SynMatic

AIM310 Series

Injection Molding Machine Drive

User Guide

Data code: C2312010100

Version: A00

Legal Information Statement:

- The product described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation.
- All operations on the product must follow respective descriptions provided in the documentation, in particular, its warning notices and safety instructions.
- Damage caused by improper use is not covered by warranty.
- The company will disclaim any legal liability for any personal injury or property damage caused by improper usage.

Contents

Safety Information and Precautions

To avoid personal injury or damage to the equipment, matters to be followed are stated as follows:

- Read and follow the Safety Information and Precautions before use.
- Use this product according to the designated environment requirements.
- Follow all safety information and precautions described in the product identification and manual.

The degree of injury and damage caused by improper use of this product is distinguished and described as follows:

DANGER	This mark indicates that failure to comply with the notice will result in severe personal injury or even death.
WARNING	This mark indicates that failure to comply with the notice may result in severe personal injury or even death.
CAUTION	This mark indicates that failure to comply with the notice may result in minor or moderate personal injury or damage to the equipment.

Matters to be followed are described using the following graphic marks:

This graphic mark indicates contents that must be performed.	This graphic mark indicates contents that must not be performed.

DANGER

- Install this product on non-combustible materials such as metal.
- Set up the product in a clean place where it does not contact water or oil.
- Installation and wiring must be performed by qualified electricians.
- Installation personnel must be familiar with product installation requirements and relevant technical materials.
- The moving, installation, wiring, and inspection of this product can be performed only after you cut off the power supply, wait at least 10 minutes, and determine that there is no risk of electric shock.
- Follow the proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap to perform wiring.
- The cables should be properly connected. The energized part must be properly insulated using an insulator.

- Do not place any combustible material around this product.
- Do not place this product around heating elements such as heaters and large wire-wound resistors.
- Do not use this product in a corrosive and inflammable gas environment or in a place close to combustible materials.
- Do not use this product in a place with strong vibration or impact.
- Do not use this product after the cables are immersed in oil or water.
- Do not perform wiring at power-on.
- Do not damage the cables or apply any excessive external force, weight, or pinch to them.
- Do not connect this product directly to the commercial power supply.
- Do not perform installation and wiring in a place with strong electric or magnetic field.
- Do not perform wiring and equipment operations with wet hands.
- Do not reach your hands into this product.

⚠ WARNING

- Specialized loading and unloading equipment must be used to handle the product.
- When handling the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling.
- Handle the equipment with care during transportation and mind your steps.
- When this product is installed in a terminal device, the terminal device must be equipped with protection. The protection class must comply with relevant IEC standards and local regulations.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.
- When the product is lifted by a crane, personnel cannot stand or stay under the product.
- Do not modify this product.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- Do not connect the input power supply to the output end of the equipment.

⚠ CAUTION

- Check whether the equipment or accessories show the evidence of damage, rust, impact, or dampness.
- Check whether the package contents are consistent with the packing list.
- After wiring is completed, ensure that there are no screws fallen or cables exposed in the equipment.
- Make sure that the temperature around the equipment is within the range of temperature and humidity.
- Dispose of the equipment as industrial waste during discarding.

- Do not stand on the equipment or place a weight on it.
- Do not let the equipment fall or invert it during the handling or setup.
- Do not place any barriers around the product and peripheral equipment to hinder ventilation.
- Do not let the equipment suffer from any strong impact.

Safety Label:

Danger

- Conduct protective grounding to prevent electric shock. Read through the guide and follow the safety instructions before use.

Hazardous Voltage

- Do not disassemble the machine or touch terminals with power-on or within 15 minutes after disconnecting the power supply to prevent the risk of electric shock.

Hot

- Do not touch the drive during operation and within a short time after shutdown. Failure to comply may cause burns.

Environmental Protection

Reuse

- Some components of the product can be reused due to high metal content. Dismantle the product into individual components to improve the metal recycling efficiency. Electrical and electronic components contain metal materials that can also be recycled through a specific separation process.

Disposal

- Discard components that cannot be degraded and recycled as industrial wastes according to local regulations.

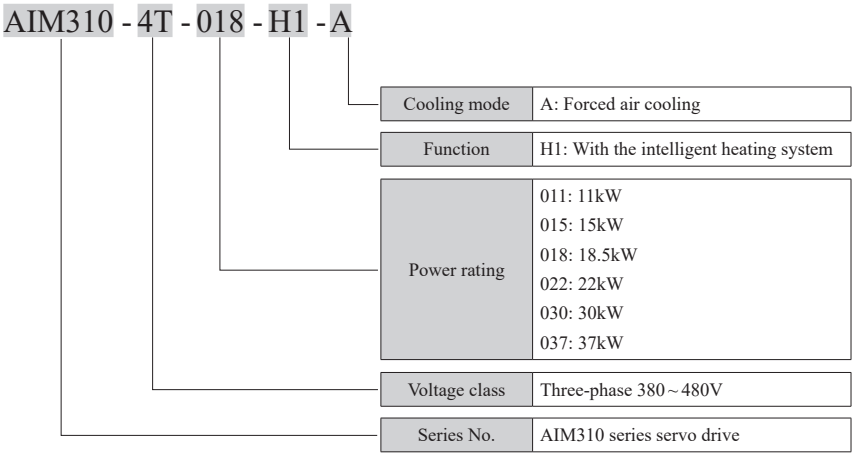
Chapter 1 Product Information

1.1 Features

The AIM310 series drives are disruptive innovation products developed by Suzhou Anchi Control System Co., Ltd. for the injection molding industry. These drives integrate advanced technologies of automation control.

- First integrated intelligent heating system in the industry, capable of energy-saving and power consumption reduction, implementing intelligent heating control.
- First product with all models providing the Safe Torque Off (STO) function, which is safe and reliable.
- Comprehensive performance improvement of the injection molding machine system, such as the injection molding speed, pressure-holding accuracy, and drive stability, making the system stable and efficient.
- Hardware and underlying software design for the servo platform, empowering simple and convenient operation and maintenance.

1.2 Model



1.3 Ratings

Model	Heating power (Number of output circuits × kW)	Output power (kW)	Power capacity (kVA)	Input current (A)	Output current (A)	Applicable motor (kW)
Three-phase four-wire input power supply: 400 V (±15%), 50/60 Hz						
AIM310-4T011H1-A	5×3	11	30	35	25	11
AIM310-4T015H1-A	5×3	15	39	45	32	15
AIM310-4T018H1-A	6×3	18.5	45	60	37	18.5
AIM310-4T022H1-A	6×3	22	54	65	45	22
AIM310-4T030H1-A	6×6	30	52	75	60	30
AIM310-4T037H1-A	6×6	37	63	90	75	37

1.4 Technical Specifications

■ Basic specifications

Item	Specification
Weight	11 – 15kW: About 5.7kg 18.5 – 30kW: About 10.2kg 30 – 37kW: About 19.5kg

Item	Specification
Maximum frequency	Vector control: 0 – 300 Hz V/f control: 0 – 300 Hz
Carrier frequency	2.0 – 6.0 kHz
Input frequency resolution	Digital setting: 0.01 Hz
Control mode	Feedback vector control (FVC)
Starting torque	0 Hz / 180% (FVC)
Speed range	1 : 1000 (FVC)
Speed stabilization accuracy	±0.02% (FVC)
Torque control accuracy	±5% (FVC)
Overload capacity	60 s for 150% of the rated current; 1 s for 200% of the rated current.
Acceleration/deceleration curve	Linear acceleration/deceleration mode; Two groups of acceleration/deceleration time, ranging from 0.0 s to 6500.0 s.
DC braking	DC braking frequency: 0.00 Hz to maximum frequency Braking time: 0.0 s to 36.0 s Injection braking current: 0.0% to 100.0%
Oil pressure PID	It facilitates implementation of the closed-loop process control system.
Overvoltage/Overcurrent stall control	The current and voltage are limited automatically during running to avoid frequent tripping due to overvoltage/overcurrent.
Torque limiting and control	This function is used to limit torque automatically during running to avoid frequent tripping due to overcurrent. The torque can be controlled in closed-loop vector control mode.
Protection level	CLASS I

■ Electrical parameters

Item	Specification
Input voltage (VIN) range	Rated input voltage: three-phase 380 – 480 V AC (-15% to +10%) 50/60 Hz
Power range	11 – 37 kW
Efficiency	> 97%
Power supply system	TT/TN

■ Ambient conditions

Item	Specification
Operating temperature range	-10 °C to +50 °C For temperature above 40 °C, derate 1.5% for every additional 1 °C. The temperature is up to 50 °C.
Humidity range	5% – 95%, non-condensing
Pollution degree	2
Altitude	< 1000 m For altitudes above 1000 m, derate 1% for every additional 100 m. The altitude is up to 2000 m.
Solar radiation	< 700 W/m²
IP rating	IP20
Transport and storage temperature	-20 – 60 °C, air temperature change < 1°C/min
Transport and storage humidity range	5% – 95%, condensing

■ Functions

Item	Specification
Command source	Operating panel setting, control terminal setting, and serial communication port setting. Switchover between these sources can be implemented in multiple ways.
Frequency source	The options are digital setting, analog voltage setting, pulse setting, serial port setting, and PID setting. Switchover between these sources can be implemented in multiple ways.
Input terminal	Standard: Six digital input terminals. Three analog input terminals, supporting 0 – 10 V input voltage or 0 – 20 mA input current.
Output terminal	Standard: One digital output terminal. Two relay output terminals. Two analog output terminals, supporting 0 – 20 mA output current or 0 – 10 V output voltage.

■ Display and operation on the operating panel

Item	Specification
Human-machine interface (HMI)	LED keyboard
Display	Standard integrated LED keyboard
Parameter copy	Disabled
Key locking and function selection	This function can lock some keys and define the function range of some keys to prevent misoperation.
Protection functions	Motor short-circuit detection at power-on, and protection against input/output phase loss, overcurrent, overvoltage, undervoltage, over-temperature, and overload.

■ Heating drive

Item	Specification
Load type	Resistance coil
IP rating	IP20
I/O	Nine common DIs Two common DOs
Communication mode	1×RS485 / 1×CAN
Voltage withstand	2000 V AC

NOTICE

Running status upon startup:

- When the machine starts to run, the drive unit does not work, the heating component starts pre-heating, and the machine runs at the rated power.
- When the temperature of the heated device reaches the target, the drive unit starts to work and the heating PID is dynamically adjusted. (In the state, the heating power does not exceed half of the rated power.)

1.5 Components

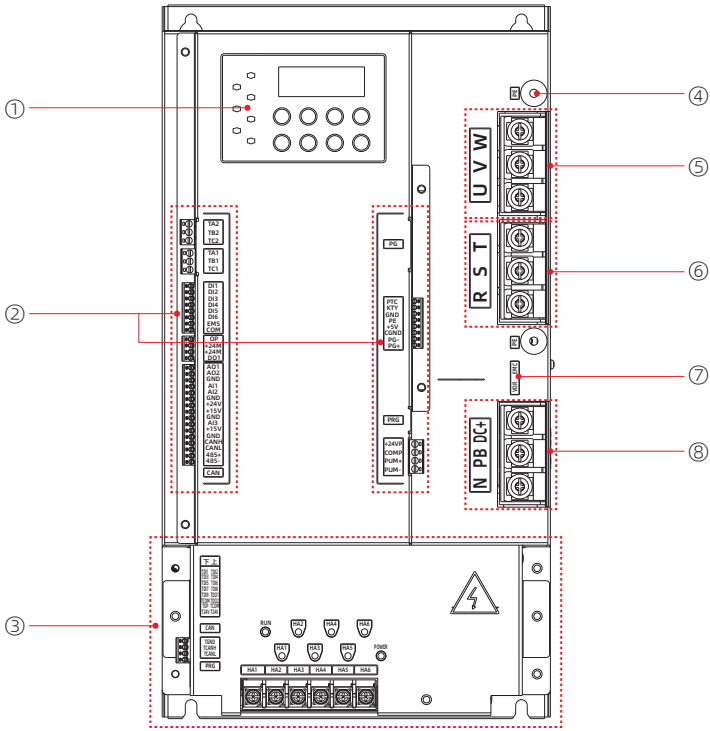


Figure 1-1 Components of drive

No.	Name	No.	Name
①	Display and operation area	⑤	Motor power output
②	Control signal interface	⑥	Power input interface
③	Heating module	⑦	Quick release screws of EMC and VDR
④	Ground terminal	⑧	Braking resistor and neutral line

NOTICE

- The above figure describes the component layout of the 18.5 – 22 kW drive. The component layout of other models may be different.

Chapter 2 Mechanical Installation

2.1 Installation Environment

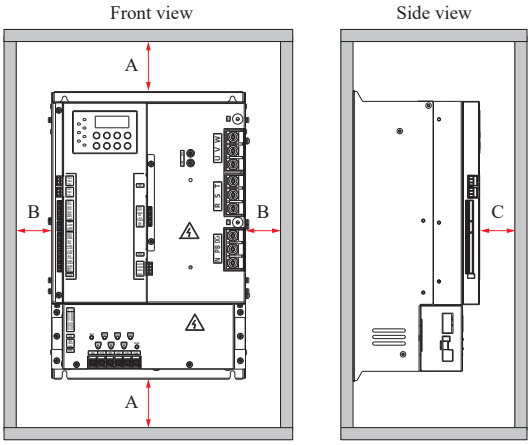
Item	Requirements
Temperature	–10 °C to 50 °C; ambient temperature variation: < 0.5 °C/min; maximum 50 °C
Humidity	Less than 95% RH, non-condensing.
Vibration	1g
Heat dissipation	Install and fix the device to the surface of an incombustible object and leave sufficient surrounding space for heat dissipation.
Protection	Avoid places with direct sunlight exposure, moisture, and water drop. Avoid places with corrosive, combustible, or explosive gas. Free from greasy dirt and dust.

NOTICE

- The AIM310 series drive must be installed in a fireproof cabinet as a part of a final system that is provided with effective electrical and mechanical protection. The installation must comply with the local laws and regulations and relevant IEC standards.

2.2 Installation clearance

When you install the AIM310 series drive in a cabinet, refer to relevant drawings in engineering technical documents and reserve sufficient clearance around it to ensure smooth airflow, heat dissipation, and maintenance access.



Power rating	Space requirements
11 – 22 kW	A ≥ 200 mm
	B ≥ 10 mm
	C ≥ 50 mm
30 – 37 kW	A ≥ 200 mm
	B ≥ 50 mm
	C ≥ 50 mm

Figure 2-1 Installation clearance

2.3 Installation dimensions

The mounting holes of an AIM310 drive are located at four corners on the backplane of the drive. The following figure shows the drive dimensions and positions of the mounting holes.

■ 11 – 15 kW

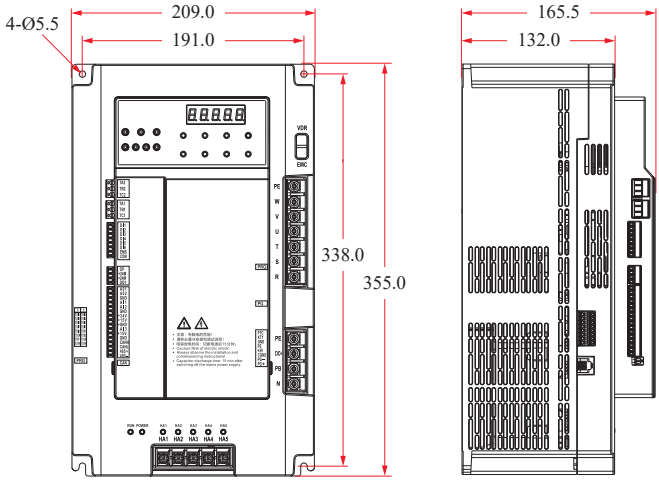


Figure 2-2 Dimensions of 11 – 15 kW model (mm)

■ 18.5 – 22 kW

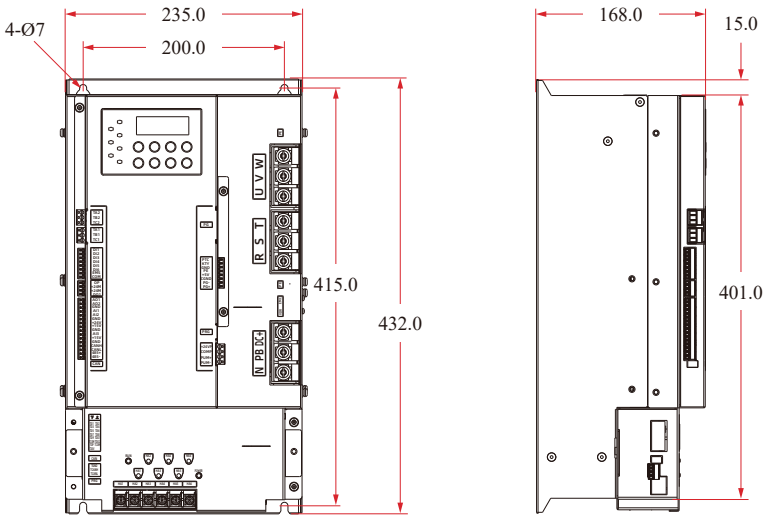


Figure 2-3 Dimensions of 18.5 – 22 kW model (mm)

■ 30 – 37 kW

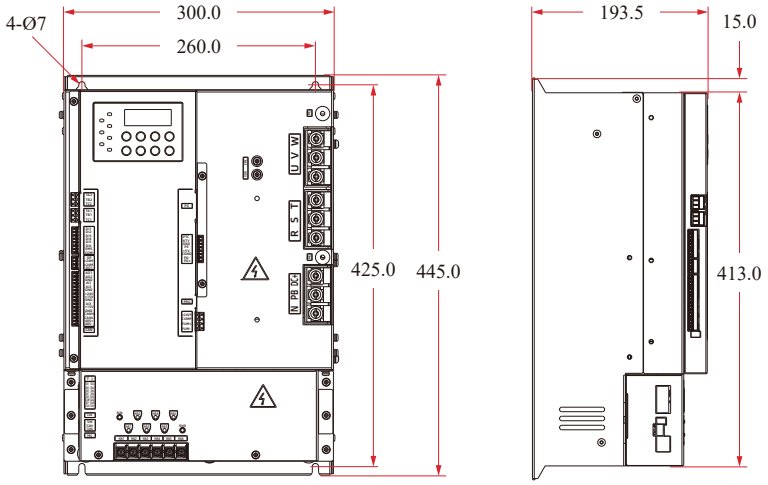


Figure 2-4 Dimensions of 30 – 37 kW model (mm)

Chapter 3 Electrical Installation

⚠ WARNING

- Do not power on the device before wiring is completed. Failure to comply may result in an electric shock.
- Never connect the drive output terminals U, V, and W to a three-phase power supply. Failure to comply may result in physical injury or a fire.
- Do not connect the motor terminals U, V, and W to a mains power supply. Failure to comply may result in physical injury or a fire.

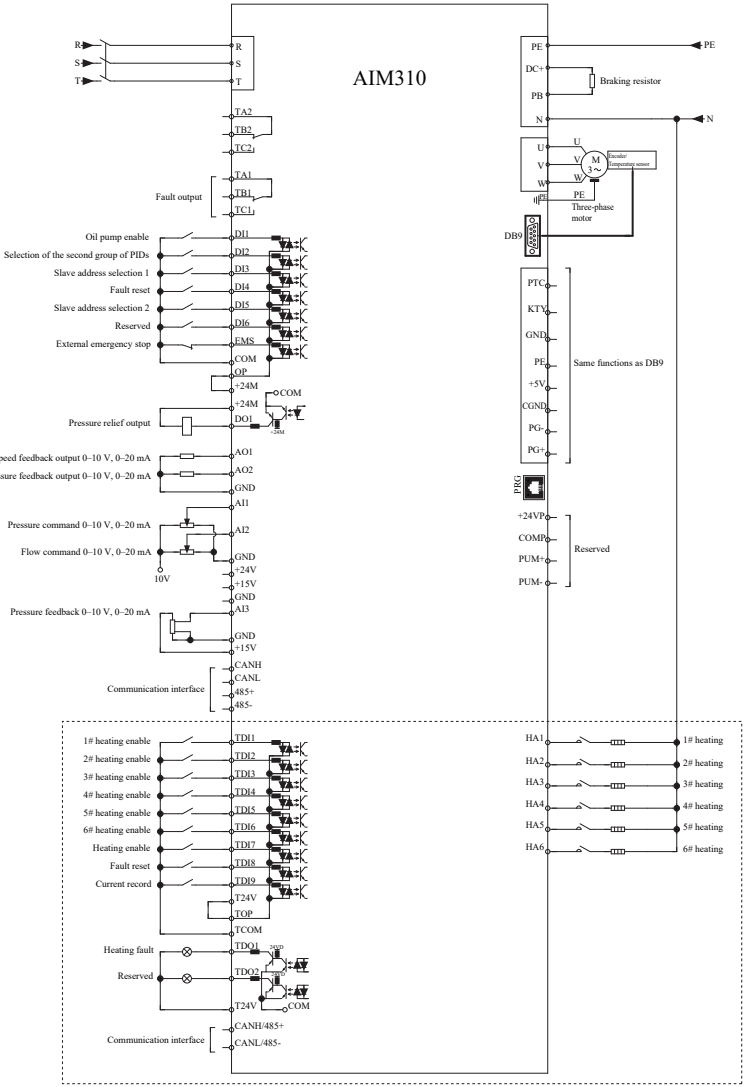
- Wiring must be performed by trained professionals. Failure to comply may cause damage to the device or physical injury.
- The input power voltage must be consistent with the rated voltage of the drive. Failure to comply may cause damage to the servo drive.
- The motor must match the drive. Failure to comply may cause damage to the motor or protection of the drive.
- Insulate the connection part of power supply terminals during wiring of the power supply and main circuit. Failure to comply may result in an electric shock.
- Connect an electromagnetic contactor between the input power supply and the main circuit of the drive, to form a structure that can cut off the power supply on the power side of the drive. Otherwise, continuous large current upon drive faults may cause a fire.
- Do not connect the power supply to the U, V, W, or HA*+ terminals. Failure to comply may cause damage to the drive.
- HA*+ terminals of the heating power supply must be separately powered for each heating coil.
- The air switch must be separately configured for the output of each heating coil in the heating system.
- Ground the entire system. Failure to comply may result in injury or accidents.
- After power-off, wait at least 15 minutes before further wiring operations because residual voltage exists after power-off. Failure to comply may result in an electric shock.

⚠ CAUTION

- Never place cables under heavy objects or drag cables vigorously. Failure to comply may result in an electric shock due to cable damage.
- Never allow metal debris, screws, or liquid to enter the drive during wiring. Failure to comply will result in insulation failure or a short circuit.

- Protect external wiring, branches, and short circuits according to local regulations.
- Ensure compliance with cable diameter and withstand voltage requirements of the power cable and control power incoming line.
- Strictly follow the specified torque when tightening the screws.
- When using peripheral devices, read the user guide for each component and use it properly after fully confirming the precautions.
- Wire devices properly. Improper wiring may cause damage to the drive and motor.

3.1 System Wiring



*This figure is only for reference. Terminals vary with models, and actual wiring shall prevail.

Figure 3-1 Electrical wiring diagram

3.2 Signal Terminals

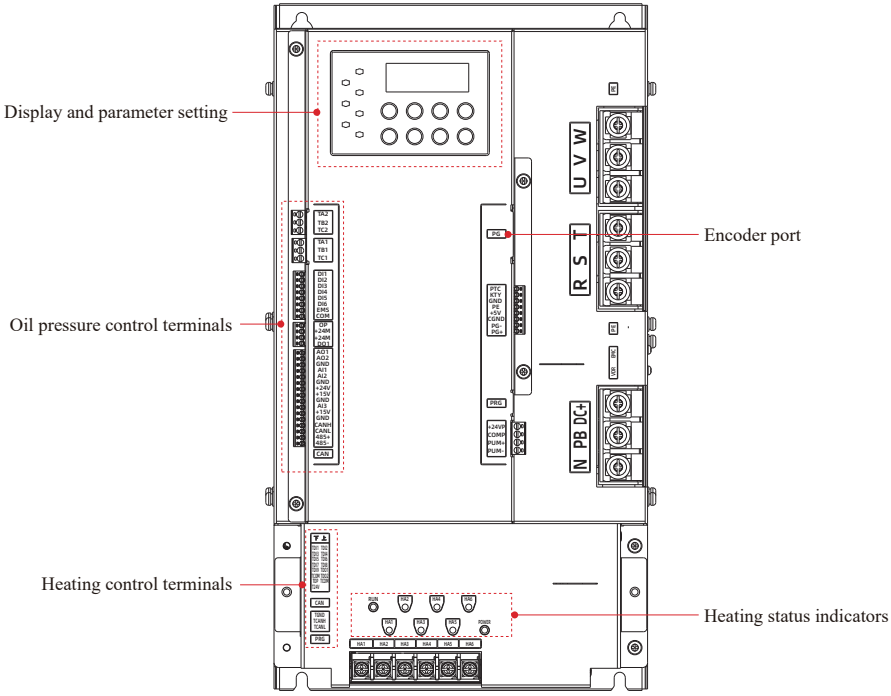


Figure 3-2 Layout of signal terminals

NOTICE

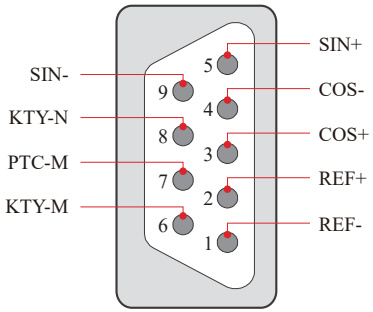
- The above figure shows the layout of signal terminals on the 18.5 – 22 kW drive. The signal terminal layout of other models may be different.

■ Terminal definition

Category	Terminal symbol	Terminal name	Description
Motor drive			
Communication	CANH	CANopen-CANH	CAN communication, maximum baud rate 500 Kbps.
	CANL	CANopen-CANL	CAN communication, maximum baud rate 500 Kbps.
	485+	Modbus-485+	RS485 communication, maximum baud rate 115200 bps.
	485-	Modbus-485-	RS485 communication, maximum baud rate 115200 bps.
Power supply	+24V-GND	+24 V power supply	Used to provide 24 V DC power supply to an external unit and power up DI/DO terminals. 24 V ± 10%, no-load ghost voltage not more than 25 V, maximum output current 100 mA, internally isolated from GND.
	+15V-GND	+15 V power supply	Used to provide 15 V DC power supply to an external unit and power up DI/DO terminals. 15 V ± 10%, no-load ghost voltage not more than 17 V, maximum output current 100 mA, internally isolated from GND.
Digital input	DI1-COM	Oil pump enable	Voltage range upon level input: 0 – 30 V 24 V reference: "0" < 5 V; "1" > 15 V Input impedance 3.3 kΩ, input frequency 100 Hz. Input type: Dry contact, NPN, and PNP.
	DI2-COM	Selection of the second group of PIDs	
	DI3-COM	Slave address selection 1	
	DI4-COM	Fault reset	
	DI5-COM	Slave address selection 2	
	DI6-COM	Reserved	
	EMS-COM	Emergency stop	Drive output off when EMS is invalid.
Analog input	AI1-GND	Pressure command	Input range: 0 – 10 V, 12-bit resolution, correction accuracy 0.5%. Resistor resistance range: 1 – 10 kΩ
	AI2-GND	Flow command	
	AI3-GND	Pressure feedback	
Digital output	DO1-24V	Pressure relief output	Triode open-collector output. Output voltage range: 0 – 30 V Output current range: 0 – 300 mA

Category	Terminal symbol	Terminal name	Description
Relay output	TA1-TB1	Fault alarm	Driving capacity of the contact: 250 V AC, 3 A, CosØ = 0.4 30 V DC, 1 A
	TA1-TC1		
	TA2-TB2	Reserved	
	TA2-TC2		
Analog output	AO1-GND	Feedback speed output	Output range: 0 – 10 V, 12-bit resolution, correction accuracy 0.5%.
	AO2-GND	Feedback pressure output	
Motor temperature	PTC-GND	Motor PTC temperature protection	Connected to corresponding pins of the PG card.
Heating drive			
Communication	TCANH	CANopen-CANH	CAN communication, maximum baud rate 500 Kbps.
	TCANL	CANopen-CANL	CAN communication, maximum baud rate 500 Kbps.
Power supply	T24V-TCOM	+24 V power supply	Used to provide 24 V DC power supply to an external unit and power up DI/DO terminals. 24 V ± 10%, no-load ghost voltage not more than 30 V, maximum output current 200 mA, internally isolated from GND.
Digital input	TDI1	1st heating command	Voltage range upon level input: 0 – 30 V 24 V reference: "0" < 5 V; "1" > 15 V Input impedance 3.3 kΩ, input frequency 100 Hz. Input type: Dry contact
	TDI2	2nd heating command	
	TDI3	3rd heating command	
	TDI4	4th heating command	
	TDI5	5th heating command	
	TDI6	6th heating command	
	TDI7	Heating always-enabled	
	TDI8	Fault reset	
	TDI9	Current record	
	TOP	Common point of DI power supply	Voltage range upon level input: 0 – 30 V
Digital output	TDO1-TCOM	Fault output	Triode open-collector output. Output voltage range: 0 – 30 V Output current range: 0 – 300 mA
	TDO2-TCOM	Reserved	

■ Encoder ports

Pin	Name	Description	Pin assignment on the terminal
1	REF-	Excitation signal	
2	REF+		
3	COS+	Cosine feedback signal	
4	COS-		
5	SIN+	Sine feedback signal	
9	SIN-		
6	KTY-M	KTY resistor positive	
7	PTC-M	PTC resistor positive	
8	KTY-N	KTY/PTC resistor negative	

3.3 Power terminals

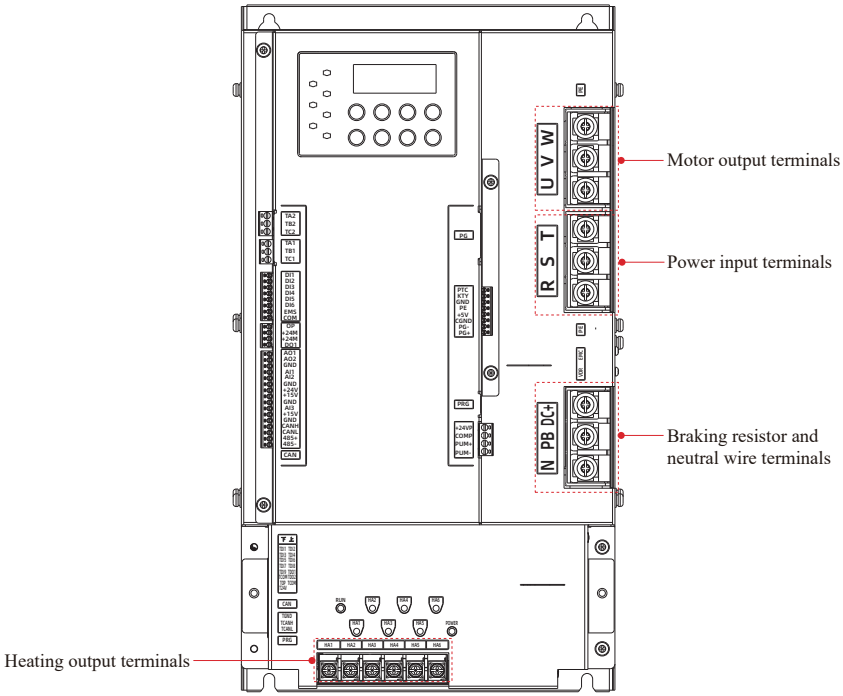


Figure 3-3 Layout of power terminals

NOTICE

- The above figure shows the layout of power terminals on the 18.5 – 22 kW drive. The power terminal layout of other models may be different.

■ Terminal definition

Mark	Name	Remarks
R, S, T, N	Power input terminals	Wire the terminal in three-phase four-wire mode R-S-T-N during three-phase input.
U, V, W	Motor power terminals	Do not connect any capacitor or surge protection device.
DC+, PB	Braking resistor connecti ng terminals	The resistance cannot be less than the minimum value recommended.
DC-	External bus connecting terminals	-
HA*	Heating output terminals	Do not connect any capacitor or surge protection device. The terminals must be powered for each heating coil.
PE	Ground terminal	The terminal must be grounded properly with a grounding cable whose resistance is less than 0.1 Ω. Never use the terminal as a neutral wire terminal, or vice versa. It is recommended to use grounding conductors that use the same material as the phase line. The cross-sectional area requirements of the grounding conductor are listed in the following table:

Phase line cross-sectional area (S) (unit: mm^2)	Minimum cross-sectional area of grounding conductor (SP) (unit: mm^2)
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S$	S/2

■ Screw specifications

Model	Power input	Motor output	Braking resistor	Heating output	Grounding	Recommended torque
11 – 15 kW	M4	M4	M4	M4	M4	M4: 1.5 N·m (12 kgf·cm) M5: 3 N·m (28 kgf·cm) M6: 5 N·m (48 kgf·cm) M8: 12 N·m (130 kgf·cm)
18.5 – 22 kW	M6	M6	M6	M4	M5	
30 – 37 kW	M6	M6	M6	M4	M5	

■ Recommended cable specifications

Model	Power input	Host output
AIM310-4T011H1-A	10 AWG or 4 mm²	12 AWG or 4 mm²
AIM310-4T015H1-A	8 AWG or 6 mm²	10 AWG or 4 mm²
AIM310-4T018H1-A	8 AWG or 10 mm²	10 AWG or 6 mm²
AIM310-4T022H1-A	6 AWG or 10 mm²	8 AWG or 10 mm²
AIM310-4T030H1-A	4 AWG or 16 mm²	6 AWG or 16 mm²
AIM310-4T037H1-A	4 AWG or 25 mm²	4 AWG or 16 mm²

■ Braking resistor model selection

Model	Recommended braking resistance (unit: Ω)	Braking resistor power (kW)
AIM310-4T011H1-A	28 – 35/Intelligent braking unit	1.5
AIM310-4T015H1-A	26 – 32/Intelligent braking unit	1.5
AIM310-4T018H1-A	22 – 26/Intelligent braking unit	2
AIM310-4T022H1-A	18 – 22/Intelligent braking unit	2
AIM310-4T030H1-A	14 – 18/Intelligent braking unit	2.5
AIM310-4T037H1-A	12 – 16/Intelligent braking unit	3

Chapter 4 Peripheries

4.1 List of Peripheries

It is recommended to install some electrical components (such as the magnetic ring and magnetic buckle) on the periphery of the drive to ensure the safety and stability of the AIM310 drive for the control purpose.

Component Name	Installation Location	Applicable Model	Description
Fuse and circuit breaker	Input side of the drive	All	To comply with EN 61800-5-1 and UL 61800-5-1 standards, install a fuse/circuit breaker on the input side of the servo drive to prevent accidents caused by short circuit in the internal circuit.
AC input reactor	Input side of the drive	All	Eliminate harmonics and improves the power factor on the input side.
EMC filter	Input side of the drive	All	Reduce the conducted and radiated interference that escapes from the servo drive to the outside.
Magnetic ring	Output side of the drive	All	Reduce interference to the outside and the bearing current.
	Signal cable	All	Improve the anti-interference performance of signals.

4.2 Selection guide

Power	Rated current	Recommended specifications (rated current)		
		Fuse	Contactor	Circuit breaker
11kW	25A	80A	50A	63A
15kW	32A	100A	65A	80A
18.5kW	37A	125A	80A	100A
22kW	45A	125A	80A	100A
30kW	60A	125A	95A	115A
37kW	75A	150A	115A	125A

4.3 Installation instructions

■ Circuit breaker

Installation Location	Usage
Installed between the power supply and the controller on the input side.	**Circuit breaker:** Cuts off the power supply when overcurrent occurs on downstream devices to prevent accidents.
	Earth leakage circuit breaker (ELCB): Provides protection against potential leakage current during operation to prevent electric shock that may cause a fire. Select a proper ELCB based on actual applications.

■ Magnetic ring and buckle

Installation Location	Usage
Installed between the power supply and the controller on the input side.	Installing the magnetic ring on the input side suppresses the noise in the input power supply system of the controller.
Installed near the AC drive on the output side.	Installing the magnetic ring on the output side reduces the bearing current and interference to the outside.

Chapter 5 Operation and Commissioning

5.1 Operation and Display Screen

The LED operating panel allows users to modify function parameters, monitor operating status, and control running of the AIM310 drive. The following figure shows the appearance and function areas of the operating panel.

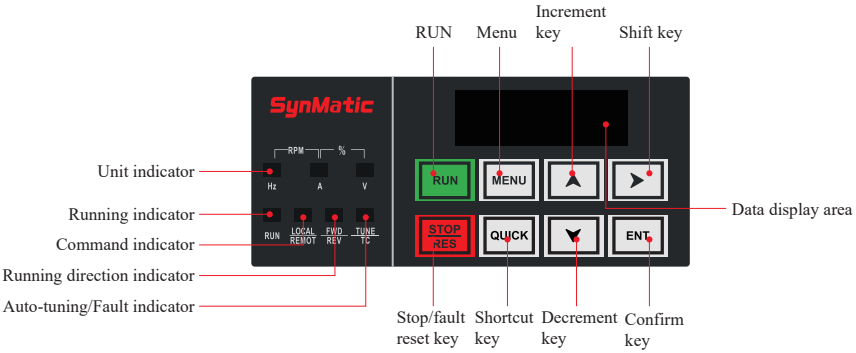


Figure 5-1 Operating panel

5.1.1 Indicators

In the following table, ☀ indicates ON; ● indicates OFF.

Table 5-1 Indicators on the operating panel

Indicator State	Description
Hz ☀ — RPM ● — A ● — % ● — V ●	Frequency unit: Hz
Hz ● — RPM ● — A ☀ — % ● — V ●	Current unit: A
Hz ● — RPM ● — A ● — % ● — V ☀	Voltage unit: V
Hz ☀ — RPM ● — A ☀ — % ● — V ●	Speed unit: RPM

Indicator State	Description
Hz — RPM — A — % — V	Percentage: %

5.1.2 Buttons

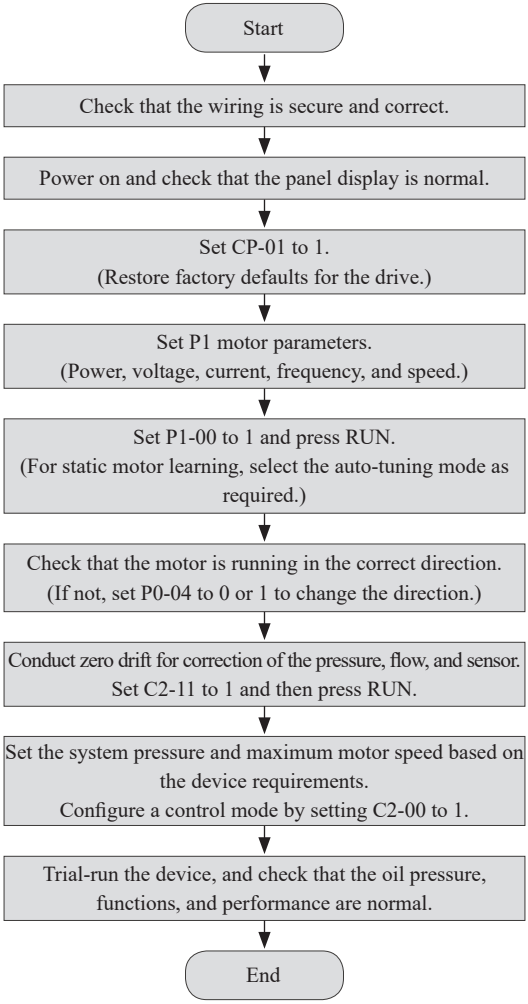
Table 5-2 Keys on the operating panel

Button	Name	Function
MENU	Menu	Enter or exit the menu.
ENT	Confirm	Enter submenu interfaces level by level and confirm parameter settings.
▲	Cursor up / Increment	Move the cursor up to select a parameter or increase the data.
▼	Cursor down / decrement	Move the cursor down to select a parameter or decrease the data decrement.
➤	Page-up / page-down / Shift	Page up or page down in the parameter column interface. Select the parameter bit to be modified.
RUN	RUN	Control the running of the motor in the local control mode.
STOP RES	Stop / Reset	Control the stop of the motor in the local control mode. Reset the alarm upon fault/alarm.
QUICK	Shortcut keys	Help users to access shortcut parameter groups.

NOTICE

- Do not press the keys using a metal or sharp tool to avoid a short circuit or damage to the elements.

5.2 Hydraulic Control Commissioning Process



NOTICE

- The mechanical and electrical components must be checked before commissioning to ensure site safety and that the system allows commissioning.
- At least two persons should be present during commissioning. Cut off the power supply immediately in case of an anomaly.

Chapter 6 Function Parameters

6.1 Parameters

All the parameter operations for the AIM310 series drive are divided into three levels:

■ Level-1 menu: parameter group

■ Level-2 menu: parameter

■ Level-3 menu: parameter value

Symbols in the parameter table are specified as follows:

" ☆ ": The parameter value can be modified when the servo drive is in the stop or running state.

" ★ ": The parameter value cannot be modified when the servo drive is running.

" ● ": The parameter value is measured or logged data and cannot be modified.

"*": The parameter is a factory parameter and cannot be modified by users.

6.2 Function Parameter Tables

■ P0 -Basic function parameters

Parameter	Name	Setting Range	Unit	Default	Property
P0-00	Control mode of master motor	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC) 2: V/f control	-	1	★
P0-01	Frequency setting source selection of master motor	0: Local HMI 1: AI1 (reserved) 2: AI2 (reserved) 3: PID (reserved) 4: Communication (reserved) 5: Injection molding machine mode	-	0	★
P0-02	Command source selection of master motor	0: Local 1: DI 2: Remote communication	-	0	☆

Parameter	Name	Setting Range	Unit	Default	Property
P0-03	Local set frequency of master motor	Maximum reverse rotation frequency of the master motor to maximum frequency of the master motor	Hz	5	☆
P0-04	Running direction selection of master motor	0: Forward 1: Reverse	-	0	★
P0-05	Maximum frequency of master motor	5.00 – 300.00	Hz	133.33	★
P0-08	Frequency lower limit	0.00 to frequency upper limit	Hz	0.00	☆
P0-09	Maximum reverse rotation frequency of master motor	-300.00 – 0.00	Hz	-20.00	☆
P0-10	Carrier frequency of master motor	0.8 – 6.0	kHz	6.0	☆
P0-11	Acceleration time of master motor	0 – 65535	s	0	☆
P0-12	Deceleration time of master motor	0 – 65535	s	0	☆

■ P1 -Motor parameters

Parameter	Name	Setting Range	Unit	Default	Property
P1-00	Auto-tuning selection of master motor	0: No operation 1: No-load static auto-tuning of the synchronous motor 2: No-load reverse dynamic auto-tuning of the synchronous motor 3: On-load static auto-tuning of the synchronous motor 4: On-load reverse dynamic auto-tuning of the synchronous motor	-	0	★
P1-01	Master motor type	0: Asynchronous motor 1: Synchronous motor	-	1	★
P1-02	Master motor power	0.1 – 1000.0	kW	23.6	★
P1-03	Rated voltage of master motor	1 – 2000	V	380	★

Parameter	Name	Setting Range	Unit	Default	Property
P1-04	Rated current of master motor	0.01 – 655.35	A	45.20	★
P1-05	Rated frequency of master motor	0.01 to maximum frequency	Hz	100.00	★
P1-06	Rated speed of master motor	1 – 65535	rpm	1500	★
P1-07	Stator resistance of master motor	0.001 – 65.535	Ω	0.187	★
P1-12	D-axis inductance of master motor	0.00 – 655.35	mh	2.57	★
P1-13	Q-axis inductance of master motor	0.00 – 655.35	mh	4.89	★
P1-14	Back EMF of master motor	0.0 – 6553.5	V	328.0	★
P1-15	Motor moment of inertia	1 – 65535	kg/cm²	272	★
P1-16	Total moment of inertia ratio	1 – 65535	%	100	★

■ P2 -Vector control parameters

Parameter	Name	Setting Range	Unit	Default	Property
P2-00	Speed drive command word	Bit0: Feedforward enabled Bit1: Integral scheme	-	1	☆
P2-01	Speed drive HF bandwidth	0.1 – 1000.0	Hz	20.0	☆
P2-02	Speed drive HF damping	0.10 – 10.00	-	1.00	☆
P2-03	Speed drive LF bandwidth	0.1 – 1000.0	Hz	20.0	☆
P2-04	Speed drive LF damping	0.10 – 10.00	-	1.00	☆
P2-05	Speed drive LF switching point	0.0 – 6500.0	Hz	5.0	☆
P2-06	Speed drive HF switching point	0.0 – 6500.0	Hz	10.0	☆
P2-10	Max. electric torque of speed drive	0.0 – 300.0	%	300.0	☆
P2-11	Max. generator torque of speed drive	0.0 – 300.0	%	300.0	☆

■ P4 -Logic input (DI) parameters

Parameter	Name	Setting Range	Unit	Default	Property
P4-00	DI filter time	0.000 – 1.000	s	0.010	☆
P4-01	DI1 function selection (standard)	Thousands: DI logical inversion 1: Forward enabled 2: Reverse enabled 7: Fault reset 8: Second group of PIDs enabled 9: Velocity mode 10: Slave pump address selection 1 11: Slave pump address selection 2	-	1	☆
P4-02	DI2 function selection (standard)		-	8	☆
P4-03	DI3 function selection (standard)		-	10	☆
P4-04	DI4 function selection (standard)		-	7	☆
P4-05	DI5 function selection (standard)		-	11	☆

■ P5 -Logic output (DO and relay) parameters

Parameter	Name	Setting Range	Unit	Default	Property
P5-00	DO1 function selection (standard)	Thousands: DO logical inversion 1: Motor KTY temperature reached 2: Fault output 3: Drive running 4: Pressure relief output	-	1004	☆
P5-01	DO2 function selection (standard)		-	1002	☆
P5-02	DO3 function selection (standard)		-	0	☆

■ P7 -Analog input (AI) parameters

Parameter	Name	Setting Range	Unit	Default	Property
P7-00	AI1 filter time	0.000 – 10.000	s	0.010	☆
P7-01	AI1 minimum input	0.000 to AI1 maximum input	V	0.050	☆
P7-02	Corresponding setpoint of AI1 minimum input	0.0 – 100.0	%	0.0	☆
P7-03	AI1 maximum input	AI1 minimum input to 10.000	V	10.000	☆
P7-04	Corresponding setpoint of AI1 maximum input	0.0 – 100.0	%	100.0	☆
P7-09	AI2 filter time	0.000 – 10.000	s	0.005	☆

Parameter	Name	Setting Range	Unit	Default	Property
P7-10	AI2 minimum input	0.000 to AI2 maximum input	V	0.050	☆
P7-11	Corresponding setpoint of AI2 minimum input	0.0 – 100.0	%	0.0	☆
P7-12	AI2 maximum input	AI2 minimum input to 10.000	V	10.000	☆
P7-13	Corresponding setpoint of AI2 maximum input	0.0 – 100.0	%	100.0	☆
P7-18	AI3 filter time	0.000 – 10.000	s	0.000	☆
P7-19	AI3 minimum input	0.000 to AI3 maximum input	V	0.050	☆
P7-20	Corresponding setpoint of AI3 minimum input	0.0 – 100.0	%	0.0	☆
P7-21	AI3 maximum input	AI3 minimum input to 10.000	V	10.000	☆
P7-22	Corresponding setpoint of AI3 maximum input	0.0 – 100.0	%	100.0	☆

■ P9 -Fault and protection parameters

Parameter	Name	Setting Range	Unit	Default	Property
P9-00	Master motor overload protection	0: Disabled 1: Enabled	-	1	☆
P9-07	Output-to-ground protection	0: Disabled 1: Enabled	-	1	☆
P9-09	Input phase loss protection of master motor	0: Disabled 1: Enabled	-	1	☆
P9-10	Output phase loss protection of master motor	0: Disabled 1: Enabled	-	1	☆
P9-17	System undervoltage point	150 – 350	V	350	★
P9-20	Fan control mode	0: Fan always running 1: Fan running during system running	-	0	☆
P9-21	1st fault	0 – 65535	-	0	●
P9-22	2nd fault	0 – 65535	-	0	●
P9-23	3rd fault	0 – 65535	-	0	●
P9-24	Frequency upon 1st fault	0.00 – 655.35	Hz	0.00	●

Parameter	Name	Setting Range	Unit	Default	Property
P9-25	Current upon 1st fault	0.00 – 655.35	A	0.00	●
P9-26	Bus voltage upon 1st fault	0.0 – 6553.5	V	0.0	●
P9-27	Status upon 1st fault	0 – 65535	-	0	●
P9-28	Frequency upon 2nd fault	0.00 – 655.35	Hz	0.00	●
P9-29	Current upon 2nd fault	0.00 – 655.35	A	0.00	●
P9-30	Bus voltage upon 2nd fault	0.0 – 6553.5	V	0.0	●
P9-31	Status upon 2nd fault	0 – 65535	-	0	●
P9-32	Frequency upon 3rd fault	0.00 – 655.35	Hz	0.00	●
P9-33	Current upon 3rd fault	0.00 – 655.35	A	0.00	●
P9-34	Bus voltage upon 3rd fault	0.0 – 6553.5	V	0.0	●
P9-35	Status upon 3rd fault	0 – 65535	-	0	●
P9-36	Time allowed to enable braking unit	0.0 – 3600.0	s	8.0	☆
P9-37	KTY temperature upper limit	0 – 300	℃	130	☆
P9-38	PTC temperature protection enable	0: Disabled 1: Enabled	-	1	☆
P9-39	Communication timeout interval of heating module	0.1 – 60.0	s	5.0	☆
P9-40	CANopen communication timeout interval	0.10 – 3.00	s	1.00	☆
P9-42	Zero drift protection for analog input	0: Disabled 1: Enabled	-	1	☆
P9-43	Braking unit start voltage	200 – 2000	-	760	☆

■ PA-Auxiliary control parameters

Parameter	Name	Setting Range	Unit	Default	Property
PA-23	Firmware software version	0 – 65535	-	-	●
PA-24	Application software version	0.00 – 655.35	-	-	●

■ PB -CANopen communication parameters

Parameter	Name	Setting Range	Unit	Default	Property
PB-00	CAN baud rate	0: 20 kbps 1: 50 kbps 2: 100 bps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	-	5	★
PB-01	CAN station number	1 – 127	-	1	★
PB-02	Number of nodes in multi-pump distributed/convergent flow mode	0 – 9	-	0	☆
PB-03	Multi-pump slave address 1	0 – 65535	-	0	☆
PB-04	Multi-pump slave address 2	0 – 65535	-	0	☆
PB-05	Multi-pump slave address 3	0 – 65535	-	0	☆
PB-06	Multi-pump slave address 4	0 – 65535	-	0	☆

■ C1 -Encoder parameters

Parameter	Name	Setting Range	Unit	Default	Property
C1-00	PG card type of master motor	0: ABZ incremental encoder 1: UVW incremental encoder 2: Resolver 3: Sine/Cosine encoder 4: Wire-saving UVW encoder	-	2	★
C1-01	Encoder installation angle	0.0 – 359.9	°	0.0	★
C1-02	Number of pole pairs of resolver of master motor	1 – 65535	-	1	★
C1-04	Encoder PPR of master motor	1 – 65535	-	1024	★
C1-07	Transmission ratio of master motor	0.1 – 100.0	%	100.0	★
C1-08	Encoder direction selection of master motor	0: Forward 1: Reverse	-	0	★
C1-11	Encoder filter time	0.1 – 1000.0	ms	1.0	☆

■ C2 -Oil pressure control parameters

Parameter	Name	Setting Range	Unit	Default	Property
C2-00	Oil pressure control mode	0: Non-oil pressure control mode 1: Drive oil pressure control mode 1 (Analog channel setting) 2: CANopen communication	-	0	★
C2-01	Maximum speed	0 – 30000	rpm	2000	☆
C2-02	Maximum reverse speed	-100 – 0	%	-15	☆
C2-03	System oil pressure	0.0 to maximum oil pressure	kg/cm²	140.0	☆
C2-04	Maximum oil pressure	0.0 – 500.0	kg/cm²	250.0	☆
C2-05	Base flow	0.0 – 50.0	%	0.5	☆
C2-06	Base pressure	0.0 to maximum oil pressure	kg/cm²	0.5	☆
C2-07	Flow command rising time	0.001 – 2.000	s	0.030	☆
C2-08	Flow command falling time	0.001 – 2.000	s	0.050	☆
C2-09	Oil pressure command rising time	0.001 – 2.000	s	0.000	☆
C2-10	Oil pressure command falling time	0.001 – 2.000	s	0.000	☆
C2-11	Zero drift for auto correction of analog channel	0: Disabled 1: Enabled	-	0	☆
C2-13	High voltage bandwidth of oil pressure drive	0.1 – 100.0	Hz	12.0	☆
C2-14	High voltage damping of oil pressure drive	0.10 – 10.00	-	1.50	☆
C2-15	Low voltage bandwidth of oil pressure drive	0.1 – 100.0	Hz	12.0	☆
C2-16	Low voltage damping of oil pressure drive	0.10 – 10.00	-	1.50	☆
C2-17	Low voltage switching point of oil pressure drive	0.0 to maximum oil pressure	kg/cm²	5.0	☆
C2-18	High voltage switching point of oil pressure drive	0.0 to maximum oil pressure	kg/cm²	10.0	☆

Parameter	Name	Setting Range	Unit	Default	Property
C2-19	Gain coefficient of oil pressure drive	10 – 1000	%	100	☆
C2-20	Command filter coefficient of oil pressure drive	1 – 100	-	10	☆
C2-21	Gain coefficient 2 of oil pressure drive	1 – 100	-	10	★
C2-27	Second bandwidth of oil pressure drive	0.1 – 100.0	Hz	12.0	☆
C2-28	Second damping of oil pressure drive	0.10 – 10.00	-	1.50	☆
C2-29	Second bandwidth coefficient of oil pressure drive	10 – 1000	%	100	☆
C2-30	Second filter coefficient of oil pressure drive	1 – 100	-	10	☆
C2-31	Second gain coefficient of oil pressure drive	1 – 100	-	20	★
C2-40	Disconnection detection time of pressure sensor	0 – 60000	s	0.5	☆
C2-41	Fault detection current lower limit of pressure sensor	0 – 300	%	100	☆
C2-42	Fault detection speed upper limit of pressure sensor	0 – 200	%	50	☆
C2-49	Deviation pressure for entering pressure release	0.0 to maximum oil pressure	kg/cm²	1.0	☆
C2-50	Delay time for entering pressure release	0.00 – 10.00	s	0.00	☆
C2-51	Deviation pressure for exiting pressure release	0.0 to maximum oil pressure	kg/cm²	1.0	☆
C2-52	Delay time for exiting pressure release	0.00 – 10.00	s	0.05	☆
C2-53	Reverse of slave pump following master pump	0: Disabled 1: Enabled	-	0	☆
C2-54	Slave intermediate point input	0 – 1000	%	0	☆

Parameter	Name	Setting Range	Unit	Default	Property
C2-56	Speed gain switchover frequency in the pressure-holding state	0.0 to maximum frequency	Hz	0.0	☆
C2-57	Speed bandwidth gain under high pressure	0.00 – 600.00	-	1.00	☆
C2-58	Speed damping gain under high pressure	0.00 – 600.00	-	1.00	☆
C2-59	Speed bandwidth gain under low pressure	0.00 – 600.00	-	0.50	☆
C2-60	Speed damping gain under low pressure	0.00 – 600.00	-	1.00	☆
C2-61	Low-pressure switching point of pressure-holding speed gain	0.0 to maximum oil pressure	kg/cm²	100.0	☆
C2-62	High-pressure switching point of pressure-holding speed gain	0.0 to maximum oil pressure	kg/cm²	140.0	☆
C2-63	Overload oil pressure setup	0.0 – 100.0	kg/cm²	18.0	☆
C2-64	Overload oil pressure duration	0.000 – 10.000	s	0.200	☆
C2-65	Overload torque threshold	0.0 – 400.0	%	200.0	☆
C2-66	Overload torque protection time	0.000 – 10.000	s	0.000	☆
C2-67	Pressure released upon reverse stop	0.0 to maximum oil pressure	kg/cm²	0.0	☆
C2-68	Reverse protection time	0.0 – 500.0	s	0.0	☆
C2-84	Oil pressure suppression gain	0 – 100	%	4	☆
C2-85	Max. oil pressure suppression deviation	0.0 to maximum oil pressure	kg/cm²	15.0	☆
C2-86	Oil pressure deviation upon oil pressure suppression cancellation	0.0 to maximum oil pressure	kg/cm²	5.0	☆

■ CP-Initialization parameters

Parameter	Name	Setting Range	Unit	Default	Property
CP-00	Password	0 – 65535	-	0	☆
CP-01	Parameter initialization	0: No operation 1: Restore some parameters to factory defaults 2: Clear records and save parameters 3: Save records and parameters 20: Restore all parameters to factory defaults	-	0	★

■ U0 -Drive parameters

Parameter	Name	Setting Range	Unit	Default	Property
U0-00	Running frequency	-100.00 – +300.00	Hz	-	●
U0-01	Frequency reference	-100.00 – +300.00	Hz	-	●
U0-02	Bus voltage	0.1 – 6553.5	V (DC)	-	●
U0-03	Output voltage	0.1 – 6553.5	V (AC)	-	●
U0-04	Output current	0.1 – 6553.5	A	-	●
U0-05	Output power	-1000.0 – +3000.0	kW	-	●
U0-06	Output torque	-1000.0 – +3000.0	%	-	●
U0-07	Local DI status	Ones: DI1 Tens: DI2 Hundreds: DI3 Thousands: DI4 Ten thousands: DI5	-	-	●
U0-08	Local DO status	Ones: DO1 Tens: TA1 / TB1 / TC1 Hundreds: TA2 / TB2 / TC2	-	-	●
U0-11	Resolver mechanical angle	0.0~ 359.9	°	-	●
U0-12	Motor speed	-10000 – +30000	rpm	-	●
U0-13	Speed reference	-10000 – +30000	rpm	-	●
U0-14	Accumulated overload	0 – 65535	-	-	●
U0-17	AI1 voltage (before calibration)	-10.000 – +10.000	V (DC)	-	●

Parameter	Name	Setting Range	Unit	Default	Property
U0-18	AI2 voltage (before calibration)	-10.000 – +10.000	V (DC)	-	●
U0-19	AI3 voltage (before calibration)	-10.000 – +10.000	V (DC)	-	●
U0-20	AO1 output voltage	0.000 – 65.535	V (DC)	-	●
U0-21	AO2 output voltage	0.000 – 65.535	V (DC)	-	●
U0-22	Motor KTY temperature	-40 – +170	℃	-	●
U0-23	Drive module temperature	-40 – +170	℃	-	●
U0-25	Current fault	0 – 65000	-	-	●

■ U1 -Oil pressure parameters

Parameter	Name	Setting Range	Unit	Default	Property
U1-00	Real-time angle	0.0 – 359.9	°	-	●
U1-01	Oil pressure setting	0.0 to system oil pressure	kg/cm²	-	●
U1-02	Oil pressure feedback	0.0 to maximum oil pressure	kg/cm²	-	●
U1-03	Host controller flow setting	0.00 – 100.00	%	-	●
U1-04	Flow feedback	0.00 – 100.00	%	-	●
U1-05	Voltage after AI1 zero drift	-10.000 – +10.000	V (DC)	-	●
U1-06	Voltage after AI2 zero drift	-10.000 – +10.000	V (DC)	-	●
U1-07	Voltage after AI3 zero drift	-10.000 – +10.000	V (DC)	-	●
U1-08	AI1 zero drift simulation	-10.00 – +10.000	V (DC)	-	●
U1-09	AI2 zero drift simulation	-10.00 – +10.000	V (DC)	-	●
U1-10	AI3 zero drift simulation	-10.00 – +10.000	V (DC)	-	●
U1-11	Resolver signal interference status	0 – 65535	-	-	●
U1-14	Heating module bus voltage	0 – 65535	V (DC)	-	●
U1-18	Heating module software version	0 – 65535	-	-	●
U1-19	Heating module temperature	0 – 65535	℃	-	●
U1-20	DI□□□□	0 – 65535	-	-	●

Parameter	Name	Setting Range	Unit	Default	Property
U1-21	Open-circuit/Short-circuit status of heating module	0 – 65535	-	-	●
U1-25	Heating module vital signs	0 – 255	-	-	●
U1-26	Channel 1 current of heating module	0 – 65535	A	-	●
U1-27	Channel 2 current of heating module	0 – 65535	A	-	●
U1-28	Channel 3 current of heating module	0 – 65535	A	-	●
U1-29	Channel 4 current of heating module	0 – 65535	A	-	●
U1-30	Channel 5 current of heating module	0 – 65535	A	-	●
U1-31	Channel 6 current of heating module	0 – 65535	A	-	●
U1-32	Channel 1 recorded current of heating module	0 – 65535	A	-	●
U1-33	Channel 2 recorded current of heating module	0 – 65535	A	-	●
U1-34	Channel 3 recorded current of heating module	0 – 65535	A	-	●
U1-35	Channel 4 recorded current of heating module	0 – 65535	A	-	●
U1-36	Channel 5 recorded current of heating module	0 – 65535	A	-	●
U1-37	Channel 6 recorded current of heating module	0 – 65535	A	-	●

■ U3 -Oil pressure parameters

Parameter	Name	Setting Range	Unit	Default	Property
U3-00	PQ control word	0 – 65535	-	0	●
U3-01	Multi-pump control word	0 – 65535	-	0	●
U3-02	Pressure setting	0.0 – 500.0	kg/cm²	0.0	●
U3-03	Flow setting	0.00 – 100.00	%	0.00	●
U3-04	Frequency setting	-300.00 – +300.00	Hz	0.00	●

Parameter	Name	Setting Range	Unit	Default	Property
U3-05	Master pump vital signs	0 – 65535	-	0	●
U3-11	Overvoltage braking open-tube 1	0: Disabled 1: Enabled	-	0	☆
U3-12	Overvoltage braking open-tube 2	0: Disabled 1: Enabled	-	1	☆
U3-13	Overvoltage braking open-tube 3	0: Disabled 1: Enabled	-	1	☆
U3-14	Overvoltage braking open-tube 4	0: Disabled 1: Enabled	-	1	☆
U3-15	Overvoltage braking open-tube 5	0: Disabled 1: Enabled	-	1	☆
U3-16	Overvoltage braking open-tube 6	0: Disabled 1: Enabled	-	1	☆
U3-20	Setting of channel 1 current	0.0 – 6553.5	A	0.0	☆
U3-21	Setting of channel 2 current	0.0 – 6553.5	A	0.0	☆
U3-22	Setting of channel 3 current	0.0 – 6553.5	A	0.0	☆
U3-23	Setting of channel 4 current	0.0 – 6553.5	A	0.0	☆
U3-24	Setting of channel 5 current	0.0 – 6553.5	A	0.0	☆
U3-25	Setting of channel 6 current	0.0 – 6553.5	A	0.0	☆

Chapter 7 Troubleshooting

7.1 Alarm code table

Oil pressure control alarm code		
Alarm code	**Item**	**Cause and countermeasure**
Er002	Output overcurrent	● The main circuit output of the drive is grounded or short-circuited. ● The braking circuit is short-circuited. ● Parameter auto-tuning is not carried out or completed. ● The maximum output torque is set too large. ● The drive suffers external disturbance.
Er005	Bus overvoltage	● The main circuit input voltage of the drive is too high. ● No braking resistor is installed, or the braking resistor is in poor contact. ● The deceleration time is too short or the resistance of the braking resistor is too high. ● The motor is short-circuited to the ground. ● The motor inertia is large, prolonging the rising and falling time of pressure and flow.
Er008	Pre-charge resistor fault	● The pre-charge resistor is frequently switched on and off in a short period.
Er009	Bus undervoltage	● The main circuit input voltage of the drive is too low. ● The drive hardware or software fails.
Er010	Drive overload	● The overload lasts for a period. ● Parameter auto-tuning is not carried out or completed. ● The motor is mechanically stalled. ● The drive encoder fails.
Er012	Input phase loss	● The three-phase power supply for the main circuit input of the drive is not connected reliably. ● The drive hardware fails.

Oil pressure control alarm code		
Alarm code	**Item**	**Cause and countermeasure**
Er013	Output phase loss	● The connection between the drive and the motor fails. ● The motor winding fails and the three-phase resistance is unbalanced. ● The drive hardware fails.
Er014	Module overheat	● The ambient temperature is too high. ● The air duct is blocked or the cooling fan is damaged. ● The drive hardware fails.
Er018	Current detection fault	● The drive hardware fails.
Er019	Motor auto-tuning fault	● The connection between the drive and the motor fails. ● The encoder cable connection is incorrect. ● Motor parameters are incorrectly set. ● Encoder parameters are incorrectly set.
Er020	Encoder fault	● Encoder and motor parameters are incorrectly set.
Er021	Data read-write fault	● Power on the device again. ● Restore factory defaults. ● The drive control board fails.
Er023	PTC over-temperature	● Check that the motor PTC is wired. ● The temperature of the PTC detection motor is too high.
Er024	Zero drift fault	● The input voltage of channels AI1, AI2, and AI3 is too high during zero drift.
Er030	Output load loss	● The output load is lost.
Er042	CAN communication timeout	● Check that the CAN wiring is normal. ● Check that CAN parameters are correct. ● CAN hardware is damaged.
Er044	Motor over-speed	● The connection between the drive and the motor fails. ● The encoder cable connection is incorrect. ● The output torque reaches the upper limit. ● The drive hardware fails.
Er045	The motor KTY temperature is too high.	● Check that the motor fan is working properly. ● Check that the motor air duct is not blocked. ● The load is too heavy. ● The KTY is damaged.

Oil pressure control alarm code		
Alarm code	**Item**	**Cause and countermeasure**
Er046	Pressure sensor fault	● The power supply and feedback wiring for the pressure sensor fail. ● The motor and the oil pump are mechanically stuck.
Er049	Encoder hardware fault	● The encoder cable connection is incorrect. ● Encoder parameters are incorrectly set. ● The encoder signal is interfered with.
Er061	Braking transistor overcurrent	● An incorrect braking resistor model is selected. ● Braking resistor wiring fails. ● The drive hardware fails.
Er062	Braking transistor long-term protection failure	● The time allowed to enable braking unit is improperly set. ● The braking resistor is short-circuited. ● The drive hardware fails.
Er063	Reverse time reached	● Check that the C2-67 and C2-68 parameters are set correctly. ● The pressure sensor wiring fails.
Er069	Oil pressure and torque limit	● Check that the C2-63 to C2-68 parameters are set correctly. ● The pressure sensor fails. ● The motor is demagnetized.
Er082	Short circuit to ground	● The connection between the drive and the motor is short-circuited. ● The three-phase motor is short-circuited to the ground.
Er083	Magnetic pole initial position fault	● Auto-tuning is not properly completed for the motor.
Er084	Motor overload	● The rated motor current is set too low. ● The overload lasts for a period. ● Parameter auto-tuning is not carried out or completed. ● The motor is mechanically stalled. ● The drive encoder fails.

7.2 Heating Fault Rectification

Table 7-1 Indicators of the heating system

Indicator	Name	Status
Power indicator	Power indicator	On: The drive is powered on. Off: The drive is not powered on or the hardware fails.
RUN indicator	Heating always-enabled indicator	On: Heating is prepared. Off: There is no TDI7 signal and heating is not enabled.
HA* indicator	Heating enable indicator of each segment	On: Heating Off: Heating stopped

Table 7-2 Heating faults and countermeasures

Indicator status	Fault name	Cause and countermeasure
RUN□□□□□□□□□□HA*□□□□□DO1□□□□	Heating ring open circuit	● The heating circuit is disconnected. ● The heating output circuit breaker is tripped. ● The heating ring is damaged. After the fault is cleared, enable the TDI8 to reset the fault.
The HA* indicator of the corresponding short circuit blinks, outputting the DO1 fault.	Heating ring short circuit	● The heating ring is short-circuited. ● The heating circuit is short-circuited to the ground. After the fault is cleared, enable the TDI8 to reset the fault.
The RUN indicator is off.	Heating enable failure due to no always-enabled	● Check that the TDI7 wiring is correct. ● The TDI7 hardware fails. After the fault is cleared, the fault is automatically reset.
The HA1 to HA6 indicators blink, outputting the DO1 fault.	Heating module over-temperature	● The radiator is blocked. ● Heating module hardware fails.
Only the power indicator is on.	No heating or alarming after turn-on	● Check that the TDI1 to TDI8 and TOP wiring is correct. ● Heating module hardware fails.

The fault code is displayed on the drive panel after the heating module is connected to the communication port of the main control board of the drive. For details, see Table 7-3.

Table 7-3 Heating module fault code and countermeasures

Alarm code	Item	Cause and countermeasure
Er100	Failure of communication between the heating module and the main control board	● Check that the heating module is correctly connected to the main control board. ● Check that the heating module communication jumper is correctly selected.
Er103	Heating module over-temperature	● Check that the cooling fan of the drive is working properly. ● Check that the radiator of the module is not blocked.
Er104	Heating current too low	● Before current learning, when the external open circuit triggers an alarm, judge the specific number of open circuit segments according to the indicator.
Er105	Heating current zero drift fault	● Hardware fails.
Er106	No signal upon TDI7 always-enabled	● Check that the TDI7 wiring is correct. ● TDI7 hardware fails.
Er116	Open circuit output for channel 1	● Check that the heating module and the heating ring are connected. ● Check that the heating circuit breaker is closed. ● The heating ring is short-circuited.
Er117	Open circuit output for channel 2	● Check that the heating module and the heating ring are connected. ● Check that the heating circuit breaker is closed. ● The heating ring is short-circuited.
Er118	Open circuit output for channel 3	● Check that the heating module and the heating ring are connected. ● Check that the heating circuit breaker is closed. ● The heating ring is short-circuited.
Er119	Open circuit output for channel 4	● Check that the heating module and the heating ring are connected. ● Check that the heating circuit breaker is closed. ● The heating ring is short-circuited.
Er120	Open circuit output for channel 5	● Check that the heating module and the heating ring are connected. ● Check that the heating circuit breaker is closed. ● The heating ring is short-circuited.

Alarm code	Item	Cause and countermeasure
Er121	Open circuit output for channel 6	● Check that the heating module and the heating ring are connected. ● Check that the heating circuit breaker is closed. ● The heating ring is short-circuited.
Er124	Short circuit output for channel 1	● Check that HA1 is not short-circuited to the neutral wire or grounding cable. ● Check that the corresponding heating ring is not short-circuited. ● The heating module fails.
Er125	Short circuit output for channel 2	● Check that HA2 is not short-circuited to the neutral wire or grounding cable. ● Check that the corresponding heating ring is not short-circuited. ● The heating module fails.
Er126	Short circuit output for channel 3	● Check that HA3 is not short-circuited to the neutral wire or grounding cable. ● Check that the corresponding heating ring is not short-circuited. ● The heating module fails.
Er127	Short circuit output for channel 4	● Check that HA4 is not short-circuited to the neutral wire or grounding cable. ● Check that the corresponding heating ring is not short-circuited. ● The heating module fails.
Er128	Short circuit output for channel 5	● Check that HA5 is not short-circuited to the neutral wire or grounding cable. ● Check that the corresponding heating ring is not short-circuited. ● The heating module fails.
Er129	Short circuit output for channel 6	● Check that HA6 is not short-circuited to the neutral wire or grounding cable. ● Check that the corresponding heating ring is not short-circuited. ● The heating module fails.

Chapter 8 Multi-pump Mode of Injection Molding Machine

8.1 Parallel Control Solutions for Multiple Servo Oil Pumps

Two parallel control solutions are available for multiple servo oil pumps: multi-pump convergent flow and multi-pump distributed flow.

8.1.1 Multi-pump convergent flow

One servo drive functions as the master drive and works in parallel with other servo drives that function as slave drives. The system computer outputs a group of flow and pressure analog signals.

- In the flow control state (feedback pressure less than command pressure), the speed of the master and slave drives can be the same.
- In the pressure control state (feedback pressure greater than or equal to command pressure), the slave pumps automatically stop working and the master drive takes over control separately.

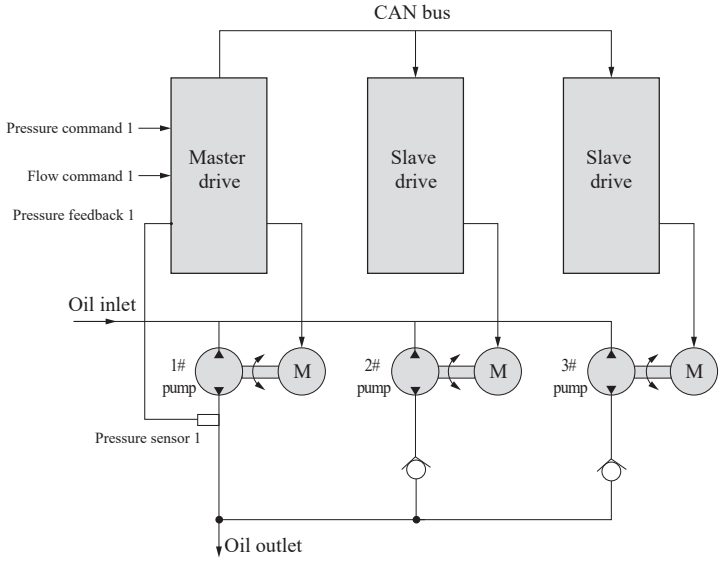


Figure 8-1 Structure diagram for multi-pump convergent flow

8.1.2 Multi-pump distributed flow

Multiple servo drives can work together in multi-pump convergent flow or multi-pump distributed flow mode (oil pressure under PID control separately). The system computer outputs multiple groups of flow and pressure analog signals.

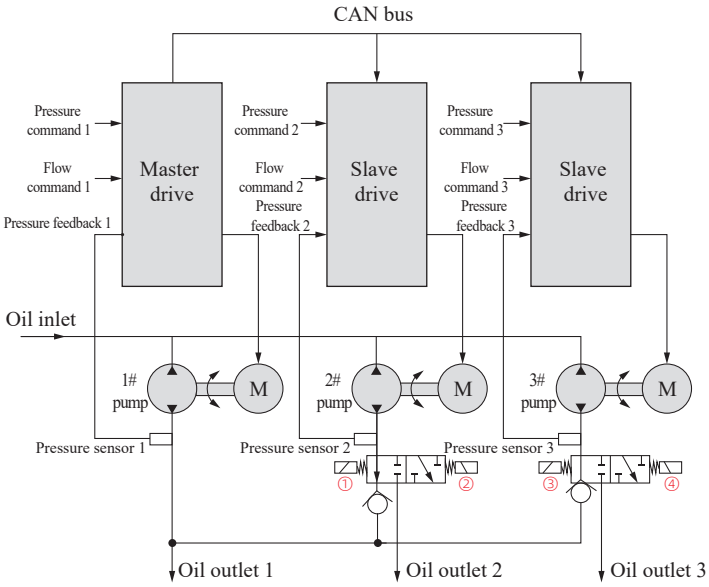


Figure 8-2 Structure diagram for multi-pump distributed flow

NOTICE

- Consistent motor speed can be ensured through communication.
- Flow convergence and distribution of pumps 2 and 3 are controlled through the energizing status of four solenoid valves (① , ② , ③ , and ④).
- During convergent flow control, the pressure and flow commands and the pressure feedback signal received by slave drives are invalid.
- During distributed flow control, the CAN communication commands received by slave drives are invalid.

The control system of Synland injection molding machine supports two pressure control modes:

- C2-00:1: In analog oil pressure mode, the multi-pump distributed/convergent flow policies are controlled by the servo drives, and the computer system of the injection molding machine switches the process only through the relay output. Figure 7-1 and Figure 7-2 show the schematic diagrams of multi-pump distributed flow and convergent flow in analog oil pressure mode.
- C2-00:2: In CANopen oil pressure mode, the multi-pump distributed/convergent flow policies are controlled by the computer system of the injection molding machine, and the servo drives only respond to the CAN communication commands of the computer system.

NOTICE

- The oil pressure control mode has a great influence on the multi-pump distributed/convergent flow policies. Changing the value of C2-00 will trigger a batch update of associated parameters, reducing the parameter setting workload and improving the system usability.

8.2 Multi-pump Control in Analog Oil Pressure Mode

In analog oil pressure mode, master pumps (servo drive) work in the oil pressure mode, responding to the pressure and flow commands and start/stop command given by the computer system of the injection molding machine, and performing oil pressure closed-loop control according to the pressure signal feedback.

Slave pumps (servo drive) work in non-oil pressure mode (speed mode), responding to the start/stop command given by the computer system of the injection molding machine and the real-time operating frequency sent by the associated master pumps (servo drive), and performing oil pressure closed-loop control according to the reference speed.

8.2.1 System topology

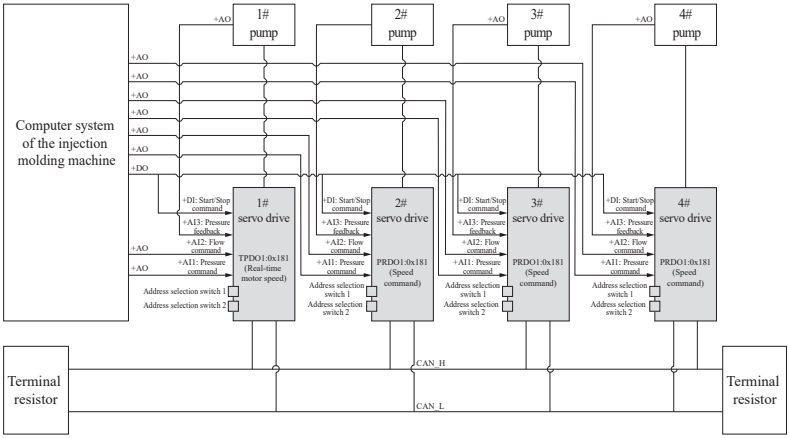


Figure 8-3 Multi-pump control system in analog oil pressure mode

8.2.2 Parameter setting

Table 8-1 Parameter setting in analog oil pressure mode

Parameter	Name	Range	Setting	Description
C2-00	Oil pressure control mode	0: Non-oil pressure control mode 1: Analog oil pressure mode 2: CANopen oil pressure mode	1	It is set based on the working condition.
P0-01	Frequency source setting	0: Local HMI 1: AI1 (reserved) 2: AI2 (reserved) 3: PID (reserved) 4: Communication (reserved) 5: Injection molding machine mode	TBD	It is automatically switched based on the master/slave relationship.
P0-02	Command source selection	0: Local 1: DI 2: Remote communication	1	It is automatically set.
P4-01	DI1 function selection (standard)	0: No function 1: Forward enabled 2: Reverse enabled 3: Decelerate to stop 4: Emergency stop 5: Jog in forward direction 6: Jog in reverse direction 7: Fault reset 8: Terminal switching PID 9: Switching from pressure mode to speed mode 10: Slave pump address selection 1 11: Slave pump address selection 2	1	Factory default.
P4-02	DI2 function selection (standard)		10	Factory default.
P4-03	DI3 function selection (standard)		11	Factory default.
C2-53	Reverse of slave pump following master pump	0: Disabled 1: Enabled	0	It is set based on the working condition.
C2-54	Slave intermediate point input	0.0 – 100.0%	0.0%	It is set based on the working condition.
PB-01	CAN station number	1 – 127	1	It is set based on the working condition.

Parameter	Name	Range	Setting	Description
PB-02	Number of nodes in multi-pump distributed/ convergent flow mode	0 – 9	0	It is set based on the working condition.
PB-03	Multi-pump slave address 1	0 – 65535	0	It is set based on the working condition.
PB-04	Multi-pump slave address 2	0 – 65535	0	It is set based on the working condition.
PB-05	Multi-pump slave address 3	0 – 65535	0	It is set based on the working condition.
PB-06	Multi-pump slave address 4	0 – 65535	0	It is set based on the working condition.

8.2.3 Operating description

■ Multi-pump convergent flow in analog oil pressure mode

1# pump is used as the unique master pump. The master pump sends its own operating frequency and vital sign (for diagnosing the network connection status) to the slave pumps, and then receives the fault code of the slave pumps.

Other pumps are slave pumps. Slave pumps receive the frequency setting and vital sign from the master pump and then send their fault information to the master pump.

NOTICE

- The factory defaults of the multi-pump convergent flow meet the requirements, so you do not need to set relevant parameters separately. (PB-03 to PB-06 parameters of the master pump and the slave pumps are all set to 0.)
- The multi-pump working mode selection terminals (10# and 11#) of the master pump and the slave pumps do not need to be connected. The master/slave relationship is determined by the PB-01 parameter. The master pump and slave pumps automatically set up the master/slave relationship and send and receive messages.

■ Multi-pump distributed flow in analog oil pressure mode

1# pump is still the master pump, and other pumps can also be set as the master pump by using the 10# and 11# terminals.

After a pump rather than 1# is set as the master pump, relevant slave pumps are automatically initialized according to the setting of PB-03 to PB-06 parameters, to establish relationships with the master pump and

respond to the frequency command of the master pump. When the 10# and 11# terminals of the pump are invalid, the pump is switched from the master pump to a slave pump. Before the switchover, the previously associated slave pumps need to be initialized to remove the master/slave relationships. These disassociated slave pumps become the slave pump of the 1# master pump by default, unless another master pump initializes them to establish master/slave relationships or they are set as the master pumps through 10# and 11# terminals.

NOTICE

- In multi-pump distributed flow mode, the slave address mappings of the master pump need to be set through PB-03 to PB-06 parameters according to working conditions. When any servo drive excluding 1# servo drive needs to work as the master pump, 10# and 11# terminals must be in the state of 01, 10, or 11. 10# and 11# terminals of all slave pumps must be in the state of 00.
- In the multi-pump distributed flow mode, both PB-01 and PB-03 to PB-06 parameters need to be set to determine the relationships between each master pump and slave pump in each process and automatically establish communication. Table 7-2 and Table 7-3 list the relationships among the master pumps and slave pumps.
- In all non-specific working conditions, the computer system of the injection molding machine will continuously switch the convergent flow and distributed flow status of the system according to the process in actual application. That is, the master/slave relationship of each pump (corresponding to a servo drive) will change with the process.

Table 7-2 lists the mappings between slave pump address selection terminals and multi-pump slave addresses.

Table 8-2 Mappings between terminals and slave addresses

11# DI terminal input	10# DI terminal input	Multi-pump slave address selection
0	0	PB-03: Multi-pump slave address 1
0	1	PB-04: Multi-pump slave address 2
1	0	PB-05: Multi-pump slave address 3
1	1	PB-06: Multi-pump slave address 4

Table 7-3 lists the settings of multi-pump slave addresses (PB-03 to PB-06 parameters).

Table 8-3 Multi-pump slave address setting

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Master	Master	Master	Master	Master	Master	Master	Master	Master	Master	Slave	Slave	Slave	Slave	Master	Master

NOTICE

- bit0 to bit15 correspond to drives whose node ID is 1 to 16. For the master pump, slave address mappings (PB-03 to PB-06 parameters) need to be set in advance according to the process of the injection molding machine, to determine the master/slave relationships. To switch the process, the computer system of the injection molding machine changes the input status of 11# and 10# terminals of the corresponding master pump by controlling the output of the relay, to switch the master/slave relationships between the servo pumps in the system.

11# and 10# terminals can be combined in four modes. For mode 00, only 1# pump can be used as the master pump. For other modes (01, 10, and 11), one or more pumps (such as 4#, 5#, 6#, and 7#) can be used as master pumps in the same state (such as 01). That is, the DI terminal status of multiple master pumps may be the same.

For master pumps with the same terminal status, the slave address mapping parameter setting must be different. For example, the terminal status of 4#, 5#, 6#, and 7# pumps is 01, but PB-03 must be set to different values for the four pumps. That is, one slave pump can be associated with only one master pump. In this case, the computer system of the injection molding machine can specify multiple master pumps and each master pump can have multiple slave pumps in different processes, such as mold closing, pressurization, mold opening, and ejection, and ejection reverse.

If master pumps work in low-speed pressure-holding mode, pressure-holding high pressure caused by automatic pressure relief of the salve pump must be prevented to ensure traffic linearity of the entire system. The C2-54 parameter can be used to set to the speed threshold to determine whether slave pumps follow master pumps when C2-53 is set to Enabled. If the speed exceeds the threshold specified by C2-54, slave pumps will follow master pumps to run. If the speed is lower than the threshold specified by C2-54, all slave pumps will stop working, and only master pumps work.

NOTICE

- The servo drives corresponding to slave pumps in the system do not detect the pressure fault (Err46).

8.3 Multi-pump control in CANopen oil pressure mode

In CANopen oil pressure mode, master pumps (servo drive) work in the oil pressure mode, responding to the pressure and flow commands and start/stop command given by the computer system of the injection molding machine, and performing oil pressure closed-loop control according to the pressure signal feedback. Slave pumps (servo drive) work in non-oil pressure mode (speed mode), responding to the start/stop command given by the computer system of the injection molding machine and the real-time operating frequency sent by the associated master pumps (servo drive), and performing oil pressure closed-loop control according to the reference speed.

8.3.1 System topology

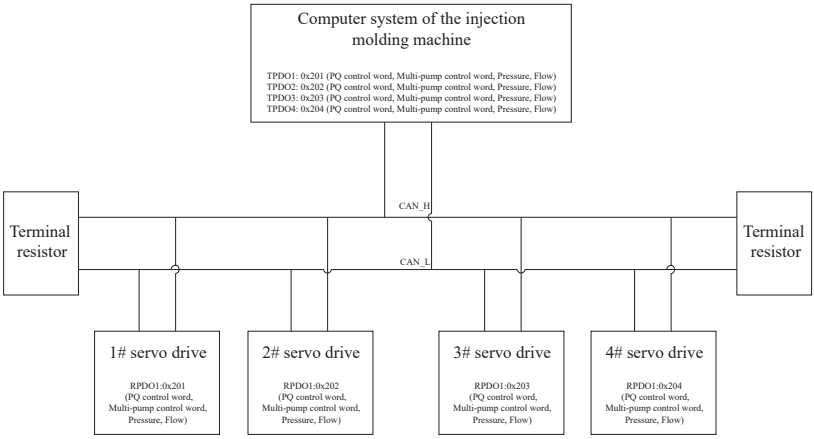


Figure 8-4 Multi-pump control in CANopen oil pressure mode

8.3.2 Parameter setting

Table 8-4 Parameter setting in CANopen oil pressure mode

Parameter	Name	Range	Setting	Description
C2-00	Oil pressure control mode	0: Non-oil pressure control mode 1: Drive oil pressure control mode 1 (Analog channel setting) 2: CANopen communication	2	It is set based on the working condition.
P0-01	Frequency source setting	0: Local HMI 2: AI2 (reserved) 3: PID (reserved) 4: Communication (reserved) 5: Injection molding machine mode	0	It is automatically updated according to master/slave pump relationships, and does not need to be manually set.

Parameter	Name	Range	Setting	Description
P0-02	Command source selection	0: Local 1: DI 2: Remote communication	2	It is automatically updated with the oil pressure mode, and does not need to be manually set.
P4-01	DI1 function selection (standard)	0: No function 1: Forward enabled 2: Reverse enabled 3: Decelerate to stop 4: Emergency stop 5: Jog in forward direction 6: Jog in reverse direction 7: Fault reset 8: Terminal switching PID 9: Switching from pressure mode to speed mode 10: Slave pump address selection 1 11: Slave pump address selection 2	0	
P4-02	DI2 function selection (standard)			
P4-03	DI3 function selection (standard)			
C2-53	Reverse of slave pump following master pump	0: Disabled 1: Enabled	0	Factory default.
C2-54	Slave intermediate point input	0.0 – 100.0%	0.0%	Factory default.
PB-01	CAN station number	1 – 127	1	Factory default.
U0-00	Running frequency	-300.00 – 300.00 Hz	0.00 Hz	Master pumps send data.
U3-00	PQ control word	0 – 65535	0	Slave pumps send data.
U3-01	Multi-pump control word	0 – 65535	0	
U3-02	Pressure setting	0.0 – 500.0 kg/cm²	0.0 kg/cm²	
U3-03	Flow setting	0.00 – 100.00%	0.00%	
U3-04	Frequency setting	-300.00 – 300.00 Hz	0.00 Hz	

Parameter	Name	Range	Setting	Description
U2-00	High bits in the mapping address of RPDO1 sub-index 1	0 – 65535	0x2013	They are automatically updated with the oil pressure mode, and do not need to be manually set.
U2-01	Low bits in the mapping address of RPDO1 sub-index 1	0 – 65535	0x0110	
U2-02	High bits in the mapping address of RPDO1 sub-index 2	0 – 65535	0x2013	
U2-03	Low bits in the mapping address of RPDO1 sub-index 2	0 – 65535	0x0210	
U2-04	High bits in the mapping address of RPDO1 sub-index 3	0 – 65535	0x2013	
U2-05	Low bits in the mapping address of RPDO1 sub-index 3	0 – 65535	0x0310	
U2-06	High bits in the mapping address of RPDO1 sub-index 4	0 – 65535	0x2013	
U2-07	Low bits in the mapping address of RPDO1 sub-index 4	0 – 65535	0x0410	
U2-32	High bits in the mapping address of TPDO1 sub-index 1	0 – 65535	0x2011	
U2-33	Low bits in the mapping address of TPDO1 sub-index 1	0 – 65535	0x3310	
U2-34	High bits in the mapping address of TPDO1 sub-index 2	0 – 65535	0x2011	
U2-35	Low bits in the mapping address of TPDO1 sub-index 2	0 – 65535	0x3410	

8.3.3 Operating description

Set C2-00 to make the servo drive work in CANopen oil pressure mode.

In the CANopen messages of the computer system of the injection molding machine:

- The PQ control word controls the start and stop of servo drives.
- The multi-pump control word controls the master/slave relationships of servo drives.
- The pressure and flow command control words are sent to control the pressure and flow of master pumps (servo drives).

During system configuration, the RPDO2 message needs to be configured for a slave pump to receive the frequency setting of the corresponding master pump. The message is COB-ID:0x18, where x indicates the node ID of the master pump corresponding to the slave pump.

The servo drive corresponding to the master pump receives the pressure signal feedback from the pressure sensor at the servo pump for pressure closed-loop.

The slave pump receives the speed command of the corresponding master pump for speed closed-loop.

By default, AIM310 uses RPDO1 to receive commands from the host controller. The mapping objects configured for RPDO1 are PQ control words, multi-pump control words, and pressure and flow commands, as listed in Table 7-5.

Table 8-5 Default mapping objects configured for RPDO1

	Mapping object 1	**Mapping object 2**	**Mapping object 3**	**Mapping object 4**
Object name	PQ control word	Multi-pump control word	Pressure (0.1bar)	Flow (0.01%)
Object index	0x2013-01	0x2013-02	0x2013-03	0x2013-04

NOTICE

- The COB-ID of RPDO1 is 0x20x, in which x indicates the CAN node ID.

PQ control words contain the running mode and drive command information, as listed in Table 7-6. You can set the last three bits of a PQ control word, and other bits can be set as specified. The first three bits of a control word can be adjusted for the computer system of the injection molding machine to control start and stop of the servo drive or reset the fault of the servo drive.

Table 8-6 Definition of PQ control words

bit	15 – 6	5	4	3	2	1	0
Description	Reserved	PID selection 00: Oil pressure control for group 1 01: Oil pressure control for group 2 10: Oil pressure control for group 3 11: Oil pressure control for group 4		Reserved	Control word 001:Forward enabled 010:Reverse enabled 101: Coast to stop 110: Decelerate to stop 111: Fault reset		

Table 7-7 lists the multi-pump control words.

Table 8-7 Multi-pump control words

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Master	Master	Master	Master	Master	Master	Master	Master	Master	Master	Slave	Slave	Slave	Slave	Master	Master

NOTICE

- bit0 to bit15 correspond to drives whose node ID is 1 to 16. If the slave address received by a drive is bit0 of itself, the drive runs in master pump mode. Otherwise, it runs in slave pump mode.

A pressure command is 16-bit unsigned integer data, and the minimum unit of the data is 0.1 bar. Table 7-8 lists examples of the pressure command.

Table 8-8 Pressure command examples

Command data	Command meaning
H01F4 (500)	50.0bar
H03E8 (1000)	100.0bar
H07D0 (2000)	200.0bar

A flow command is 16-bit unsigned integer data, and the minimum unit of the data is 0.01%. Table 7-9 lists examples of the flow command.

Table 8-9 Flow command examples

Command data	Command meaning
H07D0 (2000)	20.00%
H1388 (5000)	50.00%

H2710 (10000)	100.00%

When there is only one drive, the drive acts as an independent master pump. Assume that the drive node ID is 1. The drive needs to run forward with pressure of 60.0 bar and flow of 20.00%, and the host controller uses the default RPDO1 configuration. Table 7-10 lists the RPDO1 data sent by the host controller.

Table 8-10 Running example of an independent master pump

COB-ID	PQ control word	Multi-pump control word	Pressure (0.1bar)	Flow (0.01%)
0x201	H0001	H0000	H0258 (600)	H07D0 (2000)

Assume that there are four drives with node IDs 1, 2, 3, and 4 in the network. The drive with node ID 1 acts as the master pump, and the drives with node IDs 2, 3, and 4 act as the slave pumps of the master pump (with node ID 1). The pressure command and flow command are 60.0 bar and 20.00% respectively. The RPDO1 messages sent by the host controller to each drive are listed in Table 7-11.

Table 8-11 Example of one master pump and multiple slave pumps

COB-ID	PQ control word	Multi-pump control word	Pressure (0.1bar)	Flow (0.01%)
0x201	H0001	H000E	H0258 (600)	H07D0 (2000)
0x202	H0001	H000E	H0258 (600)	H07D0 (2000)
0x203	H0001	H000E	H0258 (600)	H07D0 (2000)
0x204	H0001	H000E	H0258 (600)	H07D0 (2000)

Assume that there are four drives with node IDs 1, 2, 3, and 4 in the network. The drives with node IDs 1 and 2 work in a group as the master and slave pumps, respectively. The drives with node IDs 4 and 3 work in a group as the master and slave pumps, respectively. The pressure command and flow command are 60.0 bar and 20.00% respectively. The RPDO1 messages sent by the host controller to each drive are listed in Table 7-12.

Table 8-12 Example of multiple master pumps and multiple slave pumps

COB-ID	PQ control word	Multi-pump control word	Pressure (0.1bar)	Flow (0.01%)
0x201	H0001	H0002	H0258 (600)	H07D0 (2000)
0x202	H0001	H0002	H0258 (600)	H07D0 (2000)
0x203	H0001	H0004	H0258 (600)	H07D0 (2000)
0x204	H0001	H0004	H0258 (600)	H07D0 (2000)

8.4 Application of Multi-pump Convergent/Distributed Flow Control

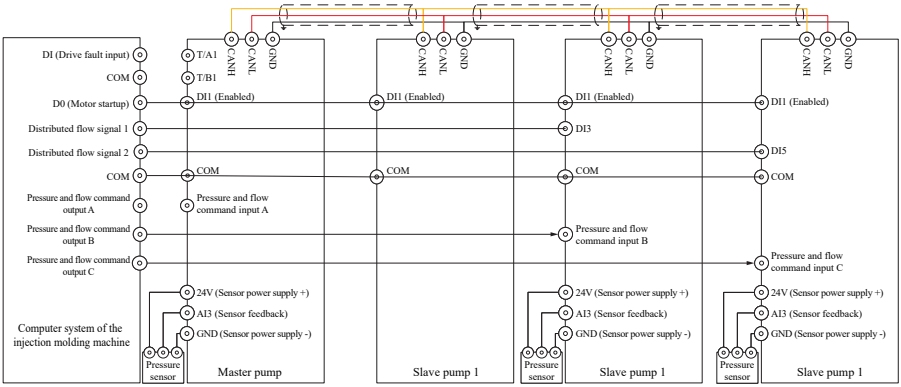


Figure 8-5 Convergent/Distributed flow control

Multi-pump convergent/distributed flow combination modes

Example: A 2000T injection molding machine needs four sets of servo drive systems and each of the system contains four oil pumps, including the master pump, slave pump 1, slave pump 2, and slave pump 3. The four pumps work in the following combination modes to provide different actions and flows:

- Combination 1: Convergent flow control for all four pumps

  Wiring description: All the four pumps work in convergent flow control mode. Wiring and debugging in this mode are simple. You only need to connect all the CAN communication cables, DI1 enable signals of each drive, and analog signals of the master pump.

  Parameter setting: Set the CAN communication addresses (PB-01) of the four drives to 1#, 2#, 3#, and 4# respectively, and set the number of drives (PB-02) to 4.

- Combination 2: 2+2 distributed flow control, with the master pump and slave pump 1 in a group, and slave pump 2 (changed to master) and slave pump 3 in another group

  Wiring description: The distributed flow signal 1 from the computer system of the injection molding machine is connected to DI3 terminal (10#) of slave pump 2. Slave pump 2 switches to the master pump and then recognizes the slave pump address.

  Parameter setting: Set the slave pump address (PB-04) of slave pump 2 to 8 (dotted decimal notation for slave pump 3), so that the master pump and slave pump 1 work in a group and slave pump 2 and slave pump 3 work in another group.

- Combination 3: 3+1 distributed flow control, with the master pump and slave pumps 1 and 2 in a group, and slave pump 3 working separately

  Wiring description: The distributed flow signal 2 from the computer system of the injection molding machine is connected to DI5 terminal (11#) of slave pump 3. Slave pump 3 switches to the master pump and then recognizes the slave pump address.

  Parameter setting: The combination contains two master pumps, and slave pump 3 runs separately. Therefore, you do not need to set other parameters.

8.5 Fault Alarms

The following figures show how to troubleshoot multi-pump control faults.

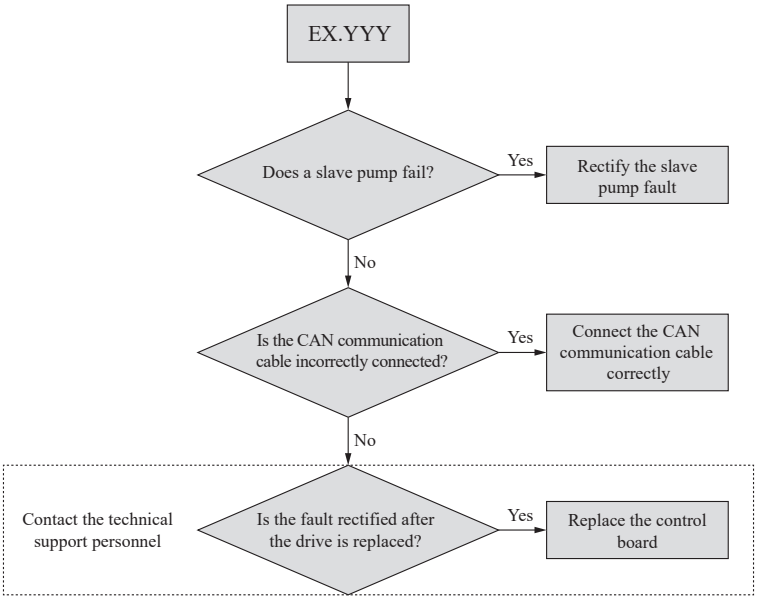


Figure 8-6 Slave pump fault warning

NOTICE

- EX indicates the station number of the slave pump, and YYY indicates the fault code of the slave pump.

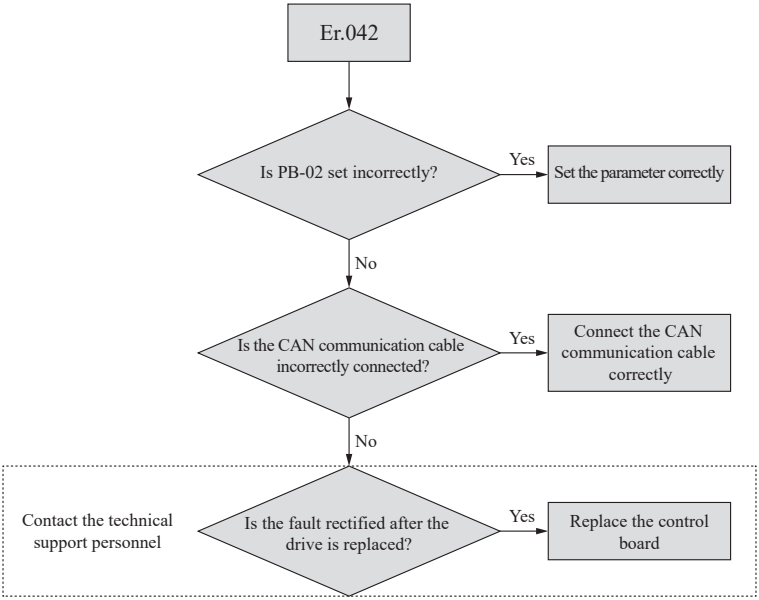


Figure 8-7 Communication fault warning

Chapter 9 Communication Network Configuration

9.1 CANopen Overview

CANopen is an application layer protocol of the CAN serial bus-based network transmission system, following the ISO/OSI standard model. Different devices in the network exchange data with each other based on object dictionaries or objects. The master node can obtain or modify data in object dictionary lists of other nodes based on process data objects (PDOs) or service data objects (SDOs). Figure 8-1 shows the CANopen device model.

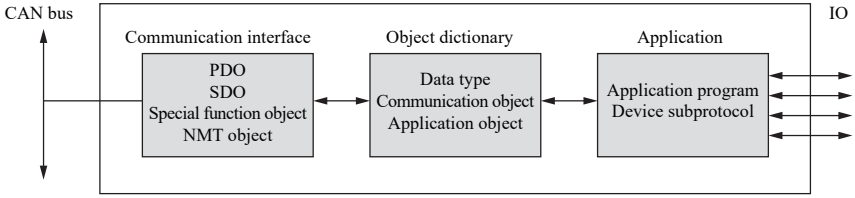


Figure 9-1 CANopen device model

9.1.1 Object dictionary

The object dictionary is the most important part of the device specification. It is an ordered collection of parameters and variables, including all parameters of device description and device network status, and it is a set of objects that can be accessed in an ordered and predefined way through the network.

The CANopen protocol uses an object dictionary with a 16-bit index and an 8-bit sub-index. Table 8-1 lists the structure of the object dictionary.

Table 9-1 Object dictionary structure

Index	Object
000	Disabled
0001h-001Fh	Static data type (specified data type, such as Boolean and Integer 16)
0020h-003Fh	Complex data type (predefined structure consisting of simple types, such as SDO parameter)
0040h-005Fh	Complex data structure defined by the manufacturer

Index	Object
0060h-007Fh	Static data type defined in the device subprotocol
0080h-009Fh	Complex data type defined in the device subprotocol
00A0h-0FFFh	Reserved
1000h-1FFFh	Communication subprotocol area (such as the device type, error register, and number of supported PDOs)
2000h-5FFFh	Manufacturer-specific subprotocol area (such as parameter mapping)
6000h-9FFFh	Standard device subprotocol area (such as the DSP-402 protocol)
A000h-FFFFh	Reserved

NOTICE

The mappings between parameters and the object dictionary of the AIM310 drive are as follows:

- Object dictionary index = 0x2000 + Parameter group number
- Object dictionary sub-index = Hexadecimal number in the parameter group + 1

9.1.2 Common communication objects

■ Network Management (NMT) object

NMT objects include the Boot-up message, Heartbeat message, and NMT message. They are used to manage and monitor each node in the network based on the master/slave communication mode to control node statuses and errors and start nodes.

■ SDO

- SDOs include received SDOs (R-SDOs) and transmitted SDOs (T-SDOs).
- By using indexes and sub-indexes, SDOs enable the client to access items in the object dictionary of the device (server).
- SDOs are implemented by using multi-domain CMS objects in CAL, which allows transmitting data of any length. When the data length exceeds 4 bytes, the data is split into several messages.
- The protocol is used to validate the service type and generate a response for each message. SDO requests and responses always contain 8 bytes.

■ PDO

- PDOs include received PDOs (RPDOs) and transmitted PDOs (TPDOs).

- PDOs are used to transmit real-time data from one creator to one or more receivers. The transmitted data contains 1 to 8 bytes.
- Each CANopen device contains 8 default PDO channels, including 4 TPDO channels and 4 RPDO channels.
- PDOs can be transmitted in synchronous or asynchronous mode, which is determined by the communication parameters corresponding to each PDO.
- PDO message content is predefined, and is determined by the parameter mapping corresponding to each PDO.

■ Synchronized (SYNC) object

SYNC objects are messages periodically broadcast to the CAN bus by the CANopen master station, to realize the basic network clock signal. Each device can decide whether to use this event to communicate with other network devices synchronously according to its configuration.

■ Emergency (EMCY) object

EMCY objects are messages sent when the internal communication of a device fails or the application fails.

9.1.3 Communication object identifier

The communication object identifier (COB-ID) specifies the priority of an object in the communication process and identifies the communication object. The COB-ID has a one-to-one mapping with the 11-bit frame ID in CAN2.0A. The 11-bit COB-ID consists of the 4-bit parameter number and the 7-bit node address (node ID), as listed in Table 8-2.

Table 9-2 COB-ID composition

10	9	8	7	6	5	4	3	2	1	0
Parameter number				Node ID						

Each communication object of CANopen has a default COB-ID, which can be read by using SDOs. Some communication objects can be modified by using SDOs.

Table 9-3 Object COB-ID list

Communication object	Parameter number	Node address	COB-ID	Corresponding object index
NMT objects	0000b	0	0h	-
SYNC objects	0001b	0	80h	1005h, 1006h
EMCY objects	0001b	1 – 127	80h+Node ID	1014h

Communication object	Parameter number	Node address	COB-ID	Corresponding object index
TPDO1	0011b	1 – 127	180h+Node ID	1800h
RPDO1	0100b	1 – 127	200h+Node ID	1400h
TPDO2	0101b	1 – 127	280h+Node ID	1801h
RPDO2	0110b	1 – 127	300h+Node ID	1401h
TPDO3	0111b	1 – 127	380h+Node ID	1802h
RPDO3	1000b	1 – 127	400h+Node ID	1402h
TPDO4	1001b	1 – 127	480h+Node ID	1803h
RPDO4	1010b	1 – 127	500h+Node ID	1403h
T_SDO	1011b	1 – 127	580h+Node ID	1200h
R_SDO	1100b	1 – 127	600h+Node ID	1200h
NMT error frames	1110b	1 – 127	700h+Node ID	1016h, 1017h

NOTICE

- Example: The COB-ID in TPDO4 of 3# slave station is 483h.

9.2 System Setup

To connect the AIM310 drive to the CANopen fieldbus network, you must set relevant parameters of the AIM310 drive, as listed in Table 8-4.

Table 9-4 Parameter setting

Parameter	Name	Setting Range	Default
PB-00	CAN baud rate	0 – 20kbps 1 – 50kbps 2 – 100kbps 3 – 125kbps 4 – 250kbps 5 – 500kbps 6 – 1000kbps	5
PB-01	CAN station number	1 – 127	1
PB-12	Producer heartbeat time	1 – 65535ms	0

9.3 NMT System

The NMT system is responsible for initializing, starting, and stopping the network and devices running in the network, which works in the master/slave state. Only one NMT host runs in the CANopen network. The CANopen network containing the host can be configured.

9.3.1 NMT service

CANopen works according to the state machine stipulated in the agreement. Conversion between some states is automatically implemented internally, while conversion between some other states must be implemented by NMT messages sent by the NMT host. Table 8-5 lists the NMT commands.

Table 9-5 NMT commands

Command word	Description
0x01	Starts a remote node.
0x02	Stops a remote node.
0x80	Enters the pre-operation state.
0x81	Resets a node.
0x82	Restores communication.

Table 8-6 lists the CANopen services supported in each NMT state.

Table 9-6 Services supported in each NMT state

Service	Pre-operation	Action	Stop
PDO	No	Yes	No
SDO	Yes	Yes	No
SYNC object	Yes	Yes	No
EMCY object	Yes	Yes	No
NMT system	Yes	Yes	Yes
Error control	Yes	Yes	Yes

9.3.2 NMT error control

NMT error control is mainly used to detect whether a device in the network is online and the status of the device, including node protection, life protection, and heartbeat messages. Since life protection and heartbeats cannot coexist, AIM310 only supports heartbeat messages.

9.4 SDO

An SDO associates with the object dictionary based on the object index and sub-index. The SDO can read the object content in the object dictionary, or modify the object data if allowed. Table 8-7 lists the format of TSDO messages.

Table 9-7 Format of TSDO messages

COB-ID	Data							
580h+Node_ID/ 600h+Node_ID	0	1	2	3	4	5	6	7
	Command code	Index		Sub-index	Data			

NOTICE

- A command code specifies the transmission type and transmission data length of an SDO. An index or a sub-index specifies the position of an object in the list. Data specifies the object value.

■ SDO message with fast write

To read or write data containing up to 4 bytes, the fast SDO transmission mode is used. The transmission of messages varies depending on the read and write methods and the data length. Table 8-8 lists the SDO messages with fast write.

Table 9-8 SDO messages with fast write

		COB-ID	0	1	2	3	4	5	6	7
Client		600h+Node_ID	23h	Index		Sub-index	Data			
			27h				Data			-
			2bh				Data		-	-
			2fh				Data	-	-	
Server	Normal	580h+Node_ID	60h	Index		Sub-index	-	-	-	-
	Abnormal		80h				Stop code			

NOTICE

- "-" indicates that data exists but is not considered. 0 is recommended when data is written.

■ SDO message with fast read

To read an SDO message containing up to 4 bytes, the fast read mode is used. Table 8-9 lists the SDO messages with fast read.

Table 9-9 SDO messages with fast read

<table>
<tr><th colspan="2"></th><th>COB-ID</th><th>0</th><th colspan="2">1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><td colspan="2" rowspan="4">Client</td><td>600h+Node_ID</td><td>40h</td><td colspan="2" rowspan="3">Index</td><td rowspan="3">Sub-index</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="3">580h+Node_ID</td><td>43h</td><td colspan="4">Data</td></tr>
<tr><td>47h</td><td colspan="3">Data</td><td>-</td></tr>
<tr><td>4bh</td><td colspan="2">Data</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Server</td><td>Normal</td><td>4fh</td><td colspan="2">Index</td><td>Sub-index</td><td>Data</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Abnormal</td><td>80h</td><td colspan="3">Stop code</td></tr>
</table>

Table 8-10 lists the format of SDO transmission stop code.

Table 9-10 SDO transmission stop code

Stop code	Description
0503 0000h	Trigger bits are not changed alternately.
0504 0000h	The SDO protocol times out.
0504 0001h	The client or server command word is invalid or unknown.
0504 0005h	The memory overflows.
0601 0000h	Objects cannot be accessed.
0601 0001h	Objects to read are write-only.
0601 0002h	Objects to write are read-only.
0602 0000h	Objects do not exist in the object dictionary.
0604 0041h	Objects fail to be mapped to PDOs.
0604 0042h	The length of mapping objects exceeds that of PDOs.
0604 0043h	General parameters are incompatible.
0604 0047h	General devices are incompatible internally.
0606 0000h	Hardware errors cause object access failure.
0607 0010h	Neither the data type nor the service parameter length is matched.
0607 0012h	The data type is not matched, and the service parameter length is excessive.

Stop code	Description
0607 0013h	The data type is not matched, and the service parameter length is too short.
0609 0011h	The sub-index does not exist.
0609 0030h	The parameter value exceeds the value range.
0609 0031h	The written parameter value is too large.
0609 0032h	The written parameter value is too small.
0609 0036h	The maximum value is less than the minimum value.
0800 0000h	General errors occur.
0800 0020h	Data fails to be transmitted or saved to applications.
0800 0021h	Data fails to be transmitted or saved to applications due to local control.
0800 0022h	Data fails to be transmitted or saved to applications due to the current device status.
0800 0023h	Errors dynamically occur in the object dictionary, or the object dictionary does not exist.
0800 0024h	The value does not exist.

9.5 PDO

PDOs are used to transmit real-time data, which is the most important data transmission mode in CANopen. Since no response is required for the PDO transmission mode, and a PDO can contain less than 8 bytes, the transmission speed is fast.

The PDO transmission mode follows the producer/consumer model. That is, TPDOs generated by the producer in the CAN bus network can be received by one or more consumer RPDOs in the network according to COB-IDs.

PDOs are divided into RPDOs (received objects) and TPDOs (transmitted objects). The final PDO transmission mode and transmitted content are determined by communication parameters and mapping parameters. The AIM310 drive uses 4 RPDOs and 4 TPDOs for PDO transmission. Table 8-11 lists the relevant objects.

Table 9-11 PDO list

Name		COB-ID	Communication object	Mapping object
RPDO	1	200h+Node_ID	1400h	1600h
	2	300h+Node_ID	1401h	1601h
	3	400h+Node_ID	1402h	1602h
	4	500h+Node_ID	1403h	1603h
TPDO	1	180h+Node_ID	1800h	1A00h
	2	280h+Node_ID	1801h	1A01h
	3	380h+Node_ID	1802h	1A02h
	4	480h+Node_ID	1803h	1A03h

Different values of sub-index 02 for communication parameters (RPDO: 1400h to 1403h, TPDO: 1800h to 1803h) represent different transmission types, defining the method of triggering TPDO transmission or processing received RPDOs. Table 8-12 lists the corresponding relationships.

Table 9-12 TPDO and RPDO triggering method

Communication type value	Synchronous		Asynchronous
	Cyclic	Acyclic	
0		√	
1 – 240	√		
241 – 253	-		
254, 255			√

NOTICE

- When the TPDO transmission type is 0, the TPDO is sent if mapped data changes and a synchronous frame is received.
- When the TPDO transmission type ranges from 1 to 240, the TPDO is sent when the same number of synchronous frames is received.
- When the TPDO transmission type is 254 or 255, the TPDO is sent if mapped data changes or the event timer arrives.
- When the RPDO transmission type ranges from 0 to 240, the latest RPDO data is updated to the application whenever a synchronous frame is received. When the RPDO transmission type is 254 or 255, the received data is directly updated to the application.

■ Prohibition time

The prohibition time is set for TPDOs and stored on sub-index 03 of communication parameters (1800h to 1803h), to prevent the CAN network from being continuously occupied by PDOs with lower priority. The unit of the parameter is 100 μs. After the parameter is set, the transmission interval of the same TPDO cannot be less than the time specified by the parameter.

■ Event timer

For asynchronous TPDO transmission (transmission type 254 or 255), an event timer is defined, which is located on sub-index 05 of communication parameters (1800h to 1803h). The event timer can also be regarded as a trigger event, which can trigger the corresponding TPDO transmission. If other events such as data changes occur during the set time, TPDO transmission is also triggered, and the event counter is reset immediately.

■ PDO mapping parameters

PDO mapping parameters include process data pointers corresponding to the PDOs to be sent or received, including indexes, sub-indexes, and length of mapped objects. Each PDO can contain up to 8 bytes and can be mapped to one or more objects at the same time. Sub-index 0 records the number of objects mapped to the PDO, while sub-indexes 1 to 8 record the mapping content. Table 8-13 defines the mapping parameters.

Table 9-13 PDO mapping parameters

Bit	31	…	16	15	…	8	7	…	0
Meaning	Index			Sub-index			Object length		

The position of an object in the object dictionary is determined by both indexes and sub-indexes. The object length specifies the bit length of the object expressed in hexadecimal format, as listed in Table 8-14.

Table 9-14 Relationships between length and bit length of objects

Object length	Bit length
08h	8-bit
10h	16-bit
20h	32-bit

9.6 SYNC Object

SYNC is a special mechanism to control the coordination and synchronization of data sent and transmitted between multiple nodes, and it is used for synchronous PDO transmission.

Similar to the PDO transmission mode, the SYNC object transmission mode also follows the producer/consumer model. That is, when the producer sends a synchronous frame, all other nodes in the CAN

network can receive the synchronous frame as consumers, without the need of feedback. Only one activated synchronous generator is allowed in the same CAN network.

Synchronous PDO transmission is closely related to synchronous frames.

- In terms of synchronous RPDO transmission, if a PDO is received, the received PDO will be updated to the application upon the next SYNC.
- Synchronous TPDO transmission involves the cyclic and acyclic modes. For synchronous PDO transmission in acyclic mode, the transmission type is 0. The PDO is sent upon the next SYNC if the mapped object content changes. For synchronous PDO transmission in cyclic mode, the transmission type ranges from 1 to 240. The TPDO is sent when the SYNC specified by the transmission type is reached, regardless of whether the data changes.

9.7 EMCY Object

When an error occurs in a CANopen node, the node will send an emergency message according to the standardized mechanism. The emergency message follows the producer/consumer model, where other nodes in the CAN network can choose to handle the fault after the node fault is sent. The AIM310 drive only serves as the producer of emergency messages and does not process emergency messages from other nodes.

When a node fails, the error register and predefined error codes need to be updated, regardless of whether the EMCY object is activated. Table 8-15 lists the format of emergency messages.

Table 9-15 Format of emergency messages

COB-ID	0	1	2	3	4	5	6	7
80h+Node_ID	Error code		Error register	Reserved	Auxiliary byte			

NOTICE

The error register is always the same as 1001h.

- When the communication fails, the error code remains the same as that required by the DS301 and the auxiliary byte is 0.
- When the drive encounters an error described in the DS402 subprotocol, the error code remains the same as that required by the DS402 and corresponds to object 603Fh, with additional description by the auxiliary byte.
- When the drive encounters an error specified by the user, the error code is 0xFF00, and the auxiliary byte displays the error code specified by the user.

Chapter 10 Maintenance

10.1 Routine Inspection

The ambient temperature, humidity, dust, and vibration may cause aging and damage to the internal components of the device, resulting in faults or reducing the service life of the device. Therefore, to ensure normal functions of the device and prevent the device from damage, perform routine inspection on the device according to Table 9-1.

Table 10-1 Routine inspection items

Item	Checkpoint	Solution
Motor	Whether abnormal sound and vibration occur on the motor	● Check that the mechanical connection is normal. ● Check the motor for phase loss. ● Check that the fixing screws of the motor are tightened.
Cooling fan	Whether the cooling fan of the drive works improperly	● Check that the cooling fan of the drive works properly. ● Check that the air vent is not blocked. ● Check that the ambient temperature is in the allowed range.
Installation environment	Whether the cabinet and cable duct are abnormal	● Check that the insulating cover of drive cables is not damaged. ● Check that no vibration occurs during installation of the mounting bracket. ● Check that the copper busbars and cable terminals are not loose or corroded.
Load	Whether the drive running current exceeds the rated current of the drive or motor	● Check that the motor parameters are set correctly. ● Check that the motor is not overloaded. ● Check that the mechanical vibration is not excessive (< 1 g).
Input voltage	Whether the power voltage between the main circuit and the control circuit is normal	● Check that the input voltage is in the allowed range. ● Check that start of heavy load does not exist.

10.2 Periodic Inspection

NOTICE

- To prevent an electric shock, do not perform inspection when the power is on.
- Before inspection, cut off the power supply of all devices and wait for more than 10 minutes to prevent danger caused by residual voltage in the internal capacitor of the drive.

The drive in operation must be always kept clean. Remove dust on the surface of the drive regularly to prevent dirt retention and metal dust from entering the drive, and remove oil from the cooling fan of the drive.

More frequent inspection is required if the device is used in harsh environments, such as:

- High ambient temperature
- Frequent start and stop
- Fluctuations in the AC power supply or load
- Excessive vibrations or shock loading
- Dust, metal dust, hydrochloric acid, and other corrosive articles

Perform periodic inspection according to Table 9-2.

Table 10-2 Periodic inspection items

Item	Checkpoint	Solution
Drive	Whether any waste, dirt, or dust exists on the surface.	● Check that the drive cabinet is powered off. ● Use a vacuum cleaner to suck up wastes and dust to prevent direct touching. ● Wipe stubborn stains with alcohol and wait until the alcohol evaporates.
Cable	● Whether the power lines and connections are discolored. ● Whether the insulation layer is aged or cracked.	Replace aged cables.

Item	Checkpoint	Solution
Peripheral devices of the electromagnetic contactor	● Whether the electromagnetic contactor has loose connection or abnormal noise during operation. ● Whether any peripheral devices encounter a short circuit, water contamination, expansion, or crack.	Replace abnormal elements.
Air vent	● Whether the air vent or heatsink is blocked. ● Whether the fan is damaged.	● Clean the air vent. ● Replace the fan.
Control circuit	● Whether the control element is in poor contact. ● Whether the terminal screws are loose. ● Whether the insulation layer of control cables is cracked.	● Remove foreign objects on the surface of control cables and connecting terminals. ● Replace damaged or corroded control cables.

10.3 Fan Replacement

■ 11 – 15kW model

Fans of 11 – 15 kW models are fixed with their own buckles, and no special tools are required for replacement.

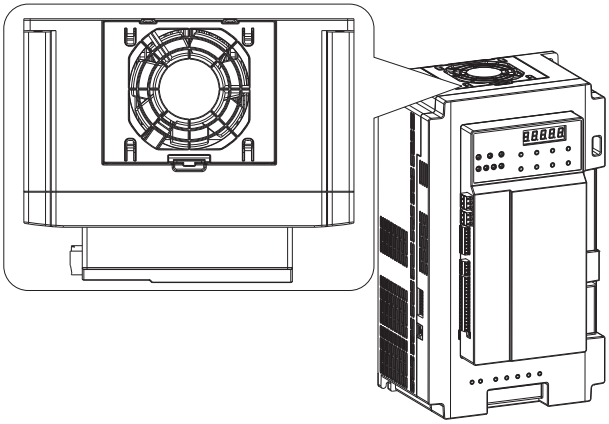


Figure 10-1 Fixing a fan with a buckle

■ ≥18 kW model

Fans of 18 kW and above models are fixed with screws. To replace a fan, use a wrench to loosen the four fixing screws of the fan, place the new fan, and then tighten the fixing screws.

- Screw specifications: M5
- Installation torque: 3 N·m (28 kgf·cm)

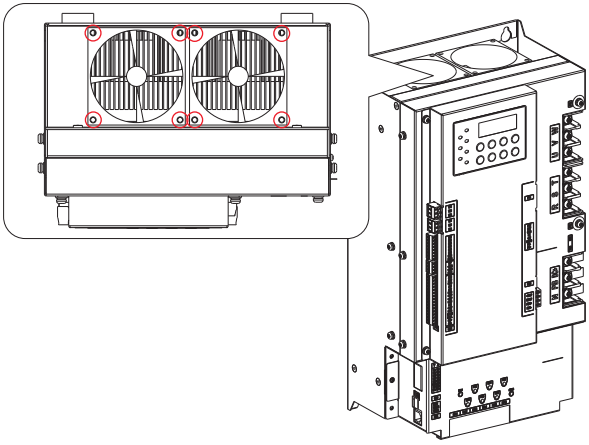


Figure 10-2 Fixing a fan with screws

Chapter 11 Certification and Standard Requirements

11.1 Compliant Certifications, Directives, and Standards

Relevant certifications, directives, and standards are listed in the following table. Whether the relevant certifications are awarded is subject to the information on the product nameplate.

Certification Name	Directive Name		Compliant Standard
CE certification	Electromagnetic Compatibility (EMC) directive	2014/30/EU	EN IEC 61800-3
	Low Voltage Directive (LVD)	2014/35/EU	EN 61800-5-1
	Restriction of Hazardous Substances (RoHS) directive	2011/65/EU	EN 50581

CE certification of the product complies with the latest version of directives and standards.

11.2 CE Certification

Figure 11-1 CE marking

- CE marking is a marking indicating that a product complies with the LVD, EMC, and RoHS directives when commercial trade (production, import, and sales) of the product is conducted in the European Economic Area (EEA).
- CE marking is mandatory for commercial trade (production, import, and sales) conducted in the EEA.
- This product complies with the LVD, EMC, and RoHS directives, and a CE marking is affixed on the product.
- The machinery and devices installed with this product must also meet CE requirements when sold in the EEA.

- When affixing the CE marking on the terminal where this product is installed, the responsibility shall be borne by the customer who assembles the product, and the customer shall confirm whether the machinery and devices of the final product comply with the CE certification.

■ Compliance with EMC Directive

This product complies with the EMC Directive 2014/30/EU, meets the requirements of EN IEC 61800-3, and is applicable to the first and second environments.

NOTICE

- If used in the first environment, this product may cause radio interference. In addition to the CE compliance requirements mentioned in this chapter, users should also take necessary measures to prevent interference.

To ensure that this product meets the requirements of EMC directives and standards, users must install an EMC filter on the input side and select the recommended shielding cable at the output end. In addition, ensure reliable grounding of the filter and the 360° reliable overlap of the output cable shielding layer.

NOTICE

- The system manufacturer who installs this product is responsible for ensuring that the system complies with the EMC directive and meets the EN IEC 61800-3 requirements based on the application environment of the system.

■ EMC Specifications

Follow the product requirements during installation. This product meets the EN IEC 61800-3 requirements. The maximum allowable lengths of motor cables for conducted and radiated emissions are listed in the table below.

Table 11-1 Maximum allowable lengths of motor cables for conducted and radiated emissions

Product model	External EMC filter	
	Maximum Cable Length for Conducted Emission	Maximum Cable Length for Radiated Emission
11 – 75kW	3m	3m

■ Introduction of EMC Standards

EMC refers to the ability of electrical and electronic equipment to operate normally in the environment

of electromagnetic interference and not to introduce too much electromagnetic interference to other local equipment or systems, so as to avoid affecting stable operation of other equipment. EMC includes the following requirements:

- The electromagnetic interference generated by the equipment to the environment during normal operation cannot exceed a certain limit.
- The equipment has a certain degree of immunity (that is, electromagnetic susceptibility) to electromagnetic interference in the environment and can operate normally in such an environment.

EN IEC 61800-3 defines two types of environments:

- First environment: This includes domestic premises and also establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies power to buildings used for domestic purposes.
- Second environment: This includes all establishments other than those directly connected to a low-voltage power supply network which supplies power to buildings used for domestic purposes.

According to the intended use environment, products are divided into the following four categories:

- C1: This applies to PDSs with rated voltage less than 1000 V, intended for use in the first environment.
- C2: This applies to PDSs with rated voltage less than 1000 V. It is neither a plug-in device nor a movable device. When used in the first environment, it is intended to be installed and commissioned only by a professional.
- C3: This applies to PDSs with rated voltage less than 1000 V, intended for use in the second environment only but not the first environment.
- C4: This applies to PDSs with rated voltage greater than or equal to 1000 V, or rated current greater than or equal to 400 A, or intended for use in complex systems in the second environment.

11.2.1 Compliance with LVD

The product has been tested according to EN 61800-5-1, and the test result indicates that the product complies with the LVD. To ensure that the machinery and devices installed with this product comply with the LVD, the following requirements must be met.

■ Installation Site

Install this product on a site with overvoltage category (OVC) III and pollution degree (PD) 2 and below as specified in IEC 60664-1.

■ Installation Environment

For details about installation environment requirements, see "2.1 Installation Environment".

■ Installation Protection Requirements

- This product is a cabinet mounted product that needs to be installed and used in the final system.

The final system should provide the corresponding fireproof enclosure, electrical protective enclosure, and mechanical protective enclosure, and comply with local laws and regulations and relevant IEC standards.

- When installing a cabinet (IP20) mounted product, install it in a structure where foreign objects cannot enter from the top or front.

■ Terminal Wiring Requirements of Main Circuit

For details about terminal wiring requirements of main circuit, see "Chapter 3 Electrical Installation".

■ Protective Device Requirements

To meet the EN 61800-5-1 requirements, connect a fuse or circuit breaker on the input side to prevent accidents caused by short circuits of the internal circuit. For details about recommended fuses, see "4.2 Selection Guide".

Revision History

Date	Changed Version	Change Description
April 2024	A00	First release

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