MH500 series Servo-hydraulic System for Injection Molding Machines

Manual

SHANGHAI KINWAY TECHNOLOGIES, INC.

Preface

The MH500 series servo product is specialized for such hydraulic equipments as injection molding machines and die casting machines, etc. It is equipped with high performance vector control and characterized by energy-conservation, high precision, extraordinary efficiency and outstanding durability. Besides, its multiple external interfaces and CAN communication interface facilitate configuration of a parallel system with multiple pumps and control of the hydraulic system with large flow.

Thank you for purchasing this MH500 series servo system made by Kinway. We suggest a close reading of this manual for proper operation and keeping it in safe for reference at any time.

- This manual is used for:
  1) Engineers of this control system
  2) Installing or wiring professionals
  3) Users or maintenance personnel

- Adhere to the following items before complete reading of this manual:
  1) The installation environment shall be clean of water vapor, corrosive gas and inflammable gas.
  2) Forbid directly wiring power of grid and terminals of U, V and W on the motor. Otherwise any wrong wiring may cause irrevocable damage to the driver and the motor.
  3) Make sure safety ground of the earth wire.

4) Do not disassemble the driver, motor and pump or change wiring when they are energized.

5) Do not touch heat sink during operation lest empyrosis.

Kinway provides thorough aftersale and maintenance services for the products. Any attempt to disassemble or change the driver, LED panel or motor shell without permission can damage them and void your warranty. In this case, Kinway bears no responsibility for its consequences.

You can consult your dealer or our contact center if any problem occurs in the process of operation.

Contents

1. Safety Cautions

Please read this manual closely and abide by all the safety cautions contained before moving, installing, operating and maintaining the equipments lest physical injury, equipment damage and even death.

KINWAY assumes no responsibility for any physical injury or equipment damage casused by your or your clients'nonobservance of these safety cautions.

1.1. Safety Concepts

The safety cautions can be classified into "Danger", "Warn"and "Attention".

：Indicates latent dangers such as severe physical injury or equipment damage caused by your wrong operation against the requirements.

：Indicates latent dangers such as moderate physical injury or equipment damage caused by your wrong operation against the requirements.

Attention ：Indicates latent dangers like moderate physical injury caused by your wrong operation against the requirements.

1.2. Safety Instruction

Danger	1. Only trained eligible professionals can install and maintain the products.
	2. Forbidden to check wiring conditions or change components when the equipment is powered on. Before wiring and inspection, you must make sure all the input power have been powered off and wait 10 minutes at least or until the D.C. bus voltage is below 36 V.
	3. Do not check and maintain the machine without insulated safety guard lest any electric shock or physical injury.
	4. Connect the earth wire correctly in accordance with the wiring arrangement by professionals lest any electric shock or fire accident.
	5. Do not have the motor, driver and braking resistor installed near combustibles lest fire accidents.
	6. Never attempt to reconstruct the products without permission lest any possible electric shock, malfunction, burn or fire disaster.
Alarm	1. No lifting of the connecting components of aviation plugs when carrying the motor lest damages to them which may cause motor crash or injuries.
	2. No beating of the motor during installation lest any damage to the precise components on the spindle or any adverse effect on precision.
	3. The surface temperature of the servo motor under continuous full load operation may rise up to 100 degrees which is safe to run in normal. Nevertheless, make sure the motor is installed

	out of the reach of human and animals lest empyrosis.
	4. The external braking resistor may be highly heated when the motor is under frequent braking operation, thus keep the thermal passage well-ventilated. It is suggested to be installed outside the control box (such as on the top ventilator outlet) with adequate protection. If inside the control box is necessary, it still shall be installed near the top ventilator outlet and far away from other devices.
	5. You must check all the external wirings carefully before the first electrification lest unexpected accidents brought about by wrong wiring.
	6. Operate the motor in no-load condition as much as possible when enabling for the first time and be ready to shut the enable off depending on the operating condition.
	7. Please start or stop the servo system through enabling operation rather than by turn on/off the power.
	8. The products contain electrolytic capacitor, integrated circuit, epoxy boards and the like, thus should be disposed as industrial wastes if necessary. Otherwise they may cause personal injuries and environmental contamination.
Attention	1. Carry and install the driver carefully to be safe from physical shock and vibration. Do not hold the front coverplate only when carrying the driver, lest fall.
	2. Prevent screws, cables and other conductive materials from falling into the driver.
	3. L1，L2 and L3 are the input power end, while U，V and W are the output motor end. Please connect the input power cables

	and motor cables correctly, or else the driver might be damaged.
	4. You must close the front cover board or junction box before running the driver lest the risk of electric shock.
	5. Fasten the screws with proper torque during installation and wiring.
	6. Forbidden to conduct any hi-pot test to the driver or to test the control loop of the driver with a tramegger.

※ Please take into consideration the equipments' safety issue in working occasions where severe accidents or great loss may be caused by their incidental failure.

※ The manufacturer, the dealer and the service provider are not responsible for relational loss or joint liability, except of this servo system, brought about by the system fault.

2. Product Information

2.1. Product Confirmation

Please validate the products you received as the following items.

Confirm Items	Comment
Does the model of the products conform to the one you ordered?	Please check the "model" bar on the inscriptions of servo motor and servo driver to confirm. (refer to the instruction of 2.3 for detail)
Can the spindle of servo motor rotate smoothly?	It is normal if you can rotate it by hand.
Is there any damage?	Check through the outward appearance and see if there is any damage caused by transportation or other factors.
Are the accessories and materials intact?	Check if all the accessories, certificate of quality and warranty are contained as the packing list.

If there is anything wrong with the above items, please contact with the store where you bought the product or the sales department of KINWAY timely.

2.2. Nameplate of Servo Driver

2.3. Instruction of Servo Driver Models

KT- CT -1502 -A -0

Version No.

Cooling method

A- air cooling

B- oil cooling

Rated output power

7501-7.5KW

1502-15KW

3502-35KW

Servo driver

Kinway brand

2.4. Specification of Servo Driver

Driver Model KT-CT	**7501**	**1502**	**1802**	**2502**	**3502**	**4502**
Applicable Motor Capacity [kW]	7.5	15	18	25	35	45
Rated Output Current [Arms]	15	30	38	53	75	95
Rated Input Current [Arms]	17	33	39	59	83	105
Max. Output Current [Arms]	38	64	95	113	170	212
Input Power	Three-phase AC 323~475V±0% 45~65Hz±0%					
Weight	8.7kg	9kg	9.5kg	13kg	29kg	35.5kg
Regenerative Braking Resistor	15Ω 500W	15Ω 500W	15Ω 500W	10Ω 1000W	5Ω 4500W	5Ω 4500W

2.5. Technical Conditions of Servo Driver

Basic Specifications	Control mode		Three-phase full-wave rectification, IGBT PWMV control sine-wave current drive mode
	Max. output frequency		400 Hz
	Position sensor of motor		Resolver Resolution 4096/rev
	Service conditions	Temperature for operation/storage	－20 ～ +55 ℃（Derating use above 45 degrees）/－20 ～ +85 ℃

		Humidity	Below 95%RH (non-condensing)
		Air	Indoor (no sunlight), no corrosiveness, flammable gas, oil vapor and dust
		Sea level elevation	Below 2000m
	Protection level		IP20
	Cooling method		Forced air cooling
	Digital signal	Input	10 points input: ①servo on (S-ON) ②alarm reset (ALM－RST) ③8 external input interfaces (I1，I2，I3，I4，I5，I6，I7 and I8) Refer to 4.7 IO interface for detail functions.
		Output	4 points optocoupler output: ① alarm output (ALM) ② servo driver ready (S-RDY) ③ control output interface Refer to 4.7 IO interface for detail functions. 1 point relay output: displacement switch control of the double displacement pump (O1)
	Analog signal	Input	3 points input; 10 bits A/D

			（AIN1，AIN2，AIN3）
		Output	2 points output; 10 bits D/A （ANOUT1，ANOUT2）; You can set the output of internal parameters through LED panel or external HMI
	Power	Output	Provides reference power supply of 15V.
	Communication function	CAN communication	By communicating with the host machine, it can set parameters, control the driver, send commands and save parameters and so on. (When RS485 is in service, the LED display panel and external HMI will be out of commission temporarily.)
		RS485	
	LED display panel and key panel		5-bit LED display, 5 function keys
	External HMI		By communicating with the driver through Interface RS485, the external HMI can set parameters, control the driver, send commands and save parameters and so on.
Control Function	Control mode		The user can select one control mode from ① process control

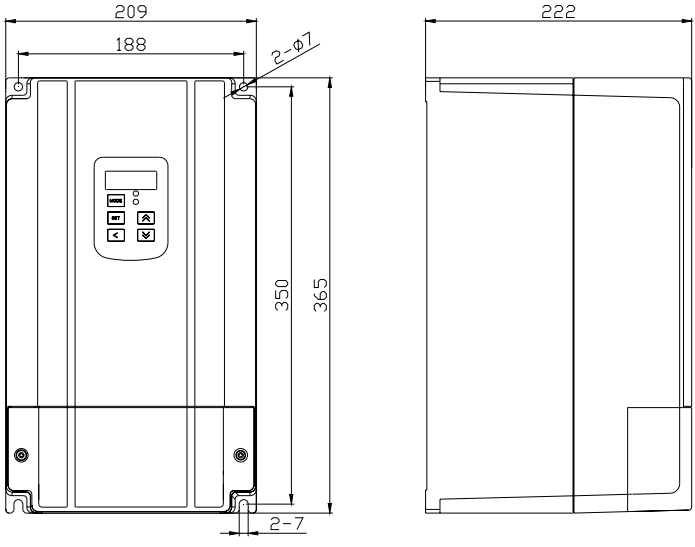
Performance		and ② speed control by setting parameters.
	Control input	Hydraulic control command input: analog input, CAN or RS485 communication. Speed command input: CAN or RS485 communication.
	Parallel control of multiple pumps	Able to control 16 pumps in three ways (multi-pump control, compound control and multi-mode control)
	Precision of pressure control	±1bar（screw pump）
	Precision of flow control	±0.5%FS
	Step response of pressure control	≤100ms flow command >70%(screw pump)
	Speed step response in flow control	≤50ms feedback pressure < 10 bar
	Flow calibration function	Calibrate the pressure of output flow according to the characters of different pumps.
	Speed command input	RS485,CAN communication
	Precision of speed control	±0.5%
	Torque response time	≤2ms
	Overload capacity	2.5 times at most

Protection Function	Hardware error	Overcurrent, DC overvoltage, DC undervoltage, braking resistor damage, module overheat, pressure transducer malfunction, forward and backward overspeed, braking overload and so on.
	Software error	Software malfunction and task replication, etc.
	Alarm records storage	It can store 5 alarm records.

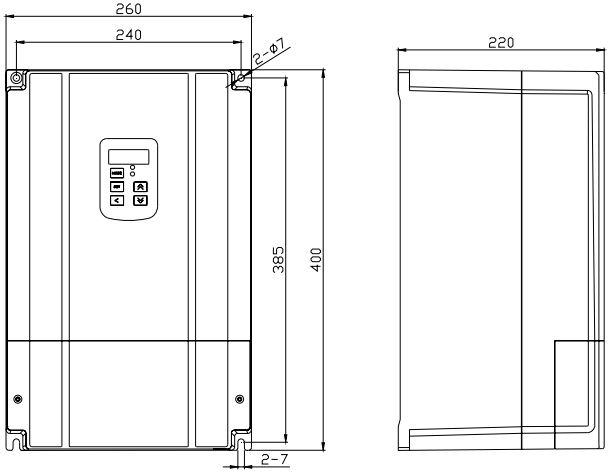
※ When the servo driver is working in the environment over 45 degrees, please derate by 3% as the temperature rises one degree. In addition, avoid using the servo driver in the environment over 55 degrees. As for the servo driver installed in the control box, its temperature inside the box should be the ambient temperature.

2.6. Dimension of Servo Driver

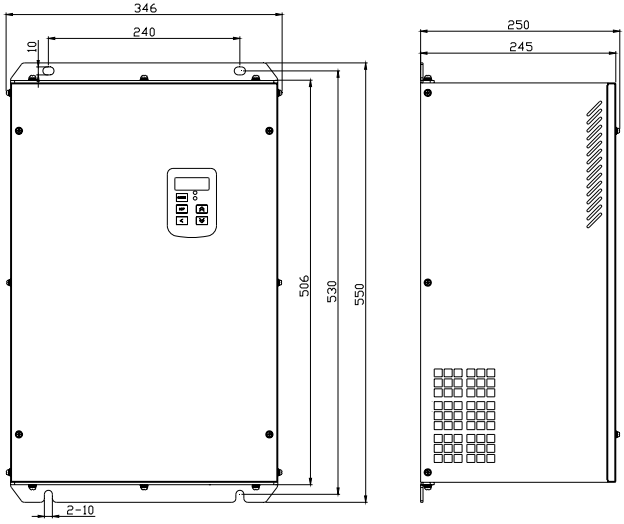
(1) The dimension (mm) of KT-CT-7501-A-0，KT-CT-1502-A-0 and KT-CT-1801-A-* is as followed：



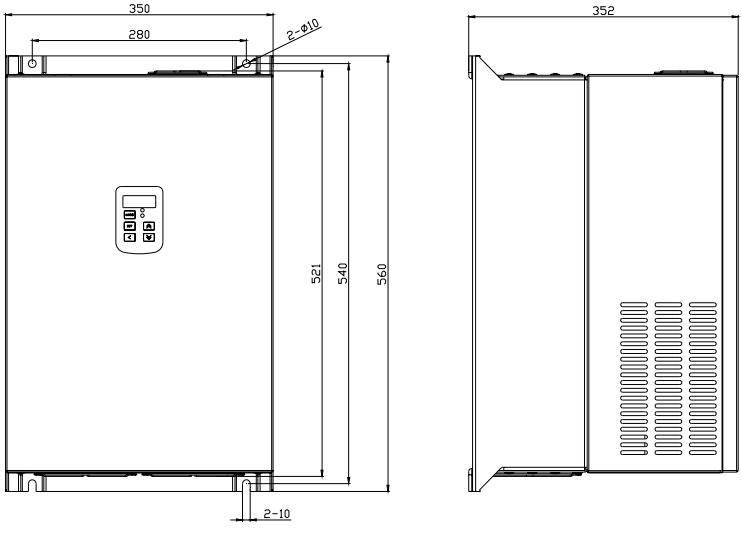
(2) The dimension (mm) of KT-CT-2502-A-1 is as followed:



(3) The dimension (mm) of KT-CT-3502-A-0 is as followed:

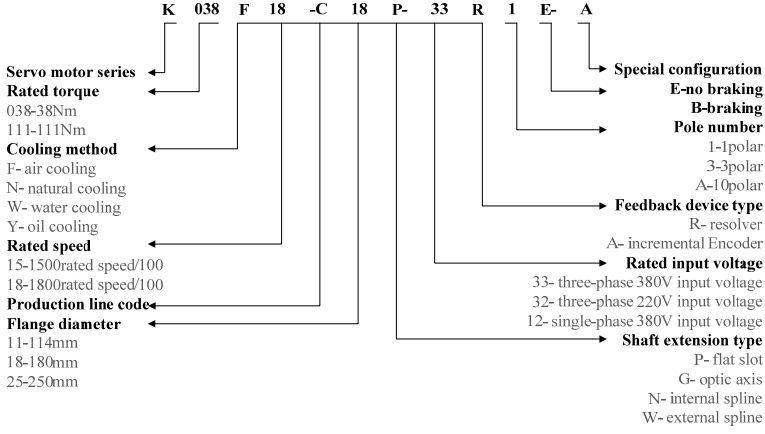


(4) The dimension (mm) of KT-CT-4502-A-1 is as followed:



2.7. Nameplate of Servo Motor

2.8. Instruction of Servo Motor Models



2.9. Specifications of Servo Motor

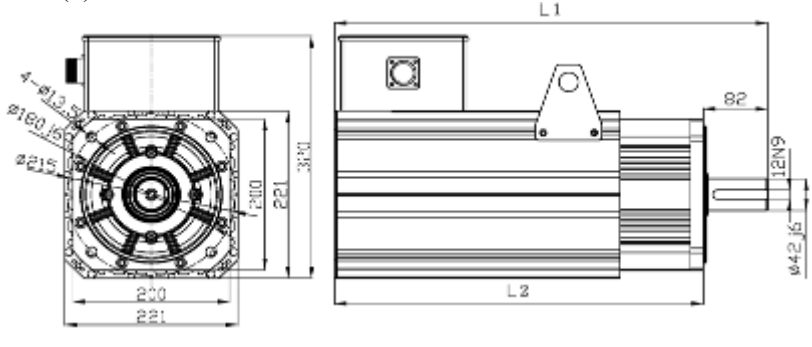
Model	K038F18C 18P-33R 1E-A	K058F18C 18P-33R 1E-A	K072F18C 18P-33R 1E-A	K091F15C 18P-33R 1E-A	K111F15C 18P-33R 1E-A	K132F18C 18P-33R 1E-A	K187F18C 25P-33R 1E-A
Rated Output Power kw	7.5	11	13	15	18	25	35
Max. Output Power kw	18	28	33	39	50	63	91
Counter EMF Vrms/1000rpm	180	182	180	200	237	198	167
Rated Torque Nm	38	58	72	91	111	133	187
Max. Torque Nm	120	174	220	275	306	400	487

Rated Current A(Rms)	14	20	25	30	35.2	49	74.6
Max. Current A(Rms)	56	76	88	102	97	147	194
Rated Speed Rpm	1800	1800	1800	1500	1500	1800	1800
Max. Speed Rpm	2500	2500	2500	2200	2200	2500	2500
Torque Value Nm/Arms	2.8	2.9	2.8	3.2	3.86	3.17	2.58
Voltage Level V(Rms)	380						
Rated Time	Continuous						
Heatproof Level	F						
Dielectric and Voltage Withstand Strength	AC1800V 1minute <10mA						
Dielectric Resistor	DC1000V，above 50MΩ						
Vibration Level	<15um						
Protection Mode	Fully enclosed and unventilated IP54 (excluding the part penetrated by the spindle)						
Anti-vibration Behavior	It can withstand vibration tests under the first and the second environmental levels specified in Chart 6 under Section 4.26 of GB/T 7345-94.						
Storage	-25 ～ +85 ℃						

Temperature	
Ambient Temperature	-20～ +45 ℃
Ambient Humidity	20% ～ 95%(non-condensing)
Excitation Method	Permanent magnet
Installation Method	IMB5
Position Detection	Resolver 1 pole

2.10. Installation Dimension of Servo Motor

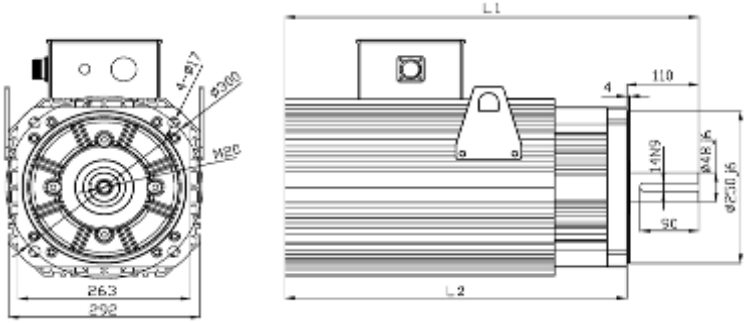
(1) Dimension of K038F18C18P~ K132F18C18P



Motor Model	Length（mm）	
	L1	L2
K038F18C18P	412.5	330.5

K058F18C18P	447.5	365.5
K072F18C18P	482.5	400.5
K091F15C18P	517.5	435.5
K111F15C18P	552.5	470.5
K132F18C18P	622.5	540.5

(2) Dimension of K187F18C25P/35kw



Motor Model	Length（mm）	
	L1	L2
K187F18C25P	632	520

3. Mechanical Installation

3.1. Installation Environment

For the sake of sound performance and long life-span, the MH500 servo driver should be installed under the following environmental conditions to be free from damage.

Attention	1. Keep the driver from direct sunlight and operation outdoors as well.
	2. Avoid using the driver in the environment with corrosive gas or liquid.
	3. Ensure the operating environment clean of oil fog or splashing water.
	4. Do not use it in salt spray atmosphere.
	5. Do not use it in rainy or damp environment.
	6. A filter unit is necessary in the environment with drifting metal powder or silk fiber flocks.
	7. Do not use it in the occasion with mechanical shock and vibration.
	8. If the ambient temperature rises up above 55 degrees, keep the driver from operating until the cooling measures take effect.
	9. Operate the driver in the range from －20℃ to +55℃ since either undercooling or overheating may cause equipment failures.
	10. Keep the operating driver away from power noises since high-power electric equipments like welding machines may impact its operation.

	11. The radioactive material may influence the operation of the device.
	12. Keep the equipment far away from any flammables, diluents and dissolvent.

3.2. Installation of Servo Driver

(1) Install the driver perpendicular to the wall as follows and reserve ample space (>200mm) above and below the driver for ventilating and wiring to facilitate heat dissipation and equipment operation.

(2) Cool the servo driver by means of natural convection or the ventilator.

(3) Fix the servo unit stoutly on the fitting surface by advantage of the four mounting holes.

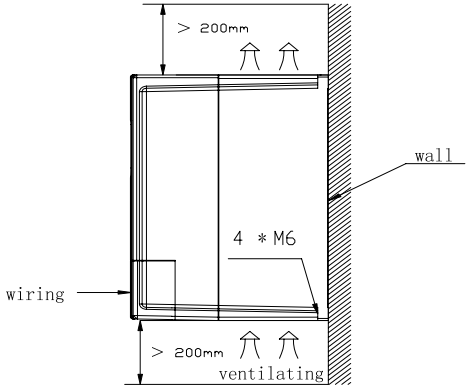
(4) If multiple drivers are needed to be installed in the cabinet:

  (a) Please install the front side of the driver (the mounting surface of the LED panel) toward the operator.

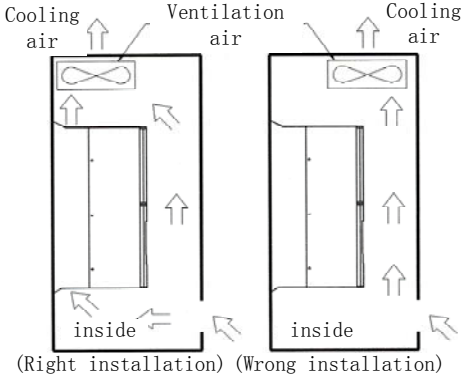
  (b) Install the ventilator inside the cabinet correctly to ensure effect cooling through the ventilator and natural convection; otherwise its improper installation may lead to the rise in ambient temperature outside the driver, influencing the cooling effect.

  (c) Reserve the space of over 50mm in each lateral side and over 200mm in each vertical side in the matter of side-by-side installation. In addition, install a cooling fan above the servo unit. It is necessary to keep average temperature inside the control cabinet in case of local overheating of the ambient environment.

■ Schematic view of installing the driver



■ Placement chart of installing ventilator inside the control cabinet

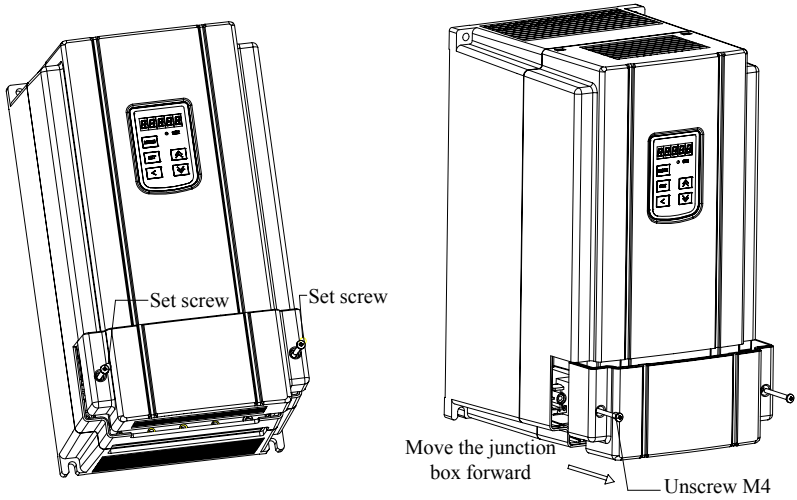


3.3. Mounting & Dismounting of Drive Junction Box

Dismounting of the servo driver's junction box: (take KT-CT-1502-A-0 for instance)

① Loosen and remove the two set screws holding the junction box.

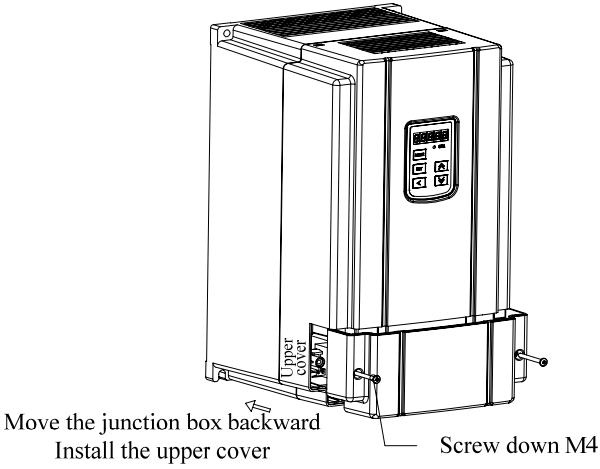
② Pull the junction box outward and take it out of the driver.



Mounting of the servo driver's junction box: (take KT-CT-1502-A-0 for instance)

① Place the junction box horizontally inside system flange slot and push it also horizontally until it gets in line with the shell gap.

② Tighten the two set screws holding the junction box.



3.4. Installation of Servo Motor

Please install the motor as the following instructions to ensure safe and stable operation.

Attention	1. Install the servo motor in horizontal or vertical direction.
	2. We suggest connecting the motor with the machine by means of the coupling and keeping both axle centers of the servo motor and the machine in the same line. In the process of motor installation, the insufficient concentricity may result in vibration and damage the bearing or encoder, etc.
	3. For the installation of feedback elements (photoelectric encoder and resolver), there are locating requirements that some fixed relative position should be reserved between the feedback elements and motor rotors as well as stators and the user are forbidden to disassemble or replace them without permission.
	4. Never inflict any tension to electric wires, especially the signal

	wires which, owing to their fragile filling threads, cannot be pulled too tightly during wiring (or application).
	5. During installation, protect the bearings safe from direct shocks lest any damage to their precision components (photoelectric encoder and resolver) or adverse impact to the precision.

Install the motor and the pump as the following steps:

(1) Couple the flat slot and the pump together, put on one half of the coupling and screw the bolts loosely.

(2) Couple the flat slot and the motor together, put on one half of the coupling and screw the bolts loosely.

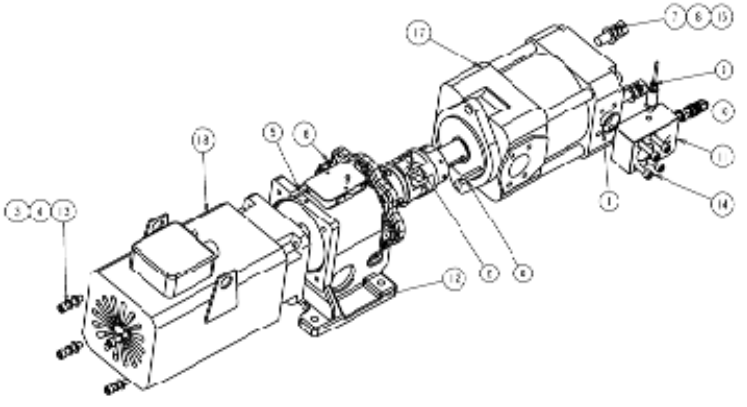
(3) Couple the pump and the motor bracket, and then screw up the bolts after orientation.

(4) Couple the motor and its bracket, and then screw up the bolts after orientation.

(5) Adjust the clearance of elastic couplings, ranging from 2 to 3mm, screw up the bolts in both ends, and make sure you can rotate it smoothly without abnormal sounds.

(6) Prepare the linking components of the motor, motor bracket and pump in the installation site, field match for the motor bracket and fix the screw holes.

(7) Fix and screw up the bolts.



① O-shaped rubber seal ② coupling component ③ spring washer ④ flat washer

⑤ motor flat slot ⑥ pump flat slot ⑦ spring ring ⑧ flat washer ⑨ pressure transducer

⑩ knock-down thread relief valve ⑪ oil discharge board of integrated block

⑫ motor bracket ⑬ hexagon socket head cap screw ⑭ hexagon socket head cap screw

⑮ hexagon bolt ⑯ cross-shaped round-head screw ⑰ oil pump ⑱ servo motor

4. Electrical Connection

4.1. Wiring Cautions

⚠ Alarm	1. Only professionals can conduct wiring operation in case of any improper wiring which may cause electric shock or fire disaster.
	2. The MH500 series servo driver can be connected with the industrial power cord without isolation through transformers, which may cause unexpected accidents. In order to avoid servo systematic cross electric shocks, you must apply the wiring breaker or fuse.
	3. Since the MH500 series servo driver has no built-in ground fault protection circuit, it is safer to configure a circuit breaker for protection against overload and short-circuit or an earth leakage circuit breaker assorted with wiring breaker.
Attention	1. We suggest three earthing methods: A, B and C (the value of earthing resistor should be below 10Ω). One-point earthing is necessary. When the servo motor and other firmwares are separately insulated, you may directly earth the motor.
	2. The grounding wire should be as bold as possible (above 2.0 mm^2).
	3. At present, most of the earth leakage circuit breakers in the market are electronic. Their anti-jamming capabilities are not in common owing to the big difference in interior leakage current detection and processing circuits. For users of this servo driver, we suggest adopting the earth leakage circuit breaker with powerful anti-jamming capability. For instance, the Zhengtai earth leakage circuit breaker is a good choice in terms of its

	relatively better performance in this aspect.
	4. In the process of wiring, please separate strong wires such as power supply wires and input wires of servo motor from signal wires and keep a certain distance over 30cm between them. Never place them in the same pipe or bind them together.
	5. Never share its power supply with the electric welding machine, electric discharge machine and so on. If there is any high-frequency generator around, even though it is not sharing the same power supply with the equipments, please connect a noise filter from the input side of the power line.
	6. You must install a surge suppressor on the coils of electric relay, solenoid and electromagnetic contactor.
	7. Configure the input commander device and noise filter as near to the servo unit as possible lest any malfunction led by noises.
	8. Make sure the conducting wire diameter, switch capacity and contactor capacity are proper. You may refer to the following section "Selection of Switch, Contactor and Wire Diameter".

※ Attention that wrong wiring may cause system faults or personal safety hazards.

4.2. Selection of Switch, Contactor and Wire Diameter

Driver model	Dynamic feed-line circuit breaker (A)	Rated working current of AC contactor AC3 (400v) (A)	Major loop				Control loop
			Suggested wire sectional area (mm^2)			Max. wire sectional area (mm^2)	Max. wire cross section 1.5 mm^2
			Input wire	U+ and PB wire	Output wire		
KT-CT-750	50	50	6	6	6	25	

1-A-0							
KT-CT-150 2-A-0	100	100	10	6	10	25	
KT-CT-180 2-A-*	125	125	10	6	10	25	
KT-CT-250 2-A-0 KT-CT-250 2-A-1	160	170	16	10	16	25	
KT-CT-35 02-A-0	250	250	16	16	16	35	
KT-CT-45 02-A-1 KT-CT-45 02-A-2	300	300	25	16	25	35	

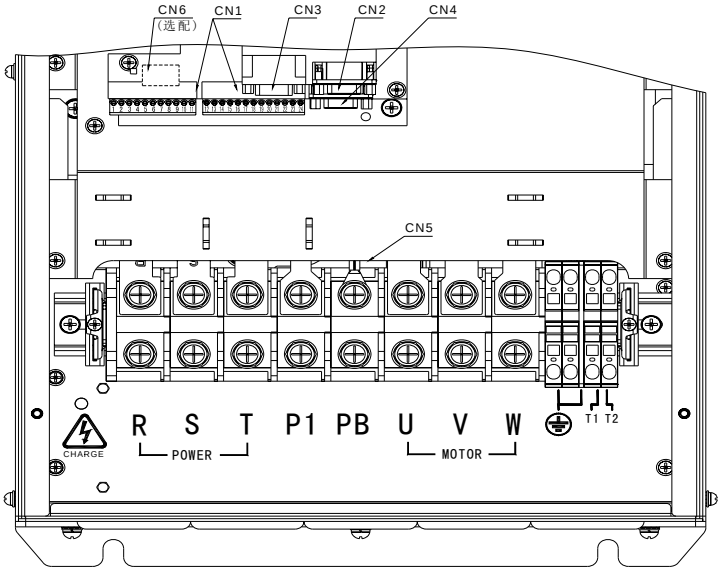
※ The suggested wire size can be applied to the major loop if the ambient temperature is below 40 degrees and the wiring distance shorter than 10m. You are advised to amplify the wire size if the ambient temperature and the wiring distance are beyond the above conditions. And the plastic insulated wire of 600VIV is a suggested choice.

※ The Max. wire cross section refers to the maximum sectional area confined by the size of wiring terminals.

※ The braking resistors for KT-CT-7501-A-0，KT-CT-1502-A-0，KT-CT-1802-A-* have their own wires. You may extend the wires according to the above sizes if necessary.

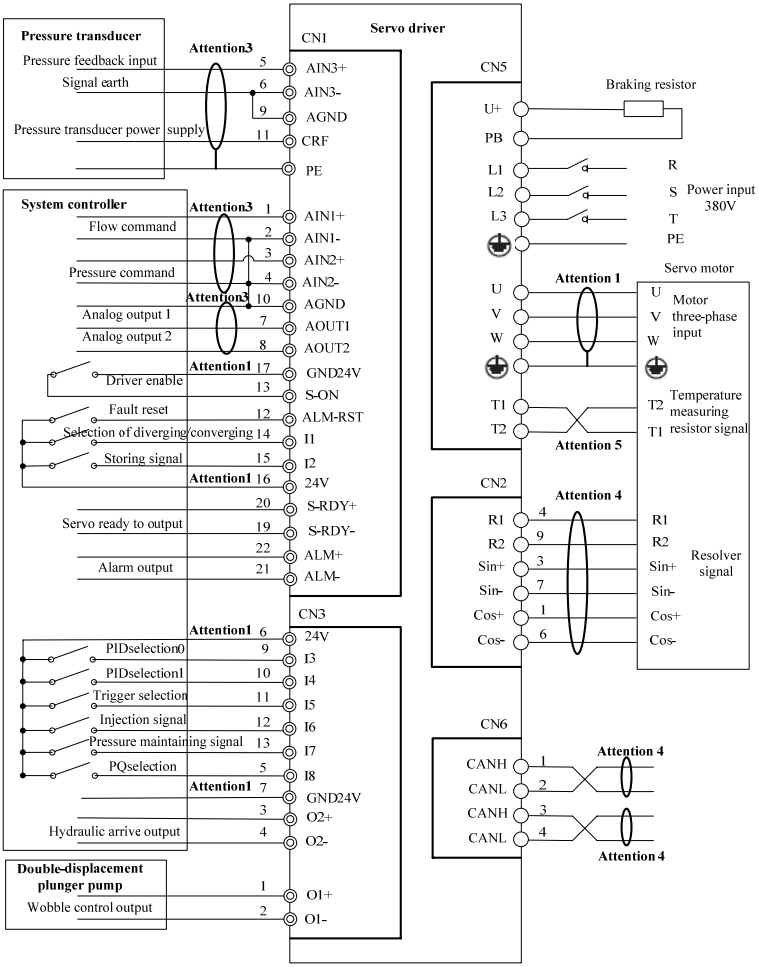
4.3. Terminal Distribution

(Take Driver KT-CT-3502-A-0 for instance.)



Terminal Name	Function
CN1	Connector of input/output signals
CN2	Connector of resolver signals
CN3	Connector of extended input/output signals
CN4	LED panel and common connector for external HMI
CN5	Main circuit terminal
CN6	Connector of CAN communication signals

4.4. Standard Wiring



Annotation 1: In this wiring diagram, only the digital input signal can access to the power supply of control system, while the terminals for 24V power supply on CN1 and CN3 should be

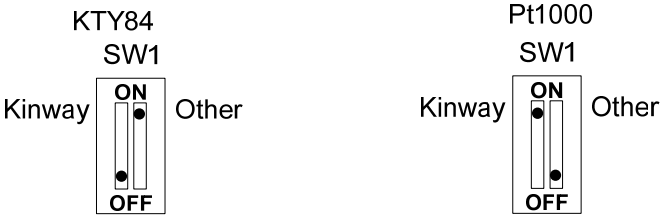
connected to an external power source which you may utilize the power supply, whose terminals are CRF and AGND, of the pressure transducer in the driver to substitute.

Annotation 2: The pressure transducer of this driver requires the power supply of 15V, accepts the pressure signal between 0 to 10V or 1 to 5V which you may set through the dial switch J9 on the control panel. Refer to the interfaces of analog input circuits in Section 4.8.1 for details.

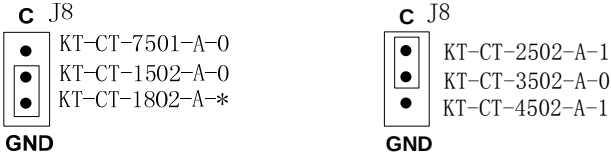
Annotation 3: To prevent the influence on the driver from undesired signals, we suggest using shield cables, their screen grounded correctly, as analog signal driver lines and motor three-phase input lines,

Annotation 4: You must adopt twisted pair shield cables as the resolver wires and communication wires and guarantee their screen grounded correctly. Terminal resistors should be matched and added to the two ends of the communication wires. Since this driver has a built-in terminal resistor of 120 Ω for the CAN communication signal connector, you may decide whether to connect the communication wires to the bus in parallel through the jumper wire. In the operation of multi-pump parallel system, it is necessary to connect terminal resistors to the CAN communication wires by the two ends.

Annotation 5: To prevent the influence on the motor temperature samples from undesired signals, we suggest adopting the twisted pair cable. This driver supports temperature samples of two types of motor temperature sensors, KTY84 and Pt1000, which you can choose from through the jumper wire SW1 on the power panel. If the dial switch written with “KINWAY”is at ON while the one written with “OTHER” at OFF, it indicates that the driver supports Pt1000 temperature sensor. If the dial switch written with “KINWAY”is at OFF while the one written with “OTHER” at ON, it indicates that the driver supports KTY84 temperature sensor. It is not allowed that both the dial switches are at ON or OFF at the same time.

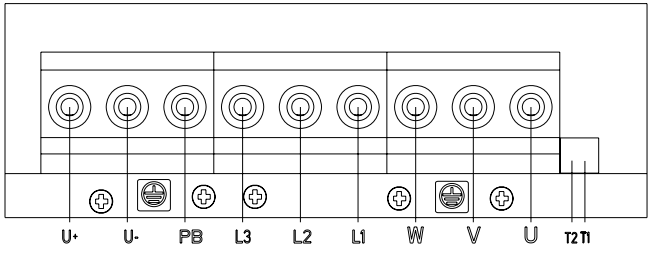


Annotation 6: Relying on the jumper wire J8 on the control panel, the terminal AGND can be connected to PE directly or through resistors and capacitors. If the middle one of short circuit J8 and the one at the side of GND are PIN, then the connecting method is suitable for the drivers of KT-CT-7501-A-0，KT-CT-1502-A-0 and KT-CT-1802-A-*. If the middle one of short circuit J8 and the one at the side of C are PIN, then the connecting method is suitable for the drivers of KT-CT-2501-A-1，KT-CT-3502-A-0 and KT-CT-4501-A-1.

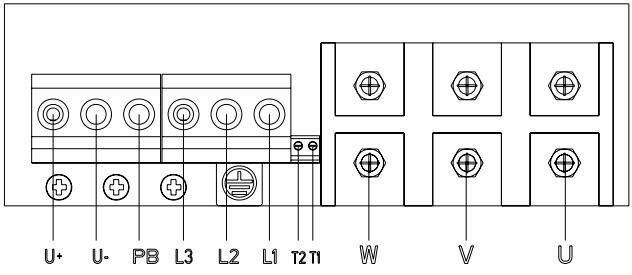


4.5. Main Circuit Wiring

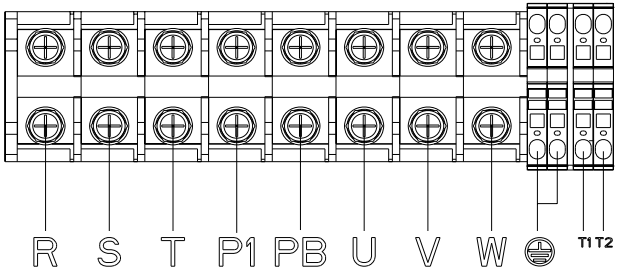
4.5.1. Names and Functions of Main Circuit Terminals (CN5)



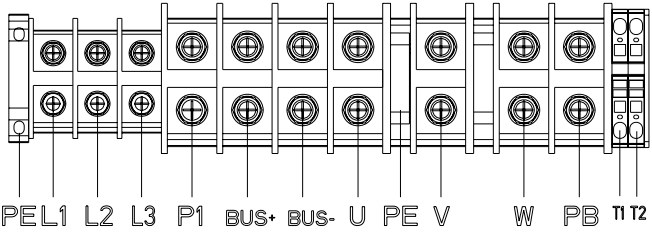
Terminal diagram of driver models KT-CT-7501-A-0/KT-CT-1502-A-0/KT-CT-1802-A-*



Terminal diagram of the driver model KT-CT-2502-A-1



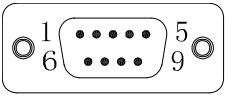
Terminal diagram of the driver model KT-CT-3502-A-0



Terminal diagram of the driver model KT-CT-4502-A-1

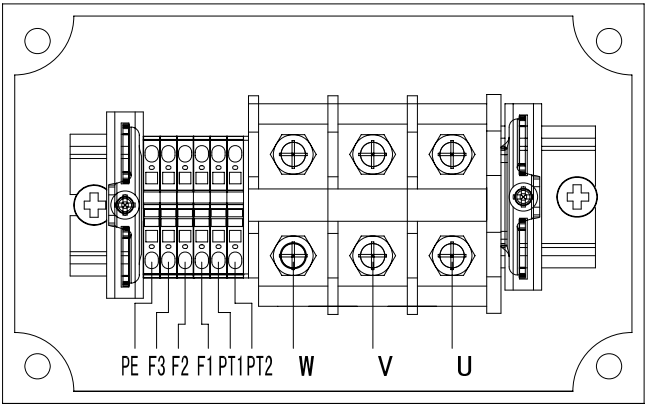
Terminal Name	**Terminal Symbol**	**Function**
Power input terminals of main circuit	L1，L2，L3	Three-phase AC380V ±15%（50/60Hz） Note that in the case of KT-CT-3502-A-0, the corresponding terminal symbols should be R, S and T.
Connecting terminals of servo motor	U，V，W	Connecting to the servo motor.
Earthing terminal	⏚	It can be connected to the power earthing terminal and the motor earthing terminal to facilitate ground processing.
Connecting terminals of external braking resistor	U+，PB	The external braking resistor can be connected between U+ and PB. Note that in the case of KT-CT-3502-A-0, the external braking resistor should be connected between P1 and PB.
Connecting terminal of motor temperature measuring resistor	T1，T2	They are used to connect the motor temperature measuring resistor.

4.5.2. Names and Functions of the Signal Connector (CN2) for the Resolver



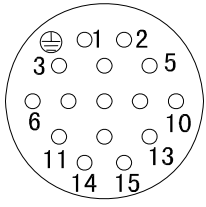
Signal Name	Code	Subscript	Function
Resolver Sino input+ Resolver Sino input-	Sin+ Sin-	CN2-3 CN2-7	The resolver feeds back signals sinusoidally.
Resolver cosine input+ Resolver cosine input -	Cos+ Cos-	CN2-1 CN2-6	The resolver feeds back signals cosinusoidally.
Reference signal+ Reference signal-	R1 R2	CN2-4 CN2-9	The resolver radiates signals.

4.5.3. Power Wires and Temperature Measuring Resistor Terminals for the Motor (KINWAY mM series motors)



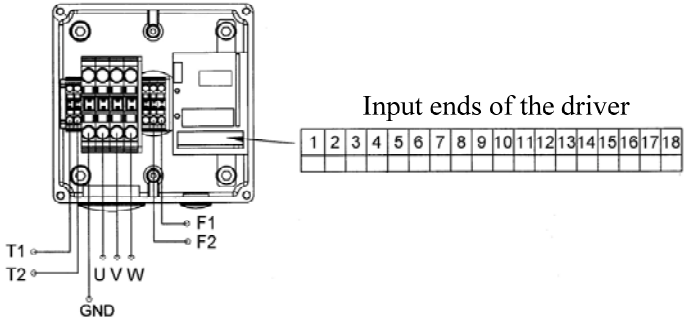
No.	Name	Definition
1	U	Motor three-phase input
2	V	
3	W	
4	PT1	Temperature measuring resistor
5	PT2	
6	F1	Ventilator power 380V AC
7	F2	
8	F3	
9	PE	Earthing

4.5.4. Resolver Terminals for the Motor (KINWAY mM series motors)



No.	Name	Definition
1	NC	Null
2	R1	Reference signal+
3	R2	Reference signal-
4	Sin+	Resolver sine output+
5	Sin-	Resolver sine output-
6	Cos+	Resolver cosine output +
7	Cos-	Resolver cosine output -
8~15	NC	Null

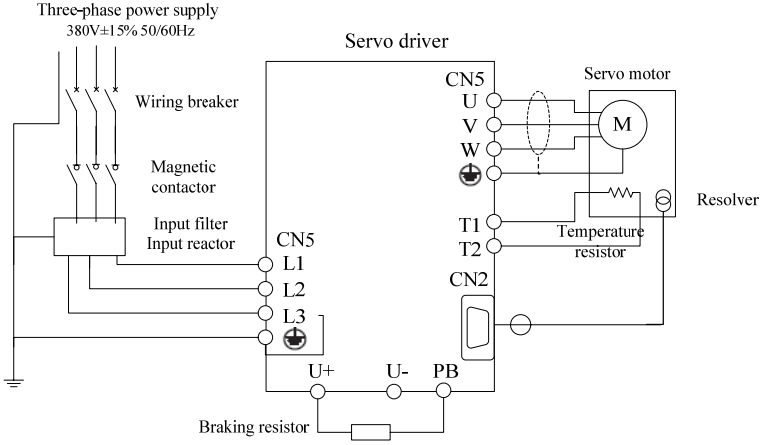
4.5.5. Motor Terminals (PHASE Motor)



Terminal	Definition	Terminal	Definition
U	Motor three-phase input	1	$R-$ Resolver reference input signal-
V		2	$R+$ Resolver reference input signal+
W		3	$Sin-$ Resolver sine output signal-
GND	Motor earthing	4	$Sin+$ Resolver sine output signal+
T1	Internal temperature measuring resistor of the motor	5	$Cos-$ Resolver cosine output signal-
T2		6	$Cos+$ Resolver cosine output signal+
F1	Internal cooling fan of the motor with AC power input of 220VAC	7~14	Null
F2		15	PTC+
17~18	Null	16	PTC-

4.5.6. Typical Wiring Instance of the Main Circuit

Attention	1. One electric wire only for one interface of the connector.
	2. The three-phase wire of the motor should be shielded and be attached at one end to the earth wire of the driver and at the other end to the earth wire of the motor connector.
	3. All screws shall be fixed with proper tightness to ensure good connection.



4.5.7. Wiring Procedure of Main Circuit Terminals

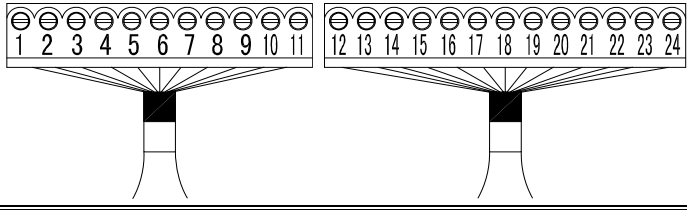
(1) Connect input power cables separately to the three power input terminals, L1, L2 and L3, of the driver, then link their earthing conductor with any earthing screw (PE) of the driver, fixing the screw with proper tightness to ensure good connection.

(2) Connect motor three-phase input terminals, W, V and U, separately to connecting terminals, W, V and U, which links the driver and the servo motor, meanwhile make sure the screws are fixed with proper tightness for the sake of good connection. Attach earth wire terminals of the motor to any earthing screw (PE) of the driver. Connect terminals of motor temperature measuring resistor and driver terminals, T1 and T2, and also make sure the screws are fixed with proper tightness for the sake of good connection. Link connecting terminals of the motor resolver with the driver connector CN2 and tighten the screws.

(3) Connect the two wiring terminals of the braking resistor to the driver terminals U+ and PB, having the screws fixed with proper tightness to ensure good connection.

4.6. Input & Output Signal Wiring

4.6.1. Function of Input & Output Signal Connector (CN1)



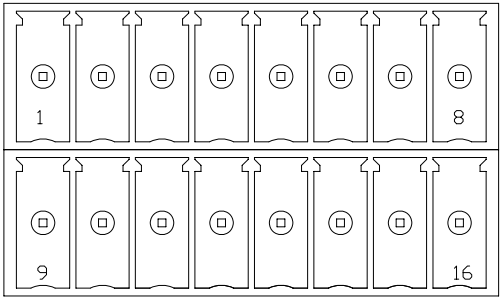
Signal Name	Code	Subscript	Function
Analog command 1 input+ Analog command 1 input-	AIN1+ AIN1-	CN1-1 CN1-2	Flow command input: The input gain value can be adjusted through LED panel and HMI.
Analog command 2 input+ Analog command 2 input-	AIN2+ AIN2-	CN1-3 CN1-4	Pressure command input: The input gain can be adjusted through LED panel and HMI.
Feedback input+ Feedback input-	AIN3+ AIN3-	CN1-5 CN1-6	Pressure feedback input: The input gain can be adjusted through LED panel and HMI.
Analog output1	AOUT1	CN1-7	Monitor the output and command internal parameter output through LED panel and HMI.
Analog output2	AOUT2	CN1-8	
Power supply of pressure transducer	CRF	CN1-11	Voltage: +15 VDC，±5% (full scale), 25°C output<100mA
Analog ground	AGND	CN1-9 CN1-10	

Fault reset signal	ALM-RST	CN1-12	Disable the servo alarm.
Driver enabling	S-ON	CN1-13	Turn the motor to power-up state by lifting parts of grid blockades of the driver.
PLC digital input1 PLC digital input2	I1 I2	CN1-14 CN1-15	I1：Select split-flow or merged-flow (use with the function of multi-pump distribution) High level for merged-flow and low level for split-flow. I2：Storing signal input (use with the function of electronic backpressure) High level in storing state of the injection molding machine and low level in other states.
Servo ready+ Servo ready-	S-RDY+ S-RDY-	CN1-20 CN1-19	Execute conduction if there is no servo alarm when the main circuit is powered on and the enabling end of the driver turns to LOW.
Alarm output+ Alarm output-	ALM+ ALM-	CN1-22 CN1-21	Able to conduct the fault once sensing abnormities. Photocoupler output. Max. voltage: DC30V, Max. current: DC50mA
PLC digital input2 PLC digital input2	COIN+ COIN-	CN1-24 CN1-23	Output the signal logic of PLC digital input 2.
Control supply input for digital	+24V	CN1-16	The user prepares the power supply of +24V.

signals			Operational voltage scope: +8V ～ +25V
Digital signal ground	GND24V	CN1-17 CN1-18	

4.6.2. Names and Functions of Input & Output Signal Connector (CN3)

The schematic diagram of CN3 double-row terminal location numbers:



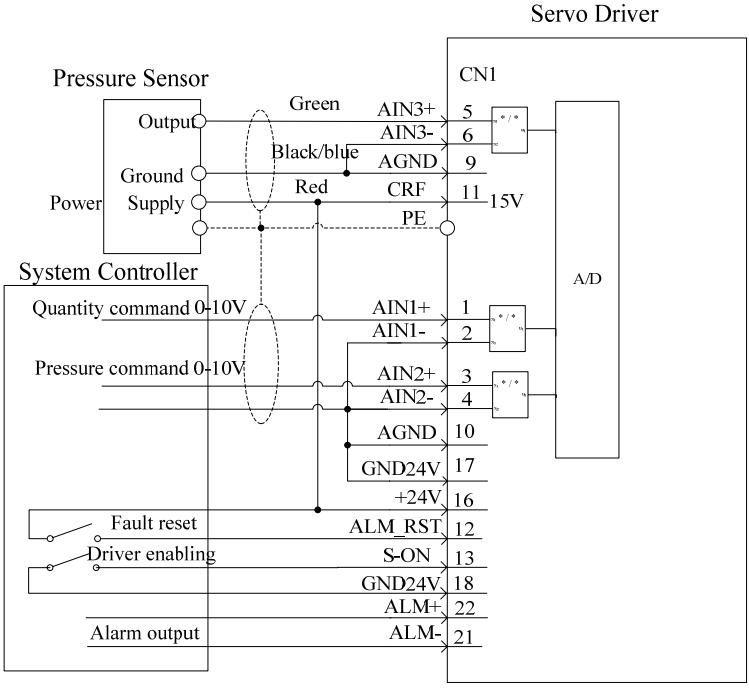
Instruction of terminal definitions:

Signal Name	Code	Subscript	Function
Digital input3	I3	CN3-9	PID parameter selection of single-punmp pressure control sections (4 sections), I4, I3 KP No. KI No. KD No. low low 0 0 0 low high 1 1 1 high low 2 2 2 high high 3 3 3
Digital input4	I4	CN3-10	

			PID parameter selection of multi-pump pressure control sections (4 sections), I4, I3 KP No. KI No. KD No. low low 0 0 0 low high 1 1 1 high low 2 2 2 high high 3 3 3
Digital input 5	I5	CN3-11	Selection of trigger modes (use with PQ control and note that the triggerless mode is effective for the driver) High level for triggering and low level for the triggerless.
Digital input 6	I6	CN3-12	Injection input signal (use with wobble control of the double-displacement pump) High level in the injecting state and low level in other states.
Digital input 7	I7	CN3-13	Packing input signal (use with wobble control of the double-displacement pump) High level in the packing state and low level in other states.
Digital input 8	I8	CN3-5	PQ selection signal (use with PQ control) High level for Q control and low level for P control)
Digital output 1	O1+ O1-	CN3-1 CN3-2	Wobble output signal (use with wobble control of the double-displacement pump) Conduct the small displacement and cut off the large displacement.

			Contact capacity of relay output: 3A /250VAC 1A/30VDC
Digital output 2	O2+ O2-	CN3-3 CN3-4	Conduct when the oil pressure is up to the output value and the feedback pressure up to a certain percentage which you may set of the command value. Photocoupler output, max. voltage: DC30V, max. current: DC50mA
Control power input for digital signals	+24V	CN3-6 CN3-14 CN3-15	The user prepares the power supply of +24V. Operational voltage scope: +8V ～ +25V
Digital signal ground	GND 24V	CN3-7 CN3-8 CN3-16	

4.6.3. Wiring Diagram of Typical Control Signals



4.7. Communication Signal Wiring

4.7.1. Names and Functions of Serial Communication Signal Connector (CN4)

Serial communication connector is communal for KINWAY LED panel and external HMI. It is linked to the LED panel by factory set. If you need the external HMI to commission the machine, you may pull out the wire linked to the LED panel and plug in another wire for connection with the external HMI.

Signal Name	Code	Subscript	Function
RS485 communication interface	RS485_A RS485_B	CN4_2 CN4_7	Half-duplex, Max. communication speed 115200bits/s（Factory set 19200 bits/s）
Communication power supply	+5VA	CN4_4,8	Max. output current 200mA, precision ± 5%
GND	GND_5VA	CN4_5,9	

4.7.2. Names and Functions Of CAN Communication Signal Connector (CN6)

Due to factory set, no CAN communication signal connector is attached to the KINWAY general driver. If you need one to control the driver or have to apply the driver in parallel system with multiple pumps, please purchase our other drivers with CAN communication signal connectors. But if you need this function for commission only, you may directly ask us for a dedicated cable of CAN communication.

The jumper wire J3 on CAN communication signal connector is used to decide whether to connect a terminal resistor of 120Ω in parallel to the bus. Plugging in the jumper cap means connection and removing it means disconnection.

Signal Name	Code	Subscript	Function
CAN communication interface	CANH CANL	CN6_1,3 CN6_2,4	Transform to standard signals of CAN protocal through KINWAY's delicated cable and attach to CAN-BUS.

4.8. Interface Circuit

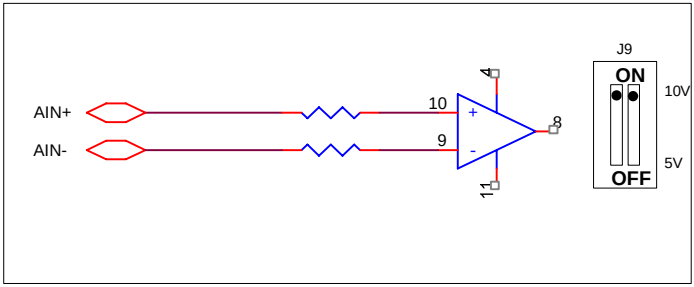
4.8.1. Analog Input Circuit Interface

The analog input circuits are as followed:

(1) Instruction of 1-2 (flow command) and 3-4 (pressure command) terminals of connector CN1. The input impedance of voltage input method is about 20kΩ and the max. allowable voltage is 15V.

(2) Instruction of 5-6 (feedback input) of connector CN1.The analog signal means the feedback signal of oil pressure. You can select the pressure transducer with the output value of 0-10V or 1-5V through dial switch J9.

The input impedance is about 100 kΩ and the max. allowable voltage is 15V.

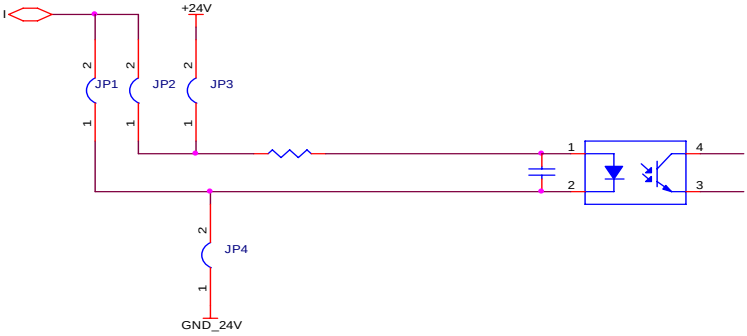


4.8.2. Digital Input Circuit Interface

Instruction of 12-15 terminals on connector CN1 and 5 and 9-13 terminals on connector CN3 is as followed:

Through jumper wires, you can choose high level effective circuit input (JP2, JP4 short circuit, JP1, JP3 disconnect) or low level effective circuit input (JP2, JP4 disconnect, JP1, JP3 short

circuit). According to the factory set, S-ON is designed with low level effective circuit and ALM-RST and I1-I8 with high level effective circuit. If you need the method of low level effective circuit, you may contact with the producer who should be responsible for modification of interface logic. The interface circuits are as followed:

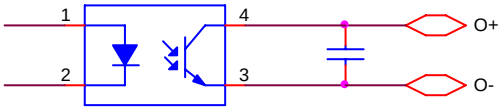


4.8.3. Digital Output Circuit Interface

(1) Instruction of photocoupler output circuit:

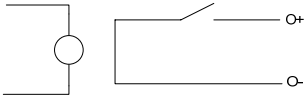
Instruction of digital terminals 8-13 on connector CN1 and 3&4 on connector CN3:

Since the digital output signals (S_RDY，ALM，COIN，O2) are outputted by photocoupler collector, please use photocoupler circuits, relay circuits or bus receiver circuits. The following is the legend of interface circuits:



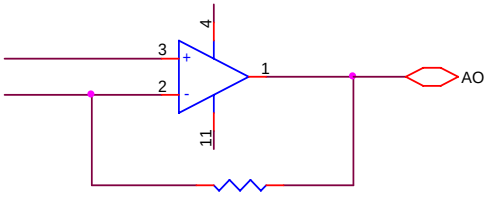
- Max. voltage：DC30V
- Max. current：DC50mA

Instruction of digital output terminals 1 and 2 on connector CN3: The digital output signal (01) is outputted by relay. The following is the legend of interface circuits:



(2) Analog output circuit:

Instruction of analog output terminals 7 and 8 on connector CN1: The analog output signals (AOUT1 and AOUT2) are outputted by operational amplifier and constitutes output loop together with AGND. You may select a proper internal parameter output through LED panel, HMI and SCM. According to factory set, AOUT1 is pressure output and AOUT2 is flow output of the motor. The following is the legend of interface circuits:



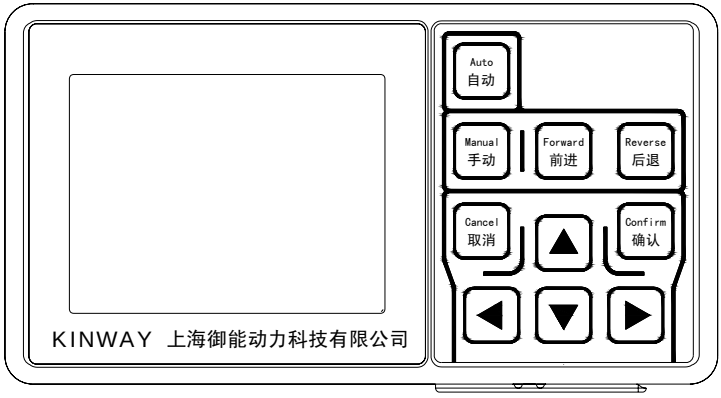
- Output precision：10位D/A
- Voltage range：0～10V
- Max. current：DC10mA

5. Display & Function

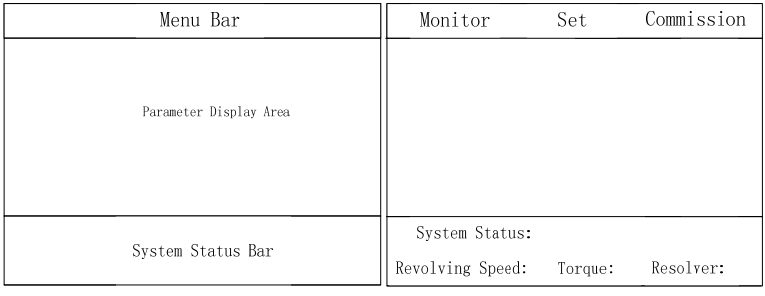
5.1. External HMI Display and Function

5.1.1. Instruction of HMI Panel

The control panel is composed of LCD display area and a keypad. LCD is a screen of 5.7 inches with a resolution of 320×240. And ten keys constitute the keypad which can be divided to areas of running keys, arrow keys and set keys as followed.



The display profile of LCD area is shown as followed:



Menu bar: It displays menu items under different conditions. The chosen item is shown with blue texts on white and the else with white texts on blue. The menu bar can display at most 3 items simultaneously. The user can shift among different items through right and left arrow keys to decide display of the follow-up or the former item.

Parameter display area: It displays names, values and units of parameters attached to the chosen menu.

System status bar: It shows the present status of the system as well as the values of torque, revolving speed and resolver. The units defined by default (torque: nm; revolving speed: rpm) are not shown.

The contents in the menu bar and parameter display area change with key operation of the user while the system running status decides what's displayed in the system status bar.

5.2. Functions of Keys on Control Panel

5.2.1. Functions of Running Keys

Auto 自动	Press this to switch the run enable between “enable” and “forbidden”.
Manual 手动	Reserve
Forward 前进	Under the commission menu, press this if the “jog enable” is enabling and the motor will revolve to the forward direction at the jog speed you set.
Reverse 后退	Under the commission menu, press this if the “jog enable” is enabling and the motor will revolve to the reverse direction at the jog speed you set.

5.2.2. Functions of Arrow Keys

▶	1. During menu switch, press this to select the desired menu by rolling to the right. 2. During parameter set, press this to switch the highlight area "□" among parameter digits and keys of "save"/"cancel" to the right.
◀	1. During menu switch, press this to select the desired menu by rolling to the left. 2. During parameter set, press this to switch the highlight area "□" among parameter digits and keys of "save"/"cancel" to the left.
▲	1. During parameter check, press this to select corresponding parameters by scrolling up. 2. During parameter set, when one digit is chosen, press this to change the digit by adding one and it can realize carry change.

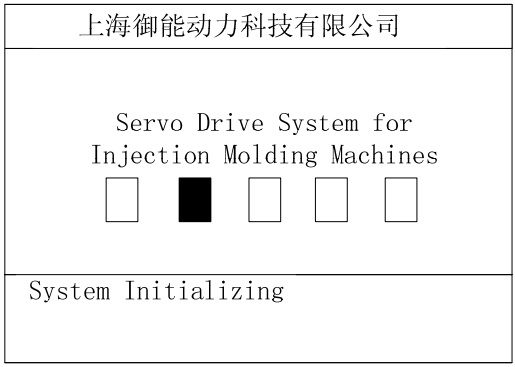
▼	1. During parameter check, press this to select corresponding parameter by scrolling down. 2. During parameter set, when one digit is chosen, press this to change the digit by subtracting one and it can realize abdicated change.

5.2.3. Functions of Set Keys

Confirm 确认	1. Press it to turn from parameter check to parameter set or to disable/enable. 2. After selecting the virtual key of "save" / "cancel", press this to save/cancel parameter setting.
Cancel 取消	1. Press it to return to parameter check from parameter set.

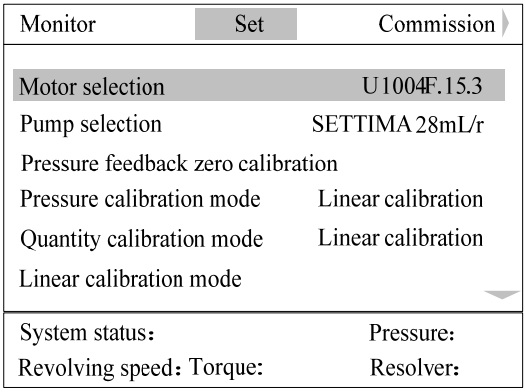
5.3. External HMI Functions

After powering on the connecting driver, the screen of HMI will present the process of initialization. The user can not use keys to operate HMI until it accomplishes initialization.



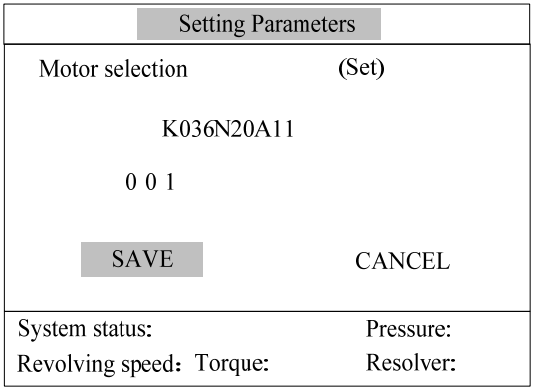
According to the parameter list, the user can switch among five menu bars of “monitor", “set”, “commission”, “multi-pump” and “parameter download” through ◀ and ▶. The chosen menu will

be highlighted by the cursor. Switch the highlight cursor to the desired parameter through ◀ and ▶.



After the parameter is highlighted, press 确认 to enter the interface of parameter modification.

Move the highlight cursor through ◀ and ▶ to the selected motor and choose the desired model through ▲ and ▼.



Switch the highlight cursor to "SAVE" through ◀ and ▶.

then press 确认 to save the parameter and exit to the set menu bar. The current parameter will be sent to the driver through HMI.

Some commission parameters are slightly different from setting parameters. For instance, the user can just press 确认 to modify the parameter directly when the diagnose enable parameter is highlighted.

5.3.1. List of Monitor Menu

Menu No.	Menu Name	Description	Parameter Range	Unit
Screen 1				
0	Flow command + Analog signal voltage	Command flow quantity Voltage value of flow command analog signal	[0,2400.0] [0,10.00]	L/min V
1	Pressure command + Analog signal voltage	Command pressure value Voltage value of pressure command analog signal	[0,250.0] [0,10.00]	bar V
2	System fault	Alarm of system fault (able to display multiple concurrent faults.)	Refer to “List of protection display”	
3	Motor current	Effective value of motor winding current	[0,900.0]	A
4	AC voltage	AC input voltage	[0,500]	Vrms
5	DC voltage	DC bus voltage	[0,800]	V
Screen 2				

6	Torque limit	Output capability of system RT torque	[0,1800]	Nm
7	Motor temperature	Temperature of machine winding	[-52,244]	℃
8	Driver temperature	Temperature of IGBI module	[-46,244]	℃
9	Ambient temperature	Ambient temperature of the driver	[-18,114]	℃
10	Machine material	Driver No. for modification	[1,999]	
11	Max. system pressure	Max. pressure to exhaust hydraulic oil. from the pump	[0,250.0]	bar
Screen 3				
12	System max. flow	Max. flow to exhaust hydraulic oil. from the pump	[0,2400.0]	L/min
13	Power	Mechanical power of motor output	[0,327.67]	Kw
14	Software version	Software version of the driver	Software version No. of the driver	
15	Interface version	Software version of HMI	Software version No. of HMI	

16	Runtime	Accumulative running time of the driver	[0,99] [0,364] [0,23] [0,59]	year day h m

5.3.2. List of Set Menu

Menu No.	Menu Name	Description	Parameter Range	Unit
Screen 1				
1	Driver selection	Driver model	Refer to Chapter 5.5.4 in the list of driver models	
2	Motor selection	Motor model	Refer to Chapter 5.5.4 in the list of motor models	
3	Pump selection	Oil pump model	Refer to Chapter 5.5.4 in the list of oil pump models	
4	Pressure feedback zero calibration	Able to eliminate the zero offset of pressure transducer through pressure feedback zero calibration	Calibration	
5	Pressure calibration	Calibration method of	Linear	

	mode	pressure command analog signal	pressure calibration Fold line pressure calibration	
6	Flow calibration mode	Calibration method of flow command analog signal	Linear flow calibration Fold line flow calibration	
Screen 2				
7	Linear/fold line pressure calibration	It is used to decide whether to conduct linear/fold line pressure calibration. Keep the driver in disable state during calibration. During linear calibration, modify the pressure command value of injection molding machine's system driver to zero and to the max. respectively for calibrations of linear zero and linear range. During fold line	Under the linear calibration mode: zero full scale Under the fold line calibration mode: fold line node 0 fold line node 1 fold line node 2 fold line node 3	

		calibration, the pressure command value of injection molding machine's system driver should be equal to the pressure value at the fold line node.	fold line node 4 fold line node 5 fold line node 6 fold line node 7 fold line node 8 fold line node 9 fold line node 10 fold line node 11 fold line node 12	
8	Linear/fold line flow calibration	It is used to decide whether to conduct linear/fold line flow calibration. Keep the driver in disable state during calibration. During linear calibration, modify the command flow quantity	Under the linear calibration mode: zero full scale Under the fold line calibration mode:	

		of injection molding machine's system driver to zero and to the max. respectively for calibrations of linear zero and linear range. During fold line calibration, the command flow quantity of injection molding machine's system driver should be equal to the flow quantity at the fold line node.	fold line node 0 fold line node 1 fold line node 2 fold line node 3 fold line node 4 fold line node 5 fold line node 6 fold line node 7 fold line node 8 fold line node 9 fold line node 10 fold line node 11 fold line node 12	
9	Pressure filtering	Calculation counts of	[1,32]	

		average filtering for pressure command samples		
10	Pressure full scale	Set the full scale of pressure at the node.	[1,system max. pressure (multiple pumps in parallel) or max. pressure of the machine (single pump)]	bar
11	Flow full scale	Set the full scale of flow at the node.	[1, max. system flow (multiple pumps in parallel) or max. flow of the machine (single pump)]	L/min
12	Max. flow	Set max. flow value at the node.	[0,2400.0]	L/min
Screen 3				
13	Max. pressure	Set max. pressure value at the node.	[0,250]	bar
14	Flow filtering	Calculation counts of average filtering for flow command	[1,32]	

		samples		
15	Speed proportional gain	Proportional parameter of speed PID control	[0,32767]	
16	Speed integral gain	Integral parameter of speed PID control	[0,32767]	
17	Pressure feedback gain	Magnification of pressure feedback signal	[0,32767]	
18	Rising slope of pressure command	Rising step of pressure command per millisecond	[0,32767]	
Screen 4				
19	Descending slope of pressure command	Descending step of pressure command per millisecond	[0,32767]	
20	Pressure proportional gain 0	Segment 0 of proportional gain of pressure PID control	[0,32767]	
21	Pressure integral gain 0	Segment 0 of integral gain of pressure PID control	[0,32767]	
22	Pressure differential gain 0	Segment 0 of differential gain of pressure PID control	[0,32767]	
23	Pressure proportional gain 1	The 1st segment of proportional gain of pressure PID control	[0,32767]	

24	Pressure integral gain 1	The 1st segment of integral gain of pressure PID control	[0,32767]	
Screen 5				
25	Pressure differential gain 1	The 1st segment of differential gain of pressure PID control	[0,32767]	
26	Pressure proportional gain 2	The 2nd segment of proportional gain of pressure PID control	[0,32767]	
27	Pressure integral gain 2	The 2nd segment of integral gain of pressure PID control	[0,32767]	
28	Pressure differential gain 2	The 2nd segment of differential gain of pressure PID control	[0,32767]	
29	Pressure proportional gain 3	The 3rd segment of proportional gain of pressure PID control	[0,32767]	
30	Pressure Integral gain 3	The 3rd segment of integral gain of pressure PID control	[0,32767]	
Screen 6				
31	Pressure differential gain of 3	The 3rd segment of differential gain of pressure PID control	[0,32767]	

32	Pump displacement (reset)	Displacement per rev of oil pump	[0,32767]	mL/rev
33	Pump leakage (reset)	Ratio of oil pump's leakage loss and outlet pressure	[0,100.00]	L/min/bar
34	Pump reversal speed limit	Max. reversal speed of oil pump	[0,-6000]	rpm
35	Max. revolving speed of motor	Max. revolving speed in the forward and reversal directions of motor	[0,6000]	rpm
36	DC voltage calibration	Calibrate the DC voltage of driver with actual DC bus voltage	[0,800]	V
Screen 7				
37	AC voltage calibration	Calibrate the AC voltage of driver with actual AC input voltage	[0,500]	V
38	Base flow enable	It is used to set the control mode, whether with base flow or not, of oil pressure.	No base flow With base flow	
39	Base flow pressure	The parameter is used to set target pressure value of base flow when the system is under the control mode with base flow.	[0,250.00]	bar

40	Base flow quantity	The parameter, base flow quantity, is used to set the flow quantity to make the system achieve the pressure value of base flow when the system is under the control mode with base flow.	[0,327.67]	L/min
41	Overshoot limit value	Once the difference between feedback pressure and command pressure of the oil pump exceeds this set value, the motor will speed down promptly to restrict pressure overshoot.	[5,50]	bar
42	Motor revolving direction	Set revolving direction of motor	Forward Reversal	
Screen 8				
43	Resolve direction	Set revolving direction of resolver	Forward Reversal	
44	Backpressure method	Select the control method of backpressure storing of injection	Manual Auto	

		molding machine		
45	Type of pressure transducer	Pressure transducer type	1-5v|200bar 0-10v|250bar	
46	Type of plunger pump	Select displacement type	Single displacement Double displacement	
47	Displacement ratio of plunger pump	The ratio of large and small displacement of double displacement pump.	[0,100.0]	%
48	Pressure threshold value of wobble switch	Feedback pressure threshold value for wobble to switch to small displacement	[0,250.0]	bar
Screen 9				
49	Displacement switch mode	0：overpressure 1：dwell overpressure		
50	Delay of displacement pressure judge	The wobble will start switching when its switch condition is satisfied by system and the duration exceeds the delay of displacement pressure judge.	[0,32767]	ms
51	Delay of displacement switch rise	The time taken since the beginning when the	[0,32767]	ms

		driver's wobble makes the digital outlet switch to off until the pump displacement increases to the high volume.		
52	Delay of displacement switch descend	The time taken since the beginning when the driver's wobble makes the digital outlet switch to on until the pump displacement decreases to the low volume.	[0,32767]	ms
53	Wobble switch speed upper limit	Speed threshold value for wobble to switch to large displacement	[0,6000]	rpm
54	Wobble switch speed lower limit	Speed threshold value for wobble to switch to small displacement	[0,6000]	rpm
Screen 10				
55	Zero dead zone of flow command	Small-signal restrain from analog signals of flow command	[0,100.00]	%
56	Zero dead zone of pressure command	Small-signal restrain from analog signals of pressure command	[0,100.00]	%
57	Zero dead zone of pressure feedback	Small-signal restrain from analog input	[0,100.00]	%

		signals of pressure feedback		
58	O2 Breakover pressure coefficient	When the ratio of feedback pressure and command pressure exceeds this coefficient, output 02 to turn to breakover.	[0,100.00]	%
59	Negative moment restrain	When the negative moment restrain is enabled, the threshold value of motor's negative moment is zero.	0：disable 1：enable	

5.3.3. List of Commission Menu

Menu No.	Menu Name	Description	Parameter Range	Unit
Screen 1				
0	Run enable	Turn on/off motor drive function	Disable Enable	
1	Diagnose enable	Turn on/off diagnose function	Disable Enable	
2	Driver test (only available when diagnose enable is on)	Refer to "Driver Test of Section 8.1.7"	Disable Enable	
3	Initial angle	Refer to "Measurement	Disable	

	measurement (only available when diagnose enable is on)	of Motor Initial Angle of Section 8.1.6"	Enable	
4	Jog enable (only available when diagnose enable is on)	Refer to "Low Speed Jog and Exhaust of Section 8.1.8"	Disable Enable	
5	Control mode	Set control mode of driver	Speed mode Process mode	
Screen 2				
6	Speed command (available in speed mode)		The command value of forward and reverse speed should not exceed the max. speed of motor	rpm
7	Process instruction mode	It is used to select input method of command.	Digital input Analog input CAN continue 485 continue	
8	Flow command	The command flow quantity is effective when digital input is taken to input command.	[0, max. flow]	L\min
9	Pressure command	The pressure command	[0, max.	bar

		value is effective when digital input is taken to input command.	pressure]	
10	Max. jog speed	Max. speed of motor when pressing forward/backward key.	The forward and reverse speed should not exceed the max. speed of motor.	rpm
11	Revolving offset value	Zero offset angle of resolver and motor	[0,4096]	
Screen 3				
12	DA1	Set output variable of analog outlet 1	Pressure command Pressure feedback Flow command Flow feedback Speed command Speed feedback Torque command Torque feedback Resolve feedback	

			D.C. voltage Phase current Error message state word 1 Error message state word 2 Communication command	
13	DA1 max.	Digital input corresponding to max. output of analog outlet 1	[-32767,32767]	
14	DA1 min.	Digital input corresponding to min. output of analog outlet 1	[-32767,32767]	
15	DA2	Set output variable of analog outlet 2	Pressure command Pressure feedback Flow command Flow feedback Speed command Speed feedback Torque command Torque feedback	

			Resolve feedback D.C. voltage Phase current Error message state word 1 Error message state word 2 Communication command	
16	DA2 max.	Digital input corresponding to max. output of analog outlet 2	[-32767,32767]	
17	DA2 min.	Digital input corresponding to min. output of analog outlet 2	[-32767,32767]	
Screen 4				
18	DA output value	The analog outlet will output the variable when communication command is taken for DA variable output.	[-32767,32767]	

5.3.4. List of Multi-pump Menu

Menu No.	Menu Name	Description	Parameter Range	Unit
Screen 1				

0	Net enable/disable	Net enable control	Disable Enable	
1	Net open/close tube	It controls motor enable/disable of all nodes, only available in the multi-pump mode	Close tube Open tube	
2	Converging type	Select converging type	Single pump Compound Multi-pump Multi-mode	
3	Node No.	It refers to host machine when the node number is 0. It refers to slave machine when the node number is between 1 and 15.	[0,15]	
4	Slave node No.	The slave node number refers to the number of slave machines linked to the host machine when it is 0.	[0,15]	
5	Node type	Set the running method of driver at nodes	Single unit Control unit Follow unit	
Screen 2				
6	Flow enter threshold	Condition for next	[0,100.0]	%

		pump to participate in operation together. When system flow is beyond the present flow enter threshold of pump, then put next pump into work.		
7	Flow enter hysteresis upper limit	Condition for next pump to participate in operation together. It is used to avoid start & stop back and forth of pump led by flow at the critical point.	[0,100.0]	%
8	Flow enter hysteresis lower limit	Condition for next pump to participate in operation together. It is used to avoid start & stop back and forth of pump led by flow at the critical point.	[0,100.0]	%
9	Multi-pump pressure proportional gain 0	Segment 0 of proportional parameter under multi-pump pressure PID control	[0,32767]	
10	Multi-pump pressure integral gain 0	Segment 0 of integral parameter under	[0,32767]	

		multi-pump pressure PID control		
11	Multi-pump pressure differential gain 0	Segment 0 of differential parameter under multi-pump pressure PID control	[0,32767]	
Screen 3				
12	Multi-pump pressure proportional gain 1	The 1st segment of proportional parameter under multi-pump pressure PID control	[0,32767]	
13	Multi-pump pressure integral gain 1	The 1st segment of integral parameter under multi-pump pressure PID control	[0,32767]	
14	Multi-pump pressure differential gain 1	The 1st segment of differential parameter under multi-pump pressure PID control	[0,32767]	
15	Multi-pump pressure proportional gain 2	The 2nd segment of proportional parameter under multi-pump pressure PID control	[0,32767]	
16	Multi-pump pressure integral gain 2	The 2nd segment of integral parameter under multi-pump pressure PID control	[0,32767]	

17	Multi-pump pressure differential gain 2	The 2nd segment of differential parameter under multi-pump pressure PID control	[0,32767]	
Screen 4				
18	Multi-pump pressure proportional gain 3	The 3rd segment of proportional parameter under multi-pump pressure PID control	[0,32767]	
19	Multi-pump pressure integral gain 3	The 3rd segment of integral parameter under multi-pump pressure PID control	[0,32767]	
20	Multi-pump pressure differential gain 3	The 3rd segment of differential parameter under multi-pump pressure PID control	[0,32767]	

5.3.5. List of Parameter Download Menu

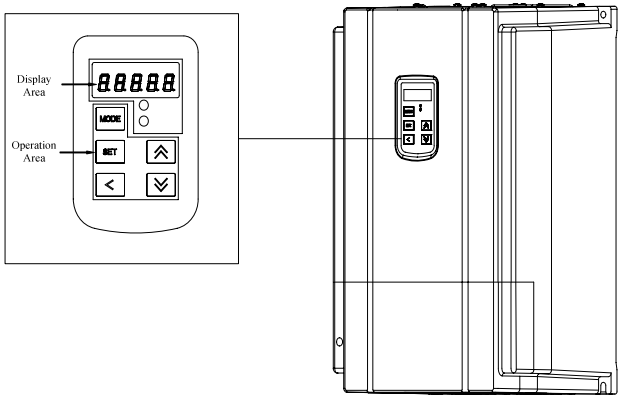
Menu No.	Menu Name	Description
Screen 1		
0	Parameter download	Download the RAM parameter inside driver to EEPROM.
1	Factory reset	Parameter used for factory reset
2	Batch parameter read	Batch read the parameter in EEPROM of HMI.

3	Batch parameter download	Batch download the parameter to EEPROM of HMI
4	Batch parameter delete	Delete the parameter saved in EEPROM of HMI
5	Error record check	Read error records

※ If the power supply of the driver is cut off during "factory reset" and "parameter download" is not performed yet, then no factory set will be reserved even after the driver is restarted.

5.4. LED Display and Operation

5.4.1. Description of LED Panel

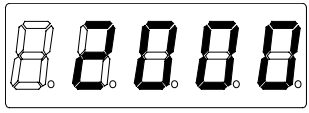


Slot	Description	Slot	Description	Slot	Description
MODE	Menu skip/cancel	▲	Up	◀	Left
SET	Set	▼	Down		

LED display table：

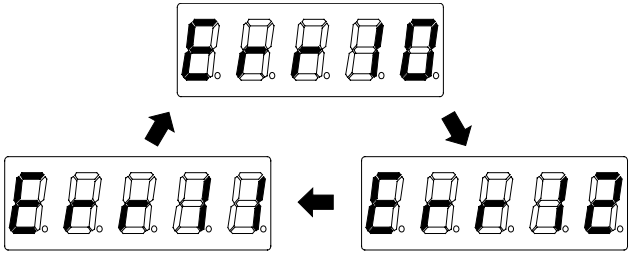
Displayed Letter	Corresponding Letter	Displayed Letter	Corresponding Letter	Displayed Letter	Corresponding Letter	Displayed Letter	Corresponding Letter	Displayed Letter	Corresponding Letter	Displayed Letter	Corresponding Letter
	0		1		2		3		4		5
	6		7		8		9		A		b
	C		d		E		F		G		H
	I		J		K		L		M		N
	O		P		q		R		S		T
	U		V		W		X		Y		Z
	.		-								

When power of servo driver is on, LED nixie tube will be lit up and the revolving speed (rpm) of motor, accurate to the unit value, will be displayed by default.



If any fault happens during powering on or operation, the red light on panel will flash and the LED panel will show the error code which consists of error identifier (Err in the first three places from left to right on nixie tube) and error code number (two digits in the last two places from left to right on nixie tube). After occurrence of an error, the error code will flash once per second.

If several faults happen simultaneously, then several error codes will be displayed repeatedly as well as recurrently.



If keyboard operation is necessary in the state of speed or error display, press ▲ and ▼ simultaneously for one second and LED panel will show UNLOCK which indicates the system keyboard is unlocked. After that the user can operate the keyboard.

The user can access to the shortcut mode through the keyboard if the driver is working in normal or by pressing MODE if the driver is out of order.

In the process of keyboard operation, press ▲ and ▼ simultaneously for one second at any time and LED panel will show LOCK which indicates the system keyboard is locked and LED panel display will exit to the state of speed or error display.

5.4.2. Description of Indicator Light Display

The indicator light area which consists of a red LED light and a green LED light shows the current running state of MH500 system through the on , off & flash states of the two LED lights.

No.	Green Light	Red Light	Control State
1	Off	Off	Turn off
2	On	Off	Ready
3	Off	On	Power on
4	On	On	Diagnose
5	Flash	Off	Normal
6	Off	Flash	Fault

5.5. LED Panel Function

5.5.1. Keyboard Operation Mode

This driver has five modes of keyboard operation among which the user can switch with MODE when the keyboard is unlocked.

Shortcut mode: to display key parameters

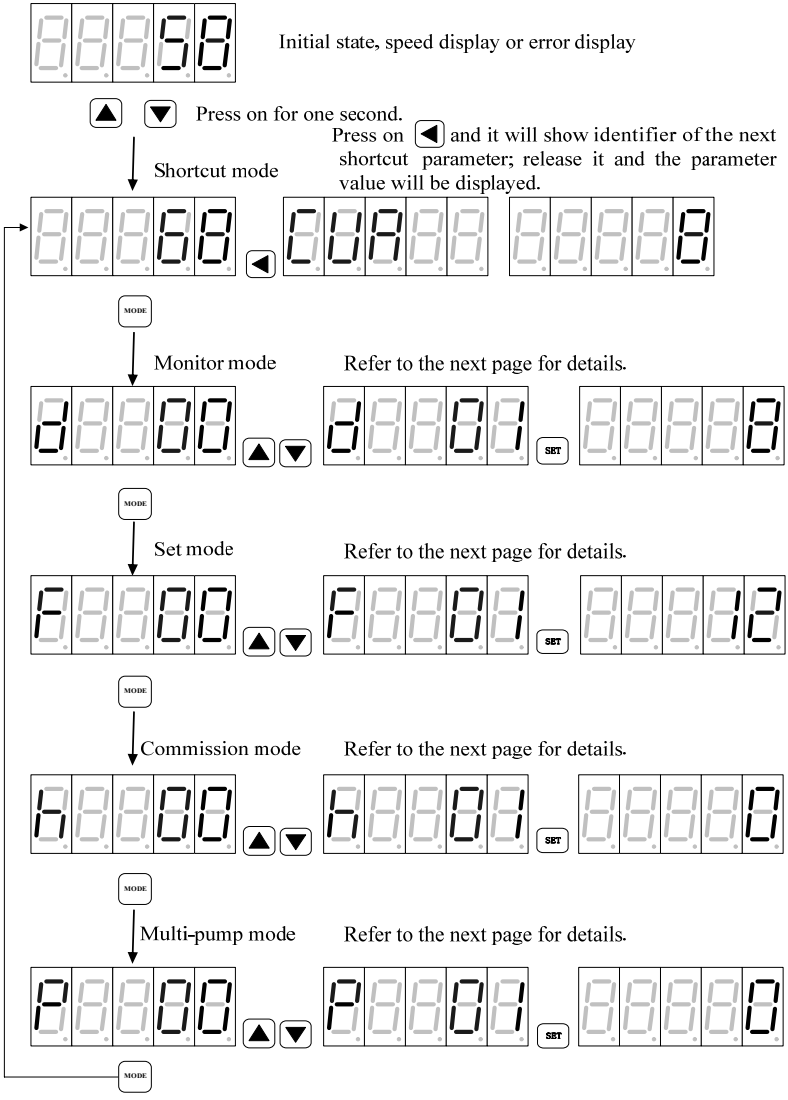
Monitor mode: to display state parameters

Set mode: to set basic parameters

Commission mode: to commission motor and reserve parameters

Multi-pump mode: to set parameters of multiple pumps in parallel

Operational flowchart is as followed:



5.5.2. Shortcut Mode

In shortcut mode, it is achievable to observe significant parameters of the driver by pressing ▲. In the state of LOCK, press on ▲ and ▼ simultaneously for one second to enter "shortcut mode" and LED will show values of the chosen parameter. Press ◀ and LED will show the identifier of the next parameter. Release ◀ and LED will show the corresponding parameter values.

※ In shortcut mode, if there's no key operation in ten minutes, it will switch automatically to speed and error display interface.

Parameter chart in shortcut mode:

Identifier	Definition & Description	Parameter Range	Unit
SPD	Speed feedback	[-6000,6000]	rpm
CUR	Current feedback	[0,900.0]	A
RES	Resolve feedback	[0,4096]	
PRS	Pressure feedback	[-250,250]	bar
PIDS	PID segment No.	[0,3]	

5.5.3. Monitor Mode

Press MODE to enter "monitor mode" and LED panel will show "d—xx" of which xx stand for identifiers of various parameters. Press ▲ or ▼ to select the desired parameter identifier. Press SET after selection and LED panel will show corresponding parameter values. Press MODE again to exit.

※ In monitor mode, if there's no key operation in ten minutes, it will switch automatically to speed and error display interface.

Definitions of monitor parameters of the driver in monitor mode:

Code	Name	Parameter Range	Unit
d00	Flow command	[0,2400.0]	L/min
d01	Pressure command	[0,250.0]	bar
d02	System fault	System fault alarm (able to display several concurrent faults)	
d03	Motor current	[0,900.0]	A
d04	AC voltage	[0,500]	Vrms
d05	DC voltage	[0,800]	V
d06	Torque limit	[0,1800]	Nm
d07	Speed feedback	[-6000,6000]	Rpm
d08	Resolve feedback	[0,4095]	
d09	Pressure feedback	[-250,250]	bar
d10	Torque feedback	[-1800,1800]	Nm
d11	Run mode	3：speed mode 4：process mode	
d12	Motor temperature	[-52,244]	℃

d13	Driver temperature	[-46,244]	℃
d14	Ambient temperature	[-18,114]	℃
d15	Machine material	[1,999]	
d16	DSP software version		
d17	Panel software version		
d18	Max. system pressure	[0,250.0]	bar
d19	Max. system flow	[0,2400.0]	L/min
d20	Power	[0.00,327.67]	Kw
d21	Converging type	0：single-pump 1：compound 2：multi-pump 3：multi-mode	

※ Refer to List of HMI Monitor Menu in Chapter 5.3.1 for parameter description.

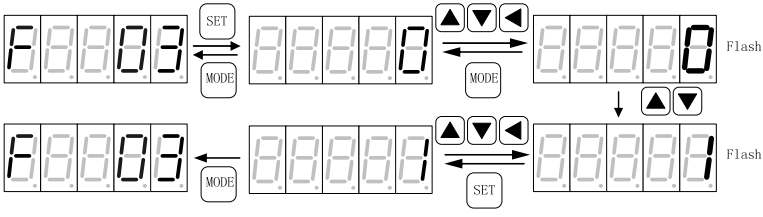
5.5.4. Set Mode

Press MODE to enter "set mode" and LED panel will show "F—xx" of which xx stand for different parameter identifiers. Press ▲/▼ to choose the desired parameter identifier. Press SET after selection and LED panel will show corresponding parameter values. Press ◀ to move the flashing position when modifying parameter values and press ▲/▼ to change the value of the flashing position. After modification, press SET to reserve and the flash stops

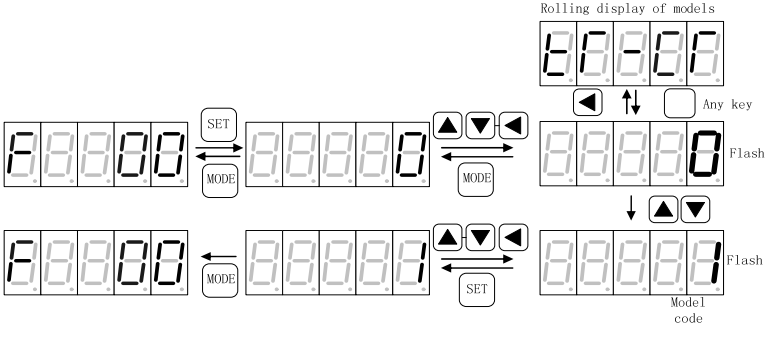
meanwhile. At the moment, press SET or ▲/▼ to remodify parameter values and meanwhile the position for modification will keep flashing. Press MODE again to exit.

The selection of driver, motor, and pump differs from that of other parameters. The specific operation is as followed:

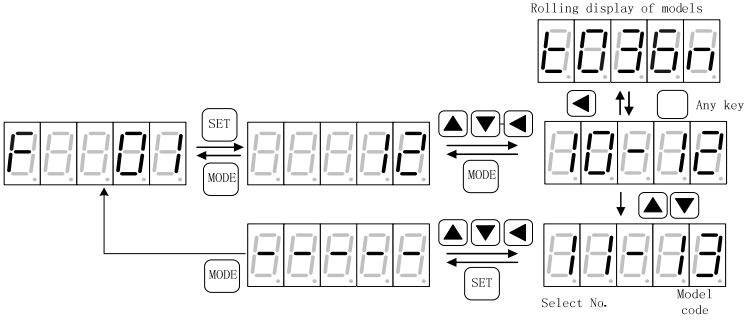
Operational flowchart of parameter set:



Operational flowchart of driver set:



Operational flowchart of motor and pump set:



Select No.: arrangement SN of motors or pumps of various models

Model code: digital codes of motors or pumps of various models

※ In set mode, if there's no key operation in ten minutes, it will switch automatically to speed and error display interface.

1) List of driver models:

Driver model	Driver model code
KT-CT-1502-A-0	0
KT-CT-1802-A-*	1
KT-CT-7501-A-0	2
----------(reserve)	3
----------(reserve)	4
KT-CT-4502-A-1	5
KT-CT-3502-A-0	6
KT-CT-2502-A-0	7
KT-CT-4502-A-2	8
KT-CT-2502-A-1	9

2) List of motor models:

Motor select No.	Motor model	Motor model code	Manufacturer	Winding temperature resistor model
0	K038F18C18P	60	KINWAY	Pt1000
1	K036F20C18P	65	KINWAY	Pt1000
2	K058F18C18P	33	KINWAY	Pt1000
3	K060F18C18P	66	KINWAY	Pt1000
4	K072F18C18P	61	KINWAY	Pt1000
5	K091F15C18P	34	KINWAY	Pt1000
6	K111F15C18P	35	KINWAY	Pt1000
7	K132F18C18P	62	KINWAY	Pt1000
8	K187F18C25P	63	KINWAY	Pt1000
9	K053F20D18P	67	KINWAY	Pt1000
10	K070F20D18P	68	KINWAY	Pt1000
11	K087F20D18P	64	KINWAY	Pt1000
12	K105F20D18P	69	KINWAY	Pt1000
13	K189F15D25P	70	KINWAY	Pt1000
14	K172F18D25P	71	KINWAY	Pt1000
15	K260F20D25P	72	KINWAY	Pt1000
16	K053F20E18P	47	ANXIN MOTOR	KTY84
17	K070F20E18P	48	ANXIN MOTOR	KTY84
18	K087F20E18P	49	ANXIN MOTOR	KTY84
19	K105F20E18P	50	ANXIN	KTY84

			MOTOR	
20	K189F15E25P	51	ANXIN MOTOR	KTY84
21	K172F18E25P	52	ANXIN MOTOR	KTY84
22	K260F20E25P	53	ANXIN MOTOR	KTY84
23	U1004F.15.3	12	PHASE MOTOR	KTY84
24	U1004F.17.3	13	PHASE MOTOR	KTY84
25	U1004F.20.3	14	PHASE MOTOR	KTY84
26	U1005F.15.3	15	PHASE MOTOR	KTY84
27	U1005F.17.3	16	PHASE MOTOR	KTY84
28	U1005F.20.3	17	PHASE MOTOR	KTY84
29	U1007F.15.3	18	PHASE MOTOR	KTY84
30	U1007F.17.3	9	PHASE MOTOR	KTY84
31	U1007F.20.3	19	PHASE MOTOR	KTY84
32	U1008F.15.3	20	PHASE	KTY84

			MOTOR	
33	U1008F.17.3	21	PHASE MOTOR	KTY84
34	U1008F.20.3	22	PHASE MOTOR	KTY84
35	U1010F.15.3	6	PHASE MOTOR	KTY84
36	U1010F.18.3	10	PHASE MOTOR	KTY84
37	U1010F.20.3	4	PHASE MOTOR	KTY84
38	U1013F.15.3	23	PHASE MOTOR	KTY84
39	U1013F.17.3	24	PHASE MOTOR	KTY84
40	U1013F.18.3	25	PHASE MOTOR	KTY84
41	U1013F.20.3	8	PHASE MOTOR	KTY84
42	U1320F.15.3	26	PHASE MOTOR	KTY84
43	U1320F.17.3	11	PHASE MOTOR	KTY84
44	U1320F.18.3	27	PHASE MOTOR	KTY84
45	U1320F.20.3	28	PHASE	KTY84

			MOTOR	
46	U1330F.15.3	36	PHASE MOTOR	KTY84
47	U1330F.18.3	37	PHASE MOTOR	KTY84
48	U1330F.20.3	38	PHASE MOTOR	KTY84
49	U1340F.15.3	41	PHASE MOTOR	KTY84
50	U1340F.18.3	42	PHASE MOTOR	KTY84
51	U1340F.20.3	43	PHASE MOTOR	KTY84
52	GK6133-161	44	DENGQI	KTY84
53	GK6135-161	45	DENGQI	KTY84
54	GK6137-B61	40	DENGQI	KTY84
55	GK6137-161	46	DENGQI	KTY84
56	GK6139-B61	39	DENGQI	KTY84
57	K058N18B11	30	SULIDE	Pt1000
58	K038N18B11	31	SULIDE	Pt1000
59	K072N18B11	32	SULIDE	Pt1000
60	K042N25A11	0	SUQIANG	Pt1000
61	K036N20A11	3	SUQIANG	Pt1000
62	K053N20A11	5	SUQIANG	Pt1000
63	K062N20A11	1	SUQIANG	Pt1000
64	K072N20A11	29	SUQIANG	Pt1000

3) List of oil pump models

Pump Select No.	Pump Model	Pump Model Code	Manufacturer
0	CHENGJIE 032cc/rev	52	CHENGJIE
1	CHENGJIE 040cc/rev	17	CHENGJIE
2	CHENGJIE 050cc/rev	18	CHENGJIE
3	CHENGJIE 080cc/rev	08	CHENGJIE
4	CHENGJIE 100cc/rev	09	CHENGJIE
5	CHENGJIE 125cc/rev	10	CHENGJIE
6	SUMITOMO 032cc/rev	00	SUMITOMO
7	SUMITOMO 050cc/rev	02	SUMITOMO
8	VOITH 025cc/rev	43	VOITH
9	VOITH 032cc/rev	36	VOITH
10	VOITH 040cc/rev	37	VOITH
11	VOITH 050cc/rev	38	VOITH
12	VOITH 064cc/rev	39	VOITH
13	VOITH 080cc/rev	40	VOITH
14	VOITH 100cc/rev	41	VOITH
15	VOITH 125cc/rev	42	VOITH
16	ECKERLE 025cc/rev	44	ECKERLE
17	ECKERLE 032cc/rev	45	ECKERLE
18	ECKERLE 040cc/rev	46	ECKERLE
19	ECKERLE 050cc/rev	47	ECKERLE
20	ECKERLE 064cc/rev	48	ECKERLE
21	ECKERLE 080cc/rev	49	ECKERLE

22	ECKERLE 100cc/rev	50	ECKERLE
23	ECKERLE 125cc/rev	51	ECKERLE
24	SETTIMA 028cc/rev	19	SETTIMA
25	SETTIMA 032cc/rev	03	SETTIMA
26	SETTIMA 036cc/rev	04	SETTIMA
27	SETTIMA 040cc/rev	05	SETTIMA
28	SETTIMA 045cc/rev	06	SETTIMA
29	SETTIMA 050cc/rev	07	SETTIMA
30	SETTIMA 063cc/rev	11	SETTIMA
31	SETTIMA 075cc/rev	12	SETTIMA
32	SETTIMA 090cc/rev	13	SETTIMA
33	SETTIMA 101cc/rev	16	SETTIMA
34	SETTIMA 125cc/rev	14	SETTIMA
35	SETTIMA 150cc/rev	15	SETTIMA
36	SUNNY 018cc/rev	20	SUNNY
37	SUNNY 028cc/rev	21	SUNNY
38	SUNNY 031cc/rev	22	SUNNY
39	SUNNY 037cc/rev	23	SUNNY
40	SUNNY 040cc/rev	24	SUNNY
41	SUNNY 045cc/rev	25	SUNNY
42	SUNNY 056cc/rev	26	SUNNY
43	SUNNY 062cc/rev	27	SUNNY
44	SUNNY 071cc/rev	28	SUNNY
45	SUNNY 078cc/rev	29	SUNNY
46	SUNNY 090cc/rev	30	SUNNY
47	SUNNY 101cc/rev	31	SUNNY

48	SUNNY	120cc/rev	32	SUNNY
49	SUNNY	130cc/rev	33	SUNNY
50	SUNNY	140cc/rev	34	SUNNY
51	EATON	160cc/rev	35	EATON

Definitions of parameter table in set mode:

Code	Definition & Description	Parameter Range	Unit
F00	Driver selection	Refer to the above list of driver models for details	
F01	Motor selection	Refer to the above list of motor models for details	
F02	Pump selection	Refer to above list of oil pump models for details	
F03	Pressure feedback zero calibration	0： no calibration 1： calibration	
F04	Pressure calibration mode	0： linear pressure calibration 1： fold line pressure calibration	
F05	Flow calibration mode	0： linear flow calibration 1： fold line flow calibration	
F06	Pressure calibration	0： no action 1： linear zero 2： linear range 3：fold line node 0 4：fold line node 1 5：fold line node 2 6：fold line node 3 7：fold line node 4	

		8：fold line node 5 9：fold line node 6 10：fold line node 7 11：fold line node 8 12：fold line node 9 13：fold line node 10 14：fold line node 11 15：fold line node 12	
F07	Flow calibration	0： no action 1： linear zero 2： linear range 3：fold line node 0 4：fold line node 1 5：fold line node 2 6：fold line node 3 7：fold line node 4 8：fold line node 5 9：fold line node 6 10：fold line node 7 11：fold line node 8 12：fold line node 9 13：fold line node 10 14：fold line node 11 15：fold line node 12	
F08	Pressure filtering	[1,32]	Sampling time of moving

			average（1ms）
F09	Flow filtering	[1,32]	Sampling time of moving average（1ms）
F10	Pressure full scale	[1, system max. pressure (multi-pump in parallel) or local max. pressure (single pump)]	bar
F11	Flow full scale	[1, system max. flow (multi-pump in parallel) or local max. flow (single pump)]	L/min
F12	Max. pressure	[0,250]	bar
F13	Max. flow	[0,2400]	L/min
F14	Speed proportional gain	[0,32767]	
F15	Speed integral gain	[0,32767]	
F16	Pressure feedback gain	[0,32767]	
F17	Rising slope of pressure command	[0,32767]	
F18	Descending slope of pressure command	[0,32767]	
F19	Pressure proportional gain 0	[0,32767]	
F20	Pressure integral gain 0	[0,32767]	
F21	Pressure differential gain 0	[0,32767]	

F22	Pressure proportional gain 1	[0,32767]	
F23	Pressure integral gain 1	[0,32767]	
F24	Pressure differential gain 1	[0,32767]	
F25	Pressure proportional gain 2	[0,32767]	
F26	Pressure integral gain 2	[0,32767]	
F27	Pressure differential gain 2	[0,32767]	
F28	Pressure proportional gain 3	[0,32767]	
F29	Pressure integral gain 3	[0,32767]	
F30	Pressure differential gain 3	[0,32767]	
F31	Pump displacement	[0,32767]	mL/r
F32	Pump leakage	[0,100.00]	L/min/bar
F33	Max. reverse speed of pump	[0,-6000]	Rpm
F34	Max. revolving speed of motor	[0,6000]	Rpm
F35	D.C. voltage calibration	[0,800] （only fine tuning）	V
F36	A.C. voltage calibration	[0,500] （only fine tuning）	V
F37	Base flow enable	0：no base flow 1：base flow	
F38	Base flow pressure	[0,250.00]	bar
F39	Base flow quantity	[0,327.67]	L/Min
F40	Overshoot limit	[5,50]	bar
F41	Revolving direction of	0：forward	

	motor	1：reversal	
F42	Resolve direction	0：forward 1：reversal	
F43	Backpressure method	0：manual 1：auto	
F44	Pressure transducer selection	0：5V 2：10V	
F45	Plug pump selection	0：single displacement 1：double displacement	
F46	Plug pump displacement ratio	[0,100.0]	%
F47	Threshold of wobble pressure switch	[0,250.0]	bar
F48	Delay of wobble pressure switch	[0,32767]	ms
F49	DA1	0： pressure command 1： pressure feedback 2： flow command 3： flow feedback 4： speed command 5： speed feedback 6： torque command 7： torque feedback 8： resolve feedback 9： D.C. voltage 10： phase current 11： Error message state word 1	

		12： Error message state word 2 13： communication command	
F50	DA1 max.	[-32767,32767]	
F51	DA1 min.	[-32767,32767]	
F52	DA2	0： pressure command 1： pressure feedback 2： flow command 3： flow feedback 4： speed command 5： speed feedback 6： torque command 7： torque feedback 8： resolve feedback 9： D.C. voltage 10： phase current 11： Error message state word 1 12： Error message state word 2 13： communication command	
F53	DA2 max.	[-32767,32767]	
F54	DA2 min.	[-32767,32767]	
F55	DA output value	[-32767,32767]	
F56	Rising delay of wobble switch	[0，32767]	ms
F57	Descending delay of wobble switch	[0，32767]	ms
F58	Speed switch upper limit	[0，6000]	rpm

F59	Speed switch lower limit	[0 , 6000]	rpm
F60	Flow command zero dead zone	[0.00 , 100.00]	%
F61	Pressure command zero dead zone	[0.00 , 100.00]	%
F62	Pressure feedback zero dead zone	[0.00，100.00]	%
F63	OUT2 breakover pressure coefficient	[0.00，100.00]	%
F64	Negative moment inhibit	0：disable 1：enable	
F65	Displacement switch mode	0 ： overpressure 1 ： dwell overpressure	
F66	Factory reset	1：recover	
F67	Fault records check (display fault codes)	1：fault 1 2：fault 2 3：fault 3 4：fault 4 5：fault 5	
F68	Parameter download	1：download	

※ Refer to the List of Set Menu in Chapter 5.3.2 and List of HMI Parameter Download Menu in Chapter 5.3.5.

5.5.5. Commission mode

Press MODE to enter “commission mode”, LED panel will display “h—xx” of which xx stand for different parameter identifiers. Press ▲/▼ to choose the desired parameter identifier. Press SET after selection and LED panel will show corresponding parameter values.

Press ◀ to move the flashing position when modifying parameter values and change the value of the flashing position through ▲/▼. After modification, press SET to reserve and the flash stops meanwhile. At the moment, press SET or ▲/▼ to remodify parameter values and meanwhile the position for modification will keep flashing. Press MODE again to exit

※ In commission mode, if there's no key operation in ten minutes, it will switch automatically to speed and error display interface.

Definitions of parameter table in set mode:

Code	Definition & Description	Parameter Range	Unit
H00	Run enable	0：disable 1：enable	
H01	Diagnose enable	0：disable 1：enable	
H02	Diagnose content (only available when diagnose enable is on)	0：no action 1: measure initial angle 2： jog enable 3~5： invalid 6： driver test	
H03	Jog (only available when diagnose enable is on)	▲: forward ▼: reverse	
H04	Control mode	3： speed mode 4： process mode	
H05	Speed command (only available in speed mode)	related to motor model	r/m
H06	Process instruction mode	0：digital input	

		1： analog input 2：CAN continue 3：485 continue	
H07	Flow command (process mode is digital input)	[0, max. flow]	l/m
H08	Pressure command (process mode is digital input)	[0, max. pressure]	kg
H09	Max. jog speed	The max. motor speed when pressing ▲ or ▼.	Rpm
H10	Revolve offset value	[0,4096]	

※ Refer to List of HMI Commission Menu in Chapter 5.3.3.

5.5.6. Multi-pump mode

Press MODE to enter "multi-pump mode", LED panel will display "p--xx" of which xx stand for different parameter identifiers. Press ▲/▼ to choose the desired parameter identifier. Press SET after selection and LED panel will show corresponding parameter values. Press ◀ to move the flashing position when modifying parameter values and press ▲/▼ to change the value of the flashing position. After modification, press SET to reserve and the flash stops meanwhile. At the moment, press SET or ▲/▼ to remodify parameter values and meanwhile the position for modification will keep flashing. Press MODE again to exit.

Code	Definition & Description	Parameter Range	Unit
P00	Net enable	0:disable	

		1:enable	
P01	Net open tube	0： close tube 1： open tube	
P02	Converging type	0： single pump 1： compound 2： multi-pump 3： multi-mode	
P03	Node No.	[0,15]	
P04	Slave node number	[0,15]	
P05	Node type	0： single unit 1： control unit 2： follow unit	
P06	Flow enter threshold	[0,100.0]	%
P07	Flow enter hysteresis upper limit	[0,100.0]	%
P08	Flow enter hysteresis lower limit	[0,100.0]	%
P09	Multi-pump pressure proportional gain 0	[0,32767]	
P10	Multi-pump pressure integral gain 0	[0,32767]	
P11	Multi-pump pressure differential gain 0	[0,32767]	
P12	Multi-pump pressure proportional gain 1	[0,32767]	
P13	Multi-pump pressure	[0,32767]	

	integral gain1		
P14	Multi-pump pressure differential gain 1	[0,32767]	
P15	Multi-pump pressure proportional gain 2	[0,32767]	
P16	Multi-pump pressure integral gain 2	[0,32767]	
P17	Multi-pump pressure differential gain 2	[0,32767]	
P18	Multi-pump pressure proportional gain 3	[0,32767]	
P19	Multi-pump pressure integral gain3	[0,32767]	
P20	Multi-pump pressure differential gain 3	[0,32767]	

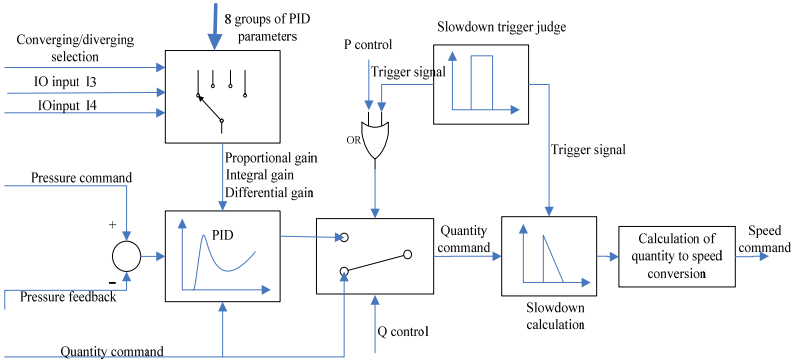
※ Refer to the List of HMI Multi-pump Menu in Chapter 5.3.4 for parameter description.

6. Oil Pump Control

6.1. Introduction to Control Mode of Oil Pump

Through the oil pump control mode of the servo driver, it is achievable to control the output pressure and flow by adjusting the revolving speed of A.C. servo motor in accordance with the input pressure command and flow command of external control system and feedback signals from the pressure transducer. The pressure control refers to closed loop PID control through signals of the pressure transducer on the oil outlet. The flow control refers to adjusting the output flow of the pump by adjusting its revolving speed through A.C.servo motor.

Basic functional block diagram of oil pump control:



6.2. Prior Control of General Pressure (P control)

The flow control is conducted when feedback pressure is less

than command value. It is required that the output flow of the pump can always follow the change of flow command quickly and accurately. Since the output flow of the pump is proportional to the revolving speed of the motor, it turns out that the flow command decides the revolving speed command of the motor. In pressure control mode, it is required that the system pressure feedback can always follow the change of pressure command quickly and accurately. Since the change in revolving speed of the motor leads to the change in pressure feedback, it turns out that the pressure PID regulator decides speed command of the motor.

In practical hydraulic system, it is necessary to switch between the two control modes frequently and rapidly with small pressure overshoot and vibration. The user may ameliorate the performance of flow control, pressure control and control switch by adjusting speed proportional gain, speed integral gain, pressure proportional gain, pressure integral gain and pressure differential gain.

Commission parameter chart of pressure prior control:

LED Display Code	Parameter Name	Function Description	Initial Value
F14	Speed proportional gain	Increasing speed proportional gain can enhance transient response of motor speed control, boost stability of motor speed and suppress disturbance. Too much gain may cause severe vibration.	When selecting different pumps
F15	Speed integral gain	Increasing speed integral gain can minish speed governing deviation and suppress overshoot. Too much gain may	

		cause severe vibration.	
F19，F22 F25，F28	Pressure proportional gain	Increasing pressure proportional gain can enhance transient response and stability of pressure control, suppress disturbance and minish pressure overshoot. Too much gain may cause severe vibration.	13000
P09，P12 P15，P18	Multi-pump pressure proportional gain 0-3		8000
F20，F23 F26，F29	Pressure integral gain 0-3	Increasing pressure integral gain can enhance transient response of pressure control minish pressure control deviation and add pressure overshoot. Too much gain may cause severe vibration.	100
P10，P13 P16，P19	Multi-pump pressure integral gain 0-3		100
F21，F24 F27，F30	Pressure differential gain 0-3	The higher the pressure differential gain, the less overshoot when switching to pressure control. Too much gain may destroy the function of pressure control deviation and cause severe vibration.	0
P11，P14 P17，P20	Multi-pump pressure differential gain 0-3		0

6.3. Flow Prior Control (Q control)

In pressure prior control mode, the extremely low pressure command influences the rising speed of flow command. Meanwhile, in flow control mode, if pressure feedback rises quickly to around command pressure, flow command may also get influenced. The

flow prior control mode can be applied to a few conditions when flow control is demanded and flow command is free from influence of pressure command and pressure feedback. In flow control mode, take flow command as the command of system flow. Through parameter modification, the user can adjust the conditions of switching from flow control to pressure control. Use the pressure trigger control to minish pressure overshoot during mode switch.

※ The factory set for the driver is pressure prior control mode by default. Flow prior control can only be commissioned by the PC software SCM of KINWAY.

Commission parameter chart of flow prior control:

Parameter Name	Function Description	Initial Value	Unit
Control mode	P mode refers to pressure control prior mode and Q mode refers to flow control prior mode.	P control	
Trigger integral value	The setting revolving speeds of the motor in pressure trigger control when switching from flow control to pressure control.	200	Rpm
Trigger way	Decide whether to apply pressure trigger control when switching from flow control to pressure control.	None trigger	
Pressure differential trigger threshold	The pressure rise speed condition of entering pressure trigger mode.	10	bar\ms
Enter trigger coefficient 1	The upper limit of the ratio between feedback pressure and command pressure to enter pressure trigger	90	%

	mode.		
Enter trigger coefficient 2	The lower limit of D-value between command pressure and feedback pressure when entering pressure trigger mode.	10	bar
Exit trigger coefficient 1	The lower limit of ratio between feedback pressure and command pressure when exiting from pressure trigger mode.	80	%
Exit trigger coefficient 2	The upper limit of D-value between command pressure and feedback pressure when exiting from pressure trigger mode.	15	bar

6.4. Double-displacement Pump Control

The user can switch between big and small swash plate dips to change the displacement by powering on/off the swash plate switch coil. The big swash plate dip is used for the system demanding output of large flow quantities while the small one is used for the system in dwell or demanding high pressure and small flow quantities so as to enhance the performance of pressure control and minish energy consumption. This driver has two control modes for the swash plate switch of the double-displacement pump: overpressure switch and dwell overpressure switch.

Overpressure switch mode: Switch to small swash plate dip when system feedback pressure exceeds pressure threshold of displacement switch and motor speed is less than lower speed limit of displacement switch. Switch to big swash plate dip when motor

speed exceeds upper speed limit of displacement switch.

Dwell overpressure switch mode: Connect the injection input signal of the upper control system to the digital input signal I6（CN3-12）of the driver. The high input indicates that the injection molding machine is under injection dwell state. At this moment, if feedback pressure reaches pressure command value or exceeds pressure threshold of displacement switch and meanwhile motor speed is less than lower speed limit of displacement switch, switch to small swash plate dip. If motor speed exceeds upper speed limit of displacement switch or the digital input signal I6 is low, switch to big swash plate dip.

For the constancy of output flow of the oil pump, the driver may compensate speed command of the motor according to displacement ratio when switching to small swash plate dip.

Commission parameter chart of double-displacement pump control:

LED Display Code	Parameter Name	Function Description	Initial Value	Unit
F45	Plunger pump selection	Selection the model of plunger pump	0：single displacement	0：single displacement 1：double displacement
F46	Displacement ratio of plunger pump	Displacement ratio of small swash plate dip and big swash plate dip.	30	%
F47	Wobble pressure	The threshold value of feedback pressure	195	bar

	switch threshold	when switching to small swash plate dip.		
F48	Wobble pressure judge delay	The duration condition of higher feedback pressure than wobble pressure switch threshold when switching to small swash plate dip.	100	ms
F56	Wobble switch rising delay	The time delayed for speed compensation when switching from small swash plate dip to big swash plate dip.	10	ms
F57	Wobble switch descending delay	The time delayed for speed compensation when switching from big swash plate dip to small swash plate dip.	10	ms
F58	Upper limit of speed switch	The threshold value of motor speed when switching to	1200	rpm

		big swash plate dip.		
F59	Lower limit of speed switch	The threshold value of motor speed when switching to small swash plate dip.	200	rpm
F65	Displacement switch mode	0: overpressure 1: dwell overpressure	0：overpressure	

7. Multi-pump Parallel Control

For the hydraulic control of large-tonnage injection molding machines, the single-pump system has been far from meeting the flow demand owing to the limit of pump displacement and motor power. To obtain large flow quantities, it is necessary to connect oil outlets of multiple single-pump systems in parallel. In converging system, for the purpose of higher production efficiency and shorter processing cycle, the single-loop hydraulic system is divided into double loops or triple loops with independent control hydraulic system so as to accomplish two or more motions. In diverging control, every loop controls the flow and pressure independently. In converging control, however, one host driver controls the pressure and total flow of the system while the other drivers conduct single-loop flow control by converting total system flow command of the host driver to flow commands for various loops through the calculation process of flow distribution. The total system output flow is the sum of all output pump flows of various loop systems.

7.1. Multi-Pump Pattern

Once the nodes (in single-pump system) are set to multi-pump pattern as converging type, they can only work in converging control. In this condition, the host node controls the pressure and total system flow by receiving signals of pressure command, flow command and run enable from the upper control system and signals of the pressure transducer at the oil outlet. The slave nodes manage

the speed by converting total system flow command from CAN communication into speed command through the following formula of flow distribution.

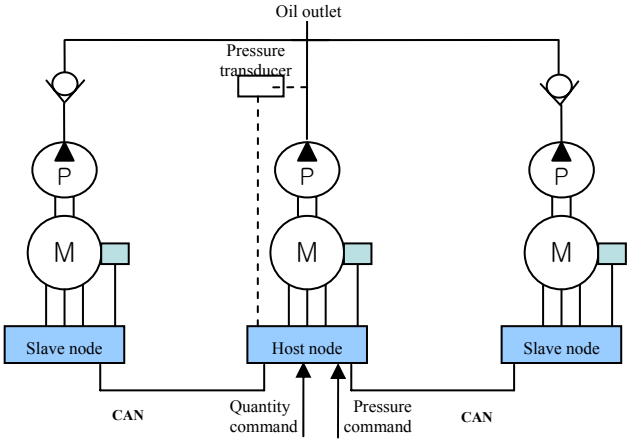
Flow distribution method for multi-pump convergence and compound convergence:

Each node (in single-pump system) has a flow it can bear alone, that is, max. private flow.

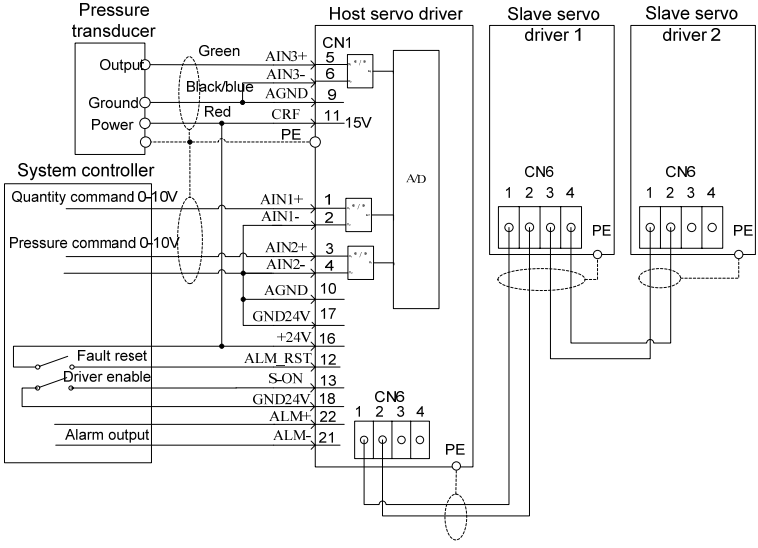
Max. private flow = node max. flow × flow enter threshold ratio

If the command total system flow is lower than the max. private flow of the host pump 0, the host pump 0 bears all flow demands of the system; if higher, the host pump 0 provides its max. private flow and meanwhile the slave pumps bear the rest flow demand; if the rest flow demand is lower than the max. private flow of the slave pump 1, the slave pump 1 bears all rest flow on its own; if the rest flow demand is higher than the max. private flow of the slave pump provides its max. private flow and meanwhile other slave pumps bear the rest flow demand; it goes on by such analogy until all the rest flow quantities are undertaken by the rest slave pumps; if the max. private flow of the last slave pump is lower than the rest flow demand, that is, the max. private flow sum of all pumps cannot bear the total system flow demands, then the system flow demands will be distributed to all pumps on average (at a certain rate).

1) System diagram of multi-pump pattern:



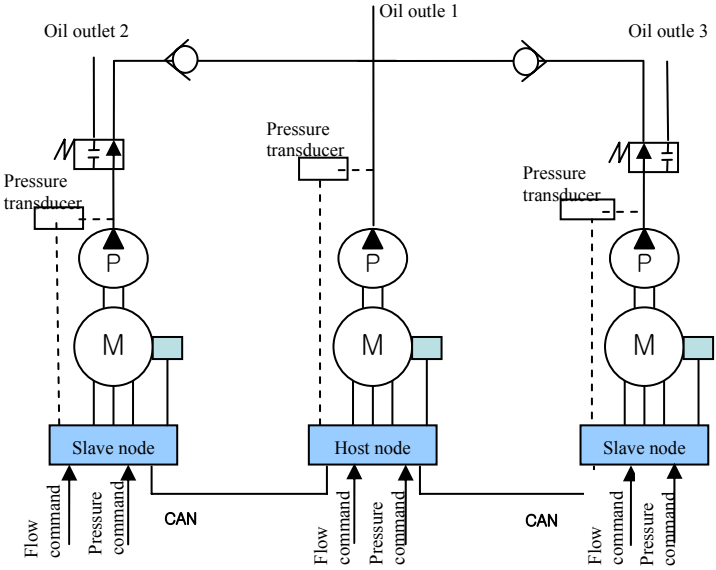
2) Wiring scheme of multi-pump pattern:



7.2. Compound Pattern

The system has two control modes: converging mode and diverging mode. It can switch between the two modes of various nodes through the signals of digital input I1 (C/D). In diverging mode, each node accomplishes flow control and pressure as a single-loop hydraulic system. In converging mode, just the same as in multi-pump pattern, the host node controls the pressure and the total system flow while the slave nodes manage the speed by converting total system flow command from CAN communication into speed command through the above formula of flow distribution.

3) System diagram of compound pattern:



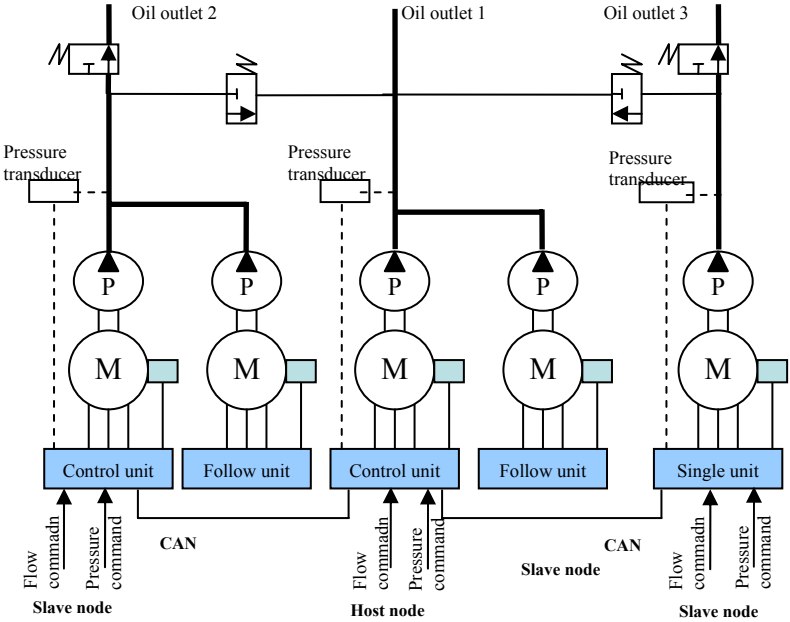
7.3. Multi-Mode Pattern

This system is composed of three nodes each of which consists of one or more single-pump systems. The single-pump system refers

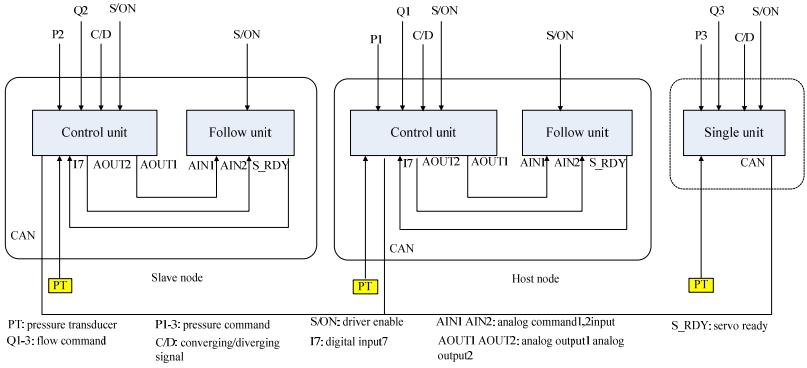
to the control unit. A node with one control unit is called single-unit node and a node with several control unit can be considered as the node made up with duplex pumps or multiplex pumps. The multi-unit node is comprised of one control unit and one or more follow units. At every node, there is one pressure transducer connected to the control unit which receives signals of pressure command and flow command from the upper control system through the analog interfaces of AIN1 and AIN2. The two DA outputs of the control unit shall be connected to two analog input interfaces AIN1 and AIN2 of the follow unit separately as the speed command signal of the motor and the enable signal of the driver. There are series connections among RDY output interfaces of which the positive pole is linked with the power supply of 24V and the negative pole is linked with the digital input interface I7 through which the control unit gets running status of the follow unit driver.

The digital signal I1 (C/D) is applied to each node for the switch of control modes. High I1 (C/D) indicates the node is in converging mode while low I1 (C/D) indicates the node is in diverging mode. In converging mode, the converging node number is variable and the slave nodes run at the same speed with the host node which bears pressure control and total system flow. The formula of flow distribution mentioned above is not available in multi-mode pattern. In diverging mode, the control units of the nodes conduct pressure control and flow control separately at the same speed with the follow units.

System diagram of multi-mode pattern:



Wiring scheme of compound pattern and multi-mode pattern:



Commission parameter chart of multi-pump parallel control:

LED Display Code	Parameter Name	Function Description	Initial Value	Unit
P00	Net enable	Net enable control. First, set the parameter of each node for the single pump, converging type of nodes, node No., slave node numbers of the host node, flow enter threshold, flow enter hysteresis upper limit and flow enter hysteresis lower limit. Then perform the net enable command from the slave nodes to the host node in sequence. 0：disable 1：enable	0：disable	
P01	Net open tube	Disable or enable the driver of all nodes, only applicable in multi-pump mode. 0：close tube 1：open tube	0：close tube	
P02	Converging type	Select converging type 0：single pump 1：compound 2：multi-pump 3：multi-mode	0：single pump	
P03	Node No.	It indicates the host machine if the node number is zero and the	0	

		slave machine if the number is between 1 and 15.		
P04	Slave node number	If the node number is zero, the slave number indicates the number of slave machines connected to the host machine.	0	
P05	Node type	Set the operation mode of the driver at the nodes. 0: single unit 1: control unit 2: follow unit	0:single unit	
P06	Flow enter threshold	The precondition for the next pump to join in operation. When the system flow exceeds the flow enter threshold of the pump, the next pump will join in operation.	25	%
P07	Hysteresis upper limit of flow enter	The precondition for the next pump to join in operation. It is used to prevent the pump from starting and stopping back and forth when the flow reaches to the threshold.	5	%
P08	Hysteresis lower limit of flow enter	The precondition for the next pump to join in operation. It is used to prevent the pump from starting and stopping back and	2.5	%

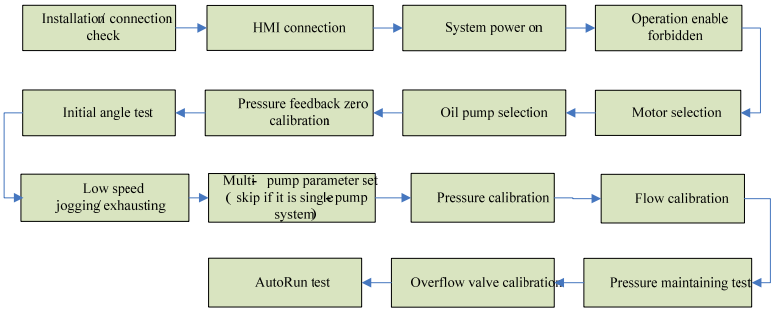
		forth when the flow reaches to the threshold.		
P09	Multi-pump pressure proportional gain 0	Segment 0 of the proportional parameter under multi-pump pressure PID control.	8000	
P10	Multi-pump pressure integral gain 0	Segment 0 of the integral parameter under multi-pump pressure PID control.	88	
P11	Multi-pump pressure differential gain 0	Segment 0 of the differential parameter under multi-pump pressure PID control.	0	
P12	Multi-pump pressure proportional gain 1	Segment 1 of the proportional parameter under multi-pump pressure PID control.	8000	
P13	Multi-pump pressure integral gain 1	Segment 1 of the integral parameter under multi-pump pressure PID control.	88	
P14	Multi-pump pressure differential gain 1	Segment 1 of the differential parameter under multi-pump pressure PID control.	0	
P15	Multi-pump	Segment 2 of the proportional	8000	

	pressure proportional gain 2	parameter under multi-pump pressure PID control.		
P16	Multi-pump pressure integral gain 2	Segment 2 of the integral parameter under multi-pump pressure PID control.	88	
P17	Multi-pump pressure differential gain 2	Segment 2 of the differential parameter under multi-pump pressure PID control.	0	
P18	Multi-pump pressure proportional gain 3	Segment 3 of the proportional parameter under multi-pump pressure PID control.	8000	
P19	Multi-pump pressure integral gain 3	Segment 3 of the integral parameter under multi-pump pressure PID control.	88	
P20	Multi-pump pressure differential gain 3	Segment 3 of the differential parameter under multi-pump pressure PID control.	0	

8. Run Commission

This servo hydraulic system for MH500 series injection molding machines has two commission methods to cater for clients of various demands. The user can commission it through the external HMI (selective pairing) which looks friendly with its LCD of 5.7 inches and its interface in Chinese. On the other hand, the user can also commission it through the built-in LED panel of the servo driver.

8.1. Commission Flow Chart



8.2. Commission Steps

The following instruction describes specific operation steps of commissioning the system through HMI. No operation steps of LED panel are mentioned here excepting some graphs indicating the parameter identifiers to be set. Please refer to Chapter 5.4 LED Display and Operation if it is necessary to commission the system through LED panel.

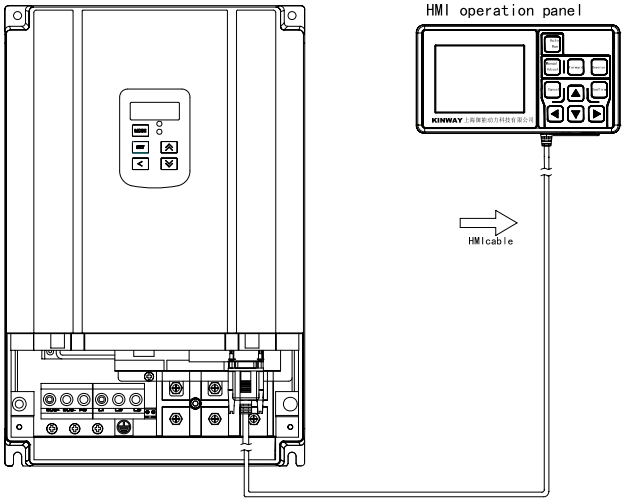
8.2.1. Commission Preparation

(1) Installation confirm

Inspect connections of all terminals and ensure that all fix screws have been fastened in case of any slippage.

(2) HMI connection

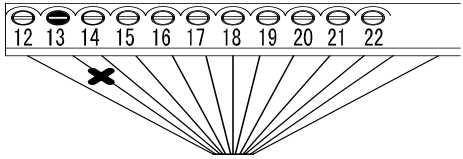
This servo hydraulic system for the MH500 series supports HMI hot swapping. Plug the terminal DSUB9 of the HMI into the terminals CN4 in the front cover of the driver to connect the HMI to the driver. (Skip this step if LED panel is used to commission the system)



(3) Enable forbidden

In order to ensure system security during commission process, it is necessary to disable the system enable before switching on the three-phase AC. When the HMI is not turned on, there are two ways

of disabling the system enable:



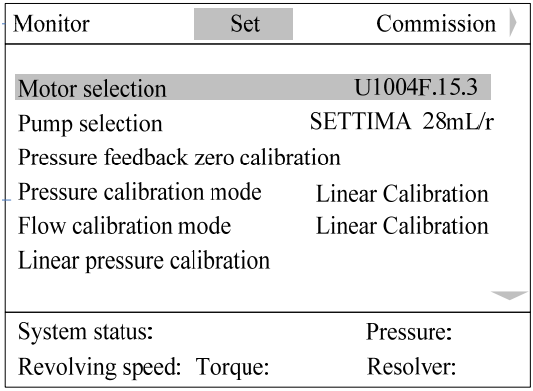
Method 1: Cut off the terminal wiring of the driver enable.

Method 2: Disable the system enable if the upper computer is equipped with the function of system enable and the enable output has been connected to the enable terminals of the driver.

8.2.2. Motor Selection

(1) Motor selection operation

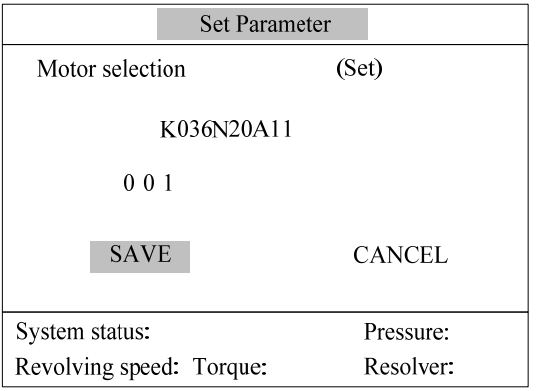
Refer to the List of Motor Selection in Chapter 5.5.4. Switch to the "set" mode by pressing ◀ and ▶. Move the highlight cursor to "motor selection"through ▲ and ▼ and press Confirm to enter.



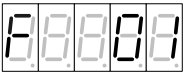
Move the highlight cursor to the number of motor selection through ◀ and ▶. Adjust the number through ▲ and ▼ to

the corresponding number of the motor. (Please refer to the nameplates of motors for specific models. The following chart takes the selection of "K036N20A11" for instance.

Move the highlight cursor through ◀ and ▶ to "SAVE" and press Confirm 确认 to save the parameter and exit to set menu. The current parameter of the motor will be sent to the driver through the HMI. On the right side of the motor selection menu, it will display "parameter downloading" during the process and then the motor model "K036N20A11" after the process.



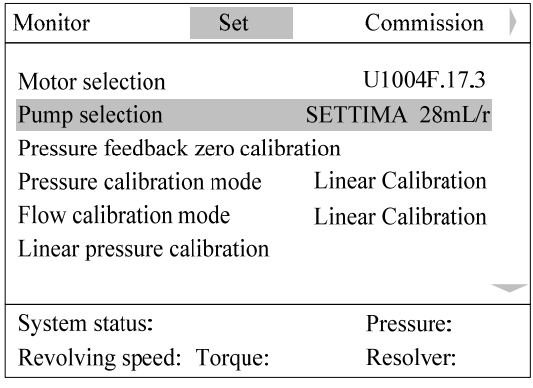
Set parameter of LED panel commission:



8.2.3. Pump Selection

(1) Pump selection operation

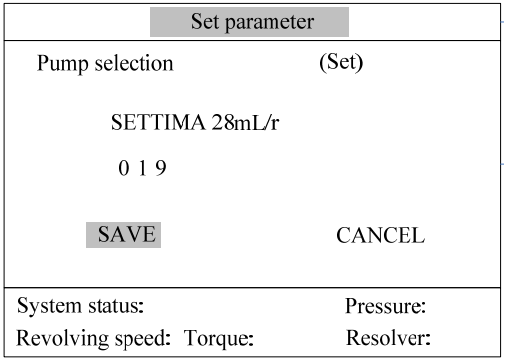
Refer to the List of Oil Pump Models in Chapter 5.5.4. Move the highlight cursor through ▲ and ▼ to "pump selection" and press Confirm 确认 to enter.



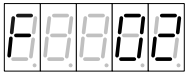
Move the highlight cursor through ◀ and ▶ to the number of pump models and then adjust it through ▲ and ▼ to the corresponding number of the desired pump model. (Please refer to the nameplate of the selected pump for the specific model. The following chart takes the selection of "SETTIMA 28mL/r" for instance.)

Move the highlight cursor through ◀ and ▶ to "SAVE' and press Confirm 确认 to save and exit to set menu. The current parameter of the pump will be sent to the driver through the HMI.

On the right side of the "pump selection" menu, it will display "parameter downloading" during the process and then the pump model "SETTIMA 28mL/r" after the process.



Set parameter of LED panel commission:



If the selected pump is not included in the selection list, then reset the parameter. Adjust the pump displacement (reset) [F31] and the pump leakage (reset) [F32] in the set menu.

If the system configuration is the same to the default value, then skip the following steps from 8.2.4（3） to 8.2.4（12）.

(2) Backpressure selection [F43] (manual backpressure by default)
   (a) Auto: electronic backpressure as the storing method
   (b) Manual: manual backpressure as the storing method

(3) Pressure transducer selection [F44] (5V by default)
   (a) 5V: Voltage range of driver sampling 0~5V, output range of transducer 1~5V, test range 0~200bar.
   (b) 10V : Voltage range of driver sampling 0~10V, output range of transducer 0~10V, test range 0~250bar.

(4) Plunger pump selection [F45] (single-displacement plunger pump by default)

(a) Double displacement: double-displacement plunger pump
(b) Single displacement: single displacement plunger pump

(5) Plunger pump displacement ratio [F46] (skip this if it is a single displacement plunger pump)

The parameter value is the ratio between the small displacement and the large displacement.

(6) Wobble switch mode [F65] (skip this if it is a single displacement plunger pump)

Set the mode of displacement switch.

(7) Wobble switch pressure threshold [F47] (skip this if it is a single displacement plunger pump)

Set the pressure threshold of displacement switch.

(8) Wobble pressure judge delay [F48] (skip this if it is a single displacement plunger pump)

Set the pressure duration of wobble switch

(9) Wobble switch rising delay [F56] (skip this if it is a single displacement plunger pump)

Set the rising duration of displacement switch

(10) Wobble switch descending delay [F57] (skip this if it is a single displacement plunger pump)

Set the descending duration of displacement switch

(11) Speed switch upper limit [F58] (skip this if it is a single displacement plunger pump)

Set the upper limit of speed switch

(12) Speed switch lower limit [F59] (skip this if it is a single displacement plunger pump)

Set the lower limit of speed switch

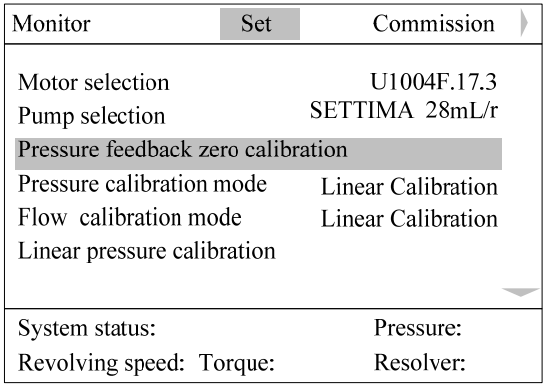
(13) Multi-section pressure PID set

If the system needs to be controlled by sections with various pressure PID parameters, make a connection between the two digital input terminals I3（CN3-9）and I4（CN3-10）as the index signal in control section, then set the pressure PID parameters (4 sections in total) corresponding to those sections. The relationship between the digital input signals and the different sections of pressure PID is shown in the following chart:

Single-Pump Pressure Control PID Parameter Sections: Pressure PID Parameter				
I4	I3	KP NO.	KI NO.	KD NO.
low	low	0	0	0
low	high	1	1	1
high	low	2	2	2
high	high	3	3	3

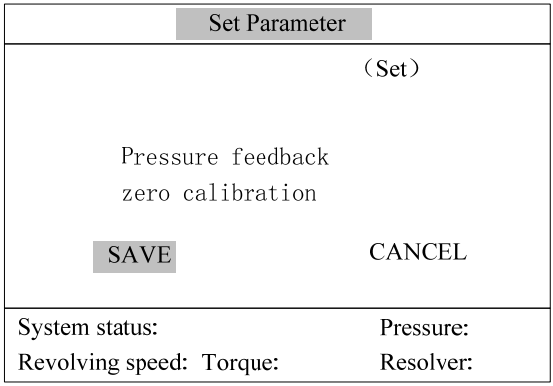
8.2.4. Pressure Feedback Zero Calibration Method

In set mode, move the highlight cursor through ▲ and ▼ to “pressure feedback zero calibration” and press Confirm 确认 to enter its set interface.

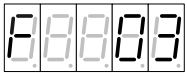


Adjust the pressure of system oil circuit to "0" (subject to the pressure gauge of the injection molding machine) before conducting pressure feedback zero calibration.

Move the highlight recursor through ◀ and ▶ to "SAVE" and press Confirm 确认 to return to the set menu in which the "pressure feedback zero calibration" will be displaying "calibrating". When the "calibrating" disappears, it indicates the calibration is accomplished.



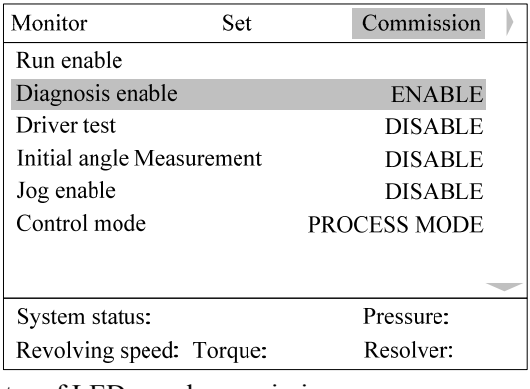
Set parameter of LED panel commission:



8.2.5. Initial Angle Test of the Motor

(1) Diagnosis function “enable”

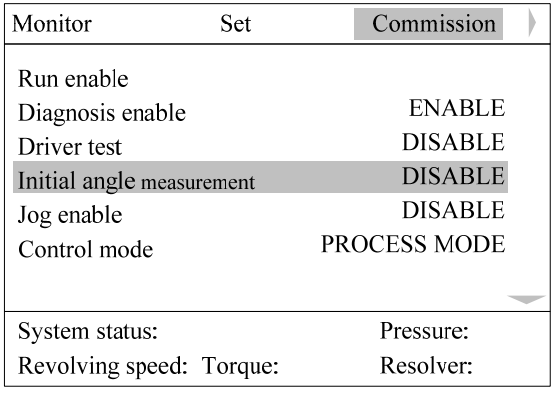
Switch to “commission mode” through ◀ and ▶. Move the highlight cursor through ▲ and ▼ to “diagnosis function” and press Confirm 确认 to turn its status to “enable”.



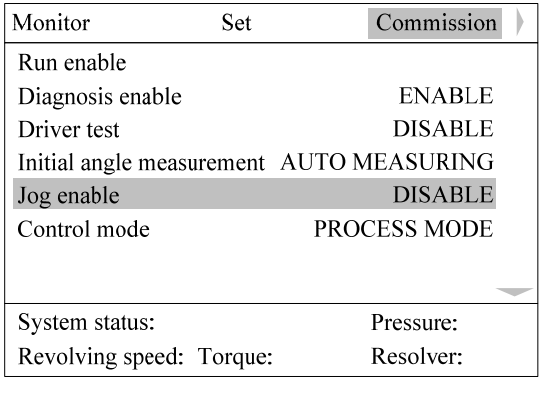
Set parameter of LED panel commission:

(2) Initial angle test of the motor

After entering the commission interface, move the highlight cursor through ▲/▼ to “initial angle test” and press Confirm 确认 to turn its status to “enable”.

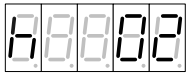


After set, the system will measure the initial angle automatically and it will display “auto measuring” on the right side of “initial angle measurement”.



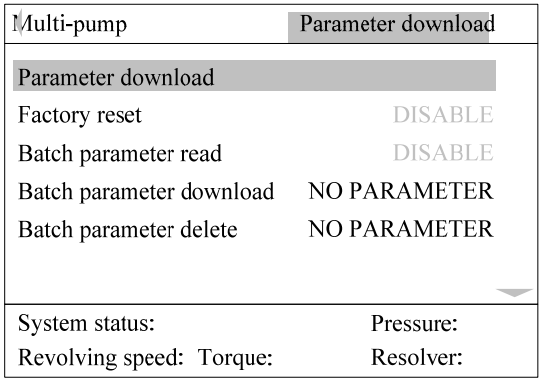
After measurement, it will display “success” on the right side of “initial angle measurement” and the result in the item of “resolver offset” which will switch to “disable” status automatically after a while.

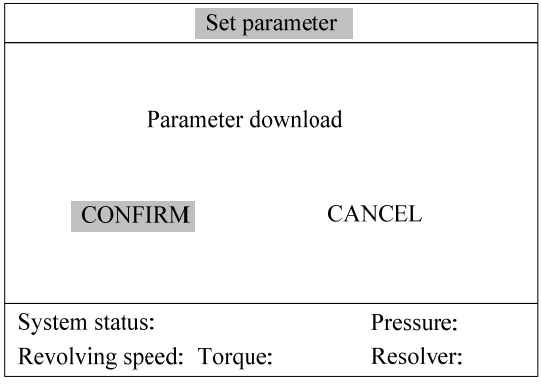
Set parameter of LED panel commission:



The operator must store the measuring value and the latest calibration status to EEPROM through the function of “parameter download” in the set menu. Otherwise, when the system is powered off, the calibration status will turn back to the value before calibration. The operation of parameter download is as followed:

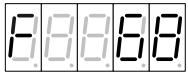
In parameter download mode, move the highlight cursor through ▲ and ▼ to “parameter download” and press Confirm 确认 to enter its set interface.





Move the highlight cursor through ◀/▶ to "CONFIRM" and press Confirm 确认 to return to of "parameter download" on the right side of which it will display "downloading". When the "downloading" disappears, it indicates parameter download has been accomplished.

Set parameter of LED panel commission:



8.2.6. Slow Jog & Exhaust

Test purpose: to check whether the basic functions of hydraulic system operation are normal.

(1) Inspection and preparation before operation

Before operating the servo system for the first time, the operator ought to inspect and ensure the hydraulic loop connection and servo system electrical connection are correct, meanwhile the oil pump displacement and working pressure are in accordance with the values marked on the nameplate. In the early stage, adjust the system such as changing the overflow pressure of overflow valve to

the minimum, until the output oil will return to the oil box directly. Attention: forbid starting the machine while the oil pump is outputting side interception flow.

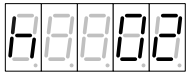
(2) Slow light load operation

Start jog enable and adjust max. jog speed to enter commission interface. Move the highlight cursor through ▲ and ▼ to the item of "jog enable" and presss Confirm 确认 to keep the item in the state of "enable".

Monitor	Set	Commission
Run enable		
Diagnosis enable		ENABLE
Driver test		
Initial angle measurement		
Jog enable		ENABLE
Control mode		PROCESS MODE
System status:		Pressure:
Revolving speed: torque		Resolver:

After adjustment, the operator can conduct jog enable of the motor in the forward/reverse direction through Forward 前进/Reverse 后退. Pressing on Forward 前进/Reverse 后退 to maximize the jog speed and rotate constantly in the forward/reverse direction (use ▲/▼ in LED panel commission).

Set parameter of LED panel commission:



(a) Confirm operating conditions

Ensure the revolving direction of the pump is in line with the

direction of the arrow on the pump caution plate while the motor is revolving in the forward direction, the noise and virbration are within the allowable range and oil absorption of the pump is working in normal.

Wrong Condition	Phenomenon	Solution
Condition 1	The motor does not revolving and the torque value is very high.	Change the revolving direction of the motor in set menu. Reoperate as the steps from 8.2.5 to 8.2.6（2）(b)
Condition 2	The revolving direction of the pump and the direction of the arrow on the pump caution plate are different while the motor is revolving in the forward direction.	Change the revolving direction of the motor in set menu. Reoperate as the steps from 8.2.5 to 8.2.6（2）(b)

(b) Exhaust

Ensure the operating conditions in 8.2.6（2）(b) are normal, then keep the pump revolving in forward direction to exhaust the air in the hydraulic system.

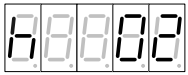
Attention: It is normal to hear noises at the start since there might be air mixed in the hydraulic oil. If the noises are not disappearing in a certain time, it is necessary to exhaust the air from the hydraulic oil circuit.

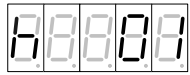
(c) Disable jog enable and diagnosis enable

Disable the “jog enable”as the method in 8.2.6（2）（a）, then adjust the status of “diagnosis function” to “disable” as the method in 8.2.5（1）.

Monitor	Set	Commission
Run enable		DISABLE
Diagnosis enable		DISABLE
Driver test		
Initial angle measurement		
Jog enable		
Control mode		PROCESS MODE
System status:		Pressure:
Revolving speed:	Torque:	Resolver:

Set parameter of LED panel commission:

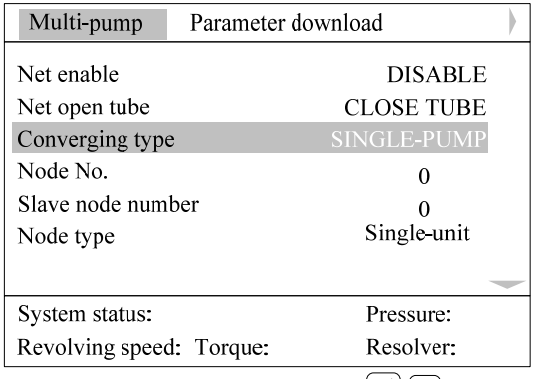




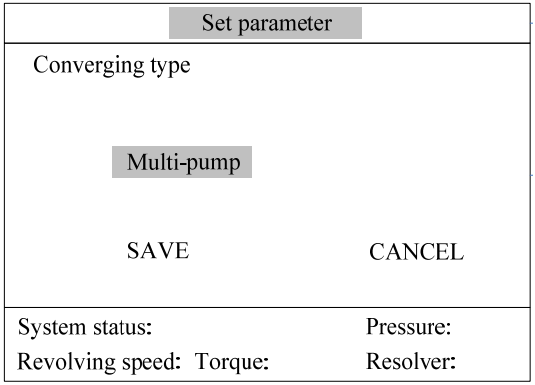
8.2.7. Multi-pump Parameter Set (skip this if it is a single-pump system)

(1) Converging type set

Switch to “multi-pump” through ◀/▶, then move the highlight cursor through ▲/▼ to “converging type”and press c to enter its set menu.

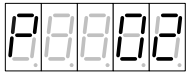


Move the highlight cursor through ◀/▶ to type selection and change the converging type to the desired type through ▲/▼ (take "multi-pump" for instance as the above graph).



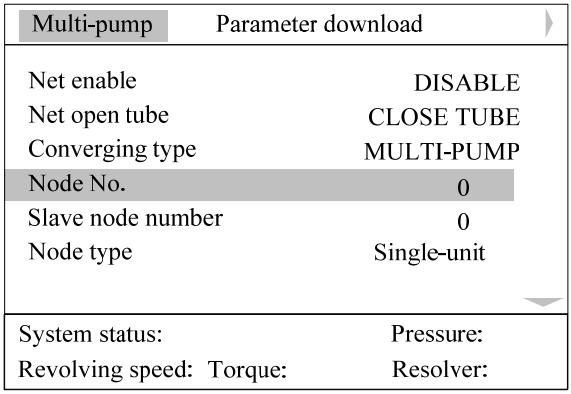
Move the highlight cursor through ◀/▶ to "SAVE" and press ◀/▶ to save and exit to multi-pump menu, then it will display all type for selection on the right side of converging type menu (take "multi-pump" for instance as the above graph).

Set parameter of LED panel commission:

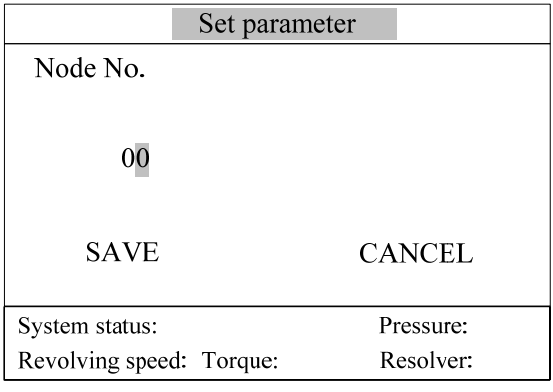


(2) Node No. set

Switch to "multi-pump" through ◀/▶, then move the highlight cursor through ◀/▶ to "Node No." and press Confirm 确认 to enter set menu.

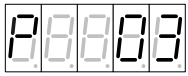


Move the highlight cursor through ◀/▶ to type selection and set the node No. through ◀/▶; set the node No. of the host system as 0 and the node No. of the slave system as "1", "2" and so on according to the number of slave systems (take the set of "0" for the host system as the following graph).



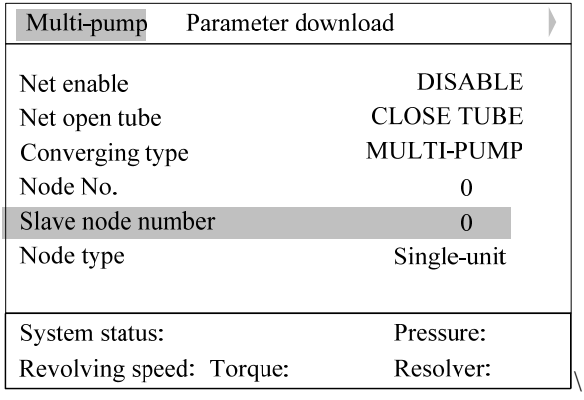
Move the highlight cursor through ◀/▶ to "SAVE" and press 确认 to save and exit to multi-pump menu, then it will display the node No. of the current system on the right side of node No. menu (take the selection of "0" for instance as the above graph).

Set parameter of LED panel commission:

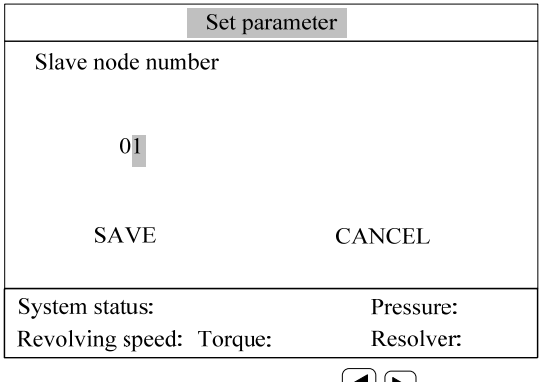


(3) Slave node number set (necessary for node No. 0 and skip this if they are other node numbers)

Switch to "multi-pump" through ◀/▶, then move the highlight cursor through ▲/▼ to "slave node number"and press Confirm 确认 to enter its set menu.



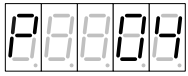
Move the highlight cursor through ◀/▶ to the type selection and set the number of slave nodes as well as slave systems through ▲/▼ (take the set of "1" for one slave system for instance as the following graph).



Move the highlight cursor through ◀/▶ to "SAVE" and press Confirm 确认 to save and exit to multi-pump menu, then it will display the slave node number of the current system on the right side of the slave node number menu (take the selection of "1" for instance as

the above graph).

Set parameter of LED panel commission:



(4) Multi-pump flow set

Set the “flow enter threshold” [P06], 25% in general.

Set the “flow enter hysteresis upper limit” [P07], 5% in general.

Set the “flow enter hysteresis lower limit” [P08], 2.5% in general.

(5) Net enable set and net open tube set

Net enable: In the order of slave machines first and the host machine next, set the “net enable/disable” [P00] separately for the driver.

Net open tube: Only effective when the converging type is multi-pump mode. Set “net open tube” [P01] to enable the motors for all drivers in the multi-pump parallel system.

(6) Node type set

If a certain node in multi-pump parallel system is a multi-unit node comprised of several drivers, it is necessary to set the parameters of “node type” [P05] for those drivers at this node.

8.2.8. Pressure Calibration

Attention: The calibrations are different in the patterns of “single-pump”, “compound”, multi-mode” or “multi-pump”.

■ Single pump pattern:

Calibrate directly, regardless of the “net enable” [P00] parameter.

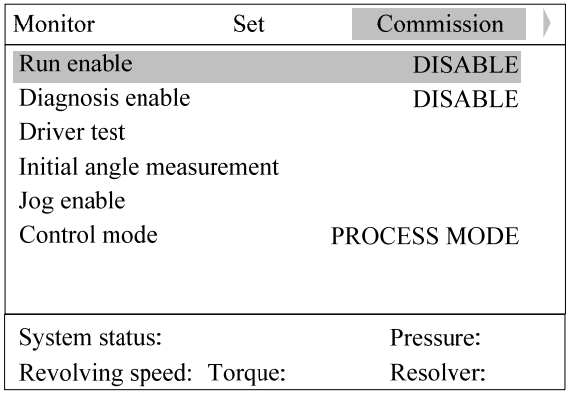
■ Compound pattern and multi-mode pattern:

Disable “net enable” [P00] in “multi-pump” menu first, then calibrate each node as the calibration method in the single-pump system.

■ Multi-pump pattern:

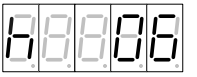
First disable the “net enable” [P00] in “multi-pump” menu and set the “max. flow” [F13] and “max. pressure” [F12] for each node, then enable the net of multi-pump parallel system as the method in 8.2.7（5）. At this time, the max. system pressure is the min. value of the “max. pressure”at the host and slave nodes. At last, calibrate as the following method.

Disable the “run enable” [H00] (disable the “net open tube” [P01] in multi-pump pattern) and change the “process command mode” to “analog input”.



Monitor	Set	Commission
Speed command		0 R/M
Process command mode		ANALOG INPUT
Flow command		0.0L/M
Pressure command		0.0KG
System status:		Pressure:
Revolving speed: Torque:		Resolver:

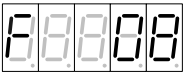
Set parameter of LED panel commission:



(1) Filtering adjust

Set parameter	
Pressure filtering	（Set）
Pressure Analog Input	81.0
0 1	
SAVE	CANCEL
System status:	Pressure:
Revolving speed: Torque:	Resolver:

Set parameter of LED panel commission:



Adjust pressure command of the upper computer to 40% and observe the change of pressure analog input.

Increase the parameter value of pressure filtering in the method of parameter set until the pressure analog input fluctuation reaches the standard in the chart.

Pressure analog input fluctuation	≤0.2V	Measure this when the pressure command is 40%

(2) Calibration

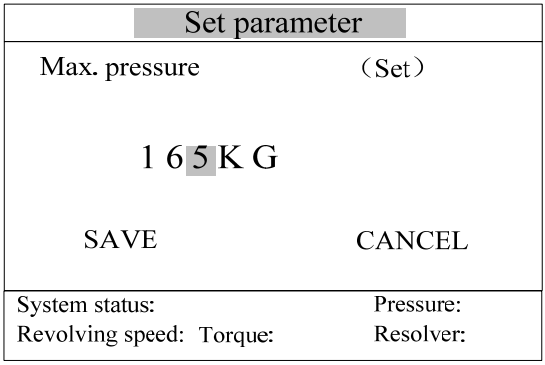
Calibration purpose: Only with the reference analog quantity given by the control system for the servo driver can the servo system convert the analog quantity of control system to the desired quantity in real operation.

(a) Set the max. pressure and pressure full scale

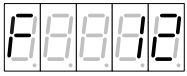
The purpose of setting the max. pressure is to avoid harm to the system caused by the abnormal pressure command exceeding the upper limit of the system. In multi-pump parttern, this parameter has been set before, thus skip this step.

In set mode, move the highlight cursor through ▲/▼ and press Confirm 确认 to enter its set interface.

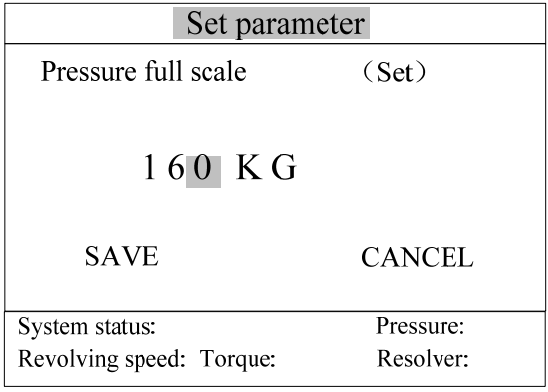
Adjust the parameter value of the max. pressure as the method of numeric parameter set (take the set of 165kg for instance as the following graph).



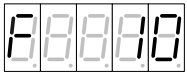
Set parameter of LED panel commission:



Adjust the “pressure full scale” to the desired value in the same way (take the set of 160kg for instance as the following graph).



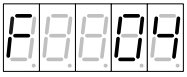
Set parameter of LED panel commission:



(b) Linear calibration

Set the "pressure calibration mode" as "linear calibration" as the method of functional parameter set.

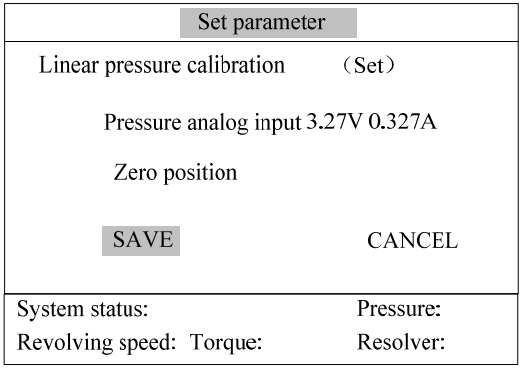
Set parameter of LED panel commission:



Move the highlight cursor through ▲/▼ to "linear pressure calibration" and press Confirm 确认 to enter.

Move the highlight cursor through ◀/▶ to the selection item of linear pressure calibration and adjust it to "zero position" through ▲/▼.

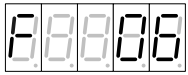
Move the highlight cursor through ◀/▶ to "SAVE", then adjust the pressure command of the upper computer to Obar and press Confirm 确认 to its set menu.



If "success" appears for a while in the status bar of linear pressure calibration and then disappears, it indicates calibration has been accomplished successfully.

Monitor	Set	Commission
Max. flow		101 L/M
Max. pressure		165 kg
Pressure calibration mode		Linear calibration
Flow calibration mode		Linear calibration
Linear pressure calibration		Success
Linear flow calibration		
System status:		Pressure:
Revolving speed: Torque:		Resolver:

If the state bar of linear pressure calibration shows “failure”, then the operator needs to recalibrate until it displays success.
Set parameter of LED panel commission:

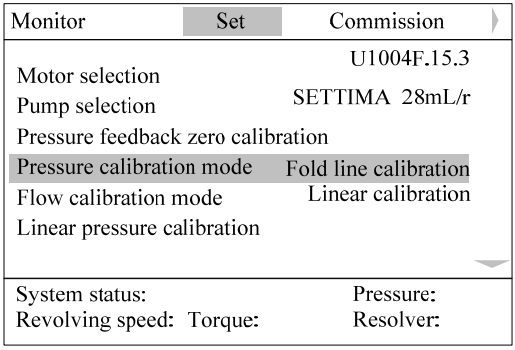


The calibration method of full scale is the same to that of zero position. Adjust the pressure command of the upper computer to the pressure of full scale and change the pressure calibration point to “full scale”. Then adjust the pressure of the injection molding machine to the corresponding pressure of full scale, finally, calibrate and confirm the adjustment.

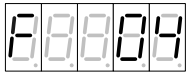
(c) Fold line calibration

The method of fold line calibration is almost similar to that of linear calibration. The operator can regard the fold line calibration as the composition of several line calibrations.

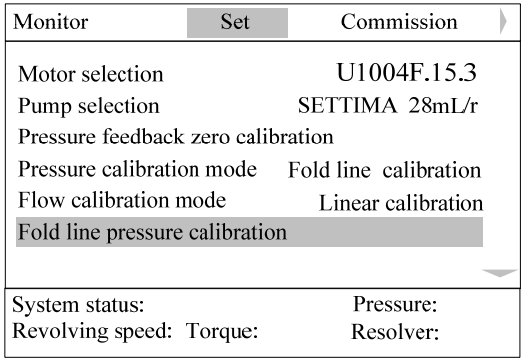
Set the “pressure calibration mode” as “fold line calibration” in the method of functional parameter set.



Set parameter of LED panel commission:



Move the highlight cursor through ▲/▼ to fold line pressure calibration and press Confirm 确认 to enter the selection interface of fold line pressure calibration point.

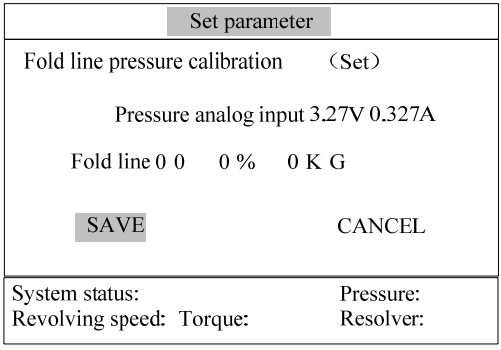


Before the following operation, please adjust the pressure command of the injection molding machine to 0bar first.

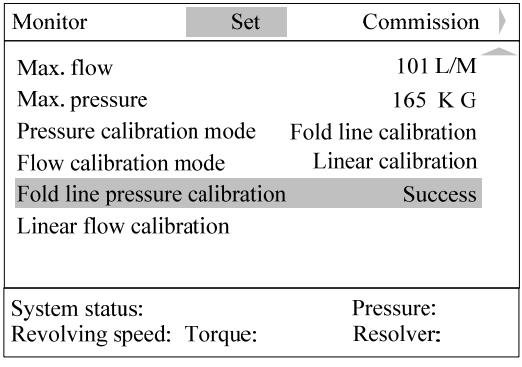
Move the highlight cursor through ◀/▶ to fold line pressure

calibration point and adjust it to “00”, the same to the pressure calibration of “0bar”, through ▲/▼.

Move the highlight cursor through ◀/▶ to “SAVE”.

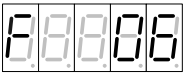


Press 确认 to return to its set menu. If “success” appears for a while in the state bar of fold line pressure calibration and disappears, it indicates the calibration point has been calibrated successfully.



If the state bar of fold line pressure calibration shows “failure”, then the operator needs to recalibrate until it displays success.

Set parameter of LED panel commission:



The calibration method of other calibration points is the same to that of the 0bar point. Referring to the following chart, the operator can adjust the upper computer to the corresponding pressure command value.

No.	Calibration Quantity （Relationship with Full Scale）
0	0%
1	5%
2	10%
3	20%
4	30%
5	40%
6	50%
7	60%
8	70%
9	80%
10	90%
11	95%
12	100%

8.2.9. Flow Calibration

The calibrations are different in the patterns of “single pump”, “compound”, “multi-mode”or “multi-pump”:

■ Single pump:

Calibrate directly in spite of the "net enable"[P00] parameter.

■ Compound and multi-mode:

Keep the "net enable" [P00] of the multi-pump menu in the state of "disable", then calibrate the nodes separately as the calibration method in single-pump system.

■ Multi-pump:

There is "max. flow" set for every node in Pressure Calibration of Chapter 8.2.8. The sum of all these max. flows is the max. system flow, thus there's no need to set the "max. flow" during flow calibration.

Disable the "run enable" [H00] (disable the "net open tube" [P01] in multi-pump pattern) and turn the "process instruction mode" [H06] to "analog input.

(1) Filtering adjustment[F09]

The same to 8.2.8（1）

(2) Calibration

(a) Set the max. flow and flow full scale[F13][F11]

The same to 8.2.8（2）（a）

There's no need to set this in the multi-pump pattern since it has been set in 8.2.8.

(b) Linear calibration [F07]

The same to 8.2.8（2）（b）

(c) Fold line calibration [F07]

The same to 8.2.8（2）（c）

(3) Parameter download

The above parameter set must be downloaded before the driver

is powered off, otherwise the original parameter will remain unchanged. Refer to Chapter 8.2.5 for the methods of parameter download.

8.2.10. Dwell Test

(1) Low voltage dwell test

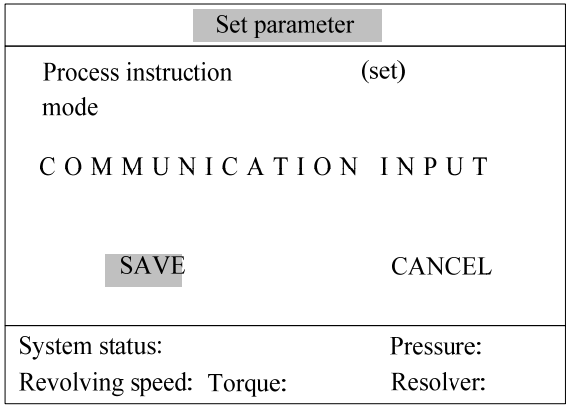
Please adjust the overflow pressure of the overflow valve to the max. value before conducting the following operation.

In the commission mode, when the control mode is “process mode”, move the highlight cursor through ▲ and ▼ to “process instruction mode”and press Confirm 确认 to the set interface.

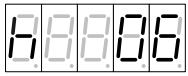
Monitor	Set	Commission
Speed command		0 R/M
Process instruction mode		ANALOG INPUT
Flow command		0.0L/ M
Pressure command		0.0KG
System status:		Pressure:
Revolving speed:	Torque：	Resolver:

Change the name of process instruction mode to “communication input”through ▲ and ▼.

Move the highlight cursor through ◀ and ▶ to “SAVE” and press “confirm” to return to the commission menu. Then the user may find that “process instruction mode” has been changed to “communication input”.



Set parameter of LED panel：



Adjust “flow command”[H07] to 10L/M; “pressure command” [H08] to 20 bar and “run enable” [H00] to the state of “enable”.

Check whether there is oil leakage; whether the pressure feedback value [d09] on the HMI and the pressure gauge of the injection molding machine are 20 bars.

(2) High voltage dwell test

After the low voltage dwell test, the following steps can be conducted for the high voltage dwell test. When “run enable”[H00] is in the state of “enable”, “flow command” [H07] equals to 80% of the max. system flow and “pressure command” [H08] will gradually rise to the max. pressure demand of the injection molding machine. Then observe the real pressure [d09] and motor speed [07] of the system.

If the real system pressure reaches to the command value but

the average motor speed exceeds the recommended value, the further steps need to be done to find the cause of oil leakage:

Case 1: abnormal leakage of the oil pump

Case 2: abnormal leakage of the hydraulic oil circuit

Case 3: leakage of the overflow valve

Mersurement Definition	Passing Criteria (Recommanded Value)
Dwell motor speed （pressure command 100%FS，dwell time 5s）	60-100rpm（plunger pump） <150rpm（screw pump） <300rpm（gear pump）

Ensure the dwell pressure and motor speed for dwell have reached the passing criteria, the check as the following chart to see whether the pressure fluctuation has met the system demand meanwhile.

Mersurement Definition	Passing Criteria (Recommanded Value)
Pressure fluctuation (pressure command 100%FS，dwell time 5s）	≤3bar（plunger pump） ≤2bar（screw pump） ≤3bar（gear pump）

8.2.11. Overflow Valve Calibration

When “run enable” [H00] is in the state of “enable”, “flow command” [H07] equals to 30% of the max. system flow and “pressure command” [H08] means the protection pressure of the overflow valve. Adjust the overflow pressure of the overflow valve to ensure the overflow valve can discharge the effusive flow when the real pressure exceeds the protection pressure.

8.2.12. Calibration Review

Set the “pressure command” [H08] of the upper computer separately as 2bar, 10bar, 50bar, 100 bar, -2bar of the full scale pressure and full scale pressure. Check if the values of pressure gage equal to the set values. If not, recalibrate the pressure.

Set the “flow command” [H08] of the upper computer separately as 2%, 50%, 98% and 100%. Check if the revolving speed of the motor is in proportion to the quantity of hydraulic oil flow (measure through revolving speed of hydraulic motor or the speed of injection cylinder). If not, recalibrate the flow.

8.2.13. All-auto run and system performance adjustment

(1) System restart

After powering off the system, restart the “run enable”, then conduct inversion operation as the disabling method in Section （3） of Chapter 8.2.1.

Restart the system power, ensure the servo system is working, let the driver of injection molding machine control the servo system on the basis of the product parameters of injection molding machine.

(2) System performance adjustment

The process control of the servo system contains the following gain parameters which can be set to adjust the response and static characteristics of the servo system.

Set for the single-pump pattern or diverging pattern:

Pressure proportional gain 0-3，[F19] [F22] [F25] [F28]

Pressure integral gain 0-3, [F20] [F23] [F26] [F29]

Set for converging pattern:

Multi-pump pressure proportional gain 0-3，[P09] [P12] [P15]

[P18]

Multi-pump pressure integral gain 0-3, [P10] [P13] [P16] [P19]

Speed proportional gain，[F14]

Speed integral gain，[F15]

Once the set of motor selection and pump selection have been done, the driver will have selected the matching values of corresponding motor and pump. If you are not satisfied with the above system performance index, please conduct fine tuning the above parameter values to meet your requirement.

9. Alarming & Processing

9.1. List of Protection Display

Servo driver itself has functions of alarming and safeguard in case of overvoltage and overcurrent. Once any abnormal faults occur, the safeguard function will be activated to keep servo driver from outputting and motor from running. Please look for error causes and solutions according to the content of servo driver's abnormal display. The latest five error records will be kept in the internal storage as well as the time they occur and they can be checked through digital LED operation panel or HMI communication.

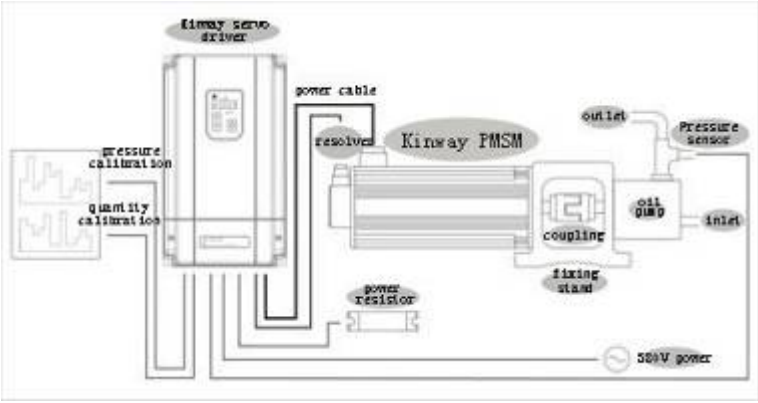
Code	Content	Implication	Code	Content	Implication
Err01	IPM error	Instant short-circuit current in power module	Err02	Overcurrent	The output current exceeds the allowable value of the driver.
Err03	DC overvoltage	The DC voltage on the main circuit is excessively high.	Err04	DC undervoltage	The DC voltage on the main circuit has been lower than the allowable value in the process of motor operation.
Err05	Overspeed in forward direction	The revolving speed in forward direction of the servo	Err06	Module overheated	The radiator of servo driver is overheated.

		motor is excessively high.			
Err07	Motor overheated	The winding of the servo motor is overheated.	Err08	Software fault	Abnormal software operation of the servo driver.
Err09	CAN fault	When the process command mode is in CAN continue or multi-pump parallel application, the driver with CAN communicatio n fault will alarm.	Err10	Environment overheated	The air temperature inside the driver is excessively high.
Err11	Self-checking fault	The internal hardware of the driver is anomalous.	Err12	Mission reentry	Software routine call fault
Err13	Excessive oil pressure	The oil pressure of the system surpasses the allowable value.	Err14	Overspeed in reverse direction	Overspeeded motor reversal in the process control mode.
Err15	Pressure transducer fault	Wiring error or breakdown of pressure transducer.	Err16	Brake resistor failure.	Brake resistor is unlinked or damaged.
Err17	AC overvoltage	The input AC voltage is excessively high.	Err18	EEPROM fault	Abnormal data of the servo unit EEPROM

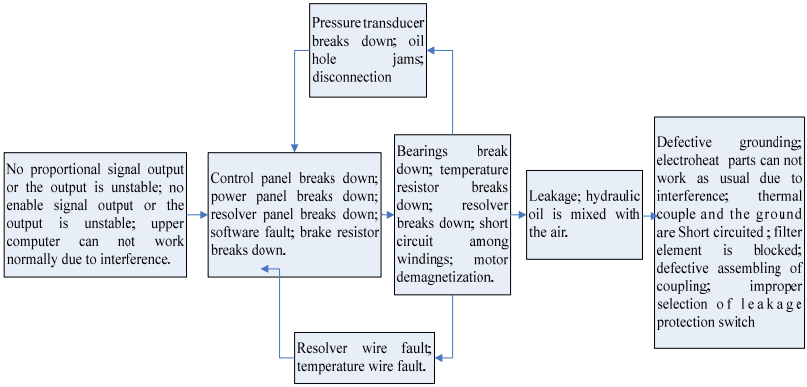
Err19	Enabling undervoltage	The DC voltage on the main circuit is excessively low at the beginning of electrifying motor.	Err20	AC undervoltage	The input AC voltage is too low.
Err21	Braking overload	Overheated brake resistor led by overload.	Err22	Node failure	In multi-pump parallel application, the slave nodes are at fault and the host driver will alarm this fault.
Err23	Rectifying unit fault	Detection value of AV and DV is incompatible.	Err24	Overtime electrifying	Overtime operating of the electrified relay.
Err25	485 communication fault	When the process command mode is in 485 continue, the driver with 485 communicatio n fault will alarm.			

9.2. Analysis of Error Causes

As presented in the following diagram, the electro-hydraulic servo system of the KINWAY injection molding machine is mainly comprised by permanent synchronous motor, motor rotor position or speed transducer, servo driver, oil pump coaxially linked to servo motor, pressure transducer for detecting the system's oil pressure and other critical components.



Technically speaking, all the above components (including the connecting lines) can be identified as error sources. The system error profile is as followed:



It facilitates analyzing errors thoroughly and systematically to have a good master of the error profile so as to find sources quickly and accurately.

9.3. Protection Causes & Measures

When errors with alarming codes occur, the panel display will show the codes which are listed together with measures in the following chart. Please contact with our service department if the problem can't be solved.

Error group 1：

Error Code	Content	Cause	Measure
Err01	IPM fault	Wrong connection between ground wire and U，V&W	Check the wiring and correct the linkage.
		The U, V&W phases of cables for motor's main circuit and ground wire are short circuited.	Revise or replace cables of the main circuit for motor.
		Wrong wiring for the regenerative resistor.	Check the wiring and correct the linkage.
		Servo driver error (error of current feedback circuit, power transistor or circuit board)	Replace servo driver.
		The U, V and W phases of the servo motor and the ground are short circuited.	Replace servo motor.
		The U, V and W phases of the servo motor are short circuited.	
		Wrong parameter set of the driver.	Reset parameters.
		Wrong method (in direction or distance from other parts) of	Reduce ambient temperature of servo unit

		installing servo driver (whether there is influence from the heating equipments around).	below 45 degrees.

Error group 2:

Error Code	Content	Cause	Measure
Err02	Overcurrent	Abnormal wiring of motor (defective wiring or linkage)	Correct the wiring of the motor.
		Abnormal wiring of position transducer (defective wiring or linkage)	Correct the wiring of position transducer.
		Error of servo driver	Replace the servo driver.
Err03 Err17	DC overvoltage AC overvoltage	AC power voltage is too high.	Adjust the AC power voltage to the normal range.
		Check AC power voltage (whether severe change in voltage).	
		High revolution, too much load rotary inertia (lack of ability in regenerative braking).	Reanalyze the load conditions and operation conditions.
		Servo driver fault.	Replace servo driver.

Error group 3:

Error Code	Content	Cause	Measure
Err04 Err20 Err19	DC undervoltage AC undervoltage enabling undervoltage	Low AC power voltage (whether excessive drop of voltage)	Regulate AC power voltage to normal range.
		Instant power cut.	Restart after restoration.
		Cable for the main circuit of motor is short circuited.	Revise or replace cable for the main circuit of motor.
		Servo driver error.	Replace servo driver.
Err05 Err14	Overspeed in forward direction； Overspeed in reverse direction	U, V&W phases of wiring for motor in disorder.	Correct wiring of the motor.
		Wrong wiring of the position transducer.	Revise wiring of the position transducer.
		Malfunction of position transducer led by interference.	Implement anti-jamming measure for wiring of position transducer.
		Circuit board fault of servo driver.	Replace servo driver.
Err06 Err07 Err10	Module overheated; Motor overheated Environment overheated	Beyond command load.	Revaluate conditions of load and operation or motor capacity.
		The environment temperature of servo system is beyond 55 degrees.	Regulate environment temperature of servo unit below 55 degrees.
		Wrong wiring for temperature	Correct wiring for

		transducer of servo motor.	temperature transducer of servo motor.
		Servo driver fault.	Replace the servo driver.

Error group 4:

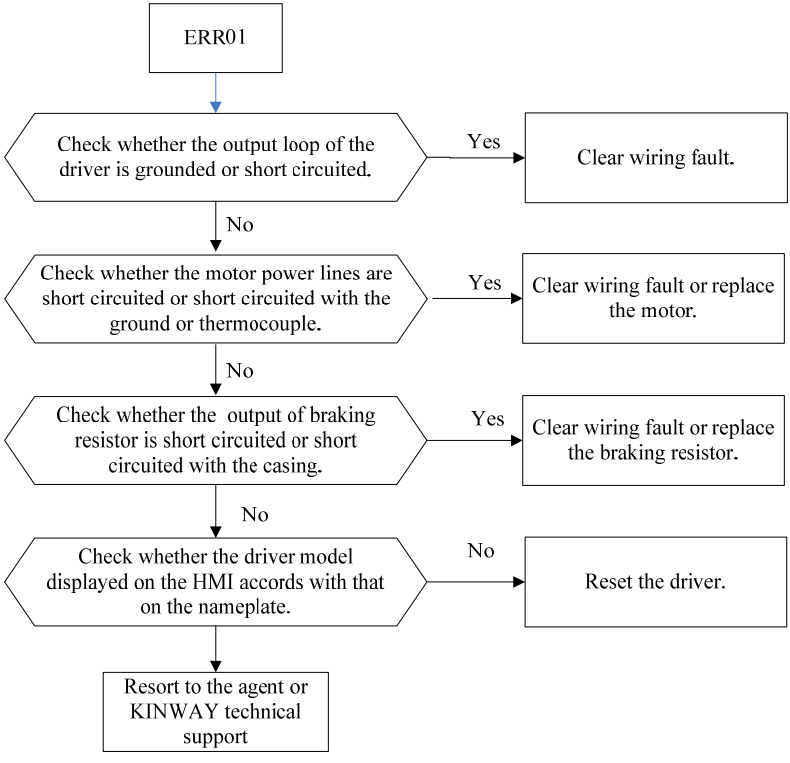
Error Code	Content	Cause	Measure
Err08	Program fleet fault.	Interference from static or thunder strike.	Restart after restoration.
Err11	Self-checking fault	Abnormality in position transducer of motor.	Replace motor.
		Servo driver fault.	Replace servo driver.
Err12	Software fault	Servo driver fault.	Replace servo driver.
Err13	Excessive oil pressure.	Wrong wiring of pressure transducer.	Revise wiring of pressure transducer.
		Abnormality in pressure transducer.	Replace pressure transducer.
		Improper commission of oil pump control and speed control parameters.	Adjust the control parameters to the reasonable values.

Error group 5:

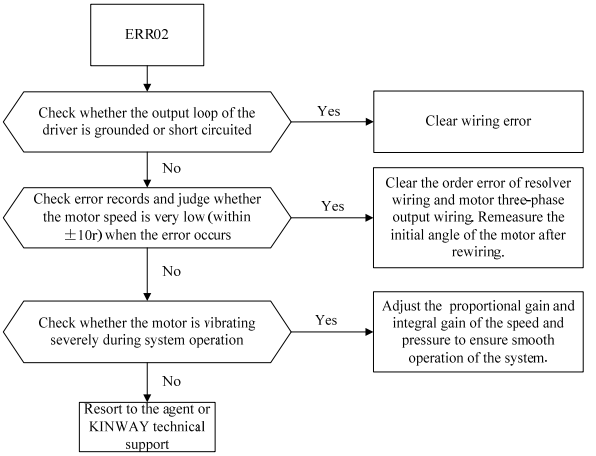
Error Code	Content	Cause	Measure
Err15	Pressure transducer fault	Wrong wiring of pressure transducer.	Revise the wiring of pressure transducer.
		Abnormality of pressure transducer.	Replace pressure transducer.
		Servo driver fault.	Replace servo driver.
Err16	Brake resistor breakdown.	The revolving energy is beyond capacity of DB resistor when DB stops.	Reselect capacity of regenerative resistor or revaluate load conditions.
		Check the regenerative resistor whether its wiring is wrong, separated or broken.	Correct the wiring of external regenerative resistor.
		Servo driver fault (fault in regenerative transistor and voltage detection parts).	Replace servo driver.
Err18	EEPROM breakdown	Power off during parameter setting.	Reset parameter after restoring to factory default..
		Power off during error code download.	
		Power off during parameter setting.	Replace servo driver.
Err21	Overload of brake resistor.	Long-term power on of motor or frequent start and stop.	Adjust operating conditions of motor or replace with brake resistor of higher power.

9.4. Flow Chart of Trouble Shooting

Err01：IPM fault



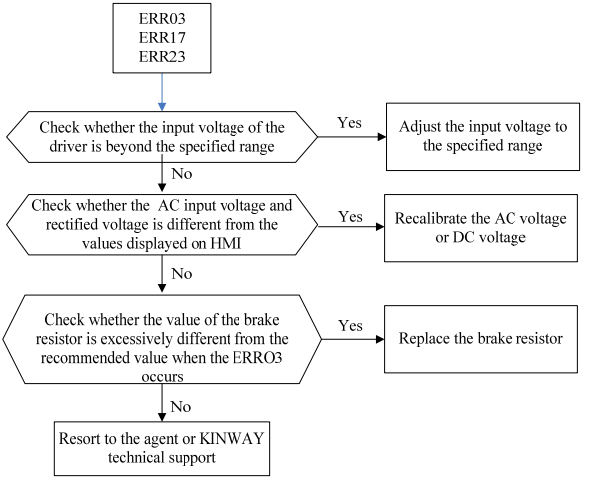
Err02：Overcurrent



Err03：DC overvoltage

Err17：AC overvoltage

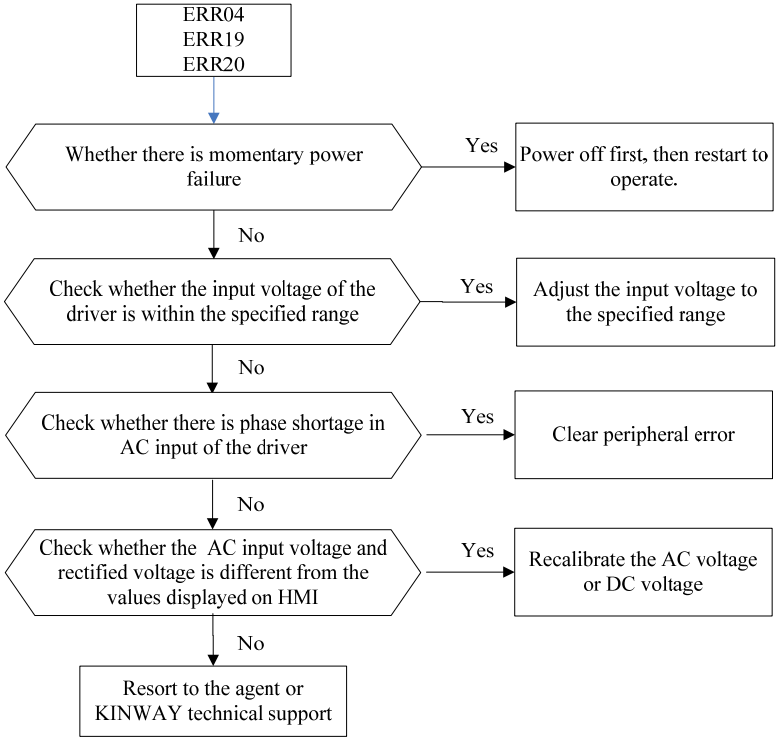
Err23：Rectifying unit error



Err04：DC undervoltage

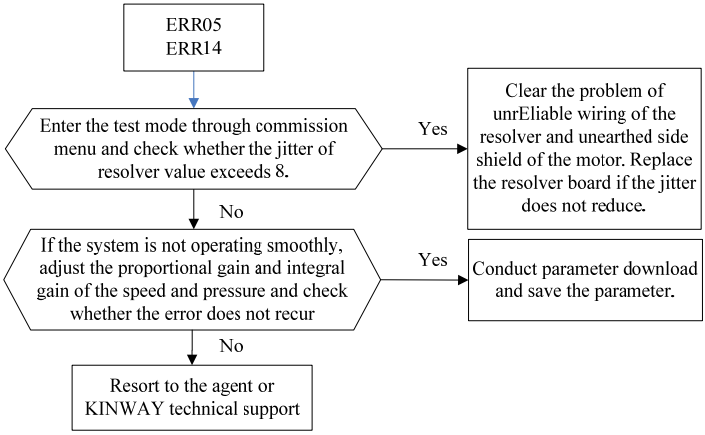
Err19：Enable undervoltage

Err20：AC undervoltage

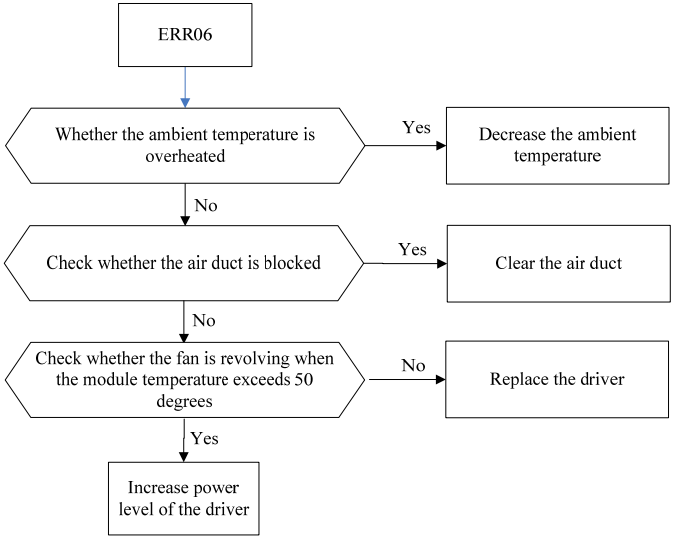


Err05：Forward overspeed

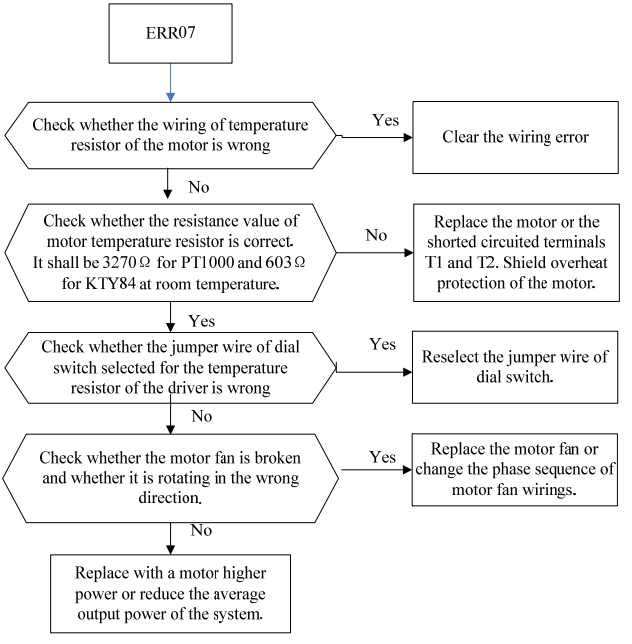
Err14：Reverse overspeed



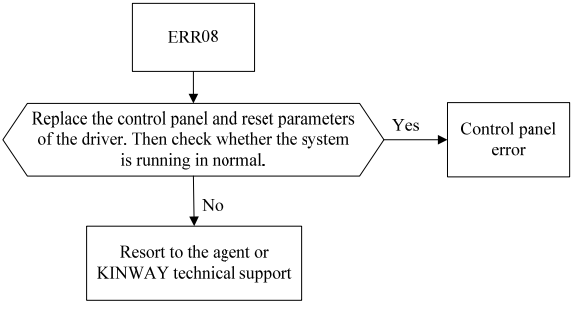
Err06：Module overheated



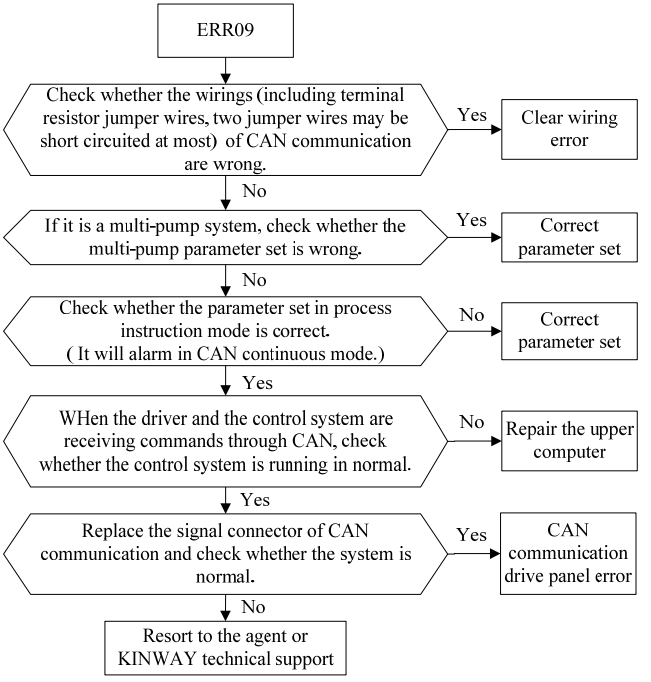
Err07：Motor overheated



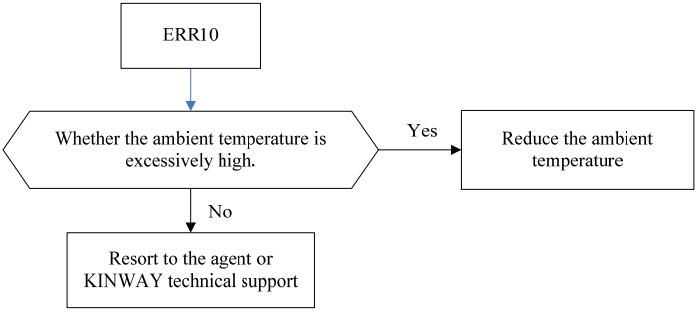
Err08：Software error



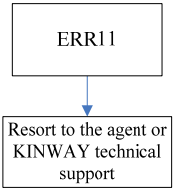
Err09：CAN error



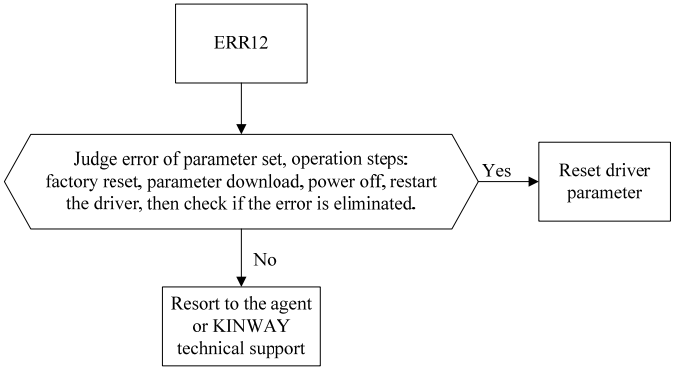
Err10： Temperature overheated



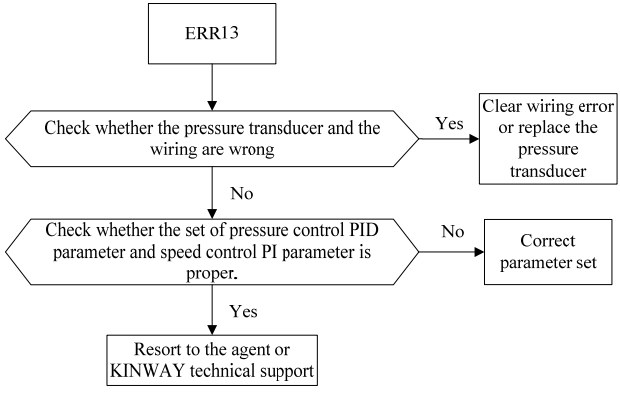
Err11：Self-checking error



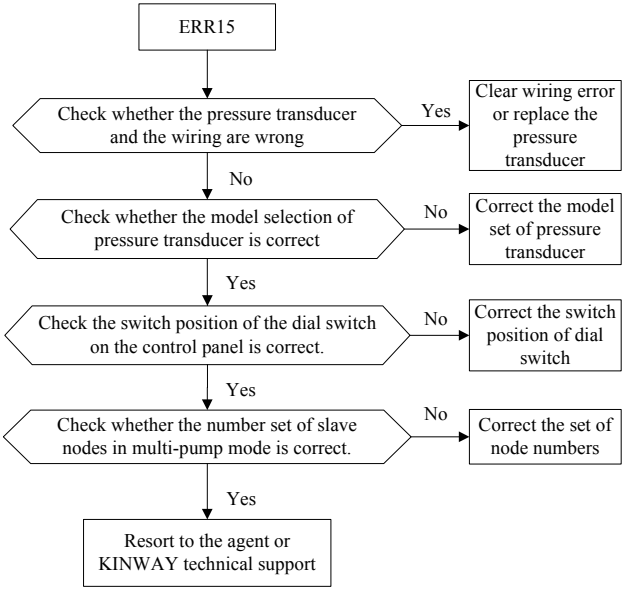
Err12：Mission reentry



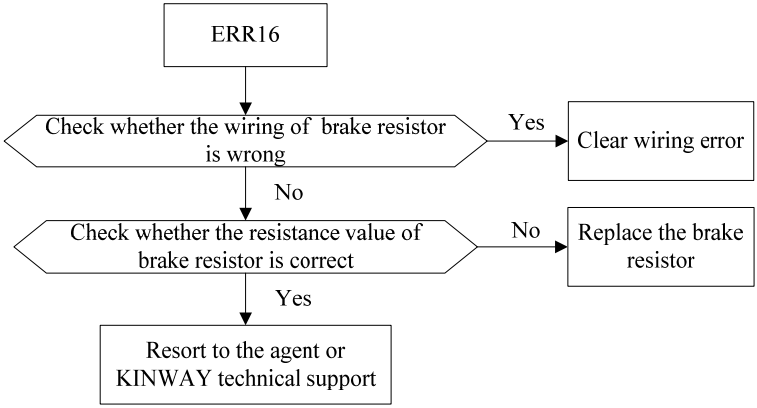
Err13：Oil pressure overpressure



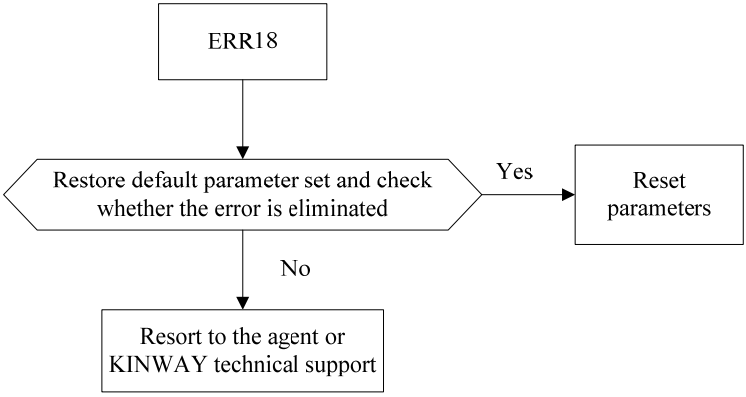
Err15：Pressure transducer error



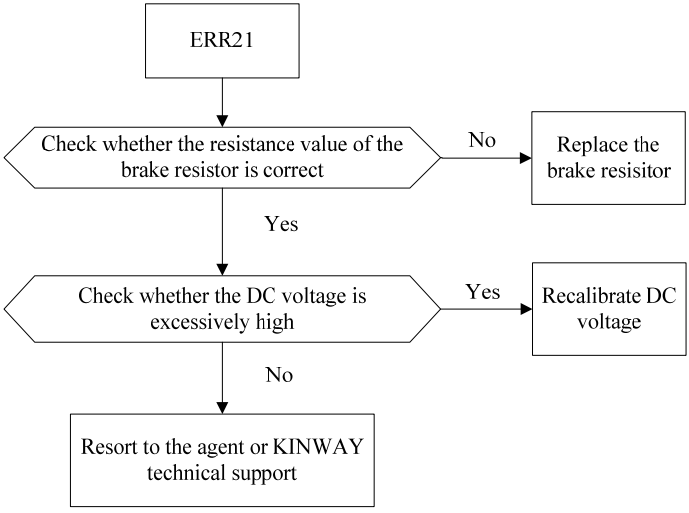
Err16：Braking resistor breakdown



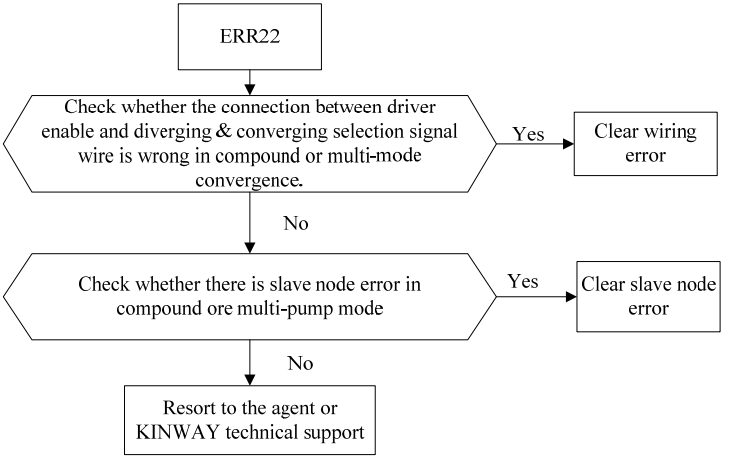
Err18：EEPROM error



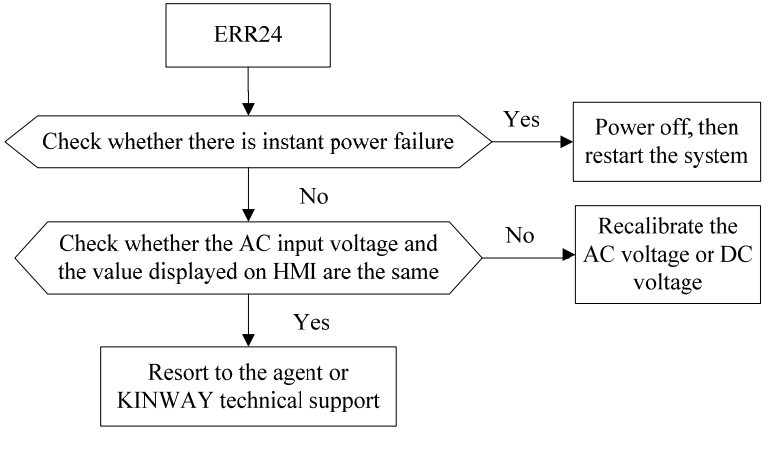
Err21：Braking overload



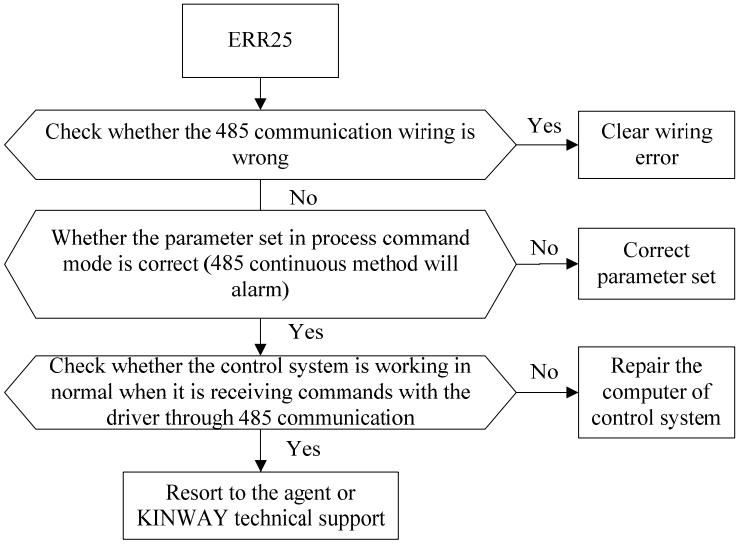
Err22：Node error



Err24：Powering on overtime



Err25：485 communication error



10. Maintenance & Inspection

Only maintenance personnel with professional training are allowed to touch the internal circuit parts in case of any electric shock! Good maintenance and regular inspection are necessary for the long-term operation of the servo hydraulic control system of the injection molding machine.

10.1. Attention Items

There is high voltage electricity remaining in the internal capacitance of the driver within a certain time after all power supplies have been cut off. After electricity discharge, measure the voltages of both terminals U+ and U- through the multimeter and make sure they are below 36V. Then inspect the driver.

10.2. Inspection Items

Items needing regular inspection:

Inspection Item	Inspection Content	Inspection Method & Measurement Equipment	Criteria
Application environment	Ambient temperature, humidity, dust level, dust composition, oil/acid spoils and so on.	Ocular estimation, thermometer and hygrometer	Meet the requirements of the manual.
Power voltage	Whether the voltage of power supply is normal.	Voltmeter and multimeter	Meet the requirements of the manual.
	Whether the logic actions (of contactor, air switch, etc.) when powering on are normal.		
Appearance & parts	Whether there is abnormal vibration, noise,	Tighten the screws;	No abnormality

check	deformation or breakage.	Ocular estimation; multimeter	
	Whether the external braking resistor is loose or aged and whether the resistance value is normal.		
Circuit check	Peculiar smell or not	Smell, listen and observe.	No abnormality
	Whether the cooling fan is revolving in normal		
	Whether the connector assemblies are loose.		
	Whether the connecting wires are worn or crushed.		
	Whether the filtering capacitance is deformed or weeping.		

10.3. Tramegger Test

Tramegger test can only be applied to the test of insulativity between motor winding and casing. Before test, ensure all wires connecting the motor and the servo driver have been cut off. The tramegger shall be 1000V and its insulation resistance shall be more than 50MΩ.

Improper method of insulativity test may damage the servo driver, therefore, we suggest you not conducting the test without permission.

10.4. Replacement of Components & Parts

The life span of the bearing of the cooling fan is ten thousand hours. Thus the bearing needs to be replaced every 3~4 years if it is used continuously. It also needs replacement if there is any abnormal noise or vibration of the fan.

If the aluminium electrolytic capacitor is out of service for a long time, its life span will be shortened. Therefore, you'd better operate the servo driver at least one time every half a year.

11. Accessory Equipments

11.1. Model List of Accessory Equipments

Name	Model	Application
Filter	DL-50EBK5	7501/1502/1802
	DL-65EBK5	2502
	DL-100EBK5	3502/4502
AC reactor	Parameter 37KW/90A/0.19mH/2%F	All drivers
Braking resistor	15Ω，500W	7501/1502/1802
	10Ω，1000W	2502
	1.67Ω，1500W（3 cascaded）	3502/4502
Current transit box		During machine conversion, if the output signal of the host machine is current signal, then it needs to be converted to voltage signal through the transit box.
External HMI commission panel	H038-HA	Commission tool

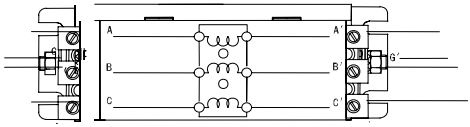
11.2. Selection of Noise Filter

(1) Table of noise filters corresponding to drivers of all

models

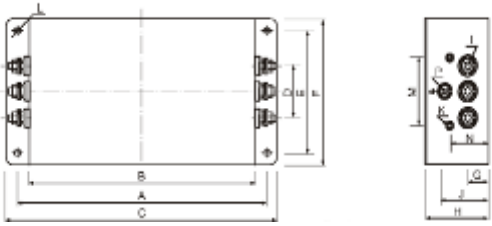
SERVO DRIVER MODEL	NOISE FILTER	
	Model	Specifications
KT-CT-7501-A-0	DL-50EBK5	50A, 320nF
KT-CT-1502-A-0	DL-50EBK5	50A, 320nF
KT-CT-1802-A-*	DL-50EBK5	50A, 320nF
KT-CT-2502-A-1	DL-65EBK5	65A, 320nF
KT-CT-3502-A-0	DL-100EBK5	100A, 320nF
KT-CT-4502-A-1	DL-100EBK5	100A, 320nF

(2) Definitions of filter terminals



LABEL	DEFINITION
A	Input three-phase power
B	
C	
G	Input power earth
A'	Input three-phase power
B'	
C'	
G'	Input power earth

(3) Overall dimensions of the filter（mm）



Model	A	B	C	D	E	F	G	H	I	J	K	M	N	P	L
DL-50EBK5	243	224	265	58	70	102	25	92	M6	58	M4	74	49	M6	6.4×9.4
DL-65EBK5															
DL-100EBK5	354	323	388	66	155	188	30	92	M8	62	M4	86	56	M8	6.4×9.4

Fix the noise filter in a drafty place with screws and make sure the ground terminals of input and output reliably connected to the system earth. Refer to "4.5.6 Typical wiring instance of the main circuit" for wiring methods.

11.3. Selection & Installation of Braking Resistor

(1) Selection table of braking resistors

Servo driver model	Specifications of braking resistors	
	Resistance value Ω	Power W
KT-CT-7501-A-0	15	500
KT-CT-1502-A-0	15	500
KT-CT-1802-A-*	15	500
KT-CT-2502-A-1	10	1000
KT-CT-3502-A-0	5	4500
KT-CT-4502-A-1	5	4500

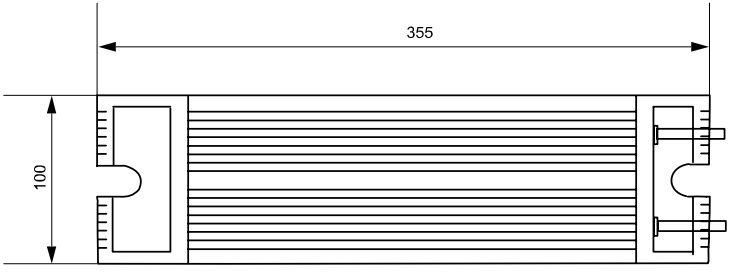
Since the servo driver has no built-in braking resistor, the user must match an external one.

If the motor needs the braking resistor of higher power to meet frequent braking, the user can match one with low resistance value and high power when making orders. The external braking resistor shall be installed in a drafty place and be far away from any combustible or heat-resistant parts.

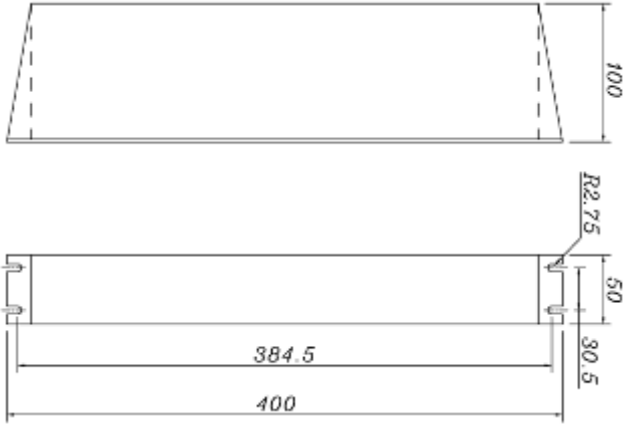
The user must make sure the resistance value is no less than the specified value when installing the external braking resistor by themselves.

(2) Overall dimensions of the braking resistor（mm）

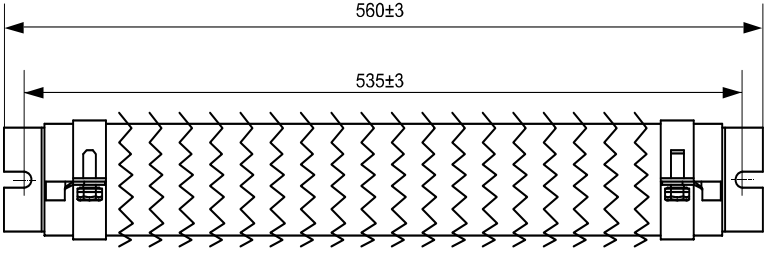
Braking resistor with aluminum case (for driver 7501/1502/1802):



Dimensions of RXLG1000W10RJ (braking resistor for driver 2502):

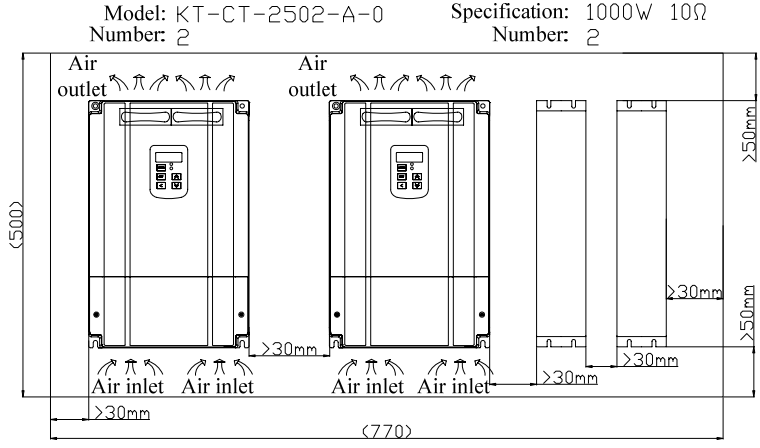


Corrugated braking resistor (braking resistor for driver 3502/4502, three cascaded):

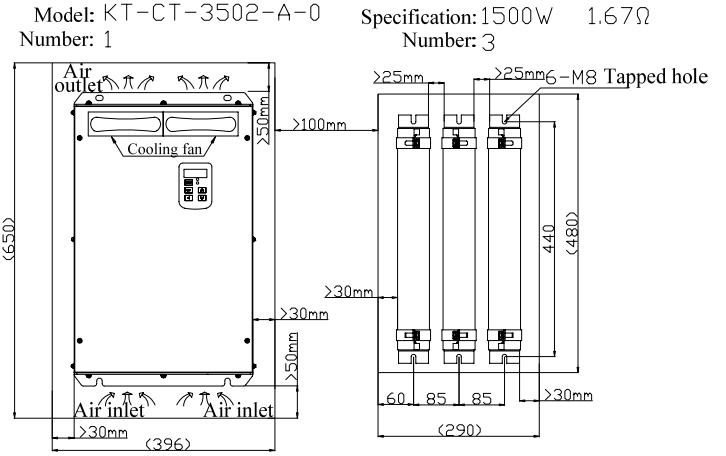


(3) Installation and configuration of braking resistor

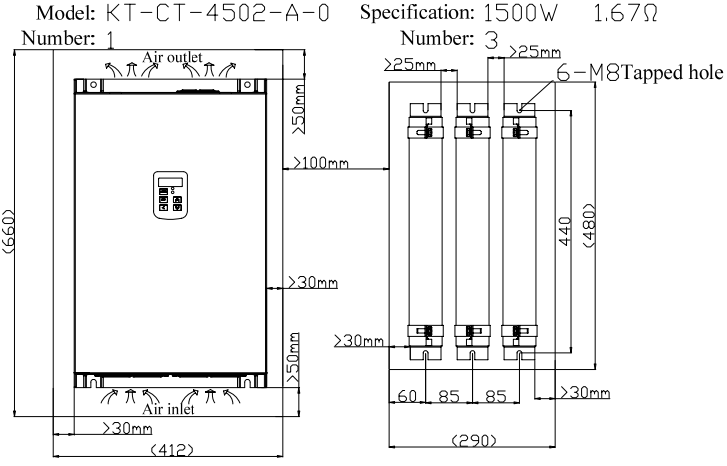
(a) Configuration chart of drivers KT-CT-7501/1502/1802/2502 and their braking resistors （mm）



(b) Configuration chart of driver KT-CT-3502 and its braking resistor（mm）

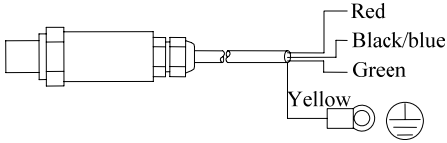


(c) Configuration chart of driver KT-CT-4502 and its braking resistor（mm）



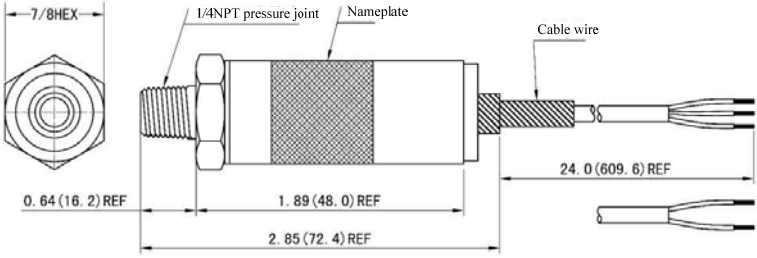
11.4. Selection of Pressure Transducer

(1) Pressure transducer terminals



Color	Name	Definition
Red	CRF	15V power
Black/blue	AIN3-	Pressure analog signal output
Green	AIN3+	
Yellow	PE	Ground wire

(2) Dimensions and installation of pressure transducer



Seal the connection between pressure transducer and oil circuit with the adhesive tape. During installation, fasten the pressure transducer in case of any leakage.

11.5. Selection of External HMI

Refer to the Display & Operation of External HMI in Chapter 5.

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