PH600 series high performance electro-hydraulic servo drive

Instruction Manual

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Version change history

Date of revision	What's Changed
2024-05	Catalog page number adjustment, brake unit specification resistance value optional table power modification (40Ω 500W to 40Ω1000W,15Ω500W to 15Ω1500W), motor model list update, correct some errors and so on
2025-06	Update content: Added parameter description of software version 5.69 or above, added F group parameters to 360, added E parameter group to 44, added d parameter group to 47, added h parameter group to 31, added P parameter group to 40, Note: must be 5.69 or above.

Preface

Welcome to use the PH600 series high-performance electro-hydraulic servo drive developed and produced by our company .

The PH600 series high-performance electro-hydraulic servo drive is designed for hydraulic equipment such as injection molding machines, die-casting machines, and hydraulic presses. It adopts high-performance vector control and has the characteristics of energy saving, precision, high efficiency, and durability. The PH600 series servo system has a variety of external expansion interfaces and CAN communication interfaces, which are convenient for forming a multi-pump parallel system and realizing hydraulic control of large flow systems.

When using the PH600 series high-performance electro-hydraulic servo drive for the first time , please read this operation manual carefully to ensure correct and safe operation. In addition, please keep this operation manual properly for reference at any time .

Our company is committed to the continuous improvement and upgrading of our products. The backend software and product information will be continuously updated along with the products.

This manual is intended for the following users:

- Control system designer
- Installation or wiring personnel
- User or maintenance personnel

Before you finish reading this manual, please be sure to follow the following instructions:

- The installation environment must be free of water vapor, corrosive gas and flammable gas.
- When wiring, it is forbidden to connect the grid power supply directly to the U, V, W terminals of the motor. If connected incorrectly, the driver and motor will be damaged.
- The grounding wire must ensure safe grounding.
- Do not disassemble the driver, motor, oil pump or change the wiring while the power is on.
- Do not touch the heat sink during work to avoid burns.

Our company provides comprehensive after-sales and maintenance services. Please do not dismantle the driver or motor casing without permission. Any modification or damage to the driver will invalidate the warranty rights, and our company will not bear any responsibility for the consequences caused by this.

If you have any questions during use, please consult the dealer or our customer service center.

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1 Safety precautions

Before carrying, installing, operating or maintaining the product, please read the instruction manual carefully and follow all safety precautions in the manual. Failure to do so may result in personal injury, equipment damage, or even death.

The company will not be held responsible for any injury or equipment damage caused by your or your customers' failure to comply with the safety precautions in the instruction manual.

1.1 Security Information Definition

The precautions for safe operation in the manual are classified into "Danger", "Warning" and "Caution".

 **Danger** : Indicates a potentially hazardous situation which, if not handled as required, may result in serious injury or death.

 **Warning** : Indicates a potentially hazardous situation which, if not handled as required, may result in personal injury or equipment damage.

CAUTION : Indicates a potentially hazardous situation which, if not followed, may result in moderate personal injury.

1.2 Safety Guide

 **Danger**	1、 Installation and maintenance work can only be performed by trained and qualified professionals.
	2、 It is forbidden to check the wiring or replace components when the power is on. Before wiring and checking, make sure that all input power has been disconnected, wait for at least 10 minutes or make sure that the DC bus voltage is lower than 36V.
	3、 Please use insulating protective tools during maintenance, otherwise it may cause electric shock or personal injury.
	4、 Please connect the ground wire reliably and ask professionals to perform wiring work to avoid electric shock or fire accidents.
	5、 Do not install the motor, brake resistor and driver near flammable materials, otherwise it may cause fire.
	6、 Please do not modify the product without permission, otherwise it may cause electric shock, malfunction, burnout or fire.
 **warn**	1、 When moving the motor, do not pull the aviation plug connector to avoid damaging the electrical connector and causing the motor to fall and cause injury.
	2、 When installing the motor, do not hit the motor to avoid damaging

	the precision parts on the shaft or causing a decrease in accuracy.
	3、 When this series of servo motors are running continuously at full load, the surface temperature may reach 100 °C . This temperature is within the design allowable range and can operate normally. However, please be careful to install the motor in a place where it is not easily accessible to people and animals to avoid burns.
	4、 The external brake resistor may reach a very high temperature when the motor is frequently braked. Please ensure that the heat dissipation channel is well ventilated. It is recommended to place it outside the control cabinet (such as the top fan outlet) and provide reliable protection. If it must be installed inside the cabinet, it should also be installed near the top fan outlet and away from other devices.
	5、 Please be sure to check all external connections carefully before powering on for the first time to avoid serious accidents caused by incorrect wiring.
	6、 When you turn on the enable for the first time, please make the motor unloaded as much as possible and be ready to turn off the enable at any time according to the operating conditions.
	7、 Do not use the method of turning the power on and off to start and stop the servo system. Use the enabling operation to start and stop.
	8、 The product contains electrolytic capacitors, integrated circuits, epoxy boards and other components. Please treat them as industrial waste when they need to be discarded. Otherwise, it may cause personal injury and environmental pollution.
Notice	1、 During transportation and installation, ensure that the drive is not subjected to physical shock and vibration. Do not just hold the front cover during transportation to avoid it falling off.
	2、 Prevent screws, cables, and other conductive objects from falling into the drive.
	3、 R, S, and T are power input terminals, and U, V, and W are output motor terminals. Please connect the input power cable and motor cable correctly, otherwise the drive will be damaged.
	4、 Before using the driver, the front cover or junction box must be closed, otherwise there will be a risk of electric shock.
	5、 Please tighten the screws with appropriate torque during installation and wiring.

	6、 The drive cannot be subjected to insulation withstand voltage test, and the drive control circuit cannot be tested using a megohmmeter.

※ In workplaces where accidental failure of this product could cause a major accident or result in significant losses, please consider the safety of the equipment separately.

※ Manufacturers, sellers, and service providers cannot assume any associated losses or joint liabilities other than those caused by servo system failure .

2 Product Information

2.1 Product Confirmation

After the product arrives, please confirm the following items.

CONFIRM PROJECT	REMARK
Does the product you received match the model you ordered?	Please confirm it in the "Model" column on the nameplate of the servo motor and servo driver (please refer to the instructions after the next item).
Is the rotating shaft of the servo motor running smoothly?	It is normal if it can be turned by hand.
Is there any damage?	Please check the entire exterior for damage caused by transportation, etc.
Are the attachments and information complete?	Check the packing list to see if the accessories, certificate of conformity and warranty are complete.

If you find any discrepancy in the above items, please contact the dealer where you purchased the product or our sales office in time.

2.2 Servo drive nameplate

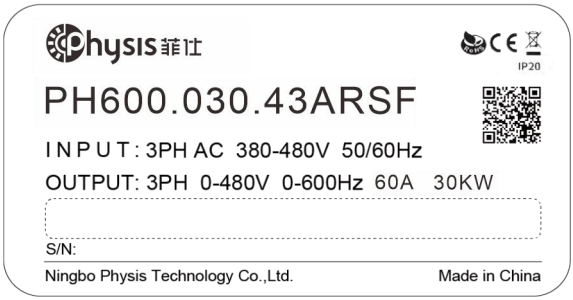


Figure 2 - 1 Servo drive nameplate diagram

2.3 Servo drive model description

PH600	.007	.43	A	R	S	F	-XX
Product Categories: Electro-hydraulic product series	Power rating: 007: 7.5KW 011:11KW 015:15KW 018:18.5KW 022:22KW 030:30KW 037:37KW	Voltage level: 23: Three-phase 2 20V 43: Three-phase 380V	Version Number : A: No built-in DC reactor , built-in brake unit (7.5kw -55kw optional)	Encoder Type : R: Rotary	Communication method: S: Standard C: CAN communication E: EtherCAT communication (function not yet	Cooling Type: F: Air cooling	spare: For marking custom machines

PH600	.007	.43	A	R	S	F	-XX
	045:45KW 055:55KW 075:75KW 090:90KW 110: 110KW		B: Built-in DC reactor , built-in brake unit (75kw-110kw standard)		online) F: Profinet communication (function not yet online)		

2.4 Servo drive specifications

Driver Model	PH600.007.43ARSF	PH600.011.43ARSF	PH600.015.43ARSF	PH600.018.43ARSF	PH600.022.43ARSF
Applicable motor capacity (kW)	7.5	11	15	18	twenty two
Rated output current (Arms)	18.5	25	32	38	45
Overload (Arms) duration 5min	26	35	48	53	67
Maximum output current (Arms) duration 30s	32.5	40.7	55.2	63.6	81.3
Rated input current(Arms)	25	32	40	47	56
Input Power	AC380V(-15%)~440V(+10%) 47Hz~63Hz				
Weight(kg)	4.8	4.8	6.1	6.1	9.5
Recommended regenerative braking resistor specifications	40Ω 1000W		40Ω 1000W		15Ω 1 500W
Minimum braking resistance (Ω)	31	31	twenty three	twenty three	1 5

Driver Model	PH600.030.43ARSF	PH600.037.43ARSF	PH600.045.43ARSF	PH600.055.43ARSF	PH600.075.43BRSF

Driver Model	PH600.030.43ARSF	PH600.037.43ARSF	PH600.045.43ARSF	PH600.055.43ARSF	PH600.075.43BRSF
Applicable motor capacity (kW)	30	37	45	55	75
Rated output current (Arms)	60	75	92	115	150
Overload (Arms) duration 5min	99	109	138	167	195
Maximum output current (Arms) duration 30s	113	141	169.7	226	297
Rated input current(Arms)	70	80	94	128	160
Input Power	AC380V(-15%)~440V(+10%) 47Hz~63Hz				
Weight(kg)	14.5	14.5	twenty one	twenty one	27
Recommended regenerative braking resistor specifications	15Ω 1 500W	10Ω 2000W	10Ω 2000W	10Ω 2000W	Two 20Ω 2000W resistors in parallel
Minimum braking resistance (Ω)	11.7		6.4		

Driver Model	PH600.090.43BRSF	PH600.110.43BRSF
Applicable motor capacity (kW)	90	110
Rated output current (Arms)	180	215
Overload (Arms) duration 5min	242	258
Maximum output current (Arms) duration 30s	318	350
Rated input current(Arms)	190	225
Input Power	AC380V(-15%)~440V(+10%) 47Hz~63Hz	

Driver Model	PH600.090.43BRSF	PH600.110.43BRSF
Weight(kg)	49	49
Recommended regenerative braking resistor specifications	2 10Ω 2000W resistors in parallel	2 10Ω 2000W resistors in parallel
Minimum braking resistance (Ω)	4.4	4.4

2.5 Servo drive technical requirements

PROJECT			CONDITION
BASIC SPECIFICATIONS	CONTROL METHOD		THREE-PHASE FULL-WAVE RECTIFICATION, IGBT PWM CONTROL SINUSOIDAL CURRENT DRIVE MODE
	MAXIMUM OUTPUT FREQUENCY		400HZ
	Motor Position Sensor		Resolver resolution 4096pluse /rev
	environment	Operating temperature	-10 °C ~+50 °C (no freezing, derating above 40 °C) the actual operating environment temperature of the servo drive exceeds 40 °C , please reduce the rated output current by 1% for every 1 °C increase in temperature. In addition, do not use the servo drive in an environment exceeding 50 °C . For servo drives installed in cabinets, the ambient temperature is the air temperature inside the cabinet.
		Storage temperature	− 30 °C ~+60 °C (no freezing)
		humidity	Working/Storage ≤90%RH, no condensation
		Air	Indoors (no sunlight), no corrosive gas, no flammable gas, no oil gas, no dust
		altitude	Below 3000m (above 1000m, use derated rating, 1% for every 100m increase in altitude)
	Protection level		IP20
	Cooling method		Air Cooling
	Digital Signal	enter	6 inputs, see 4.7 Input and output signal wiring for specific functions
		Output	3 outputs, see 4.7 Input and output signal wiring for specific functions
	simul	enter	2 channels (AI1, AI2) 12-bit D/A input, 0~10V; 1 channel (AI3)

PROJECT			CONDITION
	ation		12-bit D/A input, 0~10V/0~20mA
	Signal	Output	2 output 10-bit D/A, 0~10V/0~20mA
	power supply	Output	Provides 15V reference power supply to the outside, with a maximum output of 50mA Provides 24V reference power supply to the outside, with a maximum output of 100mA
	Communication function		Supports 4 fieldbuses: Modbus as standard; CANopen as an option
	LED display panel and keyboard		5-digit LED display, 8 function keys
Control functions performance	Oil pressure control		Can be set as analog input , internal input, communication input, RS485 serial input, CANopen input, EtherCAT input, Profinet input
	Speed control		CAN communication, RS485 communication, CANopen input
	Multi-pump parallel control		Can control 16 pumps, five working modes (multi-pump, compound, multi-mode, communication two-mode, communication four-mode)
	Pressure control accuracy		±1bar
	Flow control accuracy		±0.5%FS
	Speed control accuracy		±0.5%
	Pressure control step response		≤100ms
	Speed step response		≤50ms
	Flow correction function		Pressure correction of output flow according to various pump characteristics
	Torque response time		≤2ms
Protection function	hardware		Overcurrent, DC overvoltage, DC undervoltage, brake resistor damage, module overtemperature, pressure sensor failure, forward and reverse overspeed, brake overload, etc.

PROJECT		CONDITION
	software	Software failure, task reentry, etc.
	Alarm record memory	Can store 5 alarm records
other	EMC filters	C3: Built-in C3 filter C2: Optional external filter (optional third-party cost-effective filter) to meet C2 indicators
	Warranty period	18 months warranty at 80% load
	Certification requirements	Meet CE certification

2.6 Servo drive dimensions

2.6.1 Wall mounting dimensions

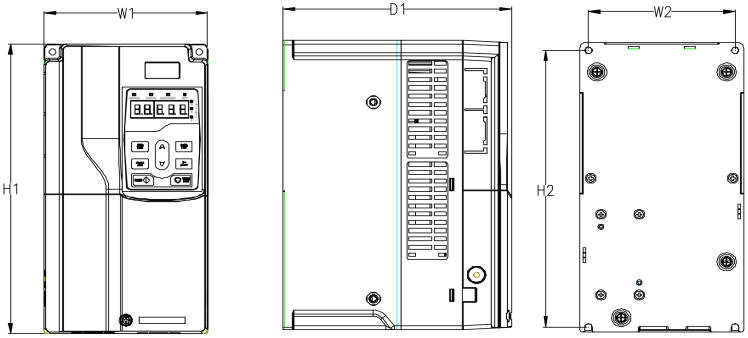


Figure 2 - 2 PH600.007.43ARSF ~ PH600.037.43ARSF Dimensions

Table 2 - 1 PH600.007.43ARSF ~ PH600.037.43ARSF wall-mounted installation dimensions (unit: mm)

Driver Specifications	Dimensions (mm)			Installation hole position (mm)			Mounting hole diameter	Fixing screw
	W1	H1	D1	H2	W2	D2		
PH600.007.43ARSF	145	280	203	268	130	/	Ø 6	M5
PH600.011.43ARSF								
PH600.015.43ARSF	169	320	210	308	154	/	Ø 6	M5
PH600.018.43ARSF								
PH600.022.43ARSF	200	341	208	328.6	185	/	Ø 6	M5
PH600.030.43ARSF	250	400	222	380	230	/	Ø 6	M5
PH600.037.43ARSF								

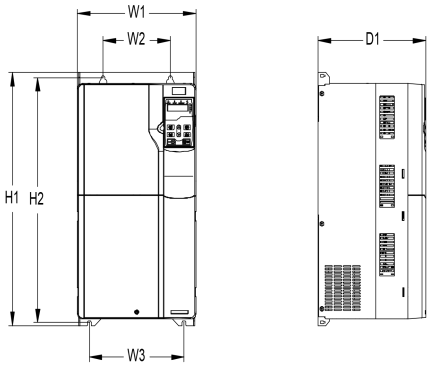


Figure 2 - 3 PH600.045.43ARSF ~ PH600.075.43BRSF size diagram

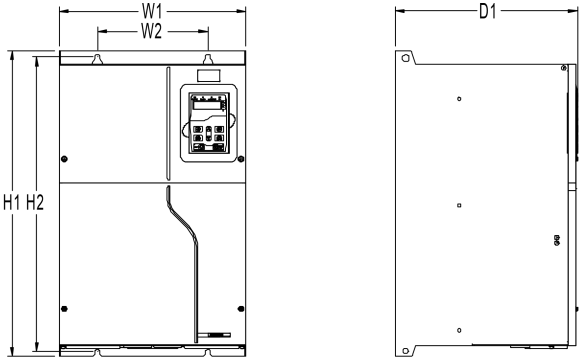


Figure 2 - 4 PH600.090.43BRSF ~ PH600.110.43BRSF dimensions

Table 2 - 2 PH600.045.43ARSF ~ PH600.110.43BRSF wall-mounted installation dimensions (unit: mm)

Driver Specifications	Dimensions (mm)			Installation hole position (mm)			Mounting hole diameter	Fixing screw
	W1	H1	D1	H2	W2	W3		
PH600.045.43ARSF	282	560	257	542	160	226	Ø 9	M8
PH600.055.43ARSF								
PH600.075.43BRSF								
PH600.090.43BRSF	338	554	330	534	200	/	Ø 9.5	M8
PH600.110.43BRSF								

2.6.2 Flange installation dimensions

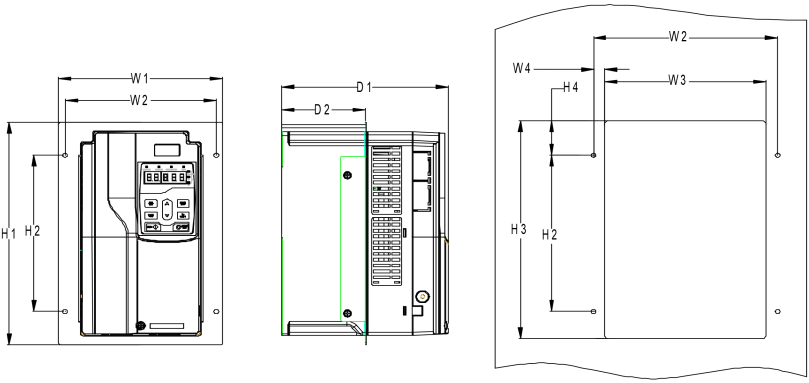


Figure 2 - 5 PH600.007.43ARSF ~ PH600.018.43ARSF dimensions

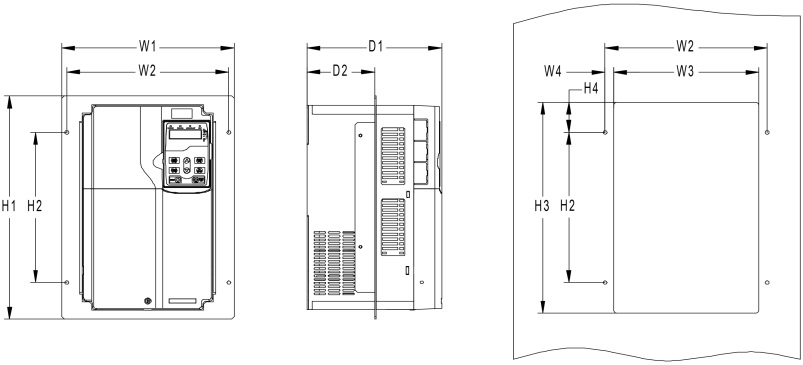


Figure 2 - 6 PH600.022.43ARSF ~ PH600.075.43BRSF dimensions

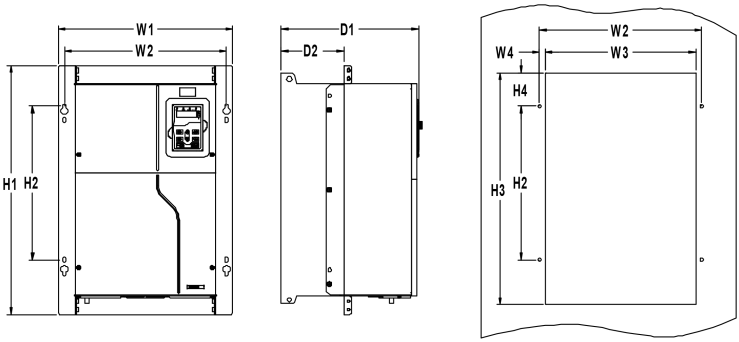


Figure 2 - 7 PH600.090.43BRSF ~ PH600.110.43BRSF dimensions

Table 2 - 3 PH600.007.43ARSF ~ PH600.110.43BRSF flange installation dimensions (unit: mm)

Driver Model	Dimensions (mm)			Installation hole position (mm)							Install Aperture	fixed Screws
	W1	H1	D1	H2	H3	H4	W2	W3	W4	D2		
PH600.007.43ARSF	200	306	203	215	282	33.5	184	164	10	102	Ø 6	M5
PH600.011.43ARSF												
PH600.015.43ARSF	224	346	210	255	322	33.5	208	189	9.5	108	Ø 6	M5
PH600.018.43ARSF												
PH600.022.43ARSF	266	371	208	250	350.6	50.3	250	224	13	104	Ø 6	M5
PH600.030.43ARSF	316	430	222	300	410	55	300	274	13	118.3	Ø 6	M5
PH600.037.43ARSF												
PH600.045.43ARSF	352	580	257	400	570	90	332	306	13	134	Ø 9	M8
PH600.055.43ARSF												
PH600.075.43BRSF												
PH600.090.43BRSF	418.5	600	330	370	559	80.5	389.5	361	14.2	149.5	Ø 10	M8
PH600.110.43BRSF												

3 Mechanical Installation

3.1 Installation Environment

In order to give full play to the performance of the drive and maintain its function for a long time, the installation environment is very important. Please install the drive in the environment shown in the table below.

environment	condition
Installation location	indoor
Ambient temperature	✧ -10~+50 °C . ✧ When the ambient temperature exceeds 40°C, please derate the power by 1% for every 1 °C derate. ✧ We do not recommend using the drive in environments above 50 °C . ✧ To improve the reliability of the machine, use the drive in a location where the temperature does not change rapidly. ✧ When using in a closed space such as a control cabinet, use a cooling fan or cooling air conditioner to cool it to prevent the internal temperature from exceeding the condition temperature. ✧ When the temperature is too low, when the power is turned on again after a long power outage, an external heating device must be added to eliminate internal freezing, otherwise it will easily cause damage to the machine .
humidity	✧ The relative humidity of the air is less than 90%. ✧ Condensation is not permitted. ✧ In spaces where corrosive gases are present , the maximum relative humidity cannot exceed 60% .
Storage temperature	-30~+60 °C .
Operating environment conditions	Please install the driver in the following location: ✧ Keep away from sources of electromagnetic radiation. ✧ Places without oil mist, corrosive gas, flammable gas, etc. ✧ A place where foreign matter such as metal powder, dust, oil, and water will not enter the interior of the drive (please do not install the drive on flammable materials such as wood). ✧ There are no radioactive or flammable materials in the place. ✧ without harmful gases and liquids . ✧ Places with less salt. ✧ without direct sunlight .
Altitude	✧ Below 1000m. ✧ When the altitude exceeds 1000m, please derate the power by 1% for

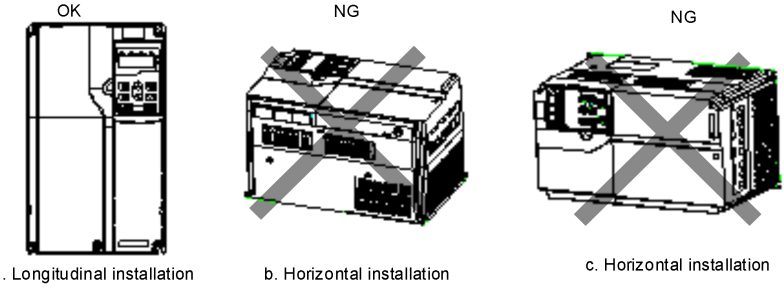
environment	condition
	every 100m. ✧ When the altitude exceeds 3000m, please contact your local INVT dealer or office for detailed information .
vibration	The maximum vibration acceleration shall not exceed 5.8m/s2（0.6g) .
Installation direction	In order not to reduce the heat dissipation effect of the drive, it is recommended to install it vertically .

3.2 Driver Installation

3.2.1 Installation direction

The drive can be mounted on a wall or in a cabinet.

The driver must be installed in a vertical direction. Please check the installation position according to the following requirements. For detailed information on the dimensions, see " 2.6 Servo Driver Dimensions ".



picture 3 - 1 Driver installation direction

3.2.2 Installation

According to the external dimensions of the drive, there are two ways to install the drive: wall-mounted and flange-mounted.

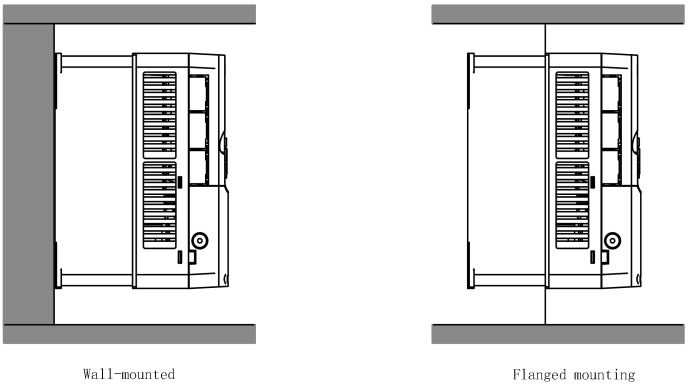


Figure 3 - 2 Installation method

The installation steps are as follows:

1、 Mark the locations of the mounting holes. For the locations of the mounting holes, refer to the drive dimensional drawing in the appendix.

2、 Fasten the screws or bolts at the marked locations.

3、 Place the drive against a wall.

4、 Tighten the fastening screws on the wall.

Note: When installing the flange, a flange mounting plate must be selected.

3.2.3 Single installation

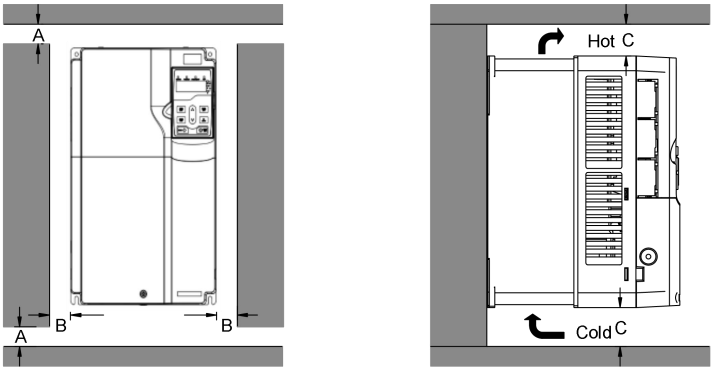


Figure 3 - 3 Single unit installation

Note: The minimum size requirement for B is 100mm, and the minimum size for C is 200mm.

3.2.4 Multiple installations

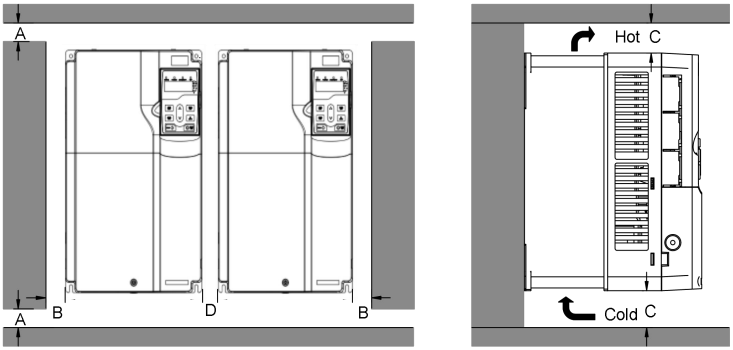


Figure 3 - 4 Multiple parallel installations

Notice:

- ✧ When installing drivers of different sizes, please align the upper positions of the drivers before installing them. This will facilitate later maintenance.
- ✧ The minimum size requirement for B and D is 100mm, and the minimum size requirement for C is 200mm.

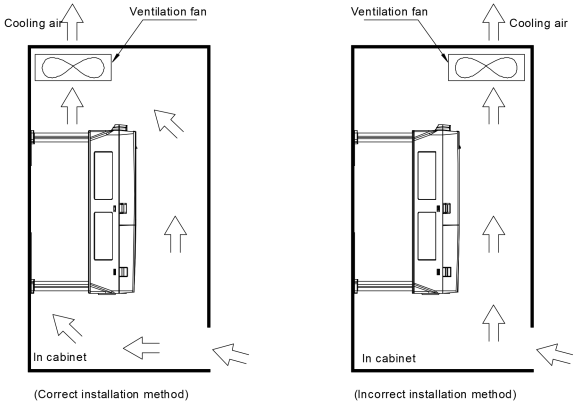


Figure 3 - 3 Installation location diagram of ventilation fan in cabinet

3.3 Disassembly and assembly of the driver junction box

Servo drive terminal box disassembly steps: (taking PH600 . 018.43ARSF as an example)

1、 Loosen the screws that fix the junction box and remove the screws;

2、 Press the buckle, pull the junction box outward, and remove the junction box.

Servo drive junction box installation steps: (taking PH600 . 018.43ARSF as an example)

1、 Place the junction box flatly into the system convex groove, and push the junction box flatly to overlap the gap between the junction box and the shell;

2、 Tighten the two fixing screws that secure the terminal box.

4 Electrical Connections

4.1 Wiring precautions

warn	1、 Wiring work can only be performed by professionals. Improper wiring may cause electric shock or fire.
	2、 The PH600 series high-performance electro-hydraulic servo drive can be directly connected to the industrial power line. In other words, there is no isolation using a transformer, etc. In order to prevent cross-electric shock accidents in the servo system, please be sure to use a wiring circuit breaker or fuse.
	3、 The PH600 series high-performance electro-hydraulic servo drive does not have a built-in grounding protection circuit. In order to form a safer system, please configure a leakage circuit breaker with both overload and short-circuit protection, or a special leakage circuit breaker for ground wire protection that is matched with the wiring circuit breaker.
Notice	1、 It is recommended to use A, B or C grounding method (grounding resistance value is less than 10Ω). Single-point grounding must be used. When the servo motor and mechanical firmware are insulated from each other, please ground the servo motor directly.
	2、 Use thick wire (4.0 mm² or more) for grounding wiring.
	3、 At present, most of the leakage protection switches on the market are electronic leakage circuit breakers. The internal leakage current detection and processing circuits of different manufacturers are quite different, which determines that the anti-interference ability of the circuit breaker is different. For users of this servo drive, it is recommended to use a leakage circuit breaker with strong anti-interference ability. Chint leakage circuit breakers have relatively good performance in this regard.
	4、 When wiring, separate the power line, servo motor input line and other strong wires from the signal line and keep a distance of more than 30cm. Do not put them in the same pipe or bundle them together.
	5、 Do not use the same power supply as welding machines, electrical discharge machines, etc. Even if it is not the same power supply, if there is a high-frequency generator nearby, please connect a noise filter to the input side of the power line.
	6、 Be sure to install a surge suppressor on the coils of relays, solenoids, and electromagnetic contactors.
	7、 To prevent malfunctions due to noise, place the input command

	device and noise filter as close to the servo drive as possible.
	8、 Please select reasonable wire diameter, switch capacity, and contactor capacity. See " 4.2 Selection of switches, contactors, and wire diameters ".

Note: Improper wiring may cause system failure or personal safety hazards.

4.2 Switch, contactor and wire diameter selection

Table 4 - 1 Recommended cable size table

Driver Model	Power line disconnect switch (A)	AC contactor AC3 rated working current (A)	Main circuit						Control loop
			Recommended cable size (mm^2)						
			R/S/T U/V/W	Recommended terminal block model	Terminal screw specifications	PE	Recommended terminal block model	Tightening torque (Nm)	Maximum cable size (mm^2)
PH600.007.43ARSF	40	25	4	TNR3.5-5	M5	4	TNR3.5-5	2~2.5	1.5
PH600.011.43ARSF	50	40	6	TNR5.5-5	M5	6	TNR5.5-5	2~2.5	1.5
PH600.015.43ARSF	60	40	10	TNR8-5	M5	10	TNR8-5	2~2.5	1.5
PH600.018.43ARSF	80	50	10	TNR8-5	M5	10	TNR8-5	2~2.5	1.5
PH600.022.43ARSF	100	65	16	GTNR16-6	M6	10	GTNR10-5	3.5	1.5
PH600.030.43ARSF	125	80	16	GTNR16-6	M6	10	GTNR10-5	3.5	1.5
PH600.037.43ARSF	160	95	25	GTNR25-6	M6	10	GTNR10-5	3.5	1.5
PH600.045.43ARSF	160	115	25	GTNR25-8	M8	16	GTNR16-6	9~11	1.5
PH600.055.43ARSF	200	150	35	GTNR35-8	M8	16	GTNR16-6	9~11	1.5
PH600.075.43BRSF	250	185	50	GTNR50-8	M8	25	GTNR25-6	9~11	1.5
PH600.090.43BRSF	315	225	70	GTNR70-12	M12	35	GTNR35-6	31~40	1.5
PH600.110.43BRSF	315	260	70	GTNR70-12	M12	35	GTNR35-6	31~40	1.5

※ The recommended cable diameter for the main circuit can be used when the ambient temperature is below 40 °C . If the ambient temperature is higher than the above conditions, it is recommended to increase the diameter by one level. It is recommended to use a cable with insulation of not less than 500V.

※ The brake resistor comes with its own wire. If it needs to be extended, the extension wire diameter should not be less than the original resistor wire diameter.


GTNR terminals

Narrow en

GTNR terminal reference brand: Suzhou Yuanli (terminals of different brands may have different models, the specific model shall be subject to the manufacturer)

SG narrow terminal reference brand: Richeng (different brands of terminals may have different models, the specific model shall be subject to the manufacturer's model)

4.3 Terminal layout

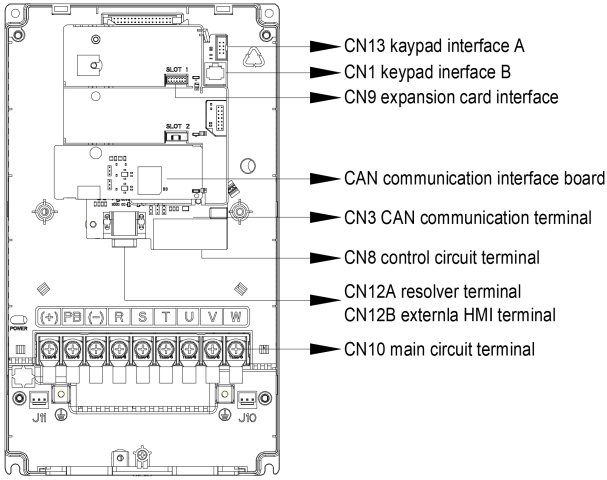


Figure 4 - 1 Terminal layout diagram

4.4 Standard wiring

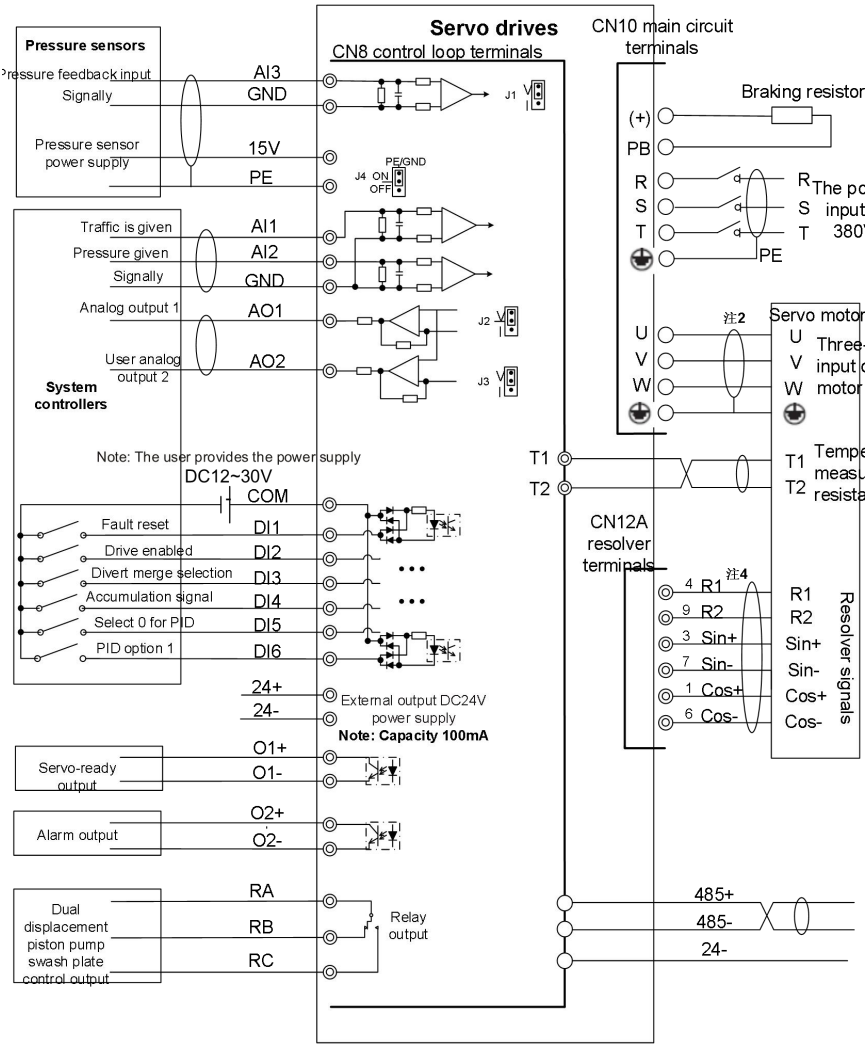


Figure 4 - 2 Standard wiring diagram

Notice:

1、 The default pressure sensor power supply of this driver is 15V, and the pressure signal received is 0~10V / 1~5V voltage signal . It can also be switched to 0mA~20mA current signal through the control board jumper J1

2、 To prevent interference signals from affecting the driver, it is recommended that all analog signal lines and motor three-phase input lines use shielded cables with the shielding layer grounded.

3、 When using analog output and digital output ports, ensure that the output load resistance is large enough so that the output current is less than the specified value. The default analog output range is 0~10V, and can also be switched to 0~20mA current output through the control board jumper J2/J3

4、 The resolver line and communication line must use twisted-pair shielded cables with the shielding layer grounded. Terminal matching resistors should be added to both ends of the communication line. The CAN communication signal connector of this driver has a 120Ω terminal resistor , and the 485 communication signal connector has a built-in 1kΩ terminal resistor.

5、 The GND terminal can be directly connected to PE or connected through an RC filter circuit through the interface board jumper J3 . The factory default is to connect directly to PE

6、 In this wiring diagram, the digital input signal uses the external user power supply by default . If the user wants to use the internal power supply of the driver , it can be achieved through external wiring (note that the internal power supply load capacity is 100mA)

4.5 Jumper Function Description

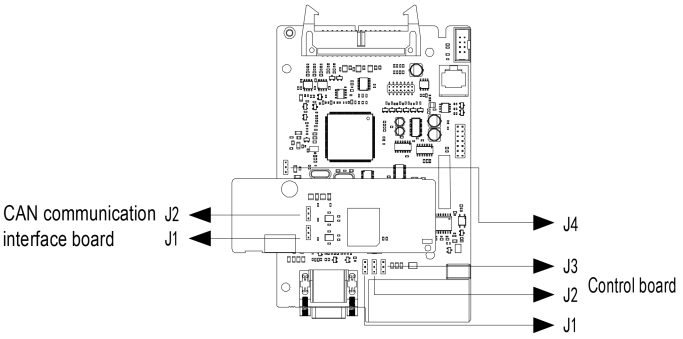


Figure 4 - 3 Control board circuit diagram

PCB board name	Jumper number	Jumper Location	Functional Description	Jumper Location	Functional Description
Control Panel	J1		The default AI3 input is voltage type (0~10V/1~5V)		AI3 input is current type (0~20mA)

PCB board name	Jumper number	Jumper Location	Functional Description	Jumper Location	Functional Description
	J2	V I	The default AO1 output is voltage type (0~10V)	V I	AO1 output is current type (0~20mA)
	J3	V I	The default AO2 output is voltage type (0~10V)	V I	AO1 output is current type (0~20mA)
	J4	C PE	By default, the GND terminal is directly connected to PE.	C PE	The GND terminal is connected to PE through a resistor and a capacitor
CAN communication interface board	J1	120Ω	CAN2 communication defaults to 1 20Ω terminal resistor	120Ω	CAN2 communication without terminal resistor
	J2	120Ω	CAN1 communication defaults to 1 20Ω terminal resistor	120Ω	CAN1 communication without terminal resistor

4.6 Main circuit wiring

4.6.1 Main circuit terminals

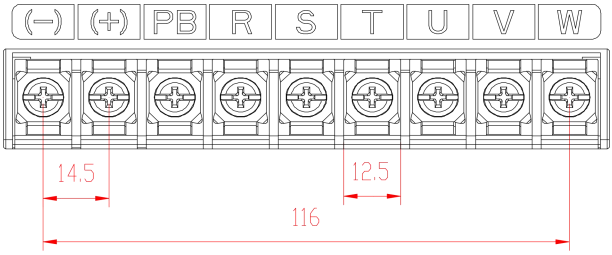


Figure 4 - 4 Three-phase 380V 7.5~11kW main circuit terminal diagram (unit: mm)

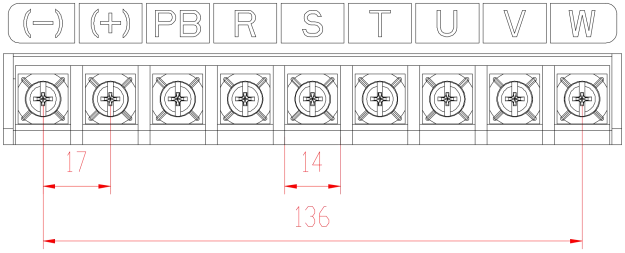


Figure 4 - 5 Schematic diagram of three-phase 380V 15~18.5kW main circuit terminals

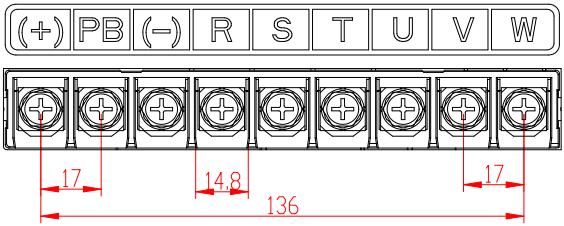


Figure 4 Schematic diagram of - 6 -phase 380V 22kW main circuit terminals

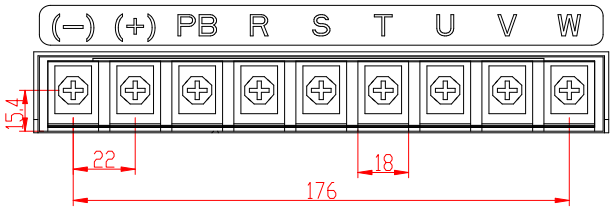


Figure 4 Schematic diagram - of the main circuit terminals of a three-phase 380V 30~37kW

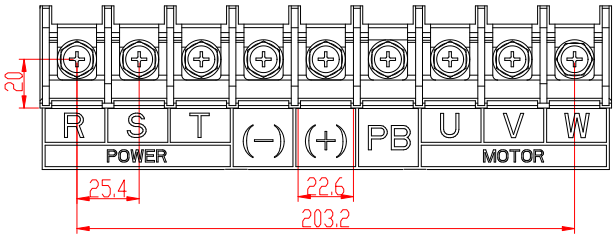


Figure 4 Schematic diagram of - 8 three-phase 380V 45~75kW main circuit terminals

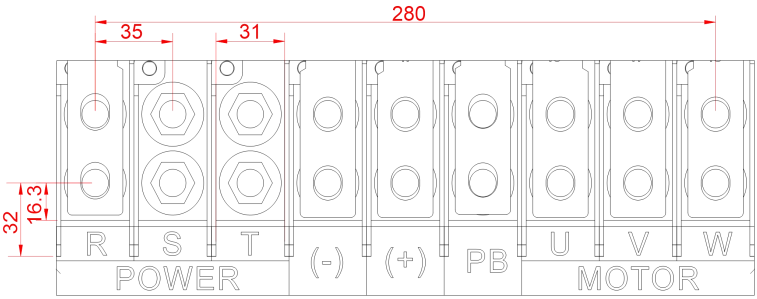


Figure 4 - 9 Three-phase 380V 90~ 110kW main circuit terminal diagram

TERMINAL NAME	TERMINAL SYMBOLS	FUNCTIONAL DESCRIPTION
Main circuit power input terminal	R, S, T	AC380V(-15%)~440V(+10%) 47Hz~63Hz
Servo motor connection terminals	U, V, W	Connected to servo motor
Ground terminal	⏚	Connect to the power grounding terminal and motor grounding terminal for grounding
External brake resistor connection terminal (rated current 180A and below has PB terminal)	(+), PB	Connect an external braking resistor between (+) and PB
DC reactor terminals (rated current 215A and above has P1 terminal)	P1, (+)	P1, (+) External DC reactor terminal

4.6.2 Names and functions of external HMI terminals and resolver terminals

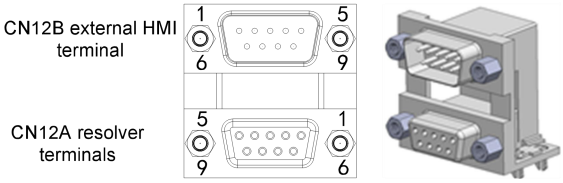


Figure 4 - 10 CN12A resolver and CN12B external HMI DB9 terminal diagram

The external HMI terminal is our company's external HMI common connector. If you use an external HMI to debug the machine, just plug in the external HMI cable and it can be used.

CN12B external HMI terminal

SIGNAL NAME	CODE	FOOT NUMBER	FUNCTION
RS485 communication interface	RS485_A RS485_B	CN12B-7 CN12B-2	Half-duplex, maximum communication rate 57600bps (factory configuration 19200 bits/s)
Communication power supply	+5VA	CN12B-4,8	5V power supply, maximum output current 200mA, accuracy ± 5%
GND	GND_5VA	CN12B-5,9	

CN12A rotary transformer terminals

SIGNAL NAME	CODE	FOOT NUMBER	FUNCTION
Resolver sine input+ Resolver Sine Input -	Sin+ Sin-	CN 12A -3 CN 12A -7	Resolver sinusoidal feedback signal
Resolver cosine input+ Resolver Cosine Input -	Cos+ Cos-	CN 12A -1 CN 12A -6	Resolver cosine feedback signal
Incentive Signal+ Incentive Signal-	R1 R2	CN 12A -4 CN 12A -9	Resolver Excitation Signal

4.6.3 Motor power line and temperature measuring resistor terminals

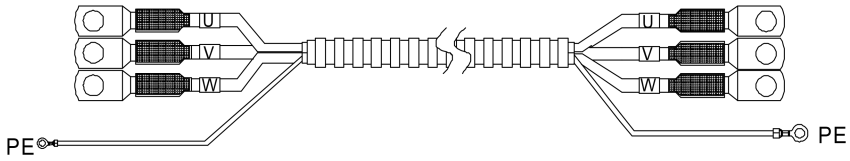


Figure 4 - 11 Motor power cable schematic

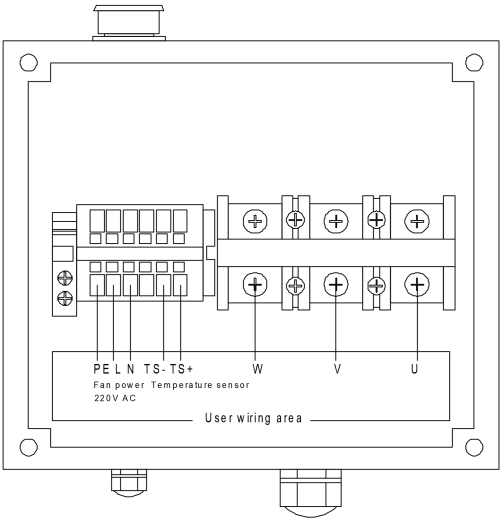


Figure 4 Schematic diagram of - 12 motor wiring terminals

SERIAL NUMBER	NAME	DEFINITION
1	U	Motor three-phase input
2	V	
3	W	
4	TS+	Temperature measuring resistor
5	TS-	
6	N	Fan power supply 220V AC
7	L	
9	PE	Grounding

4.6.4 Schematic diagram of wiring cables and terminals of motor resolver

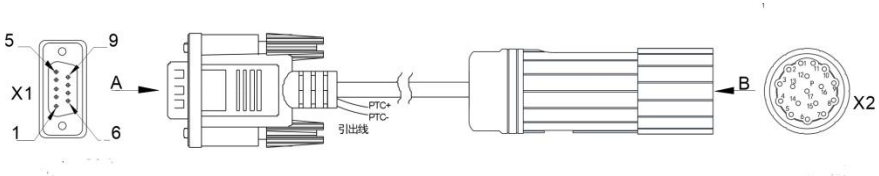


Figure 4 - 13 Motor resolver cable and terminal diagram

Table 4 - 2 Wiring relationship table

Signal	X1	X2	Core wire structure
R1	4	7	Twisted
R2	9	10	
Sin+	3	14	Twisted
Sin-	7	4	
Cos+	1	5	Twisted
Cos-	6	6	
PTC+	CN8 control terminal: T1	16	Twisted
PTC-	CN8 control terminal: T2	17	
PE	shell	shell	Weaving
Note: The resolver cable driver side plug has two lead wires, which are the motor thermistor PTC130 lead wires, directly connected to T1 and T2, regardless of positive or negative ;			

4.6.5 Typical main circuit wiring example

Notice	
	1、 Only one wire should be inserted into each wire insertion port of the connector.
	2、 The three-phase wires of the motor should use shielded wires, one end of which should be connected to the driver ground wire and the other end should be connected to the motor connector ground wire.
	3、 The screws need to be tightened to the appropriate tightness to ensure a smooth connection.

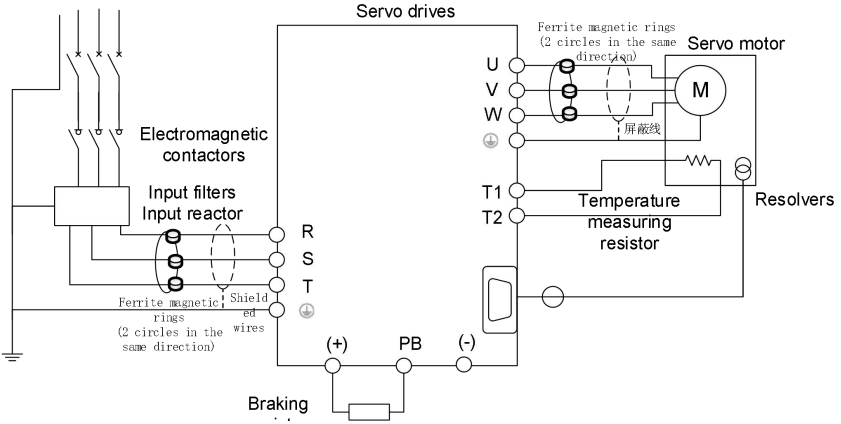


Figure 4 - 14 Main circuit wiring diagram

4.6.6 Main circuit terminal wiring process

1、 Connect the input power cable to the driver power input terminals R, S, and T respectively, connect the grounding conductor of the input power cable to any grounding screw of the driver, and tighten the screw to an appropriate tightness to ensure smooth connection.

2、 Connect the U, V, and W of the motor's three-phase input terminals to the driver's servo motor connection terminals U, V, and W respectively, and tighten the screws to an appropriate degree of tightness to ensure smooth connection. Connect the motor ground terminal to any ground screw of the driver. Connect the motor temperature resistor terminal to terminals T1 and T2 on the driver control board. Connect the motor resolver connection terminal to the driver connector CN4, and tighten the fixing screws.

3、 the two wiring terminals of the brake resistor to the driver terminals (+) and PB, and tighten the screws to an appropriate tightness to ensure smooth connection.

4.7 Input and output signal wiring

4.7.1 Control circuit terminal names and functions

1、 The control circuit terminals are shown in Figure - 4-15 :

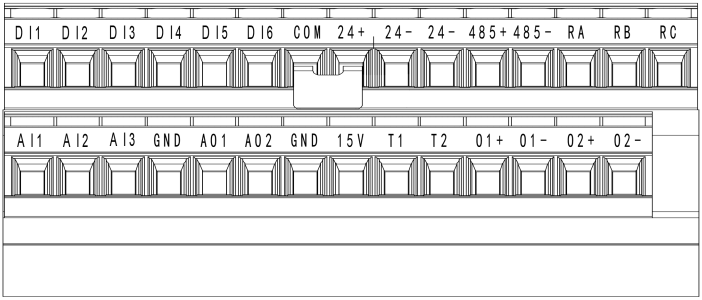


Figure 4 - 15 Control circuit terminal definition diagram

2、 Control circuit terminal function description:

CATEGORY	TERMINAL NAME	TERMINAL SYMBOLS	FOOT POSITION	FUNCTIONAL DESCRIPTION
Analog Input	Analog input 1 (Default flow rate given)	AI1	CN8-16	Input range: 0~10V, 12-bit resolution, correction accuracy 0.5%; Input impedance: 24kΩ.
	Analog input 2	AI2	CN8-17	Input range: 0~10V, 12-bit resolution,

CATEGORY	TERMINAL NAME	TERMINAL SYMBOLS	FOOT POSITION	FUNCTIONAL DESCRIPTION
	(Default pressure setting)			correction accuracy 0.5%; Input impedance: 24kΩ.
	Analog input 3 (Default pressure feedback)	AI3	CN8-18	Input range: 0~10V0~10V/1~5V /0~20mA, 12-bit resolution, calibration accuracy 0.5%, 0~10V/1~5V or 0~20mA input is determined by the J1 jumper selection on the control board; Input impedance: 100kΩ for voltage input, 500Ω for current input.
Analog Output	Analog output 1	AO1	CN8-20	Factory terminal function: pressure feedback output. Monitoring output, select internal parameter output through LED panel , and select voltage output or current output by J2 jumper on the control panel; Output range: 0~10V or 0~20mA, 10-bit resolution, calibration accuracy 1%, maximum load resistance ≤500Ω.
	Analog output 2	AO2	CN8-21	Factory terminal function: speed feedback output. Monitoring output, select internal parameter output through LED panel , and select voltage output or current output by J3 jumper on the control panel; Output range: 0~10V or 0~20mA, 10-bit resolution, calibration accuracy 1%, maximum load resistance ≤500Ω.
Motor temperature	Motor temperature sensor	T1	CN8-24	The motor temperature sensor terminals (T1, T2) have no positive or negative polarity. The driver supports KTY84, PT1000, and PTC130 motor temperature sensors (resistors). The motor temperature sensor type can be changed through the LED panel, and the hardware circuit will automatically select the corresponding temperature sensor detection circuit.
		T2	CN8-25	
power supply	Pressure sensor power supply	15V	CN8-23	Voltage: +15VDC, ±5% (full scale range), output <50mA at 25°C.

CATEGORY	TERMINAL NAME	TERMINAL SYMBOLS	FOOT POSITION	FUNCTIONAL DESCRIPTION
		GND	CN8-19 CN8-22	Analog signal ground terminal.
	24V power supply for digital signal	+24	CN8-8	24V power supply positive pole.
		-twenty four	CN8-9 CN8-10	24V power supply negative pole.
Digital Input	Digital Input 1	DI1	CN8-1	Factory terminal function : Fault reset, release servo alarm status.
	Digital Input 2	DI2	CN8-2	Factory terminal function : Servo enable, by releasing the gate blockade of the driver part, the motor becomes powered on. The first time the driver is powered on, the servo is enabled, and the motor is powered on after a delay of 3 seconds. The next enable delay is 10ms.
	Digital Input 3 Digital Input 4	DI3 DI4	CN8-3 CN8-4	DI3 factory terminal function: shunt and confluence selection (used with multi-pump confluence control function). Input is valid for confluence, input is invalid for shunt. DI4 factory terminal function: material storage signal input (used with electronic back pressure function). If a valid input is entered, the injection molding machine works in the material storage state; if an invalid input is entered, the injection molding machine works in other states; Motor rotation direction signal (automatically set when using P05=3 with flow ring unit); Input is invalid in positive direction, input is valid in reverse direction;
	Digital Input 5	DI5	CN8-5	DI5 factory terminal function : PID terminal 1 DI6 factory terminal function : PID terminal 2 Single pump pressure control segmented PID parameter selection (4 segments) , DI6, DI5 KP number KI number KD number off off 0 0 0 off on 1 1 1 on off 2 2 2
	Digital Input 6	DI6	CN8-6	

CATEGORY	TERMINAL NAME	TERMINAL SYMBOLS	FOOT POSITION	FUNCTIONAL DESCRIPTION
				on off 3 3 3 Multi-pump parallel pressure control segmented PID parameter selection (4 segments), DI6 DI5 KP serial number KI serial number KD serial number off off 0 0 0 off on 1 1 1 on off 2 2 2 on on 3 3 3
	Digital input common	COM	CN8-7	IO input common terminal, when COM is connected to high level, IO input low level is valid; when COM is connected to low level, IO input high level is valid.
Digital Output	Digital output 1	O1+	CN8-26	The output is during the operation of the driver . When the main circuit power is on, there is no alarm output. It is turned on when the driver enable terminal is valid .
		O1-	CN8-27	
	Digital output 2	O2+	CN8-28	Alarm output, if an abnormality is detected, the output signal state is reversed.
		O2-	CN8-29	
Relay output	Common terminal	RA	CN8-13	The wobble plate output signal (used in conjunction with the wobble plate control function of a dual displacement pump) switches on the small displacement and disconnects the large displacement. Relay output contact capacity : 0.5A/125VAC 1A/30VDC, RB is the normally closed terminal , RC is the normally open terminal .
	Normally closed terminal	RB	CN8-14	
	Normally open terminal	RC	CN8-15	
Communication terminal	RS485 Communication	485+	CN8-11	The 485 communication interface supports the standard Modbus RTU communication specification, with a built-in 1kΩ terminal resistor. Half-duplex, supports baud rates: 9600bps, 19200bps, 38400bps, 57600bps (factory configuration 19200bps).
		485-	CN8-12	
		twenty four-	CN8-10	RS485 shield ground.

CATEGORY	TERMINAL NAME	TERMINAL SYMBOLS	FOOT POSITION	FUNCTIONAL DESCRIPTION
		C2L	CN3-4	

4.7.2 Typical control signal wiring diagram

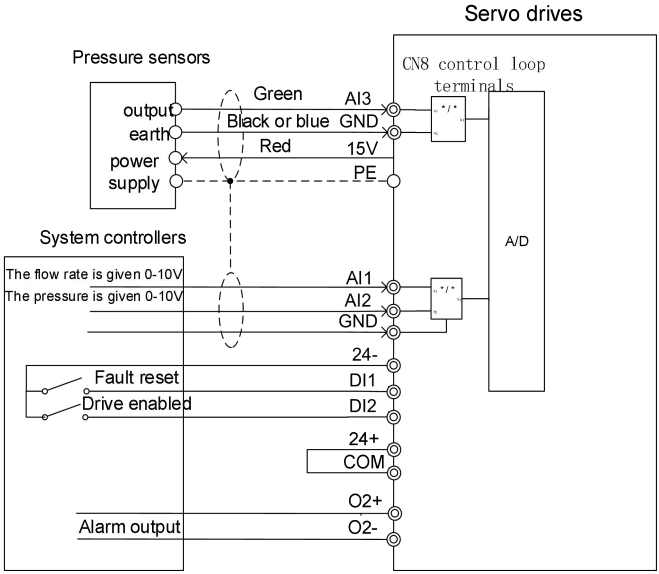


Figure 4 - 16 Typical control signal wiring diagram

4.8 Control Signal Interface Circuit

4.8.1 Analog Input Circuit

The analog input circuit is as follows:

1、 Description of pin 16 (flow setting) and pin 17 (pressure setting) of the CN8 connector.

Voltage input mode: 0~10V, input impedance 24kΩ.

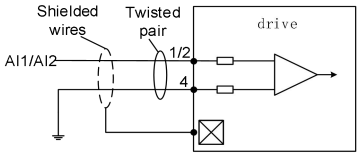


Figure 4 - 17 Analog input schematic diagram

2、 Description of pin 18 (pressure feedback input) of the CN8 connector.

The analog signal is the oil pressure feedback signal . The pressure sensor type can be

selected through jumper J1, which is 0~10V/1~5V or 0~20mA input. The factory default is 0~10V. The input impedance is 100kΩ.

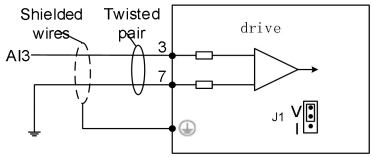


Figure 4 - 18 Schematic diagram of pressure feedback input

4.8.2 Analog Output Circuit

The analog output signal (AO1, AO2) is the output of the op amp and forms an output circuit with GND. The user can select the internal parameter output through the LED panel. The factory default setting is AO1 for pressure output and AO2 for motor speed output. The output range is 0~10V or 0~20mA, 10-bit resolution, 1% calibration accuracy, and the maximum load resistance value is ≤500Ω. The voltage output or current output is determined by the J2 and J3 jumper selections on the control board. The following figure shows the interface circuit:

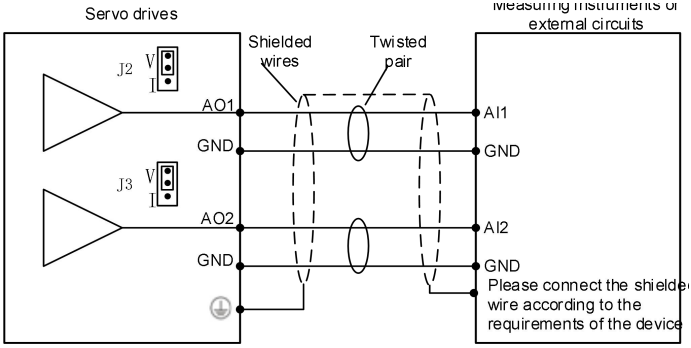


Figure 4 - 19 Analog output schematic diagram

4.8.3 Digital Input Circuit

1、 Connection method when using self-provided power supply:

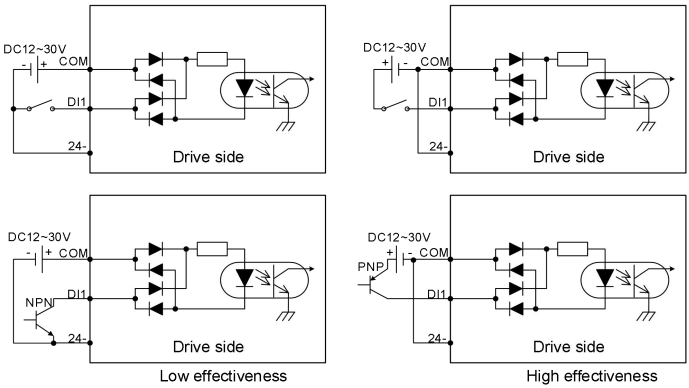


Figure 4 - 20 digital input schematic diagram

2、 Connection method when using the local power supply:

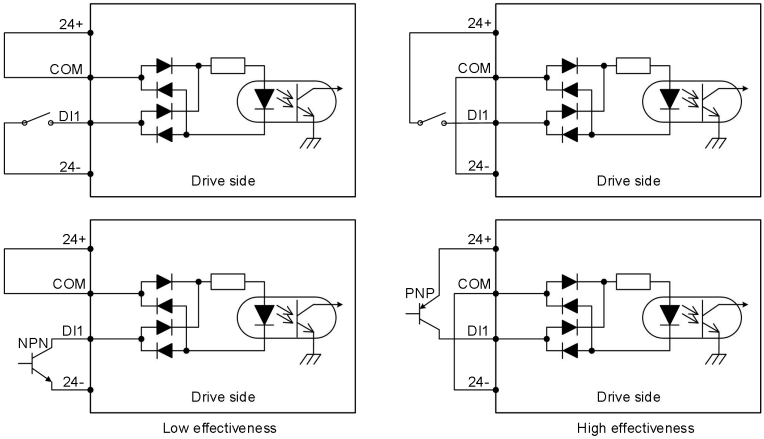


Figure 4 - 21 digital output schematic diagram

Notice:

- The switch input circuit has the mechanical switch connection method as shown in the figure and the open collector connection method of the transistor (NPN type and PNP type, but the two types cannot be mixed);
- The 24V power supply can be either the 24V power supply that comes with the servo drive (which can only provide 100mA current) or a 12~30V power supply prepared by the user.

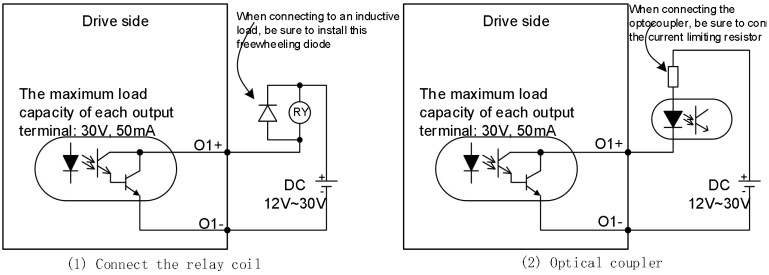
4.8.4 Digital Output Circuit

There are 3 switch output circuits, all of which are open collector output structures as shown

in Figure 4 - 22 and Figure 4 - 23 , which can be used to drive relay coils or optocoupler loads, and the load capacity is shown in Figure 4 - 22 and Figure 4 - 23. When connecting to inductive loads such as relay coils, be sure to install a freewheeling diode as shown in Figure 4 - 22 and Figure 4 - 23 ; when connecting to optocouplers, be sure to connect a current limiting resistor, otherwise the driver will be damaged.

The 24V power supply of this machine can only provide 100mA current. If the actual load current is greater than 100mA, please prepare your own power supply. The recommended capacity is above 500mA.

1、 Wiring method using customer-provided power supply:



picture 4 - 22 External power supply digital output diagram

2、 Use the power wiring method of this machine:

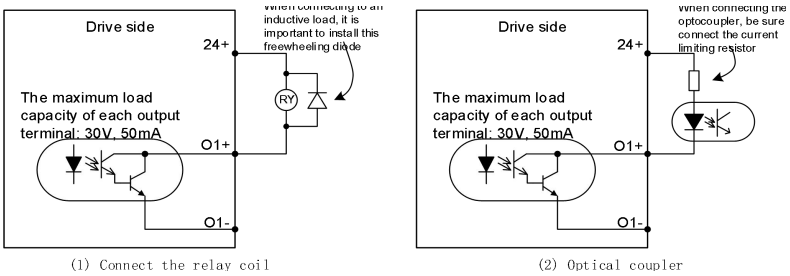


Figure 4 - 23 internal power supply digital output schematic

3、 Relay output circuit description:

Inductive loads (relays, motors) will generate voltage spikes when the current is cut off, so it is necessary to use varistors for protection at the relay contact points, and install absorption circuits on the inductive loads, such as varistors, RC absorption circuits, diodes, etc., to ensure minimal interference when shutting down.

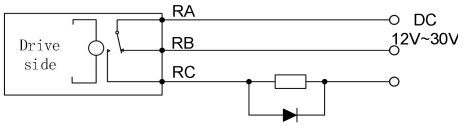


Figure 4 - 24 relay output schematic diagram

4.9 CAN expansion card usage

By connecting the CN3 terminal of the CAN communication card to the CN10 terminal of the main control board, the PH600 series servo drive can be connected to the high-speed CANopen communication network to achieve field bus control. The following figure is a schematic diagram of the CAN communication card.

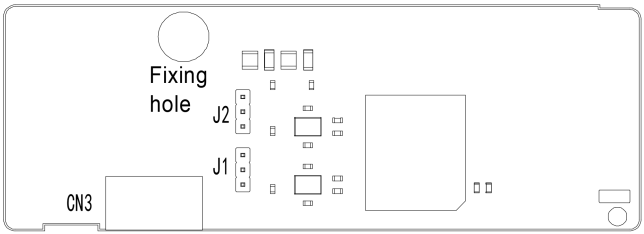
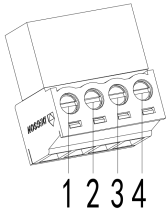


Figure 4 - 25 CAN communication board schematic diagram

4PIN terminal	**TERMINAL NAME**	**CODE**	**FOOT NUMBER**	Function
	CAN1 communicatio n	C1H C1L	CN3-1 CN3-2	CAN communication port 1 is the CAN communication interface between multiple drivers in a multi-pump parallel system; CAN protocol standard signal, optocoupler isolation, can be selected through the jumper to connect a 120Ω terminal resistor .
	CAN2 Communicati on	C2H C2L	CN3-3 CN3-4	CAN communication port 2 supports the standard CANopen communication protocol and can be connected to a 120Ω terminal resistor via a jumper.

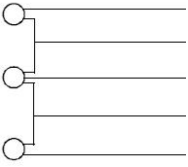
5 LED display and operation

5.1 Introduction to LED Keyboard

The purpose of the keyboard is to control the PH600 driver, read status data and adjust parameters. The schematic diagram is shown below:

Figure 5 - 1 Film keyboard

SERIAL NUMBER	NAME	DISPLAY CONTENT	illustrate
1	Status indicator	RUN/TUNE	Light off: Indicates the drive is in shutdown state The light flashes: It means the drive is in weak power or factory test state. Light on: Indicates the drive is in operation
		FWD/REV	Forward and reverse indicator light Light off: Indicates the drive is in forward state Light on: Indicates the drive is in reverse state
		LOCAL/REMOT	Command mode indicator Light off: indicates digital input (keyboard, HMI panel or PC software input) The light flashes: It indicates analog input or internal reference Light on: indicates CAN serial, 485 serial, CANopen input, EtherCAT input or Profinet input
		TRIP	Fault indicator light

SERIAL NUMBER	NAME	DISPLAY CONTENT	illustrate	
			Light off: Indicates the drive is in normal state Light on: Indicates the drive is in a fault state	
2	Unit indicator light		Hz	Frequency Unit
			RPM	Speed unit
			A	Current Unit
			%	percentage
			V	Voltage Unit
3	Digital display area	5-digit LED display, showing various monitoring data such as speed feedback, pressure feedback and alarm codes.		
4	Digital Potentiometer	Regulate input voltage.		
4	Keypad		Programming Keys	Used to switch between modes or return to the previous menu.
			Confirm key	Enter the next level menu in parameter mode and confirm the set parameter value in edit mode.
			UP increment key	Data or function code increments.
			DOWN decrement key	Data or function code decrement.
			Right Shift Key	of the function code decreases by 10, and in the edit mode the flashing character moves left to select the position to be modified.
			Shortcut multi-function key	The function code increases by 10.
			Run Key	In keyboard operation mode, it is used to run operations .
			Stop/Reset button	In keyboard operation mode, in running state, pressing this

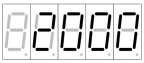
SERIAL NUMBER	NAME	DISPLAY CONTENT	illustrate	
				key can be used to stop the running operation. In the fault alarm state, this key can be used to reset the operation in all control modes .

- **LED display comparison table:**

Display letters	Corresponding letters	Display letters	Corresponding letters	Display letters	Corresponding letters	Display letters	Corresponding letters	Di le
	0		1		2		3	
	6		7		8		9	
	C		d		E		F	
	I		J		K		L	
	O		P		q		R	
	U		V		W		X	
	-		-	-	-	-	-	

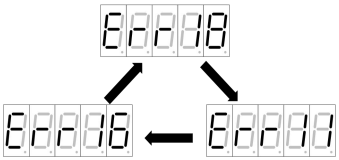
- **Keyboard display:**

When the servo drive is powered on, the LED digital tube lights up. The LED value displays the motor speed (rpm) by default, and the display is accurate to the unit digit.



If a fault occurs during power-on or operation, the TRIP fault indicator will light up and the LED value will display the fault code. The fault code consists of the fault identifier (the first three digits of the digital tube from left to right display Err) and the fault code number (the last two digits of the digital tube from left to right display two digits).

If multiple faults occur simultaneously, multiple fault codes will be displayed repeatedly in a loop.



- **Keyboard unlock:**

The LED keyboard has two operating states: locked and unlocked. When powered on, the LED keyboard is in the locked state, and the keys can only switch between shortcut mode and user mode.[PRG/ESC]

If you want to switch to other operation modes, you need to press [▲][▼] the keys simultaneously for 1 second, and the LED value will display ULOCK, indicating that the drive keyboard is unlocked. At this time, if the drive has no fault, the drive keyboard enters the shortcut mode; if the drive has a fault, you need to press [PRG/ESC] to enter the shortcut mode.

5.2 LED Panel Function

5.2.1 Keyboard operation mode

The drive has six keyboard operation modes, and keys [PRG/ESC] can be used to switch between modes.

Quick Mode (xxxxx): used to display key parameters.

Quick setting mode (Exx): used to set key parameters and motor debugging .

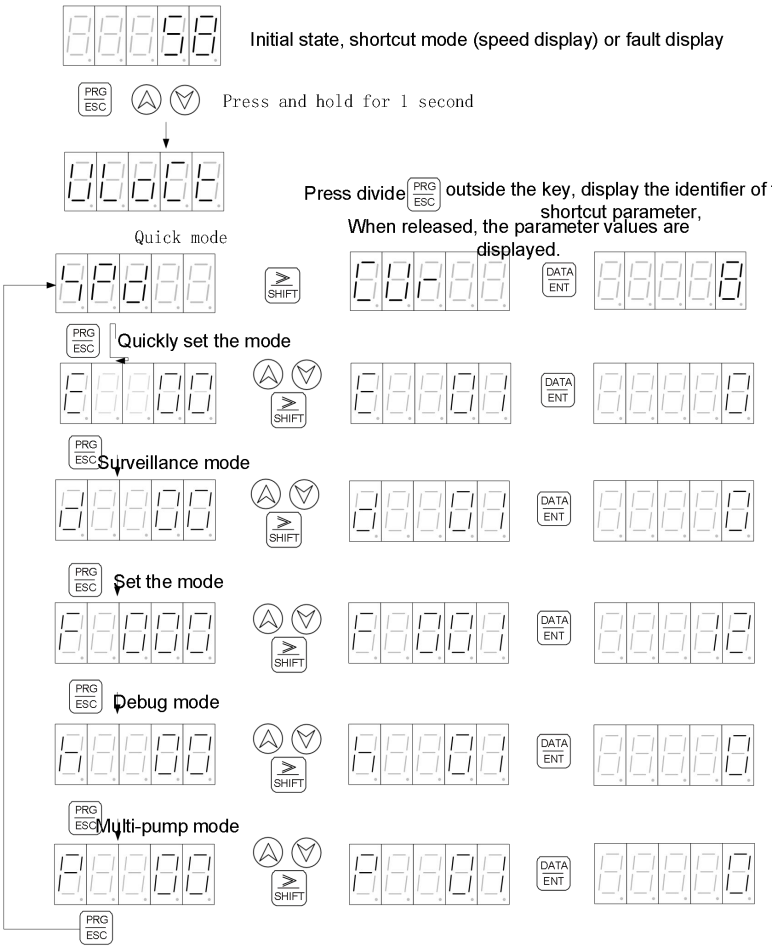
Monitoring mode (dxx): used to display status parameters.

Setting mode (Fxxx): used to set basic parameters.

Debug mode (hxx): used for motor debugging and parameter saving.

Multi-pump mode (Pxx): used to set multi-pump parallel parameters.

The operation flow chart is as follows:



5.2.2 Quick Mode

In the quick mode, you can quickly view the important parameters of the drive by pressing the buttons. SHIFT When you press the buttons together for 1 second in the LOCK state to enter the "quick mode", the LED displays the value of the selected parameter. Press and hold SHIFT the button, and the LED displays the next parameter identifier to be displayed. Release SHIFT the button and the LED displays the value of the corresponding parameter.

※ In the quick mode, if there is no key operation for 1 minute, it will automatically switch to the speed or fault display interface.

Quick mode display parameter table:

IDENTIFIER	DEFINITION AND DESCRIPTION	PARAMETER RANGE	UNIT
SPD	Speed feedback	[-6000,6000]	rpm
CUR	Current Feedback	[0,900.0]	A
RES	Resolver Feedback	[0,4096]	-
PRS	Pressure feedback	[0,500]	bar
PIDS	PID segment number	[0,3]	-

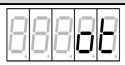
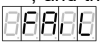
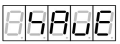
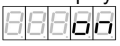
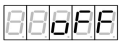
5.2.3 Quick Setting Mode

PRG ESC When the key is pressed to select "Quick Setting Mode", the LED value will display "E--xx". xx represents different parameter identifiers. Press the ▲ ▼ or SHIFT key to select the parameter identifier to be set. Release the key to complete the selection. The LED value will display the value of the corresponding parameter. When modifying the parameter value, you can DATA ENT SHIFT move the flashing digit by pressing the key, and change the value of the flashing digit by pressing ▲ or . ▼ When the modification is completed, release the key , the modified value will be saved in the parameter and stop flashing. At this time, press DATA ENT DATA ENT the or ▲ ▼ SHIFT key again to modify the parameter value again. At this time, the modifiable digit will flash. Press the key to exit. PRG ESC

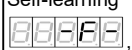
CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
E00	Run Enable DATA ENT Release the button to enter the run enable mode, the LED displays the run enable status "ON" or "OFF", and release the button to switch the run enable status. DATA ENT	OFF: Disable ON: Enable	Related to the driver enable IO level	
E01	PHYSIS Motor Selection LED display after entering 11805 The first two digits are the selection number, and the last three digits are the motor model code. Press the ▲ or ▼ key to select the motor to be set . Release the key and the LED display will start the motor DATA ENT setting . ----- After completion, the newly selected motor model will be displayed. If the selection fails, the LED display will be displayed FAIL.		E01010F173 01062	
E02	Pump selection After entering, 0008 the first two digits of the LED display are the selection number, and the last three digits are the oil pump	For details, please see the following oil pump	PUMP 100 mL/r 19100	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	displacement . Press the ▲ or ▼ key to select the oil pump to be set DATA ENT  . Release the key and the LED display will start the oil pump setting. After completion, the newly selected oil pump model will be displayed. If the selection fails, the LED will display  .	model list		
E03	After entering the pressure feedback zero position calibration, the LED displays the analog voltage feedback value of the pressure sensor. Release the button to calibrate. DATA ENT  The LED displays  if the calibration is successful  or failed .			
E04	Measuring initial angle The initial angle test can only be performed when the run enable is OFF. After releasing the button to enter the initial angle measurement menu, the LED displays the previous resolver offset. DATA ENT DATA ENT Release the button to start measuring the initial angle. The LED display  indicates that the measurement is in progress. After the measurement is completed, the LED displays the newly measured resolver offset. The LED displays if the test fails.  During the measurement, press the MODE button to exit the measurement.			
E05	Pressure full scale This value will set both the full scale and maximum pressure. At the same time, the pressure setting gain will be adjusted so that when the pressure setting input is 9.99V, the pressure setting corresponds to the newly set full scale value. After entering, the current set full scale value of pressure will be displayed. After the button changes to the required value, SHIFT ▲ ▼ DATA ENT release the button to confirm.	[1,500]	175	bar

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
E06	Flow full scale This value will set both the full scale flow rate and the maximum flow rate. At the same time, the flow setting gain will be adjusted so that when the flow setting input is 9.99V, the flow setting corresponds to the newly set full scale flow rate value. After entering, the current set full scale flow rate value will be displayed. After the button is changed to the required value, ∧ ∨ DATA ENT release the button to confirm.	[1,2400]	200	L/min
E07	Pressure zero calibration DATA ENT Release the button to enter, the LED displays the given analog value of pressure, release the button to calibrate the pressure zero position, the LED displays DATA ENT -----, the LED displays if the calibration is successful 0000 , and the LED displays if the calibration fails FAIL.	Analog voltage range [0.00,9.99]		V
E08	Pressure full scale calibration DATA ENT Release the button to enter, the LED displays the current pressure given analog value, after confirming the value, release the button to calibrate the pressure zero position, the LED displays DATA ENT 9.9.9.9 , the LED displays if the calibration is successful 0000 , and the LED displays if the calibration fails FAIL.	Analog voltage range [0.00,9.99]		V
E09	Flow zero calibration DATA ENT Release the button to enter, the LED displays the given analog value of the flow, release the button to calibrate the flow zero position, the LED displays DATA ENT -----, the LED displays if the calibration is successful 0000 , and the LED displays if the calibration fails FAIL.	Analog voltage range [0.00,9.99]		V
E10	Flow full scale calibration DATA ENT Release the button to enter, the LED displays the current flow given analog value, after confirming the value, release the button to calibrate the flow full scale, the LED displays DATA ENT ----- , the LED displays if the	Analog voltage range [0.00,9.99]		V

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	calibration is successful  , and the LED displays if the calibration fails  .			
E11	Parameter burning DATA ENT Release the button to enter, LED display shows  DATA ENT that the button is released, parameter burning starts, LED display shows  , burning is successful  , LED display shows calibration failure  .			
E12	Jog DATA ENT After the key is released to enter the jog mode, the LED display  prompts the operator to jog. Press the ▲ or ▼ key to rotate the motor forward or reverse. Press the key to exit the jog mode and return to the "Exx" menu. PRG ESC	▲: Forward ▼: Invert		
E13	Diagnostic Enablement DATA ENT Release the button to enter the diagnostic enable mode, and the LED displays the diagnostic enable status  , or release  the button to switch the diagnostic enable status. DATA ENT	OFF: Disable ON: Enable	OFF	
E14	Motor parameter self-learning The motor parameter self-learning function works only when the diagnosis is enabled. After releasing the button to enter the motor parameter self-learning menu, the LED displays "0". After selecting the parameter learning method, DATA ENT DATA ENT release the button to start the motor parameter self-learning. The LED display  indicates that the self-learning is in progress. If the self-learning is successfully completed, the LED displays  , and	0: Disable 1: Dynamic 2: Static 1 3: Static 2	0: Disable	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	if it fails, the LED displays  . During self-learning, you can press the button to exit self-learning and return to the "Exx" menu. PRG/ESC			
E15	Pressure sensor selection DATA/ENT Release the button to enter, you can select the pressure sensor type, and release the button to set it after selecting it . DATA/ENT PRG/ESC Press the button to exit and return to the "Exx" menu.	5V: 1~5V, 0~200bar sensor 10V: 0~10V, 0~250bar sensor 400bar: 0~10V, 0~400bar sensor	10V	
E16	Pressure proportional gain DATA/ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA/ENT PRG/ESC press the key to exit and return to the "Exx" menu.	[0,32767]	1 1 000	
E17	Pressure integral gain DATA/ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA/ENT PRG/ESC press the key to exit and return to the "Exx" menu.	[0,32767]	7 0	
E18	Speed proportional gain 0 DATA/ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, press DATA/ENT PRG/ESC the key to exit, and return to the "Exx" menu.	[0,32767]	6000	
E19	Speed integral gain 0 DATA/ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to	[0,32767]	120	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.			
E20	Speed proportional torque boost DATA ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.	[0,1000]	0	%
E21	Speed integral torque boost DATA ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.	[0,1000]	0	%
E22	Pump reverse maximum speed DATA ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.	[0,-6000]	-300	Rpm
E23	Reverse torque upper limit DATA ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.	[0,100]	100	%
E24	Pressure overpressure protection value DATA ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.	[0,500]	195	bar
E25	Pump stuck detection DATA ENT Release the key to enter, press the ▲ or ▼ key to set parameters, release the key to set, DATA ENT PRG ESC press the key to exit and return to the "Exx" menu.	0: Disable 1: Enable	1	
E26	Analog channel zero drift self-learning Self-learning is enabled, LED display  , DATA ENT press and release the key to automatically complete zero drift correction.	0: Invalid 1: Enable	0	
E27	Flow rate set rise time 0	[0.00,327.67]	0.00	s
E28	Flow rate set fall time 0	[0.00,327.67]	0.00	s

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
E29	Pressure setting rise time 0	[0.00,327.67]	0.00	s
E30	Pressure setting drop time 0	[0.00,327.67]	0.00	s
E31	Pump reverse maximum speed	[0,-6000]	-300	rpm
E32	Maximum motor speed	[0,6000]	2200	rpm
E33	Underflow Enable	0 : Bottomless flow 1: There is underflow	0	/
E34	Underflow pressure	[0,500.0]	3	bar
E35	Underflow	[0,327.67]	0.95	L/min
E36	Motor temperature sensor	0: NTC 1:PTC 2: KTY84 3: PT1000 4: PT1000×1 Option 3 means three PT1000 temperature measuring resistors are connected in series, and option 4 means one PT1000 temperature measuring resistor.	3	/
E37	Motor protection temperature	[0,500]	125	°C
E38	Fan Control Mode	0 : Running fan 1 : Temperature control 2 : Fan running	0 : Running fan	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		3 : When fan stop is selected 1 , the fan will run when the drive temperature is higher than 50 degrees, and the fan will stop when it is lower than 45 degrees.		
E39	Acceleration time	[0.00,327.67]	0	s
E40	Deceleration time	[0.00,327.67]	0	s
E41	Control mode selection	0 : Hydraulic mode 1 : Speed mode	0: Hydraulic mode	
E42	Speed command mode	0 : Digital input 1 : Analog input 2 : CAN continuous 3 : 485 consecutive 4 : CANopen input 5 : EtherCAT input 6 : Internal setting 7 : PROFINET input	0 : Digital input	
E43	Speed full scale	[0,6000]	2000	rpm
E44	Stop mode selection	0 : Free gliding	0 : Free gliding	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		7 : Slow down and stop This parameter is used to set the motor deceleration method when the servo is OFF .		

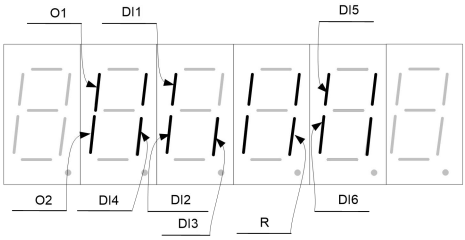
5.2.4 Monitoring Mode

PRG ESC When you press the button to select "Monitoring Mode", the LED value will display "d--xx". xx represents the identifier of different parameters. Press the ▲▼ or SHIFT key to select the parameter identifier to be displayed. After the selection is completed, press the button and the LED panel will display the value of the corresponding parameter. DATA ENT PRG ESC Press the button again to exit.

※ In monitoring mode, if there is no key operation for 1 minute, it will automatically switch to the quick mode speed feedback display or fault display interface.

The definition of monitoring parameters in this drive monitoring mode is as follows:

CODE	NAME	PARAMETER RANGE	UNIT
d00	Flow rate setting	[0,2400.0]	L/min
d01	Pressure setting	[0,500.0]	bar
d02	System failure	SYSTEM FAULT ALARM (can display multiple faults occurring simultaneously)	
d03	Motor current	[0,900.0] (valid value)	A
d04	reserve		
d05	DC voltage	[0,800]	V
d06	Torque limit	[0,1800]	Nm
d07	Speed feedback	[-6000,6000]	Rpm
d08	Resolver Feedback	[0,4096]	-
d09	Pressure feedback	[0,500]	bar
d10	Torque feedback	[-1800,1800]	Nm
d11	Operation Mode	3: Speed Mode 4: Hydraulic mode	

CODE	NAME	PARAMETER RANGE	UNIT
d12	Motor temperature	[-52,244]	°C
d13	Driver temperature	[-46,244]	°C
d14	Ambient temperature	[-18,114]	°C
d15	Machine information	[0,999]	
d16	DSP software version		
d17	Panel software version		
d18	Maximum system pressure	[0,500.0]	bar
d19	System maximum flow	[0,2400.0]	L/min
d20	power	[-327.67,327.67]	kW
d21	Confluence Type	0: Single pump 1: Compound 2: Multi-pump 3: Multi-mode 4: Communication dual mode 5: Four communication modes	
d22	Current PID segment	[0,3]	
d23	AI1 voltage	[-10.00 ,10.00]	V
d24	AI2 voltage	[-10.00 ,10.00]	V
d25	AI3 voltage	[0,10.00]	V
d26	Output voltage	[-1000,1000]	V
d27	Digital Input/Output	 When the input signal is valid, the LED is off, for example, when there is a signal in I1, the LED is off, and when there is no signal, the LED is on (where the S_ON input port light is on to indicate a high level); when the	

CODE	NAME	PARAMETER RANGE	UNIT
		output signal is invalid, the LED is on, otherwise it is off.	
d28	Motor configuration table Version		
d29	Motor power	[-327.67,327.67]	kW
d30	Energy consumption of this work	[0,999.9]	kW.h
d31	Total energy consumption is 5 digits lower	[0,999.9]	kW.h
d32	Total energy consumption is 5 digits higher	[0,9999]	1000 kW.h
d33	Motor power factor	[0,1.00]	
d34	Drive running time	[0,6553.5]	h
d35	Analog speed command	[0,6000]	rpm
d36	Analog torque command	[0,1800]	Nm
d37	Analog forward torque limit	[0,1800]	Nm
d38	Analog reverse torque limit	[0,1800]	Nm
d39	Real-time positive torque limit	[0,1800]	Nm
d40	Real-time reverse torque limit	[0,-1800]	Nm
d41	CANopen state machine status	0: Initialization 4: Stop 5: Operation 127: Pre-operation	
d42	voltage before	[-10.00 ,10.00]	V

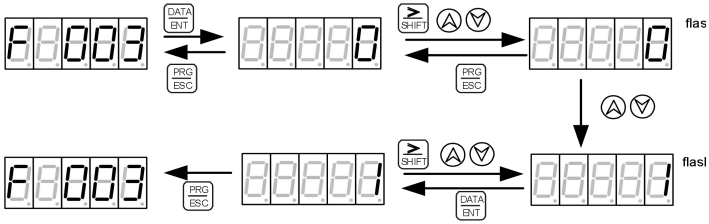
CODE	NAME	PARAMETER RANGE	UNIT
	correction		
d43	voltage before correction	[-10.00 ,10.00]	V
d44	voltage before correction	[-10.00,10.00]	V
d45	Master-slave control status	[0: master 1: slave]	
d46	A port expansion card model	[0: No card , 11: PROFINET card, 256: PG card]	
d47	B port expansion card model		

5.2.5 Setting Mode

When you PRG/ESC press to select "Setting Mode", the LED value will display "F--xxx". xxx represents different parameter identifiers. Press ▲ ▼ or SHIFT to select the parameter identifier to be set. After the selection is completed, release the key and the LED panel will display the value of the corresponding parameter. Press DATA/ENT SHIFT or ▲ ▼ and the modifiable digit will flash. When modifying the parameter value, SHIFT move the flashing digit by pressing the key and ▲ ▼ change the value of the flashing digit. When the modification is completed, release the key and the modified value will be saved in the parameter and stop flashing. At this time, press DATA/ENT SHIFT the or ▲ ▼ key again to modify the parameter value again. At this time, the modifiable digit will flash. Press the key to exit. PRG/ESC

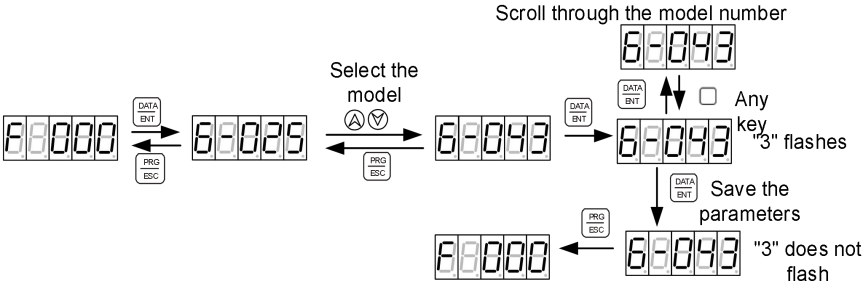
Note: The selection of driver, motor and oil pump is different from other parameter selections. The specific operations are as follows:

Parameter setting operation flow chart:

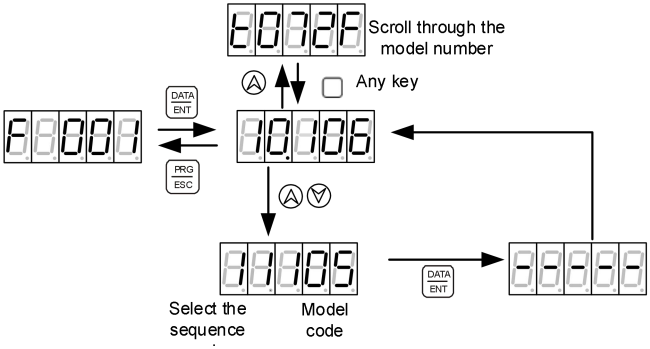


※ Calibration command, such as pressure linear zero calibration, after setting, if the LED displays 0, the calibration is successful, if the LED displays 1 all the time, it means the calibration failed.

Driver setting operation flow chart:



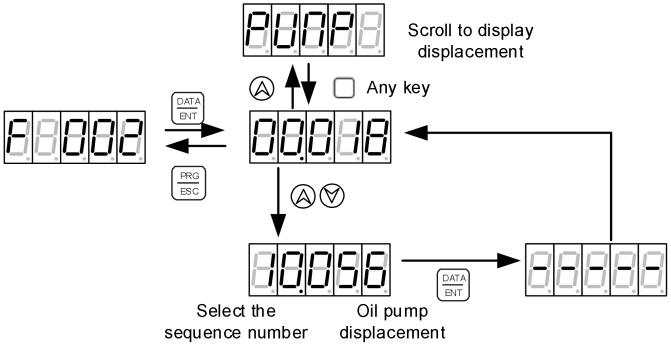
Motor setting operation flow chart:



Selection number: It is the arrangement sequence number of each model of motor.

Model code: It is the digital code of each model of motor.

Oil pump setting operation flow chart:



Selection number: It is the arrangement sequence number of each model of oil pump.

In the setting mode, if there is no key operation for 1 minute, it will automatically switch to the

quick mode speed feedback display or fault display interface.

Table 5 - 1 Driver Model List

Drive selection order	LED display mode	Driver Model	Drive model code
1	A-018	PH600.007.43ARSF	80
2	A-025	PH600.011.43ARSF	81
3	A-032	PH600.015.43ARSF	82
4	A-038	PH600.018.43ARSF	83
5	A-045	PH600.022.43ARSF	84
6	A-060	PH600.030.43ARSF	85
7	A-075	PH600.037.43ARSF	86
8	A-092	PH600.045.43ARSF	88
9	A-115	PH600.055.43ARSF	89
10	A-150	PH600.075.43BRSF	90
11	A-180	PH600.090.43BRSF	91
12	A-215	PH600.110.43BRSF	92

Table 5 - 2 Motor Model List

Arrangement sequence number	Motor Model	Motor model code	Arrangement sequence number	Motor Model	Motor model code
00	E01004F153	2 63	33	E01013F 17 3	2 4 3
twenty three	E01004F173	2 31	20	E01013F203	2 44
twenty four	E01004F203	2 32	08	E01 215 F 15 3	2 70
01	E01005F153	2 64	34	E01 215 F 17 3	2 45
25	E01005F173	2 33	54	E01 215 F 20 3	2 46
26	E01005F203	2 34	09	E01 220 F 15 3	2 71
02	E01007F153	2 65	35	E01 220 F 17 3	2 47
27	E01007F173	2 35	56	E01 220 F 203	2 48
28	E01007F203	2 36	65	E01 225 F 15 3	2 72

Arrangement sequence number	Motor Model	Motor model code	Arrangement sequence number	Motor Model	Motor model code
03	E01008F153	2 66	36	E01 225 F 173	2 49
29	E01008F173	2 37	57	E01 225 F 203	2 50
30	E01008F203	2 38	66	E01 230 F 153	2 73
04	E01010F153	267	37	E01 230 F 173	2 51
31	E01010F173	239	58	E01 230 F 203	2 52
11	E01010F203	2 40	67	E01 235 F 153	2 74
05	E01012F153	2 68	38	E01 235 F 173	2 53
32	E01012F173	2 41	73	E01 235 F 203	2 54
12	E01012F203	2 42	68	E01 240 F 153	2 75
06	E01013F153	2 69			

Table 5 - 3 Oil pump model list

Oil pump selection number	Oil pump model	Oil pump displacement mL/r	Default maximum flow
0	PUMP 018 mL/r	18	40 L/min
1	PUMP 025 mL/r	25	55 L/min
2	PUMP 028 mL/r	28	62 L/min
3	PUMP 031 mL/r	31	68 L/min
4	PUMP 032 mL/r	32	70 L/min
5	PUMP 036 mL/r	36	79 L/min
6	PUMP 037 mL/r	37	81 L/min
7	PUMP 040 mL/r	40	88 L/min

Oil pump selection number	Oil pump model	Oil pump displacement mL/r	Default maximum flow
8	PUMP 045 mL/r	45	99 L/min
9	PUMP 050 mL/r	50	110 L/min
10	PUMP 056 mL/r	56	123 L/min
11	PUMP 062 mL/r	62	136 L/min
12	PUMP 063 mL/r	63	139 L/min
13	PUMP 064 mL/r	64	141 L/min
14	PUMP 071 mL/r	71	142 L/min
15	PUMP 075 mL/r	75	150 L/min
16	PUMP 078 mL/r	78	156 L/min
17	PUMP 080 mL/r	80	160 L/min
18	PUMP 090 mL/r	90	180 L/min
19	PUMP 100 mL/r	100	200 L/min
20	PUMP 101 mL/r	101	202 L/min
twenty one	PUMP 120 mL/r	120	240 L/min
twenty two	PUMP 125 mL/r	125	250 L/min
twenty three	PUMP 130 mL/r	130	260 L/min
twenty four	PUMP 140 mL/r	140	280 L/min
25	PUMP 150 mL/r	150	300 L/min
26	PUMP 160 mL/r	160	320 L/min

※ The duplex pump is selected according to the displacement of the large displacement pump.

Table 5 - 4 Setting mode parameter definition table

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F000	Drive selection	For details, please see the drive model list above.	Same as drive plate	
F001	Motor selection		07.062	
F002	Pump selection	For details, please see the oil pump model list above	19.100	
F003	Pressure feedback zero calibration	0: No action 1: Calibration	0	
F004	Pressure calibration mode	0: Linear pressure calibration 1: Broken line pressure calibration	0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F005	Flow calibration mode	0: Linear flow calibration 1: Broken line flow calibration	0	
F006	Pressure calibration	0: No action 1: Straight line zero position 2: Linear range 3: Line point 0 4: Broken line point 1 5: Broken line point 2 6: Broken line point 3 7: Broken line point 4 8: Broken line point 5 9: Broken line point 6 10: Broken line point 7 11: Broken line point 8 12: Broken line point 9 13: Broken line point 10 14: Broken line point 11 15: Broken line point 12	0	When the linear zero or span calibration is performed, the LED displays 0 after setting to indicate a successful calibration, and displays other values to indicate a failed calibration. When the broken line calibration is performed, the LED displays the original value to indicate a successful calibration, and displays 1 to indicate a failed calibration.
F007	Flow calibration	0: No action 1: Straight line zero position 2: Linear range 3: Line point 0	0	When the linear zero or span calibration is performed,

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		4: Broken line point 1 5: Broken line point 2 6: Broken line point 3 7: Broken line point 4 8: Broken line point 5 9: Broken line point 6 10: Broken line point 7 11: Broken line point 8 12: Broken line point 9 13: Broken line point 10 14: Broken line point 11 15: Broken line point 12		the LED displays 0 after setting to indicate a successful calibration, and displays other values to indicate a failed calibration. When the broken line calibration is performed, the LED displays the original value to indicate a successful calibration, and displays 1 to indicate a failed calibration.
F008	AI2 first level average filtering times	[1,32]	6	
F009	AI1 first level average filtering times	[1,32]	6	
F010	Pressure full scale This value will set both the full scale pressure and the maximum pressure. At the same time, it will adjust the pressure reference gain so that when the pressure reference input	[1,500]	175	bar

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	is 9.99V, the pressure reference corresponds to the newly set full scale pressure value.			
F011	Flow full scale This value will set both the full scale flow rate and the maximum flow rate. At the same time, the flow reference gain will be adjusted so that when the flow reference input is 9.99V, the flow reference corresponds to the newly set full scale flow rate value.	[1,2400]	200	L/min
F012	Maximum pressure	[0,500]	180	bar
F013	Maximum flow	[0,2400]	200	L/min
F014	Speed proportional gain 0	[0,32767]	6000	
F015	Speed integral gain 0	[0,32767]	120	
F016	Pressure feedback gain	[0 , 32767]	8182	
F017	Pressure setting rising slope	[0 , 32767]	1 147	0.007629 bar/ms
F018	Pressure setting decreasing slope	[0 , 32767]	1147	0.007629 bar/ms
F019	Pressure proportional gain 0	[0,32767]	1 1 000	
F020	Pressure integral gain 0	[0,32767]	7 0	
F021	Acceleration delay time	[0,32767]	0	ms
F022	Pressure proportional gain 1	[0,32767]	1 1 000	
F023	Pressure integral gain 1	[0,32767]	7 0	
F024	Gain switching pressure low	[0, 500]	0	/
F025	Pressure proportional gain 2	[0,32767]	1 1 000	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F026	Pressure integral gain 2	[0,32767]	7 0	
F027	Gain switching pressure high	[0, 500]	0	
F028	Pressure proportional gain 3	[0,32767]	1 1 000	
F029	Pressure integral gain 3	[0,32767]	7 0	
F030	reserve	[0,32767]	0	
F031	Pump displacement	[0,32767]	100	mL/r
F032	Pump Leakage	[0,1.00]	0.00	L/min/bar
F033	Pump reverse maximum speed	[0,-6000]	-300	rpm
F034	Maximum motor speed	[0,6000]	2200	rpm
F035	DC voltage calibration	[0,800] (can only be fine-tuned)	DC voltage when entering the menu	V
F036	reserve			
F037	Underflow Enable	0: Bottomless flow 1: There is underflow	0	
F038	Underflow pressure	[0,500.0]	3.00	bar
F039	Underflow	[0,327.67]	0.95	L/min
F040	Overshoot limit	[5,50]	30	bar
F041	Motor rotation direction	0: Forward 1: Reverse	0	
F042	Rotation direction	0 : Default direction 1 : Opposite direction	0	
F043	Backpressure mode	0: Manual 1: Automatic	0	
F044	Pressure sensor selection	5V 10V 400bar	10V	
F045	Plunger pump selection	0: Single displacement 1: Double displacement	0	
F046	Piston pump displacement ratio	[0 , 100.0]	20	%
F047	Swing plate switching pressure threshold	[0, 500.0]	195	bar
F048	Displacement pressure	[0,32767]	100	ms

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	judgment delay			
F049	A O 1 output selection	0: Pressure setting 1: Pressure feedback 2: Flow rate setting 3: Traffic feedback 4: Speed setting 5: Speed feedback 6: Torque setting 7: Torque feedback 8: Resolver feedback 9: DC voltage 10: Phase current 11: Reserved 12: Reserved 13 : Communication command (F055 control) 14: Communication setting value 1 15: Communication setting value 2	1	
F050	A O 1 max.	[-32767,32767]	16384	
F051	A O 1 minimum	[-32767,32767]	0	
F052	A O 2 output selection	0: Pressure setting 1: Pressure feedback 2: Flow rate setting 3: Traffic feedback 4: Speed setting 5: Speed feedback 6: Torque setting 7: Torque feedback 8: Resolver feedback 9: DC voltage 10: Phase current 11: Reserved 12: Reserved 13 : Communication command (F055 control) 14: Communication	5	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		setting value 1 15: Communication setting value 2		
F053	A O 2 max.	[-32767,32767]	16384	
F054	A O 2 minimum	[-32767,32767]	-16384	
F055	A O output value	[-32767, 32767]	0	

AO 1 , AO 2 minimum value description :

AO 1 and AO 2 is the value of the output measurement when the analog output is 0V , and 32767 corresponds to the range of each measurement value.

For example: If the AO2 output is selected as feedback speed, the speed range is 6000rpm , and the AO2 minimum value is set to -2731 , corresponding to 6000*(- 2731/32767)=-500.0 RPM , then when the speed feedback is less than or equal to -500.0 RPM , AO2 outputs 0V , and there is voltage output only when it is greater than -499.9 RPM .

A O 1 , A O 2 maximum value description :

A O 1 and A O 2 are the values of the output measurement when the analog output is 10V , and 32767 corresponds to the range of each measurement value.

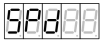
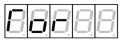
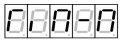
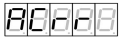
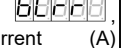
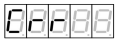
For example: If the AO2 output is selected as feedback speed, the speed range is 6000rpm , the minimum value of A O 2 is set to - 2731 , corresponding to 6000*(- 2731/32767)= - 500.0 rpm. The maximum value of A O 2 is set to 13653 , corresponding to 6000*(13653/32767)=2500.0 rpm. When the speed feedback is greater than or equal to 2500.0 rpm, the analog output is 10V , and when it is less than 2500.0 rpm, the output is 0-10V .

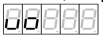
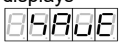
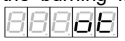
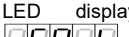
Output voltage = 10V*(speed feedback value +500.0)/(2500.0+500.0) .

The output measurement range is as follows:

Output selection value	name	Range
0	Pressure setting	500 bar
1	Pressure feedback	500 bar
2	Flow rate setting	2400 L/min
3	Traffic feedback	2400 L/min
4	Speed setting	6000 rpm

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	5	Speed feedback	6000 rpm	
	6	Torque setting	1800 Nm	
	7	Torque feedback	1800 Nm	
	8	Resolver Feedback	8* 360 °	
	9	DC voltage	32767 V	
	10	Phase current	900 A	
	11~12			
	13	Communication instructions	32767	
	14	Communication setting value 1	100.0%	
	15	Communication setting value 2	100.0%	
F056	Delay of rising of swing plate switching	[0,32767]	10	ms
F057	Delay of switching down of swing plate	[0,32767]	10	ms
F058	Speed switching upper limit	[0, 6000]	1200	rpm
F059	Speed switching lower limit	[0, 6000]	200	rpm
F060	AI1 zero dead zone	[0.00, 100.00]	0.5	%
F061	AI2 zero dead zone	[0.00, 100.00]	0.5	%
F062	AI3 zero dead zone	[0.00, 100.00]	0.0	%
F063	Oil pressure reaching pressure coefficient	[0.00, 100.00]	90.0	%
F064	Negative torque suppression control	0: Disable 1: Enable	0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F065	Displacement switching mode	0: Overvoltage 1: Maintaining overpressure	0	
F066	Restore factory settings	0: Disable 1: Recovery	0	
F067	Fault record view (Display fault code)	1: Fault 1 2: Fault 2 3: Fault 3 4: Fault 4 5: Fault 5 After entering, the last fault (serial number is 1) will be displayed. SHIFT Press the button to display the previous fault (serial number is 2). Press the button to display the following faults in sequence: DC voltage (V)  , speed feedback (rpm)  , torque feedback (Nm)  , fault time (hours)  , fault time (minutes)  , phase A current (Apk)  , phase B current (Apk)  , motor current (A)  , drive temperature (°C)  , motor temperature (°C)  , speed reference (rpm)	Current fault code	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		 , torque reference (Nm)  , output voltage (V)  , fault type  .		
F068	Parameter burning	Parameter burning  After pressing the button to enter, the LED displays   the button , the parameter burning starts, the LED displays  , the burning is successful  , and the LED displays failure  .	SAVE	
F069	Keyboard unlock password	[0,99999]	00000	-
F070	Motor rated voltage	[0,800]		V
F071	Motor rated current	[0,900]		A
F072	Motor rated speed	[0,6000]		rpm
F073	Motor rated frequency	[0,600]		Hz
F074	Motor back EMF	[0.0,800.0]		V/Krpm
F075	Motor temperature sensor	0: NTC 1:PTC 2: KTY84 3: PT1000 *3 4: PT1000*1	3	
F076	reserve			
F077	reserve			
F078	reserve			
F079	Pressure sensor range	[0, 500.0]	250.0	bar
F080	Pressure feedback fine-tuning coefficient	[50,200]	100	%
F081	Minimum flow rate	[0,2400.0]	0.0	L/min

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	setting			
F082	Overmodulation Enable	[0,1]	1	1: Enable
F083	Overmodulation ratio	[100,115]	10 6	%
F084	Carrier frequency	[4k,8k,3k,2k,6k]	4k	Hz
F085	Overload protection mode	0: Current limiting mode 1: It protection method 2, 3: Reserve	0	
F086	Busbar overvoltage protection@	[0,1000]	770	V
F087	Busbar overvoltage protection @ time	[0,30000]	20	5ms
F088	Busbar overvoltage protection	[0,1000]	800	V
F089	Busbar undervoltage protection@	[0,1000]	380	V
F090	Bus undervoltage protection @ time	[0,30000]	150	5ms
F091	Bus undervoltage protection	[0,1000]	320	V
F092	Open-tube busbar undervoltage protection	[0,1000]	315	V
F093	AC overvoltage protection@	[0,1 5 00]	1500	V
F094	AC overvoltage protection @ time	[0,30000]	300 0	5ms
F095	AC Overvoltage	[0,1 5 00]	1500	V
F096	AC undervoltage protection@	[0,1000]	0	V
F097	AC undervoltage protection @ time	[0,30000]	101	5ms
F098	AC undervoltage	[0,1000]	0	V
F099	Power-on timeout	[0,30000]	2000	5ms
F100	Motor protection temperature	[0,500]	125	°C
F101	Module protection temperature	[0,500]	86	°C
F102	Air protection	[0,500]	400	°C

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	temperature			
F103	Overcurrent protection value	[0,900]	018→61 025→70 032→110 038→110 045→140 060→200 075→240 092→290 115→380 150→480 180→500 215→562	A
F104	Forward speed protection value	[0,6000]	2700	rpm
F105	Reverse speed protection value	[-6000,0]	-2700	rpm
F106	Pressure overpressure protection value @	[0, 500]	195	bar
F107	Pressure sensor fault value	[0,32767]	0	
F108	ACDC sampling error voltage	[0,800]	80	V
F109	Braking resistor heating factor	[0,500]	018~045→35 060~215→40	
F110	Braking resistor cooling factor	[0,500]	1	
F111	Braking resistor overload threshold	[0,30000]	018~045→374 060~215→292	
F112	Motor short circuit protection value	[0,900]	10.0	A
F113	Input phase loss protection selection	0: Disable 1: Enable	1	
F114	Rectifier overload protection selection	0: Disable 1: Enable	0	
F115	Speed feedback filter mode	0: Moving average 1: Least Squares	0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		It will be effective only after power is turned on again.		
F116	Low speed proportional gain	[0,32767]	7000	
F117	Low speed integral gain	[0,32767]	140	
F118	Speed gain switching low speed	[0,6000]	5994	rpm
F119	Speed gain switching high speed	[0,6000]	5994	rpm
F120	Speed control stiffness	[1,14]	8	-
F121	Motor inertia	[0,0.655]	0.018	Kgm ^{2}
F122	Motor torque coefficient	[0,100.00]		Nm/Arms
F123	Motor self-learning direction	0: Forward 1: Reverse	0	
F124	Driver rated power	[0.00,327.67]	018→7.50 025→11.00 032→15.00 038→18.00 045→22.00 060→30.00 075→37.00 092→45.00 115→60.00 150→75.00 180→90.00 215→110.00	kW
F125	Driver rated current	[0,900]	018→18.0 025→25.0 032→32.0 038→38.0 045→45.0 060→60.0 075→75.0 092→92.0 115→115.0 150→150.0	A

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
			180→180.0 215→215.0	
F126	Torque limit	[0,1800]	400	Nm
F127	Disturbance compensation gain	[0,200]	0	%
F128	Disturbance compensation filter frequency	[0,5000]	500	Hz
F129	Disturbance compensation hysteresis period	[0,15]	5	Cycle (Speed loop period)
F130	Over speed protection time	[0,5000]	100	ms
F131	Flow rate setting rising slope	[0,32767]	16000	0.07324 (L/min)/ms
F132	Flow rate setting down slope	[0,32767]	16000	0.07324 (L/min)/ms
F133	Braking resistor fault detection	0: Disable 1: Enable	1	
F134	PWM voltage compensation	0: Disable 1: Enable	0	
F135	Pump stuck detection	0: Disable 1: Enable	1	
F136	Oil pressure relief mode	0: Normal oil circuit 1: Self-pressure relief oil circuit	0	
F137	Reverse torque upper limit	[0,100]	100	%
F138	Speed integral torque boost	[0,1000]	0	%
F139	Speed multi-stage PI enable	0: Disable 1: Enable	0	
F140	Pressure multi-stage PI enable	0: Disable 1: Enable	0	
F141	Speed proportional gain 1	[0,32767]	7000	
F142	Speed integral gain 1	[0,32767]	140	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F143	Speed proportional gain 2	[0,32767]	7000	
F144	Speed integral gain 2	[0,32767]	140	
F145	Speed proportional gain 3	[0,32767]	7000	
F146	Speed integral gain 3	[0,32767]	140	
F147	Self-decompression opening speed	[-300,300]	250	rpm
F148	Self-decompression opening pressure	[0, 500]	59	bar
F149	Self-relieving closing pressure	[0, 500]	57	bar
F150	Feed-forward cutting speed during holding pressure	[-6000,6000]	100	rpm
F151	Feed-forward cut-in pressure	[0, 500]	200	bar
F152	Pressure-maintaining feed-forward gain	[0,32767]	0	
F153	AI2 full-scale voltage	[0,11.00]	9.99	V
F154	AI1 full-scale voltage	[0,11.00]	9.99	V
F155	Resolver Fault Detection	0: Disable 1: Enable	0	
F156	How to use PID terminal	0: General 1: Dedicated for die casting machine	0	
F157	DI1 input selection	0: No function 1: Fault reset 2: Driver enable 3: Diversion and confluence selection 4: Storage signal input 5: Motor rotation direction 6: PID terminal 1 7: PID terminal 2 8: PID terminal 3	1	
F158	DI2 input selection		2	
F159	DI3 input selection		3	
F160	DI4 input selection		4	
F161	DI5 input selection		6	
F162	DI6 input selection		7	
F163	reserve		0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F164	reserve	9: PID terminal 4 10: Trigger mode selection 11: Swash plate control enable (for controlling the swash plate in pressure-maintaining and overpressure mode) 12: Swash plate switching command 13: Pressure flow control selection signal 14: Follower unit enabled 15: Internal setting 1 16: Internal reference 2 17: Internal setting 3 18: Select 1 from the node address 19: Select 2 from the node address 20: Convergence and diversion selection 1 21: Oil pressure command cuts to internal 22: Flow rate setting speed increase mode 23: Torque limit switch 24~27: Reserved 28: Positive limit switch 29: Negative limit switch	0	
F165	reserve		0	
F166	reserve		0	
F167	O1 output selection	0: No function 1: The drive is running 2: Alarm output 3: I2 terminal status 4: Swash plate control output 5: Oil pressure reaches output 6: Self-pressure relief	1	
F168	O2 output selection		2	
F169	reserve		0	
F170	R output selection		2	
F171	reserve		0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		output 7~10 reserved 11: External brake release signal 12: Speed zero output 13: Driver is ready for output 14: Communication virtual terminal output		
F172	Total energy consumption is 5 digits lower	[0,999.9]	0.0	kW.h
F173	Total energy consumption is 5 digits higher	[0,9999]	0	1000 kW.h
F174	Pressure relief PI enable	0: Disable 1: Enable	0	
F175	Pressure relief ratio P0	[0,32767]	1 1 000	
F176	Pressure relief and pressure reduction P integral 0	[0,32767]	10	
F177	Pressure relief ratio P1	[0,32767]	1 1 000	
F178	Pressure relief and pressure reduction P integral 1	[0,32767]	10	
F179	Pressure relief speed PI enable	0: Disable 1: Enable	0	
F180	Pressure relief speed ratio 0	[0,32767]	6000	
F181	Pressure relief speed integral 0	[0,32767]	50	
F182	Pressure relief speed ratio 1	[0,32767]	6000	
F183	Pressure relief speed integral 1	[0,32767]	50	
F184	Gain switching dropout high 0	[0,500]	0	bar

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F185	Gain switching dropout low 0	[0,500]	0	bar
F186	Gain switching dropout high 1	[0,500]	0	bar
F187	Gain switching dropout low 1	[0,500]	0	bar
F188	High pressure differential pressure ratio 0	[0,32767]	8000	
F189	High pressure differential pressure integral 0	[0,32767]	50	
F190	High pressure differential pressure ratio 1	[0,32767]	8000	
F191	High pressure differential pressure integral 1	[0,32767]	50	
F192	Self-decompression opening delay	[0,32767]	1	ms
F193	Self-decompression closing delay	[0,32767]	2	ms
F194	Self-relieving low pressure opening pressure	[0,500]	30	bar
F195	Self-relieving low pressure shut-off pressure	[0,500]	20	bar
F196	Pressure positive overshoot suppression	[0,3000.0]	25.0	%
F197	Pressure reverse overshoot suppression	[0,3000.0]	100.0	%
F198	Flow rate setting down slope 1	[0,32767]	16000	0.07324 (L/min)/ms
F199	Reverse pressure relief method	0: 1 segment 1: 2 segments 2: 3 segments	0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F200	Pressure relief 2-stage pressure threshold	[0,500]	45	bar
F201	Pressure relief 3-stage pressure threshold	[0,500]	4	bar
F202	Pressure drop slope of pressure relief 2 stages	[0,32767]	125	0.007629 bar/ms
F203	Pressure relief 3-stage pressure drop slope	[0,32767]	10	
F204	Multi-stage relief pressure ratio	[0,32767]	9000	
F205	Multi-stage relief pressure integral	[0,32767]	10	
F206	Multi-stage pressure relief speed ratio	[0,32767]	6000	
F207	Multi-stage pressure relief speed integral	[0,32767]	50	
F208	Pressure relief pressure PI drop threshold	[0,500]	7	bar
F209	Low voltage reverse speed limit	[-6000,6000]	-300	rpm
F210	Multi-stage pressure relief start delay	[0,32767]	5	ms
F211	Multi-stage pressure relief end delay	[0,32767]	500	ms
F212	Acceleration boost speed PI enable	0: Disable 1: Enable	0	
F213	Pressure relief bidirectional control enable	0: Disable 1: Enable	0	
F214	Field weakening control voltage utilization	[10.0,195.0]	92.1	%
F215	Weak magnetic control switch	0: Calculation 1: Prohibited 2: Closed loop 3: Calculation + closed loop	3	
F216	Field weakening closed	[0,1000]	20	Hz

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	loop bandwidth			
F217	Motor Type	0: Surface mount permanent magnet synchronous motor 1: Salient -pole permanent magnet synchronous motor	0	
F218	Salient pole motor field weakening depth	[0,100]	8 0	%
F219	Motor rated power	[0.1,3000.0]		K
F220	Motor pole pairs	[1,64]	4	p
F221	Encoder pole pairs	[1,64]	1	p
F222	Synchronous motor D-axis inductance 0	[0,327.67]	Model confirmation	mh
F223	Synchronous motor D-axis inductance 1	[0,327.67]	Model confirmation	mh
F224	Synchronous motor D-axis inductance 2	[0,327.67]	Model confirmation	mh
F225	Synchronous motor Q axis inductance 0	[0,327.67]	Model confirmation	mh
F226	Synchronous motor Q-axis inductance 1	[0,327.67]	Model confirmation	mh
F227	Synchronous motor Q-axis inductance 2	[0,327.67]	Model confirmation	mh
F228	Synchronous motor back EMF 0	[0,3276.7]	Model confirmation	Vrms/1 k rpm
F229	Synchronous motor back EMF1	[0,3276.7]	Model confirmation	Vrms/1 k rpm
F230	Synchronous motor back EMF2	[0,3276.7]	Model confirmation	Vrms/1 k rpm
F231	reserve			
F232	Motor maximum reverse speed	[0,-6000]	Model confirmation	rpm
F233	Driver rated voltage	[0,1000]	380	V
F234	Driver rated stall current	[0,900.0]	Model confirmation	A
F235	Stop mode selection	0: Free gliding	0: Free gliding	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		7: Slow down and stop This parameter is used to set the motor deceleration method when the servo is OFF.		
F236	Discharge resistor turn-on voltage	[0,1000]	740	V
F237	Discharge resistor shutdown voltage	[0,1000]	720	V
F238	Fan Control Mode	0: Running fan 1: Temperature control 2: Fan running 3: Fan stopped When 1 is selected, the fan will run when the drive temperature is higher than 50 degrees, and the fan will stop when it is lower than 45 degrees.	0: Running fan	
F239	Pressure sensor fault detection time	[0.00,60.00] If the pressure output is small and the load is heavy, and the duration exceeds this time, an Err15 fault will be reported. When set to zero, the pressure sensor fault detection function is invalid.	2.00	s
F240	Pressure sensor disconnection detection time	[0.00,60.00] If the AI3 signal line is disconnected for more than this time, an Err15 fault will be reported. When it is set to zero, the pressure sensor disconnection detection	1.00	s

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		function is invalid.		
F241	Pressure sensor fault voltage detection upper limit	[0.00,9.99] If the pressure feedback voltage suddenly exceeds this value , an Er15.3 fault will be reported. When it is set to zero, the pressure sensor fault voltage detection function is invalid.	0.00	V
F242	Pressure PI output filter frequency 0	[0,800.0]	0	Hz
F243	Pressure PI output filter frequency 1	[0,800.0]	0	Hz
F244	1st stage pressure-maintaining low speed PI enable	[0,1]	0	/
F245	1st stage pressure holding low speed pressure PI enable	[0,1]	0	/
F246	1st stage pressure-maintaining low speed PI cut-in delay time	[0,32767]	2000	ms
F247	1st stage pressure maintaining low speed pressure proportional gain	[0,32767]	7500	/
F248	1st stage pressure maintaining low speed pressure integral gain	[0,32767]	30	/
F249	Injection gain fine-tuning coefficient	[0.0,300.0] F140 = 1, pressure multi-stage PI enable is valid, d22 = 0, the current PID stage is 0, this parameter adjusts the	0.0	%

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		pressure given amplification factor, and the function is invalid when it is set to zero.		
F250	Self-decompression low pressure threshold	[0,500]	twenty one	bar
F251	Flow pressure given delay time	[0.000,5.000]	0.000	s
F252	Acceleration boost pressure PI enable	0: Disable 1: Enable	0: Disable	
F253	Delayed given flow	[0 ,2400 .0]	10.0	L/min
F254	Delayed set pressure	[0,500]	15	bar
F255	Oil pressure control execution cycle	0: 1 ms 1: 0.5ms 2~3 Reserved	0: 1 ms	
F256~F276	reserve			
F277	AI1 0V input	[-10.00 , 10.00]	0.00	V
F278	AI2 0V input	[-10.00 , 10.00]	0.00	V
F279	AI3 0V input	[-10.00 , 10.00]	0.00	V
F280	AI1 function selection	0: Flow rate setting 1: Pressure setting 2: Pressure feedback 3~7: Reserved 8: Torque command 9: Forward torque limit 10: Reverse torque limit 12: Speed command 3~7, 11 reserved	0: Flow rate setting	
F281	AI2 function selection		1: Pressure setting	
F282	AI3 function selection		2: Pressure feedback	
F283	AI3 full-scale voltage	[0,10.00]	9.99	V
F284	AI1 zero voltage	[-9.99,9.99]	0.00	V
F285	AI2 zero voltage	[-9.99,9.99]	0.00	V
F286	AI3 zero voltage	[-9.99,9.99]	0.00	V
F287	AI1 secondary average filtering times	[1,32]	6	
F288	AI2 secondary average filtering times	[1,32]	6	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F289	AI3 first level average filtering times	[1,32]	1	
F290	AI3 secondary average filtering times	[1,32]	1	
F291	Pressure feedback full scale	[0.0,500.0]	250.0	bar
F292	Flow rate set rise time 0	[0.00,327.67]	0.00	s
F293	Flow rate set fall time 0	[0.00,327.67]	0.00	s
F294	Flow rate set rise time 1	[0.00,327.67]	0.00	s
F295	Flow rate setting drop time 1	[0.00,327.67]	0.00	s
F296	Pressure setting rise time 0	[0.00,327.67]	0.00	s
F297	Pressure setting drop time 0	[0.00,327.67]	0.00	s
F298	Pressure setting rise time 1	[0.00,327.67]	0.00	s
F299	Pressure setting drop time 1	[0.00,327.67]	0.00	s
F300	Pressure setting rise S filter time 0	[0.000,32.767]	0.000	s
F301	Pressure setting drop S filter time 0	[0.000,32.767]	0.000	s
F302	Pressure setting rise S filter time 1	[0.000,32.767]	0.000	s
F303	Pressure setting drop S filter time 1	[0.000,32.767]	0.000	s
F304	Speed full scale	[0,6000]	2000	rpm
F305	Acceleration time	[0.00,327.67]	0.00	s
F306	Deceleration time	[0.00,327.67]	0.00	s
F307~F312	reserve			
F313	Torque full range	[0,1800]	200	Nm
F314~F346	reserve			
F347	Output phase loss detection time	[0,30000]	80	ms

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
F348	Motor overload protection factor	[0,300.0]	0.0	%
F349	Resolver disconnection detection time	[0,30000]	3 0	ms
F350	Control mode selection	0: Hydraulic mode 1: Speed mode	0: Hydraulic mode	
F351	Speed command mode	0: Digital input 1: Analog input 2: CAN continuous 3:485 continuous 4: CANopen input 5: EtherCAT input 6: Internal setting 7: PROFINET input	0: Digital input	

Use this parameter to select the source of the speed control command :

Settings	Input method	illustrate
0	Digital Input	The speed command sent by the host computer can be received through the LED panel or communication bus interface, and the motor speed can be changed through H05 [Speed Command].
1	Analog input	It is necessary to set any one of F280 [Analog input 1 function selection], F281 [Analog input 2 function selection] and F283 [Analog input 3 function selection] to 12 [Speed command], and set related parameters according to actual conditions.
2	CAN Continuous	Use our CAN communication protocol to send speed instructions. If the speed instruction is not received after P38 [communication disconnection detection time] , the drive will report CAN communication fault Err09
3	485 Continuous	The speed command is sent using our Modbus protocol. If the speed command is not received after P38 [communication disconnection detection time] , the drive reports 485 communication fault Err25
4	CANopen input	Supports CiA 301 protocol; uses the 60FFh object of CiA DS402 device specification to set speed commands.
5	EtherCAT Input	object of the CiA DS402 device profile .

<table>
<tr><th>CODE</th><th>DEFINITION AND DESCRIPTION</th><th>PARAMETER RANGE</th><th>DEFAULT VALUE</th><th>UNIT</th></tr>
<tr><td>6</td><td>Internal given</td><td colspan="3">The internal multi-speed can be selected by configuring parameters P157~P162 as the internal speed command selection function (internal reference 1 is 15 , internal reference 2 is 16, internal reference 3 is 17) :
<table>
<tr><th>Internal setting 3</th><th>Internal reference 2</th><th>Internal reference 1</th><th>parameter</th><th>Speed Mode</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>H14</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>H15</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>H16</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>H17</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>H18</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>H19</td><td>Internal flow/ speed setting 0</td></tr>
</table>
The full speed range is taken as 100%.</td></tr>
<tr><td>7</td><td>PROFINET input</td><td colspan="3">PZD message sending speed is given .</td></tr>
<tr><td>F352</td><td>Torque limit mode setting</td><td></td><td>0: No limit</td><td></td></tr>
<tr><td colspan="5">The parameter input format for setting torque limit is:
0: No limit, the torque limit value is the maximum output torque of the servo system.
1: Maximum torque limit 1
Maximum torque limit 1 is used as the forward and reverse torque limit source;
2: Maximum torque limit 1 + maximum torque limit 2
Maximum torque limit 1 is used as the source of forward torque limit, and maximum torque</td></tr>
</table>

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
limit 2 is used as the source of reverse torque limit; 3: Switching value selection of maximum torque limit 1 or maximum torque limit 2 Switching torque limit selects maximum torque limit 1 or maximum torque limit 2 as the forward and reverse torque limit source; 4: Forward + reverse analog torque limit (all> 0V) The analog forward torque limit (must be greater than 0) is used as the forward torque limit source, and the analog reverse torque limit (must be greater than 0) is used as the reverse torque limit source; 5: Forward analog torque limit (>0V) The analog forward torque limit (must be greater than 0) is used as the source of forward and reverse torque limit; 6: Analog torque command (>0V) Analog torque command (must be greater than 0) is used as the source of forward and reverse torque limit; 7: Forward + reverse analog torque limit (>0V+<0V) The analog forward torque limit (must be greater than 0) is used as the forward torque limit source, and the analog reverse torque limit (must be less than 0) is used as the reverse torque limit source;				
F353	Maximum torque limit 1	[0,3600]	1700	Nm
F354	Maximum torque limit 2	[0,3600]	1700	Nm
Maximum torque limit 1, 2, in Nm				
F355	Zero speed range	[0,6000]	30	rpm
Set the detection condition of speed zero output. When the absolute value of the motor speed is within this range, it is regarded as zero speed and the speed zero output signal becomes valid. There is a hysteresis of 10r/min when detecting.				
F356	Motor speed when brake is released	[0,6000]	30	rpm
Set the motor speed threshold when the electromagnetic brake is released .				
F357	Brake release delay	[0,5000]	100	ms
During the brake release delay time , the speed command is invalid .				
F358	Electromagnetic brake holding delay	[0,30000]	500	ms
This parameter is used to set the delay time of the electromagnetic brake . When the servo is OFF or an alarm occurs during operation , the speed may be high at this time . Therefore, the switch output signal configured as the external brake release signal (11) becomes invalid after a delay . If the motor speed drops below the setting value of parameter F356 [Motor speed setting when brake release] during this delay time , the				

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
output of the external brake release signal becomes invalid in advance .				
F359	Servo lock time after brake	[0,30000]	50	ms
the locking time of the servo after the brake is applied in the locked state (speed feedback is less than F355) . In the locked state , the servo is OFF, and the output state of the switch quantity (11) configured as the external brake release signal becomes invalid . At this time , the servo will continue to be locked for a period of time so that the motor will not rotate during the relay operation .				
F360	Limit switch setting	0: Limit switch is normal 1: Limit switch is invalid 2: Limit over limit fault	0: Limit switch is normal	
This parameter can be used to set whether the switch input configured as forward drive prohibition (22) and reverse drive prohibition (23) in parameters F157~F162 is valid .				

5.2.6 Debug Mode

PRG ESC When the key is pressed to select "debugging mode", the LED panel displays "h--xx". xx represents different parameter identifiers. Press the ∧ or ∨ key to select the parameter identifier to be set. After the selection is completed, release the key and the LED panel will display the value of the corresponding parameter. When modifying the parameter value, you can DATA ENT > SHIFT move the flashing bit by pressing the key and ∧ ∨ change the value of the flashing bit. When the modification is completed, release the key and the modified value will be saved in the parameter and stop flashing. At this time, press DATA ENT DATA ENT the or key again to modify the parameter value again. At this time, the modifiable bit will flash. ∧ ∨ > SHIFT PRG ESC Press the key to exit.

※ In the debugging mode, if there is no key operation for 1 minute, it will automatically switch to the quick mode speed feedback display or fault display interface.

The setting mode parameter table is defined as follows:

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
h00	Run Enable	0: Disable 1: Enable	Related to the driver enable IO level	
h01	Diagnostic Enablement	0: Disable 1: Enable	0	
h02	Diagnosis content (Effective only when the diagnostics enable is turned on)	0: No action 1: Measure the initial angle 2: Jog enable 3~5: Invalid	0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		6: Drive Test		
h03	Jog (Effective only when the diagnostics enable is turned on)	ⓐ: Forward ⓥ: Invert	0	
h04	Control Mode	3: Speed Mode 4: Hydraulic mode	4	
h05	Speed setting (Control mode: Speed mode is effective)	Depends on the motor model	0	rpm
h06	Hydraulic command mode	0: Digital input 1: Analog input 2: CAN continuous 3:485 continuous 4: CANopen input 5: EtherCAT input 6: Internal setting 7: Profinet input	1	
h07	Flow setting (oil pressure command mode is communication input)	[0, maximum flow]	0.0	L/min
h08	Pressure setting (oil pressure command mode is communication input)	[0, maximum pressure]	0.0	bar
h09	Maximum jog speed	OF THE MOTOR WHEN PRESSING ⓐ THE ⓥBUTTON, [0,100]	15	rpm
h10	Resolver offset	[0,4095]	0	
h11	Motor parameter self-learning (valid only when the diagnostic enable is turned on)	0: Disable 1: Dynamic 2: Static 1 3: Static 2	0	
h12	Advanced parameter	11111: Prohibited	00000	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	operation enable	99999: Enable Other values: No effect		
h13	Troubleshooting	0: No action 1: Clear	0	
h14	Internal flow/ speed setting 0	[-100.0 , 100.0]	0.0	%
h15	Internal flow/ speed setting 1	[-100.0 , 100.0]	0.0	%
h16	Internal flow/ speed reference 2	[-100.0 , 100.0]	0.0	%
h17	Internal flow/ speed setting 3	[-100.0 , 100.0]	0.0	%
h18	Internal flow/ speed setting 4	[-100.0 , 100.0]	0.0	%
h19	Internal flow/ speed setting 5	[-100.0 , 100.0]	0.0	%
h20	reserve	[0, 100.0]	0.0	
h21	reserve	[0, 100.0]	0.0	
h22	Internal pressure set to 0	[0, 100.0]	0.0	%
h23	Internal pressure setting 1	[0, 100.0]	0.0	%
h24	Internal pressure setting 2	[0, 100.0]	0.0	%
h25	Internal pressure setting 3	[0, 100.0]	0.0	%
h26	Internal pressure setting 4	[0, 100.0]	0.0	%
h27	Internal pressure setting 5	[0, 100.0]	0.0	%
h28	Rapid boost speed ratio increased	[0, 100.0]	0.0	%
h29	Rapid boost speed points increase	[0, 100.0]	0.0	%
h30	Run command channel	0: Keyboard operation command channel 1: Terminal operation command channel	1	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
h3 1	Speed command mode	0: Digital input 1: Analog input 2: CAN continuous 3:485 continuous 4: CANopen input 5: EtherCAT input 6: Internal setting 7: PROFINET input	0: Digital input	

Use this parameter to select the source of the speed control command :

Settings	Input method	illustrate
0	Digital Input	The speed command sent by the host computer can be received through the LED panel or communication bus interface, and the motor speed can be changed through H05 [Speed Command].
1	Analog input	It is necessary to set any one of F280 [Analog input 1 function selection], F281 [Analog input 2 function selection] and F283 [Analog input 3 function selection] to 12 [Speed command], and set related parameters according to actual conditions.
2	CAN Continuous	Use our CAN communication protocol to send speed instructions. If the speed instruction is not received after P38 [communication disconnection detection time] , the drive will report CAN communication fault Err09
3	485 Continuous	The speed command is sent using our Modbus protocol. If the speed command is not received after P38 [communication disconnection detection time] , the drive reports 485 communication fault Err25
4	CANopen input	Supports CiA 301 protocol; uses the 60FFh object of CiA DS402 device specification to set speed commands.
5	EtherCAT Input	object of the CiA DS402 device profile .
6	Internal given	The internal multi-speed can be selected by configuring parameters P157~P162 as the internal speed command selection function (internal reference 1 is 15 , internal reference 2 is 16, internal reference 3 is 17) :

Internal setting 3	Internal reference 2	Internal reference 1	parameter	Speed Mode

<table>
<tr><th>CODE</th><th>DEFINITION AND DESCRIPTION</th><th colspan="4">PARAMETER RANGE</th><th>DEFAULT VALUE</th><th>UNIT</th></tr>
<tr><td></td><td></td><td colspan="4"><table>
<tr><td>0</td><td>0</td><td>0</td><td>H14</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>H15</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>H16</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>H17</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>H18</td><td>Internal flow/ speed setting 0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>H19</td><td>Internal flow/ speed setting 0</td></tr>
</table>The full speed range is taken as 100%.</td></tr>
<tr><td>7</td><td>PROFINET input</td><td colspan="4">PZD message sending speed is given .</td></tr>
</table>

5.2.7 Multi-pump mode

PRG ESC When the button is pressed to select "multi-pump mode", the LED panel displays "P--xx".

xx represents different parameter identifiers. Press the ⋀ ⋁ or SHIFT key to select the parameter identifier to be set. After the selection is completed, release the button and the LED panel will display the value of the corresponding parameter. When modifying the parameter value, you can DATA ENT SHIFT move the flashing digit by pressing the key, and change the value of the flashing digit by pressing ⋀ or . ⋁ When the modification is completed, release the button and the modified value will be saved in the parameter and stop flashing. At this time, press DATA ENT DATA ENT the or ⋀ ⋁ SHIFT key again to modify the parameter value again. At this time, the modifiable digit will flash. Press the button to exit. PRG ESC

※ In multi-pump mode, if there is no key operation for 1 minute, it will automatically switch to the quick mode speed feedback display or fault display interface.

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
P00	Network Enablement	0: Disable 1: Enable	0	
P01	Network management	0: Disable 1: Open the tube	Related to the driver enable IO level	
P02	Confluence Type	0: Single pump 1: Composite 2: Multiple pumps 3: Multi-mode 4: Two communication modes 5: Four communication modes	0	
P03	Node Number	[0,15]	0	
P04	Number of slave nodes	[0,15]	0	
P05	Node Type	0: Independent unit 1: Control unit 2: Follower unit 3: Flow ring unit	0	-
P06	Flow cut-in threshold	[0,100.0]	25.0	%
P07	Flow cut-in hysteresis upper limit	[0,100.0]	5.0	%
P08	Flow cut-in hysteresis lower limit	[0,100.0]	2.5	%
P09	Multi-pump pressure proportional gain 0	[0 , 32767]	8000	
P10	Multi-pump pressure	[0 , 32767]	88	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
	integral gain 0			
P11	Delay time of pressure relief 1 stage	[0 , 32767]	500	ms
P12	Multi-pump pressure proportional gain 1	[0 , 32767]	8000	
P13	Multi-pump pressure integral gain 1	[0 , 32767]	88	
P14	Speed ratio increased	[0,1000]	0	%
P15	Multi-pump pressure proportional gain 2	[0 , 32767]	8000	
P16	Multi-pump pressure integral gain 2	[0 , 32767]	88	
P17	Rapid pressure relief coefficient	[0 , 32767], increase the pressure to release faster 0: Invalid	0	
P18	Multi-pump pressure proportional gain 3	[0 , 32767]	8000	
P19	Multi-pump pressure integral gain 3	[0 , 32767]	88	
P20	Pressure relief overshoot suppression coefficient	[0 , 32767] Decrease to increase suppression 0: Invalid	0	
P21	ECAT synchronization method	0: Free run 1: Sync Manager Interrupt 2: Synchronous clock	0	
P22	ECAT Synchronous Time	0:500us 1: 1ms 2: 2ms 3:4ms	0	
P23	485 local communication address	[1 , 255]	10	
P24	485 communication verification method	0: (N,8,1) 1: (E,8,1)	0	

CODE	DEFINITION AND DESCRIPTION	PARAMETER RANGE	DEFAULT VALUE	UNIT
		2: (O,8,1) 3: (N,8,2) 4: (E,8,2) 5: (O,8,2) Note: N: no parity bit; E: even parity; O: odd parity; 8-bit data; 1 or 2 stop bits;		
P25	485 communication baud rate selection	0: 9600bps 1: 19200bps 2: 38400bps 3: 57600bps	1	
P26	CANOpen communication node number	[1 , 127]	1	
P27	CANOpen communication baud rate	0: 1000kbps 1: 500kbps 2: 250kbps 3: 125kbps 4: 50kbps 5: 20kbps	1	
P28	Pressure relief boost P ratio 0	[0 , 32767]	8000	
P29	Pressure relief and boost P integral 0	[0 , 32767]	5	
P30	Pressure relief boost P ratio 1	[0 , 32767]	8000	
P31	Pressure relief boost P integral 1	[0 , 32767]	5	
P32	reserve	[0 , 32767]	6000	
P33	reserve	[0 , 32767]	5	
P34	Slave node address 1	Slave node address LED function code setting display interface:  The ten thousandth digit is the setting group number, 0 to 3 groups. The first to thousandth digits are the node number, the specific representation method is as follows:		
P35	Slave node address 2			
P36	Slave node address 3			
P37	Slave node address 4			

Ten thousand	Thousands	Hundreds	Tens	Units

<table>
<tr><th>CODE</th><th>DEFINITION AND DESCRIPTION</th><th>PARAMETER RANGE</th><th>DEFAULT VALUE</th><th>UNIT</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>0.</td><td>Node 3</td><td>Node 2</td><td>Node 1</td><td>Node 0</td></tr>
<tr><td>1.</td><td>Node 7</td><td>Node 6</td><td>Node 5</td><td>Node 4</td></tr>
<tr><td>2.</td><td>Node 11</td><td>Node 10</td><td>Node 9</td><td>Node 8</td></tr>
<tr><td>3.</td><td>Node 15</td><td>Node 14</td><td>Node 13</td><td>Node 12</td></tr>
</table>
Meaning of the values:
0: Indicates that the node with this digital address is prohibited from participating in control.
1: Indicates that the digital address node is enabled to participate in control.</td><td></td><td></td></tr>
<tr><td>P38</td><td>Communication disconnection detection time</td><td>[0 , 60.0]
0: Disconnection detection disabled</td><td>1.0</td><td>s</td></tr>
<tr><td>P39</td><td>CANopen heartbeat period</td><td>[0, 32767]</td><td>0</td><td>ms</td></tr>
<tr><td>P40</td><td>Minimum length of a PDO object</td><td>0: 8 bits
1: 16 bits</td><td>0: 8 bits</td><td></td></tr>
</table>

6 Run Debug

The PH600 series electro-hydraulic servo system can be debugged through the built-in LED button operation of the servo driver.

6.1 Pressure control debugging

6.1.1 Flowchart

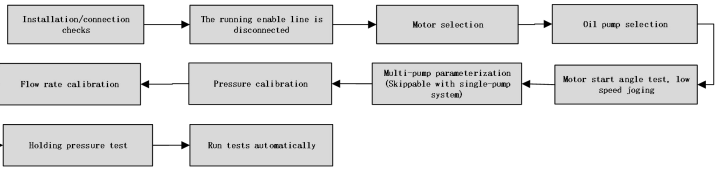


Figure 6 - 1 Debugging process diagram

6.1.2 Debugging steps

The following debugging instructions describe in detail the steps for debugging the system using LEDs.

6.1.2.1 Preparation for Debugging

Installation/connection check.

Please make sure to confirm the following items before powering on the drive:

- Observe the connection status of each terminal and confirm that all fixing screws are securely tightened and no stripping occurs.
- Make sure the drive and motor are properly grounded.
- After the drive is powered on, the normal status LED will display speed feedback 
- When there is a fault, the LED will display the fault type 

6.1.2.2 Parameter Initialization

When F066 is set to 1, the drive parameters are restored to the factory settings, but the drive and motor nameplate parameters are not restored.

6.1.2.3 Motor selection

Motor selection operation method:

Press  the keys together for 1 second, the LED value displays ULOCK and the keyboard enters unlocked state.

If you use a motor from the motor model list in Table 5 - 2 , directly use F001 to select the corresponding model motor.

When using a motor other than the one listed in Table 5 - 2 Motor Model List , set the motor temperature sensor F075 to the motor model used and the motor type F217 to the motor type

used.

For example: F075 = 2 (KTY84)

F217 = 1 (salient pole permanent magnet synchronous motor)

6.1.2.4 Motor parameter self-learning

If you select a motor other than the motor models listed in Table 5 - 2 , you must first perform motor parameter self-learning. The steps are as follows:

1、 Set the motor parameters:

F070 = Motor rated voltage

F071 = Motor rated current

F072 = Motor rated speed

P073 = Motor rated frequency

F 219 = Motor power or F12 2 = Motor torque coefficient (either of these two parameters can be set)

2、 Motor parameter self-learning

Diagnostic function "Enable" E13 = ON.

Motor parameter self-learning E14 = 1, 2 or 3.

parameter	name	illustrate
E14	Motor parameter self-learning	0: Disable. Do not perform parameter self-learning on the motor. 1: Dynamic. This is used when the motor back EMF is unknown. During the measurement, the motor runs at high speed. It is recommended to open the overflow valve. Load measurement will affect the measurement accuracy of motor parameters and the control effect. At the same time, high pressure will be generated in the oil circuit, which poses a safety hazard. 2: Static 1. It is used when the motor back EMF is known. The motor does not rotate during the measurement and the overflow valve can be opened without opening it. 3: Static 2. This mode is used when the motor back EMF is known. The motor will run at a low speed during the measurement, and it can be performed without opening the overflow valve. This mode automatically detects the motor wiring and modifies the motor rotation direction.

After the setting is completed, the LED will display " " when learning begins  , and "0"

after learning is completed.

If the drive alarms during the test, analyze the cause of the fault and continue the motor parameter self-learning operation after eliminating the problem.

6.1.2.5 Motor initial angle test

If the motor parameter self-learning operation has been completed, the motor initial angle test is not required.

LED panel debugging setting parameters: E04

After entering the "Measure Initial Angle" menu, the LED will display "READY". Release the button and the system will automatically measure the initial angle. The LED will display "  ". After the measurement is completed, the LED will display "OK".

6.1.2.6 Low speed jog

The purpose of the test is to check whether the basic functions of the hydraulic system are normal.

1、 Pre-operation inspection and preparation

When operating the servo system for the first time, you must first check whether the hydraulic circuit connection and the servo system electrical connection are correct; whether the oil pump displacement and working pressure values are consistent with those marked on the nameplate. In the early stage, first adjust the system to a state where the oil discharged by the pump returns directly to the oil tank, for example, adjust the overflow pressure of the overflow valve to the lowest.

2、 Low speed and light load operation

When the LED displays E12, release the button to enter the jog mode, the LED displays "JOG",  and the button can accelerate the motor forward and reverse to the maximum jog speed and continue to rotate.

3、 Confirm work status

Confirm that when the motor rotates forward, the rotation direction of the pump is the same as the direction of the arrow on the pump nameplate; the noise and vibration are within the normal range, and the pump can absorb oil normally.

If the pump's rotation direction is different from the arrow direction on the pump nameplate when the motor is rotating forward, change the P042 value to change the motor's rotation direction.

6.1.2.7 Pressure and flow calibration

1、 Zero drift automatic correction

Set E26 to 1, the LED keyboard displays "-FI-", press  the key, and the analog input zero drift will automatically complete the correction.

2、 System flow and pressure settings

F010 = system oil pressure, example: 175

F011 = system flow, example: 200

F106 = pressure protection value (default 195). If the system pressure exceeds 195, the default value needs to be changed.

3、 Calibration of flow and pressure setting

parameter	name	illustrate
F153	AI2 full-scale voltage	Pressure given maximum voltage input
F154	AI1 full-scale voltage	Flow given maximum voltage input

Used to set the flow and pressure command 0~10V corresponding to 0-system flow and system oil pressure.

4、 Pressure feedback calibration

parameter	name	illustrate
F044	Pressure sensor selection	5V: The sensor output range is 1~5V, and the measurement range is 0~200bar. 10V: The sensor output range is 0~10V, and the measurement range is 0~250bar. 400bar: The sensor output range is 0~10V, and the measurement range is 0~400bar.
F079	Pressure sensor range	Set the pressure sensor range to the pressure value corresponding to the input voltage of 5V or 10V.

Note: If the drive only works in speed mode, system pressure setting, pressure feedback and pressure reference calibration can be skipped.

6.1.2.8 Pressure holding test

1、 System Restart

After turning off the system power, turn it back on, and the drive control will be handed over to the equipment control computer. After the servo drive enters the running state, the RUN/TUNE light will light up and start the following test.

2、 Low pressure holding test

Before performing the following operations, please adjust the relief valve relief pressure to the maximum.

Injection pressure holding action test, set the host computer flow setting to 10%, the pressure setting to 20bar, check whether there is oil leakage, check the "pressure feedback" and whether the pressure gauge reading of the equipment is 20bar.

3、 High pressure holding test

After the low-pressure holding test is passed, the high-pressure holding test can be performed directly according to the following operations. The flow setting of the host computer is set to 80%, and the pressure setting is gradually increased to the maximum pressure required by the equipment. Observe the system "pressure feedback" and "speed feedback".

If the actual system pressure cannot reach the set pressure, it is necessary to check whether there is leakage in the hydraulic oil circuit.

If the actual system pressure reaches the set pressure, but the average motor speed is higher than normal, further inspection and analysis of the cause of the leakage is required:

Case 1: Abnormal leakage in the oil pump

Case 2: Abnormal leakage in the hydraulic oil circuit

Case 3: The overflow valve is leaking

After confirming that the holding pressure and the motor speed during holding pressure meet the requirements, refer to the data in the following table to check whether the pressure fluctuation meets the system requirements at the same time.

MEASUREMENT DEFINITION	PASS STANDARD (RECOMMENDED VALUE)
Pressure fluctuation (pressure given 100%)	≤3bar

6.1.2.9 Calibration Review

Injection pressure holding test, set the upper computer pressure setting to 10bar, 100bar, and full scale pressure. Observe whether the reading on the pressure gauge matches the setting. If not, redo the pressure calibration.

Set the upper computer flow setting to 5%, 50%, and 100% respectively, and observe whether the motor speed is proportional to the given flow. If it does not match, please redo the flow calibration.

6.1.2.10 Fully automatic operation and system performance adjustment

1、 Pressure flow command filter adjustment:

Increasing the pressure flow filter parameters will reduce command fluctuations and slow down command response.

Pressure flow command filter parameters:

Code	Definition and description	Parameter range	Default value	unit
F008	Pressure Filter	[1,32]	6	Moving average sampling times (1ms)
F009	Traffic filtering	[1,32]	6	Moving average sampling times (1ms)

Increasing the rising speed of the pressure flow command will speed up the oil pump output flow and oil pressure response, increase the operating impact, and increase the overshoot. Conversely, the response will slow down and the overshoot will decrease.

Pressure flow command rise and fall speed parameters:

Code	Definition and description	Parameter range	Default value	unit
F017	Pressure setting rising slope	[0 , 32767]	16000	0.007629 bar/ms
F018	Pressure setting decreasing slope	[0 , 32767]	16000	0.007629 bar/ms
F131	Flow rate setting rising slope	[0,32767]	16000	0.07324 (L/min)/ms
F132	Flow rate setting down slope	[0,32767]	16000	0.07324 (L/min)/ms

2、 Multi-stage speed/pressure PI setting

If the system adopts segmented PI control under different working conditions, firstly, it is necessary to connect digital input ports I5 (CN6-5) and I6 (CN6-6) as the indication signal of the control stage, and then set the speed/pressure multi-segment PI to enable. The corresponding relationship between the digital input signal and the speed/pressure PI segment is as follows:

I6	I5	KP Number	KI Number
low	low	0	0
low	high	1	1
high	low	2	2
high	high	3	3

3、 System performance tuning

The servo system oil pressure control includes the following gain parameters. By setting these parameters, the response characteristics and steady-state accuracy of the servo system can be adjusted.

Speed PI adjustment:

Code	Definition and description	set up	Parameter range	Default value
F139	Speed multi-stage PI enable		0: Disable 1: Enable	0
E18 F014	Speed proportional gain 0	Increasing the speed proportional gain can improve	[0,32767]	7000

Code	Definition and description	set up	Parameter range	Default value
F141	Speed proportional gain 1	the transient response of the motor speed control, improve the motor speed stability, and suppress interference. Setting it too high will cause oscillation.	[0,32767]	7000
F143	Speed proportional gain 2		[0,32767]	7000
F145	Speed proportional gain 3		[0,32767]	7000
E19 F015	Speed integral gain 0	Increasing the speed integral gain can improve the transient response of the motor speed control, reduce the speed regulation deviation, and increase the speed overshoot. Setting it too high will cause oscillation.	[0,32767]	170
F142	Speed integral gain 1		[0,32767]	140
F144	Speed integral gain 2		[0,32767]	140
F146	Speed integral gain 3		[0,32767]	140

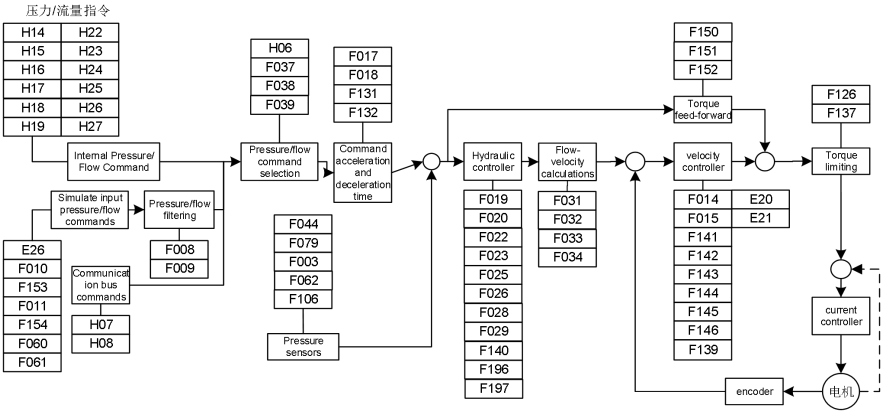
Pressure PI adjustment:

Code	Definition and description	set up	Parameter range	Default value
F140	Pressure multi-stage PI enable		0: Disable 1: Enable	0
Setting for single pump or split flow application				
E16 F019	Pressure proportional gain 0	Increasing the pressure proportional gain can improve the transient responsiveness and stability of pressure control, suppress interference, and reduce pressure overshoot. Setting it too high will cause oscillation.	[0,32767]	13000
F022	Pressure proportional gain 1		[0,32767]	13000
F025	Pressure proportional gain 2		[0,32767]	13000
F028	Pressure proportional gain 3		[0,32767]	13000
E17 F020	Pressure integral gain 0	Increasing the pressure integral gain can improve the pressure control response speed and reduce the pressure control deviation, but it will increase the pressure overshoot. Setting it too high will cause oscillation.	[0,32767]	100
F023	Pressure integral gain 1		[0,32767]	100
F026	Pressure integral gain 2		[0,32767]	100
F029	Pressure integral gain 3		[0,32767]	100

Code	Definition and description	set up	Parameter range	Default value
Set when confluence application				
P09	Multi-pump pressure proportional gain 0	Increasing the pressure proportional gain can improve the transient responsiveness and stability of pressure control, suppress interference, and reduce pressure overshoot. Setting it too high will cause oscillation.	[0 , 32767]	8000
P12	Multi-pump pressure proportional gain 1		[0 , 32767]	8000
P15	Multi-pump pressure proportional gain 2		[0 , 32767]	8000
P18	Multi-pump pressure proportional gain 3		[0 , 32767]	8000
P10	Multi-pump pressure integral gain 0	Increasing the pressure integral gain can improve the pressure control response speed and reduce the pressure control deviation, but it will increase the pressure overshoot. Setting it too high will cause oscillation.	[0 , 32767]	170
P13	Multi-pump pressure integral gain 1		[0 , 32767]	170
P16	Multi-pump pressure integral gain 2		[0 , 32767]	170
P19	Multi-pump pressure integral gain 3		[0 , 32767]	170

When the motor and pump selection settings are completed, the driver will automatically select the matching values with the motor and pump. If the system performance indicators do not meet the customer's requirements, fine-tune the above parameter values to meet the requirements.

the adjustable gain parameters in the oil pressure mode are marked in the block diagram .



6.2 Speed mode debugging

1、 After completing steps 6.1.2.1 to 6.1.2.7

2、 P05= 3 (Flow loop unit) Speed mode

3、 F160= 5 (DI4 input selection) Motor rotation direction

Disconnect DI4 and 24-, and run forward;

Turn on DI4 and 24-, reverse operation;

4、 the fully automatic operation and system performance adjustment method in 6.1.2.10 . Pressure-related parameters do not need to be adjusted, only flow and speed-related parameters need to be adjusted.

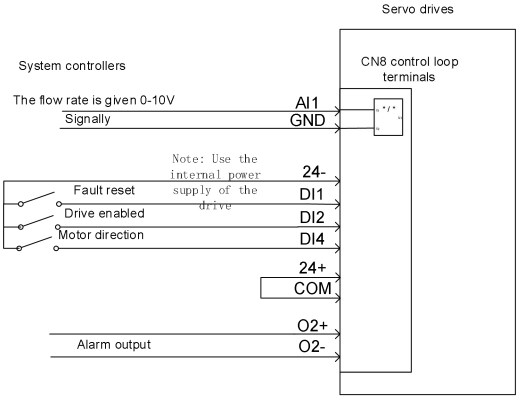


Figure 6 - 2 Speed mode control signal wiring diagram

7. Multi-pump confluence control

The hydraulic control of large-tonnage injection molding machines is far from meeting the flow requirements of single-pump systems due to the limitation of oil pump displacement or motor power. It is necessary to connect the oil outlets of multiple single-pump systems in parallel to achieve confluence to obtain large flow. In the confluence system, in order to improve production efficiency and shorten the user's product process cycle, two or more actions need to be completed at the same time. At this time, the single-circuit hydraulic system needs to be divided into two-circuit or three-circuit independent control hydraulic systems. During the shunt control, each circuit independently completes the flow and pressure control. During the confluence control, a main driver performs pressure control and system total flow control. The remaining drivers convert the system total flow command of the main driver into the flow command of each circuit through flow distribution calculation to perform single-circuit flow control. The total output flow of the system is the sum of the flow outputs of the oil pumps of each circuit system.

7.1 Multi-pump confluence flow distribution method

Add node flow control to ensure that the system outputs linear flow in the 0~100% flow command range.

Each node (single pump system) has a flow that it can bear alone, called the maximum private flow.

Maximum private traffic = maximum node traffic × traffic cut-in threshold ratio

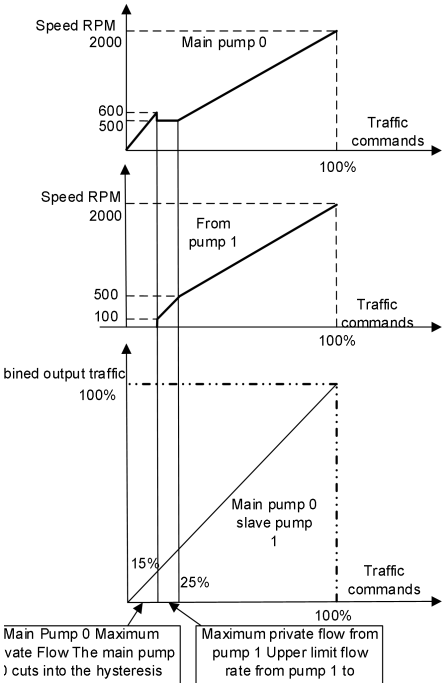


Figure 7 - 1 Graph of slave pump responding to master pump flow command

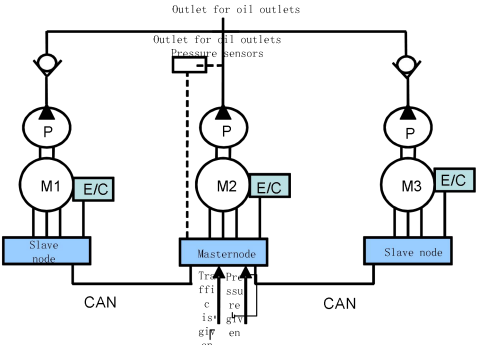
For a given system total flow command, when it is less than the maximum private flow of master pump 0, master pump 0 carries all system flow demands; when it is greater than the maximum private flow of master pump 0, master pump 0 provides its own maximum private flow, and the remaining flow demand is provided by the slave pumps; when the remaining flow demand is less than the maximum private flow of slave pump 1, slave pump 1 carries all the remaining flow; when the remaining flow demand is greater than the maximum private flow of slave pump 1, slave pump 1 provides its own maximum private flow, and the remaining flow demand is provided by the remaining slave pumps; and so on, until the remaining flow can be completely digested by the remaining slave pumps; if the maximum private flow of the last slave pump is less than the remaining flow, that is, the sum of the maximum private flows of all pumps cannot digest the system flow demand, then the system flow demand is evenly (by ratio) distributed by all pumps.

7.2 Multi-pump method

After the confluence type of each node (single pump system) is set to multi-pump, each node can only work in confluence control. The master node is responsible for receiving the pressure setting, flow setting, operation enable signal and pressure sensor signal of the system oil outlet from the upper control system to control the pressure and total system flow.

The slave node only converts the total system flow command transmitted by CAN communication into a speed command according to the above flow distribution algorithm to perform speed control.

1、 Schematic diagram of multi-pump system:



picture 7 - 2 Schematic diagram of multi-pump system

2、 Multi-pump system wiring diagram:

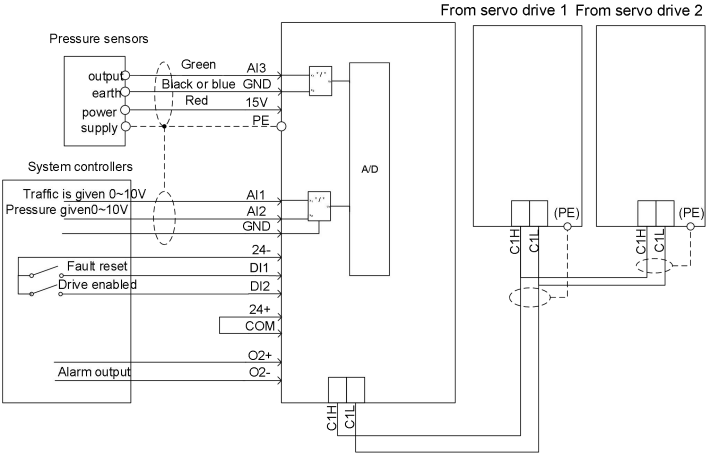


Figure 7 - 3 multi-pump system wiring diagram

7.3 Composite method

The system has two control modes: converging and diverging. The control mode of each node is switched through the digital input I1 (C/D) signal. When diverging, each node acts as a single-loop hydraulic system to complete flow and pressure control. When converging, it is the same as the multi-pump mode. The master node completes pressure control and system total flow control. The slave node only performs speed control based on the system total flow

command transmitted by CAN communication, which is converted into a speed command according to the above-mentioned flow distribution algorithm.

Composite system diagram:

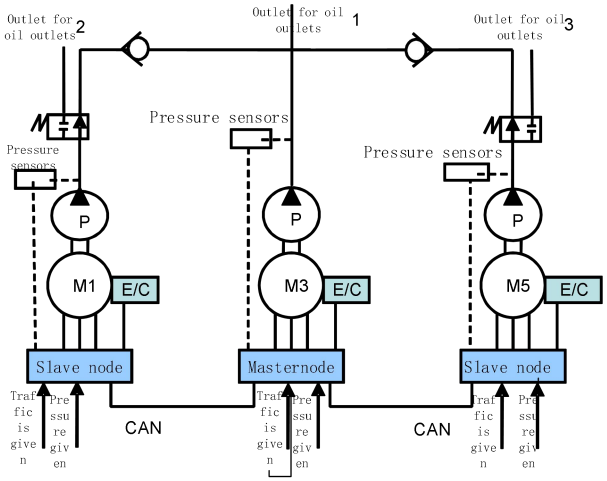


Figure 7 Schematic diagram of - 4 -composite system

7.4 Multi-mode approach

The hydraulic servo system consists of three nodes, each of which consists of one or more single pump systems. The single pump system is called a control unit. A node consisting of a control unit is an independent unit node. A multi-unit node consisting of multiple control units can be regarded as a node consisting of a double or multi-pump. The multi-unit node consists of a control unit and one or more follower units. Each node has a pressure sensor connected to the control unit. The control unit is connected to the upper control system through the AI1 and AI2 analog interfaces to receive pressure and flow given signals. The two DA outputs of the control unit are respectively connected to the analog inputs AI1 and AI2 of the follower unit as the motor speed given signal and the driver enable signal. The RDY output ports of the follower unit are connected in series, with the positive end connected to the 24V power supply and the negative end connected to the digital input port I7 of the control unit. The control unit obtains the operating status of the follower unit driver through this digital input port.

Each node uses the digital input signal I1 (C/D) to switch the control mode of each node. When I1 (C/D) is high, the node works in the confluence state, and when I1 (C/D) is low, it works in the diversion state. When the system works in the confluence state, the number of confluence nodes can be changed. The master node completes the pressure control and the total flow of the system. The slave nodes working in the confluence mode run at the same speed as the master node. The above-mentioned flow distribution algorithm is not used in the multi-mode mode. The control unit of each node performs pressure control and flow control

respectively when operating in the diversion mode, and the follower unit runs at the same speed as the control unit.

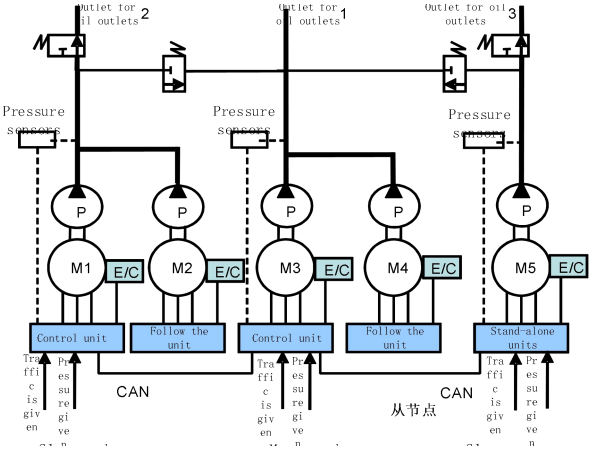
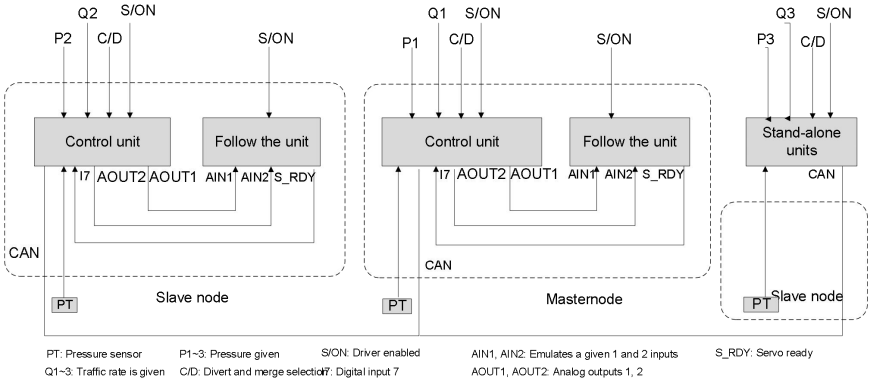


Figure 7 Schematic diagram of - 5 multi-mode system



picture 7 - 6 Composite and multi-mode wiring diagram

7.5 Two communication modes

One master node (single pump system), multiple slave nodes (single pump system), through the shunt and confluence selection terminal, to set the master node to select which slave nodes to control confluence together, there are two slave node combinations.

Dividing and merging selection	CAN slave node address selection
Low	CAN slave node address 1
High	CAN slave node address 2

P34 (CAN slave node address 1) and P35 (CAN slave node address 2): used to set a slave node to merge with the master node. The 16-bit integer supports 15 slave node settings. The corresponding bit 1 represents merging with the master node, and 0 represents shunting, autonomously controlling the oil pump. The master node and the slave node merge to work. Bit0 is set to 1, and the master node works independently. Bit0 is set to 0.

CAN slave node address Hexadecimal range 0x0000~0xffff Decimal range 0~65535															
16-bit integer, each bit corresponds to a node															
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Slave Node 15	Slave Node 14	Slave Node 13	Slave Node 12	Slave Node 11	Slave Node 10	Slave Node 9	Slave Node 8	Slave Node 7	Slave Node 6	Slave Node 5	Slave Node 4	Slave Node 3	Slave Node 2	Slave Node 1	Master Node 0

Communication two-mode wiring diagram:

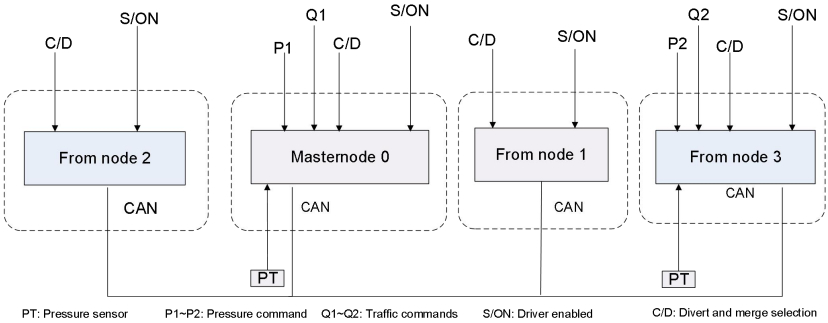


Figure 7 Schematic diagram of wiring - for two communication modes

For example: There are 4 oil pumps in the hydraulic system, and the addresses are set to 0, 1, 2, and 3. There are the following 2 action combinations:

Combination 1: Nodes 0, 1, and 2 merge, and node 3 branches off from the master node to work.

The host computer board gives a low level to the shunt and confluence selection terminals of all master and slave nodes. CAN slave node address selection: Address 1

P34 (CAN slave node address 1) = 7 (0x0007)

Master node 0 joins with slave nodes 1 and 2 to work, and slave node 3 splits and becomes the master node

Combination 2: Nodes 0, 1, 2, and 3 merge.

The host computer board gives a high level to the shunt and confluence selection terminals

of all master and slave nodes. CAN slave node address selection: Address 2

P35 (CAN slave node address 2) = 15 (0x000f)

4 nodes work together

7.6 Four communication modes

One master node (single pump system), multiple slave nodes (single pump system), through the shunt and confluence selection terminal, shunt and confluence selection 1 terminal, to set the master node to select which slave nodes to control to merge together, there are four slave node combinations in total.

Shunt and confluence selection 1 terminal	Splitting and converging selection terminal	CAN slave node address selection
Low	Low	CAN slave node address 1
Low	High	CAN slave node address 2
High	Low	CAN slave node address 3
High	High	CAN slave node address 4

P34, P35, P36 and P37 (CAN slave node addresses 1, 2, 3 and 4): used to set a slave node to merge with the master node. 16-bit integer, supports 15 slave node settings, corresponding to bit 1: represents merging with the master node, 0 represents shunting, autonomous control of the oil pump. The master node and the slave node merge Bit0 is set to 1, and the master node works independently Bit0 is set to 0.

CAN slave node address Hexadecimal range 0x0000~0xffff Decimal range 0-65535															
16-bit integer, each bit corresponds to a node															
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Slave Node 15	Slave Node 14	Slave Node 13	Slave Node 12	Slave Node 11	Slave Node 10	Slave Node 9	Slave Node 8	Slave Node 7	Slave Node 6	Slave Node 5	Slave Node 4	Slave Node 3	Slave Node 2	Slave Node 1	Master Node 0

Communication four-mode wiring diagram:

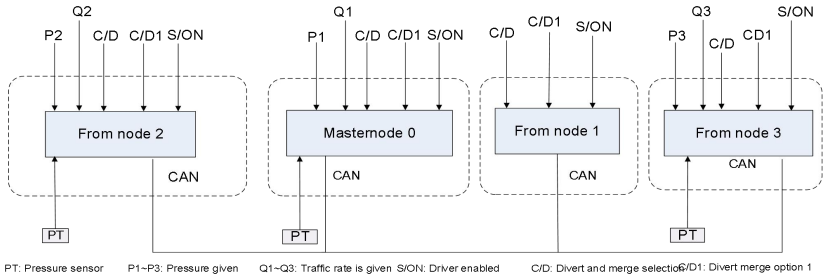


Figure 7 - 8 Communication four-mode wiring diagram

For example: There are 4 oil pumps in the hydraulic system, and the addresses are set to 0, 1, 2, and 3. There are the following 4 action combinations:

Combination 1: Nodes 0 and 1 merge, nodes 2 and 3 diverge, and the nodes work as the main node.

The host computer board gives a low level to the shunt and confluence selection terminal of all nodes, and the low level is connected to the shunt and confluence selection 1 terminal of all nodes. The CAN slave node address selection is: address 1

P34 (CAN slave node address 1) = 3 (0x0003)

Master node 0 and slave node 1 work together, slave nodes 2 and 3 work separately, and switch to the master node

Combination 2: Nodes 0, 1, and 2 merge, and node 3 diverges, switching to the main node to work.

The host computer board gives a high level to the shunt and confluence selection terminal of all nodes, and a low level to the shunt and confluence selection 1 terminal of all nodes . CAN slave node address selection: address 2

P35 (CAN slave node address 2) = 7 (0x0007)

Master node 0 joins with slave nodes 1 and 2 to work, and node 3 splits and becomes the master node

Combination 3: Nodes 0, 1, and 3 merge, and node 2 diverges and switches to the main node.

The host computer board gives a high level to the shunt and confluence selection terminal of all nodes, and a low level to the shunt and confluence selection 1 terminal of all nodes . CAN slave node address selection: address 3

P36 (CAN slave node address 3) = 11 (0x000B)

Master node 0 joins with slave nodes 1 and 2 to work, and slave node 3 splits and becomes the master node

Combination 4: Nodes 0, 1, 2, and 3 merge.

The host computer board gives a high level to the shunt and confluence selection terminal of all nodes, and a low level to the shunt and confluence selection 1 terminal of all nodes . CAN slave node address selection: address 4

P37 (CAN slave node address 4) = 15 (0x000F)

4 nodes work together

Multi-node parallel control debugging parameter table:

LED Display Code	Parameter name	Functional description	Initial Value	unit
P00	Network Enablement	Network enable control . First, individually debug the parameters used by each node single pump and the node confluence type, node number, number of slave nodes to be set for the master node, flow cut-in threshold, flow cut-in hysteresis upper limit, flow cut-in hysteresis lower limit, and then execute the network enable command in sequence from the slave node first and then the master node. 0: Disable 1: Enable	0	
P01	Network management	Controls the driver enable/disable of all nodes, only applicable to multi-pump mode 0: Disable 1: Open the tube	0	
P02	Confluence Type	Select confluence type 0: Single pump 1: Composite 2: Multiple pumps 3: Multi-mode	0	
P03	Node Number	If the node number is 0, it means it is the host If the node number is 1 to 15, it means that the slave	0	
P04	Number of slave nodes	If the node number is 0, the slave node number indicates the number of slaves	0	

LED Display Code	Parameter name	Functional description	Initial Value	unit
		connected to the host.		
P05	Node Type	Sets how the driver works in the node 0: Independent unit 1: Control unit 2: Follower unit 3: Flow ring unit	0	
P06	Flow cut-in threshold	The next pump will start working when the system flow exceeds the flow cut-in threshold of the current pump .	25	%
P07	Flow cut-in hysteresis upper limit	The next pump is required to work together to prevent the pump from starting and stopping due to the critical flow rate.	5	%
P08	Flow cut-in hysteresis lower limit	The next pump is required to work together to prevent the pump from starting and stopping due to the critical flow rate.	2.5	%
P09	Multi-pump pressure proportional gain 0	Proportional parameters of multi-pump pressure PID control section 0	8000	
P10	Multi-pump pressure integral gain 0	Integral parameter section 0 for multi-pump pressure PID control	88	
P12	Multi-pump pressure proportional gain 1	Proportional parameters of multi-pump pressure PID control section 1	8000	
P13	Multi-pump pressure integral gain 1	Integral parameters of multi-pump pressure PID control Section 1	88	
P15	Multi-pump pressure proportional gain 2	Proportional parameters of multi-pump pressure PID control section 2	8000	
P16	Multi-pump pressure integral gain 2	Integral parameters for multi-pump pressure PID control Section 2	88	
P18	Multi-pump pressure	Proportional parameters of multi-pump pressure PID control section 3	8000	

LED Display Code	Parameter name	Functional description	Initial Value	unit
	proportional gain 3			
P19	Multi-pump pressure integral gain 3	Integral parameters for multi-pump pressure PID control Section 3	88	
P34	CAN slave node address 1	4 groups of slave addresses, ranging from 0 to 65535	0	
P35	CAN slave node address 2		0	
P36	CAN slave node address 3		0	
P37	CAN slave node address 4		0	

7.7 Multi-pump control mode setting

7.7.1 Pump selection

Reference

Table 5 -3 Oil pump model list , directly use E02 to select the oil pump with the same displacement. If the selected pump displacement is not in the selection table, you need to manually set the oil pump parameters and adjust the pump displacement (reset) F031 parameter value.

7.7.2 Multi-pump parameter settings

1、 Confluence type settings

Set "Merge Type" P02

0: Single pump 1: Compound 2: Multi-pump 3: Multi-mode 4: Two communication modes 5: Four communication modes

2、 Node number setting

Set "Node Number" P03

3、 Set the number of slave nodes P04

Slave node number setting (node 0 needs to be set, other nodes are skipped)

4、 Multi-pump flow setting

Set the "Flow Cut-in Threshold" P06, usually set to 25%

Set the upper limit of "Flow cut-in hysteresis" P07, usually set to 5%

Set the lower limit of "Flow cut-in hysteresis" P08, usually set to 2.5%

5、 Network enablement and network management settings

Network enable: Set network enable P00=1 to enable the network of the drive in the order of slave first and then master.

7.7.3 Flow calibration

When the confluence type is multi-pump, the master node (master pump) needs to recalibrate the flow setting. At this time, the maximum flow of the system is equal to the sum of the maximum flow of each node, and the flow full range setting cannot exceed this value.

parameter	name	illustrate
d19	System maximum flow	It is zero when there is only one pump. After the multi-pump confluence network is successfully enabled, the maximum flow of the system is equal to the sum of the maximum flow of each node.

1、 Flow full scale setting

F01 1 = Maximum flow rate of the system, e.g. 500.0 L/min

parameter	name	illustrate
F01 1	Flow full scale	This value will set the flow full scale. At the same time, the flow set gain will be adjusted so that when the flow set input is 9.99V, the flow set corresponds to the newly set flow full scale value.

2、 Calibration of flow and pressure setting

parameter	name	illustrate
F154	AI 1 full-scale voltage	Flow given maximum voltage input.

8Alarm and processing

8.1 Protection display list

The servo drive has multiple warning messages and protection functions such as overvoltage and overcurrent. Once an abnormal fault occurs, the protection function is activated, the servo drive stops output, and the motor stops running. Please handle it according to the abnormal display content of the servo drive and the abnormal cause and disposal method. The abnormal record will be stored in the internal memory of the servo drive, which can record the information and occurrence time of the last five abnormalities, and can be viewed through the digital LED operation panel. The fault code display is as follows. If the bad condition cannot be solved after processing, please contact the dealer or our service department.

CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
Err01	IPM Failure	The instantaneous output of the power module exceeds the short-circuit current	E r02.1	Inverter unit protection	The U, V, W current detection values exceed the threshold.
E r02.2	Driver overcurrent	The output current exceeds the driver's allowable operating current	Err03	DC overvoltage	The main circuit DC voltage is abnormally high
Err04	DC undervoltage	When the motor is powered on, the DC voltage of the main circuit drops below the protection value.	Err05	Forward overspeed	The servo motor speed exceeds the forward speed protection value
Err06	Module over temperature	The servo drive exceeds the module protection temperature	Err07	Motor overheating	The servo motor temperature exceeds the motor protection temperature
Err08	Software failure	The servo drive software is running abnormally	Err09	CAN Failure	When the process instruction mode is CAN continuous or multi-pump joint application, the driver reports this fault if the CAN communication is

CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
					abnormal.
Err10	reserve	/	Err11	Self-test fault	The drive's internal hardware is abnormal. The current zero drift detected during shutdown is too large
Err12	Task reentry	Software program call error	Err13	Oil pressure overpressure	The oil pressure system pressure exceeds the overpressure protection value
Err14	Reverse overspeed	The servo motor speed exceeds the reverse speed protection value	Er15 .1	Pressure sensor failure	The pressure sensor is damaged or blocked.
Er 15.2	Pressure sensor disconnection failure	Pressure sensor wiring error	Er 15.3	Pressure sensor voltage detection failure	The pressure feedback voltage suddenly exceeds the value of F241
Err16	Brake pipe failure	Brake pipe damage	Err17	AC overvoltage	Input AC voltage exceeds AC overvoltage protection @
Err18	EEPROM Failure	Servo unit EEPROM data abnormality	Err19	reserve	/
Err20	AC undervoltage	Input AC voltage is lower than AC undervoltage protection @	Err21	Braking overload	The brake resistor overload rate exceeds the brake resistor overload threshold
Err22	Node failure	When multiple pumps are connected in	Err23	Input phase failure	Input phase loss or three-phase imbalance

CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
		parallel, if a slave node fails, the master driver will report this failure.			
Err24	reserve	/	Err25	485 Communication failure	When the process instruction mode is 485 continuous, the driver reports this fault if the 485 communication is abnormal.
Err26	Current feedback channel fault	The zero drift of the power-on self-test current is large	Er27 .1	Driver rectifier overload	The driver rectifier unit is overloaded and runs for too long.
Er27 .2	Drive inverter overload	The drive inverter unit is overloaded and runs for too long.	Er27.3	Drive stall overload	The motor runs at zero speed overload for too long
Er27.4	Oil pump stuck	The oil pump is stuck and the driver outputs high current for a long time	Err28	Motor overload	The motor is overloaded and runs for too long
Err29.1	U phase output phase failure	The output current is unbalanced when the motor is running, and the lead from the driver to the motor is abnormal	Err29.2	V phase output phase failure	The output current is unbalanced when the motor is running, and the lead from the driver to the motor is abnormal
Err29.3	W phase output phase failure	The output current is unbalanced when the motor is running, and the lead from the driver to the motor is abnormal			

CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
Er30.1	Position positive overtravel	Touch the positive limit switch	Er30.2	Position reverse overtravel	Hit the reverse limit switch
Err31	Resolver Fault	The resolver line is not connected or the resolver is faulty.	Err32	reserve	/
Err33	Resolver sampling fluctuation fault	In the diagnostic enable mode, the driver test shows that the resolver sampling value fluctuates greatly	Err34	A phase current sampling fluctuation is too large fault	In the diagnostic enable mode, the drive test shows that the current sampling fluctuation of phase A is too large
Err35	B phase current sampling fluctuation is too large fault	In the diagnostic enable mode, the drive test shows that the B phase current sampling fluctuation is too large	Err36	A phase current sampling zero drift is too large fault	In the diagnostic enable mode, the driver is tested and the zero drift of the current sampling of phase A is too large
Err37	B phase current sampling zero drift is too large fault	In the diagnostic enable mode, the driver is tested and the zero drift of the B phase current sampling is too large.	Err38	DC voltage sampling fluctuation is too large fault	In the diagnostic enable mode, the driver test, the DC voltage sampling fluctuation is too large
Err39	Pressure feedback sampling fluctuation is too large.	In the diagnostics enabled mode, during the driver test, the pressure feedback sampling fluctuation was too	Err40	Pressure feedback sampling zero drift is too large.	In the diagnostic enable mode, the driver test shows that the pressure feedback sampling zero drift is too

CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
		large			large.
Err41	Pressure given sampling fluctuation is too large fault	In the diagnostic enable mode, the drive test, the pressure reference sampling fluctuation is too large	Err42	Flow given sampling fluctuation is too large fault	In the diagnostic enable mode, the driver test shows that the flow rate sampling fluctuation is too large.
Err43	reserve	/	Err44	Module temperature sampling fluctuation is too large.	In the diagnostics enabled mode, during the driver test, the module temperature sampling fluctuation was too large
Err45	Motor temperature sampling fluctuation is too large fault	In the diagnostic enable mode, the motor temperature sampling fluctuates too much during the drive test.	Err46 ~ Err48	reserve	
Err49	Encoder initial angle test failure	In the diagnosis enable mode, when the motor parameters are self-learning, the encoder initial angle test current does not follow, the time is timed out, etc.	Err50	Phase sequence detection fault	In the diagnosis enable mode, when the motor parameters are self-learned, the motor pole pair number is calculated incorrectly, the speed limit value is invalid, the current does not follow, and the time is timed out.

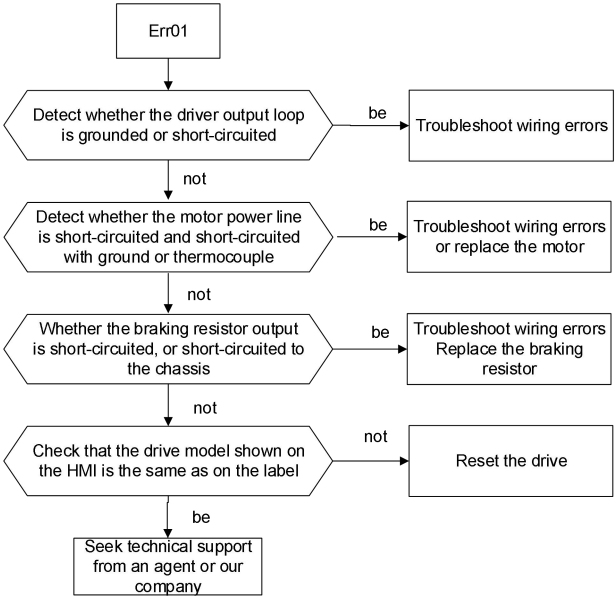
CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
Err51	Motor resistance test failure	In the diagnosis enable mode, when the motor parameters are self-learning, the current does not follow, the time is exceeded, and the resistance test value is invalid	Err52	Motor parameter dynamic test failure	In the diagnostic enable mode, when the motor parameters are self-learning, the speed error is large, the current does not follow, the load is large, the time is exceeded, and the test value is invalid
Err53	Motor parameter static test failure	In the diagnosis enable mode, when the motor parameters are self-learning, the motor parameter calculation results are invalid	Err54	Diagnostic interrupt fault	If a fault occurs during the diagnostic operation, the drive will stop the diagnosis and display Err54 fault.
Err55	reserve	/	Err56	EtherCAT initialization failure	EtherCAT chip has poor contact
Err57	EtherCAT communication EEPROM failure	There is no data in EEPROM or data reading fails.	Err58	EtherCAT disconnection fault	After the driver is enabled, it is detected that the network cable is not plugged in properly or the EtherCAT master is not running normally.
Err59	EtherCAT Communication Failure	No PDO data is received within a period of time after the driver is enabled	Err60	ProfiNet disconnection fault	After the driver is enabled, it is detected that the network cable is not plugged in properly or the

CODE	PROTECTING CONTENT	MEANING	CODE	PROTECTING CONTENT	MEANING
					ProfiNet The master station is not operating normally

8.2 Troubleshooting Flowchart

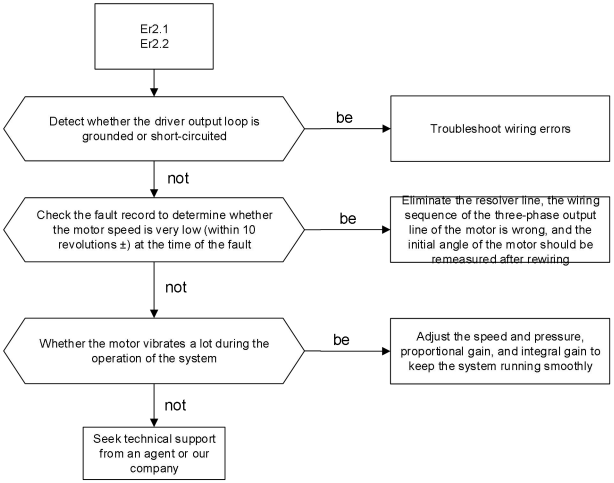
8.3

- **Err01: IPM failure**



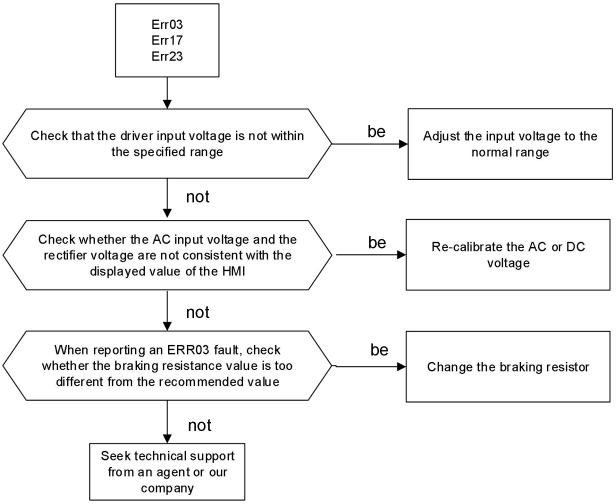
- **Er02.1: Inverter unit protection**

Er02.1 : Driver overcurrent



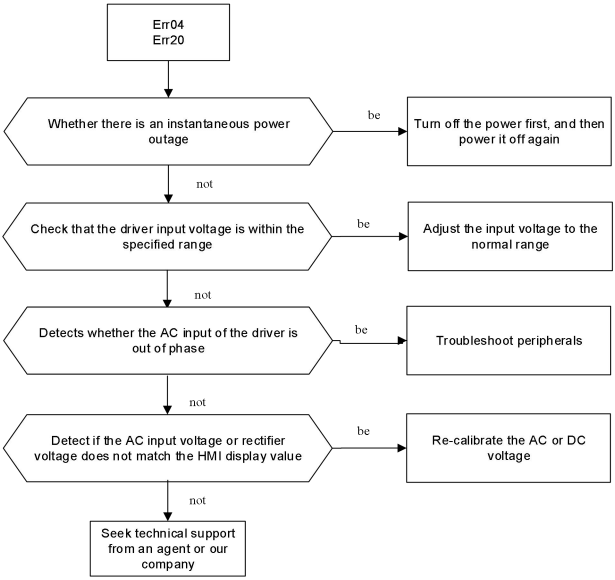
- **Err03: DC overvoltage**

Err23: Input phase failure



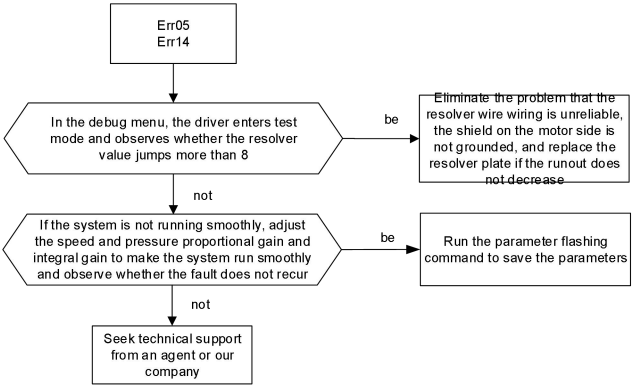
- **Err04: DC undervoltage**

  Err20: AC undervoltage

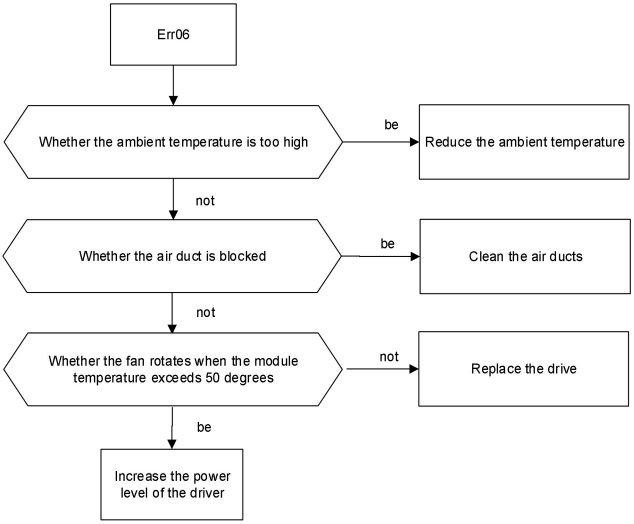


- **Err05: Forward overspeed**

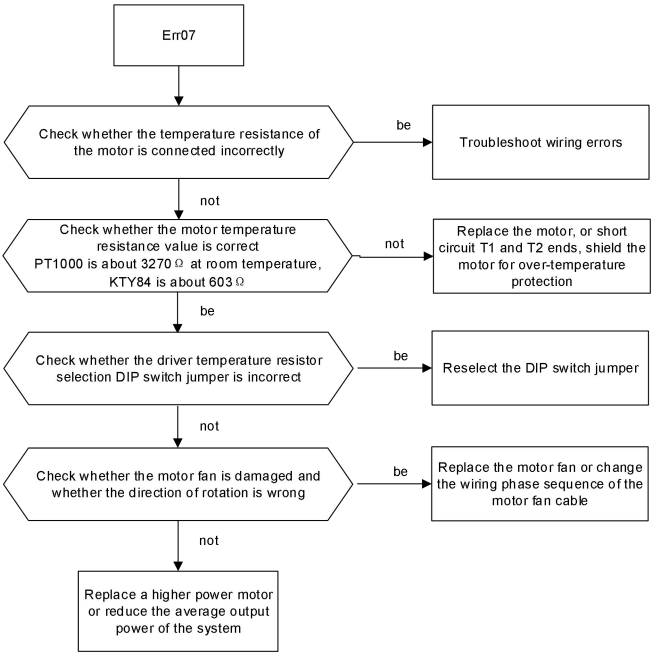
  Err14: Reverse overspeed



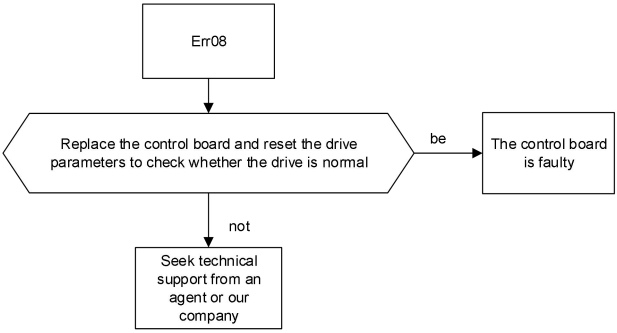
- **Err06: Module overheating**



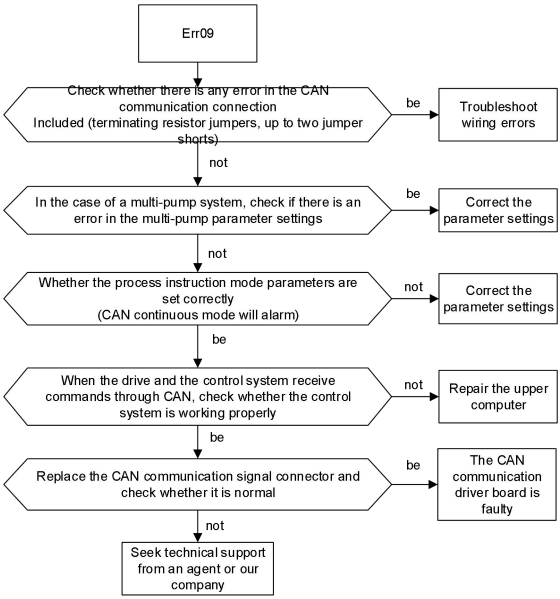
- **Err07: Motor overheating**



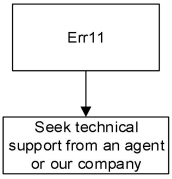
- **Err08: Software failure**



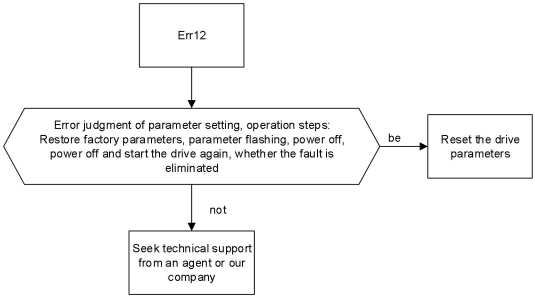
- **Err09: CAN fault**



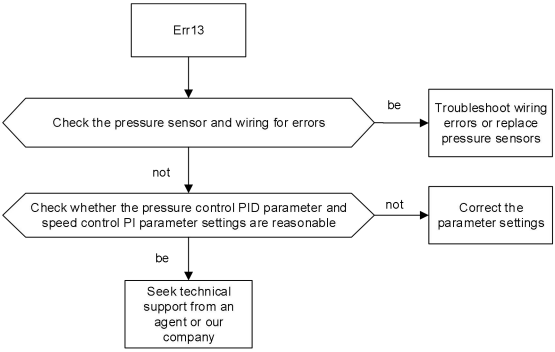
- **Err11: Self-test failure**



- **Err12: Task reentry**



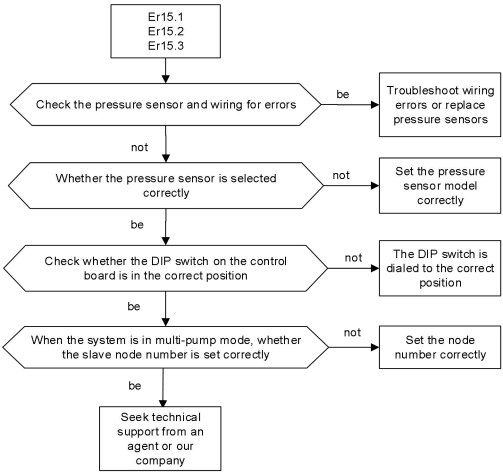
- **Err13: Oil pressure overpressure**



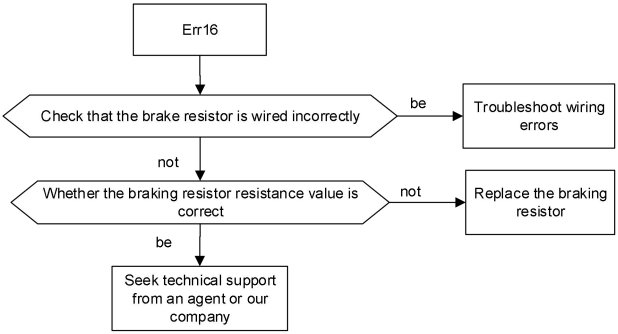
- **Er15.1 : Pressure sensor** failure

  Er15.2 : Pressure sensor disconnection fault

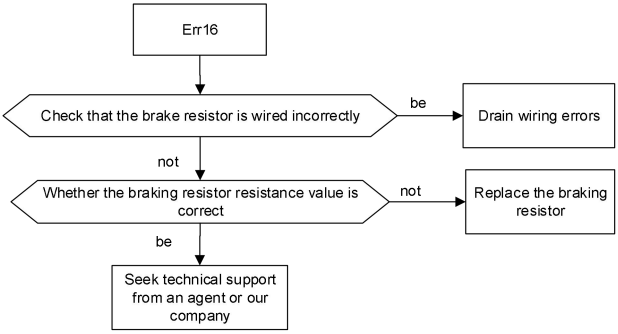
  Er15.3 : Pressure sensor **voltage** detection failure



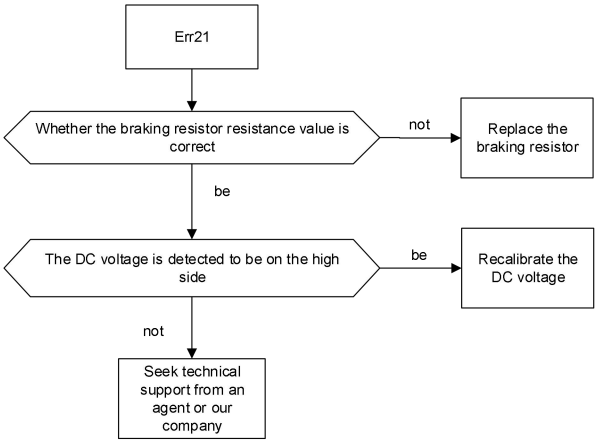
- **Err16: Brake pipe failure**



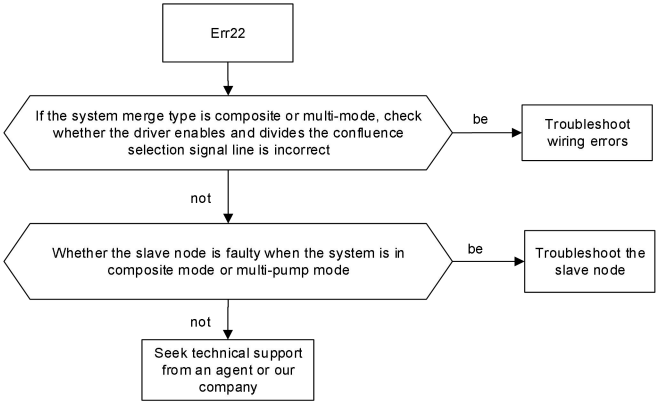
- **Err18: EEPROM failure**



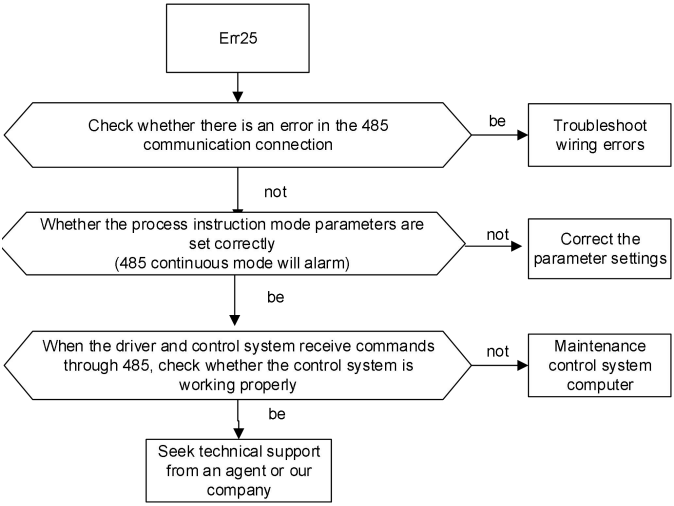
- **Err21: Braking overload**



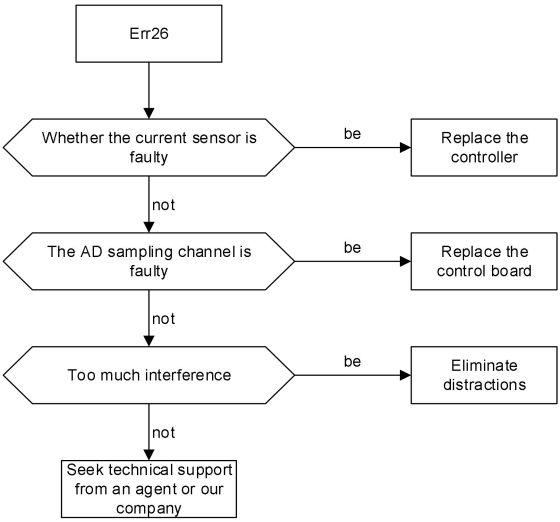
- **Err22: Node failure**



- **Err25: 485 communication failure**


Err25
Check whether there is an error in the 485 communication connection
be
Troubleshoot wiring errors
not
Whether the process instruction mode parameters are set correctly (485 continuous mode will alarm)
not
Correct the parameter settings
be
When the driver and control system receive commands through 485, check whether the control system is working properly
not
Maintenance control system computer
be
Seek technical support from an agent or our company

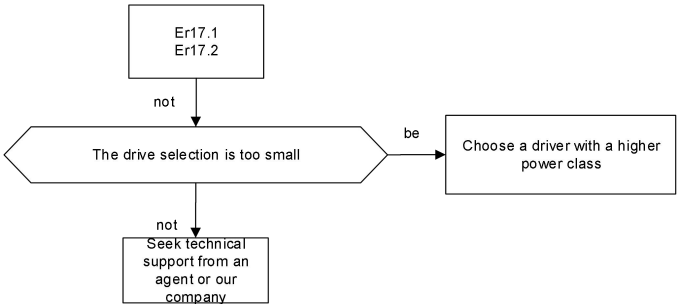
- **Err26: Current feedback channel fault**



- **Er 27.1 : Driver rectifier overload**

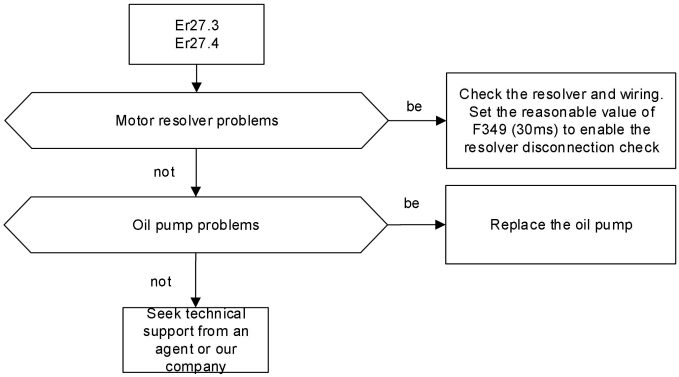
  Er27.2 : Drive inverter overload

  Er27.3: Driver stall overload



- **Er27.3 : Driver stall overload**

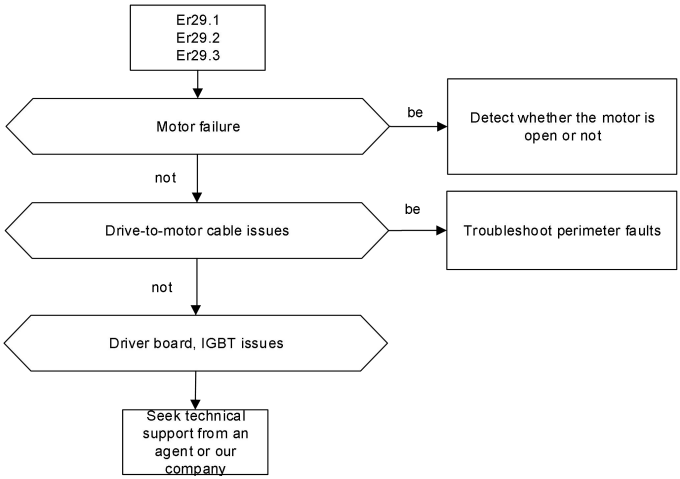
  Er27.4 Oil pump stuck



- **Err29.1 U phase output phase failure**

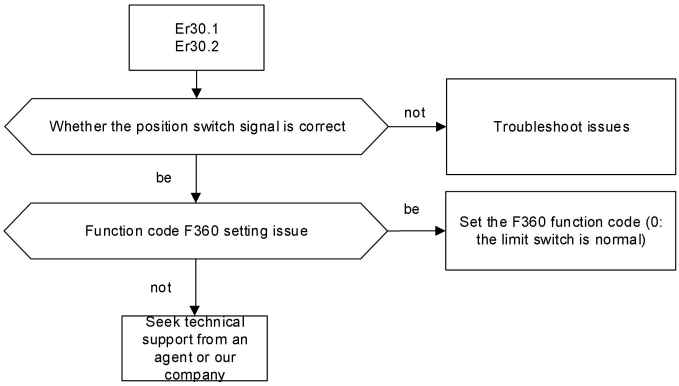
  Err29.2 W phase output phase failure

  Err29.3 W phase output phase failure

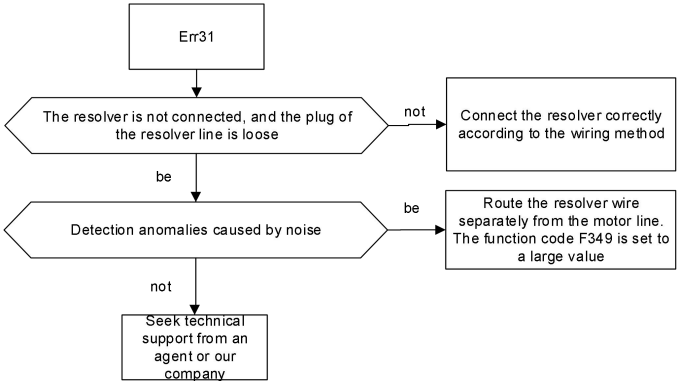


- **Er30.1 Position positive overtravel**

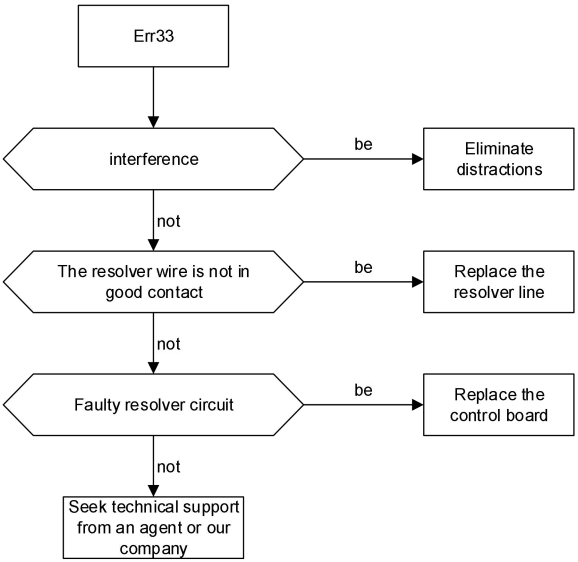
  Er30.2 Position reverse overtravel



- **Err31 resolver fault**



- **Err33: The sampling fluctuation of the resolver is too large**

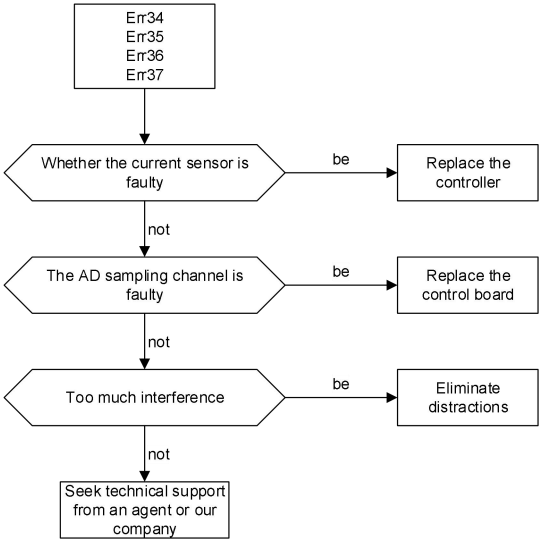

Err33
interference
be
Eliminate distractions
not
The resolver wire is not in good contact
be
Replace the resolver line
not
Faulty resolver circuit
be
Replace the control board
not
Seek technical support from an agent or our company

- **Err34: A phase current sampling fluctuation is too large fault**

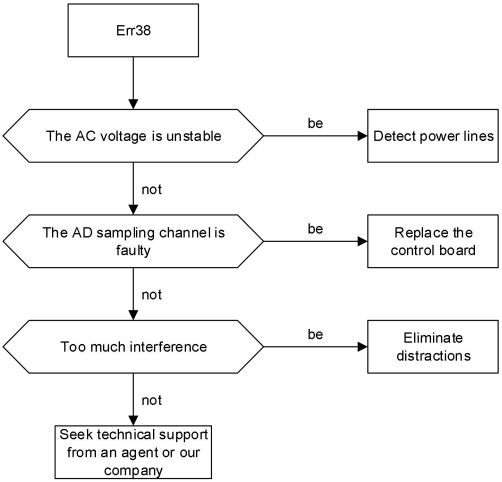
  Err35: B phase current sampling fluctuation is too large fault

  Err36: A phase current sampling zero drift is too large fault

  Err37: B phase current sampling zero drift is too large fault

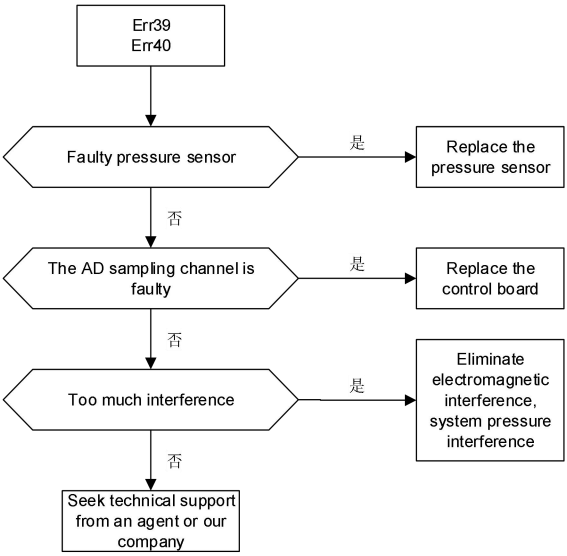


- **Err38: DC voltage sampling fluctuation is too large fault**



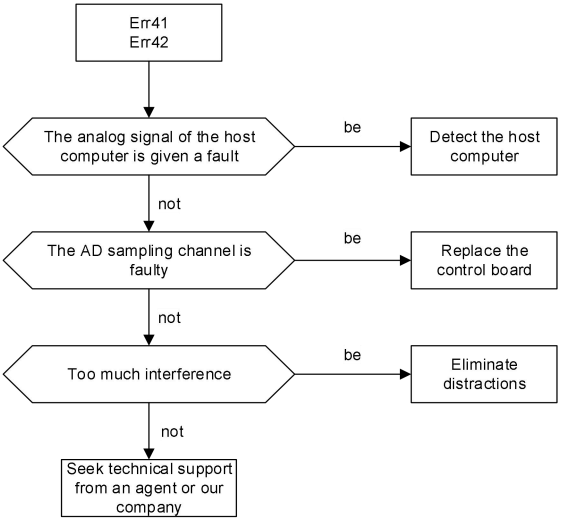
- **Err39: Pressure feedback sampling fluctuation is too large fault**

  Err40: Pressure feedback sampling zero drift is too large fault



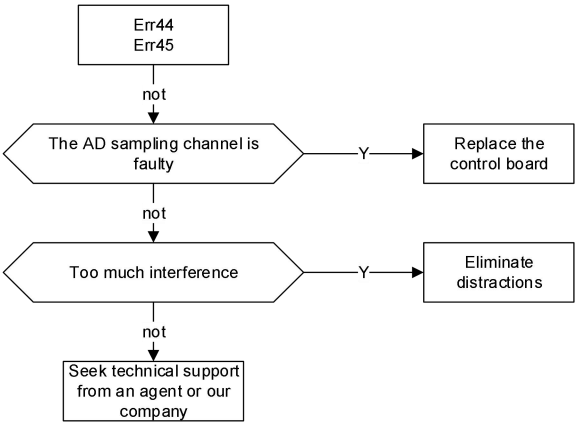
- **Err41: Flow given sampling fluctuation is too large fault**

  Err42: Pressure setting sampling fluctuation is too large fault

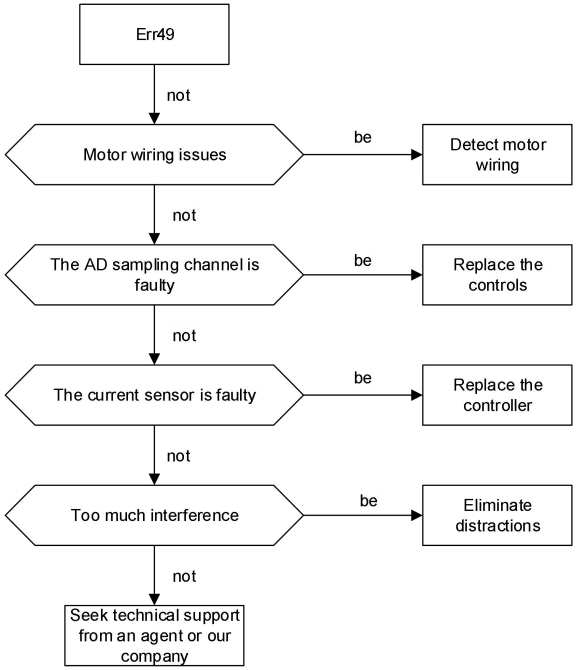


- **Err44: Module temperature sampling fluctuation is too large fault**

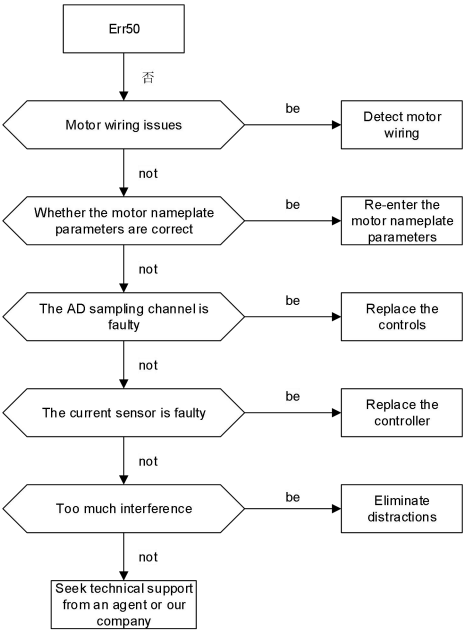
  Err45: Motor temperature sampling fluctuation is too large fault



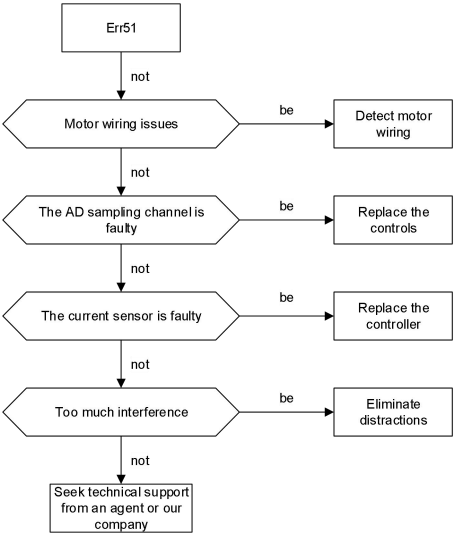
- **Err49: Encoder initial angle test failure**



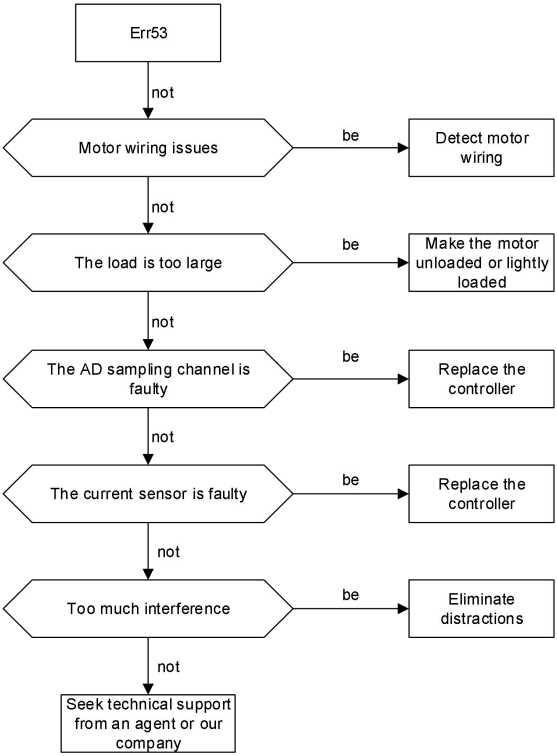
- **Err50: Phase sequence detection failure**



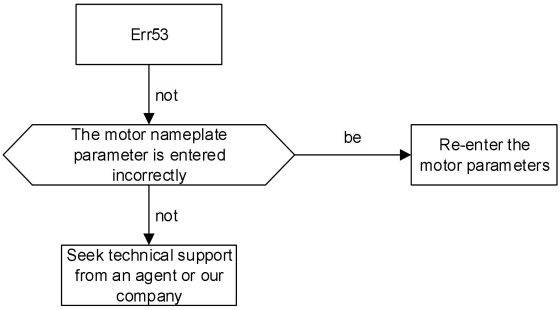
- **Err51: Motor resistance test failure**



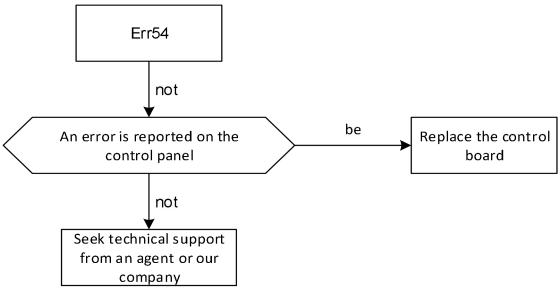
- **Err52: Motor parameter dynamic test failure**



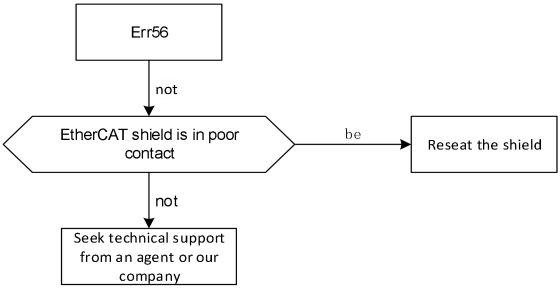
- **Err53: Motor parameter static test failure**



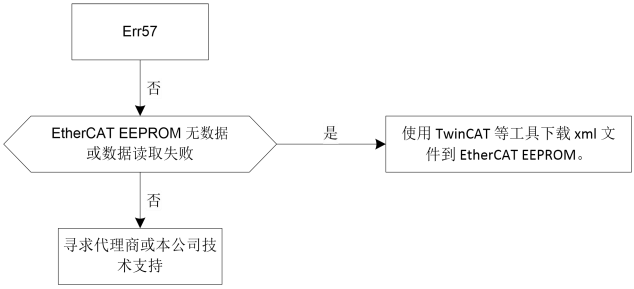
- **Err54: Diagnostic interrupt failure**



- **Err56: EtherCAT initialization failure**

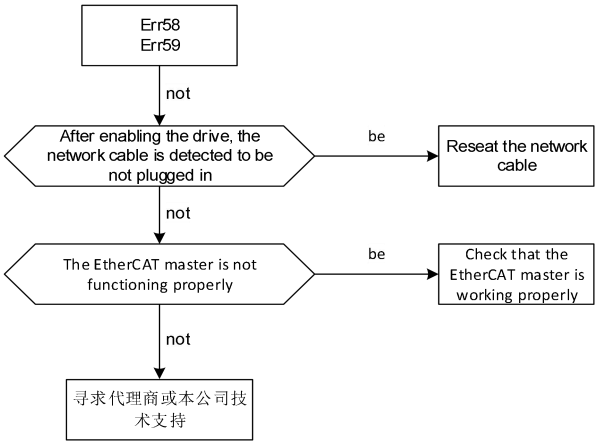


- **Err57: EtherCAT communication EEPROM failure**



- **Err58: EtherCAT short line fault**

  Err59: EtherCAT communication failure



8.4 Common faults and solutions

The following faults may occur during the use of the servo drive. Please refer to the following methods for simple fault analysis:

SERIAL NUMBER	FAULT PHENOMENON	REASON	TREATMENT MEASURES
1	No display after power on	● Servo drive power input is bad ● The cable connecting the driver board and the control board is loose ● Servo drive internal component failure	● Check the input power ● Reseat the cable ● Seek manufacturer services
2	Driver DI terminal failure	● DI terminal wiring is loose ● Parameter setting error ● J1, J2 shorting pieces are loose or the internal or external power supply is incorrectly selected ● Control board terminal failure	● Reseat the wiring harness ● Check and reset parameters ● Check whether the shorting piece is loose and whether the shorting method is correct. ● Seek manufacturer services
3	The motor does not rotate after	● The resolver line has poor contact	● Rewiring ● Replace the motor or check

SERIAL NUMBER	FAULT PHENOMENON	REASON	TREATMENT MEASURES
	the driver is running	● Motor is damaged or blocked ● Driver parameter setting error	for mechanical failure ● Reset drive parameters
4	Overcurrent fault	● Motor wiring is abnormal (bad wiring, poor connection) ● Parameter setting error ● Load fluctuation or oil pump damage ● Position sensor wiring abnormality (bad wiring, bad connection) ● Servo drive failure	● Correct the motor wiring ● Recalibrate overcurrent parameters ● Recalibrate the load system and oil system ● Correct the position sensor wiring ● Replacement of servo drive
5	Overvoltage fault	● AC input power voltage is too high ● Parameter setting error ● Braking unit abnormality ● Servo drive failure	● Adjust the AC power voltage to the normal range ● Recalibrate overvoltage parameters ● Seek manufacturer services ● Replace the servo drive
6	Undervoltage fault	● The AC input power voltage is low (is there too much voltage drop) ● AC three-phase input voltage phase loss ● Soft start relay is not energized ● Servo drive failure	● Adjust the AC power voltage to the normal range ● Check the power supply and restart the operation ● Seek manufacturer services ● Replace the servo drive
7	Motor and driver overtemperature fault	● The load exceeds the rated load. ● The ambient temperature of the servo system exceeds 50 °C ● Servo motor temperature sensor wiring error ● Fan damage, air duct blockage ● Servo drive internal circuit	● Review load conditions, operating conditions or motor capacity ● Adjust the ambient temperature of the servo unit to below 50 °C ● Correct the wiring of the motor temperature sensor ● Replace the fan and clean the air duct

SERIAL NUMBER	FAULT PHENOMENON	REASON	TREATMENT MEASURES
		failure	● Replace the servo drive
8	Pressure sensor failure	● Pressure sensor wiring error ● Pressure sensor abnormality ● Wrong pressure sensor selection ● Servo drive failure	● Correct the pressure sensor wiring ● Replace the pressure sensor ● Reselect pressure sensor type ● Replace the servo drive

9Maintenance and Inspection

Due to the influence of environmental temperature, humidity, dust, vibration and other factors, the internal components of the servo drive will age, causing potential failures or shortening its life. Therefore, it is necessary to perform daily inspections and regular maintenance on the servo drive.

9.1 Notes

To prevent electric shock, do not perform inspection work when the power is on, otherwise there is a risk of electric shock.

Before checking, please cut off the power supply of all devices and wait for more than 10 minutes or use a multimeter to measure the voltage of U+ and U- terminals to be lower than 36V before checking to avoid danger caused by residual voltage of the internal capacitor of the servo drive.

9.2 Inspection Items

The items that need to be checked regularly are shown in the table below:

INSPECTION ITEMS	CHECK CONTENT	INSPECTION METHODS AND MEASURING INSTRUMENTS	JUDGMENT CRITERIA
Usage Environment	Ambient temperature, humidity, dust quantity, dust composition, oil/acid-base mist, etc.	Visual inspection, thermometer, hygrometer	Meet the requirements of the instruction manual
Supply voltage	Is the power supply voltage normal?	Voltmeter Multimeter	Meet the requirements of the instruction manual
	Is the power-on logic action (contactor, air switch, etc.) normal?		
Driver appearance and component inspection	Is there any abnormal vibration, noise, deformation or damage?	Tighten the screws, visual inspection, multimeter	No abnormality
	Check whether the external brake resistor is loose, whether the resistor is aged, and whether the resistance value is normal.		
Cables	Check whether the power cables and connections are discolored, aged, or whether the insulation layer is broken.	Visual inspection	No discoloration, cracking or other aging phenomena
Air duct vents	Are the air ducts and heat sinks	Visual inspection	No clogging

	blocked?		

9.3 Main circuit insulation test

The megohmmeter test is limited to the insulation test between the motor winding and the housing, and before the test, make sure that all the connections between the motor and the servo drive are disconnected. The test should use a 1000V megohmmeter, and the insulation resistance should be greater than 50MΩ.

Improper insulation test methods may damage the servo drive, so it is not recommended for users to perform it themselves.

9.4 Replacement of wearing parts

9.4.1 Lifespan of vulnerable components

The vulnerable components of the servo drive are mainly cooling fans and electrolytic capacitors for filtering. Their lifespan is closely related to the use environment and maintenance conditions. The general continuous service life is shown below. Users can determine the replacement period based on the operating time.

DEVICE NAME	LIFE TIME	TEST CONDITIONS
fan	≥ 5 years	Ambient temperature: 40 °C ; Load rate: 80%; Operating hours: 24 hours/day
Electrolytic Capacitors	≥ 5 years	

9.4.2 Replacement of vulnerable components

When the fan or electrolytic capacitor reaches the end of its service life or is damaged, it needs to be replaced in time to avoid affecting the normal use of the servo drive. The replacement conditions and methods are as follows:

Device Name	Damage phenomenon	Criteria	Replacement method
fan	Bearing wear, blade aging, fan blades do not rotate	Check whether the blades have cracks, or whether there are abnormal noises or vibrations during operation.	Loosen the fixing screws, remove the fan cover, and pull it outwards. After replacement, ensure that the wind direction is blowing outwards
Electrolytic Capacitors	Is there any liquid outflow, is the safety valve loose, is the static capacitance value changed	The outer body is broken, there is liquid flow, the safety valve is loose, and the capacity value	Since electrolytic capacitors involve internal components of the servo drive,

		changes	users are prohibited from replacing them by themselves. Please contact the supplier for replacement.

10 Accessories

10.1 Selection of noise filtering tools

Table 10 - 1 Comparison table of noise filters for various types of drivers

Servo drive model	Magnetic ring configuration	Input Reactor Configuration	Filter Configuration
PH600.007.43ARSF	Small 63*38*25	20A	32A
PH600.011.43ARSF		3 0A	
PH600.015.43ARSF	Small 63*38*25	40A	45A
PH600.018.43ARSF		5 0A	
PH600.022.43ARSF	Medium 80*52*20	60A	65A
PH600.030.43ARSF		9 0A	
PH600.037.43ARSF	Medium 80*52*20	9 0A	100A
PH600.045.43ARSF	Medium 80*52*20	120A	
PH600.055.43ARSF	Medium 80*52*20	150A	150A
PH600.075.43BRSF	Extra large 102*65*20	200A	
PH600.090.43BRSF	Extra large 102*65*20	250A	240A
PH600.110.43BRSF	Extra large 102*65*20	250A	

10.2 Selection and installation of brake resistor

Table 10 - 2 Braking resistor and braking unit selection comparison table

Servo drive model	Braking resistor specifications		Braking unit specifications
	Resistance value Ω	Power W	
PH600.007.43ARSF	40	10 00	Built-in brake unit
PH600.011.43ARSF	40	10 00	
PH600.015.43ARSF	40	10 00	
PH600.018.43ARSF	40	10 00	
PH600.022.43ARSF	15	1 500	
PH600.030.43ARSF	15	1 500	
PH600.037.43ARSF	10	2000	
PH600.045.43ARSF	10	2 000	
PH600.055.43ARSF	10	2000	
PH600.075.43BRSF	10	4000 (2 20Ω/2000W in parallel)	
PH600.090.43BRSF	5	4 000 (2 10Ω / 2000W in parallel)	
PH600.110.43BRSF	5	4 000 (2 10Ω / 2000W in parallel)	

The servo drive has a built-in brake unit, but no brake resistor is built into the drive. Please be sure to connect an external brake resistor. When the motor brakes frequently and requires a higher power brake resistor, the user can select a brake resistor with a lower resistance and higher power when placing an order. The external brake resistor should be installed in a well-ventilated place and away from flammable objects or non-heat-resistant parts.

When users install external brake resistors by themselves, they should pay attention that the resistance value must not be less than the specified value, otherwise the drive may be damaged.

1、 Braking resistor installation layout

All resistors must be installed in a location with good cooling.

	The materials near the brake resistor/brake unit must be flame retardant. The temperature of the resistor surface is very high. The temperature of the air flowing out of the resistor is also several hundred degrees Celsius. The material must be

	prevented from coming into contact with the resistor.

2、 Installation of brake resistor:

	● PB, (+) is the wire terminal of the braking resistor.

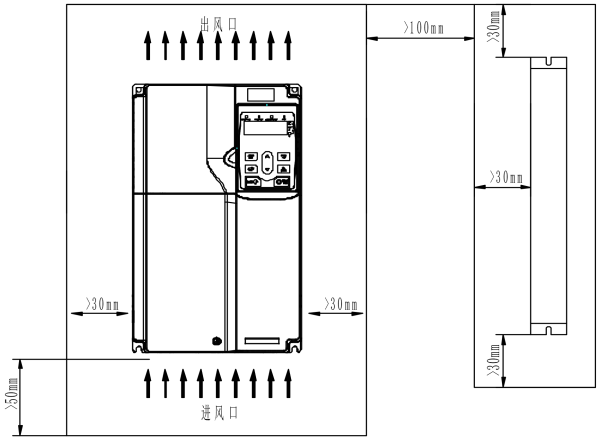


Figure 10 - 1 PH600.007.43ARSF ~ PH600.037.43ARSF brake resistor assembly diagram

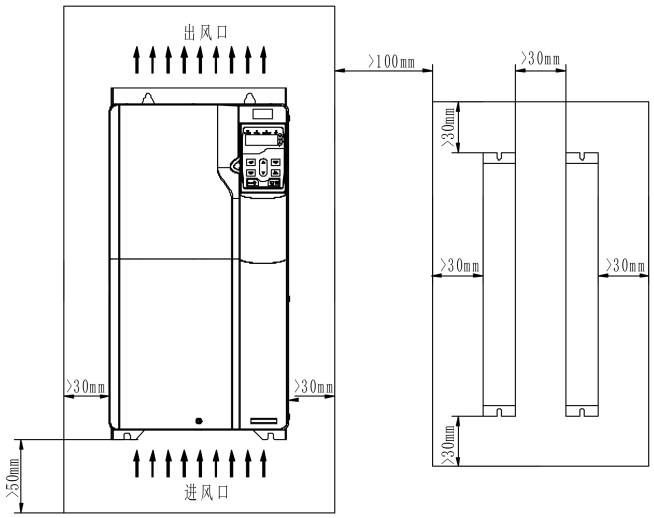


Figure 10 - 2 PH600.045.43ARSF ~ PH600.075.43BRSF driver and brake resistor layout

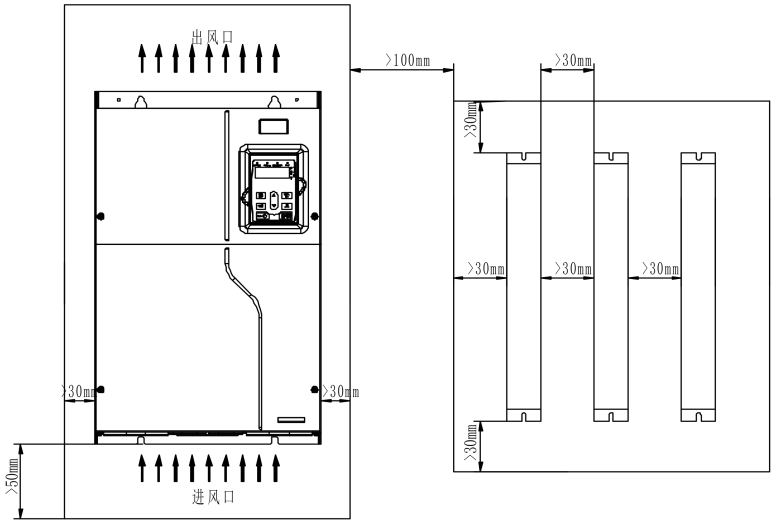


Figure 10 - 3 PH600.090.43BRSF ~ PH600.110.43BRSF driver and brake resistor layout

10.3 Pressure sensor selection

Pressure sensor terminals

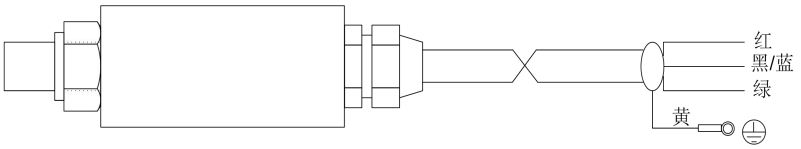


Figure 10 Schematic diagram of - 4- pressure sensor

COLOR	NAME	DEFINITION
red	15V	15V power supply
Black/Blue	GND	Pressure analog signal output
green	AI3	
yellow	PE	Ground wire

When the pressure sensor is connected to the oil circuit, it should be sealed with raw tape. When installing, the pressure sensor should be tightened to ensure no leakage.

11. Warranty

Our company solemnly promises that from the date when the user purchases the product from our company (hereinafter referred to as the manufacturer), the user will enjoy the following product after-sales warranty services:

1、 This product has an 18-month free warranty from the date of purchase (except for products exported abroad/non-standard products).

2、 If any quality problem occurs on this product within one month from the date of purchase, the manufacturer will provide refund, replacement and warranty.

3、 If any quality problem occurs on this product within three months from the date of purchase, the manufacturer will provide replacement and warranty.

4、 This product enjoys paid lifetime service from the date the user purchases it from the manufacturer.

5、 Disclaimer: Product failures caused by the following reasons are not covered by the manufacturer's 18-month free warranty service commitment:

（1） The user does not perform correct operations according to the procedures listed in the "Product Manual";

（2） The user repairs the product without consulting the manufacturer or modifies the product without authorization, causing product failure;

（3） The user uses the product beyond the standard usage range, causing product failure;

（4） Abnormal aging or failure of product components due to poor user environment;

（5） Product damage caused by force majeure such as earthquake, fire, wind and water disasters, lightning strikes, abnormal voltage or other natural disasters;

（6） After the user purchases the product, the product is damaged due to drop or other external force intrusion during transportation due to improper transportation method selection; (the transportation method is reasonably selected by the user, and the company assists in handling the consignment procedures on behalf of the user)

6、 The manufacturer reserves the right not to provide warranty service in the following circumstances:

（1） When the brand, trademark, serial number, nameplate and other marks marked on the product by the manufacturer are damaged or unrecognizable;

（2） When the user fails to pay the full amount of the goods according to the Purchase and Sales Contract signed by both parties;

（3） When the user conceals to the manufacturer's after-sales service provider any improper use of the product during installation, wiring, operation, maintenance or other processes.

PERPETUAL MOTION

Version：PHSMOM2506-V05