

# User Manual

## TS-I series servo drive is introduction



**V&T**



# Foreword

**TS-I series synchronous servo driver is a high performance and highly reliable servo driver with high responding speed for electrolytic mixing system of the injection molding machine.** The product is based on a flexible digital control module that uses high performance DSP, which realizes high performance vector control, precision position and speed control, non-linear weak magnetic high speed control and position calibration space vector low speed control for each kind of control algorithm and software for servo motors. In the meantime, in order to meet the high speed and high precision servo control requirements, its embedded self immunity control and speed control algorithm can realize better dynamic tracking and stable performance, and realize the trye high speed response, high precision and high reliably with the forward feed control of compensation servo and smoothing technology. In addition, the product can decouple the PQ control algorithm according to the features of the injection molding machine, increase the response speed and smooth moving speed of the injection molding machine and the mutual conversion of pressure control.

This manual is the operation and commissioning instruction manual for TS-I series synchronous servo driver for electrolytic mixing system of the injection molding machine.

This manual provides the safety precautions, model selection, installation, parameter setting, field commissioning, troubleshooting, and daily maintenance knowledge for users. In order to correctly use this series servo driver, read this manual carefully and keep it for future using. The customer that integrates this product shall deliver the manual to the end user.

The user that uses this product for the first time should read the manual carefully. If there is any question to the function and performance of the product, please consult the technical support personnel of V&T to seek the help and technical support so as to ensure the correct use of the product.

We are improving the servo driver continuously, so we reserve the right to modify the manual without prior notice.

## High Reliability Design

### ■ Meeting the Relevant International Product Standards

IEC61800-2	General requirements–Rating specifications for low voltage adjustable frequency a.c. power drive systems
IEC61800-3	EMC product standard including specific test methods
IEC61000-6	Electromagnetic compatibility (EMC) –Part6:Generic standards
IEC61800-5-1	Safety requirements –Electrical, thermal and energy
UL508C	UL Standard for Safety for Power Conversion Equipment

### ■ Integrated Design

- ◆ Unified design of hardware interfaces: Unified design of control board, button/shuttle type operation panel facilitates the operation and maintenance.
- ◆ Unified design of software protocol: The driver series have unified terminal/operation panel RS485, and universal expansion port SPI protocols(Modbus protocol).
- ◆ Integrated design of main circuit terminals:TS-I-4T030A and the following integrated, TS-I-4T039A~TS-I-4T150A integrated, TS-I-4T176A and the above integrated, to facilitate the operation and maintenance..
- ◆ Built-in braking unit design: to reduce the cost and the installation space.
- ◆ Unified design of built-in expansion cards: Functional card/ PG feedback card/communication adapter card, meeting the industry application requirement.
- ◆ Full series standard shared DC bus design: Realizing standard shared DC bus schemeshared DC bus without modifying the driver or adding peripheral circuit. It is applicable to such industry applications as paper making, chemical fiber, metallurgy and EPS.

### ■ Adaptability Design

- ◆ Independent duct design: The full series supports the application demand of mounting heatsink out of the cabinet,
- ◆ Compact structure design: With complete thermal simulation and unique cold plate process, the driver has compact structure, meeting the demands of OEM customers.
- ◆ Complete system protection design: The advanced system designs, e.g., adopting protective coating on PCB, galvanizing the copper buses, and adopting sealed key in full series of product components, and the button and shuttle type operation panels meeting with the IP54 requirement, greatly improve the protection capacity of the system.
- ◆ Wide voltage range design: the DC operating voltage range is DC 360–720V, with mains voltage fluctuation recording function.
- ◆ Precise current detection and protection: The full series of drivers adopt precise Hall sensor to detect the output current, meeting the quick real time control and protection requirement of software and hardware, ensuring the performance and

reliability of the system.

- ◆ Independent power supply for control: The driver provides an independent DC input interface. External UPS power supply can be connected to the driver through an option card. It is applicable to the applications of oilfield, chemical industry and printing and dyeing industry.
- ◆ Power-up self-detection function: It realizes the power-up detection on the peripheral circuit, such as motor grounding, disconnection, greatly improving the system reliability.
- ◆ Comprehensive system protection function: software/hardware current limiting protection, overcurrent and overvoltage protection, grounding short circuit protection, overload protection, IGBT short circuit protection, abnormal current detection protection, relay suction pull-on anomaly protection.
- ◆ Perfect terminal protection function: short circuit and overload protection for the +24V、 +13V and +10V power supply of the control terminal, operation panel cable reverse connection protection, input signal cable disconnection and abnormal analog input protection.
- ◆ Over-temperature prealarm protection function: Automatic adjustment will be made according to the temperature to ensure the reliable operation of the product, and maximum operating temperature will be recorded.
- ◆ Comprehensive switching power protection function: including switching power output short circuit protection, overload protection, power-up walk-in function, open loop self-locking and voltage limiting protection function, ensuring the system reliability.

## Customized Functions

### ■ Multiple Function Code Display Modes

- ◆ bASE: Basic menu mode, displays all the function codes.
- ◆ FASt : Fast menu mode, display the common parameters to be used in the commissioning, is especially suitable for the naive users.
- ◆ ndFt: Non-factory setting menu mode, it only displays the function codes different from the leave-factory values to facilitate the inquiry and commissioning.
- ◆ LAsT: Last change menu mode, it displays the 10 functions codes that are recently changed and P0.02 to facilitate the inquiry and commissioning.
- ◆ User can define the function codes for inquiry and modification by themselves.

### ■ Multiple Function Code Encryption Modes (to Protect the Intellectual Property of the Customers)

- ◆ User can encrypt any group function codes by themselves.
- ◆ User can lock operation panel.
- ◆ User can set function parameter password protection.
- ◆ The technical secrets, such as system specific process parameters, cannot be copied.

### ■ User Self-defined Parameter Display Function

- ◆ User can choose the common parameters displayed by the operation panel and use to >> key switch such parameters.
- ◆ User can define the parameters displayed upon running and stopping respectively.
- ◆ User can define such parameters as pressure, temperature, flux and line speed.

### ■ User can Make Secondary Development

- ◆ Universal expansion port is provided as standard.
- ◆ Physical port SPI bus, software protocol Modbus.
- ◆ The ports provide +24V,  $\pm 15V$  and 5V power supply and two ways of A/D input.
- ◆ The CPU expansion scheme can realize PLC function.
- ◆ It supports the programming by user to realize process control.

### ■ Enhanced Function

- ◆ Settable software filtering time for the AI1, AI2 and AI3 analog input to enhance the anti-interference capacity.
- ◆ Independent multi-section modification can be made on the AI1, AI2 and AI3 analog input curve.
- ◆ Supporting the overload protection with motor temperature feedback.

## Safety Precautions

Description of safety marks:



Danger: The misuse may cause fire, severe injury, even death.



Note: The misuse may cause medium or minor injury and equipment damage.

### ■ Use



- This series synchronous servo driver is used to control the 3-phase (single phase) permanent magnetic synchronous motor (PMSM), cannot be used for single-phase motor or other applications. Otherwise, driver failure or fire may happen.
- This series of driver cannot be simply used in the applications directly related to the human safety, such as the medical equipment.
- This series of driver is produced under strict quality management system. If the driver failure may cause severe accident or loss, safety measures, such as redundancy or bypass, shall be taken.

### ■ Installation



- When handling and installing the driver, please hold the driver bottom. Do not hold the enclosure only. Otherwise, your feet may be injured and the driver may be damaged because of dropping.
- The driver shall be mounted on the fire retardant surface, such as metal, and kept far away from the inflammables and heat source.
- Keep the drilling scraps from falling into the driver during the installation; otherwise, driver failure may be caused.
- When the driver is installed inside the cabinet, the electricity control cabinet shall be equipped with fan and ventilation port. And ducts for heat dissipation shall be constructed in the cabinet.
- If the unit is installed in an erosive site, please use liquid cooling driver and take anti erosion measures and seal the cabinet door.

## ■ Wiring



- The wiring must be conducted by qualified electricians. Otherwise, electric shock may happen or driver damage.
- Before wiring, confirm that the power supply is disconnected. Otherwise, electric shock may happen or fire.
- The PE terminal must be reliably grounded, and should use the third grounding method for grounding the PMSM motor at equal voltage potential, otherwise, the driver enclosure may become live.
- Please do not touch the main circuit terminals. The wires of the main circuit terminals must not contact the driver enclosure. Otherwise, electric shock may happen.
- The connecting terminals for the braking resistor are ②/B1 and B2. Please do not connect terminals other than these two. Otherwise, fire may be caused.
- The leakage current of the driver system is more than 3.5mA, and the specific value of the leakage current is determined by the operation/application conditions. The driver and the motor must be grounded to ensure the safety. Suitable leakage current protection device shall be used if a RCCB is used to avoid unnecessary tripping. Do not connect the PE of the driver to the N line otherwise electric shock may happen or the driver may be damaged.

## ■ Wiring



- The three-phase power supply cannot connect to output terminals U/T1, V/T2 and W/T3, otherwise, the driver will be damaged.
- It is forbidden to connect the driver output terminals to the capacitor or LC/RC noise filter with phase lead, otherwise, the internal components of the driver may be damaged.
- Please confirm that the power supply phases, rated voltage are consistent with those indicated by the nameplate, otherwise, the driver may be damaged.
- Do not perform dielectric strength test on the driver, otherwise, the driver may be damaged.
- The wires of the main circuit terminals and the wires of the control circuit terminals shall be laid separately or in a square-crossing mode, otherwise, the control signal may be interfered.
- The wires of the main circuit terminals shall adopt lugs with insulating sleeves.
- The sectional area of driver input and output cables should be selected according to the driver power. With the shielding layer and the pressure resistant 1000V cables.
- When the cables between the driver and the motor are longer than 100m, it is suggested to use output reactor to avoid the driver failure caused by the overcurrent of the distribution capacitor.
- For the application with big voltage fluctuation, an input reactor should be installed; For the application with strict EMC requirement, an input filter and input inductor with input impedance higher than 3.5% and DC reactor should be equipped.
- The driver equipped with a DC reactor must be connected with a DC reactor between the terminals of ① 1 and ② 2, otherwise the driver will not display after power on.

## ■ Operation



- Power supply can only be connected after the wiring is completed and the cover is installed. It is forbidden to remove the cover in live condition; otherwise, electric shock may happen.
- When auto failure reset function or restart function is enabled, isolation measures shall be taken for the mechanical equipment, otherwise, personal injury may be caused.
- When the driver is powered on, its terminals are still live even when it is in stop state. Do not touch the driver terminals; otherwise electric shock may happen.
- The failure and alarm signal can only be reset after the running command has been cut off. Otherwise, personal injury may be caused.



- Do not start or shut down the driver by switching on or off the power supply, otherwise, the driver may be damaged.
- Before operation, please confirm if the motor and equipment are in the normal use range, otherwise, the equipment may be damaged.
- The heatsink and the braking resistor have high temperature. Please do not touch such device; otherwise, you may be burnt.
- When using in some special machine, please use a mechanical interlock device.
- The phase rotation of output U/T1, V/T2 and W/T3 should be identical with that of the U, V and W of the motor, otherwise fault will occur.
- Please do not change the driver parameter randomly. Most of the factory settings of the driver can meet the operating requirement, and the user only needs to set some necessary parameters. Any random change of the parameter may cause the damage of the mechanical equipment.

## ■ Maintenance, Inspection



- In the power-on state, please do not touch the driver terminals; otherwise, electric shock may happen.
- If cover is to be removed, the power supply must be disconnected first.
- Wait for at least 10 minutes after power off or confirm that the CHARGE LED is off before maintenance and inspection to prevent the human injury caused by the residual voltage of the electrolytic capacitor in main circuit.
- The components shall be maintained, inspected or replaced by qualified electricians.

**Note**

- The circuit boards have large scale CMOS IC. Please do not touch the board to avoid the circuit board damage caused by ESD.

**■ Others****Danger**

- It is forbidden to modify the driver unauthorizedly; otherwise, human injury may be caused.

**■ Confirm the following when the goods arrives:**

Confirm the following when the goods arrive:

<b>Items to be confirmed</b>	<b>Method of confirming</b>
Whether the goods are the driver you ordered?	Check if the information in the nameplate is same with that in the order?
Whether there is any damage?	Check if the package and the unit are damaged in transportation?
Whether the fasteners become loosened?	If necessary, use a screwdriver or torque driver to check if the screws are tightened.

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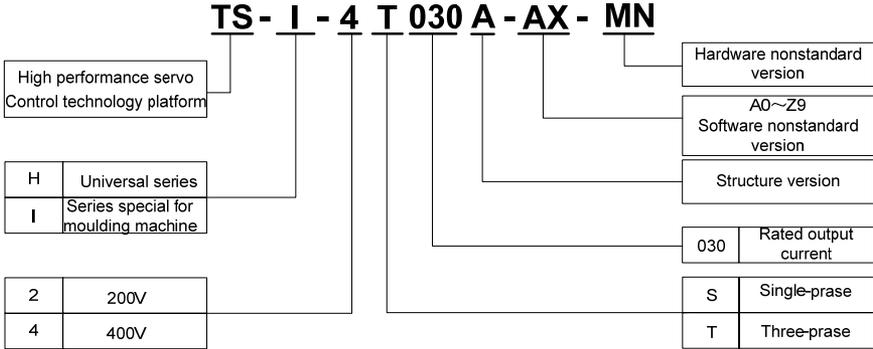
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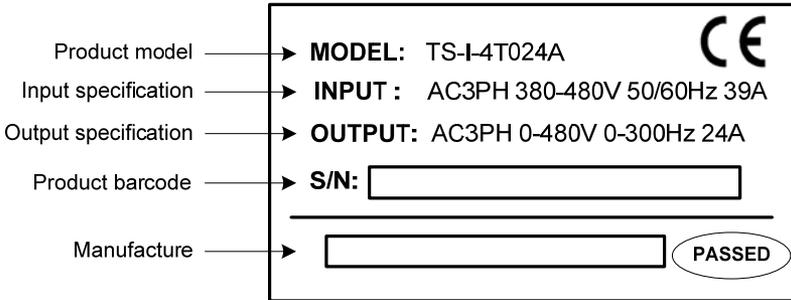
## Chapter 1 TS-I series servo drive is introduction

### 1.1 Product Model Description

The digits and letters in the driver model field on the nameplate indicate such information as the driver series, power supply class, power class and software/hardware versions.



### 1.2 Product Nameplate Description



## 1.3 A series of models and technical parameters of product

### Three-phase 400V Constant torque/heavy-duty application

servo driver model	The input voltage (V)	The power supply capacity (KVA)	The input current (A)	Output current (A)	Overload capacity
TS-I-4T009A	Three-phase AC380V 50Hz/60Hz  Allowable voltage range: 323V~528V  Voltage unbalance: ≤3%  Allow the frequency fluctuation: ±5%	5.77	10.3	9.0	150%le 1minutes; 180%le 10seconds; 200%le 0.5 seconds; An interval of 10 minutes (inverse time characteristic)
TS-I-4T013A		9.20	14.5	13.0	
TS-I-4T017A		12.12	20.8	17.0	
TS-I-4T024A		16.70	25.9	24.0	
TS-I-4T030A		21.58	35.6	30.0	
TS-I-4T039A		24.14	38.2	39.0	
TS-I-4T045A		30.12	46.7	45.0	
TS-I-4T060A		40.75	62.3	60.0	
TS-I-4T075A		47.85	75.9	75.0	
TS-I-4T091A		68.67	92.1	91.0	
TS-I-4T112A		83.75	113.6	112.0	
TS-I-4T150A		115.81	157.2	150.0	
TS-I-4T176A		122.97	160.0 *	176.0	
TS-I-4T210A		130.48	196.0 *	210.0	
TS-I-4T253A		182.42	232.0 *	253.0	
TS-I-4T304A	222.73	282.0 *	304.0		

\* TS-I-4T176A and above products are equipped with external DC reactor as standard.

Note: the special requirements of the occasion of some peripheral environment and the machine, should increase the level of power.

## 1.4 Product Component Name

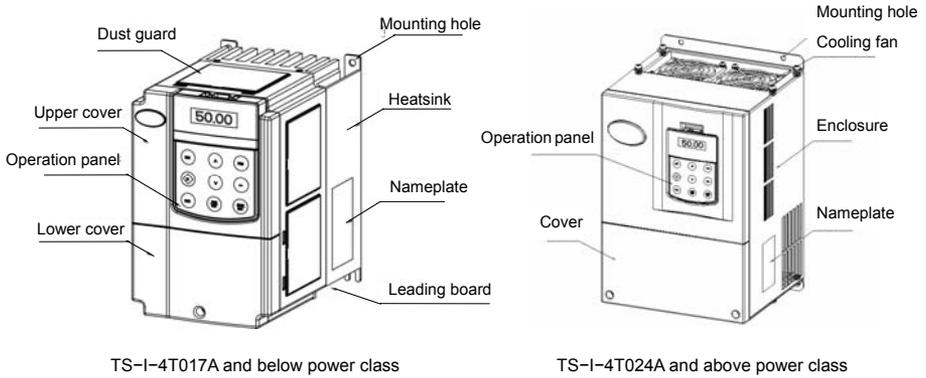


Figure 1-1 Product component name

## 1.5 Product Outline, Mounting Dimension, and Weight

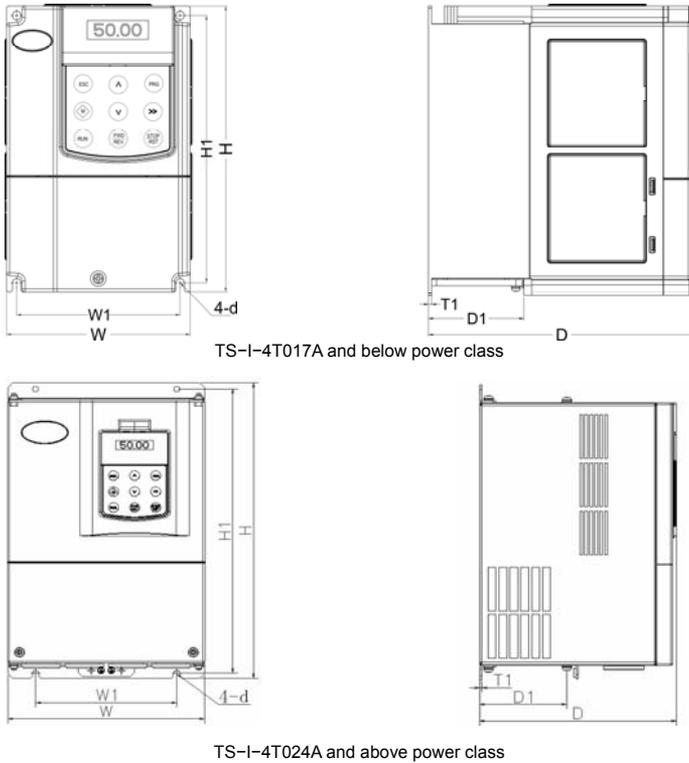


Figure 1-2 Product outline and mounting dimension

**Product outline, mounting dimension, and weight**

	servo driver model	Outline and mounting dimension (mm)								Approximate weight (kg)
		W	H	D	W1	H1	D1	T1	Mounting hole diameter	
Voltage class	TS-I-4T009A	118	190	167	105	173	60.5	4	5.5	2.6
	TS-I-4T013A	155	249	177	136	232	69	8	5.5	4.5
	TS-I-4T017A									
	TS-I-4T024A	210	337	200	150	324	88	2	7	8.5
	TS-I-4T030A									
	TS-I-4T039A	285	440	233	200	425	107.5	2.5	7	17
	TS-I-4T045A									
	TS-I-4T060A									
	TS-I-4T075A	315	575	248	220	553	123.5	2.5	10	25
	TS-I-4T091A									
	TS-I-4T112A	404	615	255	270	590	86.5	3.0	10	35
	TS-I-4T150A									
	TS-I-4T176A	465	745	325	343	715	151.5	3.0	12	55
	TS-I-4T210A									
	TS-I-4T253A	540	890	385	370	855	205.5	4.0	14	85
TS-I-4T304A										

## 1.6 Operation Panel Outline and Mounting Dimension

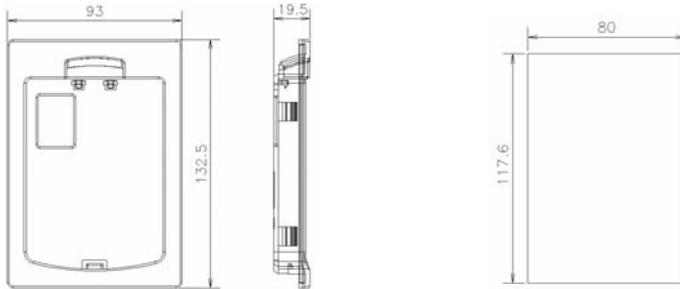


Button type operation panel (V6-DP02)

Rear view of operation panel

Figure 1-3 Operation panel outline and mounting dimension

V6-DP05 is the mounting pallet when the operation panel is to install on the electric control cabinet. The outline and dimension are as follows:



Pallet (V6-DP05)

Open pore dimension of pallet

Figure 1-4 Pallet outline and mounting dimension

## 1.7 Models of Braking Resistor

servo driver model	Braking unit	Braking resistor unit			
		Braking resistor power	Braking resistor	Qty.	Braking torque%
TS-I-4T009A	Built-in as standard	390W	150Ω	1	150
TS-I-4T013A		500W	100Ω	1	175
TS-I-4T017A		500W	75Ω	1	120
TS-I-4T024A		800W	50Ω	1	185
TS-I-4T030A		1000W	40Ω	1	200
TS-I-4T039A	Built-in as option	1300W	30Ω	1	200
TS-I-4T045A		1500W	25Ω	1	200
TS-I-4T060A		2500W	20Ω	1	150
TS-I-4T075A		3700W	15Ω	1	120
TS-I-4T091A		4500W	15Ω	1	180
TS-I-4T112A		5500W	10Ω	1	160
TS-I-4T150A		9600W	13.6Ω	2 and	180
TS-I-4T176A	External must match	9600W	13.6Ω	2 and	160
TS-I-4T210A		6000W	20Ω	3 and	200
TS-I-4T253A		6000W	20Ω	3 and	160
TS-I-4T304A		9600W	13.6Ω	4 and	180

## Chapter 2 Installation and connection of servo driver

### 2.1 Environment for Product Installation

- Do not install the driver in the sites with oil mist, metal powder and dust.
- Do not install the driver in the sites with hazardous gas and liquid, and corrosive, combustible and explosive gas.
- Do not install the drivers in salty sites.
- Do not install the driver in the sites with direct sunlight.
- Do not mount the driver on the combustible materials, such as wood.
- Keep the drilling scraps from falling into the driver during the installation.
- Mount the driver vertically in the electric control cabinet, mount the cooling fan or air conditioner to prevent the ambient temperature from rising to above 45 °C.
- For the sites with adverse environment, we recommend you install the heatsink outside of the cabinet or use the water cooled or liquid cooled driver.

### 2.2 Mounting Direction and Space

In order not to reduce the cooling effect of driver, the driver must be mounted vertically, and certain clearance must be maintained, as shown in Figure 2-1 and Figure 2-2.

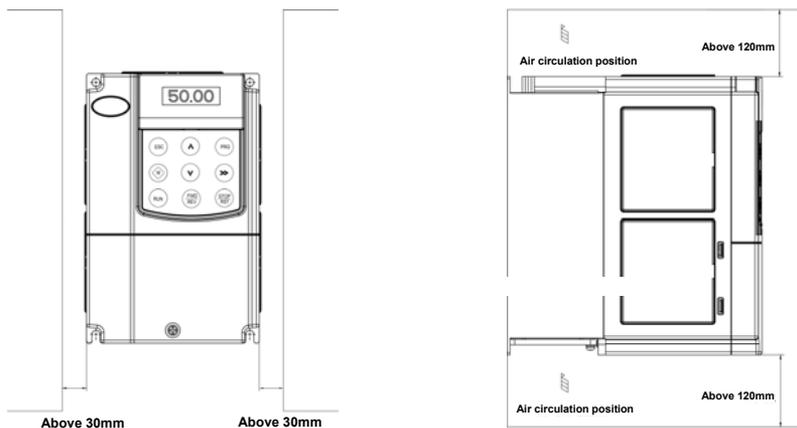


Figure 2-1 Mounting direction and clearance for TS-I-4T017A and below power class

#### Note:

When the TS-I-4T017A and below power class drivers are mounted side by side in the cabinet, please remove the upper dust filter and the lower leading board.

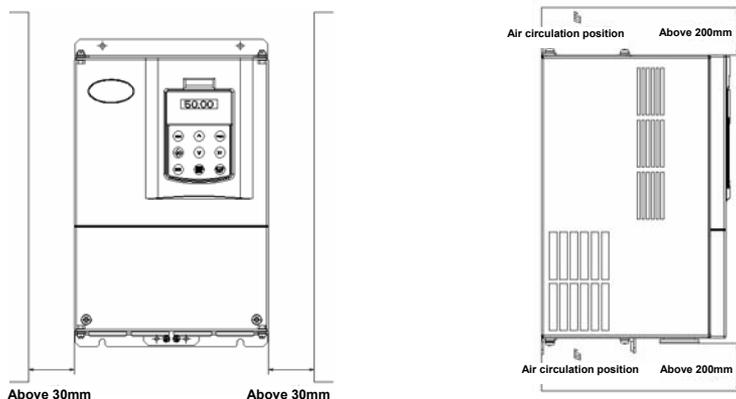


Figure 2-2 Mounting direction and space for V5-H-4T11G/15L and above power class

## 2.3 Removal and Mounting of Operation Panel and Cover

### 2.3.1 Removal and Mounting of Operation Panel

◆ Removal of operation panel

As shown in Figure 2-3, the grab the operation panel forcefully in direction 1, and then lift the panel body in direction 2.

◆ Mounting of operation panel

As shown in Figure 2-4, align with the lower clamping position of the operation panel in direction 1, and then press down the operation panel in direction 2, until the “crack” sound is heard. Do not mount the operation panel in any other direction; otherwise, the operation panel will have poor contact.

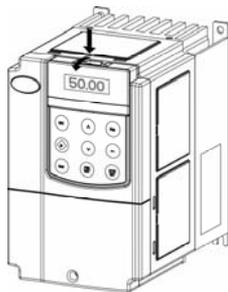


Figure 2-3 Removal of operation panel

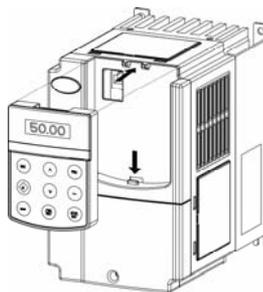


Figure 2-4 Mounting of operation panel

### 2.3.2 Removal and Mounting of Covers of Driver with Plastic Enclosure

◆ Removal of operation panel

Please refer to 2.3.1 removal and mounting of operation panel.

◆ Removal of lower cover

After removing the mounting screws of the cover, press the left and right sides of the cover forcefully

in direction 1 and at the same time lift the cover in direction 2, as shown in Figure 2-5.

◆ Removal of upper cover

As shown in Figure 2-6, press the left and right sides of the cover forcefully in direction 1, and at the same time lift the cover in direction 2.

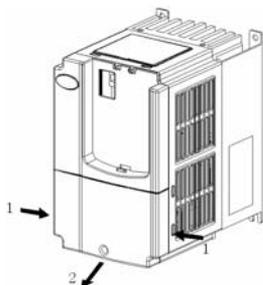


Figure 2-5 Removal of lower cover

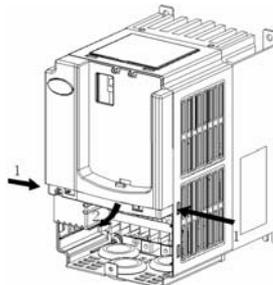


Figure 2-6 Removal of upper cover

◆ Mounting of upper cover

After connecting the cables of main circuit terminals and control circuit terminals, insert the upper claw grab of the upper cover into the groove of the driver body, as shown in position 1 in Figure 2-7, and then press the lower part of the upper cover in direction 2 as shown in Figure 2-7, until the “crack” sound is heard.

◆ Mounting of lower cover

Insert the upper claw grab of the lower cover into the groove of the upper cover, as shown in position 1 of Figure 2-8, and then press the lower part of the lower cover in direction 2 of Figure 2-8, until the “crack” sound is heard. Now, tighten the cover screws.

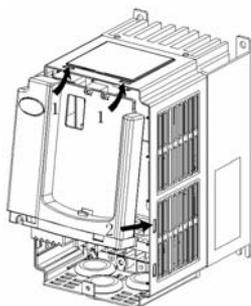


Figure 2-7 Mounting of upper cover

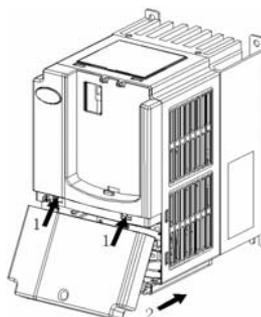


Figure 2-8 Mounting of lower cover

◆ Mounting of operation panel

Please refer to 2.3.1 Removal and mounting of operation panel.

### 2.3.3 Removal and Mounting of Covers of TS-I-4T024A~TS-I-4T150A and Above Power Class Driver with Sheet-metal Enclosure

◆ Removal of operation panel

Please refer to 2.3.1 Removal and mounting of operation panel.

◆ Removal of cover

Remove the mounting screws on the lower part of the cover, lift the cover in direction 1 as shown in

Figure 2-9, and then take out the cover in direction 2.

◆ Mounting of cover

After connecting the cables of main circuit terminals and control circuit terminals, cramp the cover in direction 1 as shown in Figure 2-10, press down the cover in direction 2 and then tighten the cover screws.

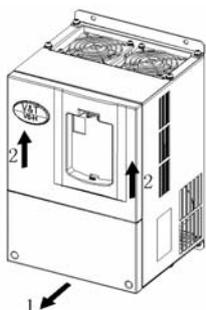


Figure 2-9 Removal of cover

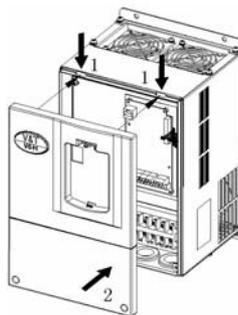


Figure 2-10 Mounting of cover

◆ Mounting of operation panel

Please refer to 2.3.1 Removal and mounting of operation panel.



Note:

Do not directly mount the cover with operation panel on the driver, otherwise, the operation panel will have poor contact.

### 2.3.4 Open and Close of Doors of TS-I-4T176A and Above Power Class Driver with Sheet-metal Enclosure

◆ Opening of the door

Press the latch following direction 1 in Figure 2-11 and open the door following direction 2.

◆ Removal of operation panel

The operation panel is connected to the control board through the standard network cable and will not interfere with the open/close of the door. To remove the operation panel, refer to section 2.3.1 Removal and Mounting of Operation Panel

◆ Mounting of cover

After connecting the cables of main circuit terminals and control circuit terminals, close the door following direction 1 in Figure 2-12, and then press down the latch following direction 2 to lock the door.

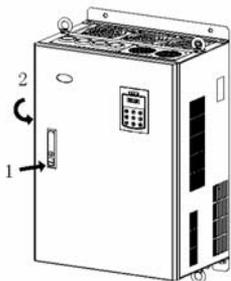


Figure 2-11 opening the door

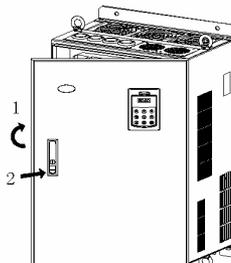


Figure 2-12 closing the door

## 2.4 Connection of the driver and Peripheral Devices

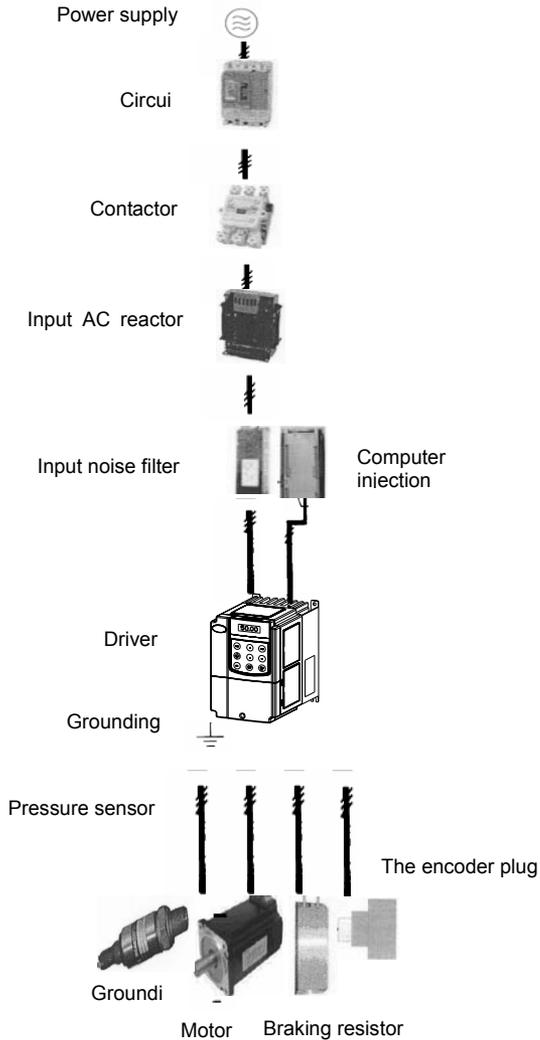


Figure 2-13 Connection diagram of the driver and peripheral devices

## 2.5 Description of Peripheral Devices for Main Circuit

Circuit breaker	The circuit breaker capacity shall be 1.5 ~ 2 times of the driver rated current. The time features of the circuit breaker shall fully consider the time features of the driver overload protection.
RCCB	Because the driver output is the high-frequency pulse, there will be high-frequency leakage current. Special RCCB shall be used when installing RCCB at the driver input side. It is suggested that B type RCCB be used, and the leakage current value shall be set to 300mA.
Contactor	Frequent contactor tripping will cause driver failure, so the highest frequency for contactor tripping shall not exceed 10 times/min. When a braking resistor is used, to avoid the overtemperature damage of the braking resistor, a thermal protection relay with braking resistor overtemperature detection shall be installed to disconnect the contactor at the contact control power side of the thermal protection relay.
Input AC reactor or DC reactor	<ol style="list-style-type: none"> <li>1. The driver power supply capacity is more than 600kVA or 10 times of the driver capacity.</li> <li>2. If there is switch type reactive-load compensation capacitor or load with silicon control at the same power node, there will be high peak current flowing into input power circuit, which damages the rectifier components.</li> <li>3. When the voltage imbalance of the three-phase power supply of the driver exceeds 3%, the rectifier component will be damaged.</li> <li>4. It is required that the input power factor of the driver shall be higher than 90%.</li> </ol> When the above situations occur, install the AC reactor at the driver input side or DC reactor to the DC reactor terminal.
Input noise filter	The noise input from the power end to the driver and output from the driver to the power end can be reduced.
Thermal protection relay	Although the driver has motor overload protection function, when one driver drives two or more motors or multi-pole motors, to prevent the motor overtemperature failure, a thermal protection relay shall be installed between the driver and each motor, and the motor overload protection parameter P9.16 shall be set to "2" (motor protection disabled).
Output noise filter	When the output of the driver is connected with noise filter, the conduction and radiation interference can be reduced.
Output AC reactor	When the cable connecting the driver and the motor is longer than 100m, it is suggested to install AC output reactor to suppress the high-frequency oscillation to avoid damaging motor insulation, large leakage current and frequent driver protective action.

## 2.6 Models of Main Circuit Peripheral Devices

Drive model	Circuit Breaker (A)	Contact (A)	R/L1、S/L2、T/L3、⊕1、⊕2/B1、B2、⊖、U/T1、V/T2、W/T3			PE terminal ⊕		
			Terminal screw	Tightening torque (N·m)	Wire specification (mm <sup>2</sup> )	Terminal screw	Tightening torque (N·m)	Wire specification (mm <sup>2</sup> )
TS-I-4T009A	25	16	M4	1.2~1.5	4	M4	1.2~1.5	4
TS-I-4T013A	32	25	M4	1.2~1.5	6	M4	1.2~1.5	6
TS-I-4T017A	40	32	M4	1.2~1.5	6	M4	1.2~1.5	6
TS-I-4T024A	63	40	M5	2.5~3.0	6	M5	2.5~3.0	6
TS-I-4T030A	63	63	M5	2.5~3.0	6	M5	2.5~3.0	6
TS-I-4T039A	100	63	M6	4.0~5.0	10	M6	4.0~5.0	10
TS-I-4T045A	100	100	M6	4.0~5.0	16	M6	4.0~5.0	16
TS-I-4T060A	125	100	M6	4.0~5.0	25	M6	4.0~5.0	16
TS-I-4T075A	160	100	M8	9.0~10.0	25	M8	9.0~10.0	16
TS-I-4T091A	200	125	M8	9.0~10.0	35	M8	9.0~10.0	16
TS-I-4T112A	315	250	M10	17.6~22.5	50	M10	14.0~15.0	25
TS-I-4T150A	350	330	M10	17.6~22.5	60	M10	14.0~15.0	35
TS-I-4T176A	315	250	M10	17.6~22.5	70	M10	14.0~15.0	35
TS-I-4T253A	400	330	M12	31.4~39.2	150	M12	17.6~22.5	75
TS-I-4T304A	500	400	M12	31.4~39.2	185	M12	17.6~22.5	50×2

## 2.7 Functions of Main Circuit Terminal

### 2.7.1 TS-I-4T030A And the following

R/L1	S/L2	T/L3	⊕1	⊕2/B1	B2	⊖	U/T1	V/T2	W/T3
POWER			OPTION			MOTOR			



Terminal symbol	Terminal name and function description
R/L1、S/L2、T/L3	Three-phase AC input terminal
⊕1、⊕2/B1	DC reactor connecting terminal, short circuited with copper bus upon delivery
⊕2/B1、B2	Connecting terminal of braking resistor
⊕2/B1、⊖	DC power input terminal; DC input terminal of external braking unit
U/T1、V/T2、W/T3	Three-phase AC output terminal
⊕	PE terminal

### 2.7.2 Internal Braking Unit Option for TS-I-4T039A~TS-I-4T150A

R/L1	S/L2	T/L3	B1	B2	⊖	U/T1	V/T2	W/T3
POWER			OPTION		MOTOR			



Terminal symbol	Terminal name and function description
R/L1、S/L2、T/L3	Three-phase AC input terminal
B1、⊖*	DC reactor connecting terminala *
B1、B2*	Connecting terminal of braking resistor *
U/T1、V/T2、W/T3	Three-phase AC output terminal
⊕	PE terminal

Note: \*The driver equipped with braking unit as standard can realized shared DC bus and braking function, if needed connect DC reactor and braking function should contact factory, and the terminal of main circuit B1、B2、⊖ should change to ⊕1、⊕2/B1、B2.

### 2.7.3 TS-I-4T176A~TS-I-4T304A The built-in braking unit options

The drive of TS-I-4T176~TS-I-4T304 adopt the top cable-inlet bottom cable-outlet wiring mode.



Sketch Map

Terminal symbol	Terminal name and function description
R/L1、S/L2、T/L3	Three-phase AC input terminal
⊕1、⊕2	DC reactor connecting terminal, if don't connect DC reactor, the driver will
⊕2、⊖	DC power input terminal; DC output terminal of external braking unit
U/T1、V/T2、W/T3	Three-phase AC output terminal
⊕	PE terminal

## 2.8 Attention for Main Circuit Wiring

### 2.8.1 Power Supply Wiring

- ◆ It is forbidden to connect the power cable to the driver output terminal, otherwise, the internal components of the driver will be damaged.
- ◆ The driver shall connect to the power supply through a circuit breaker or RCCB and contactor to protect the driver input against over current or disconnect the input power for maintenance.
- ◆ Please confirm that the power supply phases and rated voltage are consistent with that of the nameplate, otherwise, the driver may be damaged.

### 2.8.2 Motor Wiring

- ◆ It is forbidden to short circuit or ground the driver output terminal, otherwise the internal components of the driver will be damaged.
- ◆ Avoid short circuit the output cable and the driver enclosure, otherwise electric shock may happen.
- ◆ It is forbidden to connect the driver output terminals to the capacitor or LC/RC noise filter with phase lead, otherwise, the internal components of the driver may be damaged.
- ◆ When contactor is installed between the driver and the motor, it is forbidden to switch on/off the contactor when the driver is running, otherwise, large current will flow into the driver, triggering the driver protection action.
- ◆ Length of cable between the driver and motor
- ◆ If the cable between the driver and the motor is too long, the high-order harmonic leakage current of the output end will cause adverse impact on the driver and the peripheral devices. Output AC reactor

should be installed if the motor cable is longer than 100m. Refer to the following table for the carrier frequency setting.

Length of cable between the driver and motor	Less than 50m	Less than 100 m	More than 100m
Carrier frequency (PA.00)	Less than 15kHz	Less than 10kHz	Less than 5kHz

### 2.8.3 Grounding Wiring

- ◆ The drive will produce leakage current. The higher the carrier frequency is, the larger the leakage current will be. The leakage current of the driver system is more than 3.5mA, and the specific value of the leakage current is determined by the application conditions. To ensure the safety, the driver and the motor must be grounded.
- ◆ The grounding resistance shall be less than 10ohm. For the grounding wire diameter requirement, refer to 3.3 Models of main circuit peripheral devices.
- ◆ Do not share grounding wire with the welding machine and other power equipment.
- ◆ In the applications with more than 2 drivers, keep the grounding wire from forming a loop.

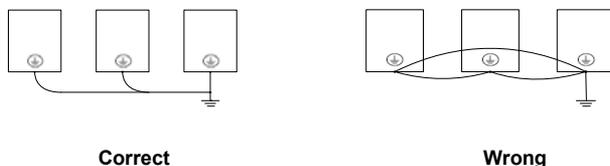


Figure 2-14 Grounding wiring

### 2.8.4 Countermeasures for Conduction and Radiation Interference

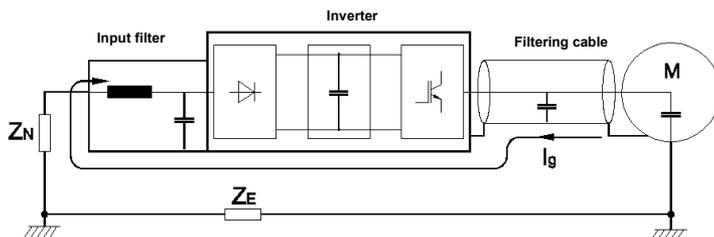


Figure 2-15 Noise current illustration

- ◆ When the input noise filter is installed, the wire connecting the filter to the driver input power terminals shall be as short as possible.
- ◆ The filter enclosure and mounting cabinet shall be reliably connected in large area to reduce the back flow impedance of the noise current  $I_g$ .
- ◆ The wire connecting the driver and the motor shall be as short as possible. The motor cable adopts 4-core cable, with the grounding end grounded at the driver side, the other end connected to the motor enclosure. The motor cable shall be sleeved into the metal tube.

- ◆ The input power wire and output motor wire shall be kept away from each other as long as possible.
- ◆ The equipment and signal cables vulnerable to EMI shall be kept far away from the driver.
- ◆ Key signal cables shall adopt shielded cable. It is suggested that the shielded layer shall be grounded with 360-degree grounding method and sleeved into the metal tube. The signal cable shall be kept far away from the driver input wire and output motor wire. If the signal cable must cross the input wire and output motor wire, they shall be kept orthogonal.
- ◆ When analog voltage and current signals are adopted for remote frequency setting, shielded twisted pair cable shall be used. The shielded layer shall be connected to the PE terminal of the driver, and the signal cable shall be no longer than 50m.
- ◆ The wires of the control circuit terminals RA/RB/RC and other control circuit terminals shall be separately routed.
- ◆ It is forbidden to short circuit the shielded layer and other signal cables or equipment.
- ◆ When the driver is connected to the inductive load equipment (e.g. electromagnetic contactor, relay and solenoid valve), surge suppressor must be installed on the load equipment coil, as shown in Figure 2-16.

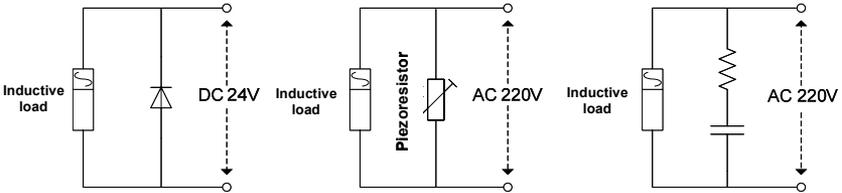
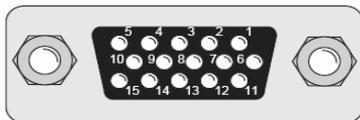


Figure 2-16 Application of inductive load surge suppressor

## 2.9 Connection of rotating PG and temperature sensor cable of the motor

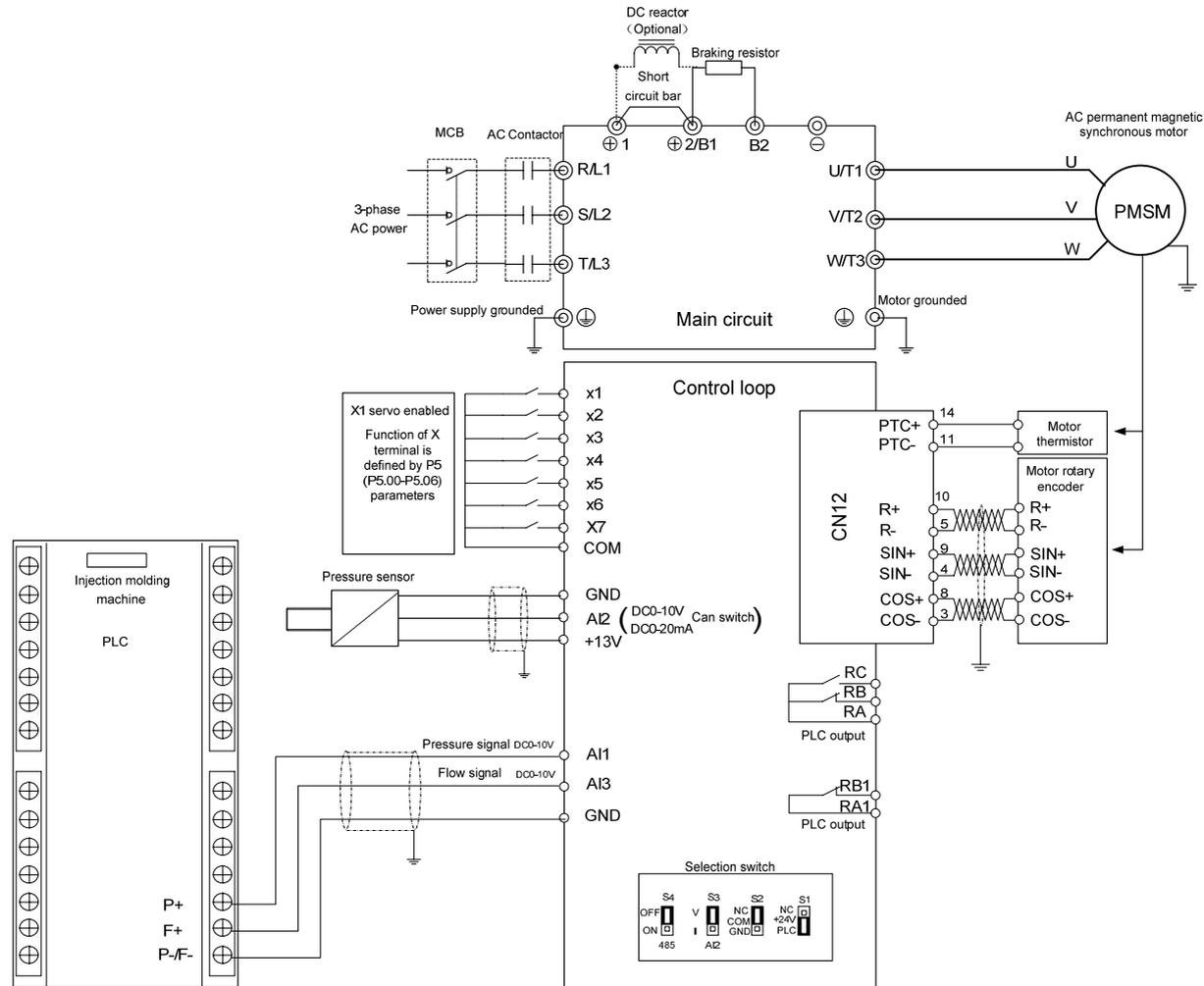
### 2.9.1 Appearance of connection terminal



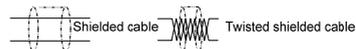
### 2.9.2 Defintion of pins and illustration drawing

Pin	Name	Description of function	Definition of pins
3	COS-	Rotating COSINE feedback signal	
8	COS+		
4	SIN-	Rotating SINE feedback signal	
9	SIN+		
5	REF-(EXC-)	Rotating excitation signal	
10	REF+(EXC+)		
11	PTC130-	Internal temperature sensing resistor of the motor	
14	PTC130+		
1	KTY84-130-	Internal temperature sensing resistor of the motor (optional)	
6	KTY84-130+		

## 2.10 The main circuit and the control terminal of a circuit wiring diagram



Note: If the PLC output analog values of pressure and flow are current signals, please use a IW conversion board.



(With TS-I-4T030A as an example)

## 2.11 The control circuit terminal function

Type	Terminal symbol	Terminal function description	Technical specification
485 and CAN Dispatch terminal	485+	Positive end of RS485 differential signal	Rate: 4800/9600/19200/38400/57600bps Up to 32 sets of equipment can be paralleled*. Relay shall be used if the number exceeds 32. Maximum distance: 500m (adopt standard twisted shielded cable)
	485-	Negative end of RS485 differential signal	
	GND	Shielding grounding of RS485 communication	Internal isolated with COM
	CANH	CAN Communication terminal	The highest rate of 1Mbps
	CANL	CAN Communication terminal	
	GND	CAN The communication of the shielding and grounding	Internal isolated with GND
The operation panel 485	CN11	RS485 port of operation panel	When used for communication connection with host computer, it is the same as RS485 terminal.
			The maximum distance is 15m for the communication connection of operation panel (adopt standard twisted non-shielded network cable)
Digital input	X1	Servo function enabled  See P5.01 ~ P5.06 Parameter setting	Input specification: 24VDC, 5mA Frequency range: 0~200Hz Voltage range: 24VDC±20% Pulse input: 0.1~50KHz
	X2		
	X3		
	X4		
	X5		
	X6		
	X7		
Analog input	+13V	Pressure sensor power supply	10V ±3%, internal isolated with COM, Maximum output current: 10mA, with short circuit and overload protection
	+10V	Analog input reference voltage	10V ±3%, isolated from COM internally Max output current: 10mA, with short circuit and overload protection
	A11	Analog input channel 1 (pressure reference channel)	0~20mA: 500Ω input resistance, 30mA max input current 0~10V: 20kΩ input resistance, 15V max input voltage 12-bit resolution (0.025%) Select 0~20mA or 0~10V analog input via jumper
	A12	Analog input channel 2 (pressure feedback channel)	Same as A11
	A13	Analog input channel 3 (flow reference channel)	-10V~10V: 20kΩ input resistance 12-bit resolution (0.025%) ±15V max input voltage
	GND	Analog ground	isolated from COM internally
Analog output	AO1	Analog output 1	0~20mA: Permitted output impedance: 200~500Ω 0~10V: Permitted output impedance ≥10kΩ Output precision: 2%, 10-bit resolution (0.1%) With short circuit protection Select 0~20mA or 0~10V analog input via jumper
	AO2	Analog output 2	Same as AO1
	GND	Analog ground	isolated from COM internally

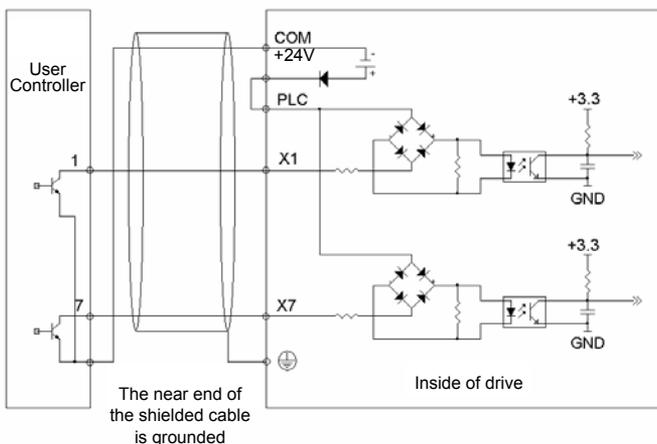
Relay output 1	RA/RB/RC	Relay output	RA-RB: NC RA-RC: NO Contact capacity: 250VAC/1A, 30VDC/1A
Relay output 2	RA1/RB1	Relay output	RA-RB: NC Contact capacity: 250VAC/1A, 30VDC/1A

**Note:**

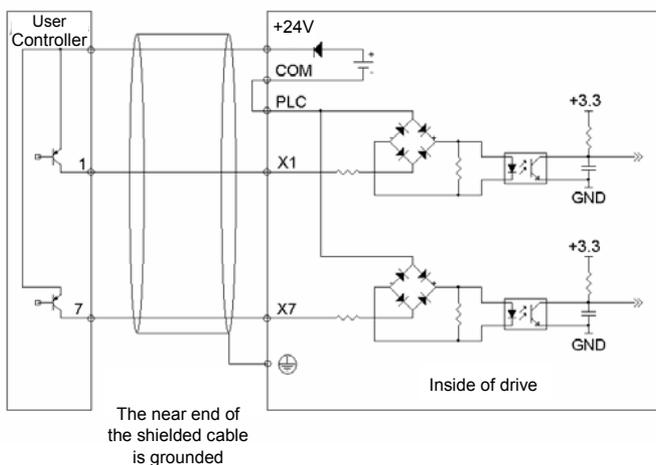
\* If the user connects adjustable potentiometer between +10V and GND, the resistance of the potentiometer shall be no less than 5kΩ,

1. Wiring mode of the multi-functional input/output terminals

- When the internal +24V power supply of the drive is used, the external controller adopts NPN sink current wiring mode.

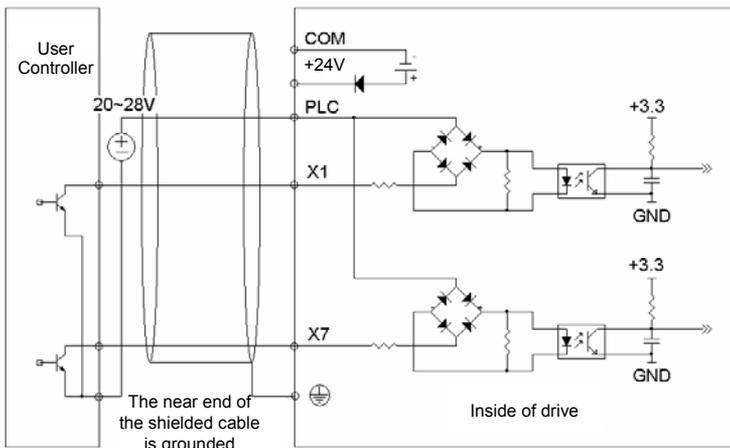


- When the internal +24V power supply of the drive is used, the external controller adopts PNP draw-off current wiring mode.



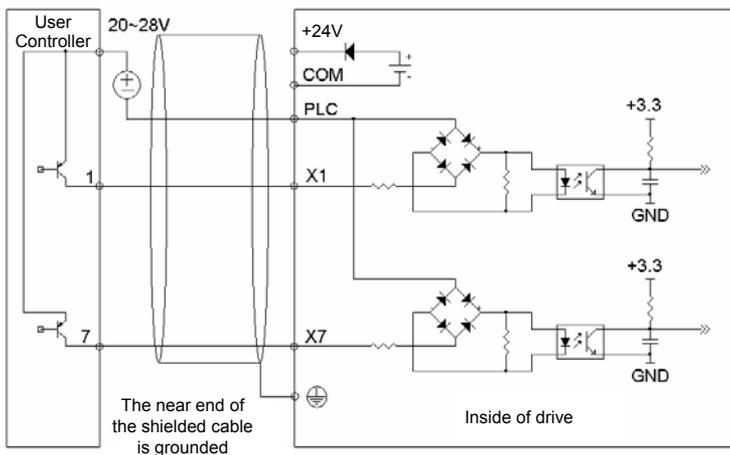
**Note:** The short circuit bar between terminal +24V and terminal PLC must be removed and short circuit bar shall be connected between PLC and COM terminals.

- When the external power supply is used, the external controller adopts NPN sink current wiring mode.



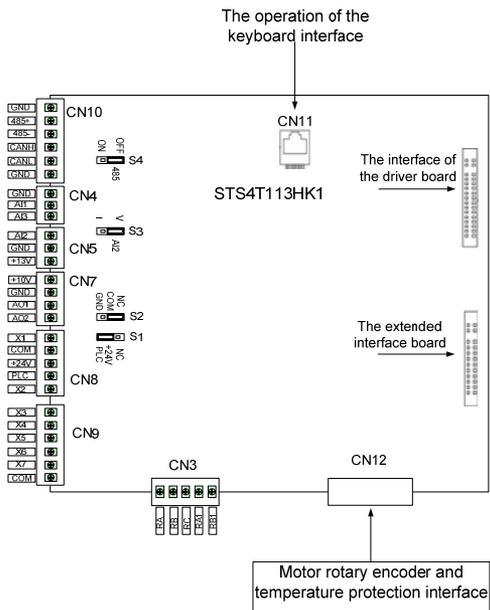
**Note:** The short circuit bar between terminal +24V and terminal PLC must be removed.

- When the external power supply is used, the external controller adopts PNP draw-off current wiring mode.



**Note:** The short circuit bar between terminal +24V and terminal PLC must be removed.

## 2.12 Schematic Diagram of Control Board

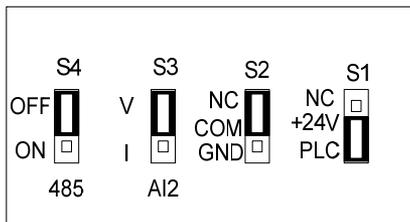


## 2.13 Descriptions of Control Circuit Terminals

Terminal number	Terminal screw	Tightening torque (N·m)	Wire specification mm <sup>2</sup>	Wire type
+10V、+13V、AI1、AI2、AI3、CANH、CANL、485+、485-、AO1、AO2、GND、	M3	0.5~0.6	0.75	Shielded twisted pair cable
+24V、PLC、X1、X2、X3、X4、X5、X6、X7、COM、RA、RB、RC、RA1、RB1	M3	0.5~0.6	0.75	Shielded cable

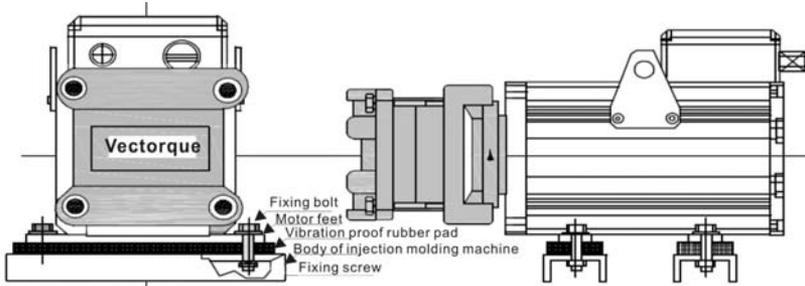
## 2.14 Description of Jumper Function

Jumper control panel select switch:

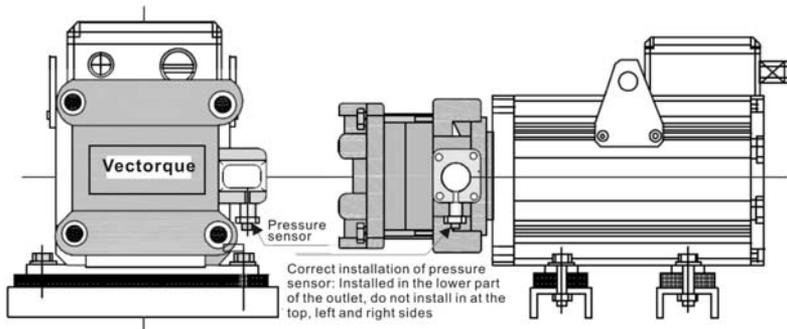


Name	Function	Leave-factory setting
S4	RS485 terminal resistor selection: ON: there is 100Ω terminal resistor, OFF: there is no terminal resistor	There is no terminal resistor
S3	AI2 selection mode: I is the current input (0~20mA), V is the voltage input(0~10V)	0~10V voltage input
S2	Connection of analog ground or digital ground: NC-COM does not share the ground, COM-GND shares the ground	NC-COM does not share the ground
S1	Power supply via digital terminal: NC-+24V external power supply, +24V-PLC internal power supply	+24V-PLC internal power supply

## 2.15 Cautions for installing servo motor and pressure sensor



**Installation method of servo motor**



**Installation method of pressure sensor**

## Chapter 3 Digital actuator button, display and motor learning

### 3.1 Introduction to Operation Panel



Figure 3-1 Display unit of operation panel

### 3.2 Descriptions of Indicators

Symbol of Indicator	Name	Meanings	Color	
Unit indicator	Hz	Motor speed	On: Actual motor speed is displayed	Green
			Blinking: Motor speed setting is displayed	
	A	Current indicator	On: Current displayed parameter is current	Green
	V	DC voltage	On: DC bus voltage of the driver is displayed	Green
	Hz+A	Setting pressure	Blinking: Setting pressure is displayed	Green
	Hz+V	Setting speed	On: Setting speed is displayed	Green
	Hz+A	Feedback pressure	On: Actual pressure is displayed	Green
	MON	Method of issuing running command	On: Servo is enabled via panel	Red
			Off: Servo is enabled via terminal	
			Blinking: Servo is enabled via host computer	
	RUN	Running status indicating	On: Servo driver is running	Red
Off: Servo driver is stopped				
Blinking: Servo driver is stopping				
FWD	Running forward	On: Servo driver is running	Red	
		Off: Servo driver fails		
		Blinking: Servo driver is identifying motor parameters		
REV	No function	On: Servo driver is discharging pressure	Red	

### 3.3 Descriptions of Indicators

Symbol	Name	Function
Key-type		
	Programmin g key PRG	<ol style="list-style-type: none"> <li>1、 Enter each level of menu</li> <li>2、 Validate data change</li> <li>3、 Check function code in sequence</li> <li>4、 Confirm the Running command issuing mode with <b>M</b> key</li> </ol>
	Escape Key ESC	<ol style="list-style-type: none"> <li>1、 Back to first level menu from second level menu; Back from first level menu to standby status, running status, and fault status</li> <li>2、 Give up data change after modifying data.</li> <li>3、 Back to basic menu mode after pressing this key for more than 5s. Refer to 4.4.3. When LCD cannot display all the function codes, use this method to re-display all the function codes.</li> <li>4、 After using <b>&gt;&gt;</b> key to switch from fault display to Stop / Run parameter display, press <b>ESC</b> to back to fault display status.</li> </ol>
	Increase Key ▲	<ol style="list-style-type: none"> <li>5、 In first level menu, increase function code according to edit bit.</li> <li>6、 In second level menu, increase the function code data.</li> </ol>
	Decrease Key ▼	<ol style="list-style-type: none"> <li>7、 In first level menu, decrease function code according to edit bit.</li> <li>8、 In second level menu, decrease the function code data.</li> </ol>
	Shift Key >>	<ol style="list-style-type: none"> <li>1、 In first level menu, use <b>&gt;&gt;</b> key to move edit bit of PX.YZ menu</li> <li>2、 In second level menu, use <b>&gt;&gt;</b> key to move the edit bit of data</li> <li>3、 In stop/run status, switch the panel display parameters such as frequency, current and voltage.</li> <li>4、 In fault status, change from fault display to stop/run display.</li> </ol>
	Run Key RUN	<ol style="list-style-type: none"> <li>1、 When running command is given via operation panel, press the key to start the drive.</li> <li>2、 After setting the parameter auto tuning,start parameter auto tuning for drive startup</li> </ol>
	Stop/Reset Key STOP/RST	<ol style="list-style-type: none"> <li>1、 When running command is given via operation panel, press the key to stop the drive.</li> <li>2、 This key is used as a stop key when drive only has fault alarm but does not stop.</li> <li>3、 When the drive has fault and has stopped, this key is used as RESET key to clear the fault alarm.</li> </ol>
	Multi-functio n Key <b>M</b>	Trial operation keys
	Forward/reve rse Key FWD/REV	Function

### 3.4 Menu Style

The menu style is 2-level menu.

#### 3.4.1 Format of First Level Menu

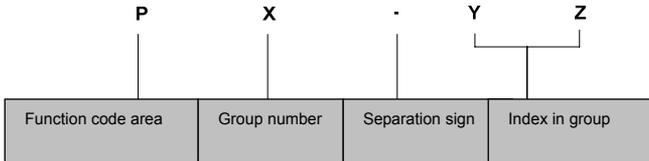
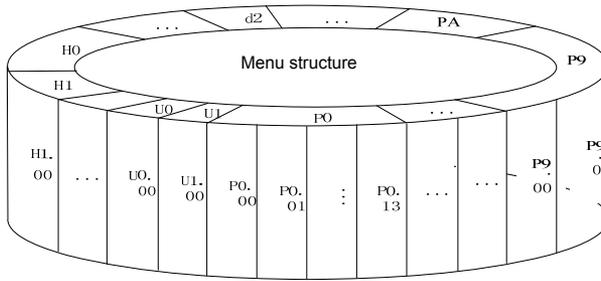


Figure 3-2 Format of first level menu

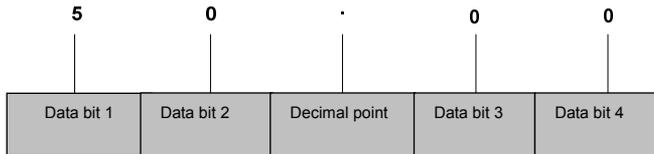
◆ Dividing the first level menu

Password action area	Function code area	Group number in area	Function code range
Protection area of user password P0.00	User operation area (P area)	P0 group	P0.00~P0.13
		P1 group	P1.00~P1.10
		P2 group	P2.00~P2.07
		P3 group	P3.00~P3.10
		P4 group	P4.00~P4.11
		P5 group	P5.00~P5.07
		P6 group	P6.00~P6.10
		P7 group	P7.00~P7.10
		P8 group	P8.00~P8.20
		P9 group	P9.00~P9.25
		PA group	PA.00~PA..08
		Pb group	Pb.00~Pb.23
		PC group	PC.00~PC.07
		Pd group	Pd.00~Pd.11
		H0 group	H0.00~H0.17
H1 group	H1.00~H1.10		
	Equipment status area (d area)	d0 group	d0.00~d0.11
		d1 group	d1.00~d1.11
		d2 group	d2.00~d2.24
A0.00 protection area	Function code display/hidden area defined by user (A area)	A0 group	A0.00 ~ A0.02
C0.00 reserved area	Reserved (C area)	Reserved parameter area	Reserved
U0.00 reserved area	Reserved (U0 area)	Reserved parameter area	Reserved
U1.00 reserved area	Reserved (U1 area)	Reserved parameter area	Reserved

◆ Structure of first level menu



3.4.2 Format of Second Level Menu



◆ Format of display/set for second level menu

Display/set decimal:

From data bit 1 to 4, the characters of 0, 1.....9 can be displayed or set.

When displayed data >9999, the last bit will be omitted:

For example: When data is 12345, operation panel displays “1234”.

When data is 1234.5, operation panel displays “1234”.

When data is 123.45, operation panel displays “123.4”.

When data is 12.345, operation panel displays “12.34”.

Display/set hex code:

From data bit 1 to 4, the characters of 0, 1.....9, A, B, C, D, E and F can be displayed or set.

◆ Meanings of 0. 0. 0. 0. displayed in second level menu

After entering second level menu, besides the displayed data, there are also 4 dots, this means the password protection and you need to enter the password. The function codes that require password validation are P0.00、A0.00、C0.00、U0.00、U1.00. C area, U0 area and U1 area are factory reserved parameter area.

### 3.4.3 Menu Mode

Menu mode setting (P0.02)	Menu mode name	Visible function code range	Operation panel display
0	Basic menu	See 5.1 for the table of basic menu function code parameter	bASE
1	Fast menu	Quickly display the menu function codes in common use	FASt
2	Non-factory setting function code menu	Only display the function codes different from the leave-factory values	ndFt
3	Menu of last changed 10 function codes	Display the last changed 10 function codes and P0.02	LASt

#### ◆ Basic menu bASE

Basic menu includes all the function codes mentioned in this user manual. Except for the special descriptions, all the descriptions of this manual are in this menu mode. See 5.1 for the table of basic menu function code parameter.

#### ◆ Fast menu FASt

Fast menu includes some common function codes and you can start the drive by setting only a few function codes so as to realize the fast application. See 5.2 for the table of fast menu function code parameter.

#### ◆ Non-factory setting function code menu ndFt

This menu mode is used to search for the function codes different from the leave-factory values for the convenience of understanding the parameter setting.

#### ◆ Menu of last changed 10 function codes LASt

If this menu mode is set, it enters password protection status. Only P0.00 and C0.00 can be viewed. The recently changed function codes, P0.00 and P0.02 can be viewed only when correct password is entered into P0.00.

#### ◆ Method of back to basic menu

1. By editing the function code: Set P0.02=0, then the menu returns to basic menu mode after bASE is displayed.
2. By pressing **ESC** for a long time: Press **ESC** and do not release it for more than 5s, then the menu returns to basic menu mode after bASE is displayed. If bASE is not displayed, this means the menu is already in basic menu mode.

### 3.4.4 Common Characters Displayed by LED

Except the function codes in first and second level menus, the operation panel will also display the following characters as shown in the following table:

Prompt symbol	Meaning	Prompt symbol	Meaning
8.8.8.8.	Instantaneous display of drive when drive is powered on	LInE	Communication of operating panel fails
-LU-	Drive shutdown due to under voltage	LoAd	Drive parameters are being copied and this symbol will be displayed when parameters are uploaded to operation panel. For example, set Pb.23=1
-dc-	Drive is in DC braking status	Loc1	Operation panel is locked and the keys are disabled
-At-	Drive is in auto tuning	Loc2	Except <b>M</b> key, other keys are locked
bASE	Basic menu (P0.02=0)	Loc3	Except <b>RUN</b> and <b>STOP/RST</b> keys, other keys are locked
CoPy	Drive parameters are being downloaded and this symbol will be displayed when parameters are downloaded to drive. For example, set Pb.23=2 or 3	ndFt	Non factory setting of function code (P0.02=2)
dEFt	Restore to factory settings (P0.01=2 to 5)	P.CLr	Password is cleared, see 4.5 for password
E.XXX	E. means fault or alarm happens. Analyze the fault or alarm according to the fault or alarm list in 7.1	P.SET	Password is set successfully, see 4.5 for password operation
FASt	Fast menu (P0.02=1)	Prot	Password protection is enabled, see 4.6 for key locking and unlocking
HoLd	The parameter copy or upload function of operation panel is disabled	ULoc	Operation panel is identified as key type.
LASt	10 function codes modified recently (P0.02=3)		

If the symbol is not listed in the table, please contact the local distributor or our company directly.

### 3.4.5 Identify Symbols Displayed Via LED

The relationship between characters displayed by LED and characters/numbers are as follows:

LED display	Meanings of characters						
	0		A		I		S
	1		b		J		T
	2		C		L		t
	3		c		N		U
	4		d		n		V
	5		E		O		y
	6		F		o		-
	7		G		P		8.
	8		H		q		.
	9		h		r		

### 3.5 Password Operation

- Set Password

Enter password function code and set to the identical parameters for two times continuously. After “P.Set” is displayed, the password setting is successful. See 4.8.3 for password setting.

- Password Verification

Enter password function code, enter password correctly and you can see the parameters protected by password. See 4.8.4 descriptions of password verification.

- Clear Password

After passing password verification, enter password function code, set 0000 continuously for two times, “P. CLr” is displayed, this means the password is successfully cleared. From now on, you need not enter password for access the password protection area. See 4.8.5 descriptions of clearing password.

- Method of Enabling Password

One of following three methods can be used to enable the password:

1. Press ESC+PRG + at the same time (for shuttle type, turning clock wise is equivalent to the key) to display “Prot”. If key locking function is enabled, “Loc1” (P2.00=1) or

“Loc2”(P2.00=2) or “Loc3”(P2.00=3) is displayed.

2. Do not press any key for continuous 5 minutes.
3. Restart the drive

## 3.6 Lock/Unlock Keys

### ■ Lock Keys

- ◆ Set the function of locking keys

Select the P2.00 key locking functions:

- 0: Do not lock the keys on the operation panel and all the keys can be used;
- 1: Lock the keys on the operation panel and all the keys cannot be used;
- 2: Except multi-function key **M**, all the keys cannot be used;
- 3: Except **RUN** and **STOP/RST** keys, all the keys cannot be used.

- ◆ Key Locking Function is Enabled

One of following three methods can be used to enable the key locking function:

1. Press **ESC+PRG +▲** at the same time (for shuttle type, turning clock wise is equivalent to the **▲** key) to display “Loc1” (P2.00=1) or “Loc2”(P2.00=2) or “Loc3”(P2.00=3), the operation panel is locked according to the setting method of P2.00. When P2.00=0, “Prot” is displayed and the operation panel is not locked and only the password protection is enabled.
2. Power on the drive again to lock the operation panel.
3. If no key is pressed within 5 minutes after setting the function code, the operation panel is locked automatically.

### ■ Unlock Keys:

Press **ESC+>>+▼** keys at the same time (for shuttle type, turning anti-clock wise is equivalent to **▼** key) to unlock.

## 3.7 Operation Panel Display and Key Operation

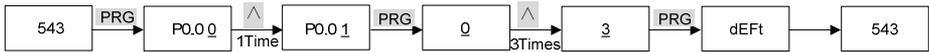
### 3.7.1 Classification of Display Status

There are 8 types of display status of operation panel:

SN	Status	Meaning
1	Display status of stopping parameters	Press <b>&gt;&gt;</b> key to switch the displayed parameters, P2.03 can be used to set the displayed parameters.
2	Display status of running parameters	Press <b>&gt;&gt;</b> key to switch the displayed parameters, P2.02 can be used to set the displayed parameters.
3	Display status of fault and alarm	In other 7 kinds of display status, if there is any fault happens, directly enter this status.
4	Display status of first level menu	When the keys are not locked, in status of SN1, SN2, SN3 and SN7, press <b>PRG</b> to enter.
5	Display status of second level menu	In the display status of first level menu, press <b>PRG</b> to enter.
6	Password verification status	If password protection is enabled, press <b>PRG</b> to enter in the display status of first level menu.

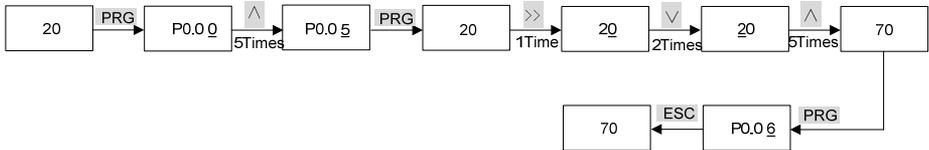


For example, setting P0.01=3: Restore all the parameters in P area to factory settings except the motor parameters (F9 group).



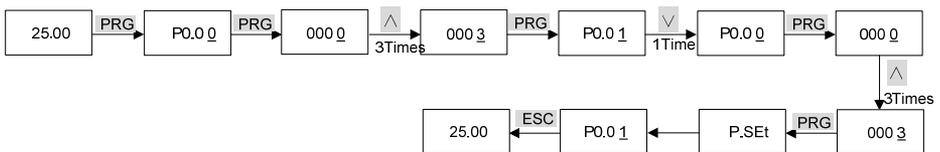
### 3.8.2 Setting Frequency

For example, setting P0.05=25.00Hz.



### 3.8.3 Setting Password

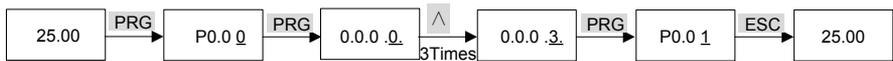
For example, set user password P0.00 0003.



### 3.8.4 Password Verification

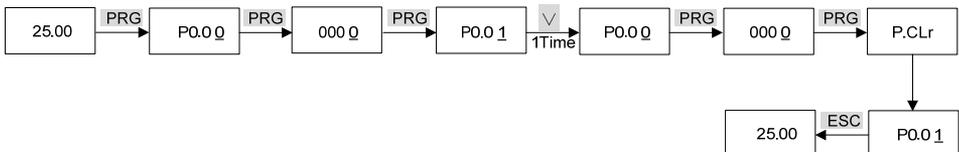
Assume that the function codes after P0.00 are protected by password and the password is 3. If the password protection is not enabled, you can press **ESC+PRG+^** to enable the password in last example of P0.00. You can verify the password according to the following process:

**Note:** If you use RS 485 communication mode to perform password verification, please refer to Appendix A. Description of register 0xF000 in Modbus communication protocol.



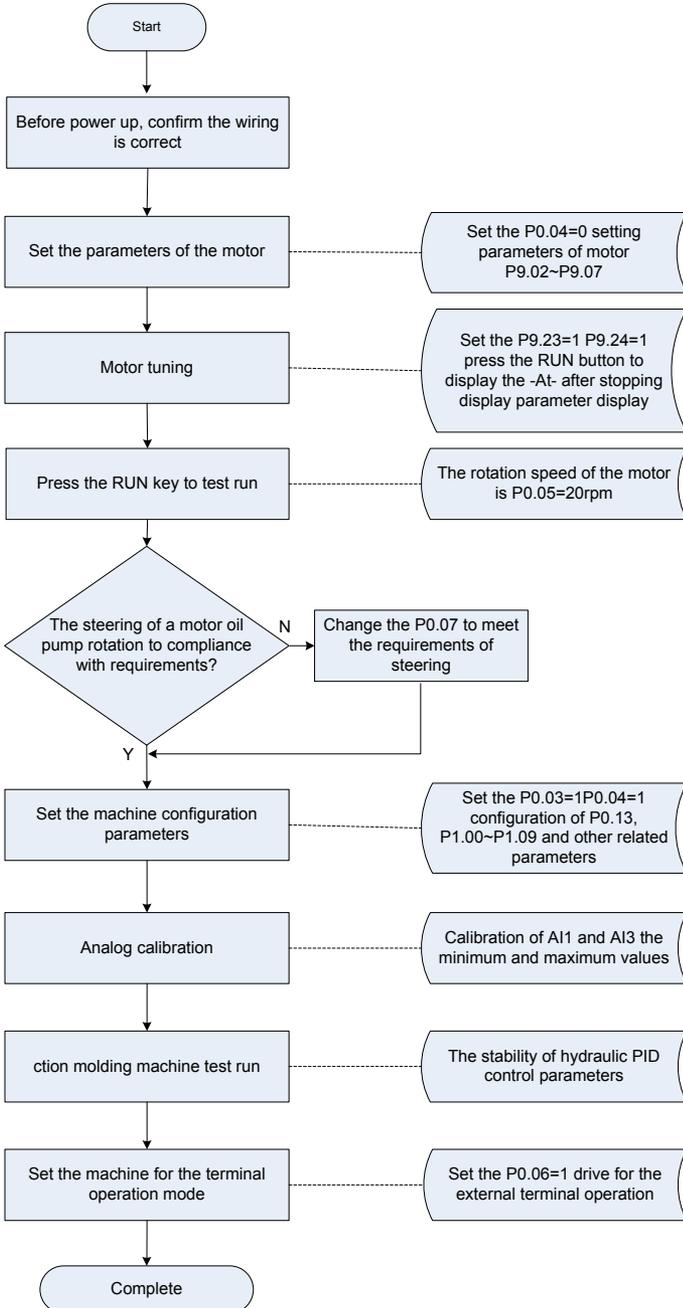
### 3.8.5 Clearing Password

For example, clear the user password P0.00.



## 3.9 Running for the First Time

The following is the first on the routine operation of electric operation, such as failure, please control fault and alarm signal list judge causes, troubleshooting.



## 3.10 Commissioning Instructions for Servo Pump

### 3.10.1 Motor Tuning

- ◆ Set motor parameters correctly according to the motor nameplate  
Set parameter P0.04=0 “Speed setting mode” to “Set via panel digitally (P0.05)”, then set P9.02=rated rotating speed, P9.03=rated power, P9.04=rated current, P9.05=rated voltage, P9.06=rated torque, P9.07=torque current coefficient Kt according to the nameplate of the motor.
- ◆ Tuning of initial angle  
Set P9.23=1 and P9.24=1, press RUN to start motor tuning, the process is ended after “-At-“ is displayed and the stopping parameters are displayed.

### 3.10.2 Confirmation of running direction

Set P0.05=20rpm, press RUN key to check the motor running direction, and if the running direction is reverse to the direction that builds up the pressure of the oil pump, press STOP, change the setting of P0.07 so as to change the motor running direction, thus the motor runs in a correct direction to build up the pressure in the oil pump, and there is no need to change the connection between the servo driver and the servo motor.

### 3.10.3 Configuration parameters and tuning of servo pump

- ◆ Set the oil pressure control mode and command channel (taking the analog input signal as an example)  
Set P0.03=1 “Oil pressure control mode” , speed (flow) setting command P0.04=1 “AI3 analog value setting” , pressure setting command P1.03=1 “AI1 analog value setting“, feedback pressure command P1.04=1 “AI2 analog value setting”.
- ◆ Configuration parameters for selected machine  
P0.13 “Max speed” is set via calculation of flow meter, P1.00 “Oil pump discharging capacity” is set according to the nameplate on the oil pump.  
P1.01 “Pressure sensor signal output mode” and P1.02 “Pressure sensor measure range” are set according to the pressure sensor specifications. P1.01=0 factory setting  
“0~10V” input type, if the pressure sensor is 4~20mA, change to P1.01=4 “4~20mA” and change the selection switch S3 jumper to I terminal status.  
P1.06 “Max pressure limit” is determined by the selected machine.
- ◆ Pressure flow marking  
Direct line marking: When the driver stops, set the max output pressure (P\_MAX) to generate reference voltage to AI1 terminal, and check the AI1 voltage value by pressing >> key, write the voltage value in the parameter of P6.02, for example: If the pressure setting is 140kgf/cm2, the displayed voltage is 9.45V, then change P6.02 to 9.45; Set the max output flow (Q\_MAX) to generate reference voltage to AI3 terminal, and check the AI2 voltage value by pressing >> key, write the voltage value in the parameter of P6.06, for example: Set the speed 99% test value, the displayed voltage is 9.15V, then change P6.06 to 9.15.

If the pressure flow has zero-drift voltage, you can neutralize this voltage by setting P6.11(Min pressure) and P6.13 (Min flow).

### 3.10.4 PID for regulating oil pressure

Start the driver, and the injection molding machine acts (the oil tank acts to its limit), set the pressure signal output from small value to big value to test the stability of the pressure.

If the pressure meter jitters at high pressure, adjust the following parameters: P value of P3.00 pressure loop, I value of P3.01 pressure loop, P value for P3.08 stabilizing pressure and I value for P3.09 stabilizing pressure, P value for P4.00 motor speed loop and I value for P4.01 motor speed loop, and the Pd.00 torque output the max value. The greater the oil pressure  $K_p$ , the faster the system response speed, but the oscillation will occur more easily. The greater the  $K_i$  is, the higher the system pressure is, but the bigger the impact of the machine is. During the control process, we will expand the PID regulation according to the different control requirements so as to achieve the better control effect.

### 3.10.5 Running control mode

- ◆ Set P0.06=1 “Method of enabling the servo driver” , the startup and the stop of the driver is controlled by terminal X1(S-ON) signal.

## Chapter 4 Parameters and debugging of servo drive

### Meanings of Each Item in Function Code Parameter Table

Item	Meanings
Function code number	The number of function code, such as P0.00
Function code name	The name of function code, which explains the function code's meanings.
Factory setting	Restore the settings of the function code after the drive is delivered (see P0.01).
Setting range	The value from minimum value to maximum value that can be set to this function code.
Unit	V: Voltage; A: Current; °C: Celsius degree; Ω: Ohm; mH: Milli-henry; rpm: Rotating speed; %: Percentage; bps: baud rate; Hz, kHz: Frequency; ms, s, min, h, kh: Time; kW: Power; /: No unit
Property	○: This function code can be changed during operation; ×: This function code can only be changed during stopping process; *: The setting of this function code is read-only and cannot be changed.
Function code selection	Function code parameter setting list
User setting	Used for recording parameters by user

### 4.1 List of Basic Menu Function Codes

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
<b>Group P0 Basic Function Parameter</b>							
P0.00	User password	0000	0~FFFF	/	○	0000: No password; Other: Password protection	
P0.01	Function code protection	0	0~5	/	×	0: All the parameters can be modified; 1: All the parameters cannot be modified; 2: Restore parameters in zone P to factory settings; 3: Restore parameters in zone P to factory settings; (except for P9 group) 4: Recover the parameters in zone P and zone A to factory settings; 5: Recover all the parameters to factory settings. (except for d group)	
P0.02	Function code display	0	0~3	/	○	0: Basic menu mode 1: Fast menu mode 2: Menu mode of non-leave-factory setting value function codes; 3: Menu mode of last changed 10 function codes;	
P0.03	Oil pressure control mode	1	0~1	/	×	0: Non oil control 1: Oil control mode	
P0.04	Method of issuing speed (flow) command	1	0~5	/	×	0: Issue via panel(P0.05) 1: Issue via AI3 2: Issue via computer CAN	

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
						3: Issue via multi pump CAN; 4: Issue via RS485 5: Issue via CAN+485	
P0.05	Digital speed preset speed	20	0~ P0.13	rpm	×		
P0.06	Method of enabling servo	0	0~1	/	○	0: Operation panel; 1: Terminal;	
P0.07	Motor running direction command	0	0~1	/	×	0: Run forward; 1: Run reverse	
P0.08	Flow rising time	0.10	0.01~15.00s	s	×		
P0.09	Flow falling time	0.10	0.01~15.00s	s	×		
P0.10	Pressure rising time	0.10	0.01~2.0	s	×		
P0.11	Pressure falling time	0.10	0.01~2.0	s	×		
P0.12	Trial running speed of M key	20	0-100	rpm	○		
P0.13	System Max speed	2000	0~9999	rpm	×	Set according to the calculated flow	
<b>P1 group of machine configuration parameters</b>							
P1.00	Capacity of oil tank	40	0~350	cc/rev	×		
P1.01	Output signal of pressure sensor	0	0~4	/	×	0: 0-10V;            1: 1-10V; 2: 0-5V;            3: 1-5V; 4: 4-20mA;	
P1.02	Measure range of pressure sensor	250	0.0~350.0	kgf/cm2	×		
P1.03	Method of issuing pressure command	1	0~5	/	×	0: Via digital panel (P0.05); 1: Via AI1 analog value 2: Via computer CAN 3: Via multi-pump CAN 4: Via RS485 5: Via multi mode CAN+485	
P1.04	Pressure feedback instruction	1	0~5	/	×	0: Via digital panel (P0.05); 1: Via AI2 analog value 2: Via computer CAN 3: Via multi-pump CAN 4: Via RS485 5: Via multi mode CAN+485	
P1.05	Pressure setting	10.0	0.0~140.0	kgf/cm2	○		
P1.06	Max pressure limit of machine	140.0	0~250.0	kgf/cm2	×		
P1.07	Speed limit for pressure discharging	50.0	0~500	rpm	○		
P1.08	Low pressure	5.0	0~10.0	kgf/cm2	○		
P1.09	Speed for lower flow	0	0~50	rpm	○		
P1.10	Pressure sensor error detection time	1.5	0~5.0	s	○		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
<b>Group P2    Key and Display Parameters</b>							
P2.00	Key-lock function selection	0	0~3	/	○	0: No locking; 1: Locking all keys; 2: Retain 3: Locking all keys except RUN and STOP/RST keys	
P2.01	Multi-function key definition	1	0~3	/	○	0: No function; 1: Jog function; 2: Emergent shutdown 1(Stop in shortest time); 3: Emergent shutdown 2 (Coast-to-stop);	
P2.02	Display parameter selection at running	789C	0000~FFFF	/	○	LED ones place: 0: e given speed(rpm) 1: Bus voltage (V); 2: AI1(V); 3: AI2(V); 4: AI3(V); 5: DI; 6: Motor position; 7: Motor speed(rpm); 8: Given the pressure; 9: Actual pressure A: A given torque(%); B: Running speed(rpm); C: Output current(A); D: Output torque(%); E: Output power; F: The output voltage(V); Ten, hundred, thousand: ibid.	
P2.03	Display parameter selection at stopping	2416	0000~FFFF	/	○	LED ones place: 0: The given speed(rpm); 1: Bus voltage (V); 2:AI1(V); 3: AI2(V); 4: AI3(V); 5: DI (%) 6: Motor position; 7: Motor speed(rpm); 8: Given the pressure; 9: The actual pressure; A: A given torque(%); B: For a given flow; C~F: Reserved; LED tens, hundreds, thousands place: Same with above	
P2.04	Running proportion display benchmark	0	0~F	/	○		
P2.05	Running proportion display coefficient	0	0~1000.0%	%	○		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
P2.06	Stopping proportion display benckmark	0	0~F	/	○		
P2.07	Stopping proportion display coefficient	0	0~1000.0%	%	○		
<b>Group P3 Hydraulic PID control parameters</b>							
P3.00	1st group pressure proportional coefficient Kp1	2.200	0~6.000	/	○		
P3.01	1st group pressure integration coefficient Ki1	0.200	0~1.000s	/	○		
P3.02	1st group pressure proportional coefficient Kp2	2.250	0~6.000	/	○		
P3.03	1st group pressure integration coefficient Ki2	0.200	0~1.000s	/	○		
P3.04	1st group pressure proportional coefficient Kp3	2.250	0~6.000	/	○		
P3.04	1st group pressure integration coefficient Ki3	0.200	0~1.000s		○		
P3.06	1st group pressure proportional coefficient Kp4	2.250	0~6.000	/	○		
P3.07	1st group pressure integration coefficient Ki4	0.200	0~1.000s	/	○		
P3.08	Stable pressure proportional coefficient Kp	3.000	0~8.000	/	○		
P3.09	Coefficient of integral stability of pressure Ki	0.150	0~1.000s	/	○		
P3.10	Pressure differential coefficient	0.010	0~5.00ms	/	○		
<b>Group P4 The velocity vector control parameters</b>							
P4.00	Speed loop proportional gain 0(ASR_Kp0)	3.050	0.001~30.000	/	○		
P4.01	Speed loop integration time 0(ASR_Ki0)	0.120	0~10.000	s	○		
P4.02	Speed loop proportional gain 1(ASR_Kp1)	2.300	0.001~30.000	/	○		
P4.03	Speed loop integration time 1(ASR_Ki1)	0.150	0~10.000	s	○		
P4.04	Speed loop proportional gain 2 (ASR_Kp2)	1.500	0.001~30.000				
P4.05	Speed loop integration time 2(ASR_Ki2)	0.150	0~10.000	s	○		
P4.06	Speed differential time (ASR_D)	0.000	0~80.000	ms	○		
P4.07	ASR-0 The switching speed	250	0~P0.04	rpm	○		
P4.08	ASR-1 The switching speed	500	0~P0.04	rpm	×		
P4.09	ASR-2 switching speed	1000	0~P0.13	rpm	×		
P4.10	ASR input filtering time	0.5	0~500.0	ms	○		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
P4.11	ASR output filtering time	0.5	0~500.0	ms	○		
<b>Group P5 X multifunctional terminal parameters</b>							
P5.00	X1 terminal input function selection	0	0~99	/	×	See input definition	
P5.01	X2 terminal input function selection	1	0~99	/	×		
P5.02	X3 terminal input function selection	2	0~99	/	×		
P5.03	X4 terminal input function selection	4	0~99	/	×		
P5.04	X5 terminal input function selection	5	0~99	/	×		
P5.05	X6 terminal input function selection	6	0~99	/	×		
P5.06	X7 terminal input function selection	7	0~99	/	×		
P5.07	X1~X7 terminal filtering time	0.010	0.000~1.000	s	×		
<b>Group P6 Analog Reference Parameter</b>							
P6.00	AI1 to AI3 and DI analog value input curve selection	000	0~444	/	○	Units bit: Reference pressure from AI1 0: Marked by P6 group; 1: Marked by H0 group Tens bit: AI2 feedback pressure 0: Marked by P6 group; Others: Invalid Hundreds bit: Reference flow from AI1 0: Marked by P6 group; 1: Marked by H1 group	
P6.01	AI zero drift clearing switch	0	0~1	/	○	0: Zero clearing invalid; 1: Using automatic zero clearing	
P6.02	AI1 voltage at max system input pressure	10.00	0~11.0	V	○		
P6.03	Reference pressure corresponded to AI1 max value	100	0~110	%	○		
P6.04	AI2 voltage at max feedback voltage	10.00	0~11.0	V	○		
P6.05	Feedback pressure corresponded to AI2 max value	100	0~110	%	○		
P6.06	AI3 voltage at max system input flow	10.00	0~11.0	V	○		
P6.07	Reference speed corresponded by AI3 Max value	100	0.0~110.0	%	○		
P6.08	AI1 filtering time	0200	0~4095	/	×		
P6.09	AI2 filtering time	2000	0~4095	/	×		
P6.10	AI3 filtering time	0200	0~4095	/	×		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
P6.11	AI1 The minimum value	0.06	0~2.00	V	○		
P6.12	AI2 The minimum value	0.06	0~6.00	V	○		
P6.13	AI3 The minimum value	0.06	0~2.00	V	○		
<b>Group P7 Multi-function Output Parameter</b>							
P7.00	Y1 terminal output function selection	03	0~47	/	○	The output function definition	
P7.01	Y2/DO terminal output function selection	04	0~47	/	○		
P7.02	Relay 1 terminal output function selection	00	0~47	/	○		
P7.03	Relay 2 terminal output function selection	01	0~47	/	○		
P7.04	AO1 terminal output function selection	48	48~71	/	○		
P7.05	AO2 terminal output function selection	49	48~71	/	○		
P7.06	AO1 gain	100.0	0.0~200.0	/	○		
P7.07	AO1 bias	0	0.0~200.0	/	○		
P7.08	AO2 gain	100.0	0.0~200.0	/	○		
P7.09	AO2 bias	0	0.0~200.0	/	○		
P7.10	Selection of positive and negative gain and bias	0000	0000~1111	/	○	Ones place: AO1 gain: 0: Positive; 1: Negative Tens place: AO1 bias: 0: Positive; 1: Negative Hundreds place: AO2 gain: 0: Positive; 1: Negative Thousands place: AO2 bias: 0: Positive; 1: Negative	
<b>P8 Group Plunger pump and multi pump control parameters</b>							
P8.00	Type of plunger pump	0	0~1	/	×	0: Single 1: Dual	
P8.01	Ratio of small swash plate capacity to big swash plate capacity	30	0.0~100.0	%	○		
P8.02	Swash plate pressure switching threshold	100	0.0~250.0	kgf/cm <sup>2</sup>	○		
P8.03	Detection delay time for switching pressure threshold	100	0~300	ms	○		
P8.04	Compensation for rising of swash plate switching	10	0~100	ms	○		
P8.05	Compensation for falling of swash plate switching	10	0~100	ms	○		
P8.06	Swash plate speed switching high limit	1000	0~2000	rpm	○		
P8.07	Swash plate speed switching low limit	200	0~500	rpm	○		
P8.08	Swash plate switching mode	0	0~1	/	○	0: Auto control mode 1: Pressure reservation control mode	

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
P8.09	Multi pump type	0000	0000~1113	/	×	Units bit: merging type 0: Single pump 1: Multi pump merging 2: Multi pump merging & splitting; 3: Multi mode combination; Tens bit: Converging control 0: IO point control 1: Auto combination of driver; Hundreds bit: IO merging signal effective 0: Enabled at high level, enter merging state 1: Enabled at low level, enter merging state Thousands bit: Stop mode(enabled when tens bit is 0) 0: At IO point control, the auxiliary pump stops according to P8.12~P8.14 1: Auxiliary pump does not stop	
P8.10	Total number of merging pump	0	0~16	pcs	×		
P8.11	Pump function in system	0	0~4	/	×	0: Merging pump 1: Merging/splitting control pump 2: Merging / splitting following pump 3: Splitting control pump 4: Splitting following pump	
P8.12	Min control speed for stopping auxiliary pump	200	0~500	rpm	○		
P8.13	Pressure threshold during stopping of auxiliary pump	95.0	0~100.0	%	○		
P8.14	Delay time for stopping of auxiliary pump	0.30	0.0~10.00		○		
P8.15	Pump capacity to total system capacity	100	0~100.0	%	○		
P8.16	Pump capacity for stopping running	5.0	2.5~10.0	%	○		
P8.17	Main pump speed when auxiliary pump starts up	50	0~500	rpm	○		
P8.18	Effectiveness of merging / splitting signal	0	0~1	/	×	0: Merging at high level and splitting at low level 1: Merging at low level and splitting at high level	
P8.19	Total number of merging pump in splitting unit	0	0~16	pcs	×		
P8.20	Pump capacity of total capacity of splitting units	100.0	0~100.0	%	○		
<b>Group P9    Motor Parameter</b>							
P9.00	Motor type	0	0~1	/	×	0:Surface mounted permanent magnetic synchronous motor 1:Embedded permanent magnetic synchronous motor	

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
P9.01	Number of motor poles	8	2~128	/	×		
P9.02	Rated rotating velocity of motor	2000	0~9999	rpm	×		
P9.03	Rated power of motor	15.0	0.4~999.9	kw	×		
P9.04	Rated current of motor	24.0	0.1~999.9	A	×		
P9.05	Rated voltage	360	0~400	V	×		
P9.06	Rated torque	51	1~9999	N.M	×		
P9.07	Torque current coefficient Kt	2.60	0.01~100.00	/	×		
P9.08	Q axis inductor	/	/	mH	×	Since learning	
P9.09	D axis inductor	/	/	mH	×	Since learning	
P9.10	Stator resistance R1	/	/	Ω	×	Since learning	
P9.11	Stator leakage inductance L1	/	/	mH	×	Since learning	
P9.12	Rotor resistance R2	/	/	Ω	×	Since learning	
P9.13	Mutual inductance L2	/	/	mH	×	Since learning	
P9.14	Constant for anti voltage potential	/	/	/	×	Since learning	
P9.15	Motor power factor	/	/	/	×	Since learning	
P9.16	Magnetic saturation coefficient	/	/	/	×	Since learning	
P9.17	Pulse number of PG per rotation	1024	1~9999	/	×		
P9.18	PG direction	0	0~1	/	×	0: positive 1: reverse	
P9.19	Installation angle of PG	16160	0~65535	/	×		
P9.20	Detection time for PG cable	2.0	0~8.0	s	×		
P9.21	Motor speed to PG speed	1.000	0.001~65.535	/	×		
P9.22	PG type	4	0~8	/	×	0: No PG; 1: ABZ increase type; 3: ABZUVW increase type; 3: COSINE and SINE type; 4: Rotating transformer; 5: Absolute value for single turn; 6: Absolute value for multi turn; 7: Magnetic PG; 8: Hall sensor	
P9.23	Motor tuning protection	0	0~1	/	×	0: Self learning disabled 1: Tuning enabled	
P9.24	Motor tuning	0	0~3	/	×	0: Disabled 1: Enabled in static state	
P9.25	Number of poles of rotating transformer	1	1~512	/	×		
<b>Group PA Control Parameter</b>							
PA.00	Carrier frequency	5.0	3.0~10.0	kHz	×		
PA.01	Carrier frequency automatic adjustment selection	0	0~1	/	×	0: No auto adjustment; 1: Auto adjustment	
PA.02	Motor overload alarm	0	0~1	/	×	0: I <sup>2</sup> T Automatic calculation; 1: PA.06~PA.07 Methods	
PA.03	Motor overload alarm detection level	130	50.0~200.0	%	×	Relative motor rated current	
PA.04	Motor overload alarm detection time	5.0	0.5~30.0	min	×		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
PA.05	Fault masking and alarm 1	0020	0000~2222	/	×	0: No masking, stop upon fault 1: No masking, do not stop upon fault 2: Masked, do not alarm and do not stop upon fault LED Units bit: Abnormal short circuit between output and ground; LED Tens bit: Abnormal power failure in running LED Hundreds bit: Input power abnormal LED Thousands bit: output phase failure	
PA.06	Fault masking and alarm 2	0000	0000~2222	/	×	LED ones place: EEPROM error LED tens place: Relay contact open/close failure LED hundreds place: Temperature sensor taking sample anomaly LED thousands place: encoder disconnection	
PA.07	Fault masking and alarm 3	2000	0000~2222	/	×	LED ones place: +10V output error LED tens place: Analog input error LED hundreds place: Motor over temperature (PTC) LED thousands place: abnormal communication 1 (serial operation panel);	
PA.08	Fault masking and alarm 4	0002	0000~2222	/	×	LED ones place: Communication was abnormal in 2 (terminal serial); LED tens place: The software version of abnormal operation panel; LED hundreds place: Abnormal pressure sensor; LED thousands place: CAN communication is abnormal.	
<b>Group Pb    Enhanced Function Parameter</b>							
Pb.00	Low limit for avoiding speed oscillation 1	0	0~P0.04	rpm	○		
Pb.01	High limit for avoiding speed oscillation 1	0	0~P0.04	rpm	○		
Pb.02	Low limit for avoiding speed oscillation 2	0	0~P0.04	rpm	○		
Pb.03	High limit for avoiding speed oscillation 2	0	0~P0.04	rpm	○		
Pb.04	Low limit for avoiding speed oscillation 3	0	0~P0.04	rpm	○		
Pb.05	High limit for avoiding speed oscillation 3	0	0~P0.04	rpm	○		
Pb.06 ~ Pb.22	Reserved			/	×	Reserved	

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
Pb.23	Parameter copy	0	0~5	/	×	: No function; 1: Parameter uploading; 2: Parameter downloading (without motor parameters); 3: Parameter downloading (with motor parameters); 4: Parameter storage enable (upload is prohibited); 5: Parameter storage disable (upload is allowed)	
<b>Group PC Communication Parameters</b>							
PC.00	Communication baud rate	6	4~8	/	×	4: 4800BPS; 5: 9600BPS; 6: 19200BPS; 7: 38400BPS; 8: 57600BPS	
PC.01	Data format	0	0~2	/		0: 1-8-1 format, no parity; 1: 1-8-1 format, even parity; 2: 1-8-1 format, odd parity	
PC.02	485 The machine address	1	1~247	/		1 ~ 247, 0 is broadcasting address	
PC.03	PC Reserved 1	303		/			
PC.04	Master-slave mode	0	0~2	/		0: SCIA slave, SCIB slave mode; 1: SCIA master, SCIB slave mode; 2: SCIA slave, SCIB master mode	
PC.05	Operation address from master to slave (set by master)	1.00	0~10.0	/		Master preset frequency written in function code of slave 0: P0.05; The other is invalid;	
PC.06	CAN baud rate	5	0~5	bps	×	0: 20K 1: 50K 2: 125K 3: 250K 4: 500K 5: 1M	
PC.07	CAN address	1	1~247	/		1~247 1: main pump (main communication) Others: (slave)	
<b>Group Pd Torque vector control factory parameters</b>							
Pd.00	Max output torque	200	0~250	%	×		
Pd.01	Min output torque	50	0~250	%	×		
Pd.02	Proportional coefficient of current loop Iq (ACR P1)	0.800	0.001~30.000	/	×		
Pd.03	Integration time of current loop Iq (ACR I1)	0.020	0~10.000	s	×		
Pd.04	Differential time of current loop Iq (ACR d1)	0.00	0~1.00	s	×		
Pd.05	Proportional coefficient of current loop Iq (ACR P2)	0.80	0.001~30.000	/	×		
Pd.06	Integration time of current loop Iq (ACR I2)	0.020	0~10.000	s	×		
Pd.07	Differential time of current loop Iq (ACR d2)	0.00	0~1.00	s	×		
Pd.08	Weak magnetic mode	0	0~1	/	×	0: Direct calculation; 1: Auto adjustment	

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
Pd.09	Max current for weak magnetic control	010	0.0~PA9.04*90%	A	×		
Pd.10	Proportional coefficient for weak magnetic adjustment	0.30	0.0001~30.000	/	×		
Pd.11	Integration coefficient for weak magnetic adjustment	0.500	0~10.000	/	×		
<b>Group d0    Fault Record Parameters</b>							
d0.00	Fault type record 2	0	0~62	/	*	Refer fault and alarm information list	
d0.01	Fault type record 1	0	0~62	/	*		
d0.02	Latest fault type record 0	0	0~62	/	*		
d0.03	Bus voltage upon latest fault	0	0~999	V	*		
d0.04	Actual current upon latest fault	0	0.0~9999	A	*		
d0.05	Running speed upon the latest fault	0	0~30000	rpm	*		
d0.06	Total power-up time on time	0	0~65535	kh	*		
d0.07	Total operation time of the drive	0	0~65535	kh	*		
d0.08	Record of maximum temperature of heatsink	0	0.0~100.0	℃	*		
d0.09	Record of maximum bus voltage fluctuation	0	0~1000	V	*		
d0.10	Reserved	0	30000	/	*		
d0.11	Reserved	0	5	/	*		
<b>Group d1    Product Identity Parameters</b>							
d1.00	Serial number	35355	8A1b	/	*		
d1.01	Software version number of control board	1000	0.00~99.99	/	*		
d1.02	Non-standard version number of software of control board	2304	0~9999	/	*		
d1.03	Software version number of operation panel	2458	0~65535	/	*		
d1.04	Software version number of extension board	0	0~65535	/	*		
d1.05	Manufacturer's bar code 1	0	0~9999	/	*		
d1.06	Manufacturer's bar code 2	0	0~9999	/	*		
d1.07	Manufacturer's bar code 3	0	0~9999	/	*		
d1.08	Manufacturer's bar code 4	0	0~9999	/	*		
d1.09	Operation panel copy identification code	100	0~65535	/	*		
d1.10	Control board software identification code	0000	0~65535	/	*		
d1.11	Reserved	0	0~65535	/	*		
<b>Group d2    Use of Display Parameters</b>							
d2.00	Temperature of heatsink 1	0	0.0~100.0	℃	*		
d2.01	Terminal count value	0	0~65535	/	*		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
d2.02	A11 percentage after curvilinear transformation	0	0~100.0	%	*		
d2.03	A12 percentage after curvilinear transformation	0	0~100.0	%	*		
d2.04	A13 percentage after curvilinear transformation	0	0~100.0	%	*		
d2.05	D1 percentage after curvilinear transformation	0	0~100.0%	%	*		
d2.06	Operation panel $\wedge/\vee$ digital adjustment value	0	0~65535	/	*		
d2.07	Terminal UP/DN digital adjustment volume	0	0~65535	/	*		
d2.07	Reserved	50984	0~65535	/	*		
d2.09	Input status display of X terminal	0	0~65535	/	*		
d2.10	Reference voltage 1 (percentage)	0	0~65535	%	*		
d2.11	Reference voltage 2 (percentage)	0	0~65535	%	*		
d2.12	AI failure source display(read only)	0		/	*		
d2.13	Temperature of heatsink 1	0		/	*		
<b>H0 Group Multi-section linear marking parameters for reference pressure</b>							
H0.00	Adjustment coefficient for 170kgf/cm2 reference pressure	100. 0	0.0~160.0	/	○		
H0.01	Adjustment coefficient for 160kgf/cm2 reference pressure	100. 0	0.0~160.0	/	○		
H0.02	Adjustment coefficient for 150kgf/cm2 reference pressure	100. 0	0.0~160.0	/	○		
H0.03	Adjustment coefficient for 140kgf/cm2 reference pressure	100. 0	0.0~160.0	/	○		
H0.04	Adjustment coefficient for 130kgf/cm2 reference pressure	92. 8	0.0~160.0	/	○		
H0.05	Adjustment coefficient for 120kgf/cm2 reference pressure	85. 7	0.0~160.0	/	○		
H0.06	Adjustment coefficient for 110kgf/cm2 reference pressure	78. 5	0.0~160.0	/	○		
H0.07	Adjustment coefficient for 100kgf/cm2 reference pressure	71. 4	0.0~160.0	/	○		
H0.08	Adjustment coefficient for 90kgf/cm2 reference pressure	64. 3	0.0~160.0	/	○		
H0.09	Adjustment coefficient for 80kgf/cm2 reference pressure	57. 1	0.0~160.0	/	○		
H0.10	Adjustment coefficient for 70kgf/cm2 reference pressure	50. 0	0.0~160.0	/	○		
H0.11	Adjustment coefficient for 60kgf/cm2 reference pressure	42. 8	0.0~160.0	/	○		
H0.12	Adjustment coefficient for 50kgf/cm2 reference pressure	35. 7	0.0~160.0	/	○		
H0.13	Adjustment coefficient for 40kgf/cm2 reference pressure	28. 5	0.0~160.0	/	○		

Function code number	Function code name	Factory setting	Setting range	Unit	Property	Function code selection	User setting
H0.14	Adjustment coefficient for 30kgf/cm2 reference pressure	21. 4	0.0~160.0	/	○		
H0.15	Adjustment coefficient for 20kgf/cm2 reference pressure	14. 3	0.0~160.0	/	○		
H0.16	Adjustment coefficient for 10kgf/cm2 reference pressure	7. 1	0.0~160.0	/	○		
H0.17	Adjustment coefficient for 0kgf/cm2 reference pressure	0.0	0.0~160.0	/	○		
<b>H1 Group Multi-section linear marking parameters for reference flow (speed)</b>							
H1.00	Adjustment coefficient 100% reference flow	100.0	0.0~160.0	/	○		
H1.01	Adjustment coefficient 90% reference flow	90.0	0.0~160.0	/	○		
H1.02	Adjustment coefficient 80% reference flow	80.0	0.0~160.0	/	○		
H1.03	Adjustment coefficient 70% reference flow	70.0	0.0~160.0	/	○		
H1.04	Adjustment coefficient 60% reference flow	60.0	0.0~160.0	/	○		
H1.05	Adjustment coefficient 50% reference flow	50.0	0.0~160.0	/	○		
H1.06	Adjustment coefficient 40% reference flow	40.0	0.0~160.0	/	○		
H1.07	Adjustment coefficient 30% reference flow	30.0	0.0~160.0	/	○		
H1.08	Adjustment coefficient 20% reference flow	20.0	0.0~160.0	/	○		
H1.09	Adjustment coefficient 10% reference flow	10.0	0.0~160.0	/	○		
H1.10	Adjustment coefficient 0% reference flow	0.0	0.0~160.0	/	○		

## 4.2 X multifunctional terminal definition table

<b>Definition table for multi function terminal X</b>			
No.	Definition of function	6	Communication enabled
0	Servo enable	7	Fault reset
1	Using the second group pressure PI	8	External fault input
2	Using the third group pressure PI	9	Motor temperature switch PTC/KTY input
3	Using the fourth group pressure PI	10	Swash plate enabled
4	Big pump enable	No.	Definition of function
5	Second oil channel		

## 4.3 Definition of multi function relay and Y terminal output

<b>Definition of multi function relay and Y terminal output</b>			
No.	Definition of function	5	RS485 communication output
0	Signal output for servo running	6	Cooling fan output
1	Servo failure signal output	7	Swash plate control of plunger pump
2	Signal output for servo ready	8	Second oil channel output
3	Stopping signal output for external fault	No.	Definition of function
4	Large pump output point	9	Auxiliary pump control

#### 4.4 Definition of multi function analog value A0 output

<b>Definition of multi function analog value A0 output</b>		
Function design	Output signal selection	AO output range definition
48	P0.13 max speed	P0.13 corresponds to 10V/20mA
49	Speed setting	P0.13 corresponds to 10V/20mA
50	Output current	Two-fold servo rated current corresponds to 10V/20mA
51	Pressure setting	Max measure range of pressure sensor corresponds to 10V/20mA
52	Output voltage	Two-fold motor rated voltage corresponds to 10V/20mA
53	Bus voltage	1000V corresponds to 10V/20mA
54	AI1	10V corresponds to 10V/20mA;20mA corresponds to 5V/10mA
55	AI2	10V corresponds to 10V/20mA;20mA corresponds to 5V/10mA
56	AI3	10V corresponds to 10V/20mA;20mA corresponds to 5V/10mA
57	Actual pressure	Max measure range of pressure sensor corresponds to 10V/20mA
58	Output power	Two-fold motor rated power corresponds to 10V/20mA
59	Actual running speed	P0.13 corresponds to 10V/20mA
60	Heatsink temperature	0~100℃ corresponds to 0~10V/0~20mA
61~71	Reserved	

## Chapter 5 Alarm and diagnosis of servo drive

### 5.1 Faults and Solutions

TS-I serial driver is equipped with complete protection functions to provide efficient protection while utilizing its performance sufficiently. Some failure instructions may be displayed during operation. Compare the instructions with the following table and analyze, decide the causes and solve failures. For damages on units or questions that can't be resolved, please contact with local distributors/agents, service centers or manufacturer for solutions.

Failure No.	Failure code	Failure description	Potential causes	Solutions
1	E.oc1	Over current protection when acceleration operation	Low grid voltage	Check the input power source
			Startup too fast during motor operation	Restart after the motor stops rotating
			Rotating inertial of load is very large and shock load is very heavy	Increase the acceleration time and reduce the occurrences of sudden change of load
			Improper setting of motor parameters	Set motor parameters properly
			If any special motor is used?	Learn the motor's parameters
		The motor's power goes beyond the driver's maximum drive current	Replace with drive with proper model	
2	E.oc2	Over current protection when deceleration operation	Low grid voltage	Check input power supply
			Too big rotating inertial of load	Choose appropriate energy braking components
			Improper setting of motor parameters	Set motor parameters properly
			If any special motor is used?	Learn the motor's parameters
			The motor's power goes beyond the driver's maximum drive current	Replace to drive with proper model
3	E.oc3	Over current protection when operation with constant speed	If any special motor is used?	Learn the motor's parameters
			Improper setting of motor parameters	Set motor parameters properly
			The motor's power goes beyond the driver's maximum drive current	Replace to drive with proper model
4	E.oV1	Over voltage protection when acceleration operation	Motor short to ground	Check motor wiring
			Abnormal input power supply voltage	Check input power supply
			Fast start-up again when motor	Start again after the motor stops
5	E.oV2	Over voltage protection when deceleration operation	Motor short to ground	Check motor wiring
			If the braking unit operates in open loop	Check the braking component
6	E.oV3	Over voltage protection when operation with constant speed	Motor short to ground	Check motor wiring
			Abnormal input power supply	Check input power supply
			If the braking unit operates in open loop	Check the braking component
7	E.PCU	Interference protection	Severely Interfered by exterior signal	Ask professional technicians to maintain
8	E.rEF	Abnormal comparison benchmark	Driver's internal connector goes loose	Ask professional technicians to maintain
			Abnormal internal switching power supply	Seek for technical support
			Abnormal signal sampling and comparison circuit	Seek for technical support

Failure No.	Failure code	Failure description	Potential causes	Solutions
9	E.AUt	Auto-tuning failure	Enable auto-tuning function during motor spinning	Perform auto-tuning after the motor stops to rotate
			Auto-tuning overtime	Check whether motor wirings are well connected Length of motor wiring within 100m
			Incorrect setting of motor parameters in group P9	Please reset the parameters according to the nameplate parameters on the motor.
10	E.FAL	Module protection	Output over current	Check whether the motor the output connection is short circuited, whether the ground is short circuited and whether the load is too heavy.
			DC terminal overvoltage	Check the mains power supply and whether the large inertia load has no function of quick stop at energy consumption brake.
11	E.oH1	Heatsink 1 over temperature protection	Ambient over-temperature	Lower the ambient temperature and strengthen ventilation and heat dissipation.
			Blockage of air duct	Clean the dusts, wools and other foreign objects in the air duct.
			Fan failure	Check whether fan wirings are well connected. Replace a new fan of the same model.
			Drive module failure	Seek for technical support
			Temperature detection circuit failure	Seek for technical support
12	E.oH2	Heatsink 2 over temperature protection	Ambient over-temperature	Lower the ambient temperature
			Blockage of air duct	Clean the dusts, wools and other
			Fan failure	Check whether fan wirings are well connected. Replace a new fan of the same model
			Rectifier module failure	Seek for technical support
			Temperature detection circuit failure	Seek for technical support
13	E.oL1	Drive overload protection	Input power under voltage	Check input power supply
			Fast start-up when motor operates with high speed	Start again after the motor stops rotating
			If any special motor is used?	Learn the motor's parameters
			The motor's power goes beyond the driver's maximum drive current	Replace to drive with proper model
14	E.oL2	Motor overload protection	Input power under voltage	Check input power supply
			Motor rotation is blocked or load mutation occurs	Prevent the motor rotation from blocking and reduce the load mutation
			If any special motor is used?	Learn the motor's parameters
			The motor's power goes beyond the driver's maximum drive current	Replace to drive with proper model

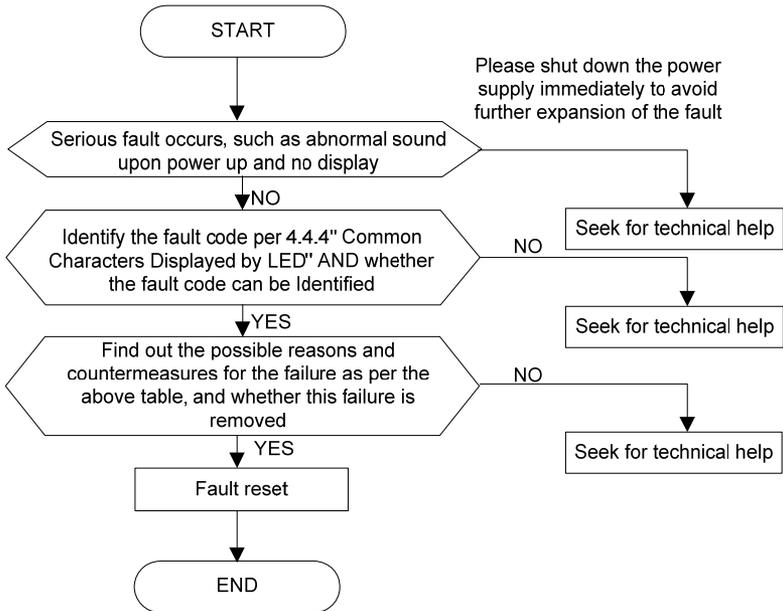
Failure No.	Failure code	Failure description	Potential causes	Solutions
15	E.oUt	Peripheral protection	External failure terminal enable	Check the external failure terminal status
			Stall over voltage or over current and the time lasts for more than one minute	Check whether the external load is normal
16	E.PEr	Something goes wrong with the pressure sensor	Pressure sensor's wiring is broken	Check the pressure sensor's wiring
			Pressure sensor's power source goes wrong	Check the pressure sensor's input power source
			Pressure sensor is damaged	Check the pressure sensor's resistance, whether short circuited to the ground
17	E.dsr	Motor speed loss protection	The motor encoder's position and direction are wrong The motor encoder is damaged U, V and W phase sequences are wrong	Check and adjust P9.18 Check if the encoder's resistance is normal and if the encoder is short circuited to the ground Check the motor and driver's U, V and W phase sequences
18	E.UV0	Wrong phase sequence	U, V and W phase sequences are wrong	Check and adjust the motor and driver's U, V and W phase sequences
19	E.CUr	Current detection fault	Current detection circuit failure	Seek for technical support
20	E.GdF	Output to ground short circuit	Wrong connection	Correct the connection error as
			Motor failure	Replace the motor after
			Invert module failure	Seek for technical support
			Too big ground-leakage current at the	Seek for technical support
21	E.LV1	Abnormal power failure	Mains power fluctuation or momentary	Check the local mains power
22	E.ILF	Input power failure	Abnormal connection, missing connection or disconnection at the power terminal of the drive	Check the power connections as per the operational regulations and eliminate the errors of missing connection and disconnection
			Serious imbalance of input power at three phases	Check whether the imbalance of input power at three phases comply with the requirements
			Burning of capacitor of the drive	Seek for technical support
			The power-on buffer circuit of the drive is faulty	Seek for technical support
23	E.oLF	Abnormal output phase loss	Abnormal connection, missing connection or disconnection at the output side of the drive	Check the power connections at the output side of the drive as per the operational regulations and eliminate the errors of missing connection and disconnection
			Imbalance of output three phases	Check whether motor is kept well Shut down the power supply to check whether the terminal characteristics both at the output side and DC side of the drive are consistent

Failure No.	Failure code	Failure description	Potential causes	Solutions
24	E.EEP	EEPROM failure	EEPROM reading and writing failure	Seek for technical support
25	E.dL3	Relay contact failure	Loose connection of connectors inside the drive	Ask professional technicians to maintain
			The power-on buffer circuit is faulty	Seek for technical support
26	E.dL2	Temperature sensor taking sample anomaly	Ambient under temperature	Check whether the ambient temperature complies with the requirements
			The temperature sampling circuit inside the drive is faulty	Seek for technical support
27	E.dL1	Encoder cable disconnection	Encoder connection is incorrect	Change the encoder cable
			Encoder has no signal output	Check whether the encoder and
			Encoder cable disconnection	Reconnect
			Abnormal function code setting	Confirm that the relevant
28	E.P10	+10V power output abnormal	+10V power overload	Increase +10V power load impedance Utilize externally independent power supply
			+10V power supply and GND is short circuited	Eliminate the short circuit failure
			+10V power terminal circuit failure	Seek for technical support
29	E.AIF	Analog input abnormal	Too high analog input voltage	Check whether the analog input voltage complies with the requirements
			Analog input circuit failure	Seek for technical support
			Analog input circuit signal interfered	Increase the P6.22 and P6.24 AI filtering time
30	E.Ptc	Motor over temperature (PTC/KTY)	The motor temperature signal reaches the alarm setting value	Strengthen ventilation and heat dissipation
			Thermistor resistance failure	Check the thermistor
			The sensor protection threshold of the motor is set improperly	Adjust the sensor protection threshold of the motor
31	E.SE1	Communication abnormal 1 (Operation panel 485)	The communication of operation panel RS485 is disconnected	Check the connection of the equipment communications
			Communication failure of operation panel RS485	Check whether the data receiving and transmission complies with the protocol, whether the check sum is correct and whether the receiving and transmission interval complies with the requirements
			The drive is set to master mode	Set the drive to slave mode
32	E.SE2	Communication abnormal 2 (RS485 terminal)	The communication of RS485 terminal is disconnected	Check the connection of the equipment communications
			The baud rate is set improperly	Set compatible baud rate
			The communication of RS485 terminal is faulty	Check whether the data receiving and transmission complies with the protocol,

whether the check sum is correct and whether the receiving and transmission interval complies

Failure No.	Failure code	Failure description	Potential causes	Solutions
				with the requirements
			The communication of RS485 terminal is time-out	Check whether the communication timeout is set properly and confirm the communication cycle of the application program
			Improper setting of failure alarm parameters	Adjust the failure alarm parameter
			The drive is set to master mode	Set the drive to slave mode
33	E.VEr	Version compatibility abnormal	Incompatible software version of the operation panel	Seek for technical support
34	E.CPy	Copy failure	The data error occurs when copying the drive parameters to the operation panel	Check the connections of the operation panel
			The data error occurs when copying the parameters from the operation panel to the drive	Check the connections of the operation panel
			The parameters are directly downloaded without undergoing copy and upload operations.	Perform download before uploading the parameters
			Control board software version incompatible	Check if d1.09 is consistent
36	E.dL4	Expansion card connection abnormal	Expansion card connection is loosened	Ask professional technicians to maintain
			Expansion card failure	Seek for technical support
37	E.loF	Terminal mutual exclusion check failed	The functions of X1 to X7, AI1, AI2 and DI terminals are set in a repeated manner	Modify the settings of X1 to X7, AI1, AI2 and DI terminals and ensure the setting functions are not repeated (excluding null function)
38	E.oL3	Hardware overload protection	Load failure	Check whether motor is blocked Replace drive with proper model
			Input failure	Check whether there is phase loss
			Output failure	Check whether there are phase loss or short circuit
63	-LU-	Power under voltage	The power supply voltage is lower than the minimum operating voltage of the equipment	Check input power supply
			Abnormal internal switching power supply	Seek for technical support

## 5.2 Troubleshooting Procedures



## Chapter 6 Debugging, selection and function application

### 6.1 Answer the questions in debugging process

#### I. Why did the keyboard will have “8.8.8.8” display or have no display sometimes?

A: (1) Check if the connectors are properly connected when the operation panel is directly connected to the drive control board;

A: (2) Check if the connection wire signals are in one to one correspondence when the keyboard is connected to the operation panel and drive control board through customized extension wires;

A: (3) Check if the network cable connectors of the operation panel and drive control board are properly connected when standard network cable is used to connect the operation panel and drive control board.

#### II. Why couldn't display or modify the function codes of the operation panel?

A: (1) When the modification could not be performed, check if P0.01 is set to 1. If yes, change it to 0.

A: (2) When the modification could not be performed, check if the function code has been set to modification disabled;

A: (3) When the modification could not be performed upon running, check if the function code could not modification upon running;

A: (4) When display is not available, check if the drive function code has been encrypted;

A: (5) When display is not available, check if the drive operation panel has been locked;

#### III. Why did the fans of drives of certain power classes will rotate upon power up, while others could not?

A: The fans of the 4T030A drives and drives of lower power class are under no control, and they will run when powered up. The operation of the fans of 4T039A~4T091A drives and drives of higher power class is controlled by the heatsink temperature. When the drive is powered up under low temperature condition, the fans will not run. 4T112A~4T150A power level drive fan is not controlled, power on operation; 4T176A and above power level drive fan running by the radiator temperature and frequency converter operation instruction of common control, temperature is low power on fan is not running, but when the frequency converter operation or the radiator fan running at high temperature.

#### IV. What will happen if the CN1 busbar of the control board is loose or damaged?

A: If the CN1 busbar of the control board is loose or damaged, the drive cannot run or will report several errors. For instance, the drive may display “-LU- ” or “relay/contacter could not pull on “, or report such errors as E.oc1, E.FAL, E.oH1, E.oH2, E.Cur and E.dL3 ect

## V. Why does the motor not rotate?

### A: 5.1 Why the motor does not run when the pressure and flow commands are issued?

- (1) Check if the P0.06 operation instruction functions properly, if P0.06=1, then the terminal is working, please check the X terminal's multiple function selection and if the said terminal is closed properly.
- (2) If there is any alarm.
- (3) If there is alarm, disconnect the servo enable signal before you remove the alarm.
- (4) When E.dL1 appears, please turn off the power and reset, otherwise the encoder pulse signal can hardly be accurate, making the operating current too big, and the motor does not run.

### 5.2 Why the driver does not receive the pressure and flow commands?

Check the reference pressure and flow signal (dc0~10V) of AI1 and AI3, and the motor will not run if one of them is 0.

- (1) With the DC voltage profile table, check the voltage of computer terminals to ground, and the voltage of AI1 and AI3 to GND meet the requirements;
- (2) Check if the PLC controller and the driver control terminals are wired properly.
- (3) Check if the Pressure Signal and Flow Signal are current type signals, if so, use the I to V conversion board;
- (4) Check if the voltage of AI1 and AI3 to GND exceed 10V, if so, adjust it.

### 5.3 Feedback signal error of pressure sensor

Check the actual pressure displayed by driver, and check the voltage of AI2 to GND, and judge if error occurs, and the motor will not run if this is true.

- (1) Check the output signal and measure range of the pressure sensor and check if P1.01 and P1.02 are correctly set.
- (2) Use a multi meter to measure if the power supply voltage of the pressure sensor is normal.
- (3) Use a multi meter to check if the pressure calculated from the feedback signal of the pressure sensor corresponds to the actual pressure (check the pressure meter, and note that this meter must be a good one).

### 5.4 UVW Open Circuit

Check if the UVW wirings from the drivers to the motor are broken or not. If broken, the motor will not run.

- (1) When you check the driver, if the current is almost 0, then UVW open circuit is highly possible.
- (2) Use a multimeter to check if the resistances of the motor's U, V and W branches are aligned to the motor's parameters, in case a big resistance is found, then the motor's inner coil must be broken.

## VI. Motor runs, but system pressure cannot be increased

- A: (1) Pressure oil goes back to oil tank through other bypass;
- A: (2) System safety valve has leakage or is damaged;
- A: (3) Hydraulic oil in oil tank is insufficient;
- A: (4) oil pump runs reversely;
- A: (5) Error occurs in the connection between the motor and oil pump.

**VII. Unstable when the system pressure is high**

- A: (1) PID regulation fails;
- A: (2) Output torque of driver reaches the max output torque;
- A: (3) Motor torque is small, severe overload;
- A: (4) Driver current reaches the max current output;
- A: (5) Internal leakage in oil pump, severe overheat;
- A: (6) Internal leakage occurs when the system pressure of oil circuit is high;
- A: (7) Over temperature of hydraulic oil

**VIII. Why E.AIF analog input abnormal is reported?**

- A: (1) Check if the input type of analog values and jumper of the control board are correct, for analog input voltage, set the corresponding jumper to the V side; For analog current input, set the corresponding jumper to I side;
- A: (2) Check if the analog input exceeds 11V

\* The above lists some common issues in commissioning, contact us if you find other issues.

## 6.2 Method of selecting the main components of the injection molding machine electrolytic mixing system

According to the manufacturer's parameters, the available information: System flow is  $Q$  (L/min) ; System pressure is  $P_e$  (kgf/cm<sup>2</sup>) ; and Max motor speed is  $V_{max}$  (rpm).

### 6.2.1 Selection of oil pump

Selection of oil pump pressure: Max pressure of oil pump  $P_{max} \geq P_e$

Selection of oil pump flow:  $L = Q \times 1000 / V_{max}$  (cc/rev)

Oil pump type selection: Select the oil pump type according to the different requirements of the injection molding machine.

Oil pump	Price	Efficiency	Stability	Noise	Reliability	Single	Rotating
Gear pump	Low	Low	Medium	Medium	High	Low	Medium
Plunger	Medium	High	Low	High	Low	Medium	Low
Screw rod	High	Medium	High	Low	Medium	High	High

### 6.2.2 Motor selection

Selection of rated speed of servo motor: According to the feature of the servo motor, the motor torque is decreased gradually as its speed is increasing. When the motor torque reaches the 150% rated speed, the internal magnetic field of the servo motor will be saturated and the torque will be decreased sharply, so this speed shall not be used as the working speed of the motor in the mixing system, so we select the following parameters:

$$V_{max} \leq 140\% V_e$$

To ensure the better control effect and safe operation of the motor, the rated speed of the servo motor is:

$$V_e = V_{max} / 1.3 \text{ (rpm)}$$

Selection of the rated torque of the servo motor: According to the energy conservation law, the max output power of the molding injection machine is:

$$P_{2max} = 1.02 P_e Q / 600 \text{ (kw)}$$

Since the mechanical and hydraulic conversion efficiency between the motor and pump should be considered, the max output power of the servo motor is:

$$P_{djmax} = 1.1 P_{2max} \text{ (kw)}$$

Max output torque of the servo motor is:

$$T_{max} = 9550 P_{djmax} / V_e \text{ (N.m)}$$

According to the characteristic, control requirement and safety and reliability of the servo motor, the max output torque should not exceed the 180% rated torque of the servo motor:

So, the rated torque of the motor:

$$T_e = T_{max} / (1.65 \sim 1.8)$$

### 6.2.3 Selection of servo driver

After selecting the servo pump and servo motor, you can get the Kt factor from the manufacturer of the servo motor and then calculate the max operating current based on this factor:

$$I = T_{\max} / K_t \text{ (A)}$$

So, the rated current of the servo driver is:

$$I_e = (0.80 \sim 1.0) I \text{ (A)}$$

This is mainly dependent on the machine structure and materials.

According to the calculated  $I_e$ , check if the specification model and technical parameters of the servo driver are suitable.

### 6.3 Multi pump control method

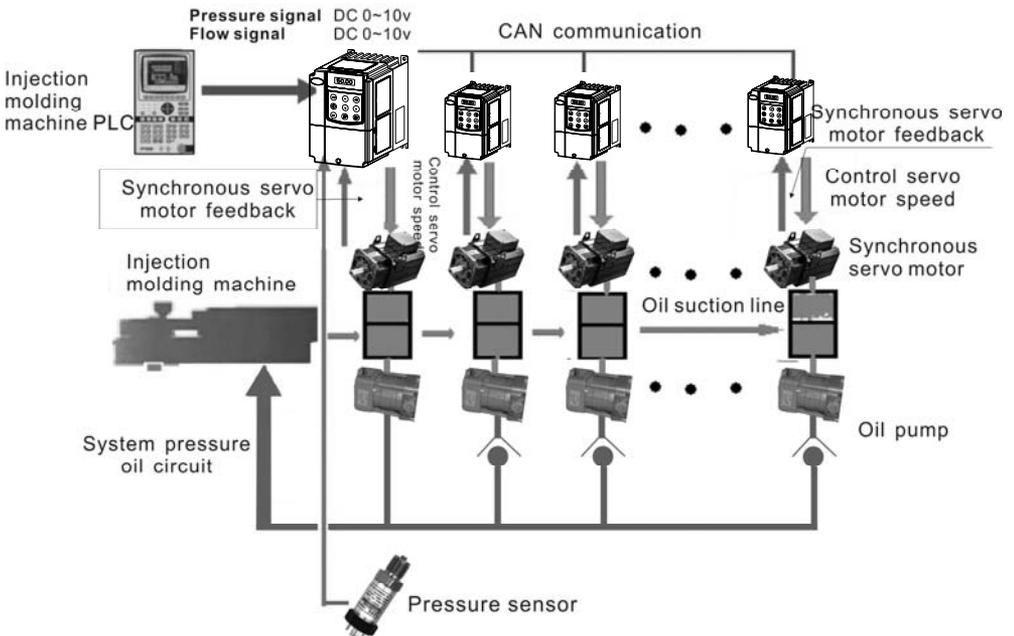
Generally there are two basic methods for multi pump control: Multi pump merged flow and multi pump split/merging flow, and many more methods and solutions can be obtained based on these two methods.

**Multi pump merged flow** One injection molding machine is consisted of many servo electrolytic mixing systems, one system is the master and the others are slave and work in parallel, and they act, run and stop synchronously, and their working mode is identical with one servo pump system> The main issue to be solved is the flow and energy saving control requirements.

**Multi pump split/merged flow** Two or more servo electrolytic mixing system can form multi pump split / merged system, to meet the requirements of big flow, and also the requirements of high efficiency operation for single control and multi actions.

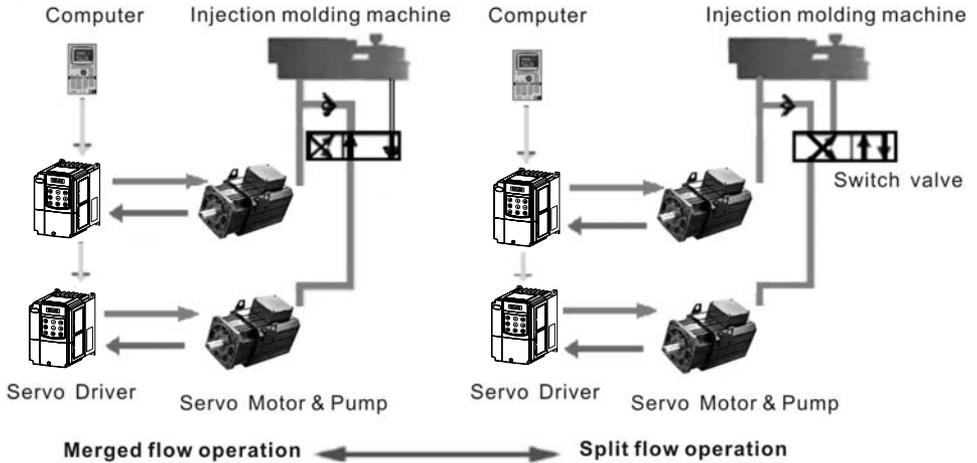
#### 6.3.1 Multi pump merged structure

The wiring of multi pump merged flow is same with that of the single system, and the master/slave systems can be controlled via CAN communication, RS485 communication, analog output, analog input and digital terminal, and the principle is as follows:



## 2. Multi pump split / merged structure

The wiring method of main oil circuit and the second oil circuit system is identical with that of the single unit. The master/slave systems can be controlled via CAN communication, RS485 communication, analog output, analog input and digital terminal, and the principle is as follows:



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