pump 6 unit: mL/r	1～260	1	×
FC10	Start auxiliary pump: 0:By FC16 1: When speed of master pump reaches the value of FC19, start auxiliary pump by FC16	0～1	0	×
FC11	Pump adjustment hysteresis When flow range is not greater than the setting value, the master pump will adjust itself. When flow range is greater than the setting value, both the master pump and auxiliary pump will be adjusted.	1～100	6	√

FC12	Adjustment speed for speed difference between master and auxiliary pump When speed difference between master and auxiliary pump is greater than the setting value of FC13, master and auxiliary pump will adjust frequency according to FC13 until speed difference returns to the range of FC13. The larger the value is, the faster the adjustment speed is, but overshoot may occur.	2～200	2	√
FC13	Speed difference between master and auxiliary pump. This parameter is used to max speed difference between master and auxiliary pump. (Unit: 0.01 rated speed)	1～100	5	√
FC15	Auxiliary pump stop setting During the setting time, if auxiliary pump does not receive speed command from master pump drive, auxiliary pump will stop working in case that auxiliary pump continues to run after master pump breaks down.(unit: ms)	15～1000	100	√
FC16	Master single pump max running ratio. It is the percentage of main pump speed accounting for max speed. When master pump speed is higher than this value, auxiliary pump starts working. For example: max speed of master pump is 2000RPM, FC16=0.400, when master pump speed is higher than 2000*0.4=800RPM, auxiliary pump starts working. When master pump speed is lower than 2000*0.4-hysteresis speed, auxiliary pump stops working.	0.001~1.000	0.400	√

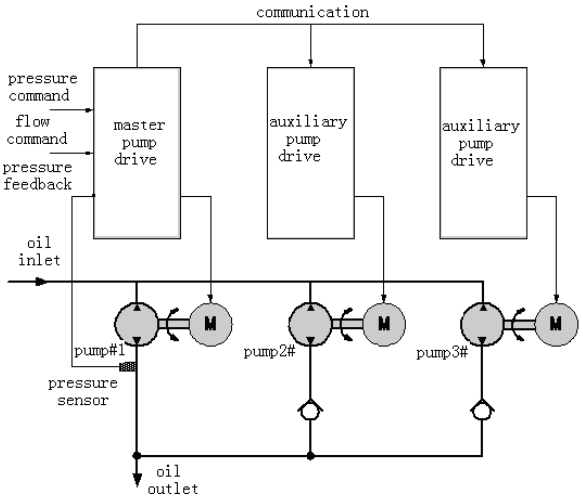
Under multiple pump combined control, master pump works in pressure closed loop mode and auxiliary pump works in speed control mode. Master pump, auxiliary pump and single pump basic parameters are as follows:

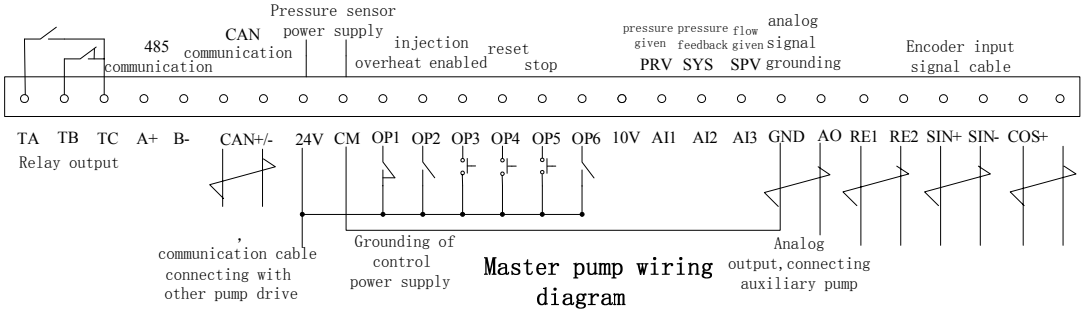
	CAN communication control		MODBUS communication control		Analog control		Single pump control
Function code	Master pump servo	Auxiliary pump servo	Master pump servo	Auxiliary pump servo	Master pump servo	Auxiliary pump servo	Single pump servo
F203	0	12	0	11	0	1	0
F905	1	1	0	0	0	0	0
FA30	1	0	1	0	1	0	1
FC00	0	0	1	0	0	0	0
FC01	1	0	1	0	1	0	0
FC02	Master pump capacity	\	Master pump capacity	\	Master pump capacity	\	1
FC03 ～ FC08	Auxiliary pump capacity	\	Auxiliary pump capacity	\	Auxiliary pump capacity	\	1

Note:

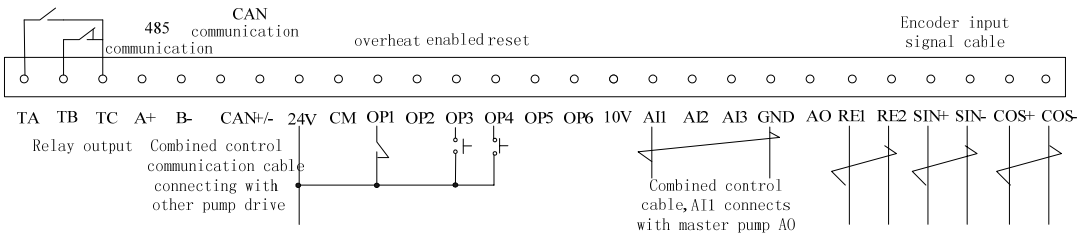
1. **\ indicating default value that can not to be modified.**
2. **One of CAN communication, MUDBUS communication and analog control can be selected for combined control. CAN communication is recommended for three or more pumps.**
3. **In communication mode, before changing master and auxiliary pump related device, please disconnect communication cable between master pump and auxiliary pump.**
4. **The maximum speed of master, auxiliary pump motor should be corresponding with oil pump's speed.**
5. **Set master pump and auxiliary pump parameters separately and study poles position.**
6. **If there are multiple auxiliary pumps and all auxiliary pumps run at same speed, set total capacity of auxiliary pumps to FC03. If minimum number of auxiliary pumps is determined by flow, set each auxiliary pump's capacity to FC03～FC08.**

5.6.8.2 Multiple pump combined control diagram



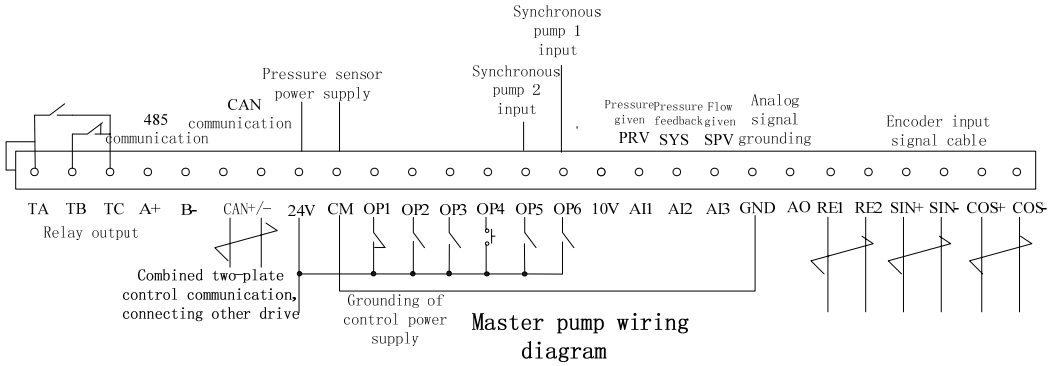


Master pump wiring diagram

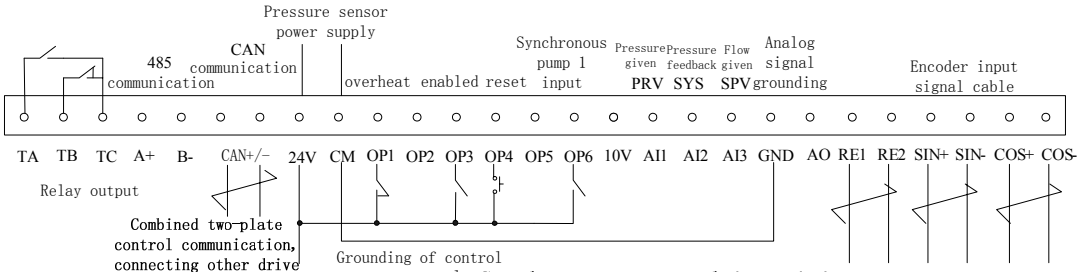


Auxiliary pump wiring diagram

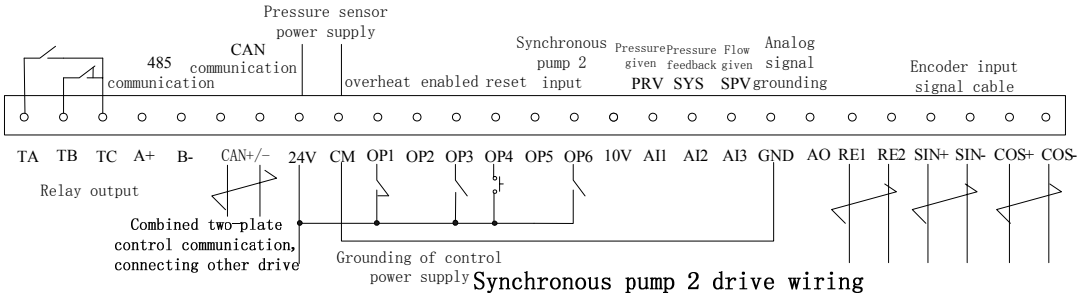
5.6.9 Two-plate injection control



Master pump wiring diagram



Synchronous pump1 drive wiring diagram



Synchronous pump 2 drive wiring diagram

Note: normally open contact relays are adopted to connect injection, synchronous pump 1 DI, synchronous pump 2 DI with related terminals.

Synchronous signal selects two auxiliary N.O.(normally open) contacts relay to separate master pump's common terminal from synchronous pump's.

function	F203	F208	F318	F320	F321	F905	F906	FA00	FA30	FC00	FC01	FC02	FC03	FC04
Master pump	0	1	15	41	40	1	3	1	1	0	1	Master pump capacity	Synchronous pump 1 capacity	Synchronous pump 1 capacity
Synchronous pump1	12	1	15	7	42	1	3	1	0	0	0	\	\	\
Synchronous pump2	12	1	15	7	42	1	3	1	0	0	0	\	\	\

6 Injection molding machine debugging

6.1 Check before power on servo drive

(1) Check the oil channel: check whether oil channel is leaked, and turn on the safe valve.

(2) Check the circuit: please check whether the wiring of R, S, T, PE is connected correctly and check whether the wiring of U, V, W is connected correctly.

(3) Check the output of servo drive: power on the servo drive without motor, then check pressure and flow.

Flow command is 0%-99% , the corresponding output voltage is 0-10V

Note: when servo drive is in the standby status, the output voltage is 0±0.05V;

When 99% of flow is output, the output voltage is 10±0.1V.

Pressure command is 0%-99% , the corresponding output voltage is 0-10V.

Note: when servo drive is in the standby status, the output voltage is 0±0.05V;

When 99% of flow is output, the output voltage is 10±0.1V.

(4) Check whether the input power wiring of servo drive is normal (Three-phase 400V, without out-phase, voltage amplitude is correct).

(5) Check whether parameters are set correctly.

6.2 Speed mode operation

(1) Turn on safe valve, and please set FA30=0.

(2) Set F113=1.00 and start the servo drive. Check whether motor runs normally (current should be lower than 5A.), then increase speed, servo drive current and motor running status, pressure rise. Users can adjust the knob of safe valve to adjust system pressure. Running frequency should be lower than 50Hz. If system works normally, stop the servo drive.

Note: before starting system, please make sure safe valve be turned on completely. Please make sure the oil can flow cross the channel smoothly, or else, the oil pump or liquid pressure system of motor may be damaged. Please check whether the wiring is correct and parameter is set correctly.

6.3 Pressure closed-loop operation

（1） Please set FA30=1

（2） Input the pressure value corresponding to 100% of given pressure into FA12.

（3） Set the sensor max range to FA16, and set voltage value of corresponding to sensor zero to FA19.

（4） Perform each process step by step and adjust the parameters of injection molding machine.

Note: parameters from FA16 to FA22 are valid after servo drive is repowered on. So please repower on servo drive again after setting these parameters.

7 Trouble Shooting

When malfunction occurs to servo drive, don't run by resetting immediately. Check any causes and get it removed if there is any.

Take counter measures by referring to this manual in case of any malfunctions on servo drive. Should it still be unsolved, contact the manufacturer. Never attempt any repairing without due authorization.

Fault	Description	Causes	Countermeasures
OC	Over current	* too short acceleration time * short circuit at output side * locked rotor with motor or motor load is too heavy. * wrong motor connection * Encoder fault or encoder circuit fault * IGBT is damaged.	*prolong acceleration time; *whether motor cable is broken; *check if motor overloads; *check if motor connection is wrong. * Check the wiring of encoder *Drive runs without motor, if OC still occurs, please ask for help from manufacture.
OL1	Servo drive overload	* load too heavy * rotating encoder is abnormal.	*reduce load; *check drive ratio; *increase servo drive's capacity *check connection between encoder and mechanical.
OL2	Motor Overload	* load too heavy	*reduce load; *check drive ratio; *increase motor's capacity
OE	Over-Voltage	*supply voltage too high; *load inertia too big *deceleration time too short; *parameter of rotary speed loop PI is set abnormally. *The effect of braking is not good. * Braking circuit is damaged * Fb38 is set wrong.	*check if rated voltage is input; *increase breaking unit capacity; *add braking resistance(optional); *increase deceleration time *set the parameter of rotary speed loop PI correctly. *check braking unit and braking resistor.
PF1	Input Out-Phase	*out-phase with input power	*check if power input is normal; *check if power off and repower on immediately.
PF2	Pre-alarm of Out-phase	*Input power out-phase *DC voltage is low	*check if power input is normal; *check if power off and repower on immediately.
LU	Under-Voltage Protection	*input voltage on the low side	*check if supply voltage is normal *check if parameter setting is correct.
ESP	Motor overheat	* servo motor overheat	*check fan *check wiring of overheat circuit
ESP1	Emergency stop	*Servo stops urgently when pressing "stop/reset" key.	*some parameters can be set when wiring is connected. * Be used for emergency stop.
O.H.	Radiator Overheat	*environment temperature too high; *radiator too dirty *install place not good for ventilation; *fan damaged * Carrier wave frequency or compensation curve is too high.	*improve ventilation; *clean air inlet and outlet and radiator; *install as required; *change fan * Decrease carrier wave frequency or compensation curve.
ERR1	Password is wrong	*When password function is valid, password is set wrong.	*please set password correctly.
ERR3	Current malfunction before running	*Current alarm signal exists before running.	*check if control board is connected with power board well. *ask for help from manufacture.

ERR4	Current zero excursion malfunction	*Flat cable is loosened. *Current detector is broken.	*check the flat cable. *ask for help from manufacture.
PP-1	Pressure sensor malfunction	*Pressure sensor damaged; *Pressure sensor oil outlet blocks up; * Pressure sensor power malfunction; *The wiring between pressure sensor and servo drive disconnected.	*replace pressure sensor; *check and dredge oil outlet; * check if pressure sensor power is normal; *check the wiring between pressure sensor and servo drive
PP-2	Oil pump keeps reversal running	*Pressure sensor damaged; *Feedback pressure is higher than given pressure.	*replace pressure sensor; *check pressure analog voltage.
PGo	Protection of rotary transformer	*Motor feedback encoder damage; *Encoder line damaged; *Control pcb encoder interface damaged.	*ask for help from manufacture; *replace the encoder wiring *ask for help from manufacture.
The speed of motor is too high and it is constant. Or motor cannot move but the current is too high.		Motor U, V, W wiring fault, studying poles position wrong, motor encoder wiring wrong and motor encoder fault.	

Common trouble shooting

1. Motor does not rotate

If system outputs pressure and flow command, motor still does not run, please refer to following reasons:

(1) Servo drive is not in the running status and does not receive pressure and flow command.
   a. Servo on, check whether the wiring of OP3 terminals is correct and source of signal is correct and F200=F201=2.
   b. Both of pressure signal and flow sigal are DC voltage signal (0～10V). Check servo drive input analog signal AI1, AI3. If one of the signals is zero, motor does not run.
   c. Check if related terminals of IO board output correct DC voltage signal with multi-meter;
   d. Check if the wiring between IO board and servo drive is correct.

(2) Pressure sensor feedback signal fault
   The fault will lead to control operator error. The motor will not rotate or rotate fiercely.
   For different pressure sensor, please set correct value for FA18 (pressure sensor range) and select coding switch position. Check if pressure sensor's output signal conversion value is corresponding to pressure meter's indicating value with multi-meter. Before this, confirm that the pressure meter works normally.

(3) The wiring of UVW and motor is disconnected.

(4) If the connection sequence of motor U, V, W wiring is wrong, please adjust the sequence, and study the poles position again.

(5) Motor encoder and the wiring of it is abnormal, please change encoder cable, control PCB of servo drive, and motor.

2. Motor is rotating, but the system pressure does not rise.

(1) In closed oil circuit, even if high pressure and flow command have been given, pressure still does not rise, and motor speed is too high and flow is too big, the following reasons may be considered:

a. Hydraulic oil returns to tank through bypass.
   If massive amounts of hydraulic oil flows through pump outlet and the pressure does not rise, hydraulic oil returns to tank through bypass.
   Check if safety overflow valve's opening is too large and hydraulic oil returns to tank through overflow valve.

Check if direction valve is operated incorrectly and closed oil circuit is not formed.
Check if massive amounts of hydraulic oil leaks

b. There is no hydraulic oil flowing through oil tube.
Please confirm that the tank has filled enough hydraulic oil. If the fuel-tank outlet has the valve switch, please turn on the valve switch.

c. If oil pump rotates reverse, please change the pump rotation direction.

(2) In closed oil circuit, even if high pressure and flow command have been given, pressure still does not rise, motor speed is too low and flow is too small, the following reasons may be considered:

a. Servo drive does not receive corresponding pressure command.
Pressure signal is DC voltage signal (0～10V). If input drive pressure signal is too small, pressure can not rise.
Check if IO board terminal outputs correct corresponding DC voltage with multi-meter.
Check if IO board is connected with servo drive correctly.

b. Servo drive does not receive corresponding flow command.
Flow signal is 0～10V DC voltage, if input drive pressure signal is too small to compensate leak flow，pressure can not rise.
Check if IO board terminal outputs correct corresponding DC voltage with multi-meter.
Check if IO board is connected with servo drive correctly.

c. Pressure sensor feedback signal fault.
The fault will cause control operation error. The motor will not rotate or rotate fiercely.
For different pressure sensor, please set correct value for FA18 (pressure sensor range) and select coding switch position.
Check if pressure sensor's output signal conversion value is corresponding to pressure meter's indicating value with multi-meter. Before this, confirm that the pressure meter works normally.

d. Pressure sensor detection range is too small.
When pressure sensor supply power is lower than DC 12V, please make sure Max pressure of sensor / max pressure of system≥1.2
When pressure sensor supply power is DC15V, please make sure that Max pressure of sensor / max pressure of system≥1.4

3. System pressure is not steady

Please refer to following reasons.

(1) Pressure loop parameter is set improperly.

The improper adjustment will cause system pressure unstable easily. Please set response parameter again referring to pressure control parameter.

(2) Servo drive has reached max output capacity, but system pressure is not enough.

Switching drive's display status can check motor current. If the motor current is close to or equal to the value of FA23 (max torque), the output system pressure can not be larger. Please fine-tune F817 for motor poles position and check if servo drive's output current decreases.

(3) Motor overheating or loss of excitation will result in insufficient output torque. Please replace the motor.\

(4) Oil pump is damaged and leaks seriously。Please replace oil pump.

(5) The feedback voltage of pressure sensor is too high, please replace pressure sensor or adjust FA18\FA19.

4. Machine vibration

In control of servo pump, servo motor control will be achieved first, followed by servo-pump control.

(1) Adjust or decrease PI parameters for servo motor control.

Motor speed loop proportional component F813, integral component F814.

Motor current loop proportional component FA27, integral component FA28.

(2) Adjust or decrease PI parameters for servo oil pump.

(3) The system signal is disturbed, please connect motor and servo drive to the grounding properly.

(4) Check whether encoder cable is connected correctly and is not broken.

(5) There is something wrong with motor, and does not run steadily.

(6) There is something wrong with oil pump, and does not run steadily.

5. Occasional high pressure out of control

(1) Pressure sensor fault, AI2 channel can not detect the feedback pressure.

(2) Some impurity in the hydraulic oil will block filter core of sensor.

(3) The feedback signal of sensor is disturbed or lost temporarily.

6. Analysis of the causes of injection point instability.

Injection parameters are set wrong or injection mode is set wrong. Pressure loop gain is not proper.

7. The product occasionally runs with fly margin when power on.

(1) The temperature of inner feed tube is too high, therefore melt viscosity is low and the fluidity is good, the products are easy to run with fly margin.
(2) Pressure is set to high.
(3) Pressure sensor is damaged.

8. In the production process, the product lacks the rubber, increasing injection pressure and speed is invalid.

(1) The melt takes away heat constantly, therefore high viscosity and poor mobility result in melt insufficiency. Please increase feed tube temperature.
(2) Melting back-pressure is not proper
(3) The melting position is bigger than max melting position.
(4) Injection valve fault. Please change, and clean aprons.

9. The motor speed is not enough when injecting and melting rubber.

（1） Please increase the value of Fb79 and Fb80.
（2） Increase the value F817 little by little.

10. pump noise increasing, pump vibration and system pressure not enough

The main reason is pump abrasion or pump bearing abrasion. Normally, pressure-holding speed for pump max pressure is slower than 70 rpm. If speed is too high, pump has been damaged, oil leakage will increase.

11. Pump and motor reverse running

(1) Pressure sensor is damaged. In normal status, if sensor does not send any command, the feedback voltage between AI2 and GND is about 0V. When the pressure is 17bar, the voltage is about 7V. If the sensor is damaged, the feedback voltage will be bigger than 10V, or bigger than 25V. Servo drive will judge that system pressure is higher than given pressure, so servo will control pump to run reverse for voltage leakage.
(2) If the wiring sequence of motor U,V,W is connected wrong, motor will run reverse all the time. So please change the sequence of U,V,W according to the terminal label and study the motor magnetic poles again.

(3) FA19 is set too low.

12. Servo drive does not send any command, but system bottom pressure is big and motor has vibration.

(1) Decrease the value of FA29 and Fb52.

(2) Decrease the value of FA19.

13. System voltage leakage is too slow

Please increase the value of Fb15

14. Braking resistor is too hot.

(1) System voltage is high.

(2) Energy feedback is too high, please increase F115.

(3) The circuit of braking unit is broken.

8 Maintenance

8.1 Periodic Checking

- Cooling fan and wind channel should be cleaned regularly to check whether it is normal; remove the dust accumulated in the servo drive on a regular basis.
- Check servo drive's input and output wiring and wiring terminals regularly and check if wirings are ageing.
- Check whether screws on each terminals are fastened.
- Check whether servo drive is corrosive.

8.2 Replacement of wearing parts

The wearing parts of servo drive include cooling fan and electrolytic capacitors.

- The life of the fan usually is 2~3 years. Users should change the cooling fan according to all running time of servo drive. Cooling fan could be damaged because bearing is damaged and fan blades are aging. Users could check fan blades for cracks or check the abnormal vibration noise when starting. Users could change fan according to abnormal phenomena.
- The useful life of electrolytic capacitors is 4~5 years. Users should change the electrolytic capacitors according to all running time of servo drive. Capacitors could be damaged because the power supply is unstable, the environment temperature is high, frequent over-load occurs and electrolyte is ageing. By checking whether there is leakage of liquid, or the safety valve bulges out, or the static electricity and insulated resistor is ok, users could change the capacitor according to these phenomena.

The wearing parts of servo motor include cooling fan and rotating transformer.

- The life of the fan usually is 2~3 years. Users should change the cooling fan according to all running time of servo motor.
- Please pay attention to the wiring of transformer.

8.3 Storage

- Please put the servo drive in the packing case of manufacture.
- If servo drive is stored for long time, please charge it within half a year to prevent the electrolytic capacitors damaged. The charging time should be longer than 5 hours.

Appendix 1　Zoom Table of Function Code

Note: √indicating that function code can be modified both in stop and run state.

* indicating that the function code can only be modified by manufacture.

×indicating that function code can only be modified in stop state.

△indicating that function code can only be checked but can not be modified.

●indicating that function code is valid only after re-power on

Function code	Function definition	Setting range	Mfr's value	Change
F100	User's Password	0～9999	8	√
F102	Rated Current	2～800	Subject to model	*
F103	Rated Power	Subject to model	Subject to model	*
F105	Software Edition No.	1.00～10.00	Subject to model	*
F107	Password Valid or Not	0：invalid　　1：valid	0	√
F108	Setting User's Password	0～9999	8	√
F111	Max Frequency	F113～400.0Hz	200.0Hz	√
F112	Min Frequency	0.00Hz～F113	0.00Hz	√
F113	Target frequency in speed mode	F111～F112	1.00Hz	√
F114	Acceleration Time	0.001～32.00S	Subject to model	√
F115	Deceleration Time	0.001～32.00S	Subject to model	√
F131	Running display items	0：present output frequency/function code; 1：current output rotary speed; 2：output current; 4：output voltage; 8：PN voltage; 32：temperature	0+1＋2＋4＋8＝15	√
F132	display of stop	0：frequency/function code; 2：target rotary speed; 4：PN voltage; 8：motor poles position; 16：temperature	2＋4+8＝14	√
F153	Carrier frequency setting	2500～7000	Subject to model	×
F160	Reverting to manufacture values	0：not reverting to manufacture values; 1：reverting to manufacture value	0	×
F200	source of start command	0：keypad command ; 1：terminal command; 2：keypad + terminal	2	×
F201	Source of stop command	0：keypad command ; 1：terminal command; 2：keypad +terminal	2	×
F202	Mode of direction setting	0：forward running locking ; 1：reverse running locking; 2：terminal setting	0	×

F203	Main frequency source X	0：digital setting memory; 1：external analog AI1; 2：external analog AI2 ; 6：external analog AI3; 11：MODBUS ; 12：CAN	0	×
F208	Terminal two-line operation control	0：no function ; 1：two-line type 1; 2：two-line type 2	0	×
F209	Selecting the mode of stopping the motor	0：stop by deceleration time ; 1：free stop	0	×
F300	Relay token output	0：no function; 1： fault protection; 5：servo on; 10：Servo drive overload pre-alarm ; 11：Servo motor overload pre-alarm; 13：Servo ready; 16：Servo overheat pre-alarm	1	√
F301	DO1 token output		11	√
F302	DO2 token output		0	√
F316	OP1 terminal function setting	0：no function ; 1：enable terminal; 2：deceleration stop terminal; 7：fault reset terminal 8：free stop terminal; 9：motor over-heat terminal; 15：“FWD” terminal; 16：“REV” terminal; 19：Glue-injection signal terminal; 40: Synchronous pump 1 switching signal input 41: Synchronous pump 2 switching signal input 42: Running mode switching signal input 43: Register terminal internal master pump Rest: Reserved	9	√
F317	OP2 terminal function setting		19	√
F318	OP3 terminal function setting		1	√
F319	OP4 terminal function setting		7	√
F320	OP5 terminal function setting		8	√
F321	OP6 terminal function setting		15	√
F324	Free stop terminal logic	0: positive logic (common-open) 1: negative logic (common-close)	0	×
F325	motor over-heat protection terminal logic	0：positive logic (common-open) 1:negative logic (common-close)	1	×
F326	OP terminal status display	NC	NC	△
F328	Terminal filtering times	1～100	5	√
F423	AO output range selecting	0：0～5V ; 1：0～10V	0	√
F424	Corresponding frequency for lowest voltage of AO output	0.0～F425	0.05Hz	√
F425	Corresponding frequency for highest voltage of AO output	F425～F111	200.00Hz	√
F426	AO output compensation	0～120%	100	√
F431	AO analog output signal selecting	0：Running frequency 1：Output current 2：Output voltage; 6：Accessorial pump speed given	0	√

F433	Corresponding current for full range of external voltmeter	0.1～5 times of rated current	2．00	×
F611	Dynamic Braking threshold	200～1000	660V	△
F612	Dynamic braking duty ratio (%)	0～100%	100	×
F706	Servo drive overloading Coefficient%	120～190	150	×
F707	Motor Overloading Coefficient%	20～100	100	×
F708	Record of The Latest Malfunction Type	Setting range: 2：over current (OC) 3：over voltage (OE) 4：input out-phase (PF1) 5：servo drive overload (OL1) 6：under voltage (LU) 7：servo drive overheat (OH) 8：motor overload (OL2) 11: motor over-heat (ESP)		△
F709	Record of Malfunction Type for Last but One			△
F710	Record of Malfunction Type for Last but Two			△
F711	Fault Frequency of The Latest Malfunction			△
F712	Fault Current of The Latest Malfunction			△
F713	Fault PN End Voltage of The Latest Malfunction			△
F714	Fault Frequency of Last Malfunction but One			△
F715	Fault Current of Last Malfunction but One			△
F716	Fault PN End Voltage of Last Malfunction but One			△
F717	Fault Frequency of Last Malfunction but Two			△
F718	Fault Current of Last Malfunction but Two			△
F719	Fault PN End Voltage of Last Malfunction but Two			△
F720	Record of over-current protection fault times			△
F721	Record of overvoltage protection fault times			△
F722	Record of servo drive overheat protection fault times			△
F723	Record of overload protection fault times			△
F724	Input out-phase	0：invalid; 1：valid	1	×
F725	Under-voltage	0：invalid; 1：valid	1	×
F726	Servo drive overheat	0：invalid; 1：valid	1	×
F728	Input out-phase filtering constant	0.1～60.0	0.5	√
F729	Under-voltage filtering constant	0.1～60.0	5.0	√
F730	Overheat protection filtering constant	0.1～60.0	5.0	√
F735	Pressure ascent segment proportional Kp	0～9999	Subject to model	√

F736	Pressure ascent segment integration Ki	0～9999	Subject to model	√
F737	Pressure ascent segment differential Kd	0～9999	Subject to model	√
F738	Pressure descent segment proportional Kp	0～9999	Subject to model	√
F739	Pressure descent segment integration Ki	0～9999	Subject to model	√
F740	Pressure descent segment differential Kd	0～9999	Subject to model	√
F750	PF2 out-phase detecting	0～1	1	√
F751	Time of PF2 alarm input open（S）	0.1～10.0	1.0	√
F752	Time of PF2 alarm input close（S）	0.1～10.0	1.0	√
F801	Rated power	0.4～315kW	Subject to model	×
F802	Rated voltage	220～460V	380	×
F803	Rated current	0.1～6500A	Subject to model	×
F804	Number of motor poles	2～100	8	×
F805	Rated rotary speed	1～3000	Subject to model	×
F806	Maximum rotary speed	1～3000	Subject to model	×
F807	Motor series	0～10	Subject to model	×
F810	Motor rated frequency	1～300	Subject to model	×
F813	Rotary speed loop KP	0.01～50.00	Subject to model	√
F814	Rotary speed loop KI	0.01～10.00	Subject to model	√
F815	d axis inductance	0～9999	Subject to model	×
F816	Back EMF voltage (corresponding to maximum rotary speed)	0～9999	Subject to model	×
F817	Poles position compensation value	0～100	25	√
F822	Poles position study	0：invalid 1：valid	0	×
F905	CANBUS enable	0：invalid 1：valid	0	×
F906	CANBUS baud rate	3：250Kbps	3	●
F907	Quadrature axle inductance	0～20.00	Subject to model	×
F910	Phase resistor of stator coil	0～9.999	Subject to model	×
FA00	Master/ auxiliary pump controlled by two-platen injection molding machine	0：invalid 1: valid	0	×
FA01	Terminal input polarity of synchronous pump 1	0: positive logic (common-open) 1: negative logic (common-close)	0	×
FA02	Terminal input polarity of synchronous pump 2	0: positive logic (common-open) 1: negative logic (common-close)	0	×
FA03	No. 42 terminal input polarity	0: positive logic (common-open) 1: negative logic (common-close)	0	×
FA10	Filtering time during ascent segment	2～9999	Subject to model	√
FA11	Filtering time during descent segment	2～9999	Subject to model	√

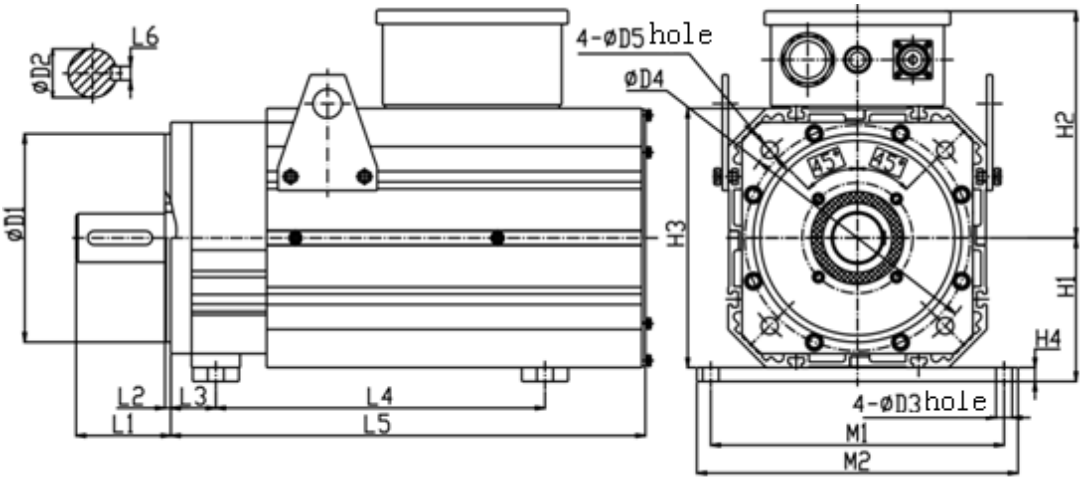
FA12	System max pressure (MP)	0.00～99.99	17.50	×
FA16	Max analog voltage of pressure given	0.00～10.00	10.00	×
FA17	Analog voltage of zero pressure given	0.00～10.00	0.04	×
FA18	Max range of pressure sensor (MP)	0.00～50.00	25.00	×
FA19	Zero pressure voltage of pressure sensor (V)	0.00～10.00	0.00	×
FA21	Max analog voltage of flow given	0.00～10.00	10.00	×
FA22	Analog voltage of zero flow given	0.00～10.00	0.04	×
FA23	Torque limit	0.00～3.50	2.10	√
FA25	System flow coefficient	0.00～5.00	1.00	√
FA27	Current loop KP	0～300	Subject to model	√
FA28	Current loop KI	0～300	Subject to model	√
FA29	System underflow setting	0.0～100.0	1.0	√
FA30	System work mode	0：speed mode; 1 :Pressure closed-loop mode	1	×
Fb04	Pressure feedback differential coefficient	0.00～90.00	3.00	√
Fb10	Register pressure internal main pump	0～1.0（The max pressure coefficient of system）	0.9	√
Fb11	Register terminal internal main pump pressure enable	0: Invalid 1: Valid	0	√
Fb12	Register terminal internal main pump input logic	0: Positive logic (common open) 1: Negative logic (common closed)	0	√
Fb15	Speed of reverse voltage leakage	0.000～0.300	0.300	√
Fb16	AI1 input voltage display	NC	NC	△
Fb17	AI2 input voltage display	NC	NC	△
Fb18	AI3 input voltage display	NC	NC	△
Fb19	FB16-FB18 display filtering	1～9999	500	√
Fb36	Zero speed threshold (RPM）	0～2000	30	√
Fb38	Hardware OE protection	0: Invalid 1: Valid	1	√
Fb52	System bottom pressure setting	0～5bar	5	√
Fb55	At pressure closed-loop mode, limit time when motor reverse running	0～50.0	10.0	√
Fb56	Rotating encoder testing filtering	2～100	10	√
Fb57	Rotating encoder fault testing enable	0: Invalid 1: Valid	1	√
Fb58	Reverse running limit enable	0: Invalid 1: Valid	0	√
Fb59	Pressure sensor test fault enable	0: Invalid 1: Valid	0	√
Fb60	Pressure feedback threshold	1～100	5	√
Fb61	Current threshold	1～500	35	√

Fb62	Duration time after checking fault	10～1000	40	√
Fb63	AI1 filtering time constant	0～255	0	√
Fb64	AI2 filtering time constant	0～255	0	√
Fb65	AI3 filtering time constant	0～255	0	√
Fb76	Whether injection signal is valid	0: invalid 1: valid	1	√
Fb77	Injection signal input logic	0: Positive logic (common open) 1: Negative logic (common closed)	0	√
Fb78	Single-point injection oil pump speed limit	0～1.00	0.45	√
FB79	Inhibition pressure overshoot coefficient 1	0～50	Subject to model	√
FB80	Inhibition pressure overshoot coefficient 2	0～50	Subject to model	√

Function code	Function definition	Setting range	Mfr's value	change
FC00	Master/auxiliary pump selection	0:auxiliary pump 1: master pump 2: reserved	0	×
FC01	The numbers of auxiliary pumps	The numbers of auxiliary pumps are needs to be set in the master pump drive, and please set the numbers in the auxiliary pumps to zero.	0	×
FC02	Master pump capacity Unit：mL/r	1～260	1	×
FC03	Capacity of auxiliary pump 1 unit: mL/r	1～260	1	×
FC04	Capacity of auxiliary pump 2 unit: mL/r	1～260	1	×
FC05	Capacity of auxiliary pump 3 unit: mL/r	1～260	1	×
FC06	Capacity of auxiliary pump 4 unit: mL/r	1～260	1	×
FC07	Capacity of auxiliary pump 5 unit: mL/r	1～260	1	×
FC08	Capacity of auxiliary pump 6 unit: mL/r	1～260	1	×
FC11	Pump adjustment hysteresis When flow range is not greater than the setting value, the master pump will adjust itself. When flow range is greater than the setting value, both the master pump and auxiliary pump will be adjusted.	1～100%	6	√
FC12	Adjustment speed for speed difference between master and auxiliary pump When speed difference between master and auxiliary pump is greater than the setting value of FC13, master and auxiliary pump will adjust frequency according to FC13 until speed difference returns to the range of FC13. The larger the value is, the faster the adjustment speed is, but overshoot may occur.	2～200	10	√
FC13	Speed difference between master and auxiliary pump. This parameter is used to max speed difference between master and auxiliary pump. (Unit: 0.01 rated speed)	1～100（unit：0.01 rated speed）	1	√

FC15	Auxiliary pump stop setting During the setting time, if auxiliary pump does not receive speed command from master pump drive, auxiliary pump will stop working in case that auxiliary pump continues to run after master pump breaks down.(unit: ms)	15～1000（unit: ms）	100	√
FC16	Master single pump max running ratio. It is the percentage of main pump speed accounting for max speed. When master pump speed is higher than this value, auxiliary pump starts working.	0.001～1.000 For example: max speed of master pump is 2000RPM, FC16=0.400, when master pump speed is higher than 2000*0.4=800RPM, auxiliary pump starts working. When master pump speed is lower than 2000*0.4-hysteresis speed, auxiliary pump stops working.	0.400	√

Appendix 2 Servo motor structure



Motor rated torque（△T=65℃）	spigot	D1	D2	D3	D4	D5	L1	L2	L3	L4	L5	L6	H1	M1
42 N·m	E	180	42	14	215	14.5	82	5	39			12	124	254
52 N·m	E	180	42	14	215	14.5	82	5	39			12	124	254
64 N·m	E	180	42	14	215	14.5	82	5	39			12	124	254
79 N·m	E	180	42	14	215	14.5	82	5	39			12	124	254
102 N·m	E	180	42	14	215	14.5	82	5	39			12	124	254
122 N·m	E	180	42	14	215	14.5	82	5	39			12	124	254
152 N·m	F	250	48	18	300	19	112	4	60			14	160	356
185 N·m	F	250	48	18	300	19	112	4	60			14	160	356
255 N·m	F	250	48	18	300	19	112	4	60			14	160	356
307 N·m	F	250	48	18	300	19	112	4	60			14	160	356

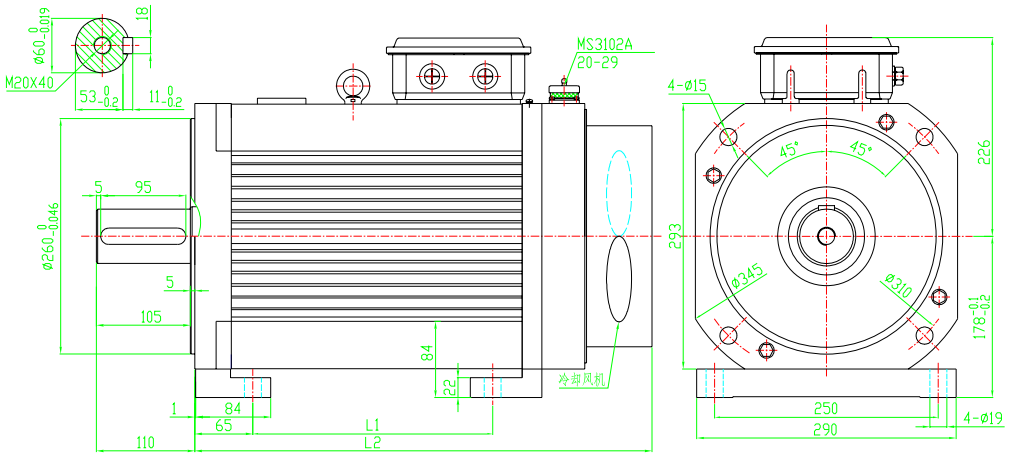


Figure 1 servo motor structure diagram for D (260 spigot) frame

Model	L1（mm）	L2（mm）
SM15-0290R6DEDFS, SM17-0330R6DEDFS	268	541
SM15-0400R6DEDFS, SM17-0450R6DEDFS	368	641
SM17-0550R6DEDFS	416	699

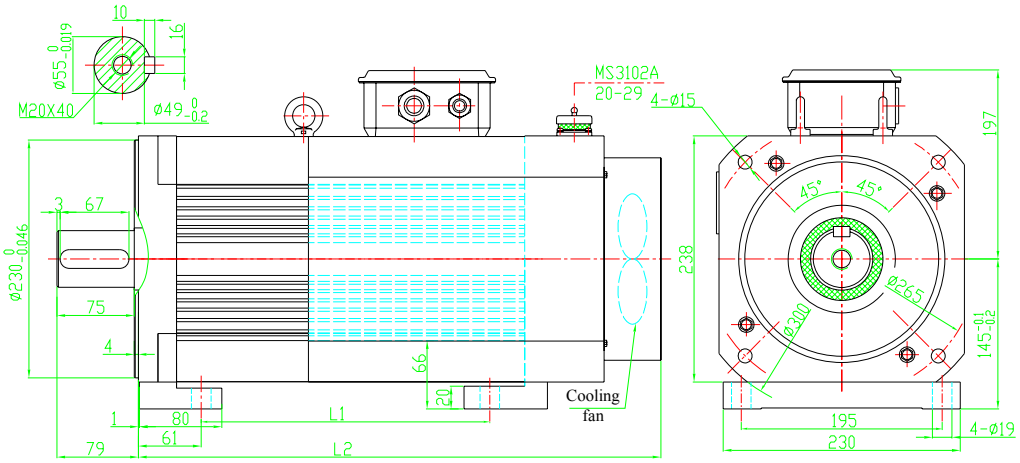


Figure 2 servo motor structure diagram for C (230 spigot) frame

Model	L1（mm）	L2（mm）
SM15-0190R6CEDFS, SM17-0220R6CEDFS	280	565
SM15-0240R6CEDFS, SM17-0270R6CEDFS	330	615

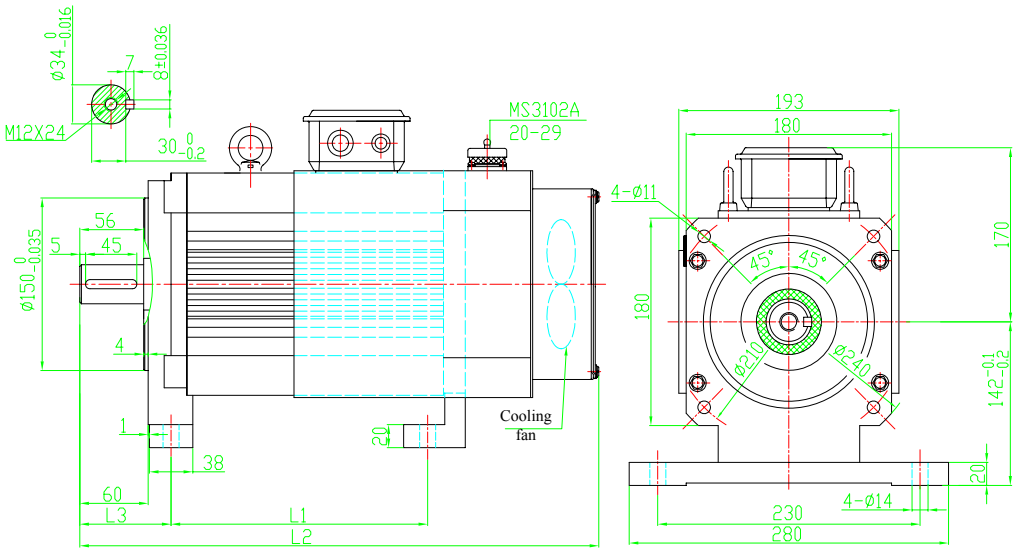


Figure 3 servo motor structure diagram for B (150 spigot) frame

Model	L1（mm）	L2（mm）	L3（mm）
SM17-0075R6BEDFS	225	455	80
SM15-0082R6BEDFS, SM17-0092R6BEDFS	275	500	75
SM15-0100R6BEDFS, SM15-0110R6BEDFS	310	545	75
SM15-0124R6BEDFS, SM17-0140R6BEDFS	360	590	80
SM15-0160R6BEDFS, SM17-0180R6BEDFS SM19-0200R6BEDFS	360	668	80

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